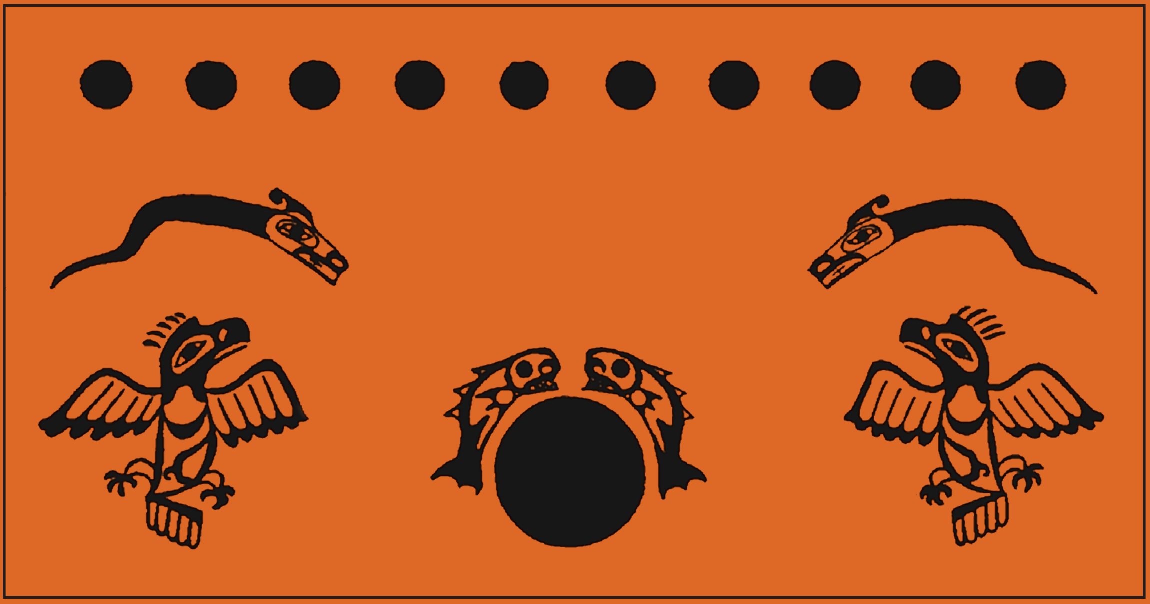
Ts'ishaa: Archaeology and Ethnography of a Nuu-chah-nulth Origin Site in Barkley Sound



Alan D. McMillan and Denis E. St. Claire

Archaeology Press • Department of Archaeology • Simon Fraser University • Burnaby, B.C. • V5A 1S6

TS'ISHAA: ARCHAEOLOGY AND ETHNOGRAPHY OF A NUU-CHAH-NULTH ORIGIN SITE IN BARKLEY SOUND

Alan D. McMillan and Denis E. St. Claire

With appendices by: Susan Crockford
Gay Frederick
Martin Magne
Iain McKechnie
Ian Sumpter
Michael Wilson

Cover design: Painted images on a high status house that once stood at Ts'ishaa, as described by Tom Saayach'apis to Edward Sapir in 1913 (drawn by First Nations artist Butch Dick).

ISBN 0-86491-271-4

Archaeology Press
Department of Archaeology
Simon Fraser University
Burnaby, B.C. V5A 1S6

Roy L. Carlson
Managing Editor

Table of Contents

List of Figures

List of Tables

Acknowledgements

This project was made possible by the cooperation and funding support of Parks Canada and the Tseshaht First Nation. Parks Canada also provided a great deal of in-field support. The Tseshaht Nation, through their office in Port Alberni, handled all the administrative tasks of the fieldwork. The British Columbia Heritage Trust provided additional funding. Salaries for a number of the young people participating in the project came from various government agencies, including the B.C. Ministry of Environment, Lands and Parks; Government of Canada, Young Canada Works Program; Government of Canada, Summer Career Placements Program; and Government of Canada, YMCA Youth Internship Program. Douglas College and the Department of Archaeology at Simon Fraser University supplied most of the equipment used in the fieldwork, as well as lab and storage space. One author (McMillan) also thanks Douglas College for educational leave time that assisted in the writing of this report.

The support of the Tseshaht Nation is gratefully acknowledged. Mich Hirano, former Chief Executive Officer, played a major role in administering the project in its early stages. Lisa Gallic and Darrell Ross served on the Tseshaht – Parks Canada Joint Committee and helped with various details. George Watts initiated and chaired the meeting that created the Joint Committee; without his forceful support at that time this project may never have happened. Thanks also go to the Tseshaht Band Council, the elders, and to hereditary chief Ed Shewish for their support.

Parks Canada generously supported the project at every stage. Ian Sumpter, from the Victoria office, was an active participant throughout the project and conducted the shell analysis presented here as Appendix C. Marty Magne in the Calgary office kindly arranged some of the funding for fieldwork and analyzed the lithics from the early component (Appendix B). Pat McFadden of Parks Canada prepared the detailed site map. Various people at Pacific Rim National Park Reserve in Ucluelet assisted in a number of ways. Jim Morgan and Barry Campbell played vital roles in getting the project under way. Barry wrote the environmental impact assessments essential for each field season and was an enthusiastic volunteer excavator. Jim ably assembled media coverage for the project and assisted in establishing the field camp before the first season of excavation. Dan Vedova, senior warden of the Broken Group Islands, is owed special thanks for his enthusiastic support of the project from its inception. He visited the site frequently and provided invaluable logistical assistance. The project directors wish specifically to thank Park Superintendent Alex Zellermeyer, as his on-going support was essential for the success of the project.

The members of the Parks Canada – Tseshaht Joint Committee deserve special acknowledgement. Members of this committee, which provided guidance to the project and served as an essential liaison between the two groups, included at various times Jim Morgan, Bob Redhead, Therese Cochlin, Paul Cormier, Larry Harbidge, and Dan Vedova from Pacific Rim National Park Reserve and Darrell Ross, Mich Hirano, Harvey Filger, Lisa Gallic, and Denis St. Claire representing the Tseshaht First Nation.

Thanks are also due to an enthusiastic and hard-working field crew. In addition to the directors, field personnel who assisted with supervision of a largely inexperienced group of workers included Ian Sumpter (Parks Canada), George Kaufmann, Jim Stafford, Wil Robinson, and Alex Clark. Chantel Christensen and Peter Vigneault joined the ranks of experienced workers by their second season. The large group of hungry workers was sustained by the capable efforts of the camp cooks: Eva Linklater, George Kaufmann, Darryl Kirsch, and Tammy Lucas took this role at various times over the three seasons. Luke George acted as Parks Canada Interpreter for the numerous visitors to the dig during the first two summers; Wil Robinson took that role in the final season. Nuu-chah-nulth young people hired as trainees or supervisors on the dig over the three seasons include Dennis Bill, Jacob Bos, Colin Charleson, Marie Clark, Amanda Fred, Tom Fred, Hank Gus, Dartwin Jeffrey, Jason Jensen, Trevor Little, Tammy Lucas, Nelda Robinson, Vance Sieber, Dave Taylor, and Ken Watts. The great many volunteers who participated in the project for various periods of time (a few over all three seasons), plus those who participated as part of programs such as Young Canada Works, are too numerous to name here, but their contributions are no less appreciated. It is due to the efforts of all these people that we are able to present the information that appears in this volume.

A number of individuals not mentioned above contributed to the analysis of the excavated materials. Gay Frederick and Susan Crockford examined the vertebrate faunal remains recovered (Appendix D), while Iain McKechnie studied the small fish bones recovered in the column samples (Appendix E). Iain also assisted by preparing samples for AMS dating and calibrating the results. Michael Wilson summarized the geology of the region and examined all stone artifacts for lithic type and source (Appendix A). Kathy Watt, under the supervision of Dongya Yang at Simon Fraser University, did the ancient DNA analysis of whalebone. Rebecca Lynn examined the botanical remains recovered through flotation in one column sample. Artifact drawings are by Kathryn Alma-Nihte (Figs. 29, 35, 37, 57, 59) and Gillian McMillan (Fig. 31); other illustrations are by Butch Dick (Fig. 7), and Jakub Josicki (Fig. 8). We also thank Randy Bouchard for his continued interest and advice on the transcription of Nuu-chah-nulth words.

The final report was submitted to Parks Canada and the Tseshaht Nation in 2003. Only minor changes have been made in this version. Roy Carlson of Archaeology Press at Simon Fraser University was instrumental at all stages of guiding the report through to publication. We thank Roy and Cheryl Takahashi for their work in transforming the manuscript into its final published form.

Chapter One: INTRODUCTION

The Tseshaht Archaeological Project

The Tseshaht Archaeological Project was initiated as a joint endeavour of the Tseshaht First Nation and Parks Canada. The Tseshaht, one of the 14 members of the Nuu-chah-nulth Tribal Council on western Vancouver Island, primarily reside today on their reserves near the city of Port Alberni. Their traditional territories, however, include the Broken Group islands of Barkley Sound, now within Pacific Rim National Park Reserve. A major stimulus for the project was the Tseshaht interest in initiating a new relationship with Parks Canada regarding their traditional lands within the park. A Tseshaht-Parks Canada Joint Committee was established in 1998 to discuss mutual concerns, including protection of heritage sites and incorporation of a human history component into the Park's interpretation programs. Such programs in the past have promoted the natural history of the area, emphasizing the "wilderness" experience to park visitors. In the future, it is hoped that boaters, kayakers, and others who travel through the Broken Group islands will not only experience the spectacular scenery and abundant wildlife but will also become aware that this was the homeland of a unique group of people who occupied these islands for thousands of years. The Tseshaht Archaeological Project was designed to contribute to our knowledge of human history in this area, both for Park interpretations and for Tseshaht educational programs. It also served to allow Parks personnel and visitors, as well as a considerable number of Tseshaht people, to experience and learn about archaeological research first-hand.

Benson Island, one of the outer islands of the Broken Group in central Barkley Sound, was selected as the focus of research (Fig. 1). This is a key location in Tseshaht history, as the large and important village of Ts'ishaa, the site from which the Tseshaht (*Ts'ishaa7ath*) take their name, once stood there. Both the depth of midden deposits evident and the importance of this location in Tseshaht oral traditions indicate lengthy occupation. This was the principal site of the Tseshaht for millennia, from their creation at this location in the Tseshaht origin stories to the village's decline during the early contact period. Immediately adjacent is Himayis, where a smaller cluster of houses associated with the main village stood. This provided an opportunity to sample an area known through ethnographic tradition to be contemporaneous but lower in status to the main site area. Today the remains of Ts'ishaa are evident as a large and impressive shell midden site, designated DfSi-16 (204T in the Parks Canada system), while a smaller and shallower shell midden, designated DfSi-17 (205T in the Parks Canada system), marks the location of Himayis.

Fieldwork began in 1999 with five weeks of test excavation at both sites, although the more extensive work was at Ts'ishaa, where a large trench was dug through the centre of the site. In the summer of 2000, the research was restricted to Ts'ishaa. In seven weeks of work, trenches were excavated through the three terraces along the western portion of the site. A higher area behind the main site was also tested in a search for older deposits. Confirmation through radiocarbon dating that the back terrace area predates the main village and was likely occupied at a time when sea levels were higher than present led to five weeks of additional research in 2001. Most attention in that field season was on the back terrace, but two units were also excavated on a low terrace near the eastern edge of the village site and an additional unit was dug at Himayis. Several units were also excavated at a shallow midden on top of a rocky bluff on the north side of adjacent Clarke Island (site DfSi-26; 212T in the Parks Canada system). The results of excavation in the three distinct areas of the Benson Island complex (Ts'ishaa main village and back terrace, plus Himayis) are presented in separate chapters of this report. Throughout, a major goal of the research was to obtain cultural historical information useful in site interpretation and educational programs. This includes length of occupation, subsistence pursuits, and evidence of cultural change through time. The information recovered through archaeological research can then be integrated with the extensive knowledge of traditional Tseshaht history and culture held by Tseshaht elders, particularly as recounted to anthropologists such as Edward Sapir early in the twentieth century.

All fieldwork was co-directed by the authors. Other key personnel are named in the acknowledgements. A core of experienced field workers provided essential direction for the large crew. Each season a group of Nuu-chah-nulth trainees (six in 1999, six plus a supervisor in 2000, and five plus a supervisor in 2001) took part in the field-

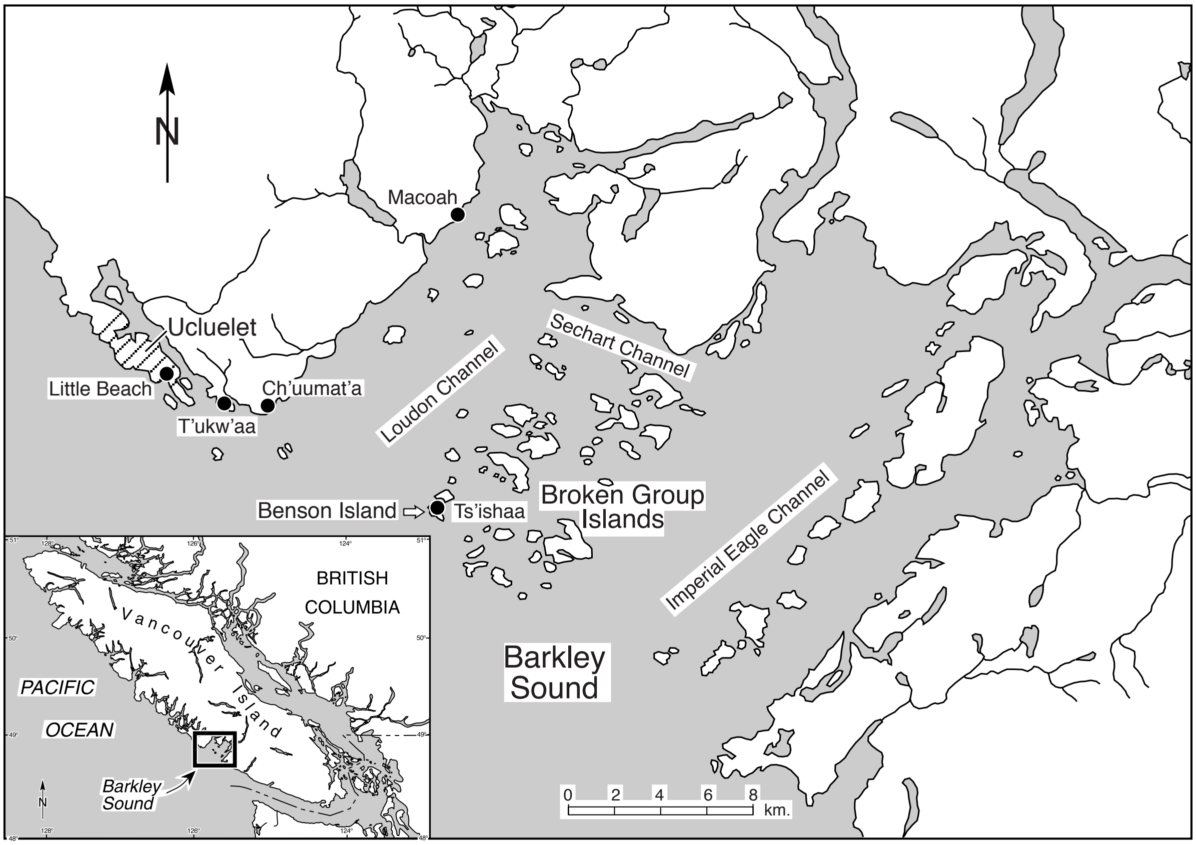


Figure 1. Barkley Sound showing the location of Benson island in the Broken Group and the major archaeological sites mentioned in the text.

work and received training in various archaeological field techniques (Figs. 2 and 3). An additional member of the Tseshaht Nation was hired by Parks Canada in the first two seasons as a site interpreter, presenting Tseshaht heritage and archaeological research to Park visitors. Another Tseshaht person, who had considerable previous experience in archaeological research, was hired as part of the regular crew and took over the interpretation duties in the final season. In addition, Parks Canada placed a number of students employed under the Young Canada Works program on the project on a rotating basis. Crew size was also swelled by many volunteers, a number of whom were Tseshaht, who worked on the project for varying periods of time. While the base crew size remained stable at about 15 to 20, there were up to 30 people working on the project at any one time. In all, a total of 34 people participated in the excavation at various times in 1999, 54 people in 2000 and 37 in 2001.

All radiocarbon dates reported here have been calibrated to more closely approximate actual calendar ages. They are generally given as calibrated age ranges before the present (cal BP), showing the maximum and minimum age estimates at two-sigma standard deviation (95% probability). Dates on marine bone have been corrected for the marine reservoir effect. Information on all radiocarbon age estimates can be found in the tables and on the stratigraphic profiles in Chapters Four and Five.

Throughout this report, but particularly in the ethnographic chapter, an effort was made to include the Nuu-chah-nulth names for places and social groups, as well as other terms. Nuu-chah-nulth words are generally shown in italics throughout the text. They are rendered in the practical orthography developed by Randy Bouchard (1971), of the B.C. Indian Language Project, Victoria. The symbol "*7*" represents a glottal stop (or "catch in the throat"), while an apostrophe indicates that the preceding sound is "strongly exploded" (glottalized). Underlining indicates that the sound is produced further back in the mouth than would otherwise be the case. A fuller published explanation is given as Appendix 1 in McMillan and St. Claire 1982. This orthography differs considerably from earlier

Figure 2. Nuu-chah-nulth trainees at Ts'ishaa, 1999 (from left: Dartwin Jeffrey, David Taylor, Jason Jensen, Nelda Robinson, Maria Clark, Trevor Little).

Figure 3. Tseshaht trainees at Ts'ishaa, 2001 (from left: Ken Watts, Tom Fred, Vance Sieber, Dennis Bill, Hank Gus; Tammy Lucas in front).

Figure 4. Aerial view of Barkley Sound, with the islands of the Broken Group in the foreground and the mountains of Vancouver Island in the background. Effingham is the large island at lower right; Benson is just off the picture to the left (Royal BC Museum PN17844-15A).

writing systems, such as that employed by Edward Sapir. Where such terms occur in quotations, the original spelling is maintained. If the reference is unclear, however, it is followed by the term in the present orthography (in square brackets).

The Natural Setting

The islands and shoreline of Barkley Sound fall within the Estevan Coastal Plain, a comparatively low-lying strip of outer coast immediately backed by the rugged topography of the Vancouver Island Range mountains (Holland 1964) (Fig. 4). The sound itself has been glacially scoured, as Pleistocene ice sheets advanced down the major inlets (such as Alberni and Effingham) and out onto the continental shelf (Wilson, Appendix A). Holland (1964: 20) characterizes the geology of this area as "folded and faulted sedimentary and volcanic rocks." Volcanic rocks such as andesites and basalts predominate, with Tertiary sandstones along the coastal plain overlain with unconsolidated Pleistocene glacial deposits (Carter 1973:442; Wilson, Appendix A). The land is thickly covered with the predominantly coniferous forests of the Coastal Western Hemlock biogeoclimatic zone (Krajina 1969; Meidinger and Pojar 1991), with the principal species being Western hemlock (*Tsuga heterophylla*), Western red cedar (*Thuja plicata*), Douglas fir (*Pseudotsuga menziesii*) and Sitka spruce (*Picea sitchensis*).

The lush forest cover is sustained by the rainy climate, with an average annual precipitation of about 300 cm. Winters are relatively warm and wet, with much of the annual rainfall occurring during that time. Snowfall occurs on average only about six days a year. Table 1 summarizes recent climatic data for the outer Barkley Sound region, based on stations at Amphitrite Point near Ucluelet, at the western edge of the sound, and Bamfield East, at the eastern edge of the sound.

Two major clusters of islands lie within Barkley Sound. The Broken Group islands occupy the central portion of the sound, while those of the Deer Group are located near the eastern shore. A smaller cluster of islands is in the northwest of the sound. The Broken Group consists of approximately 50 islands, as well as numerous small islets and exposed rocks. This large island cluster provided protected village locations, sheltered waterways, and diversified habitats that supported a wide range of fauna. Benson Island, the focus of this study, is one of the

Table 1. Barkley Sound climatic data (Canada, Atmospheric Environment Service, 1982) (figures refer to the averages from 1951 to 1980).

	Amphitrite Point	Bamfield East
mean January temperature	4.7 C	4.0 C
mean August temperature	14.3 C	14.3 C
mean annual temperature	9.4 C	9.1 C
minimum recorded temperature	–11.7 C	–10.6 C
mean annual precipitation	307.7 cm	287.9 cm
days per year with precipitation	197	193

outer islands, at the western edge of the Broken Group (Fig. 1). It is a relatively small island, at less than one kilometre in greatest length.

Offshore from Barkley Sound lies the La Perouse Bank, with its abundance of marine life. Coastal upwelling across the bank brings deep nutrient-rich water upward to the surface layer, supporting a great concentration of plankton (Thomson 1981:83; Allen et al. 2001). This provides food for large numbers of fish and sea mammals. The resultant high biomass made this area highly productive for Nuu-chah-nulth fishing, sealing, and whaling.

Numerous species of fish, bird, sea mammal, and shellfish would have been available within a short distance of each major village in the Broken Group archipelago. A survey of the birds found in Pacific Rim National Park, including both seasonal visitors and permanent residents, lists 247 species (Hatler, Campbell and Dorst 1978). Economically important bird species include a variety of ducks, geese, grebes, mergansers, cormorants, and gulls. The waters of Barkley Sound and the offshore banks provided an abundant and varied supply of fish, including halibut (*Hippoglossus stenolepis*), cod (*Gadus macrocephalus*), lingcod (*Ophiodon elongatus*), rockfish (*Sebastes* spp.), herring (*Clupea harengus pallasi*), dogfish (*Squalus acanthius*), and salmon (*Oncorhynchus* spp.). The waters also provided access to a variety of sea mammals, including Stellar or northern sea lion (*Eumetopias jubata*), California sea lion (*Zalophus californianus*), northern fur seal (*Callorhinus ursinus*), harbour seal (*Phoca vitulina*), sea otter (*Enhydra lutris*), and a number of cetaceans, the most important of which were the humpback whale (*Megaptera novaeangliae*), grey whale (*Eschrichtius robustus*), and Pacific harbour porpoise (*Phocoena phocoena*). Land mammals, on the other hand, were uncommon in this island environment, with only the coast deer (*Odocoileus hemionus columbianus*) being important in the diet, although bear (*Ursus americanus vancouveri*) and elk (*Cervus elaphus roosevelti*) could have been obtained from the nearby shores of Barkley Sound. Plant food resources were also limited in this outer island setting, although a wide range of berries and other edible plants would have been available in the broader Barkley Sound region. A range of intertidal invertebrates, including several species of clams, mussels, scallops, barnacles, chitons, and sea urchins, were available within the Broken Group and played a vital role in the local economy (Appendix C).

Previous Archaeological Research

Relatively little archaeological research has been carried out on western Vancouver Island (see McMillan 1999). Large-scale and well-dated excavation projects, where a significant quantity of cultural materials was recovered, have occurred only at Yuquot (at the entrance to Nootka Sound), at several sites in Hesquiat Harbour, at several Toquaht sites in western Barkley Sound, and at Shoemaker Bay (at the head of Alberni Inlet). A number of smaller excavations, such as at Chesterman Beach and at two nearby sites on Nitinat Lake, provide additional information. On the Olympic Peninsula, the extensive excavations at Ozette, at both the midden trench and the waterlogged house deposits, provide important information on the culture history of the Makah, close relatives of the Nuu-chah-nulth. Yuquot (DjSp-1) exhibits a long continuous sequence, showing the evolution of Nuu-chah-nulth culture from about 4700 cal BP into modern times (Dewhirst 1980; Hutchinson 1992:14). Recent research in Barkley

Sound, including the early component at Ts'ishaa reported here, extends the known history of this area to about 5000 cal BP.

These dates, however, clearly do not mark the initial settlement of western Vancouver Island. Sea levels have fluctuated dramatically over the millennia, greatly affecting archaeological visibility for all but the most recent period. As a result of such changes, any evidence of human presence prior to about 7000 cal BP may now lie below modern tides, eroded and largely inaccessible, while remains a millennium or two later may be on old strandlines which are now inland, forested and difficult to locate. The large and highly visible archaeological sites associated with modern shorelines date primarily to the last few millennia.

Mitchell (1990), in a major synthesis of archaeological knowledge for this region, proposed the West Coast culture type as the archaeological view of evolving Nuu-chah-nulth culture. Excavated data from Yuquot and Hesquiat Village, at that time the only major archaeological projects on the west coast of Vancouver Island, provided most of the information on which this construct was based. Claims for lengthy continuity at these sites led Mitchell to propose that Nuu-chah-nulth precontact history could be encompassed within a single culture type. Distinguishing features of this culture type, defined almost entirely in terms of artifacts, consist of bone points and bipoints, barbed bone points and harpoon heads, large and small composite toggling harpoon valves of bone or antler, bone splinter awls, stone and bone fishhook shanks, bark beaters and shredders of whalebone, and mussel shell celts and knives (Mitchell 1990:356). The rarity or absence of flaked stone tools and flaking detritus is also seen as an identifying trait. In fact, stone implements in general are rare, with the exception of the numerous abrasive stones which played an important role in shaping tools of other materials. According to Mitchell (1990:357),

> the archaeological assemblages are so like described Nootkan [Nuu-chah-nulth] material culture that a lengthy reconstruction of the technology is not necessary. There are artifacts interpretable as whale, small sea mammal, and salmon harpoons; parts of composite fishhooks; knives suitable for butchering salmon or herring or for preparing other fish and foods; woodworking tools; and tools for shaping the numerous bone implements …. These tools are represented even in the [earliest] levels at Yuquot Village.

The sites later excavated as part of the Toquaht Archaeological Project have the greatest relevance to the research reported here as they are only a short distance away, along the western shore of Barkley Sound near Ucluelet (see Fig. 1). Extensive excavation at two major villages, along with smaller projects at three other sites, revealed a lengthy period of occupation (McMillan and St. Claire 1992, 1996; McMillan 1999). The largest of the excavated sites is T'ukw'aa (DfSj-23), the major traditional village of the Toquaht (*T'ukw'aa7ath*), the Nuu-chah-nulth neighbours of the Tseshaht to the west. As the place from which the Toquaht derive their name, T'ukw'aa has the same historical connection to the Toquaht that Ts'ishaa does to the Tseshaht. Extensive excavation, at both the main village and on top of an adjacent headland that served as a defensive location, uncovered almost 1500 artifacts and a large quantity of faunal remains. A series of radiocarbon dates indicates that this site was first occupied about 1200 years ago, continuing in use until the early twentieth century. A nearby site, Ch'uumat'a (DfSi-4), with even deeper deposits (slightly over four metres at the back of the site), was excavated in an attempt to extend this sequence further back in time. Deposits at this site spanned the period from about 4600 cal BP to early historic times. About 750 artifacts, plus a large quantity of faunal remains, were recovered. Less extensive excavations also took place at Macoah (*Ma7akwuu7a*), the ethnographic winter village of the Toquaht, and at two lookout or defensive sites elevated on rocky islets near the entrance to Ucluelet Inlet.

Two other excavated sites lie at the western edge of Barkley Sound, at Ucluelet, quite close to the Toquaht sites. One, Ittatso North (DfSj-40), is on the modern Ucluelet (*Yuulhuu7ilh7ath*) reserve. A small test pit at this location showed the midden is at least four metres deep and covers at least the last 2300 years (Arcas Consulting Archeologists 1998). The other is Little Beach (DfSj-100), at the modern town of Ucluelet. Limited test excavation at this open-ocean site revealed that it had been used as a burial area, with graves typically consisting of shallow pits covered with low rock cairns and sometimes also with whalebone (Arcas Consulting Archeologists 1991). The graves came from a deep shell midden deposit dating between about 4500 and 2500 cal BP. There is no evidence of more recent occupation at that location.

Little Beach and the lower (pre-2000 BP) levels at Ch'uumat'a share a number of traits that set them apart from other Nuu-chah-nulth sites such as Yuquot. Cairn burials, chipped stone artifacts and flaking detritus, and several categories of decorative ground stone objects most closely correspond to assemblages from archaeological sites of equivalent age in the Strait of Georgia area, particularly those of the Locarno Beach culture type (McMillan 1998a, 1999). They also closely resemble the materials excavated from Shoemaker Bay in the Alberni Valley, accessible from Barkley Sound by the long Alberni Inlet (McMillan and St. Claire 1982). Oral traditions and ethnographic accounts document the relatively late arrival of Nuu-chah-nulth culture in the Alberni Valley. The similarity of artifacts from these three sites, and their clear ties (particularly at Shoemaker Bay) to the Strait of Georgia, has led to suggestions that these earlier materials provide evidence of population replacement in Barkley Sound, with Nuu-chah-nulth arrival dating to perhaps just over 2000 years ago (McMillan 1998a, 2003). This earlier period is still poorly known, however, and other explanations may be possible for the apparent cultural break at this time.

Although no excavation had taken place in the Broken Group islands prior to the beginning of the Tseshaht Project in 1999, survey and recording of archaeological sites had been conducted (St. Claire 1975; McMillan and St. Claire 1982), most notably by the Pacific Rim survey project for Parks Canada in 1982 (Haggarty and Inglis 1985; Inglis and Haggarty 1986). Systematic site survey throughout Pacific Rim National Park Reserve resulted in the recording of 163 Nuu-chah-nulth heritage sites in the Broken Group islands alone (Inglis and Haggarty 1986: 242). Of these, nearly half (N=80; 49%) are shell middens, of which 18 were classified as villages and 62 as camps. Ts'ishaa and Himayis form one site cluster of the ten large sites or site clusters in the Broken Group, possibly indicating that these islands were once home to ten distinct and autonomous political groups (Haggarty and Inglis 1985:37–8). Rock wall fish traps, constructed in sheltered locations behind islets and in bays, made up another large site category (N=40; 24.5%). Burial sites, most of which are in caves or rockshelters, were also relatively numerous (N=21; 12.9%). Eighteen culturally modified trees (CMTs) (11%) and four isolated find sites (2.5%) complete the total for the Broken Group islands (Inglis and Haggarty 1986: 247).

In 1995, a Parks Canada crew resurveyed and remapped the Benson Island sites (Sumpter, Fedje, and Sieber 1997). In an attempt to get an idea of the depth of deposit and length of occupation at Ts'ishaa, they took several core samples from the back of the main village. This work revealed that the midden was at least 2.8 metres in depth. Charcoal obtained from near the base of one core yielded a radiocarbon date of 2260±50 years (Sumpter, Fedje, and Sieber 1997:31), which would give an age estimate of 2350–2130 cal BP. This date, which is consistent with the results later obtained through excavation, provided an initial minimum age estimate for Ts'ishaa and stimulated interest in this important site which led to the research conducted as the Tseshaht Archaeological Project.

Chapter Two: TSESHAHT ORAL HISTORY AND ETHNOGRAPHY

Tseshaht Creation and Oral Traditions of Ts'isaa

The central role the site of Ts'ishaa plays in the history of the Tseshaht people is evident from their name, for the Tseshaht (*Ts'ishaa7ath*) are literally the "people of Ts'ishaa." For most of their history, this was the primary Tseshaht community, the "capital" of the Tseshaht people. Furthermore, Tseshaht oral traditions tell of their creation, specifying that this is the location where the Tseshaht people first came into being. A version of this story was told to Edward Sapir, a prominent anthropologist working among the Nuu-chah-nulth of Barkley Sound, by Tom Saayach'apis, an elderly and respected Tseshaht chief and one of Sapir's principal informants, in 1922.

> We Tsishaa people learned things because of the Day Chief[1], who created us at Hawkins [an earlier name for Benson] Island. Because of that we know for sure that he is the chief in the sky. Yet we do not know his name. He is an old man. She became aware, as tho [sic] awakened from sleep, that there were two people, one old man and one a shaman with bars painted across his eyes. The one who awoke there was a young woman. She realized she was a young woman. The old chief stood on a wide board and cut at the front of his thighs. The shaman scraped up the blood in his hand. He blew into it. He did that to the blood and it turned into a boy. The girl watched; they were doing this inside a house at the rear. Both the little girl and the little boy were growing rapidly. "You shall be named Day-Down"[2], they told the boy. "You shall be named Sky-Day"[3], they told the girl. Then the chief made a river. It became a real channel, the mouth at Village [Effingham] Island. The other side of the mouth would be Standing Point[4]. The river formed a lake, well closed at the head of the canal near Rocky-Shore.[5] Then they instructed the brother and sister as to the various things they would eat. They showed them all kinds of sea food. They mentioned bad things not to be eaten. They told them, "Use an instrument like this, tied along its shaft, for catching the big things of the sea". Because of that, sure enough, the whaling harpoon is tied along the shaft.
>
> The two quarrelled. The shaman became angry and scattered the river and channel everywhere. That is why the islands are scattered about now.[6] What had been a lake went into the ground, which is why Water-on-Wall never dries up, for they say there is a lake inside Hawkins [Benson] Island. That is why we have our seats at the rear end of the house. They were seated by the rear house post. It is because we were created there by my ancestor. The old man and the shaman left things so; before they went up to the sky, they finished instructing the two they had created. "You must pray to me at times for I will always hear what you want," he told them before he went. Many came from the two, being born of the womb, as a tribe which grew up fast. From the start they built a house, and that house has been copied. They came to have a canoe. Their adzing tool for felling trees was an elk bone. They got sea mammal spears. They started to hunt hairseals. They hunted porpoises. The spear line was made of hairseal guts. They hunted sealions. The tribe became numerous, reaching to the other end of the village on Hawkins [Benson] Island. They hunted sea otter. They clothed themselves in sea otter skins.
>
> The tribe was for a while called Cut Tribe (Chichuu), derived from the fact that the girl saw the old chief cut the front of this thigh. Originating from that they came to be called the Tsishaa Tribe. It became a big tribe. There were many sea otters all over

[1] In another version of this story (Golla 2000:138–39), told to Sapir by Saayach'apis in 1910, the Day Chief is identified as Kapkimyis. This figure appears in various Tseshaht stories as either the brother or son of Kwatyat, the primary creator or transformer of the Barkley Sound Nuu-chah-nulth (St. Claire 1998:8).

[2] Naasiya7atu

[3] Naasayilhim

[4] *Tlakishkuuwa,* a pinnacle rock on the northeastern end of Reeks Island, at the northeastern edge of the Broken Group.

[5] *Mukw'aa7a,* on Turret Island

[6] This refers to the origin of the Broken Group islands.

> the passes. There was a constant noise of kiikkiik as the sea otter broke up mussels. People would come home with five or six sea otters in a night when they went hunting. When Day-Dawn was first created, he was given a war club with blood along this edge. He was told, "You will keep it on the beach and your tribe will never die out in future generations" (Sapir and Swadesh 1955: 52–53)

Saayach'apis' account notes that the Tseshaht "became numerous" and the village grew large. As the population increased, separate named component groups emerged. The basic autonomous socio-economic unit in Nuu-chah-nulth society is termed a local group, which Drucker (1951:220) has described as:

> … centering in a family of chiefs who owned territorial rights, houses, and various other privileges. Such a group bore a name, usually that of their 'place' . . , or sometimes that of a chief; and had a tradition, firmly believed, of descent from a common ancestor.

Each local group was composed of a number of subgroups known as *ushtakimilh*, each with a chief at its head, representing different descent lines from the original founding ancestor.

Sapir's Tseshaht informants described three *ushtakimilh* resident at Ts'ishaa. The head chief (called the *taayii hawilh*) was from the highest-ranking *ushtakimilh*, the *Ts'ishaa7ath*, who "owned the island" (Sapir 1910–14, notebook IV: 34) and whose name was applied to the entire local group. The other groups came from them, eventually moving to adjacent beaches as the main portion of the village became too crowded. Along the western portion of the village were the *Lha7ash7ath*, who took their name from a large rock which was shaped like an overturned carrying bag or basket (*lha7aash* in the Nuu-chah-nulth language) (Sapir 1913, notebook XV:41; St. Claire 1991: 140). At the eastern end of the village were the *T'ukw'aktl'a7ath*, whose name was said to mean "narrow mouth (bay) in the rocks," referring to their location at the head of a small cove (Sapir 1913, notebook XV: 41; St. Claire 1991: 141). Continued over-crowding caused the chiefs to build houses at nearby Himayis, where they sent their slaves and low class people to live (Sapir 1913, notebook XVII:1). This eventually gave rise to a fourth *ushtakimilh*, the *Himayisath* ("Gliding-about-Beach people"; Sapir and Swadesh 1955: 386, 413). Himayis and Ts'ishaa would have been considered part of the same village community, although their physical separation has resulted in designation as two separate archaeological sites. Each *ushtakimilh* had its own house or houses in the village. Although the exact number and location of the houses are unknown, Sapir's Tseshaht informants indicated the general area of the village occupied by each *ushtakimilh* (Figs. 5 and 6: 3–6).

Originally the *Himayis7ath* were not considered a separate *ushtakimilh* as they had no chief of their own and continued to be members of their original households at Ts'ishaa. Eventually a man named Kwaayaats'ikshilh, an outsider who drifted into Ts'ishaa from "an unknown place," was made chief of the *Himayis7ath* by the Tseshaht *hawilh* (Sapir l913, notebook XVII:1). Although this marked the beginning of the *Himayis7ath* as a fully formed *ushtakimilh*, they remained the lowest ranked Tseshaht component group. Additionally, as they were an amalgam of people from the other *ushtakimilh*, they were the first Tseshaht *ushtakimilh* unable to trace their origin back to a specific child of Naasiya7atu and Naasayilhim, the first man and woman in the Tseshaht origin story. In the numerous listings of the ranked order of the Tseshaht *ushtakimilh* given by various Sapir informants between 1910 and 1922, the *Himayis7ath* are seldom mentioned and if referred to are always of the lowest rank. This persistent low status is confirmed by Sapir's informants when they stated that the *Himayis7ath* never had any high level potlatch seats in their own right, although at one point their chief was given a personal right to such an honour by his grandfather, the *Ts'ishaa7ath* head chief. Somewhat unusually, this privilege belonged to him as an individual and was not a perpetual right bestowed upon the *ushtakimilh* as a whole, a confirmation of the enduring low status of the *Himayis7ath* (Sapir 1913, notebook XV:45a).

In 1913 Saayach'apis provided Sapir with a detailed description of a house which once stood at Ts'ishaa (Sapir 1910–14, notebook XV: 39, 39a, 40a). As this was the home of the head chief of the highest-ranking *ushtakimilh*, the *Ts'ishaa7ath*, it stood somewhere in the central portion of the site. On the side of the house facing the beach two painted Thunderbirds faced each other, each with an image of the Lightning Serpent (*hiy'itl'iik*), which served as the Thunderbird's whaling harpoon, on top (Fig. 7). Two large cod-fish flanked

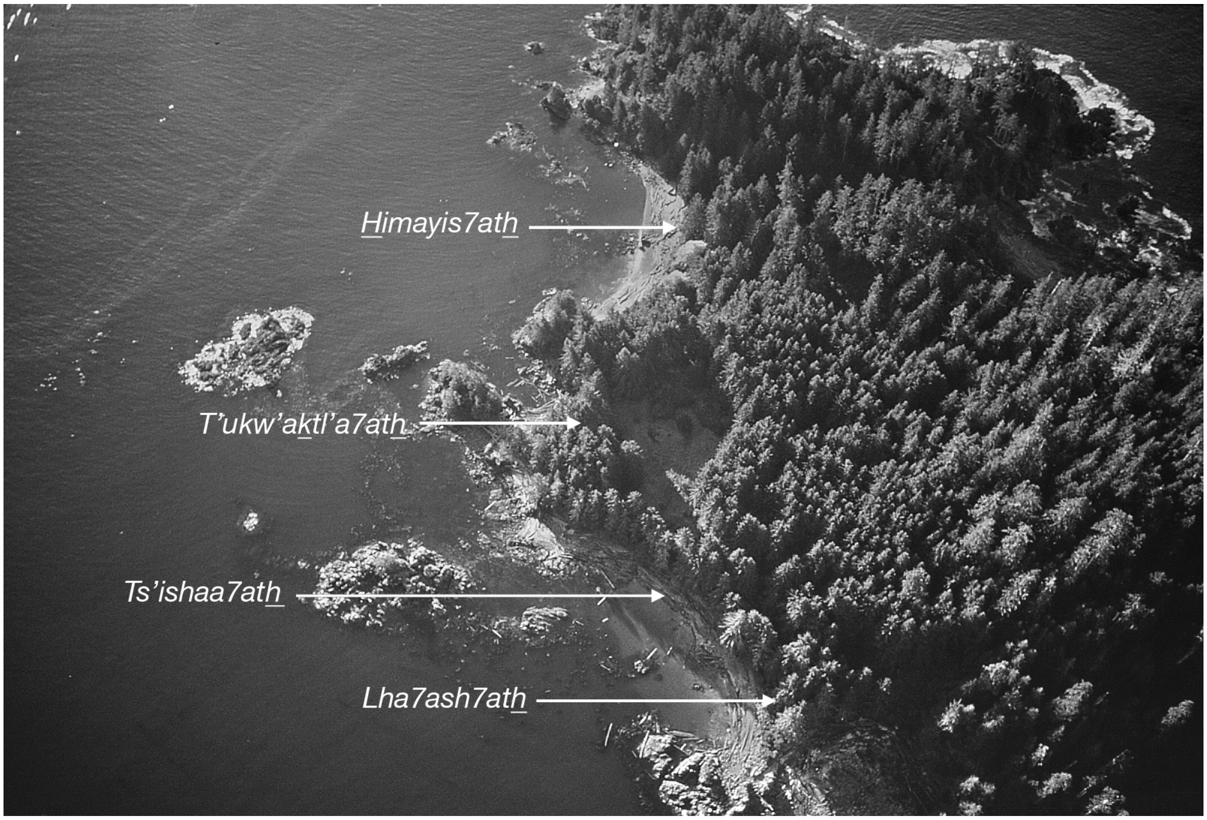


Figure 5. Aerial view of Benson Island showing the locations of the four *ushtakimilh*.

a large round hole which provided an entrance to the house. Ten smaller round holes cut through the boards represented moons. Inside, the chief's whaling vision was painted on a rear wall screen. This displayed two pairs of Thunderbirds and Lightning Serpents, with each Thunderbird holding a whale; lines representing hail indicated the storm in which this vision was experienced (Fig. 8). The main centre beam which ran the length of the house, known as *hast'ahasanulh* ("bright star all along it," referring to the Milky Way), displayed cut-out and painted circles representing stars, as well as painted geese in flight. In the middle rear of the house, the post holding the centre beam was carved to represent the first Tseshaht man, who held a chiefly whalebone war club (*ch'it'uul*) and had a carved and painted crescent moon on his forehead. Another support post carved in the shape of a man was closer to the front of the house, facing the rear. This image represented Kapkimyis, who created the first man and woman, holding a whale in his hands. In addition, the vertical faces of the sleeping platforms lining the inner walls of the house had full moons cut through at different places and sets of painted wolves facing each other. Circles representing full moons were cut through the roof boards as smoke holes over each of the four fires inside the house.

The ethnographic accounts indicate that the chiefs at Ts'ishaa were great whalers. The rocky islets around Benson Island, particularly the Pigot Islets (*Ts'ishaanuu7a*; Fig. 6:1) and Sail Rock (*Ts'utsiit*; Fig. 6:12), were favoured whaling locations, as well as good places to hunt sea otter (Sapir, 1913, notebook XVII:24; St. Claire 1991:140–2). Sapir's notes contain numerous references to whales being brought onto the beach in front of Ts'ishaa. The whales were tied to a rounded rock sticking up on the beach, called *Kapkimyis* after the creator of first man and woman, to prevent the carcasses from drifting away. The pass in front of the village, between Benson Island and Clarke Island, was known as *hamuta*, meaning "bones" (St. Claire 1991:140). This refers to stories of great Tseshaht whalers who attempted to fill the pass with the bones of the many whales that they had taken, as a monument to their whaling successes. Saayach'apis told Sapir of the exploits of a great Tseshaht hunter of gray (*maa7ak*) whales, who took ten whales at a time, stating: "The passage at Ts'isha' got dry on account of [being filled up with] the bones of *ma?ak* whales" (Golla 2000:150). A contemporary

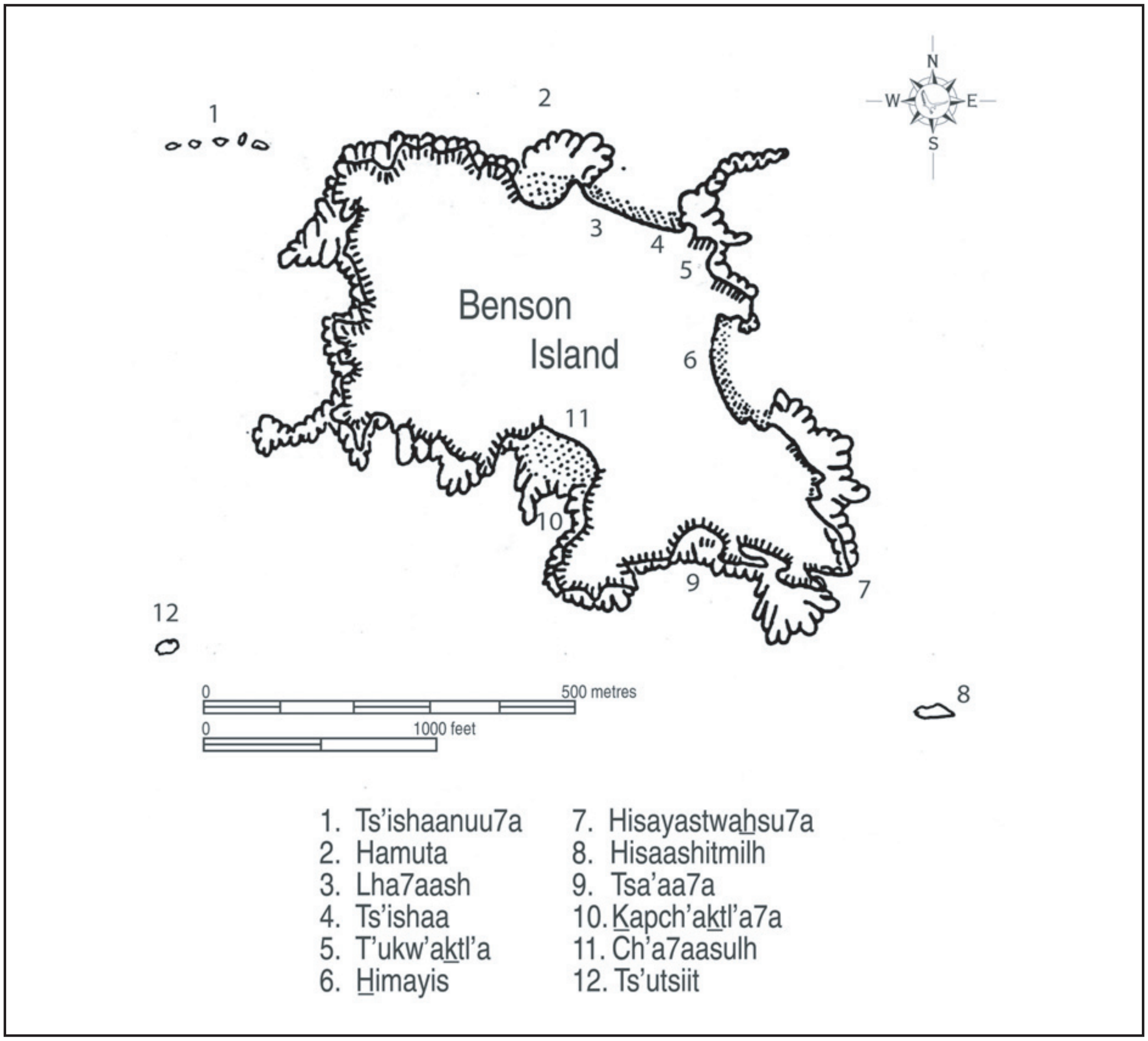


Figure 6. Map of Benson Island with known place names including the locations of the four *ushtakimilh (Nos. 3-6)*.

Tseshaht informant, Mabel Taylor, insisted that the meaning of their name relates to "stinking" or "rancid smell," referring to the odour of whales rotting on the beach at Ts'ishaa (St. Claire 1983; 1991:45), although Saayach'apis derived it from *Ch'ichu7ath*, translated as "cut-person," referring to the creation story where the shaman cut his thighs (Sapir and Swadesh 1955: 52).

Changes to the Tseshaht Local Group

As time went on and the population grew, two additional *ushtakimilh* were added to the Tseshaht local group, bringing the total to six. Sapir's Tseshaht informants described the formation of these new social units in considerable detail.

The Creation of the Naanaatsukwilh7ath

Sayaach'apis described a second instance of a stranger or "foreigner" arriving at Ts'ishaa and being welcomed and accorded a high status position (Sapir 1913, notebook XV:45a). This occurred immediately after a great flood had inundated the village, temporarily causing its abandonment. Soon after the water receded, allowing the Tseshaht to return to Ts'ishaa, a canoe with a number of people in it appeared and the Tseshaht *taayii hawilh* (head chief) invited them ashore. They spoke an unknown language and whenever the Tseshaht chief asked their leader a question he would just answer with the word *Naanaatsukwilh* and so this was given to him as his name. As the

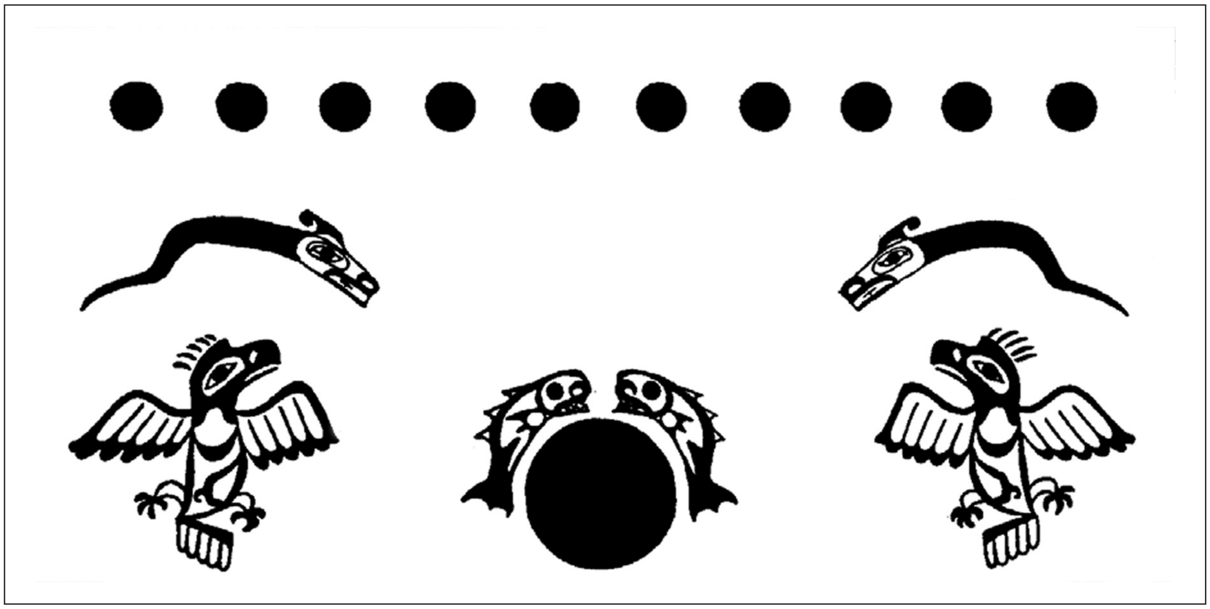


Figure 7. Painted images on the head chief's house that once stood at Ts'ishaa as described by Tom Saayach'apis to Edward Sapir in 1913.

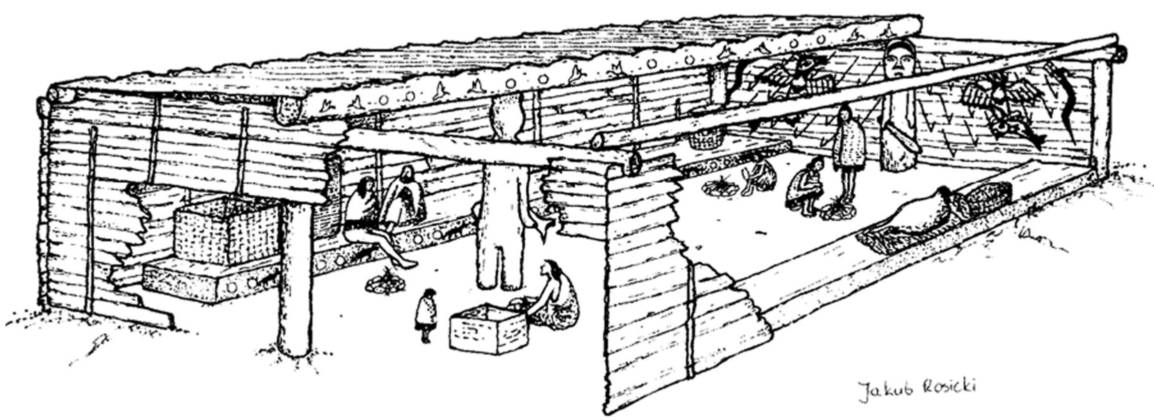


Figure 8. Artist's interpretation of inside of head chief's house at Ts'ishaa as described by Tom Saayach'apis to Edward Sapir in 1913.

Tseshaht re-established themselves at Ts'ishaa, Chief Tlatlaa<u>k</u>ukw'ap:

> … began to rejoice in his mind then, because they had not lost their home. He started to build a house in the place where it was before. When they had been there for four days he saw a canoe, and brought the men up the beach. "You build a house" said Lalaqok!wap [Tlatlaa<u>k</u>ukw'ap] … "build a house! Put yours here" … The one that came to live with them was called Nanasukwil [Naanaatsukwilh]. Thus began a new family line. The Ts!icya atH[a] [Tseshaht] became numerous again. (Sapir 1910, notebook II)

Naanaatsukwilh was instructed to build a house right next to that of the Tseshaht *<u>h</u>awilh*, with their doors facing each other (Sapir 1913, notebook XV:45a). Eventually this outsider married Naasayilhim, the *<u>h</u>awilh's* daughter, and with the birth of their son, a new *ushta<u>k</u>imilh*, the *Naanaatsukwilh7at<u>h</u>*, was created (Sapir l913, notebook XV:46). An indication of the high rank of the *Naanaatsukwilh7ath*, and the lack of a direct heir of the *hawilh*, is that the son of Naanaatsukwilh and Naasayilhim was given the right to receive the first gift in potlatches by inheriting the seat of his grandfather (the *hawilh*) at the center rear of the house. Unlike other Nuu-chah-nulth groups, where the highest ranking seat was in a rear corner (Drucker 1951:71), among the Tseshaht it was located at the center rear of the house (opposite and facing the door). This distinctive feature comes from their creation story, as it commemorates where Kapkimyis stood when he created the first Tseshaht man and woman (Sapir 1913, notebook XV:47a).

Oral traditions of sudden and dramatic floods, which inundated coastal villages and scattered human populations, are widespread among the Nuu-chah-nulth and their neighbours (McMillan and Hutchinson 2002). These occurrences are not related to the biblical flood tradition and clearly predate the arrival of Europeans. They likely refer to past seismic events, as it is known that great earthquakes, with a magnitude of 8 or larger, have been a recurrent hazard in this region over the last 3000 years, with the most recent occurring in AD 1700 (Clague 1997; Hutchinson and McMillan 1997). Such powerful earthquakes would have produced great tsunamis, possibly 10 to 15 metres in height, causing widespread damage and loss of life in the low lying Nuu-chah-nulth coastal villages. Undoubtedly, these catastrophic events would have caused great social upheaval, perhaps destroying entire local groups or reducing populations to levels that were no longer viable, forcing the survivors to seek shelter among neighbouring groups. The devastating impact of these past seismic events is evident in an oral tradition of the Huu-ay-aht (*Huu7ii7ath*), who occupy the southeastern portion of Barkley Sound. An earthquake, followed by a "big wave," destroyed a village and swept the people out to sea; only those who had built their house on higher ground survived (Arima et al. 1991:230–31).

The story of Naanaatsukwilh, specifically linked as it is to his immediate post-flood arrival, may well relate to such a seismic event and subsequent social dislocation. At an earlier time, Kwaayaats'ikshilh, who became chief of the *Himayis7ath*, is also said to have drifted into Ts'ishaa after a flood. Perhaps these two men were the leaders of surviving remnants of once autonomous groups that sought protection and assistance from the Tseshaht. Social upheaval caused by an earthquake and associated tsunami certainly provides a plausible explanation for how Naanaatsukwilh, a stranger who initially spoke an unintelligible language, could have been accepted into Tseshaht society, married the *hawilh's* daughter, and started a new *ushtakimilh*, which, with the birth of his son, became the senior component group of the Tseshaht.

The Creation of the Mukw'aa7ath

The Nuu-chah-nulth system of inheritance was based on the concept of primogeniture. Chiefly prerogatives, rights and rank were typically passed on to the oldest son. However, such hereditary rights could be acquired from both the paternal and maternal families. Although personal names and prerogatives associated with ceremonial activities could be used by all with demonstrable rights, regardless of location of residence, chiefly rank and authority could only be exercised by living within the territory to which these rights pertained.

Daughters, if the oldest offspring, held the highest rank but could never assume the role and obligations of a chief. Typically chiefly families married outside their natal group in order to create economic, ceremonial and military alliances with neighbouring peoples. Usually daughters moved away to live with their husband's family, becoming members of that group and losing their senior rank in their natal group. A chief without a son could choose to pass his position to a younger brother or a nephew. If no brothers or nephews existed, a situation which became more common in the period of severe population decline following contact with Europeans, the problem of the continuation of the descent line became more complex.

A chief's position could be passed on through a daughter who remained in her father's village after marriage. In such a marriage the husband would come to live with his wife's family. Such a practice was somewhat unusual and undoubtedly caused some loss of prestige for the husband's family, but this was more than compensated for by the knowledge that any son from the marriage would inherit the chieftainship. This method of maintaining the continuity of the chief's descent line could result in the formation of a new *ushtakimilh* based upon the descendants of a son resulting from the marriage. This is known to have occurred among a number of Barkley Sound Nuu-chah-nulth groups, and was the way in which the *Naanaatsukwilh7ath* of the Tseshaht came into being.

A slightly different scenario occurred with the creation of the *Mukw'aa7ath*, the sixth Tseshaht *ushtakimilh*. Tlatlaakukw'ap, later called Naasiya7atu, the head chief (*taayii hawilh*) of the *Ts'ishaa7ath* had three daughters and a son, Taapush'in7is. Shortly after Tlatlaakukw'ap passed his chieftainship to his son, Taapush'in7is died childless. Tlatlaakukw'ap, who had been out whaling, saw evidence of a funeral fire when he rounded the point at Ts'ishaa and immediately realized that his son had died (Golla 2000:154–155; translation from Sapir notebook II, "Legendary History of the Tsishaht"). As an expression of grief over the loss of his son, Tlatlaakukw'ap destroyed his whaling gear on the beach and refused to go up to his house. Instead, he left Ts'ishaa and, accompanied by some family members and a number of commoners, built two houses at *Mukw'aa7a* on nearby Turret Island. With the establishment of a new village and the birth of additional children to Tlatlaakukw'ap, a new *ushtakimilh*, the *Mukw'aa7ath*, was created, taking its name from that of the new village.

Traditionally a chief could not retain his position if he did not reside in the place where that rank and authority applied. Tlatlaakukw'ap relinquished his position as *taayii hawilh* by moving to *Mukw'aa7a*. As he had no surviving son of his own, he could pass the chieftainship to a younger brother or to a son of his elder daughter Naasayilhim, who married a secondary chief within the *Ts'ishaa7ath*. However, she only had a daughter and no sons. The second daughter, Tuutayilhim, also married a *Ts'ishaa7ath* man (Haayuupinuulh) and had a son, Wiihswisan7ap. It was through Tuutayilhim to this grandson that Tlatlaakukw'ap passed his chieftainship. [7]

> Tutayilim [Tuutayilhim] came to own the house full of slaves. Tutayilim got everything then, all that was left there in the house. Tutayilim had a child then. He then became the Ts'ish?atH Chief. He got the place that had belonged to N'a'siya!ato [Naasiya7atu][8] and the beach, while he did not get the land. (Golla 2000:155, translated from Sapir 1910, notebook II, "Legendary History of the Tsishaht": 3–159)

From this account it is clear that Tlatlaakukw'ap passed ownership of his house and its contents to his daughter Tuutayilhim. This act symbolizes the passing on of the right to be leader of the *Ts'ishaa7ath ushtakimilh*, the most highly ranked in the Tseshaht local group. As women could not be chiefs, regardless of their high rank, this refers to Tuutayilhim receiving the chieftainship as "dowry," the position and its associated rights to be held until the birth and maturation of a son to whom the title and its prerogatives would be passed. With the chieftainship went Tlatlaakukw'ap's "place," meaning his hereditary right to sit in a specific ranked position during ceremonial or potlatch activities.

The unusual nature of such a transfer of rank and authority and its perceived difficulties is shown when, at least initially, only leadership of the *ushtakimilh* and certain ceremonial prerogatives were transferred. Sapir's informant stated that Tuutayilhim got the rights to the "place" that had belonged to Tlatlaakukw'ap and the beach, but not the "land". The word "land" refers to the entire territory, called the *hahuulhi*, of the local group under the stewardship of the head chief. Although he was no longer residing in Ts'ishaa village, the center of Tseshaht *hahuulhi*, and consequently could not remain *hawilh*, Tlatlaakukw'ap did not assign this position to Haayuupinuulh, his daughter's husband, as a sort of regent for his son, presumably as he was not close enough to the senior descent line. Instead he appears to have followed the accepted practice of temporarily assigning these duties to his younger brother, Kwiisaahitchilh.

Elsewhere in Sapir's notes ("Legendary History of the Tsishaht" 1910, notebook 2:3–159, translated by Golla 2000:161), Kwiisaahitchilh is said to have given Wiihswisan7ap, Tuutayilhim's son, "land … and the rights to the *chakwa'si* [*tsakwaasi*]." The *tsakwaasi*, a whale's dorsal fin and the surrounding saddle of blubber and meat, was an important prerogative of the head chief. Thus, once Wiihswisan7ap was of a suitable age, his great-uncle Kwiisaahitchilh transferred to him the *hahuulhi* and the associated ceremonial honours and privileges of the Tseshaht head chief, clearly representing the final transferal of powers.

Unlike the case of the previously mentioned *Naanaatsukwilh7ath*, no new *ushtakimilh* was created with the birth of Wiihswisan7ap. His parents were both members of the *Ts'ishaa7ath ushtakimilh* (Golla 1987:96) and the chieftainship of the *ushtakimilh* was passed to him through his mother. The descent line and its name continued as before. Of course, Tlatlaakukw'ap's departure and residence at *Mukw'aa7a* did result in the creation

[7] The present Tseshaht hereditary Chief, Ed Shewish, is a direct descendant of Wiihswisan7ap.

[8] The Chief formerly called Tlatlaakukw'ap.

of a new *ushtak̲imilh*, the *Muk̲w'aa7ath̲*, the first not to reside at the village of Ts'ishaa.

Post-Contact Socio-Political and Territorial Changes

Shortly following contact with Europeans in the late eighteenth century, dramatic changes restructured much of Nuu-chah-nulth social and economic life. Drastically reduced populations, a result of introduced diseases and intensified warfare, forced amalgamations of neighbouring groups. This required new economic strategies to deal with much larger combined territories. Absorption of another group and its territory through warfare (*his7ukt*; "obtained by striking") was relatively straightforward, as all territories, possessions and ceremonial prerogatives belonging to the *h̲awilh* of the defeated group were transferred to the head chief of the victors. Secondary chiefs, the heads of *ushtak̲imilh*, could likewise acquire possessions and privileges from their captured or killed counterparts. However, peaceful amalgamations were a far more complex situation. The *taayii h̲awilh* of the subordinate member in the merger would have to accept a lower position as a secondary chief. Difficult issues that had to be resolved include the ranking of secondary chiefs and their *ushtak̲imilh*, as well as ownership of territorial and ceremonial rights. Such mergers were delicate and complicated affairs, which undoubtedly created considerable social tension until all the vital issues were resolved.

Original Tseshaht Territory

Precisely demarcated territorial boundaries are a characteristic feature of Nuu-chah-nulth land use. These generally involve prominent features of the landscape and lines of sight between them, although Sapir's informants also described the use of yew wood posts approximately one foot in diameter and four feet high, called *kakimiitt'u* ("to be evident"), as boundary markers (Sapir 1914, notebook XXIV:6). They also described a flat rock held up by a post on a point of land (1914, notebook XVIII:2a). Blenkinsop (1874:23) stated that two immense boulders on top of each other with a flat rock in between were used to mark the later Tseshaht – Uchucklesaht (*H̲uuchuk̲wtlis7ath̲*) boundary at Nob [Chup] Point, near the entrance to Alberni Inlet. However, territorial boundaries were not static but changed through time, reflecting the rise and fall of socio-political fortunes and the processes of amalgamation and fissioning of groups.

The exact extent of Tseshaht territory prior to post-contact expansion and amalgamations is difficult to discern precisely. A 1982 archaeological survey of the Broken Group Islands identified ten large midden sites (or clusters of sites) thought to represent the location of major villages (Haggarty and Inglis 1985:38). Their extent and depth are such that they cannot all belong to the same local group, as one group alone could not have used and built up so many large midden deposits in such close proximity. The accounts of Sapir's informants and the information supplied by more recent elders make it clear that the Broken Group Islands and the adjacent Barkley Sound shoreline were the territories of numerous autonomous groups which one by one disappeared or were absorbed by the Tseshaht during the late eighteenth and early nineteenth centuries.

Prior to historic expansion, Tseshaht territory appears to have been restricted to the southwest corner of the archipelago, centering upon the villages of Ts'ishaa and Muk̲w'aa7a on Benson and Turret Islands. Precise territorial delineations recorded by Sapir in 1914 (notebook XXIV:4) relate to a later period when some amalgamation of groups had already occurred. However, these same accounts do contain a description of the boundary with the *Mak̲tlZ̲ii7ath̲,* the local group which occupied the outer islands of the Broken Group to the east of the Tseshaht. The Tseshaht – *Mak̲tlZ̲ii7ath̲* interface began with the island of *iitsmakiits*, today a small unnamed island to the north of Batley Island (Fig. 9). To mark the location of the boundary, a strip down the center of the island was cleared of vegetation, with Tseshaht land to the west and *Mak̲tlZ̲ii7ath̲* to the east. From this island the boundary continued to the northeast, passing just to the west of Camblain Island (*Kw'a7atuk̲ulhh̲*) and the Faber Islets (known as *Aayapiiyis*) (Sapir 1914, notebook XXIV:4). At this point the boundary is uncertain but probably turned to the west along Thiepval Channel to include Turret Island (St. Claire 1998:20). The adjacent cluster of Willis, Turtle, Chalk and Dodd islands immediately to the north probably was not part of the original Tseshaht territory (*h̲ah̲uulhi*), as Dodd Island contains a large midden and a complex of smaller ones which was likely another local group's village. The Tseshaht would not have needed or been able to use three large villages (Ts'ishaa, Muk̲w'aa7a, and *Aalhachmak̲is* on Dodd Island) in such close proximity. If this island cluster was indeed the

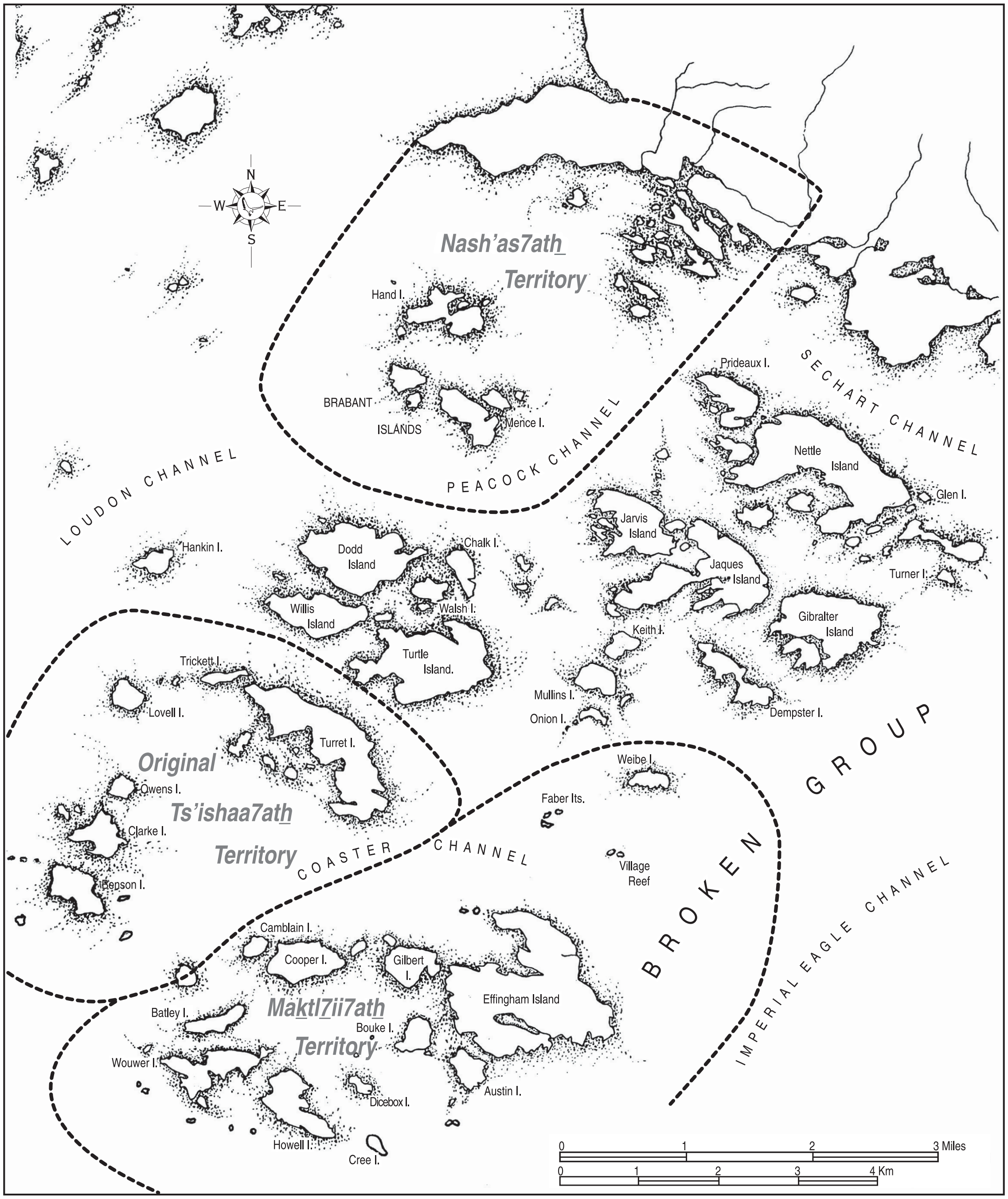


Figure 9. ***Ts'ishaa7ath, Maktl7ii7ath*****, and** ***Nash'as7ath*** **original territories.**

hahuulhi of another autonomous local group, its name and history have not survived.

Amalgamation with the Maktl7ii7ath

The first Tseshaht territorial expansion through the peaceful absorption of another local group involved the *Maktl7ii7ath*. Although there are no oral traditions of conflict between the Tseshaht and the *Maktl7ii7ath*, it was warfare that caused their amalgamation. The *Hach'aa7ath*, who occupied the northeastern Broken Group Islands and adjacent sections of the northern Barkley Sound shoreline, were aggressive and expansionistic, seizing territory from neighbouring Barkley Sound groups such as the *A7uts7ath* of Effingham Inlet and the *T'umaktli7ath* in the northeastern Broken Group. They also raided considerable distances, both north and south of Barkley Sound (St. Claire 1991:28). One of their long list of conflicts involved the *Maktl7ii7ath*. Probably in the latter years of the eighteenth century, the *Maktl7ii7ath* suffered heavily at the hands of the *Hach'aa7ath* and were so reduced in population that only 15 adult men remained (Sapir 1913, notebook XV:47). In an attempt to ensure their survival, the *Maktl7ii7ath* sought protection with their immediate neighbours, the Tseshaht, and ceased to be an autonomous local group.[9]

The *ushtakimilh* of the *Maktl7ii7ath*, although greatly reduced in population, retained their internal ranking and could host potlatches. However, they were not provided for in the seating scheme of the amalgamated Tseshaht (Sapir 1913, notebook XV:41). In order to more fully integrate themselves into their new social reality, the two senior *ushtakimilh*, the *Nach'imuuwas7ath* and the *Maktl7ii7ath* proper, potlatched the Tseshaht, asking to be given seats within the broader ceremonial structure. As a result of this potlatch, the *Maktl7ii7ath* were accorded seats at the left hand side of the rear of the house "so that no Ts!icá'atH[a] [Tseshaht] proper would be displaced" (Sapir 1913, notebook XV:47a). Even with this further step in the merger of the *Maktl7ii7ath* and the Tseshaht, their integration was not complete, as the *Maktl7ii7ath* head chief retained drift rights throughout his former *hahuulhi*. This was an important distinction which elevated his status above the chiefs of the other local groups which later joined the Tseshaht.

Amalgamation with the Wanin7ath and Nash'as7ath

The *Nash'as7ath* were centered at their village of *Ukwatis* on Sechart Channel, at what is today the Tseshaht reserve of Equis. Their territory (Fig. 9) included the western portion of Sechart Channel and a number of islands in the northwestern Broken Group. Their merger with the Tseshaht followed that of the *Maktl7ii7ath*, as is shown by comments of Sapir's informant who, when describing the *Maktl7ii7ath* amalgamation, stated:

> All this happened before the T!icya'atH[a] [Tseshaht] moved to Hikwis [Equis]. The Nash!as'atH[a] [*Nash'as7ath*] were not yet incorporated. The Natcimwasa-tH[a] [*Nach'imuuwas7ath*], MakLai'atH[a] [*Maktl7ii7ath*] and Wanin'atH[a] [*Wanin7ath*] formed one with the T!icya'atH[a] on the island of T!icya [Ts'ishaa] (Sapir 1913, notebook XV:47a)

The *Wanin7ath* mentioned in this reference were a relatively recently formed *Nash'as7ath ushtakimilh* with very close ties to the *Maktl7ii7ath*. Oral traditions recounted to Sapir indicate that they were created when a secondary chief of the *Maktl7ii7ath* called Huhinikwup married the daughter of the *Nash'as7ath hawilh*. Huhinikwup's marriage was somewhat unusual in that he chose to reside in his wife's village of *Ukwatis*[10]. The inducements to do so were considerable. The *Nash'as7ath taayii hawilh* gave him the creek called *Wanin* as dowry. Such a creek would have been very attractive to someone whose group's territory consisted of small exposed offshore islands with no salmon streams and limited sources of fresh water. Also, as the *Nash'as7ath hawilh* had no sons, by taking up residence at *Ukwatis*, Huhinikwup ensured that any son he might have would inherit this position. When eventually a son was born a new *ushtakimilh* (the *Wanin7ath*) was created, taking its name from the creek (Sapir 1913, notebook XV:48a).

The *Wanin7ath* retained close ties with their *Maktl7ii7ath* kin, as indicated by references to them participating in mutual feasting (Sapir 1913, notebook XV:48a). However, it is somewhat puzzling that, following disastrous warfare with the *Hach'aa7ath*, the *Wanin7ath* joined the Tseshaht as part of the *Maktl7ii7ath*, rather than the *Nash'as7ath*. Two of Sapir's informants indicated that the *Wanin7ath* held high rank within the *Maktl7ii7ath* (Sapir l913, notebook XV:47), although it does not seem possible that an *ushtakimilh* could have a place in the social structure of two separate and autonomous local groups. However, a possible explanation exists.

A war which eventually resulted in the destruction of the *Hach'aa7ath* was precipitated by a quarrel between the *Hach'aa7ath* and the Toquaht (*T'ukw'aa7ath*) over the possession of a small cove, called *Tl'aatl'aathtsuwat'a7a*, between Lyall Point (*Aatushap*) and *Hiikwis* (Equis) village on Sechart Channel (St. Claire 1998:32). As the location of *Tl'aatl'aathtsuwat'a7a* (Fig. 10:10)

[9] Golla has reconstructed a genealogy based upon Sapir field notes that suggests this union occurred between 1780 and 1800 (pers.com, 1983)

[10] Such an uxorilocal marriage is called *lhuchchi* by the Nuu-chah-nulth.

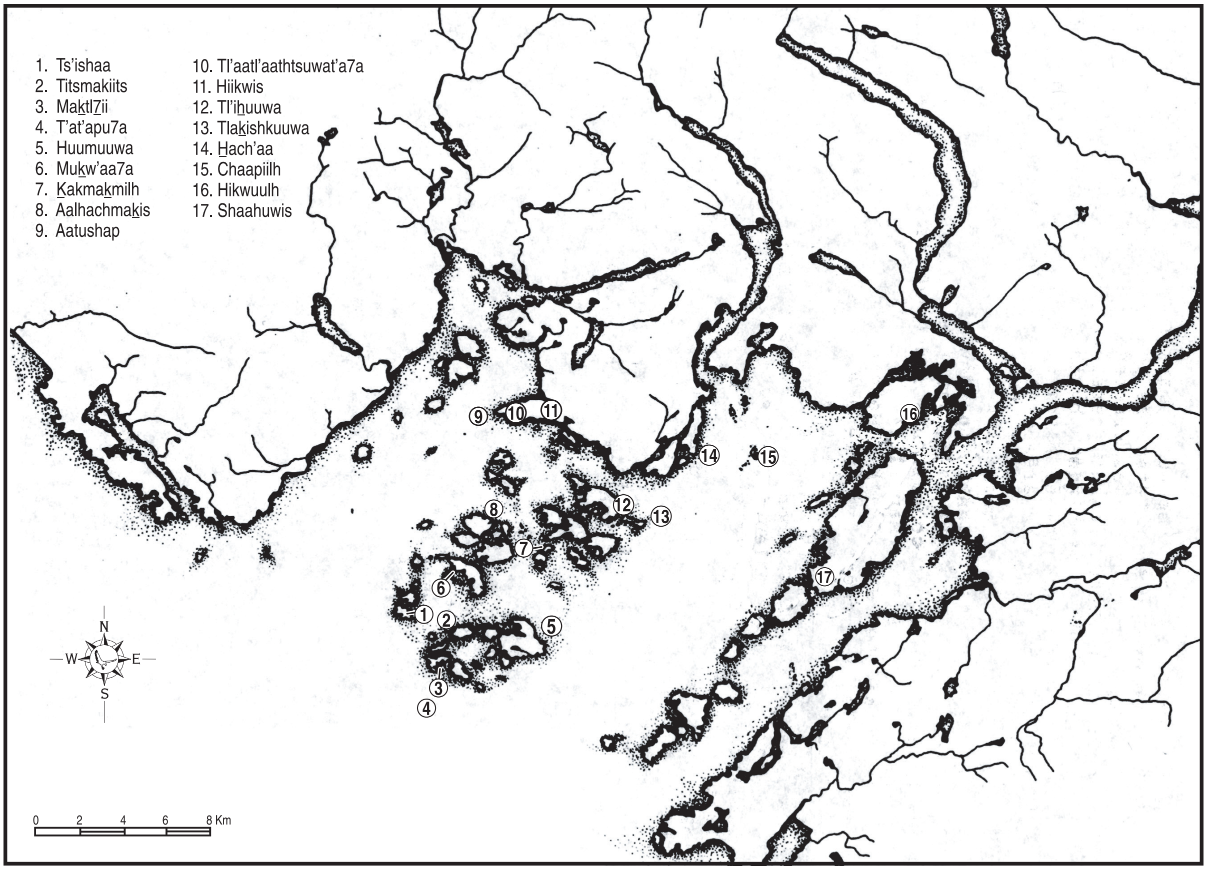


Figure 10. Barkley Sound showing place names mentioned in the text.

is well within *Nash'as7ath* territory, the Toquaht – *Hach'aa7ath* struggle over it only makes sense if the *Hach'aa7ath* had previously subjugated the *Nash'as7ath*. If this was the case, the *Wanin7ath* may have moved to join their *Maktl7ii7ath* relatives in order to escape *Hach'aa7ath* domination, only to suffer again their at hands when the *Maktl7ii7ath* found themselves at war with the *Hach'aa7ath*. The *Maktl7ii7ath* – *Wanin7ath* were decimated in the ensuing conflict and were forced to seek the protection of the Tseshaht. Although no oral traditions persist of war between the *Nash'as7ath* and the *Hach'aa7ath*, such a conflict does offer the most plausible explanation for the *Wanin7ath* enigma. This explanation assumes that the *Nash'as7ath* remained under *Hach'aa7ath* control for a period after the *Maktl7ii7ath* – *Wanin7ath* amalgamation with the Tseshaht.

Sapir states that the *Wanin7ath* held the second highest position among the *Maktl7ii7ath ushtakimilh* (Sapir 1913, notebook XVII:1). However, when the *Wanin7ath* and the *Maktl7ii7ath* joined the Tseshaht at the village of Ts'ishaa, only the *Wanin7ath* were assigned potlatch seats. This was a result of their close kinship, as the chief of the *Wanin7ath* was married to the daughter of Uutsaxaayas, the Tseshaht *taayii hawilh*. Uutsaxaayas, representing the *Naanaatsukwilh7ath ushtakimilh* of the Tseshaht, appears not to have had a son as a direct heir, for upon the absorption of the *Wanin7ath* he assigned them the potlatch seat of the *Naanaatsukwilh7ath* (Sapir 1913, notebook XV:48a). In this manner the *Wanin7ath* were completely integrated within the Tseshaht social structure.

It appears that the *Nash'as7ath* coalesced with the Tseshaht during the *Hach'aa7ath* hostilities with the Toquaht and their allies. As the *Hach'aa7ath* faced attacks from a number of enemies, they likely concentrated their forces in the center of their territory, at their village of *Hach'aa* and its associated defensive site of *Tayaanita* on the northern Alma Russell Island (Fig. 10:14). This withdrawal and preoccupation with the alliance's attacks may have enabled the *Nash'as7ath* to reassert some independence and freedom of action, possibly approaching the Tseshaht about protection and amalgamation. Because European firearms still had a very limited distribution when the war began, *Nash'as7ath* union with the Tseshaht must have been around the last decade of the eighteenth century. Support for this time frame comes from the assertion of Sapir's informant Sayaach'apis, who was born in 1843 (St. Claire 1998:36), that the *Nash'as7ath* head chief at the time of the amalgamation was his maternal great-grandfather.

Sapir's informants stated that the mother of Yaayuukwi7a, the *Nash'as7ath tyee hawilh*, was part *T'ukw'aktl'a7ath*, one of the original Tseshaht *ushtakimilh* which had died out. Yaayuukwi7a and the *Nash'as7ath* were then given the *T'ukw'aktl'a7ath* potlatch seat upon their amalgamation (Sapir 1913, notebook XV:50). Thus both the *Nash'as7ath* local group and the *Wanin7ath* *ushtakimilh* lost their autonomy and their *hahuulhi* was absorbed into that of the Tseshaht. However, they retained their names and positions of relative importance by replacing two of the original Tseshaht *ushtakimilh* (the *T'ukw'aktl'a7ath* and *Naanaatsukwilh*) which had died out. In this way their absorption into the Tseshaht was complete, minimizing any potential social tension caused by such a merger. The lands of the *Uukwatis7ath* and *Tl'asimiyis*, two *ushtakimilh* of the *Nash'as7ath*, and the *Wanin7ath* now "belonged" to the Tseshaht Chief.

> These three tribes had their own secondary chiefs and places to live but owned no country. They were masticim[11] of the Ts!icá'atH^{a} and always moved where the Ts!icá'atH^{a} moved. (Sapir 1914, notebook XXIV:4)

Amalgamation with the Hach'aa7ath

The *Hach'aa7ath* occupied the northeastern Broken Group Islands and an adjacent section of Barkley Sound shoreline that included Julia Passage and the Alma Russell Islands (Fig. 11) (Sapir 1914, notebook XXIV:5; St. Claire, 1991:28). They were described by Sapir's informants as the biggest and most aggressive tribe on the coast (Sapir 1914, notebook XXIV:5a). Their military

[11] "Those lower in rank" (Sapir, Notes on Customs, Miscellany Part 1).

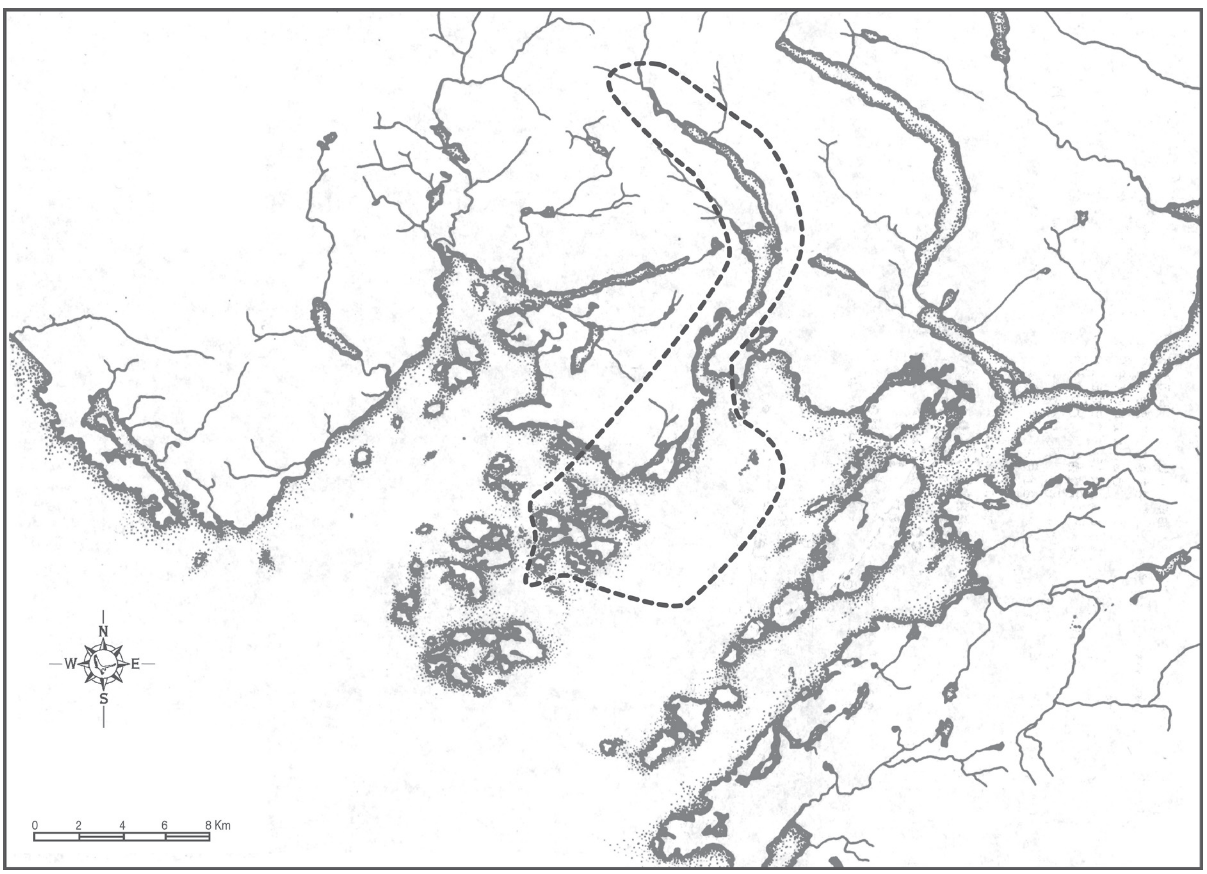


Figure 11. *Hach'aa7ath* original territory.

adventures were clearly widespread as contemporary elder John Jacobsen stated that they frequently raided the Ditidaht (*Niitiinaa7ath*) far to the south, and Peter Webster described the location of three *Hach'aa7ath* attacks within Ahousaht (*7aahuus7ath*) territory to the north (St.Claire 1998:39). *Hach'aa7ath* aggressions in Barkley Sound were at times countered by a coalition of the Tseshaht, Huu-ay-aht (*Huu7ii7ath*), and Uchucklesaht (*Huuchukwtlis7ath*) (Sapir 1914, notebook XXIV:5a).

The *Hach'aa7ath* quarrel with the Toquaht (*T'ukw'aa7ath*) quickly expanded in scope and intensity when a *Hach'aa7ath* raiding party inadvertently killed a Ucluelet (*Yuulhu7ilh7ath*) man (Sapir and Swadesh 1955:373–377). The Ucluelet were determined to seek revenge and enlisted the help of their powerful neighbours, the Tla-o-qui-aht (*Tla7uukwi7ath*). The *Hach'aa7ath* were at a serious disadvantage as the Tla-o-qui-aht had obtained guns through trade with Europeans, but none had yet reached the Barkley Sound groups. A series of battles over a period of years revealed the broad scope of the anti-*Hach'aa7ath* alliance, as groups as distant as the Mowachaht (*Muwach7ath*) of Nootka Sound and the Ahousaht are noted as participating in attacks upon them (St. Claire 1998:41). The Ditidaht also took part in the alliance, according to contemporary elders Alex Williams and John Jacobsen (St. Claire 1984b).

The *Hach'aa7ath*, battered by a series of devastating attacks, were finally overwhelmed. From that point the *Hach'aa7ath* ceased to exist as an autonomous group, although some individuals were taken by the victors as slaves and others managed to escape to relatives in neighbouring groups. Adam Shewish, the late Tseshaht *taayii hawilh*, stated that the Tseshaht did not participate in the war against the *Hach'aa7ath*, perhaps because they were closely related by high level marriages (Shewish, pers com.1982). It is probably these marital connections, as well as close geographic proximity, that caused many of the *Hach'aa7ath* survivors to flee to the protection of the Tseshaht. Although the *Hach'aa7ath* ceased to exist as an independent local group, there are numerous references to them surviving as a component group of the Tseshaht.

Because the war began before firearms had reached the Barkley Sound groups, it is likely that the conflict dates to the final years of the eighteenth century. There are indications that it lasted for a lengthy period, perhaps as much as a decade, placing the *Hach'aa7ath* amalgamation near the beginning of the nineteenth century. The *Hach'aa7ath* are known to have joined the Tseshaht after the *Nash'as7ath*, as Sapir's informants gave a very detailed account of the Tseshaht-*Hach'aa7ath* territorial boundary (Sapir 1914, notebook XXIV:4), in which the area described as Tseshaht territory includes that formerly held by the *Nash'as7ath*.

Unlike the *Nash'as7ath* and the *Wanin7ath*, the *Hach'aa7ath* did not replace a previously existing Tseshaht *ushtakimilh,* nor did they receive an existing potlatch seat, so they were not initially as completely integrated into the Tseshaht social order. Their *hahuulhi* would have been entirely absorbed by the Tseshaht. Their great losses in the war that ended their independence resulted in the destruction of much of their internal social structure. Rather than joining the Tseshaht as a group comprised of a number of *ushtakimilh*, they would only have had sufficient remaining population to act as a single unit within the amalgamated Tseshaht.

Amalgamation with the Hikwuulh7ath

The *Hikwuulh7ath* originally held territory extending from the mouth of Effingham Inlet in north-central Barkley Sound, east to the mouth of Alberni Inlet and south along the western half of Tzartus and Fleming Islands in the Deer Group archipelago (Fig. 12). They were the last of the formerly autonomous local groups in Barkley Sound to amalgamate with the Tseshaht, following severe population loss through warfare and disease.

Prior to European contact the *Hikwuulh7ath* seized control of upper Alberni Inlet and the Somass River from the *Ts'umaa7as7ath*[12]. Some uncertainty exists as to whether the *Hikwuulh7ath* or the *Hach'aa7ath* were the first of the coastal people to expand up to the Alberni Valley. Sapir informant Tyee Bob thought the *Hach'aa7ath* were first, followed by the *Hikwuulh7ath* (Sapir 1913, notebook XIX:3a), but elsewhere Sapir suggests that they moved simultaneously (Sapir 1913, notebook XIII:27a), a view shared by contemporary elder Robert Sport (St. Claire 1981). However, the preponderance of evidence suggests that the *Hikwuulh7ath* initiated the move up Alberni Inlet with the *Hach'aa7ath* in a supportive role, as

[12] A local group that eventually became part of the Hupacasath *(Huup'ach'is7ath)*, an amalgam of the three original autonomous Alberni Valley groups: the *Ts'umaa7as7ath, Muuhuulh7ath* and the *Tl'ikut7ath*.

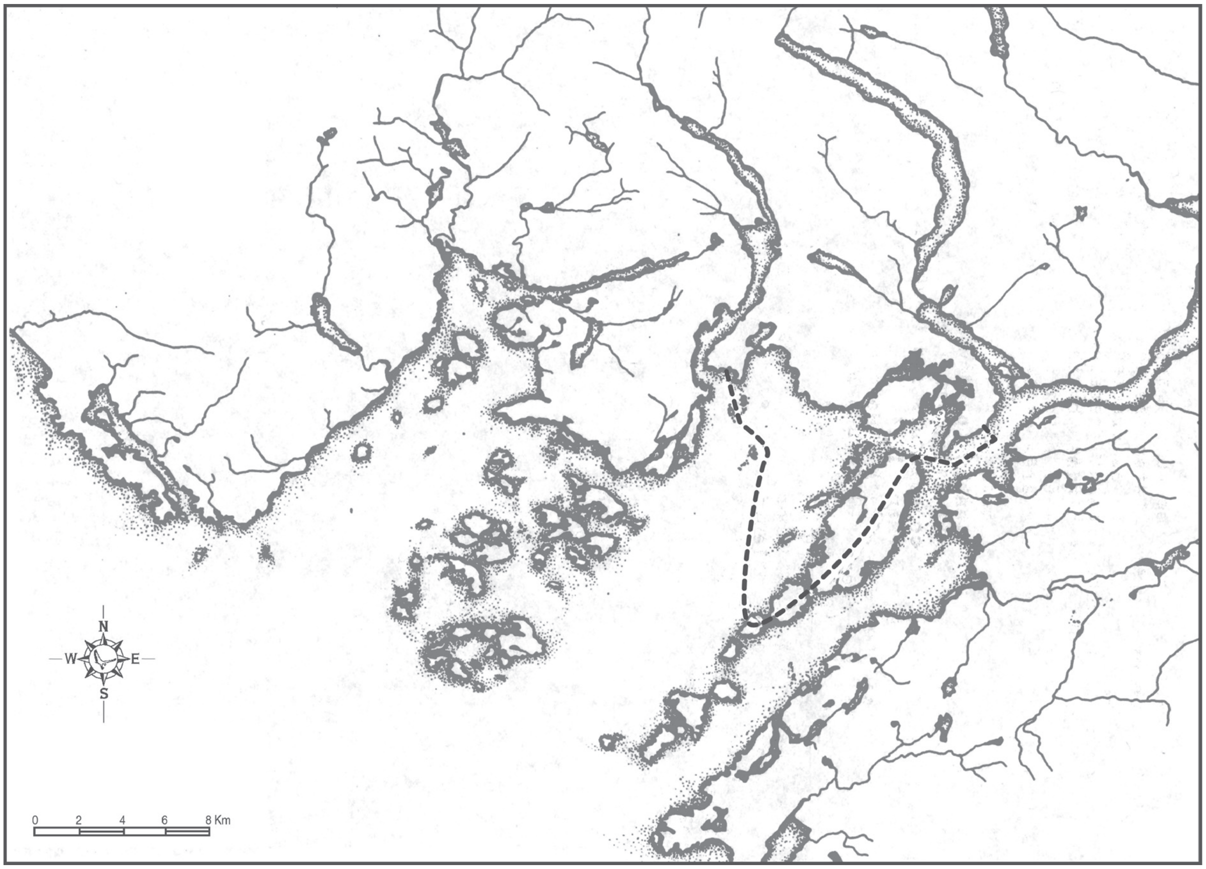


Figure 12. *Hikwuulh7ath* original territory.

suggested by Sapir informant Hamilton George (Sapir 1910, notebook I:9) and contemporary elders Ernie Lauder, John Jacobsen and Martin Edgar (St. Claire 1982, 1984). The *Hikwuulh7ath* appear to have kept sole control of upper Alberni Inlet but shared the Somass River up to just downstream from the confluence of the Sproat and Stamp rivers (St. Claire 1982). They occupied the west bank of the river while the *Hach'aa7ath* held the east (Sapir 1914, notebook XIX:3a; notebook XXIV:4).

Although the Tseshaht were not involved in the initial seizure of upper Alberni Inlet and the Somass River, they would have acquired user rights when they absorbed the *Hach'aa7ath* survivors and gained control of their *hahuulhi*. Initially they appear to have only used *Tluushtluushuk*, a site close to Coos Creek (*k'uu7as*), several kilometers from the head of the inlet (Fig. 13). Once the *Hikwuulh7ath* were reduced to a marginal population, dropping to only 48 people (Blenkinsop 1874:41) following a devastating attack by the Qualicum Salish from across the island (Brown 1896:26), they too were forced to surrender their independence. In 1874, Blenkinsop (1874:41) described their situation:

> About sixty years since being hard pressed by other Indians, and having, through sickness and war become unable to cope with their enemies, they of their own accord joined the Se.shah.ahts [Tseshaht], as they say for protection only and did not at the time surrender the right to control their own lands. The latter however seem to look on them as a conquered race.

According to Nuu-chah-nulth custom, once a group surrendered its autonomy, either by peaceful agreement or as the result of hostile actions, their full territory (*hahuulhi*) was absorbed into that of the dominant group. Thus Tseshaht territory reached its fullest extent by approximately 1815 with the absorption of the *Hikwuulh7ath*. Although the *Hikwuulh7ath* sought to maintain some autonomy even at the time of Blenkinsop's visit, effective control of their territory had passed to the Tseshaht. The Tseshaht then controlled

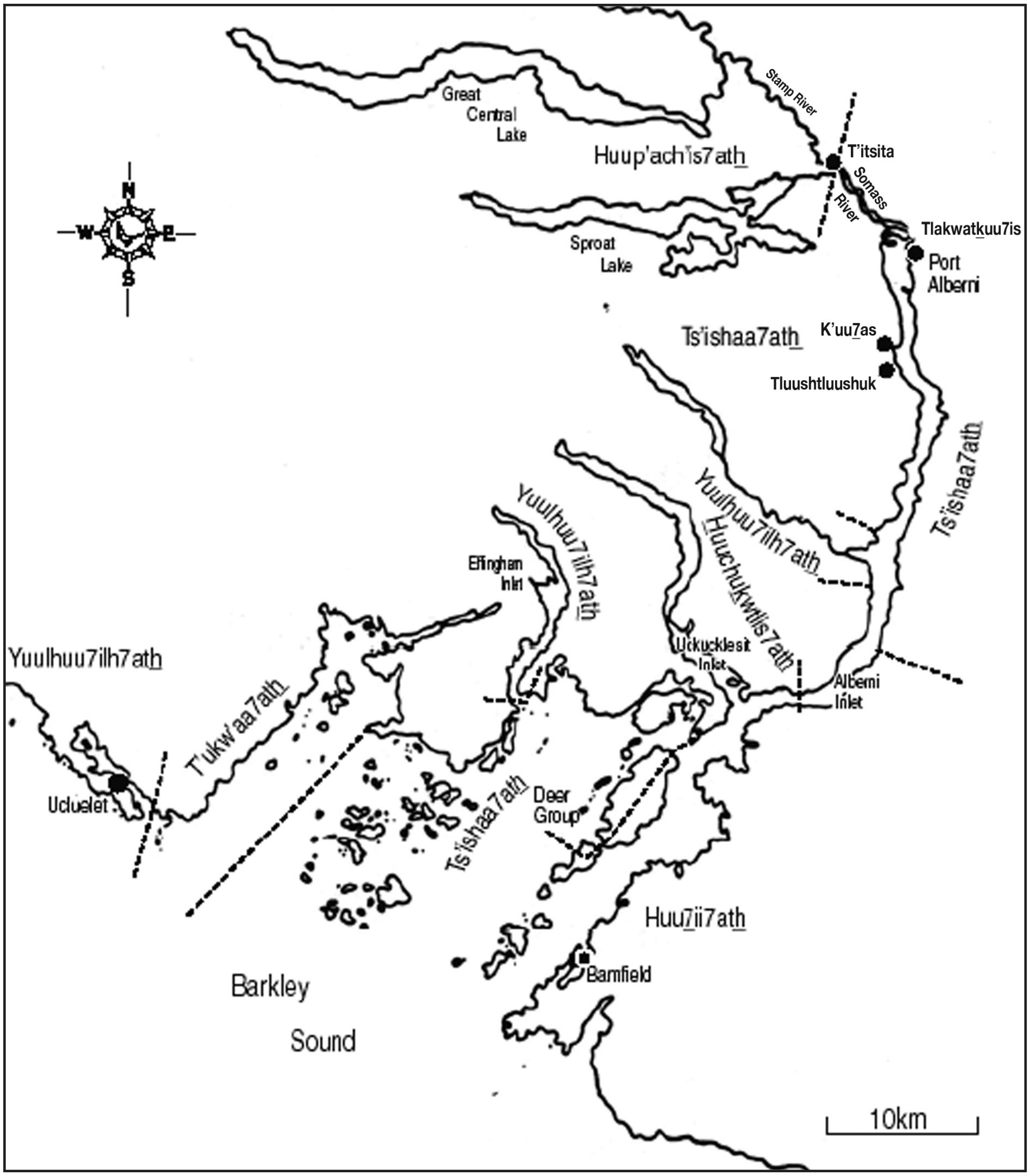


Figure 13. Local group territories in Barkley Sound and Alberni Inlet circa 1815 with place names mentioned in the text.

lands which extended from the outer islands of the Broken Group in Barkley Sound to the salmon-rich Somass River at the head of Alberni Inlet.

The Post-amalgamation Tseshaht

With the completion of this series of amalgamations early in the nineteenth century, the Tseshaht world was fundamentally transformed. From their origins as a small autonomous local group with a restricted territory in the outer Broken Group Islands, in only a few decades of rapid and far-reaching changes they had absorbed numerous neighbouring groups and expanded their territory many-fold. With the final absorption of the *Hikwuulh7ath*, Tseshaht territory encompassed the islands of the Broken Group, much of the northern and northeastern shoreline of Barkley Sound, the western half of Tzartus and Fleming Islands in the Deer Group archipelago, much of Alberni Inlet and the Somass River in the Alberni Valley up to a point just downstream of the confluence of the

Sproat and Stamp Rivers (Fig. 13). This enormous expansion of territory produced profound changes in Tseshaht life.

So severe was the population loss during the period of amalgamation that many Tseshaht *ushtakimilh* completely disappeared. Each of the original Tseshaht, *Nash'as7ath*, *Maktl7ii7ath*, *Hach'aa7ath* and *Hikwuulh7ath* local groups are known to have had at least four *ushtakimilh*. Of these at least twenty *ushtakimilh*, Sapir's informants never list more than ten and usually fewer when discussing the post-amalgamation period. As populations declined at a catastrophic rate, whole descent groups ceased to exist. Surviving individuals, once belonging to separate *ushtakimilh*, more frequently identified themselves simply by the name of their local group as the only level of identity left to them. If a perhaps conservative population estimate of approximately 400 to 500 people is assigned to each of the five local groups prior to severe population loss, then the original total for all the local groups that eventually coalesced into the "Greater Tseshaht" would have been 2000 to 2500. Yet in 1874 Blenkinsop recorded the entire amalgamated Tseshaht population as a mere 209 persons, less than that of a single precontact local group, providing a shockingly clear indication of the magnitude of the catastrophic depopulation of the Tseshaht and the Nuu-chah-nulth in general.

In many ways the post-amalgamation Tseshaht fit Drucker's (1951:220) description of a tribe: a union of several local groups which shared a common winter village, a fixed system of ranking for their chiefs, and a name. The local groups forming the tribe cooperated in joint economic, ceremonial, and military activities. Unlike the *ushtakimilh* of a local group, a tribe's component parts did not trace descent from a common ancestor or place. In reality, however, despite profound changes, the Tseshaht continued to function in many ways as a local group. In contrast to Drucker's description of a tribe, where each component local group maintained ownership of its traditional territory and the primary rights to its resources, the local groups merging with the Tseshaht lost control of their *hahuulhi* to the Tseshaht head chief. As a rapid series of changes over a relatively short period of time was thrust upon them, it was natural for the Tseshaht to attempt to accommodate these within their traditional structures and practices. The declining populations of the late eighteenth and early nineteenth centuries meant that the merging local groups were at best the former size of a single *ushtakimilh*. As a result, these once autonomous local groups actually came to function within the larger Tseshaht polity much as *ushtakimilh* had done earlier. Sapir (1922:307) described the Tseshaht at this stage in their history as:

> … a cluster of various smaller tribal units of which the Ts'isha'ath, that gave their name to the whole, were the leading group. The other subdivisions were originally independent tribes that had lost their isolated distinctiveness through conquest, weakening in numbers, or friendly removal and union. Each of the tribal subdivisions or "septs" had its own stock of legends, its distinctive privileges, its own houses in the village, its old village sites and distinctive fishing and hunting waters that were still remembered in detail by its members. While the septs now lived together as a single tribe, the basis of the sept division was really a traditional local one.

Saayach'apis told Sapir that Ts'ishaa had been their principal village, which they occupied throughout the year (Sapir 1910–14, notebook IV: 33). All economic resources within their territory were exploited from this permanent base. Sapir's notes show that the *Maktl7ii7ath* and *Wanin7ath* joined the Tseshaht at Ts'ishaa. After the absorption of the *Nash'as7ath*, however, the Tseshaht began wintering at the large village of *Hiikwis* (near the former *Nash'as7ath* village site of *Ukwatis*), along Sechart Channel on the upper shore of Barkley Sound (Fig. 10: 11). This provided a much more sheltered location, as well as access to a wide range of resources and abundant sources of fresh water. Saayach'apis described major ceremonial events taking place at *Hiikwis* (Sapir and Swadesh 1955:27–29, 39, 43–44). Ts'ishaa was reduced to a summer fishing and sea mammal hunting camp used by a relatively small number of people, particularly those who were descendants of the original Tseshaht local group. Himayis was also being used seasonally at this time (Sapir and Swadesh 1955: 45). Saayach'apis, who was born around 1843, told Sapir that the great houses which once stood at Ts'ishaa were all gone when he was a child (Sapir 1910–14, notebook XV: 40a)..

The acquisition of *Hikwuulh7ath* territory led to a further changes in economic and residence patterns. By the second half of the nineteenth century the Tseshaht were wintering along the lower Somass River, near the growing Euro-Canadian community of Port Alberni, using the islands in

Barkley Sound only as resource camps from spring through fall. A well-developed pattern of seasonal movement had developed to manage the resources of this large territory. In August the Tseshaht began to move up Alberni Inlet to exploit the rich runs of salmon returning to spawn in the Somass River system, briefly staying at several resource locations along the inlet (McMillan and St. Claire 1982: 22). By September they were installed along the Somass River, harvesting large numbers of coho, spring and chum salmon. Throughout much of November and December most of the Tseshaht were resident at the village of *Tlukwatkuuwis*[13] (Fig. 13), where important winter ceremonies, such as the *Tl'ukwaana* or wolf ritual, were carried out. By January they began to move back down Alberni Inlet to the inner, more sheltered, portions of Barkley Sound. There they occupied a number of sites, including *Hiikwis*, *Tl'ih̲uuwa* on Nettle Island, and *K̲akmak̲milh* on Keith Island (Fig. 10: 11, 12, 7) (McMillan and St. Claire 1982: 19). From May to August the Tseshaht were dispersed to a number of sites throughout the Broken Group islands, including Ts'ishaa and Himayis. The sites utilized and the people who resided at them often reflected the original autonomous local group patterns. Saayach'apis described to Sapir the mid-nineteenth century pattern of movement:

> … the Tsishaa moved apart. The Maktlii tribe went to Maktlii. The Tsishaa Band was with the Nachimwas at Tsishaa. The Himayis people went to Himayis. The Wanin people went to Wanin. The Nashas people went to Dutch Harbour[14]. The Tlasimyis people went to Tlasimyis[15]. The Hachaa people lived on Village Island[16] … the Hikuuthl people went to Shaahuwis[17]. I used to live at Mokwa'a[18]. (Sapir and Swadesh 1955:44–45).

Thus, despite losing their autonomy through amalgamation with the Tseshaht, the various component groups continued to recognize their separate origins throughout much of the nineteenth century by returning to their traditional sites during the summer months. They retained their names and separate traditions, in some cases with their chiefs holding ranked potlatch seats within the larger grouping. To a large extent, however, they had become ceremonial units among the amalgamated Tseshaht. This is evident in Saayach'apis' description of the ceremonies taking place at *Hiikwis*:

> When living there, when all had come together, someone gave a potlatch. They went to dance with the other divisions possessing names in the village. When a Nashas [*Nash'as7ath̲*] person gave a potlatch, the whole Tsishaa [Tseshaht] Band danced into the house … Then the Wanin Band [*Wanin7ath̲*] danced in . . Then the large Maktlii Band [*Mak̲tlZ̲ii7ath̲*] would all dance in. And they gave gifts to the Nashas. The Nachimwas Band [*Nach'imuuwas7ath̲*][19] also danced in. The Hikuuthl people [*Hikwuulh7ath̲*] also danced in. The Hachaa people [*H̲ach'aa7ath̲*] also danced in. That was the complete number of bands in the village at Hiikwis. (Sapir and Swadesh 1955:43–44)

Tseshaht Resource Use

The head chief (*taayii h̲awilh*) of a local group occupied his position through hereditary right. He was considered the "owner" of his group's territory (*h̲ah̲uulhi*) and was expected to manage it in the best interests of his people. Drucker (1951:244) described a head chief's duties as being executive in nature, stating: "The activities of his people were in his charge: he decided on the time of the seasonal movements, directed group enterprises such as construction of large traps and weirs, planned and managed ceremonials, and had the final voice in matters of group policy." As steward of his group *h̲ah̲uulhi*, a *taayii h̲awilh* oversaw and to a certain extent controlled all its resources, from the land, rivers, and sea, and directed their harvesting. The sea, of course, was at the centre of Nuu-chah-nulth economic life, providing countless food sources from its intertidal, subtidal and offshore zones.

Secondary or lineage chiefs (heads of *ushtak̲imilh*) owned the houses they occupied and could have specific and limited territorial or resource harvesting rights, such as the right to con-

[13] Near the foot of present day Argyle Street, Port Alberni.

[14] *Ukwatis/Hiikwis* village complex.

[15] A part of the *Ukwatis* village.

[16] *Huumuuwa* village on Effingham Island.

[17] Village site on the southern tip of Tzartus Island, Deer Group.

[18] *Muk̲w'aa7a* village on Turret Island.

[19] A senior *Mak̲tlZ̲ii7ath̲ ushtak̲imilh*.

struct fish traps or weirs in specific locations, or to control particular berry or root collecting areas or sea mammal hunting locations. These rights were usually hereditary. However, the *taayii hawilh*, by virtue of his position as head of the senior descent line in the local group, was considered the leader, the representative of the group as a whole, and as such was in overall control of the *hahuulhi*.

Salvage rights were fully included in territorial ownership. Sapir noted that, "If something of value was found drifting on the sea it also went to the Chief as he owned the sea as well as the land. Such salvage objects are called talmalni [*tamalhni*]" (Sapir 1913, notebook XVIII:2). If a drift seal or sea lion was found it was not cut up but given whole to the chief, with the expectation that he would then feast the village (Sapir 1913, notebook XVII:24a).

If a drift whale (*huu7ni*) was found, it was cut up and shared among the secondary chiefs on a prescribed hereditary basis. The person officially charged with the accurate partition of the carcass was called *kaakhsi* (from *katsilh*, "to measure"). Among the Tseshaht, the hereditary right to this position came from the *Naanaatsukwilh ushtakimilh* (Sapir 1913, notebook XVII:24a). Sapir's informant (1910, notebook IV:34–36) described the division of a drift whale at Ts'ishaa among the original, pre-amalgamation Tseshaht as follows:

1. The Chief of the *Ts'ishaa7ath ushtakimilh* received the most prestigious portion, called the *tsakwaasi*. This constituted the dorsal fin and surrounding "saddle" of blubber and meat. It was believed that inside the fin resided a man for whom the whale was a canoe. The *tsakwaasi* was put on display and songs called *ts'its'ihiimik'yak* were sung to it to induce the man to leave and enter another "canoe." After four days it was cooked and eaten in the Chief's house (Sapir 1910, notebook I:1).
2. The *T'ukw'aktla7ath* chief got one half of all the whale forward of the shoulders, which was cut vertically from front to back.
3. The Chief of the *Lha7ash7ath* received the tail.
4. The *Himayis7ath* had the other half of the head. Even the tongue was cut in half.
5. The area between the dorsal fin and the tail, called *k'ukwts'a*, belonged to the people who lived in the house next to and south of the chief of the *Ts'ishaa7ath*.
6. The lower fins (called *kwikwiniku*) went to two lower chiefs with houses south of the *hawilh*. Each received one fin.
7. The belly went to the head of the *Naanaatsukwilh ushtakimilh*, who lived in the house next to and north of the *hawilh*.
8. The area below the *tsakwaasi* section around the dorsal fin and which extended from one side of the whale to the other went to the *hawilh's* next oldest brother. This section was called the *lhuk'wanin*.
9. The region around the navel belonged to no one in particular and a canoe load of it would be given to the person who found the drift whale. This payment was called *ta7aa7ukt* (Sapir 1913, notebook XVIII:1a).

The social mosaic of the Tseshaht became far more complex following the series of amalgamations. According to Sapir's informant, whales were then butchered into 19 portions that were assigned to specific high status individuals (Sapir 1913, notebook XVII:24a,25;XVIII:1,1a). The finder of the drift whale was no longer paid with a portion as this would have interfered with the assigned rights. Instead, the *hawilh* would pay him with a canoe, or house boards, or strings of dentalium shells (Sapir 1913, notebook XVIII:1a). The senior person of the component group entitled to a particular cut could keep the blubber to distribute at feasts or divide it up among his kinsmen in chunks approximately 35 cm long and 20 cm wide. The less-prized meat was shared more widely (Sapir 1913, notebook XVIII:3).

As highly skilled whalers, the Nuu-chah-nulth did not depend solely upon dead drift animals. Whaling was a highly prestigious activity and as such was restricted to individuals of chiefly rank. Long arduous ritual preparations were necessary prior to the actual hunt. Successful hunts demonstrated a chief's inherited rights and control of supernatural power. Gray whales (*maa7ak*) and humpback whales (*iihtuup*) were the main prey species. Adult whales of up to 12,000–16,000 kilos provided large quantities of meat and their blubber and bones provided thousands of litres of oil. The latter served as a highly prized condiment and was a valuable item of trade.

After a successful hunt, the whale would be towed back to Ts'ishaa village, where butchering took place on the beach at low tide (Sapir 1913, notebook XV:32). The apportioning of the blubber and meat would differ from the case of a drift whale as it would be divided only between the head whaler and his crew. The whaling chief would hold a feast in the village, giving out the leftovers (called *mamuut*) in an informal distribution. The bones were often left on the beach, stacked with those of earlier kills as a monument to the whaler's prowess (Drucker 1951:55). Other bones, however, were boiled for the all-important oil, and were likely discarded in the village area. Stacks of whalebone also provided convenient sources of raw material for the manufacture of various tools.

Ts'ishaa was ideally suited for whaling as it sat astride the gray whale migration route. During the spring the whales moved north from their calving areas off northern Mexico. Their migration route took them around Cape Flattery and across the mouth of Juan de Fuca strait to Ditidaht (*Niitiinaa7ath*) territory near Clo-oose. From there they proceeded close to shore up the west coast of Vancouver Island, passing Pachena Bay, Cape Beale, and into Barkley Sound past the outer islands of the Deer Group and Broken Group. At this point their migration route took them close to Cree (*Ch'ituukwachisht*), Wouwer (*Maktl7ii*) and Benson islands. They than crossed the mouth of Loudoun Channel and up the outside of Ucluth peninsula (Sapir 1913, notebook XVIII:II). Other than a few stray individuals, they apparently did not enter the upper portions of Barkley Sound. Their predictable arrival each year was eagerly awaited, and was viewed in much the same way as the annual salmon spawning runs (Drucker 1951:48). In the late autumn, their return migration south was much farther offshore and thus difficult to access.

It is likely that the humpback whale was even more important than the gray as it was plentiful, somewhat larger, had a considerably higher oil content, and was available, at least in Barkley Sound, year-round. During summer they fed on the La Perouse bank, just outside of Barkley Sound. Sapir's informants stated that these whales began to go into the inner portions of Barkley Sound and its associated inlets during October, feeding upon large schools of herring. They remained in Alberni, Uchucklesaht, and Effingham Inlets and in upper sound areas such as Baeria Rocks (*Chaapiilh*) and Rainy Bay (*Hikwuulh*) until March, when they moved into the Broken Group Islands and Loudoun Channel as the herring began to spawn in those areas (Sapir 1913, notebook XVIII:II). Their importance in the archaeological record is clear from the excavated remains from two major Toquaht (*T'ukw'aa7ath*) villages at the western edge of the sound, where they comprised approximately 80% of the total identifiable whale bones, while grays averaged only 13% (Monks et al. 2001:73). When a commercial whaling station opened on Sechart Channel in the upper sound it quickly depleted humpback populations. In its first six years of operation, from 1908 to 1913, between 250 and 474 whales were taken each year, of which humpbacks made up between 79% and 93% of the total (Kool 1982:34). Thus historic records, as well as archaeological and ethnographic data, clearly indicate the predominance of humpbacks in the Barkley Sound area.

A number of areas within the Broken Group Islands, by virtue of the meaning of their names or by direct anecdote, can be identified as whaling locales. These include the Pigot islets adjacent to the village of Ts'ishaa, Cree and Wouwer islands (Sapir 1913, notebooks XVII:24 and XVIII:1), the area around *Mukw'aa7a* village (Turret Island), Gilbert Island (whose name *ihwitis* means "whale oil on it"), and an area of shoreline on Dodd Island called *ihinitsulhh* (meaning "where there are many whale skins") (Sapir n.d., Miscellaneous Nootka Material:35, 38, 40). Also, although Sapir's informants did not indicate any specific locales or site names, they stated that there were certain sandy places containing small clams where:

> Má'ak [*maa7ak*; Gray] whales would beat up the sand with their flukes allowing it to be washed away by the sea. When the clams were exposed, the whales would eat them. Such places were good ones for hunting má'ak because when their heads were down in the sand they couldn't see the canoes approaching. Such places were called tushumis meaning "place of shaking (tail) on the beach" and the right to hunt there was generally restricted to the Head Chief. (Sapir 1913, notebook XIII:29a)

Despite ethnographic accounts that Nuu-chah-nulth whaling occurred primarily in the spring with additional limited opportunities in the summer, the Tseshaht appear to have been able to hunt whales throughout much of the year. While resident at Ts'ishaa village, the Tseshaht had access to both gray and humpback whales in March and April. During the summer humpbacks were primarily on the offshore halibut banks and some juvenile grays lingered in Barkley Sound. In the autumn months humpbacks moved inshore following the schools of herring. During the winter, the Tseshaht also presumably had occasional opportunities to hunt some strays from the humpback whales feeding upon herring in the inshore waters of the upper sound and inlets. After they absorbed the territory of other local groups in upper Barkley Sound and along Alberni Inlet, the Tseshaht would have had full access to humpback winter feeding areas. Frank Williams, a Tseshaht who worked with Edward Sapir, provided specific accounts that placed these whales in Alberni, Uchucklesit, and Effingham inlets during the winter months (Sapir 1913, notebook XVIII:11). The whales were so numerous in these inlets that Williams described tapping the canoe thwarts to frighten them away while he was raking for herring.

Other sea mammal species were also numerous in Barkley Sound (Fig. 14). Sea otter, valued primarily for their luxurious pelts, were hunted in November when their fur was at its finest (Sapir 1913, notebook XVIII:3a). Sapir's informants describe November to March as the main hair (harbour) seal and sea lion hunting period, as harsher offshore weather and winter storms caused them to seek the more sheltered waters of the inner islands, bays, and inlets (Sapir 1910, notebook I:208 and 1913, notebook XVIII:30). However, Swadesh states that the Tseshaht moved in May to Ts'ishaa, *Huumuuwa*, and *Mak̲tl7̲ii*, where they hunted seals (Swadesh 1949, fieldnotes:32). Drucker (1951:45) also describes hair seal hunting in the late spring.

Fur seals are migratory and pelagic, passing by Vancouver Island a considerable distance offshore (Banfield 1974:360). Drucker (1951:46) maintained that they were not hunted by the Nuu-chah-nulth until the commercial seal hunts of the late nineteenth century. This is clearly in error, as fur seal remains dominate the vertebrate fauna found in archaeological sites along western Vancouver Island and the Olympic Peninsula (McMillan 1999:140; Crockford et al. 2002). Saayach'apis told Sapir that fur seals came into the sheltered waters in the late winter to feed on the herring gathered prior to spawning (Sapir and Swadesh 1955:45). The presence of very young fur seal elements in the faunal remains from Ts'ishaa suggests that there once was a fur seal breeding colony in the vicinity of Barkley Sound, raising the possibility that these animals would have been available year round (Crockford et al. 2002).

Porpoises were taken opportunistically, by harpooning, whenever the possibility presented itself. Although not as prized as whale oil, the oil rendered from the fat of all sea mammals was a valued commodity. Sayaach'apis described the customary procedures at sea mammal feasts:

> Someone who brought in a porpoise would give a feast. They steamed it on stones under wild currant branches with the fat cut up in strips a span long, and placed in layers of four… each person ate two such strips… Further, those who brought in two hair seals had eight people eat the flippers and the hind part. The children of the chiefs ate the limbs and the hind part, but the fathers ate the body… Those who gave a sea lion feast would cut the breast into ten strips. Ten children of the chiefs would be singled out to receive the thick fat breast cuts. (Sapir and Swadesh 1955:29)

During the winter, herring (*tlusmit*) congregated in large schools in sheltered bays and inlets prior to spawning in March. Although unlikely to spawn in the outer islands of the Broken Group, they could be harvested by way of rakes, called *chuch7yak*. In the more sheltered parts of Barkley Sound they spawned in enormous numbers. The area around the nearby village sites of *Ukwatis* and *Hiikwis*, on Sechart Channel, was a major spawning location, as clearly indicated by a place name at the eastern end of *Ukwatis* (*kiina7aa*; "Herring-guts-on-the-rocks") (St. Claire 1991: 133). Many herring were taken by dipnets, called *ts'ima*, as they crowded into the shallows to spawn (Sapir 1913, notebook XV:43). However, the major importance of herring was the spawn itself, as described by Saayach'apis:

> While they were still at Hiikwis, the herring began spawning. All the people put branches under water at the sandy shore to get herring spawn… Spawning herring attached it to that kind of thing… When it was thick enough, it was brought up out of the water. They would get as much as four or even ten canoe loads in four fathom canoes. It would get thick and heavy, for fresh herring spawn is very heavy. Then they would dry it outside in the sun. It was like many blankets stretched out to dry the whole length of the village front at Hiikwis, because the whole Tsishaa Tribe would be drying spawn… When it was perfectly dry, it went into storage baskets… They did this, first drying herring and afterward herring spawn, to prepare food for later on. The chief ate it and gave feasts in the summer. (Sapir and Swadesh 1955:30)

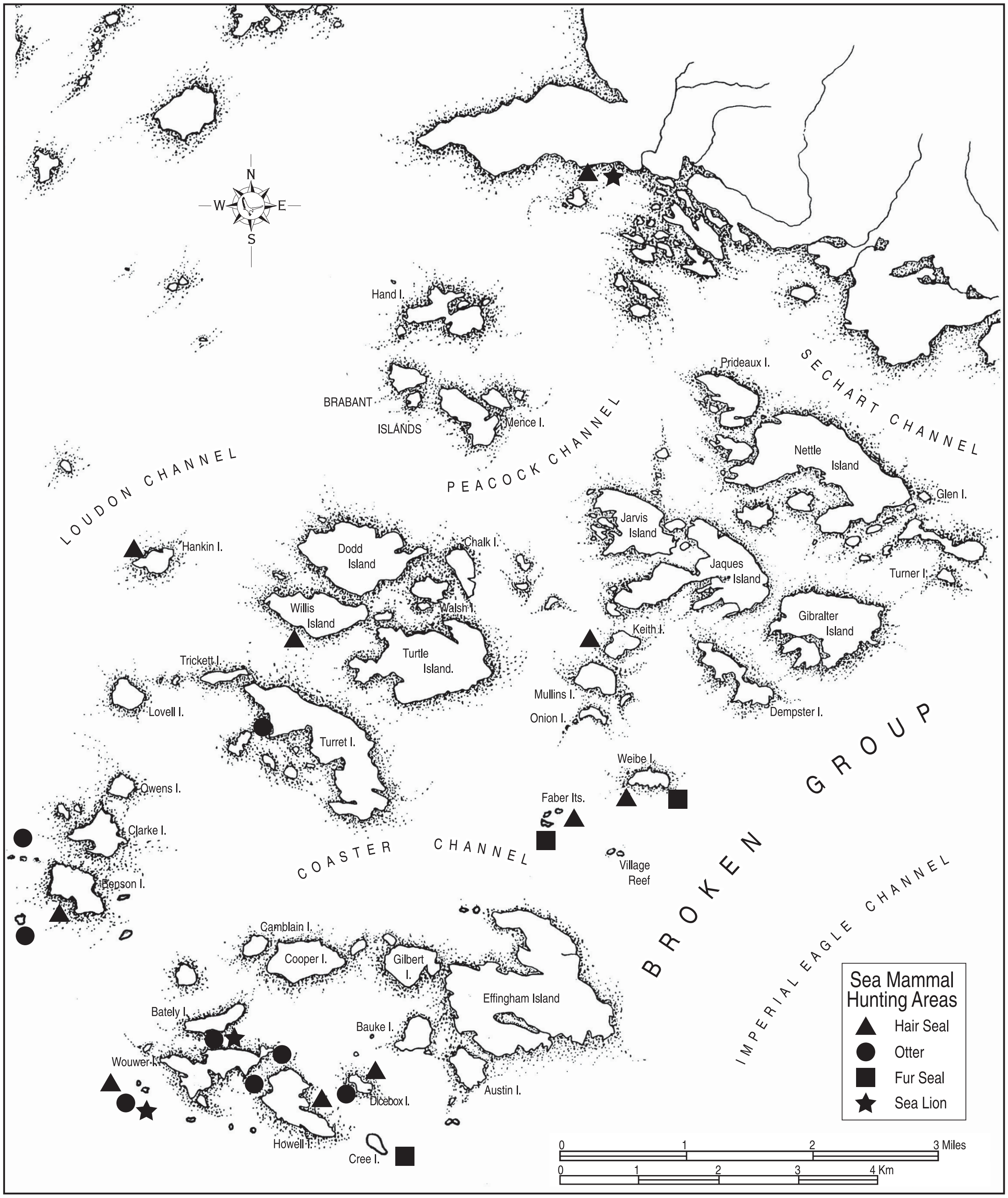


Figure 14. Known sea mammal hunting locations in the islands of the Broken Group.

The massive concentrations of herring attracted predators, which presented additional opportunities for Tseshaht hunters and fishers. Large numbers of spring salmon fed on the herring and were caught by trolling, providing a welcome source of fresh salmon after a winter of mostly dried fish. Seals, sea lions and even whales were also attracted by the huge biomass formed by the spawning herring, bringing large concentrations of sea mammals into reach of the hunters.

Small fish were also taken in stone-walled tidal fish traps, called *tiinow7as* (St. Claire 1991:151).

They were constructed in shallow protected bays, where schools of small fish such as perch, herring, pilchard or anchovy habitually collected. Two or more walls of stone were built so as to enclose a small embayment, often incorporating a natural depression or bedrock outcrop. An opening was generally left between the arms of the trap. As the tide rose and filled the area contained by the stone walls, schools of fish would enter the enclosure. To keep them within the trap a wooden gate-like structure would be fitted into the opening, allowing water but not the fish to pass through. To retain the fish within the enclosure until the tide receded to a level lower than the height of the walls, fishers in one or more canoes could place themselves adjacent to the traps, banging their paddles onto the water to create enough commotion to frighten the fish. Eventually the tide lowered sufficiently to drain the trap, making the collection of the fish an easy task. Thirty-nine of these sites have been identified within the Broken Group Islands (Fig. 15), clearly indicating their importance in the local economy (Haggarty and Inglis 1985). However, although Tseshaht elder Mabel Taylor (1910–1984) knew the name for these traps and how they were used, she had never seen them in use herself, nor did she think that they were employed by her parent's or grandparent's generation. The apparent abandonment of the traps in the nineteenth century likely reflects the massive depopulation and consequent economic shifts that occurred in this area.

Drucker also described "fish drives," called *sacha7uk*, in his field notes (1935–36). He noted that men would form a line of canoes across the mouth of small bays where perch congregate in late summer. The men held fir boughs, weighted at the tips with stones, over the sides of the canoes and gradually worked their way sideways towards the shore until the fish were sufficiently concentrated to be harvested with dip nets or rakes. Contemporary *Huuchuktlis7ath/Huu7ii7ath* elder Ella Jackson has described similar techniques used in Barkley Sound (St. Claire 1984).

In the early spring large numbers of ducks, geese and swans arrived on their annual northern migration. Periods of bad weather led to large concentrations in more sheltered bays and along protected shorelines. Working cooperatively on dark moonless nights, a number of canoes would surround a flock of birds, slowly herding them together by the use of torches and small fires lit on sand-covered crosspieces at the stern of the canoes. As the canoes approached the birds, mats were raised at the bow, creating an area of shadow from the torches and fires. The shadows attracted the birds, which were confused and agitated by the lights, and as they neared the canoes they were caught in scoop nets (Sapir and Swadesh 1955:31–32). Substantial numbers of birds could be caught in this manner. Saayach'apis described the ensuing feasts:

> The people of Hiikwis ate fowl as the torch hunters gave feasts. They ate them cooked with steam. Only the fat was boiled. The people of Hiikwis ate well, with everyone giving feasts. (Sapir and Swadesh 1955:32).

Sayaach'apis also described feasting on cormorants, fern roots (*shitl'aa*), clover roots (*7a7iitsu*) and cinquefoil roots (*tlits'yup*) while at Hiikwis (Sapir and Swadesh 1955:14,32)

In April, after the herring spawn was completed, Pacific sardines (*t'achkumik*), also known as pilchards, appeared in large numbers. As with herring, they could be harvested with dipnets and rakes. More importantly, their presence maintained the concentration of feeding salmon and sea mammals and the opportunities for further harvesting by the Tseshaht (Sapir and Swadesh 1955:30). By the end of the month the schools of pilchard scattered and went out to sea, followed by the salmon. In the post-amalgamation period, this movement of the salmon to offshore feeding areas and the arrival of favorable weather led to increased Tseshaht use of the outer islands.

As early as March some halibut (*p'uu7i*) were caught at *T'at'apu7a* (Janit Reef), on the seaward side of the outermost Broken Group Islands (Fig. 16). More frequent exploitation of such offshore resources occurred later in the spring with improved weather conditions. By May halibut and cod were caught on the offshore La Perouse Bank (*Lhulhumalhni*). Because the fishing locales were a considerable distance out in the open ocean, large canoes with four man crews were employed. At nightfall the fishers would set out, paddling all night to reach the fishing grounds at dawn. Set lines, each with five hooks baited with octopus (*tiilhuup*), were lowered to the ocean floor. Weather permitting, the fishing would continue until midday when the fishers, using bearings on the distant mountaintops, would plot their return route to the below-horizon islands of the Broken Group. Upon returning to their villages the people feasted on the halibut heads and prepared the rest for drying (Sapir and Swadesh 1955:41).

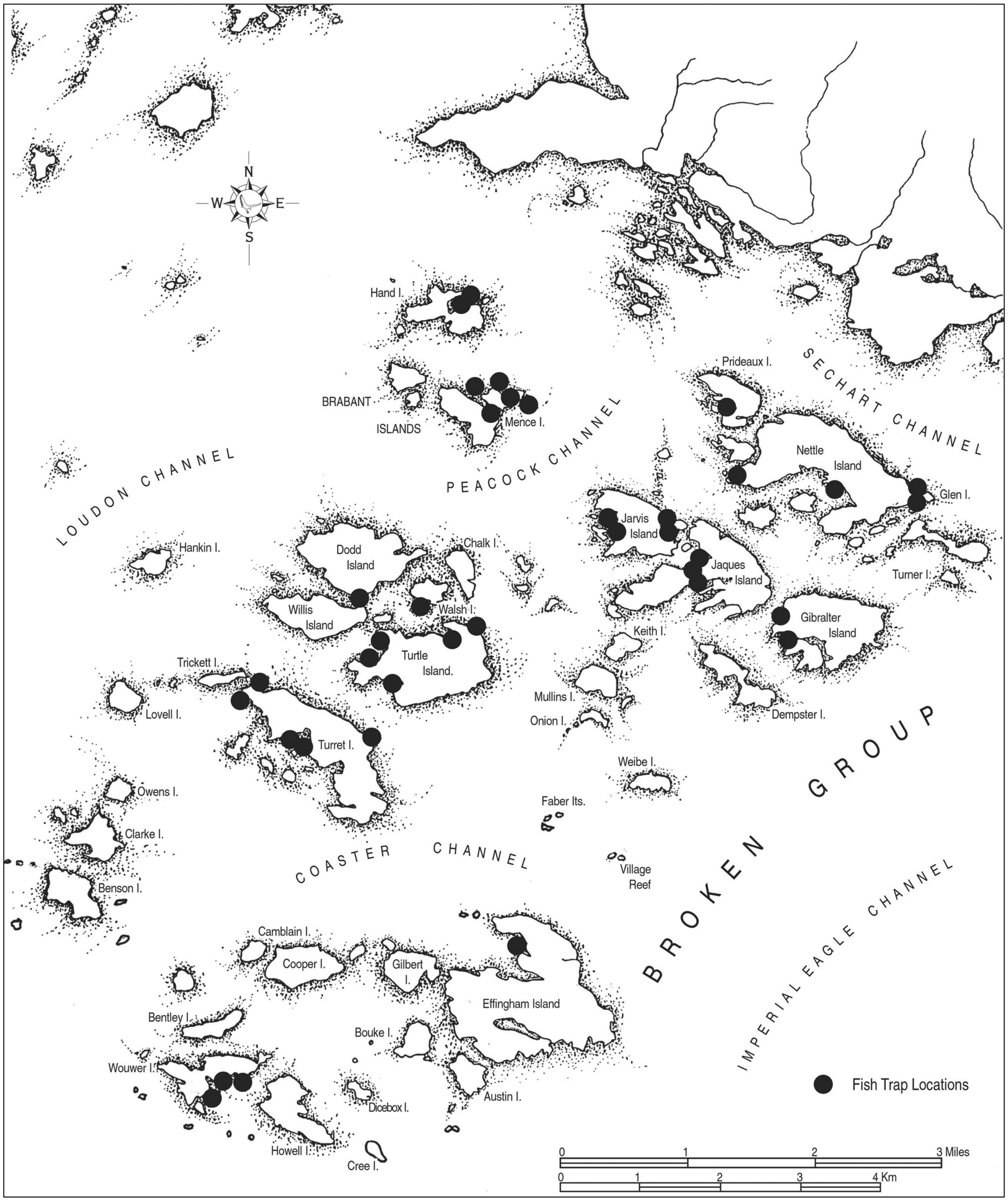


Figure 15. Stone tidal fish trap locations in the Broken Group islands (after Haggerty and Inglis 1985: 246).

Small reddish rockfish called *suuma* were caught in basket traps baited with mussels. These fish were kept alive to be used as bait for lingcod (*tushk̲wuuh̲*). The upper and lower lips of the *suuma* were pierced with a root and attached to a line of dried kelp in a process called *nichiilh* (Sapir and Swadesh 1955: 20,40). At dawn the fishers paddled offshore to the cod banks, towing their *suuma* bait alongside their canoes. Once at the fishing areas the *suuma* were attached by way of the root

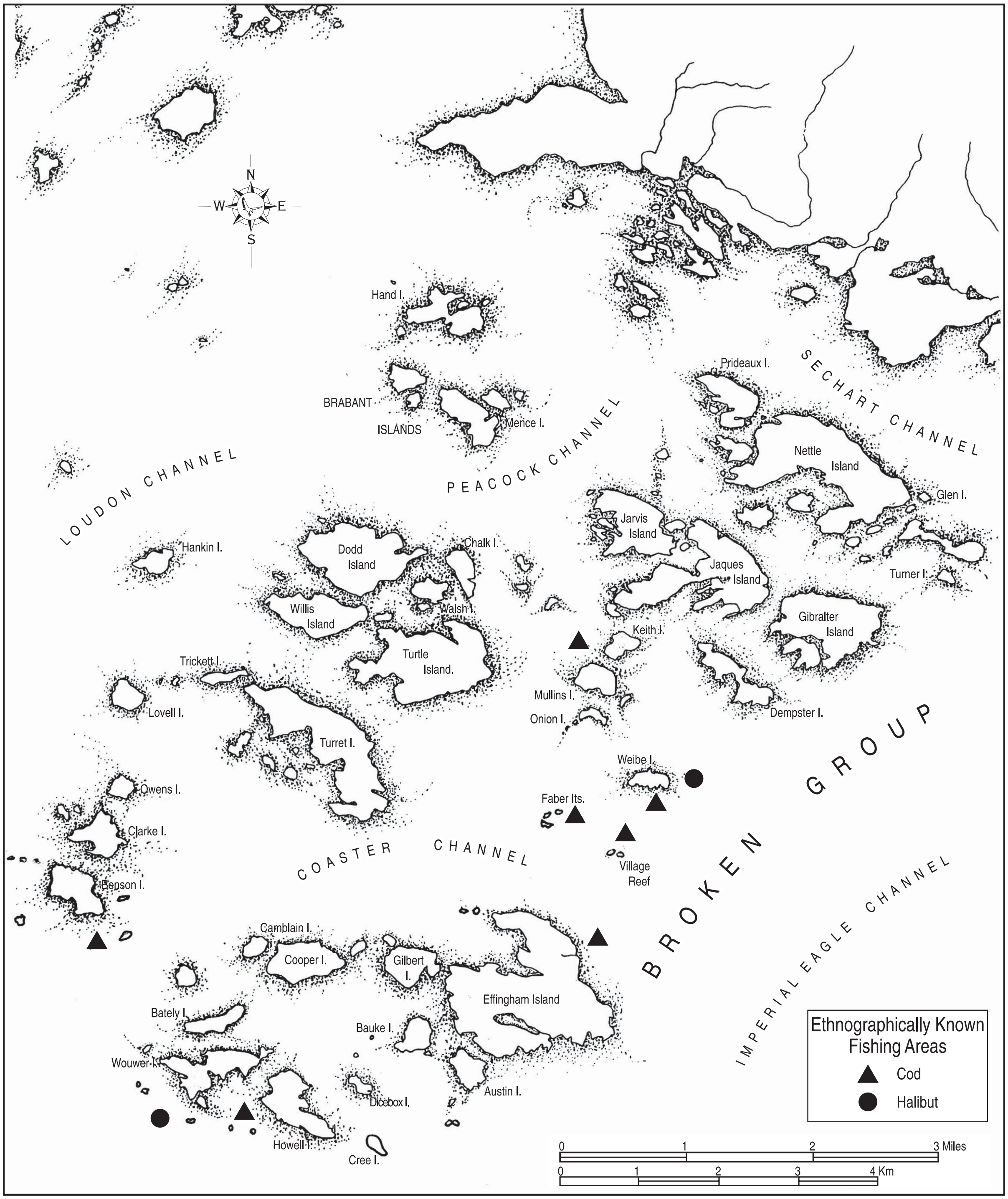


Figure 16. Known inshore cod and halibut fishing locations in the Broken Group islands.

through their lips to a long kelp line fastened to a stone sinker which was lowered to the bottom. The fisher held the end of the line in his hand and when he felt it being jerked pulled it to the surface. The lingcod was not caught by a hook but would not release its prey, so it could be reeled in. As it reached the surface it was struck with a two pronged spear. This method of live bait fishing was called *mamiita* (Sapir and Swadesh 1955: 20,21,40). Other fishers worked closer to the shoreline of islands, using the live bait technique or wooden lures resembling shuttlecocks to lure the lingcod or rockfish to the surface where they could be speared. Trolling close to islands and reefs also produced large quantities of rockfish, particularly the black rockfish called *kwikma*. As with halibut, feasts were given with the heads of lingcod while the bodies were dried. Rockfish were steam cooked (Sapir and Swadesh 1955:40,41).

The original Tseshaht territory, confined to small outer islands of the Broken Group, had excellent access to rich offshore resources. However, it contained no salmon spawning streams, so salmon played a much smaller role in the diet than for those groups along the shoreline of the sound. Undoubtedly, a significant benefit for the Tseshaht of the major territorial expansions of the late eighteenth and early nineteenth centuries was the acquisition of such streams and rivers. Until those expansions occurred, however, the Tseshaht were restricted to acquiring salmon through trolling, a much less productive method than the use of fish traps and weirs in spawning streams. In July and August coho (*tsuwit*) and then spring salmon (*suu<u>h</u>a*) appear in the Broken Group Islands en route to their natal spawning streams. Many areas were suitable for trolling for salmon, particularly those with kelp beds, a prime habitat for the small fish on which salmon feed. Chum salmon (*hinkwuu7as*) began to appear in Barkley Sound in September and were caught with the same trolling technique.

Despite their generally exposed position, the islands of the Broken Group archipelago have a wide variety of sheltered and semi-exposed locations with different substrata that provide favourable habitat for clams and other shellfish (Fig. 17). Indeed, some of the most productive bivalve locations are located in the outer islands (Lee and Bourne 1976:13). The great abundance of bivalves in easily accessible locations, plus the ease with which they could be collected, resulted in them becoming a major source of protein in the Tseshaht diet. Sayaach'apis described the collection and preparation of clams while resident at *Huumuuwa* (on Effingham Island), stating that the women:

> … would dig and dry horse clams [*<u>7</u>amii<u>k</u>*] and small clams [butter clams, *ya7isi*]. A strong energetic woman made many dried clams… They call it splitting when they take off the shells. They put the inner flesh into pack baskets. They would then fix them on whittled sticks. These were set across little poles by the fire … It became well cooked and brown as if slightly burned. Then they put it between layers of fern root and thimble berry. They cooked it all. Then they spread it out on the floor for one night. It became sweet, because of the fern root and thimbleberry. Next day they put it all in the sun till completely dry. (Sapir and Swadesh, 1955:41).

Sayaach'apis also described the collection and preparation of mussels (*tl'uchim*):

> Then they would travel about in whaling canoes to pry off shellfish, a man and wife together or two women in the middle of each canoe … The whaling vessel would be low in the water as they returned home full of mussels. They again heated stones and cooked them by steam… They put them on spits to roast … they became well cooked, brown and slightly burned. (Sapir and Swadesh 1955:41).

Although much knowledge about the location of specific resource sites has been lost, many other intertidal and subtidal foods were collected, adding variety to the Tseshaht diet. These included the black katy chiton, (*haayishtuup*), red chiton (*p'a<u>7</u>am*), red sea urchin (*t'uts'up*), green sea urchin (*nuuschi*), purple sea urchin (*<u>h</u>iix*), purple-hinged rock scallop (*tl'ii<u>h</u>awachi*), abalone (*7apts<u>7</u>in*), barnacle (*tlaanulh*), gooseneck barnacles (*ts'a7inwa*), blue mussel (*kw'utsim*) and sea cucumber (*taa<u>7</u>inwa*).

Tseshaht patterns of resource use clearly shifted dramatically during the historic period of population loss and political amalgamations described earlier in this chapter. For several millennia the Tseshaht had intensively exploited the resources of their restricted outer- coast territory from their year-round village of Ts'ishaa. Then, within approximately a single generation, political amalgamations resulted in a combined territory that covered a vast area. This greatly enlarged *<u>h</u>a<u>h</u>uulhi* provided unrestricted access to a wide spectrum of resources, from the offshore fishing banks and sea mammal hunting areas of the outer coast, to the varied resources and sheltered village sites of the inner islands and upper sound, to Alberni Inlet and the enormous salmon runs of the Somass River. Yet, at the same time, disease and warfare had greatly reduced the number of people occupying Barkley Sound. To harvest the wide range of resources throughout

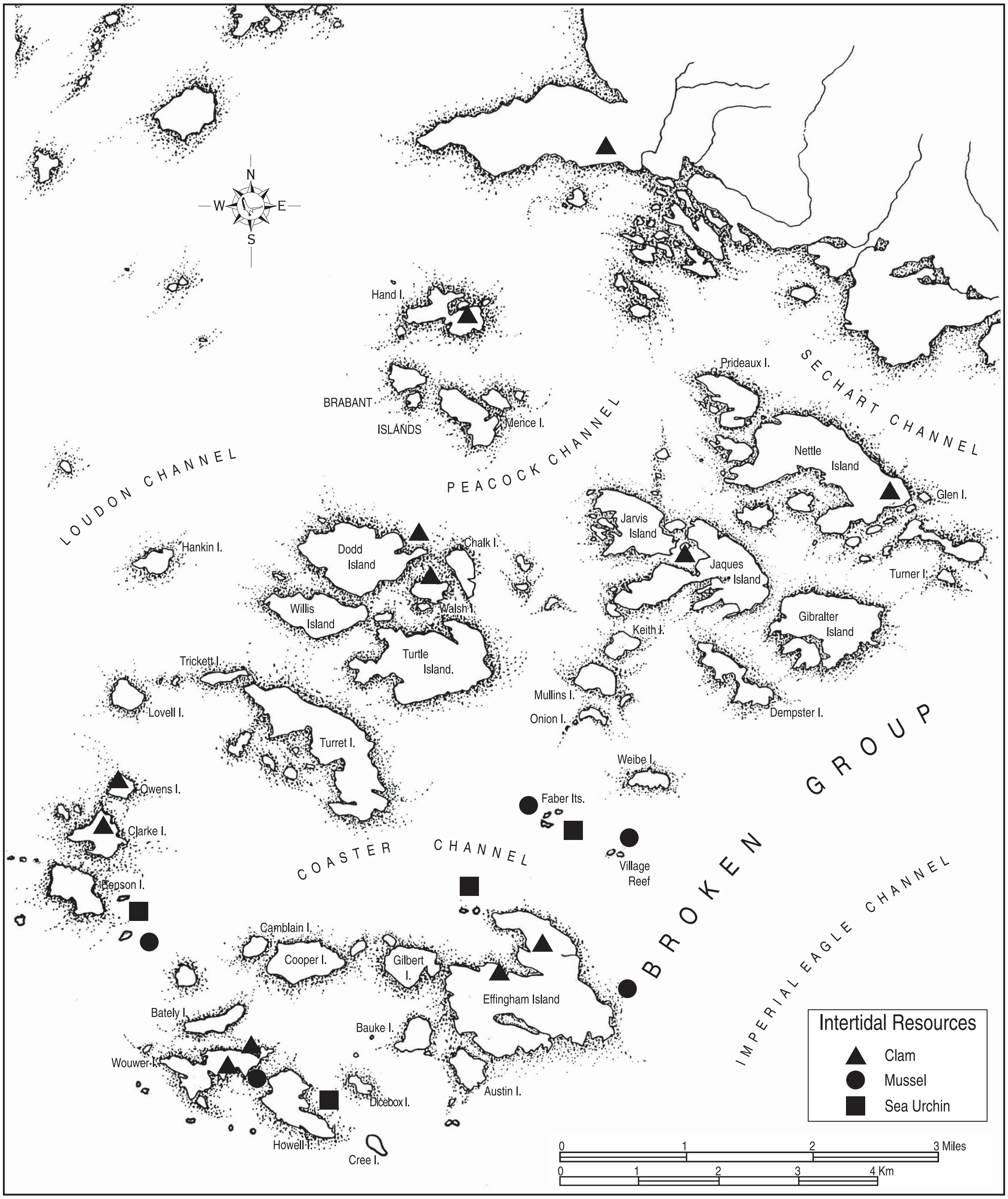


Figure 17. Known ethnographic shellfish collection locations in the Broken Group islands.

their enlarged *hahuulhi*, the surviving Tseshaht adopted a seasonal pattern of movement with residence in a series of villages and camps based on the availability of specific resources. By the early nineteenth century, their major village of Ts'ishaa was reduced to a summer fishing and sea mammal hunting location, while the political and ritual centre of the Tseshaht people shifted first to the upper sound, then to the Alberni Valley.

Chapter Three: THE NON-NATIVE PRESENCE

The first contacts between the Nuu-chah-nulth and outsiders occurred north of the study area, outside Nootka Sound. An initial brief encounter with a Spanish vessel under the command of Juan Pérez in 1774 was followed four years later by the arrival and month-long stay of Captain James Cook. This event was to have major repercussions all along the Northwest Coast. The discovery that the soft brown sea otter pelts obtained from the Nuu-chah-nulth could be exchanged for enormous profits in China led to an influx of trading vessels along the west coast. For a few brief decades, until the inevitable depletion of the sea otter populations, the Nuu-chah-nulth were in frequent contact with European and American traders. During this time they acquired great quantities of European goods, with those of metal being particularly in demand.

European discovery and exploration of Barkley Sound occurred during this early period of the maritime fur trade. Captain Charles William Barkley in the British trading vessel *Imperial Eagle* sailed into the sound in 1787. He named the sound after himself, and a number of prominent landmarks, such as Cape Beale, after members of his ship's company. His anchorage was off Effingham Island, which he called Village Island because of the presence of a large Native settlement (*Huumuuwa*; Fig. 10:5). Effingham (still known locally as Village) Island is one of the outer islands of the Broken Group, only a short distance from Benson Island. In the following year, Captain John Meares in the *Felice Adventurer* sailed into the sound to trade for furs and anchored near the same village. The American trader Robert Gray, in the vessel *Washington*, also arrived off the Broken Group in 1788 and traded with the Nuu-chah-nulth, who came out to his ship in several canoes. In the following year he entered the sound and noted two villages, although his journal does not specify their locations (Inglis and Haggarty 1986: 29).

The Spanish, under the command of Don Francisco Eliza, explored the coast south from their fortified settlement in Nootka Sound. In 1791, José Maria Narvaez, commander of the vessel *Santa Saturnina*, was sent to explore and map Barkley Sound, which the Spanish termed the "Boca de Carrasco" (Wagner 1933: 146). The Spanish officers noted that this was the most densely occupied region that they had encountered, stating that it "contained more Indians than Nuca [Nootka] and Clayocuat [Clayoquot]" (Wagner 1933:149). This suggests that Barkley Sound had a population of over 8500 people, as the Spanish had estimated that Clayoquot Sound was home to about that number (Wagner 1933:145–6). The map produced by the 1791 expedition (B.C. Archives, Maps Collection CM/A1414; see McMillan 1999:189) shows the general outline of the sound with the two major clusters of islands. Five Nuu-chah-nulth villages were noted on the map, with the only one in the Broken Group clearly being the village of *Huumuuwa* on Effingham Island. No settlement was indicated for Benson Island.

In 1793 Captain Josiah Roberts arrived in the *Jefferson* and began trading, visiting a number of villages throughout the sound. The ship's crew wintered over near the head of Toquart Bay, on the western side of the sound in Toquaht territory. An unpublished journal kept by the first officer, Bernard Magee, describes trade interactions with the Nuu-chah-nulth of the region. Relations were often strained, and at one point thefts from the ship led to violent retribution, as the crew of the *Jefferson* attacked the village of "Seshart," where they ransacked the houses and took several of the best canoes, apparently killing several people in the process (Magee 1794; Inglis and Haggarty 1986:46). "Seshart" (an early rendering of *Ts'ishaa7ath*, or Tseshaht) may refer to a village along modern Sechart Channel, which would be near the *Jefferson's* anchorage, but as this would have been prior to the amalgamations which led to Tseshaht dominance over this area it seems unlikely that any such village would have had that name at this early time. Also, Magee's reference to traveling six miles from the ship to the village would place this incident in the outer Broken Group. It seems likely that "Seshart" refers to the village of Ts'ishaa, which would be our only early historic reference to this major Tseshaht community.

The next ship to arrive was the *Ruby*, under Captain Charles Bishop, in 1795. It sailed into the western portion of the sound, probably into Ucluelet Inlet, to trade. By this time the fur trade was in decline, as the sea otter had been hunted to near extinction along this part of the coast. There is no record of another European trading ship arriving until 1817, when the French vessel *Le Bordelais*, under command of M. Camille de Roquefeuil, sailed into the eastern channel of the sound. With the exception of this last encounter, the Nuu-chah-nulth of Barkley Sound had minimal contact with outsiders for about half a century following the brief flurry of activity in the maritime fur trade.

A resumption of trade was brought about in the 1850s by the demand for dogfish oil, which was required for lubrication by the developing lumber mills in the Fraser Valley and Puget Sound. A number of trading schooners, primarily American, called into Barkley Sound to trade for dogfish oil, which the Nuu-chah-nulth were industriously catching and processing in large quantities. Dried salmon and fur seal hides were also traded for European goods during this time (Scott 1972: 75).

European settlement in Barkley Sound proceeded slowly. By 1860 the first trading post had been established by Captain Stuart at Ucluelet (Inglis and Haggarty 1986: 62). The 1861 chart of Barkley Sound prepared by Captain Richards, a Royal Navy surveyor, shows five trading posts, including two in the Ucluelet area and one on Gilbert Island, in the Broken Group (Scott 1972: 73). Other short-lived commercial enterprises in the sound include a fishing station at Effingham Island in the Broken Group and a copper mine on Tzartus (Copper) Island in the Deer Group, both established in the 1860s.

After British Columbia entered Canadian confederation in 1871, attention turned to the aboriginal land issue. In 1874 Dr. Israel Powell, the newly-appointed Superintendent of Indian Affairs, sent George Blenkinsop to Barkley Sound to gather information on Nuu-chah-nulth land use and their preferences for reserves. By this time the Tseshaht were primarily resident along the Somass River in the Alberni Valley, although *Hiikwis* on Sechart Channel was noted as their winter village and several sites in the Broken Group, such as *Huumuuwa*, were being used as fishing stations (Blenkinsop 1874). In 1882, Peter O'Reilly, the reserve commissioner, visited each of the Barkley Sound groups and allocated reserves. He assigned the Tseshaht a total of nine reserves, with by far the largest being on the lower Somass River, where most of the band resided (O'Reilly 1883). Of the remaining eight reserves, two are on Alberni Inlet (one, however, was sold early in the twentieth century), three (including *Hiikwis*) are on the upper shores of Barkley Sound, and three are in the Broken Group islands. The latter consist of *Huumuuwa* on Village Island, *K̲ak̲mak̲mlh* on Keith Island, and *Tl'ihuuwa* on Nettle Island. The Benson Island sites of Ts'ishaa and Himayis do not appear to have been occupied during either the Blenkinsop or O'Reilly visits and the land was not assigned as a Tseshaht reserve, allowing title to pass to non-Native owners.

Ownership of Benson Island has changed hands several times over the past century. The land of what was then called Hawkins Island was first alienated in 1893 by John Webb Benson, who completed the purchase of the island (for the grand sum of $33) in 1903 (Wallbank 1991). Benson built a hotel on the site of Himayis (Fig. 18) and had fruit trees and a garden, along with a meadow for his oxen, on what is today the open area of Ts'ishaa. He lived on the island until his death in 1913. Somewhat later the Colonist newspaper in Victoria reported that Hawkins [Benson] Island: "Had a hotel that was well worth visiting. There were about ten acres cleared and a portion of it was planted in garden and orchard to supply the hotel. The island and hotel are owned by Mrs. Benson, widow of an old-time sealing captain and one of the early pioneers of the West Coast of Vancouver Island" (Scott 1972: 198).

Despite Benson's occupation of the island, the Tseshaht continued to make occasional use of their traditional home. The surveyors' notes and map prepared for Benson's 1903 purchase indicate several "Indian houses" at the western end of Ts'ishaa, as well as an "Indian shack" at Himayis. These would have been temporary shelters, rather than the large multi-family structures that once stood at the site. They were still being used at the time Benson was there, according to Wallbank (1991: 1), which may account for their location at the far western edge of Ts'ishaa, as far removed from Benson's home and gardens as possible.

By 1920 the island belonged to Judge Alfred Clarke, who spent his summers there. Judge Clarke hired Delmont and Elizabeth Buck, who lived on the island year-round with their family, to be caretakers of the hotel and farm. Buck built a barn for the cow and horse sent out by the judge, plus small structures for pigs, chickens, and rabbits (Wallbank 1991: 6). Concern about their children in this isolated location, however, led the Bucks to move to Alberni in 1922. In 1937 ownership of the island passed to Judge Clarke's son, Hugh Clarke. After Clarke failed to pay the taxes on the land, Benson Island was purchased at auction by Kyle W. Kendall in 1955 (Wallbank 1991: 8). The final private owner of the island was William Garden of Seattle, who purchased it in 1962 and constructed a small summer home there. The hotel had been dismantled and had largely disappeared by that time. Only a few minor traces remain today of the

Figure 18. The Benson home and hotel constructed on the site of Himayis.

buildings constructed by these late occupants of the island.

Finally, in 1975, the island was purchased by the Crown as part of the newly-declared Pacific Rim National Park Reserve. All the islands of the Broken Group were included as one of the three units of the Park, the others being the Long Beach area (northwest of Barkley Sound) and the west coast lifesaving trail (southeast of Barkley Sound). Cabins and other traces of recent occupation were systematically removed by Park employees to enhance the "wilderness" experience for Park visitors. The sheltered waterways of the Broken Group, with their scenic beauty and abundance of wildlife, became a favoured destination for an increasing number of boaters and kayakers. On Benson Island, the open area of Ts'ishaa became a campground for these visitors, one of a limited number of such facilities within the Broken Group. Part of the recent co-operative initiative between the Tseshaht and Parks Canada involves plans to relocate campsites from Ts'ishaa and other major village sites to locations of less archaeological significance, as well as to increase visitor awareness of the importance and vulnerable nature of these heritage sites.

Chapter Four: EXCAVATION AT TS'ISHAA (DfSi-16)— MAIN VILLAGE AREA

Site Description

The extensive shell midden deposits at Ts'ishaa extend for about 145 metres along the beach facing the pass between Benson and Clarke Islands, from a cobble beach at the west end of the site to a large rock outcrop near the eastern edge. The site then turns at an angle and extends for another 50 metres along a small sheltered beach between two large rocky bluffs. Shallow midden deposits extend out on top of the bluffs, the easternmost of which would make an excellent lookout and defensive location. Along the beach just past this rock is the site of Himayis (DfSi-17), physically separated from the main site but clearly part of one large village location.

A forest fringe today largely hides the site from view from the water. Once through this outer curtain, however, much of the central and eastern portion of the site is open, covered only with grass, small areas of bush, and a few fruit trees remaining from the Euro-Canadian settlement of the early twentieth century. This may have been the area of the most recent Tseshaht habitation, presumably by a smaller social group than in earlier times, and was also the focus of later non-Native use. A steep slope up from the beach clearly indicates that at least three metres of shell midden have accumulated through occupation of this area. Along the eastern edge, between the two large rock outcrops, two distinct site levels possibly represent house platforms. The western half of the site is covered in large trees and fairly open ground characteristic of a mature forest, suggesting that this section was the first abandoned. Three distinct terraces, or possible house platforms, are visible along this western portion, with a steep drop-off behind the uppermost to a gully along the back of the site.

A smaller area of shallow midden was detected through use of soil probes at the back of the site, at a higher elevation behind the main village. A test unit was excavated in this area in 2000 in an attempt to ascertain whether this represented an earlier occupation, at a time when sea levels were several metres higher, predating the accumulation of the large shell midden deposits that mark the main village. After radiocarbon dates from this test unit supported this hypothesis, more extensive excavation was undertaken in this portion of the site in 2001. The results of these investigations are reported in a separate chapter.

The two Benson Island sites were sketch-mapped in 1982, as part of an intensive archaeological survey project throughout Pacific Rim National Park (Haggarty and Inglis 1985). In 1995, Parks Canada personnel took core samples at Ts'ishaa and prepared a more detailed map, indicating where the core samples were taken (Sumpter, Fedje and Siebert 1997). At the beginning of the 1999 field work, a detailed contour map of the Ts'ishaa - Himayis site area was prepared (by Pat McFadden, a surveyor for Parks Canada). This map shows the major physical features of the site area and the location of all excavation units. It is included in this report as Figure 19.

Extent of Excavation

Three widely-separated areas of the site were excavated, each in a different field season (1999 to 2001). These areas roughly correspond to the presumed locations of the three distinct named descent groups, or *ushtak̲imilh*, resident at the site, as described by Tseshaht elders to Edward Sapir (see Chapter Two). These were labelled EA (for Excavation Area) 1, 2 and 3, corresponding to the order in which they were investigated. Their locations are shown in Figure 19.

The area initially selected for excavation (EA 1) was in the middle of the open grassy area known to Parks Canada personnel and campers as "the meadows." Four fruit trees still stand in this area, which had been used as farmland by the early twentieth century owners of the island. This central portion of the site was ethnographically associated with the most highly ranked *ushtak̲imilh*, the Tseshaht (*Ts'ishaa7ath̲*) proper (Figs. 5, 6:4). A 10 m by 2 m trench (coordinates S 10 to 20, W 25 to 27 m) was laid out between two cherry trees, perpendicular to the beach, with the axis of the trench aligned to magnetic north and the north end extending down the top of the slope to the beach. The entire 10 m trench was excavated until a depth of about 1.4 m was reached. Work then ceased on the two end units, reducing the length of the trench to 6 m for all lower levels. After shoring was installed, excavation in this 6 m section proceeded until the culturally sterile sands and gravels of the original beach were reached. As the strata slope somewhat

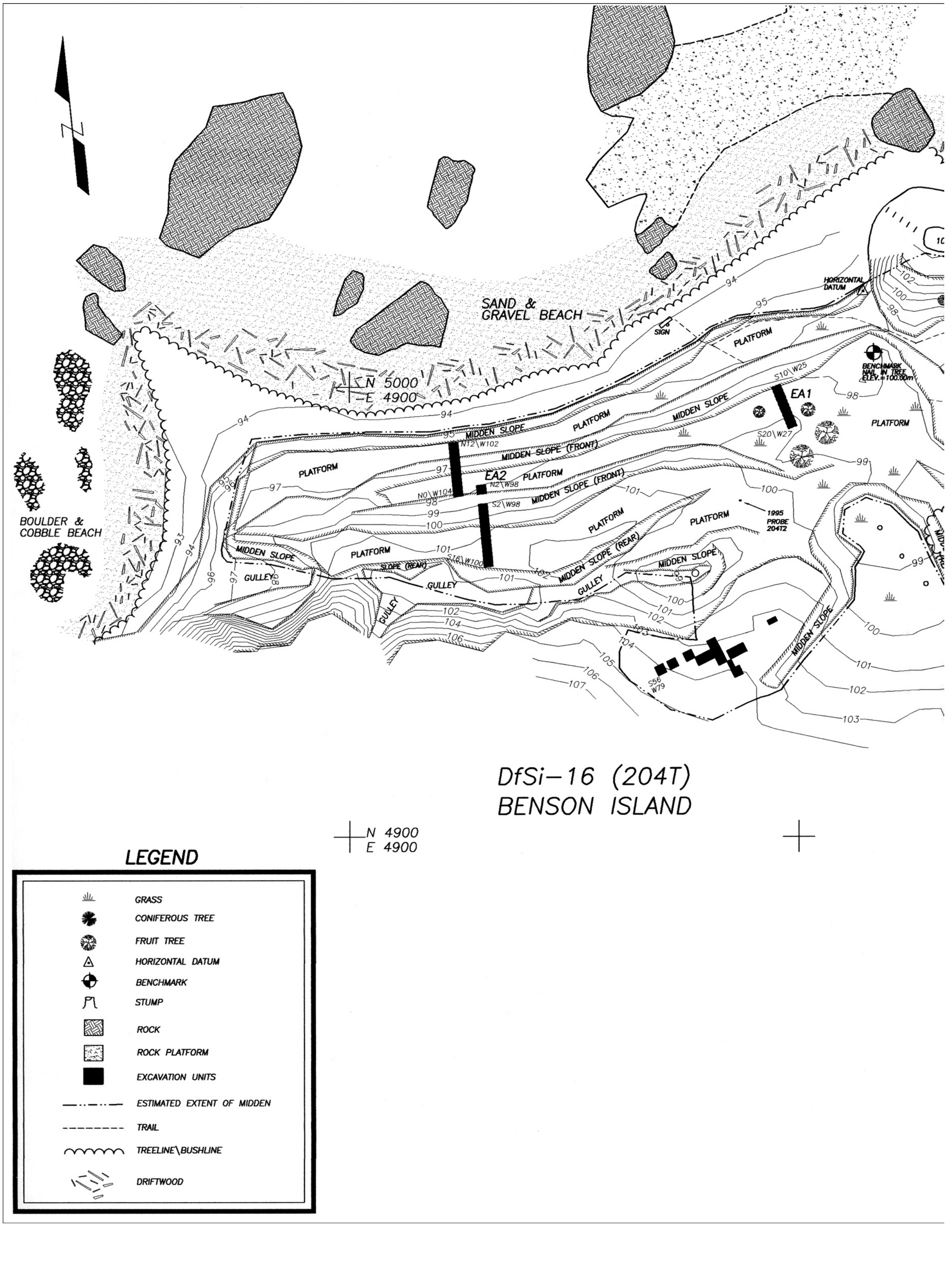
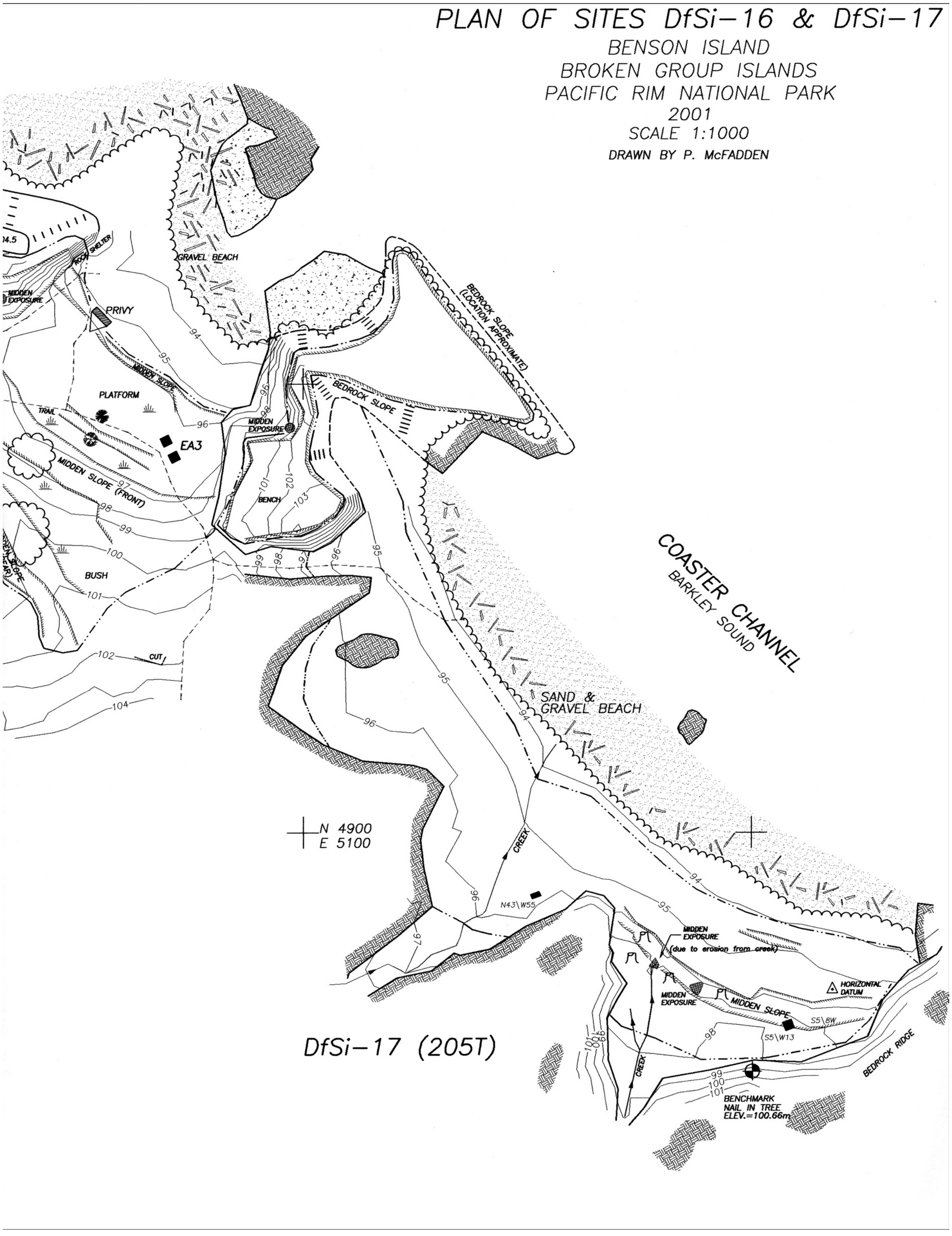


Figure 19. Contour map of Ts'ishaa (DfSi-16) and Himayis (DfSi-17), Benson Island, showing



locations of excavation units.

to the north, however, the base of deposit was not reached in the northern half of the reduced trench by the end of the field season. In the two units which reached the old beach level, the total depth of cultural deposits was about 3.7 m. In total, approximately 51.4 cubic metres of midden matrix were excavated from EA 1.

The 2000 fieldwork took place in the forested western portion of the site. Three flattened terraces or platforms extend across this area, one above the other in rows parallel to the beach (Fig. 19). The uppermost, which is the widest, and the middle flattened areas were interpreted as house platforms, while the lowest is perhaps an activity area in front of the houses and only slightly above the highest tide line. The first trench to be laid out in this area (EA 2) extended from the back of the highest terrace, just before the midden drops sharply down to a gully behind the main site, across the width of the platform and down the slope onto the back of the middle terrace. To avoid cutting across the slope at an angle, the trench had to be turned about 17º E of magnetic N–S alignment. The coordinates for this 18 m long trench are N 2 to S 16, W 98 to 100. However, the lowest unit on the slope (S 0 to 2, W 98 to 100) was barely begun when excavation on the trench halted. As a result, this excavation is better viewed as a 14 x 2 m trench (S 2 to 16, W 98 to 100) extending across the upper platform and down the slope below, plus a 2 x 2 m unit (N 0 to 2, W 98 to 100) at the back of the middle platform. Excavation across the upper platform was hindered by the loose shell deposits, which made it difficult to maintain vertical walls. As repeated slumps made it impossible to install the shoring equipment when the required depth was reached, this trench was abandoned at that point for safety reasons. The maximum depth reached in the trench was about 1.6 m; in all, approximately 29.8 cubic metres of deposit were removed. The 2 x 2 m unit on the middle platform was excavated to a depth of about 1.75 m, removing an additional 7.0 cubic metres. The deposits from this unit seemed much more consolidated and suggestive of house remains, leading to a decision to open a new trench across the lower platforms.

A second trench was then laid out two meters to the west, parallel to the alignment of the earlier trench. It extended across the relatively narrow middle platform and down the low slope to cross the lowest platform, almost reaching the drop-off to the highest tide line at the front edge of the site. Its dimensions were 12 x 2 m, with coordinates of N 0 to 12, W 102 to 104. The southernmost unit (N 0 to 2, W 102 to 104) served as a “step” outside the shoring so was only partially excavated. After reaching a depth of about 1.4 m, work in this unit was reduced to the northern half, which was taken down to about 2.4 m. All five of the remaining 2 x 2 units were excavated to the original beach level. This occurred at a depth of about 3.2 m at the southern end, adjacent to the “step” unit, and 2.4 m at the north, near the drop to the beach. About 64 cubic metres of deposit were removed, bringing the total for EA 2 to about 100.8 cubic metres.

The 2001 excavations primarily focused on the older materials behind the main site. However, two 2 x 2 m units (grid coordinates S 54–56 E 33–35 and S 58–60 E 33–35) were also excavated near the eastern end of the main village area, on the lowest and broadest of two flat platforms. A slight rise at the back of this platform, dropping off again before the slope up to the higher terrace, appears to be a back midden ridge which accumulated behind where houses once stood. In addition to extending coverage across the site, this area (EA 3) was selected because previous probing had indicated that the deposits were relatively shallow and could be dug without trenching and shoring. Maximum depth was 1.5 m. About 10.8 cubic metres of deposit were excavated from the two units of EA 3.

In total, the amount of site deposit excavated at Ts’ishaa village, not counting the units on the back terrace, was about 163 cubic metres.

Excavation Methodology

A horizontal datum (0–0 point) was placed just off the northeastern edge of the site as a spike driven into the trunk of a large spruce tree in a small cluster of trees adjacent to a large rock outcrop. All unit coordinates were laid out from that point. The vertical datum was then established as a flagged spike driven into the trunk of a large spruce tree in the open area in the eastern portion of the site, directly south of the horizontal datum and east of the initial excavation trench (EA 1). Both are shown on Figure 19. The same vertical datum was used for the EA 3 excavation units. However, for EA 2, in the western portion of the site, distance from the primary datum required establishment of a secondary datum, which was marked by a flagged spike driven into the trunk of a large hemlock tree immediately west of the excavation trench on the upper terrace. As this is markedly higher than the area around EA 1, the secondary datum had to

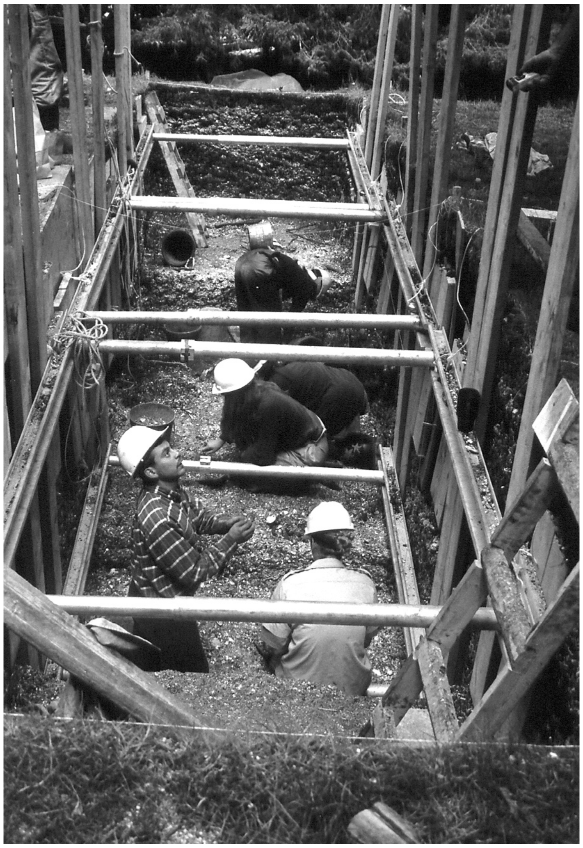


Figure 20. Excavation in progress at Ts'ishaa showing the 1999 trench (EA 1) and the shoring equipment installed for worker safety. The "step" units at each end of the trench are also evident.

be established at three metres above the primary datum; therefore all measurements between these two areas will differ by that amount. Unit datums, pegs with their tops surveyed to a depth below the main datum, were established beside each excavation unit in each of the excavation areas.

The deep and loosely consolidated shell deposits at the site required excavation in trenches, so that shoring could easily be installed for worker safety. Each trench was laid out as a series of 2 x 2 m squares, oriented in a perpendicular line to the beach. Only the central units were excavated to the base of deposits; the end units were planned as "steps," to provide access to the trench and to reduce the height of the end walls. Once the excavation reached a depth (about 1.2 m) that required safety measures, the 2 m width of the trench was braced with professional shoring equipment. Aluminum hydraulic cylinders, exerting a pressure in excess of 1000 psi, spanned each trench. Each cylinder fitted into a horizontal aluminum "whaler" on each trench wall. The whalers held vertical 2" x 8" boards, 14' [4.2 m] in length, pressed firmly against the trench walls. As excavation proceeded, the boards were driven further down and an additional horizontal unit of two whalers and two cylinders would be added at approximately 1.2 m intervals (Fig. 20). Three levels of shoring were installed in the deepest excavation units.

During excavation, all cultural deposits were removed by trowelling in ten centimetre levels, taking care to separate materials from differing natural layers. Levels were numbered while natural layers were given alphabetical designations; both were recorded on all bags and forms. Artifacts were recorded in three dimensional provenience, while faunal remains were bagged by level and layer. All trowelled matrix was screened through 1/4" mesh. Standardized forms (based on ones obtained from the Royal B.C. Museum in Victoria) were used to record data concerning artifacts, features, and radiocarbon samples, as well as the notes for each excavated level. Profile drawings were made of the stratigraphy along one long wall of each trench, as well as the end walls. Such drawings had to be done in stages as the excavation proceeded, due to the need to keep moving the shoring boards which partially covered the walls.

Several collection strategies were employed for faunal remains. All vertebrate remains were collected and were bagged by level and layer separately from shell. All shellfish remains that were relatively complete or retained one hinge (or a portion of a hinge) were collected in the initial fieldwork. Such a large volume of shell was amassed, however, that in the 2000 fieldwork only two central units in each trench were designated for intensive shell collection. In addition, an attempt was made to compensate for loss of smaller faunal elements through the 1/4" mesh screens. Although use of smaller mesh size throughout would have been prohibitive due to the large quantity of midden excavated, smaller samples were selected for more intensive collection. In both the EA 1 and 2 trenches, a 50 cm x 50 cm block in one of the central units was designated for fine-screening (through 1/4" mesh into 1/8" mesh), resulting in much higher recovery of small fish bones. In addition, a smaller block (25 x 25 cm in EA 1; 20 x 20 cm in EA 2) was collected as a bulk column sample which was then water-screened through nested sieves (from 1/2" to 1/16") for recovery of even very small bone and shell fragments (Fig. 21).

Figure 21. Ian Sumpter (Parks Canada) sorting fine-screened elements from the bulk matrix sample.

Stratigraphy and Chronology

The EA 1 stratigraphy is shown in Figure 22. This depicts the profile for the east wall of the central three units of the trench (S 12 to 18, W 25), excluding the two "stepped-down" end units. Below the red-brown humus at the surface was a brown-black silty matrix (Munsell 2.5Y 2/0) with crushed and burned shell and fire-cracked rock (FCR). Below that was a thick stratum of clam and mussel shell with black silt (Munsell 7.5YR 2/0). These two upper layers were not initially distinguished in the field, so both have been designated Layer A. Underlying that is Layer B, consisting of black silt and clay with charcoal and FCR. Shell is nearly absent from this matrix, although fish bones were abundant. A thick layer of whole and crushed shell is next in the sequence. A thin layer of brown sand, labelled Layer D, divides it into two, designated Layers C and E, although they are essentially the same in composition. Layer F below consists of black silt and sand with a small amount of shell (Munsell 2.5Y 2/0). The lowest cultural stratum, Layer G, consists of whole and crushed shell in a matrix of sand and gravel. This sits directly on the old beach surface, marked by sand and gravel with water-rolled shell fragments. This sterile beach deposit was only reached in the southern half of the trench.

Only one natural layer had been exposed on the upper terrace of EA 2 at the time excavation was discontinued in that area. The matrix was heavily concentrated whole and crushed clam shell, with some black silt (Munsell 7.5YR 2/0). Large pockets of loose whole clam shells were encountered. This type of midden material likely reflects "dump" activities and is typical of deposits found as back terraces at the rear of many village sites. However, the flat upper surface is not typical and likely represents intentional flattening, perhaps to allow an additional row of houses or other structures in the final period of village occupation. Such use may have been short-lived and is not reflected in the stratigraphy.

On the two lower terraces of EA 2, the strata are essentially of two types. Layers of concentrated whole and crushed shell with some black silt alternate with those of black silt (Munsell 7.5YR 2/0), pebbles, FCR, and a small amount of shell. In all units, Layers A and C consist of the latter, while Layers B and D consist of concentrated shell. The stratigraphy for the five units excavated to the base of cultural deposits is shown in Figure 23. Lower layers of crushed shell slope markedly from the middle terrace down toward the beach, suggesting that the slope from this platform was steeper at that time, prior to the accumulation of much of the deposit on the lower platform. The darker layers, with abundant FCR, occasional features such as post molds and hearths, and only traces of highly compacted shell, suggest activity areas or possible structures. At the base of the deposit are the sand, gravel, and some shell of the original beach (Layer E). Cultural materials (shell, FCR, charcoal, and a few artifacts) extend a short distance into this sandy matrix, presumably through trampling during the initial occupation.

The two units of EA 3 were similar in their stratigraphic records (Fig. 24). An upper layer of black silt and FCR (Munsell 7.5 YR 2/0) was underlain by a thick band of crushed and whole shell. Below that were layers of crushed shell mixed with ash, charcoal, and sand. Another thick layer consisted primarily of black silt, crushed shell, and small pebbles. Sand, gravel and waterworn shell marked the original beach at the base of the deposit. However, bands of dark silt, containing a small quantity of artifacts and other cultural materials, extended a considerable

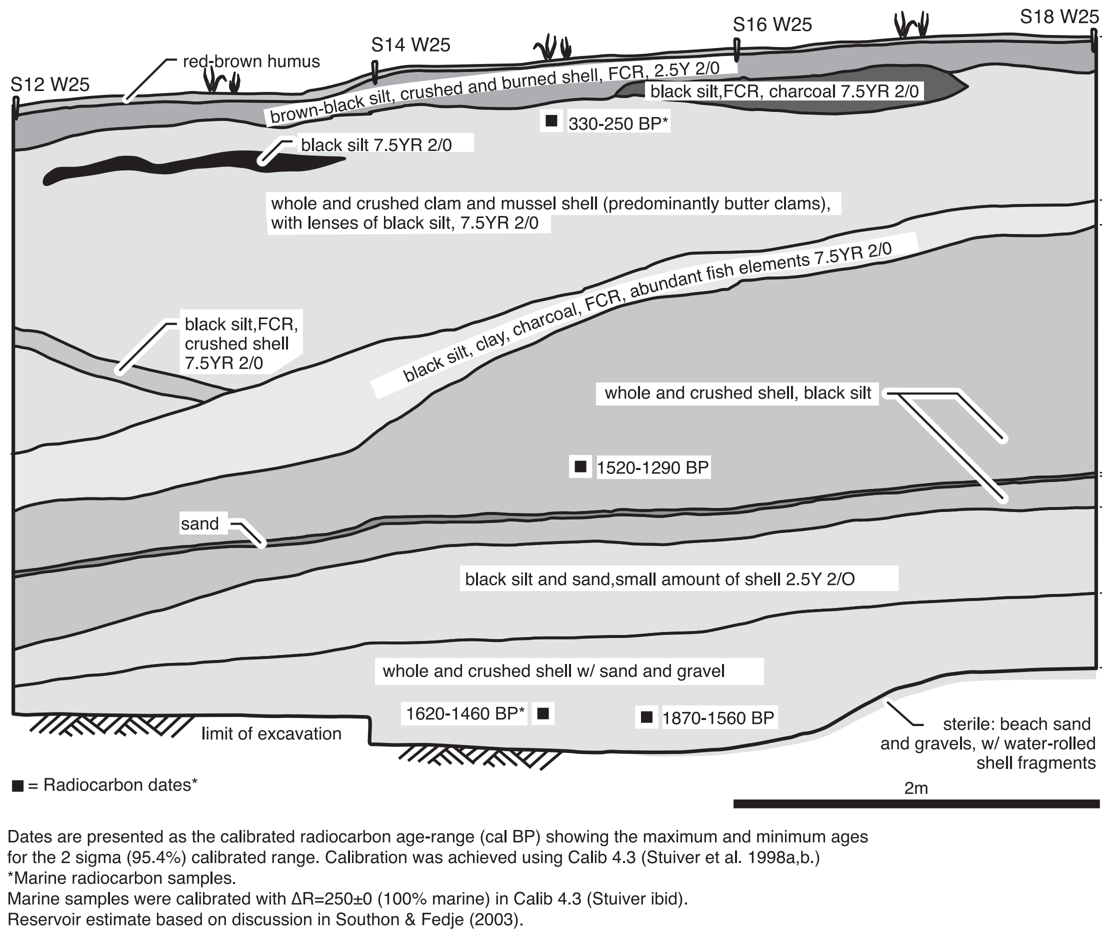


Figure 22. Stratigraphic profile of the east wall of the 1999 trench (EA 1) showing radiocarbon dates.

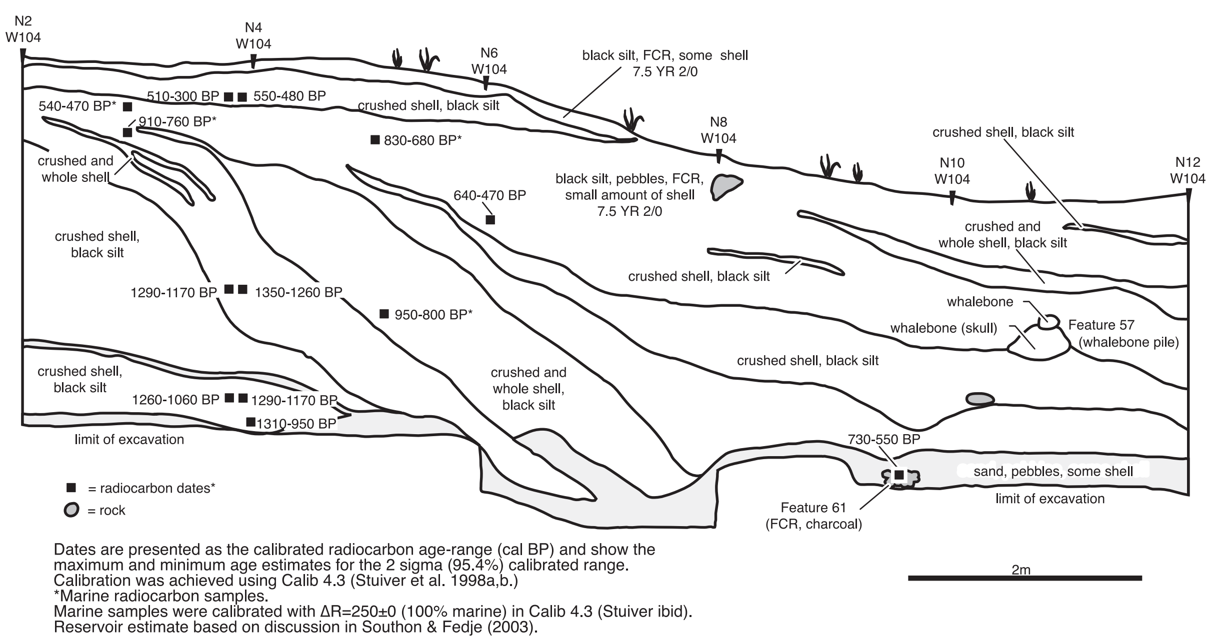


Figure 23. Stratigraphic profile of west wall of main 2000 trench (EA2) showing locations for radiocarbon dates.

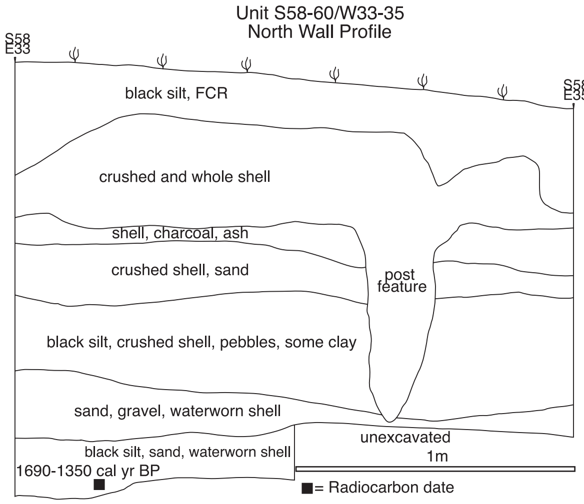


Figure 24. Stratigraphic profile for the north wall of unit S 58–60 W 33–35 in EA 3.

distance into the sand, particularly in the southernmost unit.

Radiocarbon samples of wood charcoal were collected throughout the excavation in all units. Selected samples were submitted for processing and age determination at the end of each field season. In addition, three pairs of charcoal samples were later collected from the column sample in EA 2 for precision AMS dating, along with shell from the same levels. Also, six fur seal (*Callorhinus ursinus*) bones were later selected from various locations for AMS dating; calibration of these dates takes into account the marine reservoir effect. Sample locations and results are plotted on the stratigraphic profiles (Figs. 22–24). A list of all radiocarbon dates from the village area, showing the calibrated age range (at two sigma; 95% probability), is given in Table 2.

Thirteen dates were obtained from the middle and lower terraces of EA 2, most from the southern (furthest from the beach) end of the trench (Fig. 23). Three dates from the upper layers in this area cluster in the 300 to 500 cal BP range. Just below are dates of 830 to 680 cal BP and 910 to 760 cal BP. Five dates from the lower third of the profile, representing over a metre of shell deposit, are essential contemporaneous, indicating very rapid accumulation. They suggest that the initial occupation in this area was about 1300 cal BP. Several dates from the sloping strata down to the lowest terrace are more recent, indicating that shell deposits were building toward the sea over time. A date from the base of the lowest terrace, from a hearth in beach sand, is 730 to 550 cal BP. The later site buildup on this lowest terrace may reflect gradual emergence of the land due to tectonic forces along the coast. Overall, it would appear that this western portion of the site was not occupied until somewhat later than the central and eastern areas.

One age determination on charcoal is available for EA 3, at the eastern end of the site. A sample from the black-stained sand at the base of the deposit yielded an age estimate of 1690 to 1350 cal BP.

EA 1, in the central area of the site, has four radiocarbon age estimates, including dates slightly older than the other two site areas (Fig. 22). An AMS date on fur seal bone from an upper level provided a estimate of 330 to 250 cal BP. A charcoal date from just below the middle of the deposit, at about 2.3 m depth, gave an estimate of 1520 to 1290 cal BP. Two dates from the lowest layer, just above sterile beach sands at a depth of about 3.6 metres, are 1620 to 1460 cal BP and 1870 to 1560 cal BP. The former is based on fur seal bone, while the latter is on charcoal collected from a cluster of fire-cracked rocks designated as a hearth feature. All four dates seem consistent and the oldest is assumed to be an accurate estimate for the initial occupation in this part of the site. However, a somewhat earlier date of 2350 to 2130 cal BP was obtained by the 1995 Parks Canada crew from coring behind and west of EA 1.

Artifacts Recovered

In total, 736 artifacts have been obtained from the main village at Ts'ishaa (154 from EA 1, 528 from EA 2, and 54 from EA 3). Of these, the great majority (606; 82.3%) are of bone or antler. Only 77 artifacts (10.6%) are of stone, and most consist of a single category (abrasive stones). Shell accounts for an additional 41artifacts (5.6%) and tooth for an additional 8 (1.1%). Introduced historic materials are represented by only three items (0.4%). Artifact categories and numbers are shown in Table 3.

Bone points, bipoints, and fragments of such tools dominate the assemblage from Ts'ishaa, as is the case for almost all excavated Nuu-chah-nulth sites. Although there is a considerable range in form and size, suggesting that they served a number of functions, the great majority would have been parts of composite fishing gear of various types. Collectively they total 407 objects, representing 67.2% of the bone and antler artifacts and 55.3% of the artifact total. This includes a number

Table 2. Radiocarbon dates from Ts'ishaa Main Village.

Area	Sample No.	^{14}C age (BP)	Cal age range (BP)*	Intercept (s)	$^{13}C/^{12}C$	Material*	Lev./ Layer	Comments
EA1	CAMS-85647	895±30	330-250	280	-14.1	marine bone	4A	AMS date, near top of shell
EA1	Beta-134655	1490±60	1520-1290	1350	-25	charcoal	25C	Middle of deposit, at 2.3 m depth
EA1	CAMS-85646	2235±35	1620-1460	1530	-15.3	marine bone	37G	AMS date near base
EA1	Beta-134656	1800±60	1870-1560	1710	-25	charcoal	37G	At base of unit, 3.6 m depth
EA2	CAMS-97191	350±45	510-300	434, 350, 330	-25	charcoal	3B	Paired AMS date– top of shell layer
EA2	CAMS-97192	475±35	550-480	510	-25	charcoal	3B	Paired AMS date—top of shell layer
EA2	CAMS-85651	1145±30	540-470	510	-14.4	marine bone	5C	AMS date
EA2	Beta-147072	500±60	640-470	520	-25	charcoal	10C	Middle terrace, 1.2 m depth
EA2	Beta-147075	690±60	730-550	660	-25	charcoal	25E	Lowest terrace, base of deposit, 2.4 m
EA2	CAMS-85649	1470±30	830-680	750	-14.4	marine bone	7C	AMS date
EA2	CAMS-85650	1545±30	910-760	850	-14.6	marine bone	7C	AMS date
EA2	CAMS-85648	1595±35	950-800	910	-13.4	marine bone	21D	AMS date, shell layer, 2.2 m depth
EA2	Beta-147074	1230±90	1310-950	1170	-25	charcoal	31E	Middle terrace, base of deposit, 3.1 m
EA2	CAMS-97203	1385±35	1350-1260	1290	-25	charcoal	20D	Paired AMS date from column sample – 2 m depth
EA2	CAMS-97204	1300±35	1290-1170	1260	-25	charcoal	20D	Paired AMS date from column sample – 2 m depth
EA2	CAMS-97197	1310±35	1290-1170	1260	-25	charcoal	30D	Paired AMS date from column sample – near base of deposit, 3m depth
EA2	CAMS-97198	1230±35	1260-1060	1170	-25	charcoal	30D	Paired AMS date from column sample – near base of deposit, 3 m depth
EA3	Beta-158746	1620±60	1690-1350	1530	-25	charcoal	14+E	From sand at base of deposit, 1.5 m
core	CAMS-28075	2260±50	2350-2130	2330, 2220, 2210	-25	charcoal	---	AMS date from bottom of 1995 auger test at back of midden

*Dates are presented as the calibrated radiocarbon age-range (cal BP) and show the maximum and minimum age estimates for the 2 sigma (95.4%) calibrated range. Calibration was achieved using Calif 4.3 (Stuiver et. al. 1998a,b).
*Marine samples (all fur seal [*Callorhinus*] bone) were calibrated with AR=250±0 (100% marine) in Calib 4.3 (Stuiver et. al. 1998a,b). Reservoir estimate is based on discussion in Southon and Fedje (2003).

of tip fragments, some of which could have come from other tool types, such as awls.

The number of artifacts recovered is relatively low for the size of the excavation (4.5 artifacts per cubic metre of deposit removed). This is particularly evident for EA 1 (3.0 artifacts per m^3) and the upper terrace of EA 2 (4.1 per m^3). In both cases, the low number of artifacts and features, plus the great quantity of shell and its lack of compaction, suggest that these were "dump" areas where mollusc shells and other refuse were discarded. The units on the two lower terraces of EA 2 had higher artifact densities (5.7 per m^3), with dense black layers suggesting house or activity areas.

The relative paucity of artifacts recovered from Ts'ishaa is particularly evident through comparison with other excavated Nuu-chah-nulth sites. The major village of Yuquot in Nootka Sound yielded approximately 17.9 artifacts per cubic metre of deposit, even excluding the numerous artifacts of European materials in the historic component (Dewhirst 1980). The closest comparisons would be with the excavated Toquaht sites, just a short distance from Ts'ishaa on western Barkley Sound (Fig. 1). T'ukw'aa, originally the main village of the Toquaht and therefore equivalent to Ts'ishaa, yielded 13.3 artifacts per m^3, again excluding the relatively numerous historic items of European manufacture. The figure for Ch'uumat'a, a major village nearby, is 6.5 artifacts per m^3 of deposit, while Ch'uuch'aa, a lookout site on the George Fraser Islands, had 17.2 per m^3 (McMillan and St. Claire 1992, 1994, 1996).

Artifacts are classified by raw material, then by form or presumed function. The number of examples in each category is given after the heading. All measurements, given in centimeters, are the maximum for that attribute, unless otherwise specified. Parentheses on a measurement indicate that the object is incomplete in that dimension. Wherever possible, some discussion is given of the archaeological distribution of each artifact category and the ethnographic use of similar objects within Nuu-chah-nulth territory and surrounding areas.

Artifacts of bone and antler

Bone points (112) At least two distinct categories of relatively small unbarbed bone points can be discerned. One ("abrupt tip") is characterized by greatest width near the tip and sides that gradually taper to the base (Fig. 25, lower row). A total of 37 points falls within this category. Such points tend to be quite stout, with 18 of the total being round or nearly so in cross-section while the rest are flattened. Bases take a range of forms; several are wedge-shaped, a few come to a blunt point, and a number of those round in cross-section have round flattened bases. Most have been fashioned from sections of hard land mammal limb bone, although three are of sea mammal bone. One charred and blackened example is based on the intact limb bone of a small mammal that has been extensively worked over its entire surface and ground to a sharp point. Size varies considerably, from several quite large examples to one that is very small. Measurements are summarized in Table 4. The variation in form and size suggests that these objects served several different functions. Most, however, would likely have been used as arming points in composite toggling harpoon heads. Many fit quite comfortably into the excavated toggling harpoon valves from the site although a few seem

Table 3. Artifacts from Ts'ishaa (DfSi-16) – Main Village.

	EA1	*EA2*	*EA3*	total
Bone & Antler				
Bone points				
abrupt tip	16	21	–	37
gradual taper	9	23	1	33
small wedge-based	3	3	3	9
unidentified frag	8	24	1	33
Barbed bone points	3	2	2	7
Bone bipoints	20	170	–	190
Tips of pointed bone tools	13	82	3	98
Awls				
deer ulna	1	1	1	3
deer metapodial	1	–	–	1
land mammal bone splinter	2	8	3	13
bird bone	–	4	3	7
Harpoon valves	8	14	6	28
Harpoon foreshafts	1	2	–	3
Chisels	1	6	–	7
Comb	–	1	–	1
Pendants/drilled bone	2	7	–	9
Bird bone tube	–	1	–	1
Small rectangles (net gauges?)	–	3	–	3
Wedges	–	5	–	5
Bark shredder frags.	1	1	–	2
Straight adze handle (?)	1	–	–	1
Harpoon preforms	2	–	–	2
Crude whalebone club	–	1	–	1
Worked whale bulla	–	1	–	1
Misc. worked bone (excl. whale)	14	26	3	43
Misc. worked whalebone	16	36	1	53
Misc.worked antler	2	12	1	15
(total)				606 82.3%

	EA1	*EA2*	*EA3*	total
Stone				
Chipped biface	–	–	1	1
Chipped phyllite chopper	–	–	1	1
Obsidian flake	1	–	–	1
Chipped and ground schist knife	1	–	–	1
Ground stone point	–	–	2	2
Notched pebble (sinker?)	–	1	–	1
Jet pendant	1	–	–	1
Celt preforms (?)	1	2	–	3
Fishhook shanks	–	3	–	3
Hammerstones	2	3	1	6
Abrasive stones	10	43	5	58
(total)				78 10.6%
Shell				
Mussel shell harpoon blade	–	1	–	1
Misc ground mussel shell	9	9	–	18
Dentalium shells	2	1	3	6
Olivella shell beads	–	3	10	13
Clam shell disc beads	1	–	–	1
Clam shell ochre bowl	–	1	–	1
Perforated scallop shell	–	1	–	1
(Total)				41 5.6%
Tooth				
Worked canines	1	4	1	6
Elk tooth pendant	–	1	–	1
Beaver incisor tool	–	1	–	1
(total)				8 1.1%
Historic Materials				
Iron fragments	1	–	–	1
Glass bottle frags.	–	–	2	2
(total)				3 0.4%
Grand Total	**154**	**528**	**54**	**736**

Table 4. Abrupt tip bone points – Ts'ishaa Village.

attribute	*range*	*mean*	*S.D.*	*No.*
length	1.8 to 6.6 cm	3.80 cm	0.76 cm	30
width	0.3 to 0.9 cm	0.68 cm	0.12 cm	37
thickness	0.2 to 0.8 cm	0.51 cm	0.13 cm	37

Table 5. Gradually tapering bone points – Ts'ishaa Village.

attribute	*range*	*mean*	*S.D.*	*No.*
length	2.8 to 9.9 cm	4.89 cm	1.47 cm	21
width	0.3 to 0.8 cm	0.52 cm	0.09 cm	33
thickness	0.3 to 0.6 cm	0.39 cm	0.07 cm	33

too stout and bluntly pointed to have served such a function.

Of the remaining points, 33 have been classified as "gradually tapering" (Fig. 25, upper right). These are roughly bipointed although one end is more blunt than the other; greatest width is below the centre, closest to the blunt end. Most correspond to Dewhirst's (1980) "spindle-shaped" category for Yuquot. The 21 complete examples from Ts'ishaa vary considerably in length, from 2.8 to 9.9 cm. Measurements are shown in Table 5. All but one are made from splinters of land mammal bone; the exception is a section of intact sea mammal limb bone (tentatively identified as a fur seal fibula) which has been extensively ground and sharpened to a point at its intact end. Most in this category would have functioned as barbs in composite fishing hooks of various sizes. One eroded example is notched and worn just below the mid-point, possibly as a result of hafting onto the shank of the hook; no other evidence of lashing was noted.

Nine additional small points, all of land mammal bone, range in length from 2.8 to 3.9 cm (mean = 3.23 cm; S.D. = 0.27 cm). Six are distinctly wedge-based while three are narrowed on several facets down to the base. These probably also served as barbs on very small fishhooks.

Another 33 artifacts are fragments of bone points that are too incomplete to categorize further. These are primarily base and mid-section fragments. Except for a few that could easily be recognized (such as those from abrupt tip points), tip fragments could have come from a variety of pointed bone artifacts and are listed separately. All are of land mammal bone. Several long stout fragments clearly came from artifacts that were considerably larger than any of the complete points in the collection. Only a few are relatively slender fragments from smaller bone points.

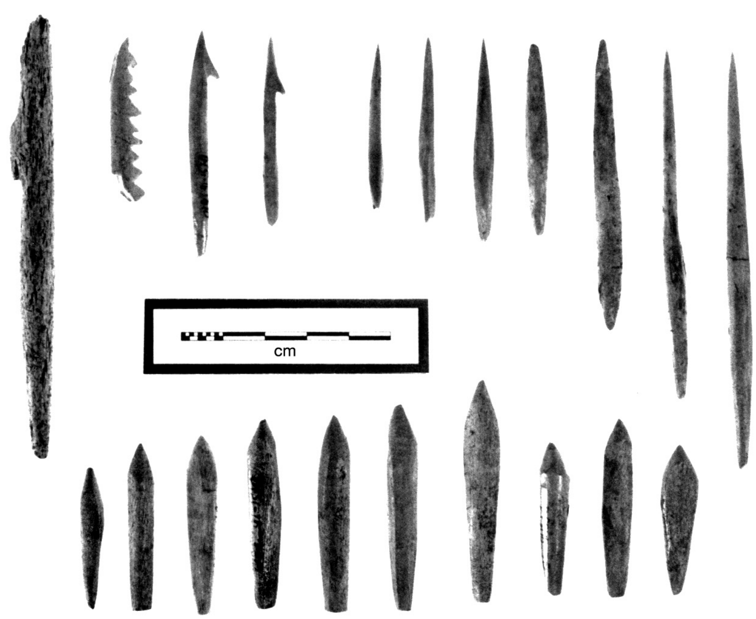


Figure 25. Bone Points from Ts'ishaa (upper left – barbed points; upper right – gradually tapering points; lower row – abrupt tip points).

Barbed bone points (7) A distinct sub-category consists of small points of land mammal bone with a single barb near a sharp tip (Fig. 25, top left). Three complete examples, with lengths of 4.6, 5.0, and 5.6 cm, came from Ts'ishaa (one from each of the three excavation areas). They are oval to round in cross-section. In two cases the base is bluntly pointed, while the third has a flat circular base. Such points likely armed composite fishhooks which had shanks of wood or bone. Drucker (1951: 22) describes a hook for catching cod or trolling for salmon as having a point "which was a barbed splinter of hardwood or bone." Jewitt (1967: 68), at Nootka Sound from 1803 to 1805, described the fishhooks in use there as "a straight piece of hard wood, in the lower part of which is inserted and well secured, with thread or whale sinew, a bit of bone made very sharp at the point and bearded [barbed]." Similar artifacts were found at Yuquot (Dewhirst 1980: 178–81), Shoemaker Bay II (McMillan and St. Claire 1982: 102–3), the Ozette midden trench (McKenzie 1974:93), and at both T'ukw'aa and Ch'uumat'a (McMillan and St. Claire 1992, 1996). They are considered to be one of the characteristic artifacts of the West Coast culture type (Mitchell 1990: 356).

The remaining four examples, although all fragmentary, appear to have been larger unilaterally barbed fixed bone points. The most complete, of sea mammal bone, is round in cross-section with a tapering round base (Fig. 25, left). Although most of the tip portion is missing, it retains one low barb. This fragment is 10.7 cm long, with a diameter of 0.9 cm. Another is a broad flat tip fragment, clearly from a much larger artifact, which retains evidence of one barb although much of it has broken away. A second tip fragment also shows evidence of one barb which has largely broken away, although this was clearly from a smaller implement. The final object is a small mid-section with nine closely-spaced barbs remaining on one side. Unilaterally barbed fixed points were common at Yuquot, where Dewhirst (1980:282) suggests that they armed arrows. They are a characteristic trait of Mitchell's (1990: 356) West Coast culture type.

Bone bipoints (190) Bone bipoints, splinters of bone with both ends sharply pointed, comprise the largest single artifact category found at Ts'ishaa (Fig. 26). A total of 190 were found, most of which came from EA 2. The 111 complete examples range in length from 2.1 to 6.6 cm (mean = 4.4 cm; S.D. = 0.76 cm). Most (135) are slender objects of bird bone. The remainder are stouter, in a few cases markedly so; these are generally of land

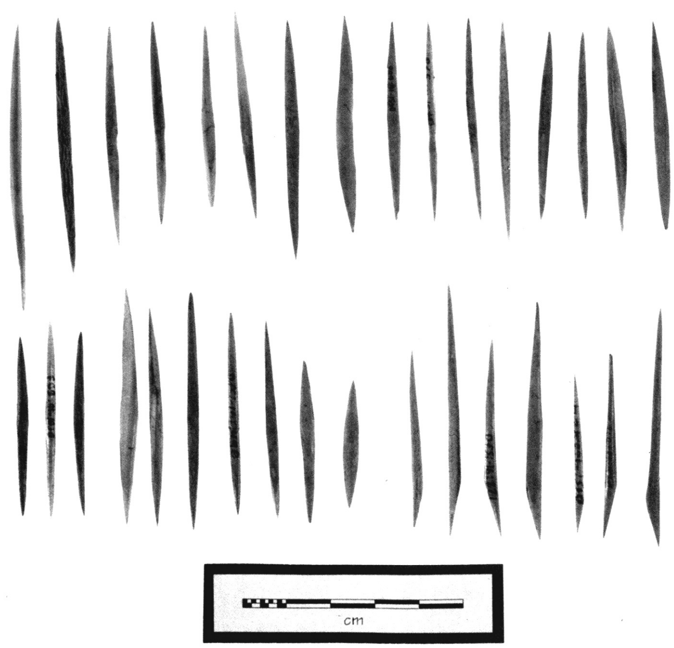


Figure 26. Bone bipoints from Ts'ishaa (scalene examples at lower right).

mammal bone, although several are from sea mammals. Although most have their greatest width at their centre, 29 examples, all but one slender bird bone bipoints, are markedly asymmetrical, taking the form of an elongated scalene triangle. Similar "scalene" objects also occur among the Yuquot gorges (Dewhirst 1980: 220–1).

Many of these sharpened splinters of bone would have been used as gorge hooks. Ethnographically, such objects were baited and tied, and used not only for taking fish but also aquatic birds. Drucker (1951: 34) describes a trap used by the Nuu-chah-nulth for catching diving waterfowl as consisting of many baited bone gorges tied to an anchored pole. Dewhirst's (1980: 210–1) Nuu-chah-nulth respondents at Nootka Sound also confirmed the use of such artifacts to take both fish and birds. However, only one of the Ts'ishaa bipoints is markedly "waisted" or indented at the centre for line suspension.

Bone bipoints are common at all excavated Nuu-chah-nulth sites. Their high frequency here (25.9% of the artifact total) compares most closely with T'ukw'aa (24.5%) and the Ozette midden trench (33.7%) (McMillan 1999:174).

Tips of pointed bone tools (98) Sharpened fragments of bone were commonly encountered in the Ts'ishaa midden deposits. A range of sizes and materials suggest that they came from a variety of pointed bone tools. Most would have been from bone points of various forms, but others would have come from bipoints, awls, or other artifact types. The majority are of land mammal bone, although sea mammal bone and bird bone are also represented. Some quite large and stout examples are generally oval to rectangular in cross-section. Others are more slender and round in cross-section. The latter, along with a number of small sharpened bird bone splinters, are likely from slender bipoints, used as gorges, of which only one end has been recovered.

Ten very small pointed bird bone objects were found in a cluster on the upper terrace of EA 2. Of these, six are fragments with only one end remaining and are included here. The other four are complete or nearly so, allowing classification as bipoints. It is likely that all ten were small bipoints. Their discovery together indicates some form of fishing gear, possibly a line with a series of small gorges attached.

Awls (24) Bone awls are of several distinct types. This category has been divided into deer ulna awls, deer metapodial awls, land mammal bone splinter awls, and bird bone awls (Fig. 27). Such tools are commonly encountered in Nuu-chah-nulth sites; bone splinter awls and deer ulna tools are specifically identified as characteristics of the West Coast culture type (Mitchell 1990).

Figure 27. Bone awls from Ts'ishaa (from left: two bird bone awls, four land mammal bone splinter awls, one deer metapodial awl, and two deer ulna tools).

Two deer ulna tools, 10.2 cm and 10.3 cm in length, are complete. On one, the unmodified distal end is missing the epiphysis, indicating that it was made from the ulna of an immature deer. The proximal end has been sharpened to a flattened, fairly broad, blunt point, with extensive grinding striations still evident. The sides near the tip are flattened, indicating that it was used as an awl rather than as a knife. The other, based on a mature deer ulna, has considerable polish over its entire surface, including the base. The sharp polished tip is oval in cross-section. Three closely-spaced shallow grooves are visible near the tip on one side. A nearly identical tip fragment is also placed in this category. This sharpened, highly polished tip, oval in cross-section, has two pronounced grooves along one side near the tip. As this is where the break occurred, there may originally have been additional grooves. Such distinctive wear possibly suggests that these were used as weaving implements. Similar wear is seen on ulna tools from Yuquot (Dewhirst 1980: 143–5), Hesquiat Village (Haggarty 1982: 125), and Shoemaker Bay II (McMillan and St. Claire 1982: 105).

Another complete example, 6.7 cm in length, is based on the distal portion of a deer metatarsal. It retains the complete unmodified articular surface at the base. The shaft of the bone has been cut at an angle, then extensively ground on flat facets to produce a blunt tip that is nearly square in cross-section.

Thirteen awls are based on splinters of land mammal bone. Each has one end worked to a sharp point, while the base of the artifact remains rough and unshaped. Three large examples were made from long sections of land mammal limb bone, with some of the natural curvature intact on the object's width. The largest has a long tapering tip from an irregular base, which appears polished through use; it is broken into several non-joining pieces but would have been greater than 14.2 cm in length. Another, complete at 9.6 cm in length, has been worked at one end to a sharp rounded tapering point. The third, (10.1) cm long, is missing only a small area at the tip, which is long, round in cross-section, and gradually tapering, resembling a drill. The tip of a small fragment is also round in cross-section and gradually tapering, flaring out to a rough base. Complete examples of the nine additional splinter awls range in length from 3.8 to 7.0 cm. Five are markedly asymmetric, with the tip at the end of one side.

Of the seven bird bone awls, four are based on intact segments of bird limb bone cut and ground at an angle to produce a sharp point. All have an intact tip but are broken at their base. The longest fragment is 6.2 cm. Diameters are 0.3, 0.4, 0.4 and 0.8 cm. Such implements are usually classified as awls, although Dewhirst (1980:190) considers similar slender examples from Yuquot to have been arming points on composite fishhooks. Three others are based on splinters of bird bone which have been sharpened at the tip but less carefully finished at the base.

<u>Harpoon valves</u> (28) All are parts of composite harpoon heads. Considerable variability in size and form is evident (Figs. 28, 29). Although most are a size that would suggest use in fishing for salmon, several larger examples may have been used for seals or other sea mammals. The 28 artifacts in this category are divided into channelled (11), slotted (5), self-armed or ancillary (3), large (3), and unclassifiable fragments (6). Sea mammal bone, land mammal bone, and antler were all used as raw materials in their manufacture.

Channelled valves comprise the largest category. Rounded channels are evident in both the upper and lower portions of the ventral face on these valves. Lashing to a nearly-identical companion valve would result in a harpoon head with a round open-ended channel at the upper end, which would hold a bone arming point that` was round in cross-section (similar to many of the abrupt tip examples). The lower channels formed a socket for insertion of the harpoon foreshaft. Most valves in this category are fragmentary, but still display parts of both channels. Four complete valves vary considerably in size. The largest (7.1 x 1.3 x 0.9 cm) has a deep rounded point channel (2.8 cm long) that would have held a substantial round bone arming point. On the curved dorsal surface, a shallow groove crosses the centre of the artifact, above which the bone is eroded and a different colour than the base, marking the area that was wrapped with binding that held the two valves and associated point in place. A similar but smaller valve (4.7 x 1.1 x 0.8 cm) has a deep rounded point channel (1.8 cm in length) and a whittled area on the upper dorsal face which may be associated with binding. This object seems typical of the size used for harpooning salmon, and many of the fragmentary examples are very similar in size. Finally, two very small valves (3.8 x 1.0 x 0.7 and 4.4 x 0.9 x 0.5 cm) have, unlike most in this category, small shallow channels that would have held small flattened bone arming points.

An additional five valves are of the slotted vari-

Figure 28. Harpoon valves from Ts'ishaa (top row – four channelled valves, two large slotted valve fragments; bottom row – four slotted valves, one ancillary valve, one incised valve fragment).

ety. All are characterized by a stepped flat surface as a point bed at the upper end of the ventral face. This would have held a flat arming point, such as a wedge-base bone point or possibly a broader point ground of mussel shell. Two complete composite harpoon heads, with very similar slotted valves and large wedge-based bone points were found intact in Shoemaker Bay I deposits (McMillan and St. Claire 1982:81). Except for the shape of the point bed, these closely resemble the previous category. All are similar in size, with the three complete examples being 4.8, 4.8, and 5.8 cm in length (with point beds that are 1.6, 1.7, and 1.9 cm in length).

Three artifacts are thought to have been parts of two-piece harpoon heads, which consist of one self-armed valve and one ancillary valve. None in this category have channels, but their shape and curvature suggest use as valves. One small example (3.4 x 0.6 x 0.3 cm) has a sharp point and a rounded wedged base. Its curvature suggests that this was a self-armed valve, which would have been paired with a very small ancillary valve to form a small harpoon head. A similar artifact, measuring (3.9) x 0.7 x 0.4, is missing a small area at its tip, but is also identified as a self-armed valve. Another example (4.2 x 0.8 x 0.4 cm) has a squared and flattened upper surface, as well as the typical flaring blunt tip at the valve's lower end. It is identified as an ancillary valve, which would have been paired with a longer pointed valve. Similar examples were common at Yuquot (Dewhirst 1980:233–249), and have been identified at Hesquiat Village (Haggarty 1982:124) and other Nuu-chah-nulth sites.

Three fragmentary examples, all of sea mammal bone, are clearly from larger harpoon heads. Unlike the previous categories, which were primarily parts of salmon fishing gear, these were likely used in hunting sea mammals such as seals and sea lions. The largest fragment, (7.5) cm in length, is slotted on the upper ventral face to create a flat bed 1.8 cm in length. This would have held a broad cutting blade of ground mussel shell, which would have been held in the slot with spruce gum and tightly wrapped in place. It is broken toward the base, at the top of the channel for the shaft socket. On the dorsal face this object is markedly "stepped" and indented at the sides below the blade slot, presumably to hold the binding in place. A second object is only a small fragment from the upper end of a similar valve, showing a flat ventral face and a marked "stepped" projection around the upper dorsal surface. Similar artifacts were excavated at Yuquot (Dewhirst 1980:302–3), Hesquiat Village (Haggarty 1982:124), T'ukw'aa (McMillan and

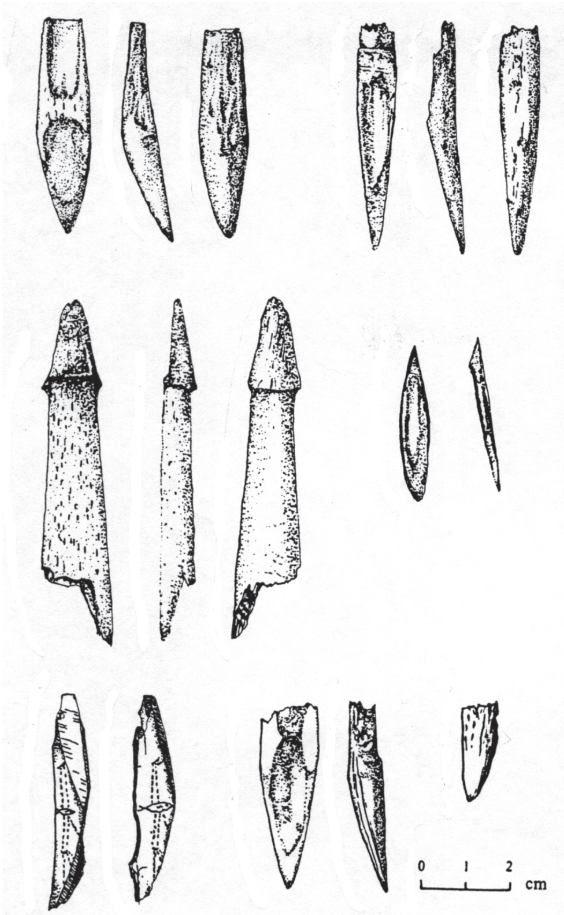


Figure 29. Harpoon valves from Ts'ishaa (upper row – channelled valve, slotted valve; middle row – large slotted valve, small self-armed valve; lower row – incised valve fragments.

St. Claire 1992: 46), and Ch'uumat'a (McMillan and St. Claire 1996:40). The third fragment is only a small portion of what appears to be the wedge-like distal end, with a flat ventral face and the break at the beginning of one channel.

Six fragments are too incomplete to classify. All come to a blunt point and appear to be the lower end of the valve. Only one retains evidence of a channel, which would have been part of the foreshaft socket. All are small and may be associated with salmon fishing.

Bone and antler harpoon valves are found in archaeological sites all along the Northwest Coast. Mitchell (1990:356) lists "large and small composite toggling harpoon valves of bone or antler" as a characteristic feature of the West Coast Culture Type. They are common at Nuu-chah-nulth sites such as Yuquot, where self-arming valves dominate the earlier periods and are gradually replaced by channelled valves in more recent levels (Dewhirst 1980). Channelled valves also are the most common type in the western Barkley Sound sites of T'ukw'aa and Ch'uumat'a (McMillan and St. Claire 1992:46–47; 1996:37). Drucker's (1951:20) illustration of a Nuu-chah-nulth salmon harpoon head shows two channelled valves and a rounded bone point.

Three fragmentary valves display parts of incised designs on their remaining outer surfaces (Fig. 29). The most elaborate of these designs is on a small segment that has split lengthways, yet is complete in length at 4.5 cm. A design along the intact lateral edge consists of a central lenticular shape, perpendicular to the long axis of the object, with two long extensions from it, forming an image that resembles a long-winged bird. A paired design would have extended along the other side of the valve, which has broken away, leaving only two lines joining near the base of the artifact. The images are formed by short punctates or dashes, joined by shallow lines. Two parallel rows of such punctates or dashes are also evident on a small valve end fragment, which has split lengthways as well. The third decorated object is the lower half of a channelled valve which has two parallel lines, formed by overlapping incisions, along each lateral edge, extending to the pointed base. Ethnographically, the valves on whaling harpoons were frequently incised with zigzag punctate designs representing the *h̲iy'itl'iik*, or Lightning Serpent. Drucker (1951:28) comments that such designs were thought to have "magical virtue," enhancing the power of the harpoon. None of the three Ts'ishaa examples are sufficiently large for use in whaling, but the "magical virtue" may have extended to hunting smaller sea mammals and to fishing with harpoons.

Harpoon foreshafts (3) All are of sea mammal bone. The most definite example is oval in cross-section, with straight, gradually converging sides and a blunt rounded tip (Fig. 34). Broken at its base, this fragment is 13.7 cm long. A small medial fragment from near the distal end is similarly oval in cross-section with straight tapering sides. The third example, measuring 19.3 cm in length although it is missing the proximal end, is somewhat different (Fig. 34). It has flat faces and bevelled sides, giving it a hexagonal cross-section. The end is flattened and rounded; it may possibly have served as a prying tool, as might be used in collecting shellfish, rather than as a harpoon foreshaft.

Objects very similar to these are reported for Yuquot (Dewhirst 1980:226–9). A complete example, measuring 35 cm in length, was found as a grave inclusion at Ch'uumat'a (McMillan and St. Claire 1996: 23). Sea mammal bone foreshafts are listed by Mitchell (1990:356) as one of the identifying features of the West Coast culture type.

Chisels (7) The only complete example, measuring 7.8 x 2.4 x 1.7 cm, is made from an elk (or wapiti, *Cervus elephas*) metapodial (Fig. 30). It has been split lengthways and extensively worked, with the articular surface at the butt end ground flat and the sides highly polished for their entire length. The bit end has been bevelled and polished from both faces. At one point, heavy use resulted in a segment being split off from one side of the bit, which was then re-ground and polished, reducing the bit width to only 0.7 cm.

The others, all incomplete, are also made from dense land mammal bone. Two large fragments, both split lengthways through use and missing their butt ends, appear similar to the above example. In one case the bone is so thick that it must also be elk, rather than deer. Remaining surfaces are polished and the bits, bevelled from both faces, are slightly curving. Three other small fragments are from the bit ends of such tools. Each of these highly polished fragments has also split lengthways, presumably through heavy use. The final example is a curving bit fragment, although it is less polished and less sturdy than the others and possibly may be the wedge-shaped base of a different type of artifact.

Comb (1) A complete comb, measuring 10.3 x 3.2 x 0.7 cm, is made from sea mammal bone (Figs. 31, 32). All six teeth are present, although the upper portions of several have been only partially cut through the bone. An incised line encircles the object above the teeth, cutting into each side to produce shallow notches. The upper portion of the comb is carved in an unusual, slightly asymmetric, outline design. Two pronounced notches on each side and a large "U-shaped" depression on the top create "eared" projections at the upper corners of the artifact. This comb is fairly recent, as it came from the middle terrace of EA 2, in the same layer as, but well above, a radiocarbon age of 640 to 470 cal BP.

Although bone or antler combs are not common in Nuu-chah-nulth sites, they are reported for three of the Toquaht sites (McMillan and St. Claire 1992: 50; 1994: 26, 39). They were also found at Ozette, in both the midden trench and the preserved house deposits (McKenzie 1974: 71; Kent 1975).

Pendants/drilled bone (9) A complete proximal phalanx, 6.2 cm in length, from a fur seal (*Callorhinus ursinus*) has been biconically drilled near the proximal end, presumably for suspension as a pendant (Fig. 32). Slight polish is evident over its surface. Perforated sea mammal phalanges were also found at Yuquot (Dewhirst 1980: 317).

One fragmentary but finely carved object of sea mammal bone resembles a miniature club (Figs. 31, 32). Only the upper portion is present. Above the shaft, which is a rounded rectangle in cross-section, is a flattened drilled and incised area that has broken away at its edges. One drilled hole

Figure 30. Bone chisels and small bone rectangles from Ts'ishaa.

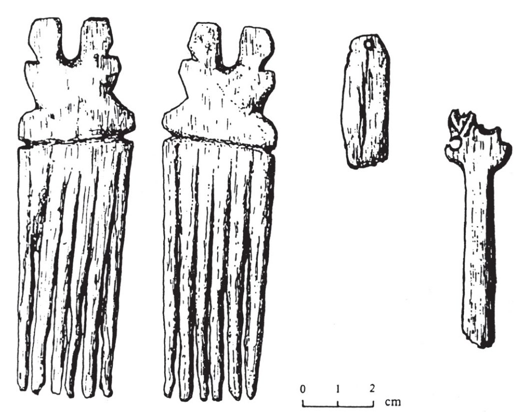


Figure 31. Decorative bone objects from Ts'ishaa (left – comb; right - pendants).

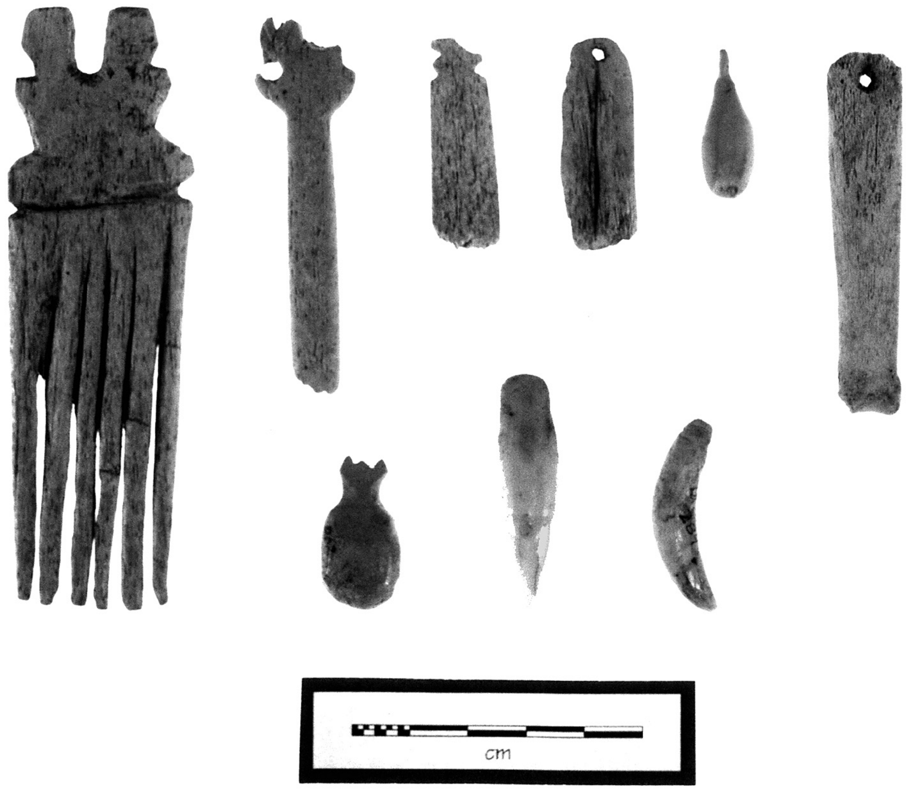


Figure 32. Bone and tooth decorative items from Ts'ishaa (left – bone comb; upper row – bone pendants; lower row – elk tooth pendant, worked canines).

is still largely intact on one side, while traces of two others are evident at the top and other side. Portions of a shallowly incised chevron design can be seen above the intact hole.

Two other pendants are complete. One, made from a curving piece of sea mammal bone, takes the form of an elongated rectangle with one rounded and one squared end (Figs. 31, 32). Near the rounded end is a drilled hole; two slight notches are also evident on one side near this end. A fairly deeply incised line runs down the centre of the object from the drilled hole to the squared end. Its dimensions are 3.7 x 1.3 x 0.3 cm. The second is a small, highly-polished section of dense land mammal bone. It is tear-shaped in outline, with the narrow end indented from each side for suspension, presumably as a small pendant. Its measurements are 2.6 x 1.0 x 0.3 cm.

Two additional objects appear to be proximal ends of pendants Both are flattened elongated forms with straight upper surfaces and notches on their upper sides for suspension. The larger, of sea mammal bone, would have had two notches on each side near the upper end, but one upper corner has broken away (Fig. 32). The other, of land mammal bone, has two notches on one side and a single notch on the other, both near the upper surface.

The remaining three are small fragmentary objects, each with a small drilled hole. Two are flat pieces of land mammal bone with a drilled hole near one end. The other is a portion of a small mammal vertebral epiphysis which has been flattened on the inner surface and a small hole drilled near one edge. The function of these objects is uncertain, although all could have been worn as pendants.

Bird bone tube (1) This polished fragment of bird limb bone is 0.7 cm in diameter. The intact end has been cut flat and polished over its surface. Similar objects were used ethnographically as drinking tubes.

Small rectangles (net gauges?) (3) Two of the three objects in this category have been cut from thin flat mammal bone, presumably scapula, most likely of deer (Fig. 30, upper right). The largest, measuring (5.0) x 2.4 x 0.2 cm, has been broken at one end. All intact edges have been polished flat. The second is complete, measuring 3.6 x 1.6 x 0.15 cm. Both sides and one end have been polished to a smooth surface. The other end shows an incised line on both faces where the object was partially cut and then snapped. However, it did not break cleanly across the cut line and this end was left unpolished and rather jagged.

The remaining example, of sea mammal bone, is a very small rectangle with straight ends and slightly concave long sides (Fig. 30, lower right). One face and all edges have been ground flat; the other face is slightly concave, with a noticeable "lip" along each side. It is complete, measuring 2.2 x 1.4 x 0.3 cm.

Although the function of these objects cannot be determined conclusively, small rectangles of bone are often classified as net gauges. A number of bone rectangles, most commonly of sea mammal bone, came from Yuquot (Dewhirst 1980:165–7). Other examples came from Ch'uumat'a (McMillan and St. Claire 1996: 42). Stewart (1973: 123) illustrates several such objects from archaeological sites in the lower Fraser River area. She notes that they are commonly cut from deer scapulae, but can also be of sea mammal bone or antler.

The smallest example, however, may have had a different function. Similar small rectangles with concave inner surfaces were found at Yuquot, where they were identified as valves in composite whistles (Dewhirst 1980: 231–3). They were used in pairs, which were tied together and concealed in the mouth. Dewhirst's Nuu-chah-nulth informants readily identified the examples from Yuquot as whistles and stated that such objects were used in the important *Tlukwana* (Wolf Ritual) ceremony. Similar items, also identified as whistle valves, came from the Ozette midden trench (McKenzie 1974: 76).

<u>Wedges</u> (5) Four wedges are made from whalebone and one is from antler (Fig. 33). Wedges played a vital role in the woodworking technology of all ethnographic groups along the Northwest Coast. Bone and antler examples are found at most archaeological sites in this region. Most wedges, however, would have been of wood, which has disappeared from the archaeological record at the vast majority of sites. This is confirmed from the waterlogged deposits at Ozette, where wedges were one of the most common tool types recovered (Gleeson 1980: 62). Wooden wedges were by far the most abundant, followed by whalebone, then by antler. A wide range of sizes and shapes suggest somewhat different functions.

All four of the whalebone wedges from Ts'ishaa appear to be based on split sections of whale ribs. This has resulted in a curved outer surface and a flat inner face. Three are complete, while one is missing the butt end. They tend to be relatively long and thin; measurements are 23.7 x 5.0 x 1.7 cm, 19.1 x 6.6 x 2.4 cm, 15.9 x 4.8 x 1.8 cm, and (11.8) x 3.6 x 1.1 cm. All three intact examples show evidence of cutting to length at the butt end and shaping along the sides. The tip is rounded in three cases, and more squared (only slightly curving) in the other. None show evidence of of extensive damage to the bit or battering at the butt end. Very similar objects are relatively common in the Ozette assemblage (Gleeson 1980: 63; Huelsbeck 1994: 287). Gleeson (1980: 62) notes that these rather thin and flat wedges are particularly useful for splitting boards.

The one antler wedge is considerably different in form. It is based on a large, stout, beam section of antler, which is clearly from an elk (wapiti) rather than the much smaller coast deer. It has been cut at an angle from about the mid-point of the object to the bit end. The cut is across the narrowest dimension of the antler beam, producing a relatively narrow, steep, rounded bit. Use damage has removed much of the butt end, although the complete length is still evident. The object's dimensions are 15.5 x 3.4 x 5.0 cm. Gleeson (1980: 62) suggests that the steeply angled bits of such tools made them particularly useful for starting splits in wood.

<u>Bark shredder fragments</u> (2) Two whalebone fragments each exhibit two flat faces and a portion of one intact edge. The latter is bifacially bevelled to produce a straight, relatively blunt, knife-like edge,

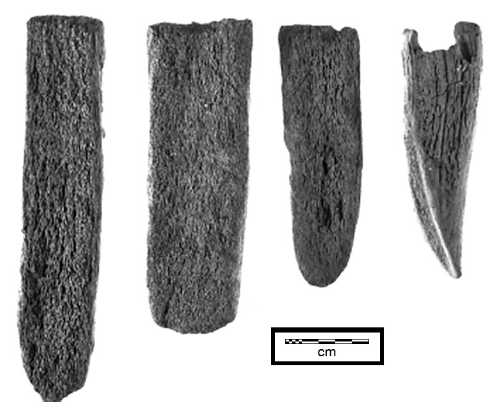


Figure 33. Wedges from Ts'ishaa (three whalebone, one antler).

such as is characteristic of bark shredders. As these are relatively small fragments, however, such an identification is tentative.

Shredded cedar bark, processed with a chopper of whalebone, had numerous uses among the Nuu-chah-nulth (Drucker 1951: 97). Whalebone shredders are found at such archaeological sites as Yuquot (Dewhirst 1980: 164) and Ch'uumat'a (McMillan and St. Claire 1994: 26). They are a relatively common artifact type at Ozette, from both the midden trench and the preserved house deposits (McKenzie 1974: 58; Fiskin 1994: 372; Huelsbeck 1994: 284). Most of the Ozette examples are simple rectangles, lacking handles or a perforated grip area, with at least one shredder-type edge. Whalebone bark shredders are listed by Mitchell (1990: 356) as one of the characteristic tools of the West Coast culture type.

Straight adze handle (?) (1) This club-like object, (22.1) cm in length, is based on a whale vertebral process (Fig. 34). Its large blunt body, with a cross-section in the form of a rounded rectangle 6.8 cm wide and 3.1 cm thick, takes its shape largely from the unmodified bone. At one end, the object has been steeply cut away from the lower surface, to produce a narrow handle, only 1.9 cm wide and 1.8 cm thick, which is oval in cross-section. Although it has broken at its end, about 7 cm of the handle remains. The work is rough, with chop marks still evident on the underside of the handle and little evidence of polish. Several long cut marks are visible along one face of the body, parallel with the long axis of the artifact.

Although this object resembles a small club, the handle is too narrow and fragile for all but the lightest of pounding. Instead, it is more likely the handle of what Gleeson (1980: 94) terms a "weighted straight adze." Several examples from Ozette are similar in size and form to this object, although they are more carefully finished and polished (Gleeson 1980: 96). A thin cutting blade of mussel shell or metal was hafted in a cut step at the end of the handle, where the break occurs on the Ts'ishaa example. The object was grasped at the base of the handle, with the weight of the body providing force in cutting. According to Olson (1927:15–16), straight adzes are generally distributed to the south of the Strait of Juan de Fuca. Gleeson (1980: 94) maintains that those from Ozette are the only archaeological examples known of this sub-type.

Figure 34. Whalebone artifacts from Ts'ishaa (upper – straight adze handle?; centre – two harpoon foreshafts; lower – harpoon preform?).

Harpoon preforms (2) Two whalebone objects appear to be roughed-out preforms for large harpoon or lance heads. One (27.4 cm in length) is intact (Fig. 34, bottom). It is rectangular in cross-section, with long sides gradually converging to a blunt tip. Two slight shoulders, possibly bilateral line guards, are above a tapering base. The object has been roughed out only; areas of chopping to shape are still evident along the sides and there is little evidence of polishing on the bone surface. The other implement (20.5 cm in length) has split lengthwise. The intact side is straight, terminating in an abrupt shoulder which extends to an elongated tapering stem. The stem, in particular, shows extensive evidence of chopping to shape, indicating that this object has only been roughed out.

Crude whalebone club (1) This object is a section of whale rib, 42 cm in length. At the distal end it shows evidence of having been roughly cut to length; although it has broken at that end it appears to be complete or nearly so. The proximal end has been adzed to a very blunt point. Large shallow areas have been removed from both sides near this end, creating a comfortable hand grip. Slight use wear appears on the underside. Such simple clubs were often used on fish or seals.

Worked whale bulla (1) One whale bulla (the dense bone of the inner ear in cetaceans) appears to have been modified. The thinner outer edge has been chipped away to expose the inner surface, leaving a ridge of hard bone. Flaking scars are still evident along this ridge, although it shows considerable wear, presumably from use as a crude scraping tool. The dense base of the object fits nicely in the palm of the hand and provides weight for heavy use. A nearly identical example, except for being blackened by burning, came from Himayis. Very similar artifacts were found in some number at Ozette, where it was first suggested that these were crude scraping tools (Fisken 1994: 375–6).

Miscellaneous worked bone (excluding whalebone) (43) Two objects show evidence of tool production from deer limb bones. One is the proximal portion of a deer metacarpal which exhibits a deep cut running the length of the fragment down its centre. This presumably marks a stage of sectioning the bone for tool manufacture. The second object is the proximal end of a deer metatarsal which had been split lengthways, then cut and snapped perpendicular to the long axis of the bone. This articular end would have been the discarded waste from tool production.

One elongated curved fragment of sea mammal bone is round in cross-section. It has one flat angled end intact, with a deep angled groove halfway through the object a short distance above the intact end and parallel to it. It is possible that the groove is the bed for a bone or wood point and that the object is the distal portion of a fishhook shank, although this identification is tentative.

A caudal vertebra from a harbour porpoise (*Phocoena phocoena*) has been deeply gouged on both faces. This may stem from some activity such as extracting oil, rather than artifact manufacture.

The remainder of the objects in this category show evidence of cutting, grinding, or polishing, but are too fragmentary to classify elsewhere. While a few represent stages in artifact manufacture, most appear to be fragments of finished tools.

Miscellaneous worked whalebone (53) Many objects in this category show evidence of adzing to shape and are fragments of roughly made implements or stages in artifact manufacture. Several prominently display rows of facets produced by adzing along their edges. Others show evidence of adzing or chopping at one or both ends, where they were partially cut to length then snapped. One short stubby object (12.4 x 5.6 x 3.5 cm) appears to be a whalebone stake, with numerous facets visible where it was adzed to a blunt point at one end.

One complete object of unknown function is spatulate in shape. One highly-polished end, slightly wedging to a flat polished base, expands to a thicker, more roughly shaped body with a flattened end. It is 12.0 cm long, with its greatest width 3.3 cm and thickness 1.1 cm. Additional pieces of whalebone show evidence of ground edges or other intentional shaping. These are presumably from finished tools which are now too fragmentary to identify.

Many other flat pieces of whalebone have been sectioned into elongated segments, presumably for tool manufacture. Many show evidence of a "cut and snap" technique.

Cut marks or prominent scratches are evident on the surfaces of other objects in this category. Several have clearly been cut to length. One whale vertebral process shows numerous striations running along its long axis on both faces, suggesting use as a cutting board.

Miscellaneous worked antler (15) Three large sections of antler beams appear to be too large for coast deer and are presumably from elk (wapiti). The largest, 20.2 cm in length, has had a side branch cut off and both ends deeply cut around their circumference and then snapped. Another has been roughly cut to length at both ends then split down the centre, so that half the beam remains. The third has been chopped to length at one end, then split lengthways, leaving about a quarter of the beam thickness. A fourth beam section is smaller (possibly from deer) and more extensively worked. It shows evidence of cutting and snapping at both ends, lengthways splitting, and shaping and polishing along the sides. All four presumably represent stages in artifact manufacture.

Other items in this classification include three elongated split cortical sections of antler beams, two smaller pieces which have been cut and shaped, and two relatively small objects which have been cut to length and width, possibly as blanks for harpoon valves. All presumably are stages in artifact manufacture.

Also included in this category are three cut antler tines and a small branching section of antler with both tines cut off. Two of the tines are tips, which may be the discarded waste of tool manufacture. The third is larger (at 13.1 cm in length) and has been cut and polished at its base, with faceting and polishing at the oval, somewhat flattened, tip indicating use as a tool.

Artifacts of Stone

Chipped biface (1) This well-made chipped biface, of very fine-grained crystalline rock with small crystal inclusions, is complete except for a small area at its base (Figs. 35, 36). Its measurements are 6.5 x 3.1 x 1.2 cm. It is generally leaf-shaped, with a thick base and slightly curving sides converging to a fairly blunt tip. As well as being flaked over both faces, grinding and polishing are evident on the high points. It was recovered from a depth of about 0.9 m in EA 3, well above a radiocarbon sample from near the base that produced an age estimate of 1690 to 1350 cal BP.

This object seems anomalous in this assemblage, where well-made chipped stone implements are otherwise lacking. Such artifacts are also absent from other Nuu-chah-nulth sites of this age. Closest parallels are with the lower levels of Ch'uumat'a (McMillan and St. Claire 1996; McMillan 1999:114) and the early component at Shoemaker Bay (McMillan and St. Claire 1982), both of which significantly predate this assemblage.

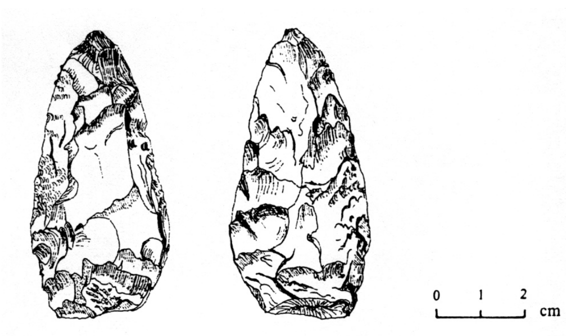


Figure 35. Chipped stone biface from EA 3, Ts'ishaa.

Chipped phyllite chopper (1) This flat slab of chlorite phyllite, measuring 13.6 x 8.7 x 1.9 cm, is an irregular four-sided shape. It has been roughly flaked along two adjacent sides, with bifacial flaking along the narrower of these producing a chopper edge.

Obsidian flake (1) One small obsidian flake was found just beneath the sod in EA 1. This thin, elongated, irregular flake, measuring 1.75 x 1.05 x 0.2 cm, appears to be from a late stage of artifact manufacture. Its presence in this assemblage, particularly from this uppermost level, seems anomalous and is assumed to be a result of disturbance from older deposits behind the main site area. Early twentieth-century farming on the island may have resulted in such surface disturbance.

Source analysis for this obsidian was conducted at the X-ray Fluorescence Laboratory in the Department of Chemistry at Simon Fraser University (James 2001). X-ray Fluorescence (XRF) is a non-destructive technique which measures the relative amounts of specific trace elements contained within the sample. The results are compared to the known composition of obsidian from various source areas. This analysis determined that the obsidian flake came from the Three Sisters source in central Oregon. This is a location of high-quality obsidian, in close proximity to other noted obsidian sources such as Glass Buttes and

Figure 36. Miscellaneous stone artifacts from Ts'ishaa (left – celt preform?; upper row – ground slate point, chipped stone point, chipped and ground schist knife; lower row - fishhook shank fragments).

Newberry Caldera. Obsidian from these sources has been reported for a number of sites in southern coastal British Columbia, particularly in the Strait of Georgia region (Carlson 1994). Small obsidian flakes were relatively numerous in the early component at Shoemaker Bay; although most came from sources on the central British Columbia coast, Glass Buttes and Newberry Caldera were represented by one flake each (McMillan and St. Claire 1982: 70). Oregon obsidian declines in quantity over time in British Columbian sites; Three Sisters obsidian is unknown from archaeological deposits dating to the last 1000 years (Carlson 1994:355; James 2001). This fact supports the inference that the Ts'ishaa example, which was found on the surface of the midden, was redeposited there from an older context. The presence of two artifacts of central Oregon obsidian from the earlier component on the back terrace at Ts'ishaa also supports the idea that this flake was redeposited from this older context.

Chipped and ground schist knife (1) This is a fragment of a flat schist artifact with a portion of one worked edge intact (Fig. 36). It is broken at both sides, measuring (6.9) x (4.7) x 0.4 cm. The intact edge has been chipped along one face, then bifacially bevelled through grinding to produce a straight cutting edge, 4.3 cm of which remains.

Chipped schist knives are unknown from other Nuu-chah-nulth sites of this age, although they have been recorded from the lower levels at Shoemaker Bay (McMillan and St. Claire 1982) and Ch'uumat'a (McMillan and St. Claire 1996; McMillan 1999: 114), and are present in the assemblage from the back terrace at Ts'ishaa (see Chapter Five). This object came from Layer D, near the base of EA 1, slightly below a radiocarbon date of 1520 to 1290 cal BP.

Ground stone points (2) One well-made slate point is largely complete, although broken into fragments (Fig. 36). The reconstructed artifact, measuring (6.8) x 2.3 x 0.5 cm, is lacking only small areas at the tip and base. The carefully ground faces are faceted to the curving sides. The second point, of phyllite, is in poor condition as the stone is friable and splitting. It measures (8.0) x 1.7 x 0.5 cm. Both faces have been ground flat, with abrupt narrow facets at the edge of each to form almost straight converging sides.

Such ground stone points are not characteristic of Nuu-chah-nulth sites, although they have been found in small numbers in the western Barkley Sound sites of T'ukw'aa and Ch'uumat'a. They are more abundant in the Shoemaker Bay assemblage (McMillan and St. Claire 1982) and in sites in the Strait of Georgia region (Mitchell 1971).

Notched pebble (sinker?) (1) This small rounded beach pebble is somewhat irregular in shape. One end shows evidence of bifacial flake removal, with a single flake removed from each opposing face, producing a notch. At the other end of the pebble is a naturally occurring notch. This minimal modification may have been all that was required to hold a line wrapped around the pebble for use as a sinker.

Jet pendant (1) One unique stone artifact is a small (3.4 x 1.3 x 0.4 cm) highly-polished black pendant, taking the form of an elongated triangle with rounded corners (Fig. 37). A small biconically drilled hole is near the wider end. The raw material appears to be jet, a hard black lustrous variety of lignite which can be carved and polished. Although the entire surface is highly polished, numerous fine abrasion lines are still evident. This object was found in the upper levels of EA 1. As it is complete, its presence in the midden likely indicates that it was lost by its original owner. A similar drilled jet pendant, although somewhat smaller and less highly polished, came from Zone III at Yuquot (Dewhirst 1980: 323), which would be roughly contemporaneous with the example from Ts'ishaa.

Muller (1980:13) speculates that "small coaly lenses" in the Jurassic rocks along the outer coast of Vancouver Island could have provided the material for the Yuquot pendant. Another possibility for the Ts'ishaa artifact is a black schistose slate from

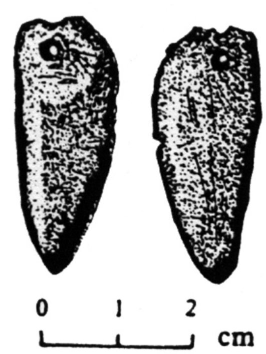


Figure 37. Jet pendant from upper EA 1 at Ts'ishaa.

a deposit to the southeast of Barkley Sound, where some occurrences are so carbonaceous, black and lustrous that they resemble graphitic coal (Clapp 1912, in Wilson, Appendix A). However, the light weight of the Ts'ishaa example suggests that it is jet rather than black slate.

Celt preforms (?) (3) Three fragments, all of black slate, show evidence of extensive grinding and polishing over at least one face. Some intact surfaces are still rough, however, suggesting that these are unfinished implements, rather than fragments of tools such as celts. The largest and most complete is rectangular in shape, with roughly parallel sides (Fig. 36). Missing one end, it measures (11.5) x 4.7 x 1.3 cm. It has been polished smooth on one flat face, but only the high points are polished on the other face and the sides. The one intact end appears to be unfinished, but the high points have been ground flat. While this object appears to represent a stage in celt manufacture, no intact stone celts have been recovered from the main village site and such an identification is tentative.

Fishhook shanks (3) All three artifacts in this category are incomplete (Fig. 36). One appears to be a simply-made distal fragment, made of fine-grained grey metamorphic rock. Nearly round in cross-section and with a flat base, it has an incised groove (1.1 cm in length) extending along one side from the base and a marked constriction at the opposite side of the base. The groove may have served as a point bed, holding a sliver of sharpened bone or hard wood, and the constriction would have helped to keep the binding in place. However, it is also possible that this is a proximal fragment, with the constriction and groove to hold the suspension line. This fragment is (3.8) cm long and 1.6 cm in diameter (although it is still expanding at that point).

Both other fragments are red in colour, made of fine-grained hematitic sandstone, and are rounded rectangles in cross-section (Fig. 36). One is a distal fragment, split lengthways into two pieces that can't be joined. An incised point bed, 1.5 cm in length, extends from the flat distal end. Although the area of the base opposite this is missing, a constriction around the sides just above the base clearly would have extended around to the missing face to facilitate binding a sharp point in the point bed. This fragment is (3.5) cm long and 1.3 cm wide. The other is a medial section, measuring (5.1) x 0.9 x 0.6 cm. Evidence of an encircling groove, presumably for line attachment, is still visible at the narrowest end, indicating that only a small area of the proximal end is missing. At the other end, the long straight shaft has the beginning of a "dog-leg" curve to the missing distal portion, typical of stone fishhook shanks.

Ethnographically, stone fishhook shanks were part of specialized trolling hooks, particularly for salmon. Drucker (1963: plate 3; 1965:18) illustrates such complete fishhooks. Such artifacts are found at all the western Barkley Sound sites (McMillan and St. Claire 1992, 1996), as well as at Yuquot (Dewhirst 1980), Hesquiat (Haggarty 1982), and Ozette (McKenzie 1974). They are a characteristic feature of the West Coast culture type (Mitchell 1990). Stone fishhook shanks are relatively late in the archaeological record, appearing only well into the Late period at Yuquot (Dewhirst 1980:343). All of the Ts'ishaa examples are late; two are from the uppermost layer of EA 2, while one came from much deeper deposits but toward the front of the site in EA 2, where all materials are relatively late.

Hammerstones (6) All are complete rounded beach cobbles that show evidence of pitting on at least one end, suggesting use as hammerstones. They range from 11.9 to 19.9 cm in maximum dimension, and from 757 to 1914 g in weight (mean = 1238 g). Two show pitting at one end only, another shows pitting at both ends, and another has extensive battering and pitting at both ends and one face, along with slight battering along one long edge. An additional example shows evidence of extensive battering at both ends, in one case heavy enough to remove a large flake, with additional pecking along both long sides, producing flattened facets. The final example, the smallest of the group, is a very smooth cobble of fine-grained material, possibly basalt. Both ends show evidence of pecking, with sufficient force to drive a small flake off one, but the entire object has been highly polished, leaving only flattened facets at each end.

Hammerstones are simple expedient tools that could be used for a wide range of tasks. For example, Drucker (1951:77) mentions the ethnographic Nuu-chah-nulth practice of laboriously producing stone mauls by pecking them to shape with any suitable hard cobble. Such tools are found in archaeological assemblages all along the Northwest Coast.

Abrasive stones (58) Abrasive stones are the most common of the stone artifacts, making up 74.4% of the total for that category (although only 7.9% of all artifacts from the site). All are of sandstone, ranging from very fine-grained to quite coarse-grained. A small fragment of polished siltstone, incomplete in all dimensions, is also included, possibly as part of a whetstone, although it may be a fragment of some other finely polished artifact. All are of a size that could be held comfortably in the hand (although one is at the upper range of such a classification). The incomplete nature of most abraders hinders classification by shape. Only 16 examples were judged to be complete. Their dimensions are shown in Table 6.

Only 16 shaped abraders were noted. Such abraders were carefully ground flat over both faces and all intact sides. The most common shape is an elongated rectangle or a tapering bar (Fig. 38). Evidence of sawing to shape is evident on three examples. In one case, one long side was formed by sawing from both faces and snapping, leaving a rough central ridge, while in two other cases this edge was then ground flat. In addition to these shaped abraders, a large irregular slab has a deep sawn groove running the length of one flat face, although the object clearly is unfinished. As fragments with no intact edges remaining were not included, this category would likely have been larger. Most abraders, however, are simply rough slabs or cobbles of sandstone that were picked up and used without further modification.

Most abraders (39; 67.2%) have been worn on both faces. Only 19 show wear on one face only and several of these are fragments which are incomplete in thickness. In the great majority of cases wear has resulted in an essentially flat surface. Seven abraders, however, have shallow dished depressions worn into one face. Two others have narrow grooves, presumably from sharpening small objects such as bone points, on one surface. One of the dished depressions exhibits a reddish encrustation which may contain red ochre, indicating that this abrader was used in preparing a red paint. Another has a thick encrustation of black, presumably organic, material on one face, while another has similar staining across one face and part of one side.

The abundance of abrasive stones in this assemblage reflects their obvious importance in the technology. Such objects were extensively used in woodworking, as well as in the production of the stone, bone, antler, and shell artifacts that show evidence of having been ground to shape. Ethnographic sources indicate the importance of such objects in the carpentry toolkit (Drucker 1951:79; Boas 1966:31). Archaeologically, abrasive stones are common in almost all Northwest Coast sites. At Ts'ishaa, however, they are much less abundant than at Yuquot or Hesquiat, where they comprise roughly half of the total artifact assemblage (McMillan 1999:172), or Shoemaker Bay, where

Table 6. Complete abrasive stones from Ts'ishaa Village (No.=16)

No.	Dimensions (cm)	Comments
354	8.0 x 2.5 x 1.2	shaped abrader – one side sawn to shape
414	9.8 x 2.6 x 1.3	irregular shaped abrader – one side sawn
352	12.2 x 4.4 x 1.4	natually shaped pebble with both faces ground flat
273	11.7 x 3.8 x 1.1	shaped abrader – elongated bar
522	19.4 x 5.4 x 3.4	natural shape with both faces ground – possible red ochre stain
555	6.8 x 4.6 x 2.5	small natural pebble with both faces ground flat
251	11.3 x 6.4 x 2.8	rounded pebble – ground depression on one face
287	25.2 x 12.0 x 4.2	large irregular slab with both faces ground flat
306	5.7 x 3.4 x 1.3	small rectangular pebble ground on one face
635	6.8 x 3.8 x 1.5	rectangular flat slab with with both faces ground flat
672	11.8 x 6.2 x 2.1	irregular flat slab – both faces ground flat with black organic staining on one face
420	9.1 x 8.2 x 2.1	irregular flat slab – both faces ground flat with black organic staining on one face
296	8.8 x 5.4 x 1.7	triangular natural shape with one ground face
224	8.6 x 5.1 x 1.3	irregular flat sandstone with both faces ground flat
102	11.5 x 8.1 x 1.7	one face only, with marked worn depression across length
295	10.0 x 9.7 x 1.3	irregular flat shape with both faces ground – broken edges show slight wear indicating continued use

they form over a third of the total (McMillan and St. Claire 1982:124).

Artifacts of shell

Mussel shell harpoon blade (1) Although missing its base and a small area at the tip, much of this object is intact. It has been extensively ground over its entire surface. Both intact edges have been bifacially bevelled, producing long, straight, converging sides, suggesting that the object was once triangular in shape. The fragment is 4.6 cm long (although the original object was clearly longer), 3.3 cm wide (although the sides are still expanding at the point of the break), and 0.4 cm thick.

Identification of this object as the cutting blade of a whaling harpoon is confirmed by its context. It was discovered during the excavation of Feature 57, a large stack of whale bones on the lowest terrace of EA 2 (see description under Features). Exposure of a large whale skull in the feature revealed the presence of the mussel shell harpoon blade, still deeply embedded in the occipital bone. Examination of the point of entry places it above and behind the right eye of the animal. Although mussel shell tends to shatter when contacting the bone, in this case the blade entered at a very shallow angle, resulting in its relatively intact state. Clearly the whale had been harpooned and dragged to the beach in front of the site, where it was butchered. Subsequently a number of bones, from several different whales, were stacked at the front edge of the site, on the lowest terrace, with the harpoon point still embedded in the skull.

The use of mussel shell for whaling harpoon blades is well documented in the ethnographic literature for the Nuu-chah-nulth and Makah (Drucker 1951: 28; Waterman 1920: 32; Koppert 1930:60; Arima and Dewhirst 1990: 395). Waterman (1920: 32) notes that the thin brittle mussel shell effectively penetrated into the flesh of the whale before shattering. Archaeologically, mussel shell harpoon points are also reported for two of the Hesquiat Harbour sites (Haggarty 1982: 122, 160) and for DfSj-30, on an outer coast islet in Toquaht territory, western Barkley Sound (McMillan and St. Claire 1994: 42). Discoveries of mussel shell blades still embedded in whale bones were made at T'ukw'aa (McMillan 1999: 132; Monks et al. 2001) and Ozette (Huelsbeck1994: 281; Fisken 1994: 367). In these cases, however, the blades had shattered as they entered the bone, leaving only a thin line of mussel shell remaining.

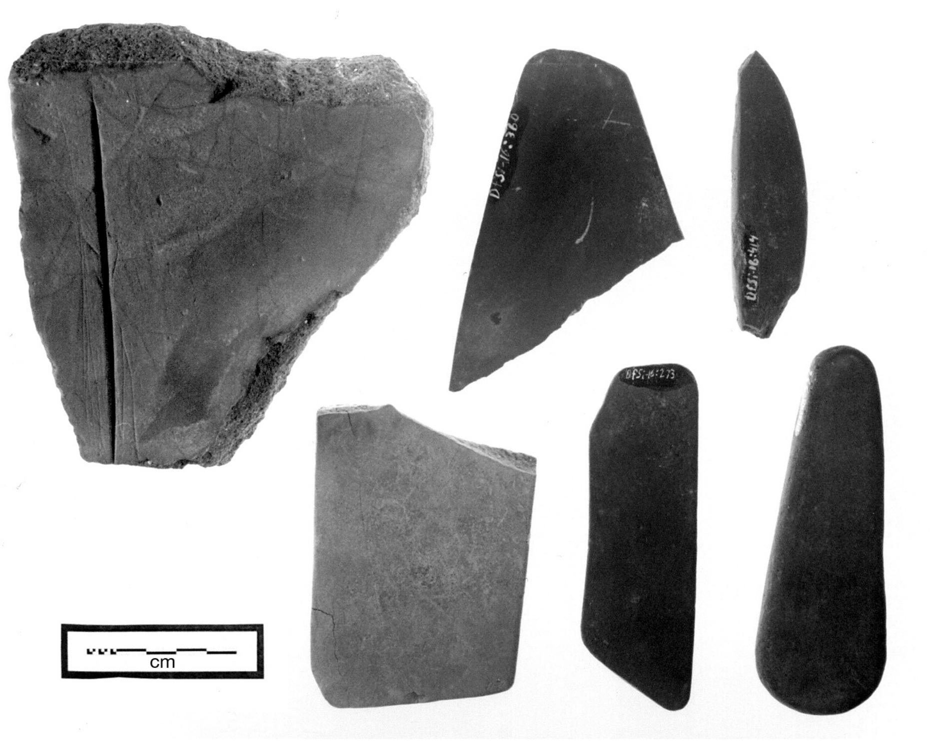


Figure 38. Abrasive stones from Ts'ishaa (large sawn abrader, shaped abraders).

Miscellaneous ground mussel shell (18). All recovered mussel shell artifacts are fragments of larger objects (Fig. 39). When exposed by excavation, mussel shell is generally very soft and fragile, requiring immediate conservation measures. Mussel shell tools are almost certainly greatly under-represented in the collection from Ts'ishaa due to factors of preservation and low visibility in a shell matrix.

Only four objects show evidence of sharpening along an edge. The most complete is a section of burnt shell that has been ground over its entire surface to produce a thin artifact (0.2 cm thickness) with a long, curving, bifacially-ground knife edge. Another two fragments each have a slightly curving, steep, unifacially-ground edge that would be serviceable as a knife or small chisel. Both have also been extensively ground over the outer (dorsal) surface of the shell. The fourth artifact appears to be a celt bit fragment, although only a small portion remains. This is a somewhat thicker object (0.9 cm), which retains part of one flat side and a small section of the steep, straight, unifacially-ground bit.

Two large, thick, well-made objects appear to be the butt ends of large shell celts, now missing their bits. One is rectangular in shape, with straight flat sides and end. It is 5.3 cm wide and 1.2 cm thick. The other, with flat sides converging to a rounded poll, is also extensively ground on both the dorsal and ventral surfaces of the shell. This fragment is 5.2 cm wide, although the shell is still flaring out at the break so the original object would have been larger, and 1.2 cm thick.

One small thin fragment has been ground flat over all surfaces, completely removing the natural ridges of the dorsal face. Measuring (4.5) x 1.4 x 0.2 cm, it is incomplete in length only. The two thin flat edges gradually converge toward one (broken) end. It is possibly a fragment of a small projectile point or harpoon cutting blade.

The remaining 11 examples are even more fragmentary. Three have portions of a flat side and adjacent end present, suggesting that these are the polls of celts or chisels. One has three intact flat, slightly curving, sides, creating an irregularly shaped flat object. Seven retain evidence of only one flat ground edge. Several of these also show evidence of grinding over the shell's dorsal surface.

Ethnographically, the widespread availability of large mussel shells made them a favoured raw

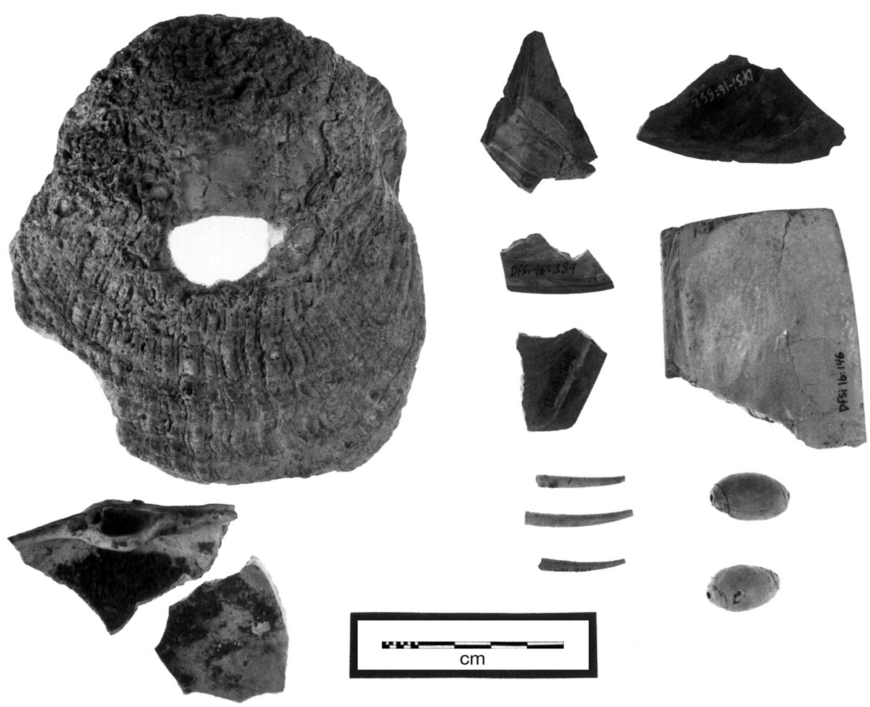


Figure 39. Shell artifacts from Ts'ishaa (clockwise from upper left: perforated scallop shell; mussel shell artifacts [harpoon cutting blade, two knife fragments, two probable celt fragments]; Olivella shell beads; dentalium beads; clam shell ochre bowl).

material for a variety of tools. Drucker (1951:91) points to the importance and common use of the mussel shell fish knife among the Nuu-chah-nulth. Sproat (1987:63) describes the use of sharpened mussel shells as heavy-duty woodworking tools among the Nuu-chah-nulth, as does Swan (1870:36) for the Makah. Mussel shell tools, including knives and celts, are one of the characteristic features of the West Coast culture type. They have been recovered from almost all Nuu-chah-nulth and Makah sites. At Ts'ishaa, they came from almost all layers of the EA 1 and 2 trenches.

<u>Dentalium shells</u> (6) Six complete dentalium shells (*Dentalium pretiosum*) came from Ts'ishaa (two from EA 1, one from the middle terrace of EA 2, and three from EA 3). Lengths are from 2.3 to 3.1 cm; diameters at the largest end are 0.3 to 0.4 cm. Only one appears to have been cut to length. Although most are unmodified, their presence in the midden likely is a result of their ornamental and prestige value (McMillan 1999:155–7).

The natural tube shape of the dentalium shell allowed stringing as beads, in necklaces and bracelets, and as ear or hair ornaments. Such items were in widespread use among the Nuu-chah-nulth (Drucker 1951:139–140). As the open waters of the west coast were the source of most dentalium, the Nuu-chah-nulth were major suppliers of this highly-sought trade item. However, only very small numbers have been excavated from Nuu-chah-nulth sites. T'ukw'aa, Ch'uumat'a, Yuquot, Shoemaker Bay, and one of the Nitinat Lake sites each had one or two examples (McMillan 1999:157). In contrast, dentalium shells have been recovered in considerable quantities from sites in the Strait of Georgia region, particularly those dating to the Marpole period, far from any natural supply of these decorative objects. Almost all, however, were recovered from burial contexts. Only in the unique circumstance of Ozette, in the well-preserved floor of a high-status Makah house, do we find evidence of substantial quantities of dentalium in a west coast site (Wessen 1994:353).

<u>Olivella shell beads</u> (13) The attractive shiny shells of the Purple Olive (*Olivella bipicata*) were made into beads simply by grinding away the spire at one end to allow stringing. Three such artifacts were recovered from the middle terrace of EA 2, all from quite recent deposits, while ten were found in the lower levels of EA 3. Olivella shell beads were also recovered from T'ukw'aa (McMillan and St. Claire 1992: 54) and were relatively common in the protohistoric Ozette house remains (Wessen 1994: 352).

<u>Clam shell disc bead</u> (1) This very small white shell bead is only 4 mm in diameter and 1 mm thick. Circular in outline, it has flat faces with a biconically-drilled central perforation, and appears to have been manufactured from clam shell. It was recovered during fine screening of bulk matrix samples from Layer B of EA 1.

<u>Clam shell ochre bowl</u> (1) A large fragmentary shell from a horse clam (*Tresus nuttalli* or *T. capax*), with only the hinge area and a section of body recovered, is thickly encrusted with dark reddish-brown ochre (Munsell 2.5YR 3/6) (Fig. 39). It came from near the base of the middle terrace in EA 2. Ochre was widely used as a pigment all along the Northwest Coast. It was ground into a powder and mixed with an organic binder, such as crushed or chewed salmon eggs, to form a paint (Drucker 1951:83). The thick hardened deposit in this clam shell suggests that it is dried paint, with the ochre mixed with its binder.

Ethnographically clam shells were used as spoons and containers by the Nuu-chah-nulth (Drucker 1951:92, 108; Jewitt 1967:59). Except for rare cases such as this, where the contents are still evident, these objects would not be recognizable in excavated shell midden sites. A similar ochre-encrusted clam shell came from the Ozette midden trench (McKenzie 1974:113). Clam shell bowls containing ochre also have been recovered from Strait of Georgia sites (Mitchell 1971:215–6; Burley 1988:126).

<u>Perforated scallop shell</u> (1) A large shell of the Purple-hinged Rock Scallop (*Crassadoma gigantea*) is complete except for a chip out of the outer margin (Fig. 39). Its dimensions are 13.1 x 11.8 x 2.4 cm. A central perforation in the form of a rounded rectangle, 2.5 x 1.7 cm in size, appears to be deliberately placed. The edges of the perforation are rough, as if it had been punched out. This central perforation may have allowed the shell, along with a number of others, to have been strung on a hoop of withe or root for use as a dance rattle.

Ethnographically, scallop shell rattles were widely used among the Wakashan and Coast Salish peoples. They are particularly well-known among the latter, where they were used by the sxwayxway ritualists (Barnett 1955:158). Suttles (1987:109) describes the equipment of such dancers as including "a rattle made of perforated scallop shells strung on a wooden hoop or pair of hoops." Scallop shell rattles were also used by the central Nuu-chah-nulth groups during a shamans' society performance (Drucker 1951:106). The Makah, who avoided eating scallops due to their "special powers," also used these rattles in their ceremonies (Swan 1870: 24). Such rattles, however, were characteristically made from the thinner shells of the large Weathervane Scallop (*Pecten caurinus*).

Archaeological discoveries interpreted as parts of scallop shell rattles have been made at several sites in the Strait of Georgia region. Again, these are all of the thinner *Pecten* shell. Burley (1989:127) reports such objects from the False Narrows site on Gabriola Island. At Tsawwassen, a cluster of *Pecten* shells, interpreted as the remnants of a complete rattle, was found intact in the midden deposits (Arcas Consulting Archeologists 1999:32, 256). The Purple-hinged rock scallop shells may be too thick and heavy to have served as effective rattles. Such shells were more commonly cut up and used for ornaments, such as pendants and gorgets (Burley 1989:127).

Another perforated Purple-hinged Rock Scallop shell came from one of the Nitinat Lake sites (Eldridge and Fisher 1997:86). It is very similar to the Ts'ishaa artifact except for being slightly smaller and having the perforation closer to the hinge. Eldridge and Fisher (1997:66) argue that the object is too heavy to have been part of a shell rattle and interpret it instead as a gorget preform. As there is little modification other than the perforation, however, it is difficult to see how that interpretation is warranted. Both the Ts'ishaa and Nitinat Lake artifacts may represent initial stages in the manufacture of shell ornaments. However, they may also have been used ritually as parts of scallop shell rattles where the more suitable *Pecten* shells were rare or unavailable. *Pecten* are not common in the site area today, and no such shells have been identified in the Ts'ishaa midden deposit.

Artifacts of tooth

<u>Worked canine teeth</u> (6) Canine tooth pendants, generally unmodified except for an incised suspension line, have been found at most West Coast sites. Two such artifacts came from Ts'ishaa. In one case, a harbour seal (*Phoca vitulina*) canine has a thin sharply incised line encircling the object near the root end (Fig. 32). The second canine, from an adult male fur seal (*Callorhinus ursinus*), is considerably larger, although it is somewhat battered and split. In this case, suspension was from a much wider, but shallow, groove near the enamel tip.

Four other canine teeth have been modified in different ways. One, a complete tooth from an adult male sea otter (*Enhydra lutris*), shows extensive grinding and polishing, creating large flattened facets on both faces extending from midbody to the root ends. Another is a large fragment of an adult male Northern sea lion (*Eumatopias jubata*) canine which has been split lengthways, with straight sawn and polished sides gradually converging toward the worn enamel tip. In the third case, a sea lion (probably adult female Northern sea lion) canine exhibits a large "V-shaped" incision which has been cut deeply into the enamel end of the tooth. The incised area has been polished and slight polish is also evident at the root end of the object. The fourth item is a split section of enamel, appearing to be from a sea lion canine, which has been cut flat and polished at the enamel tip. It is difficult to see what function any of these could have served.

<u>Elk tooth pendant</u> (1) This object is based on the distinctive upper canine of the male elk (or wapiti, *Cervus elephas*) (Fig. 32). It has been ground and polished over much of its surface, resulting in a number of flattened facets. The root end has been extensively worked, producing a "waisted" appearance for suspension. The upper surface is double notched to create three triangular peaks, with the middle one shorter than the two at the edges.

Such an object is unusual, if not unique, among Northwest Coast assemblages. Elk tooth pendants, however, are relatively common grave inclusions in late prehistoric and early historic contexts on the Plateau (Schulting 1995:37), although most are perforated for suspension. Elk tooth ornaments were also widely used ethnographically on the Plains, particularly as decorations sewn on women's dresses.

Elk are not available in the vicinity of the site today, although they could have been taken near the upper shores of Barkley Sound and its inlets. This object may have reached Ts'ishaa through trade. Its context in Layer A on the upper terrace of EA2 suggests that it is late precontact in age.

<u>Beaver incisor tool</u> (1) One beaver (*Castor canadensis*) incisor, missing the root portion and with the distal end ground to a flat surface, was found deep in the lower terrace of EA 2. Although

beaver are available on the Vancouver Island mainland, they are not found in this outer island environment, indicating that this item had to have been brought into the site, presumably for use as a tool. This artifact is typical of examples found at the Ozette site, which were snapped, the root end discarded, and the occlusal surface ground flat (Gleeson 1980:108). They were then hafted as small woodworking implements.

Beaver incisor tools are found at other Nuu-chah-nulth sites, such as Yuquot (Dewhirst 1980:133), Hesquiat Village (Haggarty 1982:122), and T'ukw'aa (McMillan and St. Claire 1992:51). A beaver tooth knife was found intact in its carved wooden haft in the preserved house deposits at Ozette (Kirk with Daugherty1978:100; Gleeson 1980:109), demonstrating Makah use of such woodworking tools in the late prehistoric or protohistoric period.

Historic materials

Iron fragment (1) Only one metal object was recovered (from the upper layer of EA 1). This is a small rectangular fragment of iron, measuring 5.3 x 1.9 x 0.5 cm, with a low circular projection in the centre of one face. Its function is not evident. The lack of other such materials is surprising, considering the Tseshaht use of this site into the late nineteenth century and the early twentieth century non-native occupation of the site.

Glass bottle fragments (2) Two water-rolled glass fragments were found in the upper levels of EA 3. One is pale green in colour, with a thickness (0.55 cm) and curvature that suggest that it is from a full-sized bottle. The other is a small fragment, deep cobalt blue in colour, that appears to be from the base of a very small bottle or vial. Cobalt blue was commonly used for historic glass, including medicine and cosmetic containers (Jones and Sullivan 1989:14). Part of a circular indentation is visible on the bottom of this small fragment. This may be the remnant of an "Owens suction scar," a distinctive mark indicating machine manufacture of standardized shapes, which would place this object after 1904 (Jones and Sullivan 1989:37).

Features

Hearths (11)

Concentrations of fire-cracked rock (FCR) and charcoal, presumably the remains of hearths, made up the largest category of features recorded in the village area. Five such features were recorded in EA 1, with three each from EA 2 and 3. They were found in almost all layers of the site, from the uppermost stratum to the original beach sands at the base of the deposit. Charcoal collected from a hearth in the sand at the base of the EA 1 trench yielded a date of 1870 to 1560 cal BP (Fig. 40).

Some circular FCR concentrations, with charcoal and bone present, seem clearly to mark the presence of *in situ* hearths. The three from EA 3, for example, appear to be hearths on possible house floors (Fig. 41). Two of these were found at the same level, just over a metre apart. A few others in this category, however, are more amorphous clusters and may represent "dump" episodes, where broken rocks and charcoal from hearths have been redeposited in the midden. This is particularly true of those in EA 1, where loose shell deposits suggest discard activities.

Concentrations of large rocks (5)

Unlike the previous category, rocks in this group tend to be larger, unbroken and rounded. Piles or concentrations of such rocks are assumed to reflect cultural activities, but their functions are not usually evident. Two were found in EA 1 and three in EA 2. They occurred from the upper layer to fairly deep in the deposit.

In one case, the cluster was associated with three possible post holes among the rocks. In another, a stack of six fairly large rocks (up to 30 cm length) had been placed over the skeletal remains of an immature individual. This occurred in Layer C of EA 1, at a depth of about 1 metre. Only one rock was moved, exposing human remains directly beneath, with no evidence of a burial pit. The rock was replaced and the remains were not further investigated or disturbed. As this occurred in a "step" unit at the end of the trench, the cairn could simply be left and later reburied. In all other cases, the rocks were removed for excavation underneath, without encountering any human remains.

Post holes (4)

A post hole just under the surface of EA 1 had four rocks tightly clustered around it, presumably to brace the post. It is clearly recent and may reflect historic farming or modern camping activity at this site. Two concentrations of post holes occurred at different levels of EA 3, both in the concentrated shell of Layer B. One

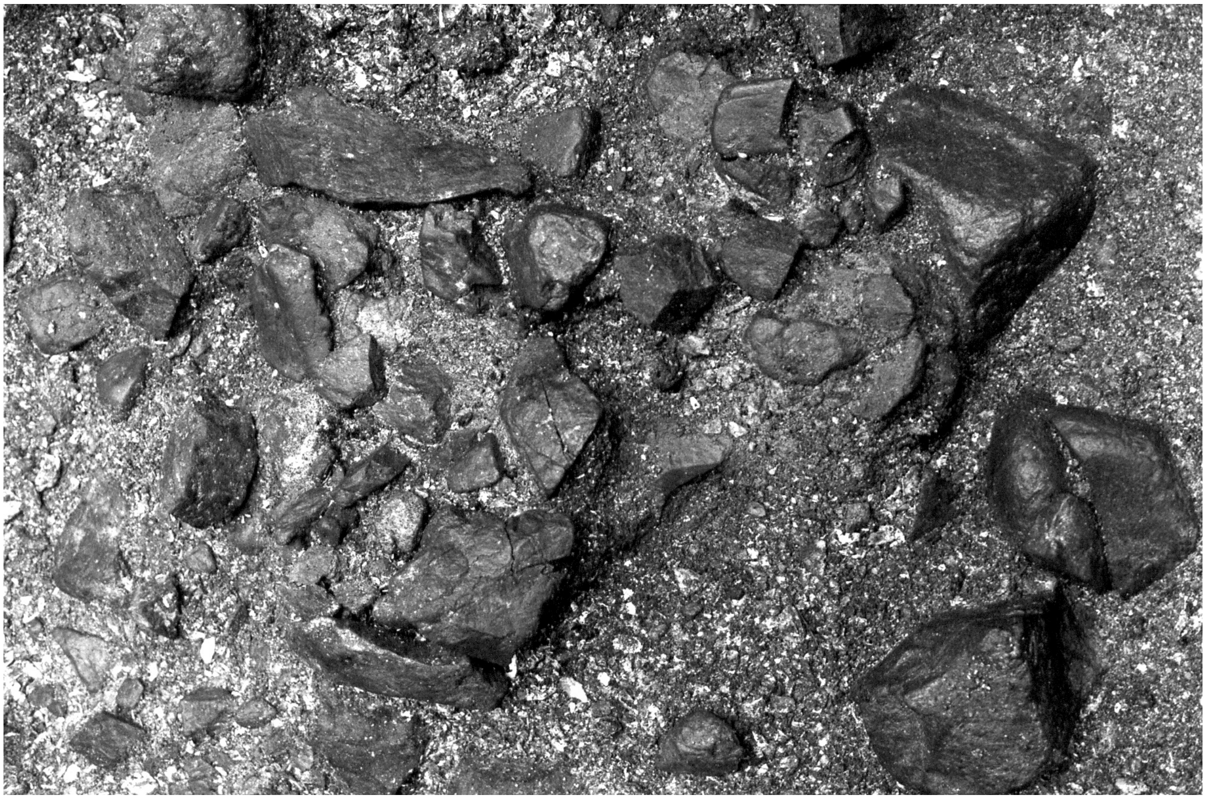


Figure 40. Hearth on basal sand, EA 1, Ts'ishaa (Feature 8 – charcoal from among the rocks provided a radiocarbon date of 1870 to 1560 cal BP).

Figure 41. Intact hearth at EA 3, Ts'ishaa (Feature 20).

consisted of five roughly circular holes, with diameters of 9 to 15 cm, scattered across the unit floor. Somewhat below these, three additional circular to oval holes of roughly the same diameter appeared. The smallest was surrounded by three support rocks.

One additional, but quite different, feature occurred in EA 2, almost a metre below the surface. This is a circular black stain, about 30 cm in diameter, which extended from the black silt of Layer C into the crushed shell of Layer D. Only in the latter matrix did this feature become visible. It presumably is the mold from a substantial post which once stood in this location.

Several additional post molds, not designated as features, are evident in the stratigraphic profiles. One substantial example in EA 3 extends about 70 cm from the shell of Layer B into the lower strata (Fig. 24). It would have held a post with a diameter of 15 to 20 cm. In EA 2, two post molds were recorded at the back of the middle platform, extending from a possible house floor (Layer C – black silt and FCR) into the underlying crushed shell (Layer D). These molds only became visible in the crushed shell. The two posts were 13 and 18 cm in diameter, with the deepest extending about 30 cm into the shell.

Faunal concentrations (2)

Two large stacks of whale bones were excavated in EA 2. One came from the middle terrace, in Layer C, on what had been noted as a possible house or activity floor. It consisted of seven large bones, concentrated in a pile without any evident order. The elements present, which are not necessarily from the same individual, consist of a complete rib, a complete radius, a vertebra, and fragmentary portions of four other bones, one of which appears to be part of a scapula and another which may be an intermaxillary (Gay Frederick, report to the authors, 2001). DNA analysis on four elements (rib, radius, scapula, and possible intermaxillary) determined that all could be identified as coming from humpback whales (Watt 2003). A radiocarbon sample taken from around this feature provided a date of 640 to 470 cal BP.

A larger concentration of whale bones was encountered on the lowest terrace, extending through Layer C to Layer D (Figs. 42, 43). Examination of

Figure 42. Feature 57, a large concentration of whalebone. The occipital condyles of a whale skull are visible with a mandible lying across it.

the stratigraphy indicates that the two whalebone piles date to about the same time, which is further confirmed by the placement of the second feature above a radiocarbon date of 730 to 550 cal BP. The lower concentration nearly filled the excavation unit and extended into the western wall of the trench (see the stratigraphic profile, Fig. 23). It included a vertebral centrum epiphysis, a phalanx, a chopped rib fragment, a split rib fragment, the posterior portion of a very large skull, a complete left mandible, and the posterior third of a much larger baleen whale mandible (Gay Frederick, report to the authors, 2001). The skull was placed with the occipital condyles pointing upward and the complete mandible resting across it, with the other elements stacked around. Species identification of five elements through DNA analysis revealed that the complete mandible came from a gray whale, while all others, including the much larger mandible fragment, came from humpback whales (Watt 2003). The large size of the skull and mandible fragment relative to other elements suggests that at least two humpback whale individuals are represented. The flattened anterior extension of the skull's occipital bone, as well as the flattened lateral surfaces of both mandibles, display numerous shallow cut marks. The partial mandible has also been deliberately sectioned and extensively burned. Interestingly, most of a mussel shell harpoon cutting blade was found embedded in the right anterior portion of the skull's occipital bone, placing the harpoon entry wound above and behind the right eye. The shallow angle of entry meant that most of the harpoon blade was still intact in the bone (see discussion under artifacts). Clearly this whale had been taken by harpooning, was butchered on the beach, and later various elements found their way into this stack on the lowest edge of the site, possibly as a memorial to the whaler's prowess or as a convenient source of raw materials. The numerous cut marks on the skull and mandibles indicate that they also served as convenient large cutting boards.

Figure 43. Excavation around the whale bones of Feature 57. A shell harpoon blade was found embedded in the skull at the front lower edge in this picture.

Faunal Remains

Analysis of the shell is reported in Appendix C. For the main village portion of the site, shell analysis was restricted to about one-third of the levels in a column sample collected in the EA 1 trench. A total of 56 species of molluscs, barnacles, chitons, and sea urchins was identified. Throughout, California mussel dominates the shellfish taxa, comprising between 78.4 and 95.3% of the deposit by weight. Acorn barnacles make up the second major constituent by weight, while clams, particularly butter and littleneck clams, came third. Several species of chiton and sea urchin were also important elements of the diet throughout the deposit.

Analysis of the vertebrate fauna is presented in Appendix D. This is based on elements recovered from selected levels of one unit in EA 1 and odd-numbered levels of two adjacent units in EA 2. A total of 43,515 vertebrate elements was examined, of which 20,809 were identified to a specific taxon. Fish dominate the assemblage, comprising between 91 and 98% of all faunal elements, except for the upper layers of EA 2, where sea mammals and birds are more abundant and fish drop to 65% of the total. Of the fish, rockfish species are overwhelmingly the most abundant, comprising between 48 and 81% of the fish elements, except for the upper layers of EA 2, where salmon become more abundant and rockfish drop to 27% of the total. Greenling and ling cod are the other important fish species, followed by surf perch. Rockfish, greenling, ling cod, and surf perch are abundant in the rocky nearshore environment immediately surrounding Benson Island.

Although significant numbers of herring and anchovy bones were recovered during troweling and screening through 1/4" mesh, these small fish species were clearly under-represented in the faunal analysis. This problem was addressed through the recovery and analysis of small elements from the column samples (Appendix E). Selected levels from each major stratum in the EA 1 and 2 trenches were examined. Overwhelmingly, the recovered skeletal elements were fish (97.7% in EA 1 and 99.2% in EA 2). Of these, herring was by far the best-represented species, comprising 56.8% of the identified fish in EA 1 and 49% in EA 2. Anchovy also occurred in great numbers, particularly in EA 2. As in the unit samples, rockfish and greenling were also important species. However, the dominance of herring reduces the importance of rockfish to 17.4% in EA 1 and 11.8% in EA 2. These column samples document a similar suite of near-shore marine fish to that recovered in the unit samples, but dramatically increase the importance of small fish, particularly herring and anchovy. The great concentrations of herring in the protected areas of Barkley Sound brought in a range of other fish, birds, and sea mammals to feed on the spawning masses. These also became prey for human hunters and fishers.

Sea mammals played a significant role in the diet at Ts'ishaa. Fur seals and whales dominate this category, with porpoises and dolphins of several species also well-represented (Appendix D). DNA analysis of ten selected whalebones from EA 2 (nine from the two faunal features described earlier plus one ulna from the east wall) revealed that all but one gray whale mandible were humpback whale elements (Watt 2003). The preponderance of identified humpbacks in the cetacean remains is in agreement with earlier studies in Barkley Sound, such as those of the Toquaht Archaeological Project (Monks et al. 2001). The embedded mussel shell harpoon cutting blade demonstrates that the people of Ts'ishaa were actively hunting whales over 500 years ago, not simply relying on drift whales. The considerable number of porpoise and dolphin remains in the deposit also show that the people of Ts'ishaa had well-developed strategies and technology for hunting such fast-swimming and elusive sea mammals.

Chapter Five: EXCAVATION AT TS'ISHAA (DfSi-16) – BACK TERRACE

Setting

A small, relatively flat, elevated area lies behind the main village site and about three to four metres above it. Although the two areas are joined at the eastern end of the back terrace, there is a substantial gully separating them elsewhere (Figs. 19, 44). As midden deposits are continuous, this area is considered part of the larger site and is included in the same site number.

Probing in 1999 (and by Parks Canada personnel in 1995) revealed shell midden across much of this area. Deep deposits of shell were evident along the slope at the eastern end, while shell disappeared entirely, except for occasional small patches, toward the western end. Probing indicated that cultural matrices covered only a small area, about 45 by 20 metres. Test excavation in 2000 was intended to investigate whether the archaeological remains reflected specialized use of this area, contemporaneous with the primary site occupation, or whether this represented an earlier period of occupation, associated with higher sea levels. Results of radiocarbon dating suggested the latter, and led to more intensive excavation in this area in 2001.

A number of scholars have examined Holocene relative sea level history for central western Vancouver Island (Friele 1991; Hutchinson 1992; Friele and Hutchinson 1993; Bobrowsky and Clague 1992; Boxwell et al. 2000). Their proposed sea level curve for this area (Fig. 45) is based primarily on data from Clayoquot Sound, although it incorporates some Barkley Sound information. Hebda's work on several of the Broken Group islands in Barkley Sound, for example, indicates that early Holocene sea levels stood at least 10 metres below present levels (Hutchinson 1992:37). From these early Holocene lows, the relative sea level rose rapidly to intersect the modern beach just prior to about 7000 cal BP. In Barkley Sound this sea level rise is marked by freshwater peats in island bogs that are overlain by marine deposits dating to around that time (Hutchinson 1992:37). The

Figure 44. The back terrace excavation area from across the gully behind the main village.

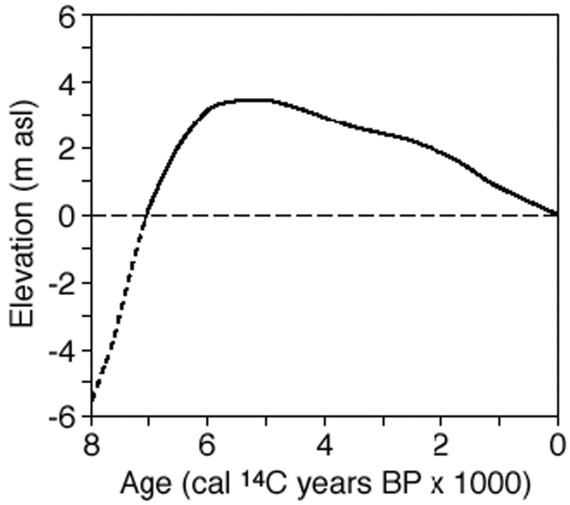


Figure 45. Proposed sea level curve for the central west coast of Vancouver Island (after Friele 1991; Hutchinson 1992; Friele and Hutchinson 1993; Bobrowsky and Clague 1992; Boxwell et. al. 2000).

relative sea level continued to rise, reaching three to four metres above present, where it remained from about 6000 to 4800 cal BP. Friele (1991) has termed this period the Ahous Bay Stillstand. Subsequent gradual emergence of the land relative to the sea throughout the late Holocene is attributed to tectonic uplift (Clague et al. 1982; Friele 1991; Friele and Hutchinson 1993; Boxwell et al. 2000).

The back terrace portion of the site today stands about nine to ten metres above the highest tide line. Its surface is about four metres above that in the large open area of the main village, around EA 1, and about six metres above the middle platform of EA 2. When the depth of cultural deposits in each area is removed from consideration, however, the base of the back terrace is about six to seven metres above the original beach sand and gravel at the base of the main village area. This would place the initial occupation only a few metres above high tide during the Ahous Bay Stillstand. Seven radiocarbon dates from near the base of the back terrace deposits fall between 5900 and 4500 cal BP, corresponding closely with the Ahous Bay Stillstand. During this initial period of occupation, the area that would later become the village of Ts'ishaa was an active beach, with highest tides coming right to the base of the rise up to the back terrace.

Excavation Extent and Methodology

An initial 2 x 2 m test unit excavated in 2000 was extended to a 4 x 2 m unit (coordinates S 58–60 W 59–63) when a large rock feature was encountered near its base. This was followed by much more extensive excavation in 2001, when nine 2 x 2 m units and two 1 x 2 m units were opened, although one of the latter was not completed due to the presence of burials. Except for a 1 x 2 m unit at the top of the eastern slope (grid coordinates S 56–57 W 50–52), all were concentrated in the area just west of the 2000 unit. Coordinates for the most westerly unit are S 54–56 W 77–79. Some of the units adjoin, providing continuous stratigraphic profiles. See Fig. 19 for unit locations. The total area encompassed in these units is 48 square metres.

The horizontal grid used in the main village area was extended to the back terrace. All excavation units were laid out in alignment with magnetic north. A secondary vertical datum was established for this part of the site as the head of a metal spike driven into the trunk of a large spruce tree near the initial unit excavated (just SE of S60 W59). This datum is taken from that used in EA 2 of the main village, which is three metres higher than in the other two excavation areas of the village. From this elevation, unit datums were established as the tops of pegs driven in beside each unit.

Excavation methodology followed that used on the main portion of the site. All cultural deposits were removed by trowelling in ten centimetre levels (Figs. 46, 47), taking care to separate materials from differing natural layers. Artifacts were recorded in three dimensional provenience, while faunal remains were bagged by level and layer. Shell and bone fauna were bagged separately. All trowelled matrix was screened through 1/4" mesh. Column samples (20 x 20 cm bulk matrix samples) were taken from the walls of two units for shell and microfaunal analysis. Charcoal was collected for radiocarbon analysis; unlike the village area, however, charcoal generally was found only as small scattered pieces, requiring that most samples be collected from across one level of the unit. Profile drawings were made of the stratigraphy on all walls.

The depth and nature of the deposit varied considerably across this portion of the site. The unit at the top of the eastern slope contained a thick layer of concentrated crushed shell over two metres in depth. Elsewhere, units varied from 70 cm to just over one metre in depth. The total volume of matrix removed was 44.7 cubic metres.

Figure 46. Ts'ishaa back terrace excavation looking west.

Figure 47. Ts'ishaa back terrace excavation area looking east

Stratigraphy and Chronology

Five adjacent excavation units provide a continuous profile extending 10 metres on a north-south line (perpendicular to the slope). This profile is shown in Figure 48. The stratigraphy of the four metre south wall of the unit excavated in 2000 is shown in Figure 49. The deep shell deposit at the eastern edge is shown in Figure 50. Table 7 presents all radiocarbon dates available from the back terrace area of the site.

The upper layer across all excavated units consisted of black silt (Munsell 7.5YR 2/0), with abundant small pebbles and larger rocks. If shell was present at all, it was only as a trace. This was only a thin layer at the back of the excavated area and in the eastern unit, where it sat directly over shell. Closer to the slope and in the western units, where shell was absent or patchy, this layer was much thicker and sat directly on the underlying silt-clay.

This upper layer is poorly dated. A charcoal sample from above the shell layer was submitted for analysis but the result was rejected as far too recent and probably dates burnt root. This layer is presumed to predate the earliest village occupation, placing its upper levels at about 2500 BP, which is consistent with comparison of artifacts with those of known age elsewhere. Where it sits directly over shell, its lower levels would date to perhaps 3200 BP, based on a number of dates from the upper shell layer. In units to the west, however, where the black silt layer is thicker and sits directly on the lower silt-clay, its lower levels seem to be contemporaneous with the shell. The one date available from such a context is 3670 to 3470 cal BP.

In most excavation units this black silt layer was underlain by a thick deposit of crushed shell, with some black silt, charcoal, and FCR. Where it was thickest, it could be divided into two, with the lower shell layer containing a greater concentration of dark silt. The most extensive shell deposit was in the unit on the eastern point of the back terrace, where it had a depth of almost 2.5 m. In the western units and in those closest to the slope down to the main village, shell was absent or occurred only in small patches.

Twelve radiocarbon results, ranging from about 3200 to 5000 cal BP, date the shell layer (Table 7). The thick shell deposits in the eastern unit provide the fullest evidence of this temporal span (Fig. 50). An age of 3380 to 3210 cal BP came from the upper shell layer, while one of 3440 to 3000 cal BP was obtained twenty cm lower. Paired AMS dates on charcoal from the column sample, taken about halfway down the deposit, gave identical ages of 3980 to 3730 cal BP. Three dates came from near the base of this shell deposit. An age estimate of 4850 to 4450 cal BP was based on a composite sample, taken from charcoal throughout a 90 cm shovel test to the basal clay. Two paired AMS dates on charcoal from the column sample, taken from near the base of the shell at 2.3 m below surface, yielded ages of 4840 to 4620 cal BP and 5260 to 4870 cal BP.

The lowest matrix was a silt-clay, which varied laterally in colour from dark grey-brown to red-brown (Munsell 5YR 3/2). Charcoal and stone artifacts were found only in the upper levels of this stratum. At the back of the excavated area this was only a thin layer sitting directly on bedrock. Elsewhere it had much greater depth, although excavation only proceeded a few levels into it, at which point no further cultural materials were recovered. In one of the western units, however, an area along one wall was shovelled down to bedrock (at a depth of 1.6 m), exposing a compact yellow-brown coarse sand and gravel layer below the clay. The clay may be of marine origin, deposited at a time of higher sea levels, that was later oxidized under conditions of forest cover (Wilson, Appendix A).

Five radiocarbon dates are available for the upper portion of this lower matrix. The most recent is a determination of 4270 to 3990 cal BP, from a grey-brown silty clay overlying red-brown clay in the lowest unit on the slope. In one of the western units, a date of 4830 to 4410 cal BP was obtained from the upper surface of the brown silt-clay. Several artifacts, including a decorated abrasive stone and a quartzite flake, were recovered from the level below the one that yielded this date. Two nearly identical dates of 5310 to 4830 cal BP and 5320 to 4870 cal BP came from the reddish-brown clay of the central units. A large decorated abrasive slab came from the same level and layer as the former date, while the latter was found with materials (shell and a small number of faunal remains, including a large chunk of sea mammal bone) that may have been tracked into the upper portion of this matrix. The earliest date obtained is 5920 to 5650 cal BP, based on charcoal collected a short distance into the clay at the base of the 2000 unit. That charcoal cannot be conclusively demonstrated as cultural in origin, although this remains a strong possibility.

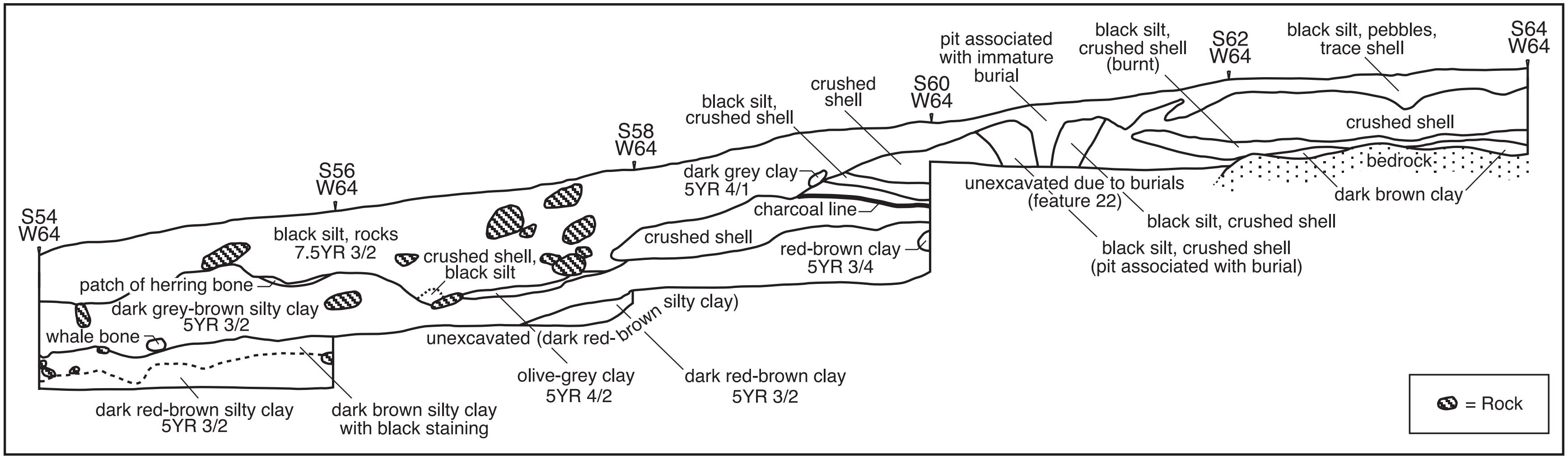


Figure 48. Ts'ishaa back terrace stratigraphic profile (10 m profile perpendicular to slope and beach).

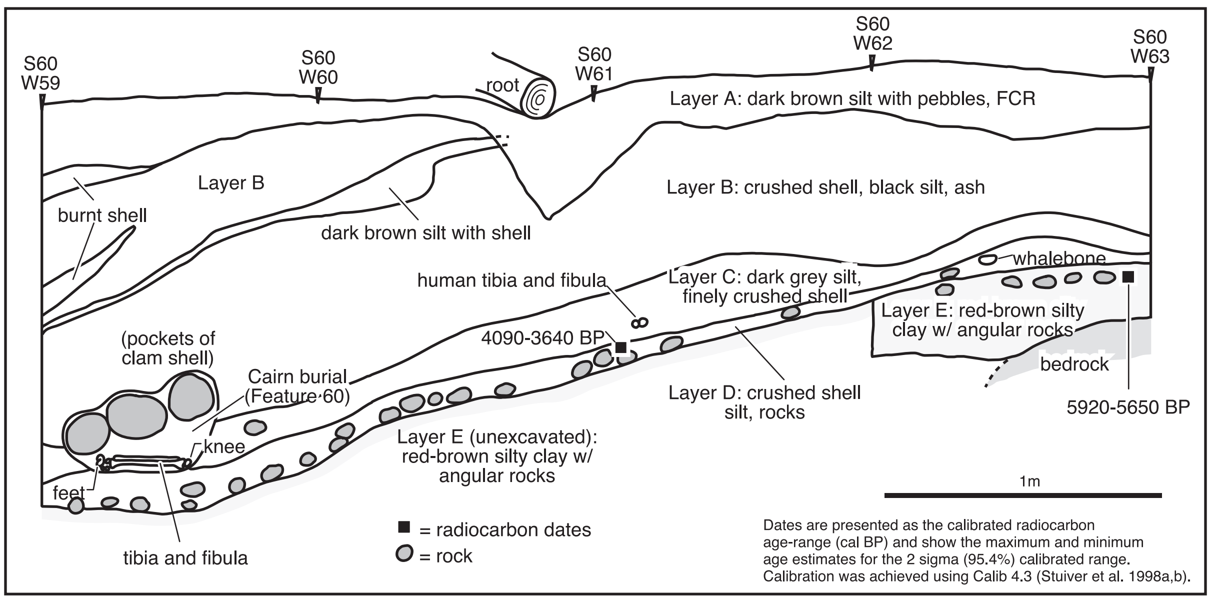


Figure 49. Stratigraphic profile of 2000 Ts'ishaa back terrace unit (S 58-60 W 59-63, south wall).

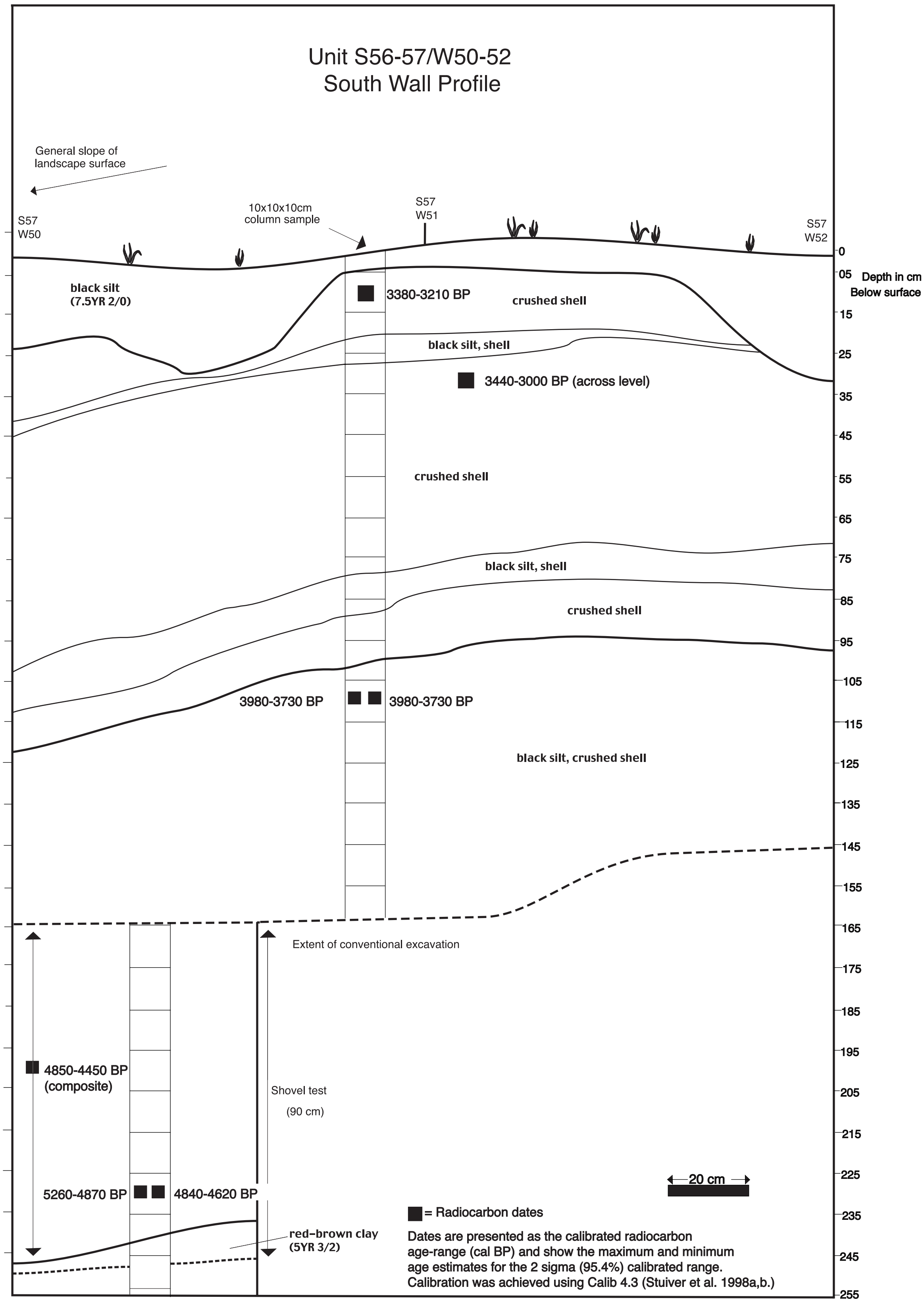


Figure 50. Ts'ishaa back terrace stratigraphic profile (S 56-57 W 50-52, west wall) showing location of radiocarbon dates.

Table 7. Radiocarbon dates from Ts'ishaa back terrace.

Sample No.	^{14}C age (BP)	Cal age range (BP)*	Intercept(s)	$^{13}C/^{12}C$	Material*	Unit	Lev./ Layer	Comments
Beta-158740	3000±70	3360-2950	3210, 3180, 3170	-25	charcoal	S62–64/ W62–64	5B	Shell layer
CAMS-48305	3770±35	3470–3330	3390	-14.5	marine bone	S62–64/ W62–64	6B	Shell layer
Beta-158741	4470±70	5320–4870	5210, 5190, 5048	-25	charcoal	S62–64/ W62–64	7/8D	From clay, just above bedrock
Beta-158742	3330±70	3810–3390	3620, 3570	-25	charcoal	S58–60/ W64–66	8D	Shell layer
Beta-158743	4430±80	5310–4830	5030, 5010, 4980	-25	charcoal	S58–60/ W64–66	10E	In red-brown clay at base
Beta-158745	4080±70	4830–4410	4570, 4560, 4550, 4540, 4530	-25	charcoal	S54–56 W70–72	8A/B	Top of silt-clay
Beta-147071	3580±80	4090–3640	3870	-25	charcoal	S58–60/ W60–63	9D	Lowest shell layer, among rocks of burial cairn
Beta-147073	5050±60	5920–5650	5860, 5830, 5750	-25	charcoal	S58–60/ W62–63	7E	In basal red-brown clay – cultural?
CAMS-48303	4320±70	4300–3900	4090	-15.0	marine bone	S56–58/ W64–66	7B	Bottom of shell layer
Beta-158739	430±60	550–320	500	-25	charcoal	S54–56/ W64–66	4A	Date rejected – burnt root?
CAMS-48304	4350±45	4270–3990	4140	-14.5	marine bone	S54–56/ W64–66	9B	Brown silt-clay
CAMS-97186	3100±35	3380–3210	3340, 3280, 3270	-25	charcoal	S56–57/ W50–52	1B	Top of shell – AMS date from column sample
Beta 158744	3050±70	3440–3000	3320, 3310, 3300, 3290, 3270	-25	charcoal	S56–57/ W50–52	4B	Near top of shell layer in deepest unit
CAMS 98341	3920±40	3670–3470		-14	marine bone	S56–58 W66–68	6A	Near base of upper black silt layer
CAMS-97176	3585±40	3980–3730	3890, 3880, 3870	-25	charcoal	S56–57/ W50–52	11C	Paired AMS date from column sample, 1.1 m depth
CAMS 97177	3575±35	3980–3730	3870	-25	charcoal	S56–57/ W50–52	11C	Paired AMS date from column sample, 1.1 m depth
BETA 158747	4160±70	4850–4450	4810, 4760, 4700, 4650	-25	charcoal	S56–57/ W50–52	23C	Composite from 90 cm shovel test at base of shell deposit
CAMS-97181	4210±35	4840–4620	4830	-25	charcoal	S56–57/ W50–52	23C	Paired AMS date from column sample – near base of shell, 2.3 m
CAMS-97182	4415±35	5260–4870	5030, 5020, 4980	-25	charcoal	S56–57 W50–52	23C	Paired AMS date from column sample – near base of shell, 2.3 m

*Dates are presented as the calibrated radiocarbon age-range (cal BP) and show the maximum and minimum age estimates for the 2 sigma (95.4%) calibrated range. Calibration was achieved using Calib 4.3 (Stuiver et. al. 1998a,b).

*Marine samples (all fur seal [*Callorhinus*] bone) were calibrated with ΔR= 250±0 (100% marine) in Calib 4.3 (Stuiver ibid). Reservoir estimate is based on discussion in Southon & Fedje (2003).

Artifacts Recovered

A total of 221 artifacts came from the Ts'ishaa back terrace (Table 8). Of these, bone implements account for 29.4%, stone for 68.8%, and shell for 1.8%. Chipped stone artifacts comprise 43.4% of the total. When unmodified and unused flakes and spalls are removed from consideration, stone drops to 58.9% and chipped stone to 25.6% of the total.

In distribution, over half of the artifact total (118; 53.4%) came from the upper layer of black silt. The shell layers yielded another 27.2% of the total, while 19.4% came from the lower silt-clay matrix. This distribution, however, varies considerably by artifact raw material. The majority (56.9%) of the bone artifacts and all the shell artifacts came from the shell deposits. Stone artifacts, however, came primarily from the upper black silt (63.8%),

Table 8. Artifacts from Ts'ishaa (DfSi-16) back terrace.

Bone	
large barbed points	5
large unbarbed point	1
small barbed points	3
bone points	
gradually tapering points	5
small abrupt tip points	10
small slender point	1
tips of pointed bone tools	7
foreshaft	1
small bone bead	1
misc. worked bone (excl. whalebone)	16
whalebone wedges	4
whalebone haft/handle	1
whalebone bark shredder (?)	1
misc. worked whalebone	9
total bone	65 (29.4%)
Ground stone	
large faceted slate points	4
slate pendant	1
celt	1
celt fragments (?)	3
knife	1
worked slate/schist fragments	5
decorated abrader	1
abrasive stones	31
abrasive slab	1
total ground stone	48 (21.7%)
Chipped stone	
obsidian biface	1
obsidian microblade core ridge flake	1
schist knives	14
choppers	10
large cores	3
small cores	2
bipolar cores	3
bipolar bashed pebbles	3
split pebbles	1
large retouched flakes	4
large utilized flake	1
large spall	1
flakes	52
total chipped stone	96 (43.4%)
Pecked stone	
hammerstones	7
anvil stone	1
total pecked stone	8 (3.6%)
Shell	
shell disk bead	1
Olivella shell beads	2
scallop shell ornament	1
total shell	4 (1.8%)
Total	**221**

with 23.7% from the lower silt-clay and only 12.5% from the shell. Preservation is clearly an issue in the lower deposit, as only seven artifacts of organic materials were found and faunal remains were uncommon, yet stone artifacts were relatively abundant. Percolation of the heavier stone objects downwards in the deposit may also be a factor, as noted by Magne (Appendix B).

Artifacts of bone

Large barbed points (5) Four large flattened artifacts of sea mammal bone were found in close association in the crushed shell layer at the back of the central excavation area. They were found within a pit feature, at the bottom of which was the extended burial of an adult male (see description under features). Fragments of these bone objects were mixed throughout the fill of the pit, rather than being directly associated with the burial. The pieces could be joined to form two large points that are complete or nearly so, plus two large fragments (Fig. 51). All have flattened faces converging at the

Figure 51. Large bone points from Ts'ishaa back terrace.

base to a wedge shape. All have narrow grooves cut at an angle along one side, creating minimal (and apparently functionless) barbs.

One complete example is 26.2 cm in length. Greatest width (2.7 cm) and thickness (0.8 cm) are near the base. The flat faces are faceted to the sides, resulting in a hexagonal cross-section. Along one side of the central portion of the artifact there are four slanting widely-spaced incised lines. Although the lines extend back to the centre of the object on each face, they have not been cut through the bone. Only slight indentations on the side at the end of each incised line create small barbs.

A similar object, also hexagonal in cross-section, is missing only a small area at its tip and a small piece from one side. It is (25.9) cm in length; projection of the sides to compensate for the missing tip indicates that the complete object would have been about 27 cm long. Greatest width (2.4 cm) and thickness (0.6 cm) are near the base. Four slanting widely-spaced incised lines are along one side, producing very shallow, essentially functionless, barbs in the middle portion of the artifact.

Two large fragments, both lenticular in cross-section for most of their lengths, are from very similar objects. Both consist of the wedged base and central portion of the object. Measurements are (15.2) x 2.6 x 1.0 and (13.8) x 2.1 x 0.8 cm. One has three intact widely-spaced slanting incisions, which have produced very shallow barbs. The second has four closely-spaced incised slanting lines along one side, with evidence of a fifth at the break. This object is somewhat more deeply incised, producing more definite barbs.

The fifth object in this category, from the upper silt layer of a different unit, is not associated with the others. It is a relatively small blunt tip fragment of sea mammal bone. This section of the implement is fairly thick, with an oval cross-section. Evidence of two widely-spaced barbs, more pronounced than on the previous examples, remain on this fragment.

Similar artifacts have been found in sites of similar age in the Strait of Georgia region. Mitchell (1971:57; 1990:341) lists large faceted points of bone and slate as characteristic of the Locarno Beach stage in that region. Matson and Coupland (1995:158) illustrate a very similar object, with a wedge base and four shallow barbs along one side, from a Locarno Beach context.

<u>Large unbarbed point</u> (1) This object was found in the same unit and the same burial pit context as the four large barbed points described above. It was lower in the pit, directly above the pelvis of the burial. It was found pointing up, indicating that it had been deposited as part of the grave fill.

This artifact, based on a flattened fragment of sea mammal bone, is the lower portion of a large point which is lenticular in cross-section (Fig. 51, right). Its dimensions are (9.3) x 2.0 x 0.5 cm. The sides slightly contract at its wedged base. Projection from the gradually converging sides suggests that the complete object may have been as much as 19 cm in length. Although approximately half the artifact is present, it is possible that the missing tip portion may have had shallow barbs, which would place this object in the same category as the others found in the pit.

<u>Small barbed points</u> (3) Two calcined bone objects appear to be fragments of small, well-made barbed points (Fig. 52, upper left). One has a well-made tip and one intact pronounced barb along one side, but is missing its base. It measures (4.3) x 0.9 x 0.3 cm. The other is a basal portion, with one remaining pronounced barb and a small projection below that may be the top of another barb or possibly a line guard (making this a small harpoon head). The former came from the lower red-brown clay, while the latter was found in the upper black silt layer. The third, from the lower silt-clay, is a tip fragment from a stout piece of land mammal bone, with a pronounced notch on one side near the tip which may be a barb.

<u>Bone points</u> (16) The largest category consists of ten artifacts with the greatest width near the abrupt tip (Fig. 52, top). All are of land mammal bone. Most are complete or nearly so. All are small, with lengths of the seven complete points ranging from 2.6 to 3.8 cm (mean=3.0, S.D.=0.33). Most have a flat, slightly-wedged base, although one is nearly square and one comes to a rough point at the base. Such artifacts may have served as arming points on composite toggling harpoon heads, although other uses are possible. Two came from the upper layer of black silt, seven from the shell layer, and one from the top of the brown silt-clay.

Five artifacts are gradually tapering points, with greatest widths just below their middle. All are made of land mammal bone. These points are substantially larger than the abrupt tip points. One complete example, measuring 6.8 x 0.8 x 0.4 cm, has a rounded base. Another, measuring 6.4 x 1.0 x 0.3 cm, is missing only a small area at its base. The latter object is markedly asymmetrical at the

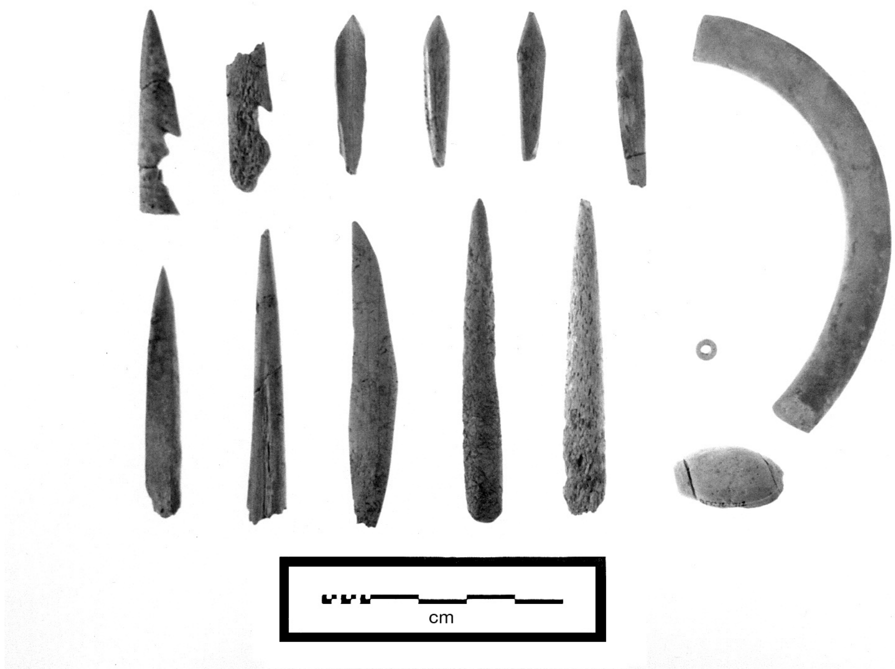


Figure 52. Miscellaneous bone and shell artifacts from Ts'ishaa back terrace (top row – barbed points, abrupt tip points; lower row – bone points, foreshaft; right – scallop shell ornament, disc bead, Olivella bead).

tip, and may possibly be an awl, although it is polished over its entire surface. The remaining three artifacts in this category are all large stout well-made points which are missing the basal portions. Most or all would have served as barbs on composite fishhooks. Three came from the upper black silt, one from the shell layer, and one from the lower brown silt-clay.

The final object is a small slender point of land mammal bone, round in cross-section. One end is sharply pointed while the other is missing. It is (3.9) cm long and 0.3 cm in diameter. Greatest width is near the broken end, which is sharply contracting at that point. Possibly this is a bipoint with one end missing. It came from the upper black silt layer.

Tips of pointed bone tools (7) These tip fragments, all of land mammal bone, may have come from a variety of points or awls. One well-made, sharply-pointed, flattened example, broken around the mid-section, is highly polished over its entire intact surface. It closely resembles bone needles recovered from the early component at Ch'uumat'a (McMillan and St. Claire 1996:36, 38), a Toquaht site on the western side of Barkley Sound, although the base is missing and no evidence of a drilled hole remains. Three fragments with rectangular cross-sections appear to be the tips of bone points. Two others are markedly asymmetric at the tip and may be awl fragments. Another possible awl fragment is roughly made, with modification largely restricted to the tip. Two came from the upper black silt layer, four from the shell, and one from the lower brown silt-clay.

Foreshaft (1) A fragment of a pointed implement of sea mammal bone, round in cross-section, is considered a possible harpoon foreshaft (Fig. 52). This fragment, (6.7) cm in length, shows extensive rodent gnawing at its broken base. It came from the deep shell layer in the eastern unit.

Small bead (1) This very small bone bead was found during fine-screening of the column samples. A short section of tubular bone has been cut and polished at the ends to produce this bead. It appears to be bird limb bone as the inside surface is straight but not smooth, indicating that the hole had not been drilled. The bead is 3 mm in diameter and 2 mm long. It came from near the top of the shell layer at the back of the site.

Miscellaneous worked bone (excluding whalebone) (16) One large fragment of bird bone is the proximal end of the right humerus from a short-tailed albatross (*Diomedea albatrus*). The articular end has largely broken away. At the shaft end, this object has been sawn almost through around its circumference and then snapped. This presumably is a result of artifact manufacture, where the shaft portion of the bone was used for some purpose and this end was discarded.

One elongated artifact of sea mammal bone is spatulate in form. The sides are parallel and the one intact end is rounded. The width is uniform throughout its length. Its measurements are (8.6) x 2.6 x 0.7 cm.

Most of the remaining fragments are of land mammal bone. One is blackened by burning and two are calcined. All show evidence of grinding to shape (or sawing in one case), but are too incomplete to classify further. The shape of one resembles the lower portion of a harpoon valve, but it is too roughly fashioned or unfinished to classify it as such. In distribution, eight came from the upper black silt, six came from shell layers, and two came from the top of the lower brown silt-clay.

Whalebone wedges (4) One finely-made narrow wedge has parallel sides and a rounded, quite thick bit (Fig. 53, lower right). It is missing the poll. Measurements are (11.7) x 2.6 x 1.3 cm. Two others are rounded bit fragments of much larger flat wedges. The fourth is a long section of sea mammal bone, dished in cross-section, with parallel sides and a rounded bit. At 17.6 x 3.4 x 1.7 cm, it appears to be complete except for a small area at the poll.

All were found in the shell deposit. Two came from the sloping lower shell layer of the 2000 unit, which has a date of 4090 to 3640 cal BP. Another came from the upper portion of the deep shell deposit in the eastern unit, just below a date of 3440 to 3000 cal BP. The fourth, from one of the back units, came from a level with a radiocarbon date of 3360 to 2960 cal BP.

Whalebone haft/handle (1) This object is made from a long curving piece of whalebone, which appears to be a rib section (Fig. 53). It is largely intact, with a length of 26.9 cm. The curving polished handle, which has been split to about half the original thickness, is rectangular in cross-section, with a flattened end. The other end, which is the full thickness of the bone, has been deeply gouged out in its soft cancellous centre, suggesting that this was used as a haft. What material was inserted and

Figure 53. Whalebone artifacts from Ts'ishaa back terrace (upper- haft/handle; lower left – bark shredder?; lower right – two wedges).

the function of the composite tool are unknown. It came from the upper black silt layer.

Whalebone bark shredder (?) (1) This flat whalebone artifact was broken into many fragments, but was largely reconstructed (Fig. 53). Although some pieces are missing, complete measurements (21.1 x 7.8 x 1.1 cm) can be determined for all dimensions. The object is a rounded rectangle in outline, with two flat faces and relatively even thickness throughout. It closely resembles simple rectangular bark shredders, such as those found at Ozette (Fisken 1994: 372–3). The edges are rounded, rather than bevelled to a chopper edge as would be expected for a shredder, so this identification is tentative. It came from the lower sloping shell layer in the 2000 unit, which had a radiocarbon date of 4090 to 3640 cal BP.

Miscellaneous worked whalebone (9) One very large, roughly rectangular slab of whalebone, 55 cm in length, shows evidence of having been chopped to shape at each end. Another is a pick-like implement, complete at 21.8 cm in length, which curves slightly to a blunt point. A complete smaller example, 14.0 cm in length, is also bluntly pointed, resembling a stout stake. Three flat pieces of whalebone show evidence of grinding to shape over at least one surface. Three narrow elongated pieces show signs of having been sectioned to produce long bone splinters, presumably as a stage in artifact manufacture. Two came from the upper black silt and seven came from shell layers.

Ground stone artifacts

Large faceted slate points (4) The most complete artifact is this category is a large, stemmed, faceted, "bayonet-type" point (Fig. 54). Although it had been broken in half, almost the entire artifact could be reconstructed. Its long straight sides gradually converge to the tip. It has flat faces faceted to the sides throughout its length, resulting in a hexagonal cross-section with six nearly equal sides. It is stepped in from each side near the base, producing a stem with slightly converging sides that is 2.9 cm in length. The stem has flat faces and edges, and is flat on its slightly wedged base. The point is 16.7 cm in length, but when the small missing section at its tip is compensated for by extending the sides, the complete object would have been about 17.1 cm. It is 2.4 cm in width just above the stem and 1.7 cm thick.

A very similar large faceted slate point was found in immediate association. This example was fragmented into many pieces, but most could be reassembled. The sharp tip and much of the body is intact, but it is missing the base. It closely resembles the more complete example in being faceted along its length, with a hexagonal cross-section consisting of six nearly equal sides. Measurements for this fragment are (15.8) x 2.5 x (0.7) cm.

The remaining two fragments may be portions of one artifact. One is the base section of a large stemmed and faceted point, closely resembling the intact example described above. This fragment is (7.0) cm in length, 2.5 cm wide just above the stem, and 0.6 cm thick. It is stepped in from each side, producing a stem with gradually converging sides which is 2.8 cm in length. The stem has flat faces and edges and is flat on its slightly wedged base. The second fragment, 0.5 cm thick, is from near the tip of the artifact, but is broken at both ends. It has flat faceted faces and straight, gradually converging sides. Both fragments are reddish-brown in colour, compared to the gray larger examples, and appear

Figure 54. Large ground slate points from the Ts'ishaa back terrace.

to have been burnt. Although it is probable that they are from the same object, they cannot be fitted together and were found in adjacent units, separated by a distance of about 1.5 m.

All four objects came from the upper silt layer around the centre of the back terrace units. The two most complete points were found in close proximity, while the tip fragment was a bit more distant in the same unit and level. The base fragment was only a short distance away in an adjacent unit. Their close association near the surface of the site suggests that they had been intentionally placed there, rather than lost or discarded. Adding to this supposition is the discovery of a complete finely-made obsidian biface in the adjacent unit with the point base. This impressive artifact, of a highly-valued raw material, clearly had not been lost or discarded. It was found in the same level as the points, only about 35 cm and 65 cm from the two most complete examples. Some form of ritual offering is suggested, possibly associated with the use of the back terrace as a burial area, although no burials were encountered near these items.

Large faceted ground slate points are one of the characteristic traits of the Locarno Beach culture in the Strait of Georgia region (Borden 1970:98; Mitchell 1971:57; 1990:341; Matson and Coupland 1995:156). Borden (1970:100) illustrates a number of examples, a few of which are stemmed, and speculates that the larger specimens may have been lance heads. Locarno Beach would be temporally equivalent to this upper layer at the Ts'ishaa back terrace. Croes (1995:216) also reports large faceted ground slate points from the Hoko River site, which dates to roughly the same time, although none of his examples are stemmed.

Slate pendant (1) This elongated but rather stubby artifact, recovered from the upper black silt layer, is roughly round in cross-section although it has flattened facets along its length (Fig. 55). Just below its flat head, this object is markedly indented from each side, presumably for suspension. Below that, the straight sides slightly converge toward the flat base. This object is complete at 3.7 x 0.9 x 0.8 cm.

This artifact likely served as a pendant, although it could possibly be a small weight. A similar schist object, although more elongated and finely-made, came from Shoemaker Bay (McMillan and St. Claire 1982:118, Fig. 73e).

Celt (1) This celt, of greenish nephrite, is complete except for some breakage at the poll and an elongated chip removed from a corner of the bit (Fig. 55). Its measurements are 9.9 x 3.9 x 1.8 cm. It has a rela-

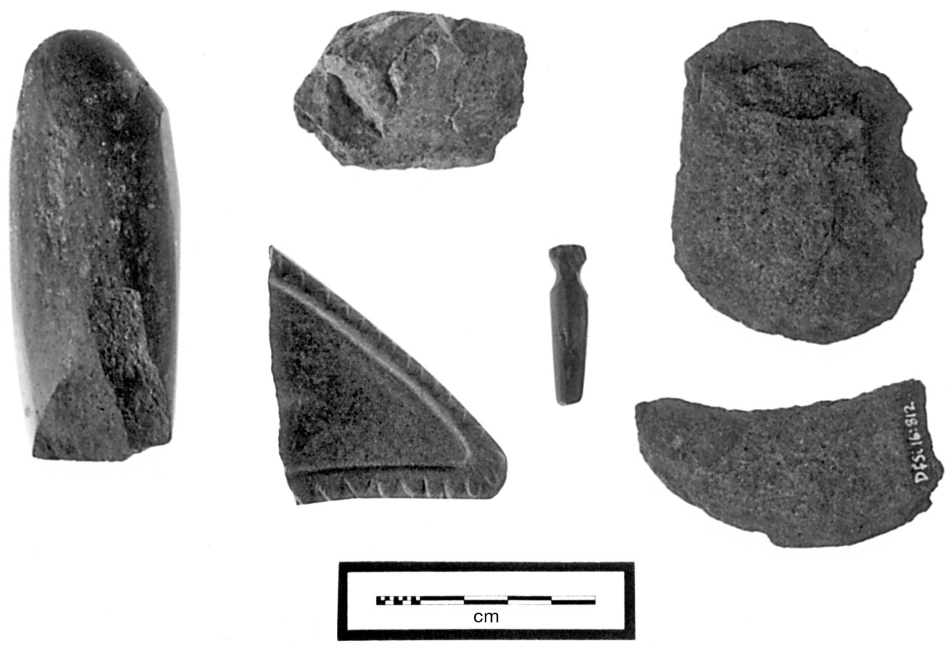


Figure 55. Miscellaneous stone artifacts from the Ts'ishaa back terrace (clockwise from left: celt, knife, two chipped schist knives, slate pendant, decorated abrasive stone).

tively narrow (3.3 cm) straight bit, a rounded poll, and rounded, slightly curving sides. Both faces are flattened, with a flat taper to the bit. The underside is highly polished over all high points, but there are extensive areas of unmodified stone that the polishing did not reach. This celt was found in the upper portion of the shell layer at the back of the site.

Ground stone celts are unknown from the later village portion of the site, although three black slate fragments have been interpreted as possible celt preforms. Similarly, stone celts are absent from the recent Toquaht sites in the western sound, occurring only in the earlier deposits at Ch'uumat'a (McMillan and St. Claire 1996:53).

Celt fragments (?) (3) All are small, relatively thin fragments, incomplete in all dimensions, with one highly polished face. Each has a slight facet on the polished face, possibly toward the side or bit. Two are nephrite and one is an unidentified metamorphic rock. The raw material and highly polished surfaces suggest that these are fragments from celts. Two were found in the upper black silt layer of the same unit, while the third came from the brown silt-clay layer in an adjacent unit.

Knife (1) This is an angular chunk of unidentified stone, possibly andesite, which is unmodified except for bifacial bevelling along a thin side of the artifact to produce a straight cutting edge 3.6 cm long (Fig. 55). It is complete, with measurements of 5.5 x 3.7 x 1.6 cm. It came from the upper black silt layer.

Similar stone artifacts, with modification restricted to bifacial bevelling along a single edge, came from Shoemaker Bay I (McMillan and St. Claire 1982:72). They are not reported for other sites in this area.

Worked slate/schist fragments (5) One slate fragment has been sawn almost through the object from one face, then snapped, leaving a narrow ridge along the base. A schist fragment (in two non-joining pieces) has been sawn through along one long side. In both cases, the sawn edge is the only evidence of modification. A small schist fragment is bifacially bevelled along one side, producing a knife-like edge. Another piece of schist is ground flat on one face and unifacially bevelled along one edge, although it has split in thickness. A small slate fragment has both faces ground flat and a curving flattened edge. All five artifacts came from the upper black silt layer.

Decorated abrader (1) A roughly triangular fragment, with two intact sides converging to a rounded tip, remains of this shaped and finely finished abrader (Figs. 55, 56). Both sides and the lower surface have been carefully polished flat. The upper surface has a slightly raised decorative rim, between 0.5 and 0.8 cm wide, along its outer edge. Although the inner surface of this rim presents a continuous raised lip, triangular shapes have been cut away from the outer edge. The space enclosed by the rim is flat, except for right at the break, where part of a marked elongated depression, presumably produced through use, is evident. This fragment is (7.7) cm long and 1.3 cm thick. It was found in the brown silt-clay, just under a radiocarbon sample which provided a date of 4830 to 4410 cal BP.

Abrasive stones (31) If the unmodified flakes and spalls are discounted, abrasive stones form the largest artifact category in this portion of the site, comprising 29.2% of the stone artifacts and 17.7% of the artifact total. All are of sandstone, ranging

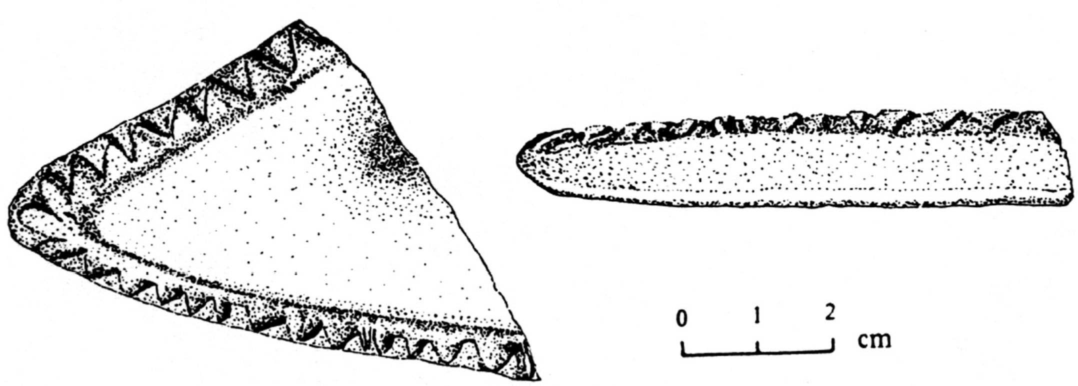


Figure 56. Decorated abrasive stone from Ts'ishaa back terrace.

from very fine-grained to quite coarse. All are of a size that could be held comfortably in the hand, although one is almost too large for this category and could have been considered an abrasive slab. They range from carefully shaped objects, with all intact surfaces ground flat, to rough sandstone slabs or cobbles that show evidence of having been used for grinding but have no further modification. The fragmentary nature of the great majority of abraders hinders classification into categories.

Only four examples were considered to be complete. One large abrader is a rounded sandstone cobble (13.3 x 13.0 x 4.9 cm) that appears to have been chipped along two sides (resembling a chopper) to get a shape and size that can easily be held in the hand. A grooved depression produced through use runs most of the length of one face. Another large example (15.5 x 4.0 x 3.4 cm) could be classified as a shaped abrader as all surfaces show some flattening by grinding; however, it is irregularly-shaped, with five sides, and not carefully finished. Another is an irregular cobble (11.0 x 8.2 x 2.9 cm) with both faces ground flat. The fourth example (8.4 x 6.9 x 1.7 cm) is also irregular in shape, with naturally-rounded edges. One broken edge has been roughly ground flat and both faces are dished through extensive use.

Eight abrader fragments show evidence of having been carefully shaped, with both faces and all intact sides ground flat (Fig. 57). As many others were fragmentary, lacking any complete sides, this category is likely under-represented. Most shaped abraders take the form of an elongated rectangular or a tapering bar.

Most abraders show use on both faces, although use on one might be more pronounced than on the other. Only four with both faces intact show no evidence of grinding on one face. In the great majority of cases, wear has produced a flat surface. On three abraders, however, wear has produced a dished depression (in one case on both faces). Three others show marked narrow grooves (one has two shallow grooves running most of the length of one face). Such wear is likely the result of grinding small artifacts such as bone points to shape. An additional abrader shows extensive pecking around the centre of one face.

Most of the abraders (20; 64.5%) were found in the upper black silt layer. Five (16.1%) came from the crushed shell layer, while six (19.4%) came from the lower brown silt-clay matrix.

The relative abundance of abrasive stones reflects their obvious use in the technology. They were used extensively in woodworking, as well as in the production of bone, antler, shell and stone artifacts that have been ground to shape. They are abundant at almost all archaeological sites along the Northwest Coast.

Abrasive slab (1) This large sandstone slab is distinguished from other sandstone abraders by being far too large to hold in the hand. This suggests that it was stationary in use, with the object being abraded moved over its surface. The shape is irregular, with four non-parallel sides. This object appears to have broken in length at some point but continued in use, as what appears to have been the broken edge shows some evidence

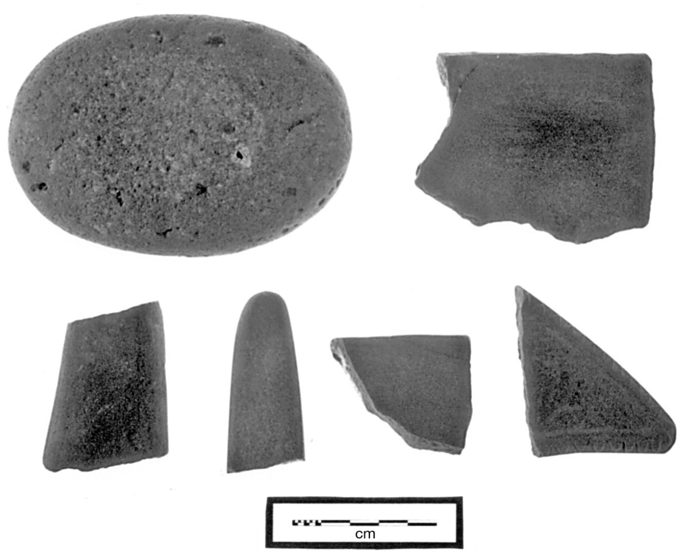


Figure 57. Anvil stone and shaped abrasive stones from Ts'ishaa back terrace.

of wear. As such, it is considered complete at 23.9 x 21.2 x 3.8 cm. Both faces have been worn flat, with extensive grinding right to the edges. The sides show less wear but have all been flattened, giving a rectangular cross-section. Deep grooves on three of the four edges extend across the full thickness of the object. The shortest side has four deeply-sawn V-shaped grooves set closely together near its centre. An adjacent side has two wide but roughly worn grooves, plus a deep sawn groove running perpendicular to the others across the middle of the artifact for almost the full length of the side. A third side has one wide U-shaped groove extending across its width. It is unclear whether these sawn grooves were meant to be decorative or whether they were used in grinding smaller objects, although only a few of the grooves show much wear.

This object was found at the base of the deposit, in the dark red-brown clay. It came from the same unit and level as a radiocarbon date of 5310 to 4830 cal BP.

Chipped stone artifacts

All chipped stone objects were first identified to raw material by Michael Wilson (Appendix A), then classified and analyzed by Martin Magne (Appendix B). The categories listed here follow those established by Magne. Additional comments and measurements for each object are provided in Appendix B.

Obsidian biface (1) One large, finely-made, leaf-shaped obsidian biface was found in the upper black silt layer of a central unit, only about 15 cm from the surface. It is roughly bipointed, although the base is blunter than the tip (Figs. 58, 59). The tip had snapped off, likely because of recent trampling, but both pieces were recovered. The object is complete, at 12.7 x 3.6 x 0.8 cm.

The obsidian, now slightly patinated, is very translucent and smoky in appearance. Source analysis for this material was conducted at the X-ray Fluorescence Laboratory in the Department of Chemistry at Simon Fraser University (James 2001). X-ray Fluorescence (XRF) is a non-destructive technique which measures the relative amounts of trace elements in the material and compares these to the known composition of obsidian from various source areas. This analysis determined that the biface was manufactured from obsidian which came from the Glass Buttes 'B' source in central Oregon. Glass Buttes is a location of high-quality obsidian, in close proximity to other noted obsidian sources. Glass Buttes obsidian has been reported for a number of sites in southern coastal British Columbia particularly in the Strait of Georgia region, where they tend to date between 5000 and 1500 BP (Carlson 1994:355). One flake of Glass Buttes obsidian came from the

Figure 58. Large obsidian biface immediately after discovery.

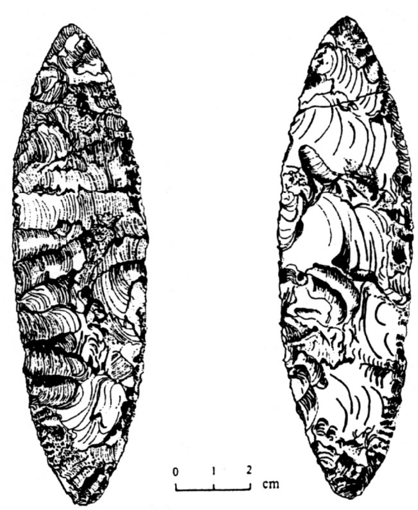


Figure 59. Large obsidian biface from Ts'ishaa back terrace.

early component at Shoemaker Bay (McMillan and St. Claire 1982:70).

The exotic raw material, large size, fine craftsmanship, and complete state of this artifact indicate that it was unlikely to have been discarded or lost at this location. The proximity of the two large, complete, finely-made, stemmed ground slate points (only about 35 and 65 cm away in the same stratum) adds to the likelihood that this was a ritual offering of some sort. This may be related to use of the back terrace as a burial area, although no burials were encountered nearby.

This object is unique in excavated assemblages from western Vancouver Island. However, Mackie (1992) notes that a leaf-shaped obsidian biface with slight side notches, now in a private collection, was found at the upper end of Ucluelet Inlet.

Obsidian microblade core ridge flake (1) This elongated, blade-like obsidian object is identified by Magne (Appendix B) as a ridge flake produced through microblade core manufacture, or possibly a biface edge spall produced by a longitudinal blow. The dorsal face has a steeply retouched, bifacially flaked surface, with a sinuous ridge extending along its length. Its measurements are 4.0 x 0.7 x 0.3 cm. It came from the brown silt-clay deposit in one of the western units, at approximately the same level as a radiocarbon sample in an adjacent unit that yielded an age of 4830 to 4410 cal BP.

This finely-flaked object of exotic raw material seems out of place in this artifact assemblage. No other evidence of a microblade technology exists. Source analysis conducted at the X-ray Fluorescence Laboratory at Simon Fraser University (James 2001) identified the obsidian as having originated from the Newberry Caldera in central Oregon. This is a source of high quality obsidian which was widely traded throughout western North America. Obsidian from this location has been found at a number of sites in south coastal British Columbia, particularly in the Strait of Georgia region (Carlson 1994:336). One flake of Newberry Caldera obsidian was found in the early component at Shoemaker Bay (McMillan and St. Claire 1982:70).

Schist knives (14) Three artifacts are classified by Magne as "schist knives." Of these, two are complete (measuring 8.4 x 5.6 x 0.6 and 7.7 x 6.0 x 0.6 cm) and one is a large fragment (Fig. 55, right). All three have bifacial retouch along at least one long curving edge. One, essentially oval in shape, is retouched around much of three sides.

The remaining artifacts in this category, classified simply as "chipped schist" by Magne, are likely fragments of similar implements. All but one are flat pieces of schist with intentional, generally bifacial, retouch along at least one intact edge. The exception is a thicker and more rounded elongated fragment, missing one end, which has been bifacially flaked along both long edges, then extensively ground over all intact surfaces.

In distribution, ten chipped schist artifacts came from the upper black silt layer, one from the shell deposit, and three from the lower brown silt-clay.

Numerous additional pieces of schist found during excavation were likely a result of the production of such tools, but only those that exhibited evidence of flaking were collected. One large block of schist found during excavation was probably brought to the site as raw material for artifact production. Schist was not available locally on the island, but could have been obtained from sources to the southeast of Barkley Sound (Wilson, Appendix A).

Similar artifacts came from the early components at Shoemaker Bay (McMillan and St. Claire 1982:64) and Ch'uumat'a (McMillan and St. Claire 1996:26), and were fairly common at the Hoko River site (Croes 1995:210–212). All three sites date to roughly the same time as the Ts'ishaa back terrace deposits. Similar chipped slate and shale knives are commonly reported for sites in the Strait of Georgia region, particularly dating to the Locarno Beach stage (Mitchell 1971:57, 100–01), which is contemporaneous with the sites mentioned above. They are rare or absent in later periods, particularly in the Nuu-chah-nulth region.

Choppers (10) This category is divided into three by Magne (Appendix B): choppers (3), cobble choppers (3), and split cobble choppers (4). All are large cobbles showing evidence of heavy percussion flaking to remove large flakes along one end or edge (Fig. 60). In four cases the cobble had been split prior to creating the chopper edge. Such tools served a variety of heavy chopping tasks. Weights range from 709 g to 1561 g (mean = 1090.5 g). Six were found in the upper black silt layer, one in the shell, and three in the lower brown silt-clay. One from the upper deposit has been heavily water-rolled, obscuring much of the flake removal scars.

Large cores (3) Three large cobbles show evidence of large flake removal, but no evidence of use as tools. Their weights are 1449, 3225, and 3264 g. One is highly water-rolled, partially obscuring

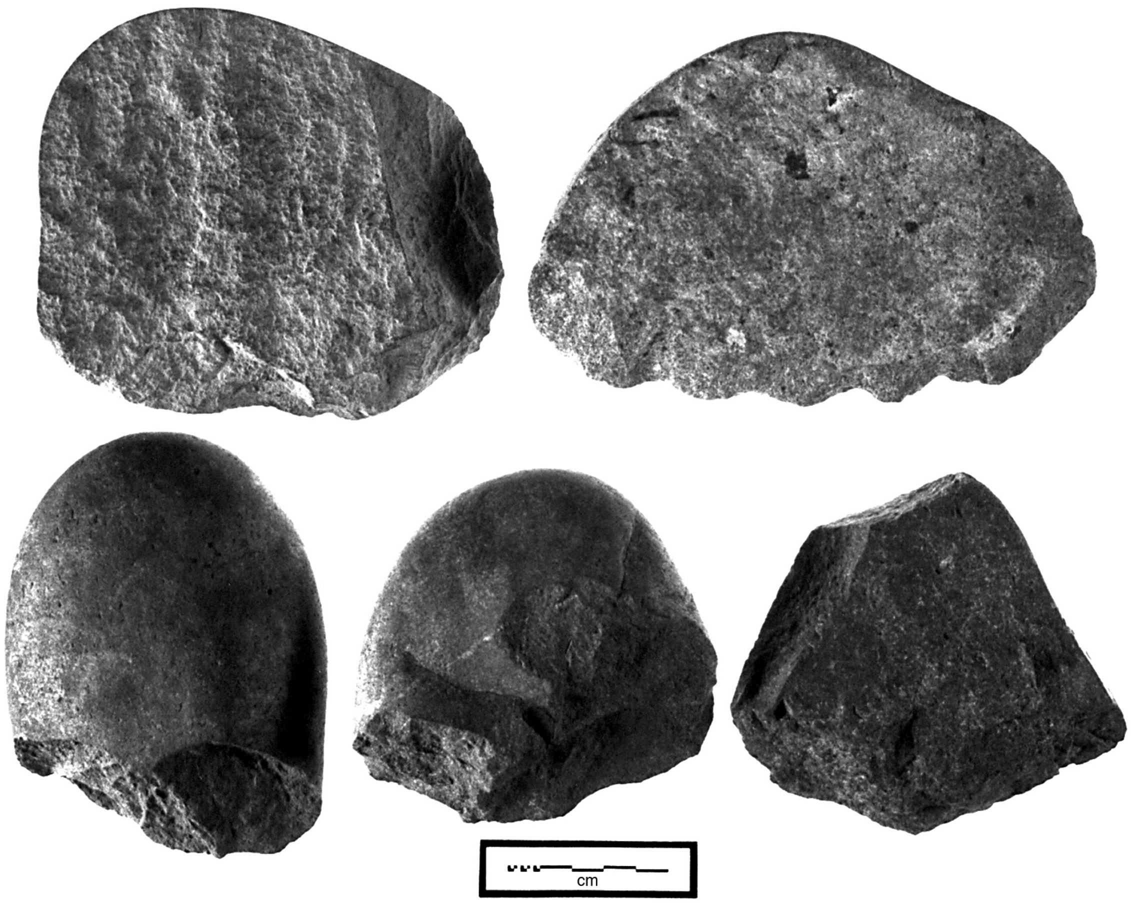


Figure 60. Stone choppers from the Ts'ishaa back terrace.

the flake scars on its surface. Two came from the shell deposit, while one is from the lower brown silt-clay.

Small cores (2) Both are small pebbles exhibiting flake removal. A small green chert example came from the upper black silt layer. The other, tentatively identified as andesite, is heavily water-rolled; it came from a shovel test dug deep into the basal brown silt-clay. Although there is a possibility that the apparent flaking stems from natural processes, this appears to be a small core. It may have sunk or been trampled into the clay at the early levels of the site during initial occupation.

Bipolar cores (3) All are small pebbles with evidence for detachment of flakes sufficiently large to be suitable for use as tools. Crushing at both ends indicates that these flakes were detached using a bipolar technique. Two are of vein quartz. The third is a rounded pebble of very fine-grained diorite with evidence of flake removal at each end, although water-rolling has obscured the flake scars (Fig. 61). All three were found in the upper black silt layer.

Bipolar bashed pebbles (3) Three small pebbles each exhibit evidence of bashing at both ends, but without removal of suitable flakes for use. Green chert, gneiss, and a fine-grained metamorphic which is probably quartzite are the raw materials. One came from the upper black silt layer, while two came from the lower brown silt-clay.

Split pebble (1) One basalt pebble has been split, but exhibits no evidence for crushing on its ends or any evidence of use. It was found in the upper black silt layer.

Large retouched flakes (4) Four large flakes or spalls, all with some remaining cortex, show some intentional retouch, producing an edge suitable for heavy chopping or scraping purposes. They

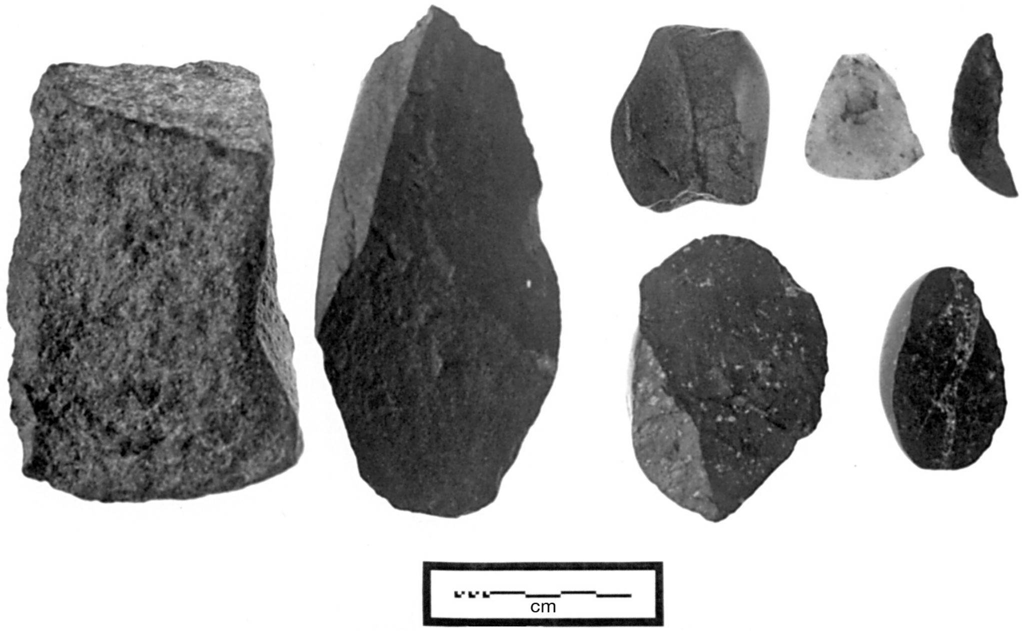


Figure 61. Miscellaneous chipped stone from Ts'ishaa back terrace (left – large retouched flake, large utilized flake; upper right – two bipolar cores, bipolar flake; lower right – split pebbles).

range from 12.3 to 16.5 cm in maximum dimension. The largest is roughly semi-circular in form, while the others are elongated. Two exhibit regular unifacial retouch along the full length of one long side (Fig. 61, left). Gabbro, gneiss, basalt, and fine-grained diorite are the raw materials. One came from the upper black silt, one from the shell deposit, and two from the lower brown silt-clay.

Large utilized flake (1) This large thick elongated flake of fine-grained basalt, 13.8 cm in length, still has some remnant cortex (Fig. 61). It appears to be heavily battered at one pick-like end. Magne (Appendix B) identifies evidence of use wear along one lateral edge. It came from the upper black silt layer.

Large spall (1) This large thick spall of gabbro, with cortex on its dorsal side, appears to have been flaked from a large cobble. It is considered to be debitage as it exhibits no evidence of retouch or use. It came from a shell layer.

Flakes (52) Four objects are classified as "bipolar flakes" by Magne (Appendix B). These are all elongated flakes which show evidence of crushing or bashing at both ends. Two small flakes are of green chert while another is vein quartz; a considerably larger example is of gneiss. Two were found in the upper black silt and two came from the lower brown silt-clay.

The remaining 48 flakes are small to medium sized pieces of debitage. The 26 flakes considered "small" (under 3 cm in maximum dimension) are predominantly of vein quartz (12) and green chert (8), although there are also examples of basalt (3), gneiss (2), and quartzite (1). The 22 larger ("medium") flakes, each greater than 3 cm in maximum dimension, are more varied in raw material, comprising gneiss (7), basalt (6), andesite (3), hornfels (2), green chert (2), gabbro (1), and quartzite (1). In distribution, 32 came from the upper black silt layer, 5 from the shell deposit, and 11 from the lower brown silt-clay.

Pecked stone artifacts

Hammerstones (7) Six examples are large rounded cobbles which show evidence of pitting or heavy battering on at least one end or edge. Five of these are large, naturally-pitted cobbles of biotite gneiss, while the smallest is a smoother, more rounded diorite cobble. They range in weight from 517 g to 3061 g (mean = 1336 g). All would have been suitable for heavy hammering or pounding tasks. Five came from the upper black silt and one from the lower brown silt-clay.

The largest object exhibits extensive battering at one end, removing part of the rock to produce a flattened and pitted striking surface. Another shows evidence of heavy battering along one end and both sides. The remaining four display less evidence of use and are more questionable due to the naturally pitted rock surface. Three show possible pitting or battering at one end and one along one side.

The seventh object in this category is very different in size. It is a small rounded elongated pebble, 6.6 cm in length and 44 g in weight. A pitted area at one end shows evidence of use for light hammering or tapping. It came from a shell layer.

Anvil stone (1) Extensive battering is evident across most of one face of this naturally rounded beach cobble (11.5 x 8.1 x 4.1 cm; 700 g) (Fig. 57). The battering has produced a slight oval depression, approximately 5.7 x 4.6 cm, on the surface. Slight battering can also be seen on the opposite face and one side. Such an object may have been used in the bipolar reduction of pebbles evident in some cores and debitage from this portion of the site. It came from the top of the shell layer.

Artifacts of shell

Shell disk bead (1) This complete well-made small bead, with flat faces and circular outline, is made from hard white shell, presumably purple-hinged rock scallop. It is 0.5 cm in diameter and 0.3 cm thick. The drilled straight central perforation is 0.2 cm in diameter. This small object was found in the column sample from near the bottom of the deep shell deposit in the eastern unit, just above a radiocarbon date of 4850–4450 cal BP.

Olivella shell beads (2) The attractive shells of the Purple Olive (*Olivella bipicata*) were made into beads simply by grinding away the spire at one end to allow stringing. Both examples from this part of the site came from the crushed shell layer, one from just below a radiocarbon date of 3440 to 3000 cal BP.

Olivella shell beads were more commonly encountered in the main village deposits, particularly in EA 3. They are reported for the nearby site of T'ukw'aa (McMillan and St. Claire 1992:54) and were relatively common in the Ozette house remains (Wessen 1994: 352).

Scallop shell ornament (1) This curving, elongated, parallel-sided section of highly polished purple-hinged rock scallop shell is broken at both ends (Fig. 52, right). It is nearly uniform in width (at 1.0 cm) throughout its curving length and is 0.3 cm in thickness. Both faces are flattened and all intact surfaces are ground and polished. The fragment is (8.9) cm in length. It came from near the top of the deep shell deposit in the eastern unit, from the same level as a date of 3440 to 3000 cal BP.

This object resembles a bracelet fragment and is assumed to be some form of personal ornamentation. A very similar, although smaller, object came from the False Narrows site in the Strait of Georgia region, where it was interpreted as an unfinished gorget or pendant (Burley 1989:126). Several complete pendants and gorgets from that site were made from purple-hinged rock scallop shell.

Features

Cairn burials (3)

In three cases, large rocks forming a cairn have been placed over human skeletal remains. None show evidence of a pit under the cairn, indicating that the body had been placed on the ground, then covered with rocks. The largest cairn, when completely exposed, extended across much of the 4 x 2 m unit excavated in 2000. The other two were only partially exposed, as they extended into the walls of their excavation units. When the rocks which make up the cairns were encountered during excavation they were exposed in place, along with any skeletal remains that protruded from below. No rocks or bones were removed from their original position and study of the human remains was restricted to what could easily be observed with them in place. No artifacts were encountered, although such associations may have existed below the rocks of the cairns. When all elements were exposed, photographed, and mapped, the units were backfilled with everything intact in the original location.

The large fully-exposed cairn is composed of rocks with an average diameter of about 30 centimetres (Fig. 62). It covers an area of about 2.7 by 1.5 metres and has a depth of about 60 centimetres. Some of the rocks sit directly on the surface of Layer E, the red-brown clay at the base of the site, while others seem to have their bases in the thin Layer D, consisting of crushed shell with silt and smaller rocks (see stratigraphic profile, Fig. 49). The upper rocks are surrounded by the thicker Layer C matrix, consisting of grey silt with finely crushed shell. The radiocarbon age of 4090 to

Figure 62. The rocks of a large burial cairn (Feature 52) at an early stage of exposure.

3640 cal BP came from a sample collected among the rocks of the cairn in Layer D.

This rock feature was clearly a burial cairn as is shown by human skeletal elements protruding from below the rocks in Layer D. The remains of one individual are evident along the northern margin of the cairn. At its northwestern edge a cluster of visible bones includes the proximal end of the left humerus articulated with the scapula and a fragmentary clavicle, as well as several lower cervical vertebrae, the sternum and some ribs. On the other side of the rock the left ulna and radius can be discerned. Under the rock directly to the west, a small portion of skull could be seen. To the east of these remains, projecting furthest from the cairn, is the left innominate, with lumbar vertebrae visible below. Further east along the northern margin of the cairn, a largely complete foot (metatarsals and phalanges) projects from beneath another rock. These all appear to belong to one individual, placed on the right side, fairly tightly flexed, with the left arm folded across the chest. A relatively wide sciatic notch on the innominate indicates that this person was female, although that identification is tentative. The individual was of small stature, although all elements visible have fused epiphyses, indicating that she was an adult. In addition, a few bones of a second individual, including an innominate, are visible below the eastern edge of the cairn, although they barely protrude from the rocks and no effort was made to expose them further. As both of these individuals are located at the margins of this large cairn, it seems likely that at least one additional person may lie buried more centrally under the rocks.

Another burial cairn was located a short distance southeast of the larger cairn, in the same excavation unit. It extends into the south wall of the unit (see stratigraphic profile, Fig. 49), with only a small portion exposed within the unit. Again, it consists of large rocks (about 30 cm average diameter) piled over human skeletal remains that are visible at the base of the cairn. The human remains sit at the bottom of Layer C, with the rocks extending upward into Layer B. Only the individual's lower limbs (tibiae, fibulae, and bones of the feet) were exposed in the wall of the excavation unit. These suggest that the individual was buried in a flexed position lying on the left side. The small size of the limb bones and the presence of unfused epiphyses indicate that this was an immature individual.

A concentration of rounded cobbles, considerably smaller than the rocks of the above two cairns, was exposed in the westernmost unit, near the base of the upper silt layer. Only part of this feature was visible as it extended into the north wall of the unit. Total depth of the feature was about 30 cm and width at the wall was about 50 cm. The rocks were pedestalled and left in place until completion of the unit, at which point some of the cobbles were removed. This exposed articulated skeletal remains of an immature individual. Only the lower limbs extended into the unit; the rest remained undisturbed to the north of the unit. The distal portion of a femur, the proximal end of two tibiae, and part of a fibula were visible. After these immature elements were mapped, the unit was filled in with no further disturbance of the human remains.

Cairn burials have now been found at a number of sites in the Nuu-chah-nulth area and may be a characteristic of a stage predating the late village sites, where midden interments are very rare. A close comparison, both in space and time, is with the Little Beach site at Ucluelet. At that site, a series of burials covered with low rock cairns was exposed in a midden deposit dated between about 4600 and 3500 cal BP (Arcas Consulting Archeologists 1991). Another close comparison is with the deposits at the back of the Ch'uumat'a village site, where two cairn burials closely resembling the Ts'ishaa examples were excavated and dated to about 2600 cal BP (McMillan and St. Claire 1996: 20–23). Another cairn burial came from the early component at Shoemaker Bay, at Port Alberni (McMillan and St. Claire 1982: 90–1).

Other burials (1)

Articulated skeletal remains of two individuals were found in the same location, although they were separate burial events dating to different times. Despite quite close proximity to the two large cairn burials, neither had cobbles placed over them. Both individuals had been placed in shallow pits (visible in the stratigraphic profile, Fig. 48).

The first remains to be encountered were those of an immature individual in the upper black silt layer. This person had been placed in a small pit about 40 cm in depth which had been dug into the underlying shell layer. This pit placed the individual directly on top of an earlier burial in the shell layer. The immature remains were only partially exposed, as much of the skeleton extended into the wall of the unit. The bones were poorly preserved in the shell-free upper matrix. Only traces were noted of the skull, although the teeth were present. The pelvis was considerably deeper than the skull and extended the furthest into the unit. Because of the poor preservation gender could not be determined and little can be said of this individual except that he/she was a young adolescent at death (based on permanent dentition with incomplete root formation).

Directly below the immature remains were those of an older adult male in the shell layer. He was in a loosely flexed position on his right side, with hands between his legs near the pelvis. The skull was not visible as it extended into the wall of the unit. The feet were under the remains of the immature individual. The bones of the arms and legs are best preserved; the ribs and pelvis were crushed and crumbling. He had been placed in a shallow pit, about 50 cm in depth.

Immediately over the adult burial was a small chunk of whalebone and one or two large *Pecten* (weathervane scallop) shells (which were fragmentary and in very poor condition). These may possibly have been placed with the individual, although they may also be accidental pit inclusions. Fragments of four large barbed bone points and one unbarbed point were also found in the pit fill, some distance above the burial.

Hearths (2)

Both features classified as hearths were encountered in the upper black silt layer. One consisted of a circular cluster of rocks (each about 15 to 20 cm in length), extending into the wall of the unit. A substantial quantity of charcoal was evident among and inside the rocks. The second hearth consisted of a circular concentration of smaller rocks and pebbles, with only a few large cobbles. Although no charcoal was present, many of the rocks were crumbling and exfoliated due to heat. Each hearth was roughly 70 to 80 cm in diameter.

Rock concentrations (4)

Features in this category tend to have rocks that are larger and more rounded than those comprising hearths, and show no evidence of charcoal or cracking due to heat. Their arrangement is assumed to be as a result of human activity, but the form is generally amorphous and gives no indication of their function.

Three were exposed in the upper black silt layer, while one came from the brown silt-clay in one of the western units. Of the former, two had large rocks extending above the surface that were visible before excavation of the unit began. Several large stacks of rocks could be described as cairns, but no burials or other materials were encountered below the rocks. Two of these features had large pieces of whalebone associated with the rocks and one was immediately adjacent to several possible post holes.

Pebble concentration (1)

This feature was a concentrated cluster of small water-rolled pebbles, all roughly the same size (about 6 cm in length). A total of 31 pebbles was included in this concentration. It is assumed that their placement is intentional, but their function is not known. This feature occurred in a shell layer in the central excavation area.

Pits/post holes (3)

One designated feature consists of a cluster of four circular, straight-sided, slanting holes in the upper level of the site, immediately under the surface. Three holes are about 10 cm in diameter, while the fourth is about 20 cm. Three of the holes could be traced for considerable depths (between 65 and 90 cm). They may represent post holes dating to the latest occupation of this part of the site, or they may be a result of natural processes, such as root holes. The holes are immediately adjacent to one of the large rock concentrations which extends above the surface of the site, also dating to the final occupation of this area.

The two other features in this category are quite different from the above. Both are basin-shaped depressions dug into the red-brown silt-clay at the base of the site. Both are oval in outline at their surface (measuring about 20 x 30 and 25 x 45 cm), sloping down for a depth of about 35 and 45 cm. These could be the bases of pits for large structural posts dating to the early occupation of the site, or they could have served as storage pits. They may be associated as they occurred at the same stratigraphic level and were only slightly over two metres apart.

Faunal feature (1)

This feature consists of the nearly-complete articulated skeleton of a large adult male river otter (identification by Gay Frederick, Appendix D). The animal was positioned on its back and was surrounded by a loose circle of fairly large rocks (up to 14 cm in diameter) in a shell layer in one of the central excavation units. Various natural agencies can deposit bones on archaeological sites, so caution must be taken in assigning a cultural interpretation. If this was a natural death event, it likely occurred during a time of site abandonment as it would be expected that the corpse would be quickly disturbed by village dogs. However, the encircling rocks suggest that this was indeed a cultural event, and that the animal may have been deliberately covered by the loose shell deposits.

Faunal Remains

Analysis of recovered shellfish remains is reported in Appendix C. This was based on examination of column samples from two units on the back terrace – one (S 62–64 W 62–64) with shallow shell deposits sitting almost directly over bedrock at the back of the main excavation area, and one (S 56–57 W 50–52) at the eastern edge of the excavated area where shell deposits had built up to a depth of almost 2.5 m on what might originally have been a point sloping down to the water. In both cases, the analysis was limited to odd-numbered levels. As in the later component, California mussel dominated the shellfish assemblage, comprising between 91.8 and 95.9% by weight of the total for the various shell layers in the two units. Barnacles and clams were the next most important categories in the shellfish assemblage. All other species made minor contributions to the total. In all, the two units yielded 22 and 23 different species of molluscs, barnacles, chitons and sea urchins.

Vertebrate fauna were examined for all levels of two relatively shallow excavation units (S 58–60 W 64–66, S 62–64 W 62–64) in the main excavation area. The results are reported in Appendix D. Of the 5345 elements recovered from these units, 2966 could be identified to a specific taxon. Fish dominate the identified specimens, although not as strongly as in the later component, making up 71% of the total. Of these, rockfish are the most common (31%), followed by greenling (23%), ling cod (13%), dogfish (9%), surf perch (6%), and anchovy (6%). When the fine-screened column samples are examined, however, the under-representation of herring becomes evident (Appendix E). In the column samples from the two units examined (S 56–57 W 50–52, S62–64 W 62–64) herring comprises 53 and 67.9% of the total identified fish elements. Greenling are also abundant (at

26.3 and 19.8%), more distantly followed by perch, anchovy, and rockfish.

Mammals make up 27% of the total identified sample, while birds comprise a meagre 1% (Appendix D). Land mammals (not counting dogs) make up 10% of the total identified sample, while commensal mammals (primarily dogs) make up another 9%. River otter is the most frequently identified land mammal, followed by mink, then by coast deer and racoon. The numbers for river otter and mink, however, may be inflated by the presence of several partial to largely complete skeletons. Dogs were also particularly abundant in the back terrace deposits, including two partial skeletons that may represent deliberate burials.

Sea mammals comprise 8% of the total identified sample. Of these, over half were classified as cetacean, but generally were too incomplete to be identified further. However, a rib fragment and a portion of a vertebra were identified through DNA analysis as humpback whale (Watt 2003). Humpbacks appear to have been the primary prey of Nuu-chah-nulth whalers in Barkley Sound for millennia (Monks et al. 2001). The second most abundant sea mammal species (at 14%) is the white-sided dolphin, although the high frequency is partially attributable to two clusters of articulated vertebrae. Fur seals (at 13%) were also important, but in much lesser numbers than in the later village portion of the site.

In an attempt to recover botanical remains, flotation analysis was undertaken on the column sample from the easternmost excavation unit (S 56–57 W 50–52). As this unit, on the slope down to the original beach, had almost 2.5 m of shell deposit, only the odd-numbered levels were examined. Overwhelmingly, the floated sample consisted of unidentified charcoal. Seeds that may provide evidence of past diet were very rare, occurring only in two widely-separated levels (Lynn 2003). At the top of the column, level one yielded two seeds identified to the genus *Sambucus* (Elderberry) and one identified to genus *Rubus* (Raspberry/Blackberry). Two metres below the surface (and above several radiocarbon dates greater than 4500 cal BP), level 20 yielded 36 charred seeds, all of which could be assigned to the genus *Rubus*. Members of this genus found on western Vancouver Island include the salmonberry, black raspberry, wild blackberry, and thimbleberry (Turner 1995). The seeds most closely resemble *R. parviflorus*, the thimbleberry (Lynn 2003), a plant known to have been harvested extensively by the Nuu-chah-nulth, who dried the berries as well as eating them fresh (Turner 1995:124; Turner and Efrat 1982:74). Drucker (1951:65) describes a "cake" consisting of layers of clams and thimbleberries dried in the sun. More intensive efforts at botanical recovery would almost certainly have yielded a broader picture of plant use over time at Ts'ishaa.

Chapter Six: EXCAVATION AT HIMAYIS (DfSi-17)

Site Description

Himayis (DfSi-17; 205T in the Parks Canada system) lies immediately adjacent to Ts'ishaa, over a trail between two rocky bluffs to the next beach (Fig. 19). Although physically separate, and thus given a separate site designation, it is clearly part of one large village complex. Shallow midden deposits fill the entire space available along the sandy beach, from the large rock outcrop that separates this site from Ts'ishaa to the rocks at the far end of the beach, a distance of about 180 metres. Midden deposits are most substantial in the southern half of the site, while only a thin trace of shell marks the site's northern portion, much of which is quite low-lying. This suggests that the initial settlement was in the higher southern section and that the village expanded over time as the population grew, eventually nearly closing the gap between it and the main community of Ts'ishaa.

In ethnographic tradition, this area was occupied as a result of population pressure at Ts'ishaa. As that village became overcrowded, chiefs sent their slaves to live along the nearby beach. Eventually the people who lived at Himayis, the *Himayisath*, became one of the four *ushtakimilh* on the island, although they were the most lowly ranked (see Chapter Two). According to this tradition, the archaeological remains along this beach should be more recent than those of the main site.

Two small intermittent creeks in the southern half of the site flow from a permanent spring a short distance inland, the only source of fresh water on the island. In the creation story told by Tseshaht elder Tom Saayach'apis to Edward Sapir (Chapter Two), when the original land and river were scattered to form the islands and channels of the Broken Group, the former lake "went into the ground" and is now inside Benson Island, ensuring that the water supply "never dries up" (Sapir and Swadesh 1955:52).

When John Webb Benson acquired the island at the end of the nineteenth century, he built a large wooden structure that served as his home and hotel

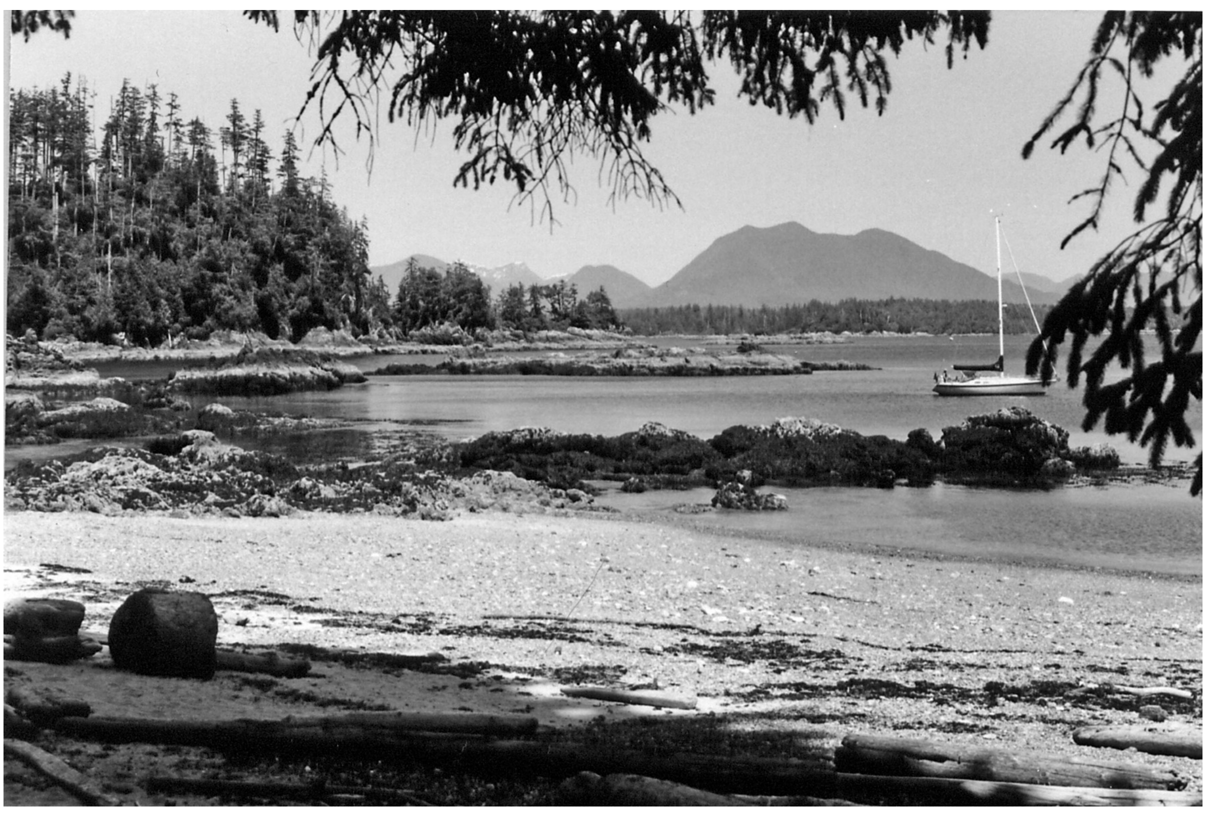


Figure 63. View into Barkley Sound from the front of Himayis.

on the flat land just north of the creek near the centre of the site (Fig. 18). Several exotic trees, including a large old nearly-collapsed chestnut, mark the location today. Parts of an iron stove, various large metal pieces, and broken crockery on the surface today are remnants of this period in the site's history.

Excavation Extent and Methodology

One 2 m x 2 m excavation unit was opened at this site in 1999. It was placed near the site's southeastern edge, near where a large bedrock ridge runs inland from the beach. A relatively open and flat area was selected among the large trees on the highest terrace, at the top of a marked midden slope down to a low-lying area and the beach. This is the highest area of the site, with the deepest midden deposits. A 0–0 point for the horizontal grid was established as a spike driven into the trunk of a large tree on the low-lying area below, at the edge of the site near the beach and the bedrock ridge (see Figure 19). From there, a unit with grid coordinates of S 5–7 W 11–13 was established on the higher terrace. The vertical datum is a flagged spike driven into a prominent large tree on the ridge that rises up behind the site. From this, a unit datum, the top of a stake beside the pit, was surveyed in.

Himayis was further tested during the 2001 season. A 1 x 2 m unit was established near the centre of the site, just south of the creek that runs through this area. Its coordinates are N 43–44 W 53–55, using the same horizontal grid and vertical datum as was established in 1999. This unit is toward the back of the site, on a small terrace above a low-lying, rather boggy area just above the high tide line. The few traces of where Benson's hotel once stood are immediately adjacent, on the other side of the creek.

Excavation methodology was the same as that employed at Ts'ishaa. All cultural deposits were removed by trowelling in ten centimetre levels, taking care to separate materials from differing natural layers. Levels were numbered while layers were given alphabetical designations; both were recorded on all bags and forms. Artifacts were recorded in three dimensional provenience, while faunal remains were bagged by level and layer. Shell and bone fauna were bagged separately. All trowelled matrix was screened through 1/4" mesh. A column sample of matrix for microfaunal analysis was taken from one wall after completion of the 1999 unit. In both units, profile drawings were made of the stratigraphy on all four walls.

The 1999 unit was excavated to a depth of about 2.3 metres but had not reached the base of cultural deposits by the end of the field season. About 8.3 cubic metres of deposit were removed. The 2001 unit, by contrast, extended into the basal sand but had an average depth of only 1.35 metres. About 2.7 cubic metres were removed. The total amount of excavated deposit at Himayis, therefore, is about 11 cubic metres.

Stratigraphy and Chronology

Three major stratigraphic layers were exposed in the 1999 unit (Fig. 64). Below the humus was a thick deposit of crushed clam and mussel shell with black silt (Layer A). Layer B was black silt and clay with a small amount of shell. Layer C consisted of concentrated crushed shell in sand and silt. The bottom of this layer was not reached. A small hole dug in one corner at the end of the fieldwork indicated that as much as 50 cm of deposit still remained above the original beach sands.

Black silt (Munsell 7.5YR 2/0) comprised the upper stratum (Layer A) of the 2001 unit. This was underlain by a thick deposit of burnt crushed shell. Layer C is black silt with crushed shell. Near the bottom, Layer D is a dark brown clay (Munsell 10YR 2/2), with large sand lenses within. Layer E is the sterile brown sand (Munsell 10YR 3/3) of the original beach.

A charcoal sample was taken from the base of each unit and submitted for radiocarbon analysis. The sample from the 2001 unit provided a result of 930 to 670 cal BP (860±60 BP; Beta-158748). The sample from the final excavated level of the 1999 unit yielded an age estimate of 970 to 740 cal BP (970±60 BP; Beta-134657). As this unit had not reached the base of deposit, the initial occupation of this portion of the site would have been somewhat earlier.

Artifacts Recovered

Only 34 artifacts were found at Himayis (28 in the 1999 unit and only 6 in the 2001 unit). This represents a very low artifact density for volume of deposit removed (3.1 artifacts per cubic metre). This is substantially below the main site of Ts'ishaa (4.5 artifacts per cubic metre), which has already been noted as having a low artifact density, and markedly below other major Nuu-chah-nulth sites, such as T'ukw'aa (13.3 artifacts per cubic metre).

Himayis artifact categories and numbers are shown in Table 9. Those of bone and antler domi-

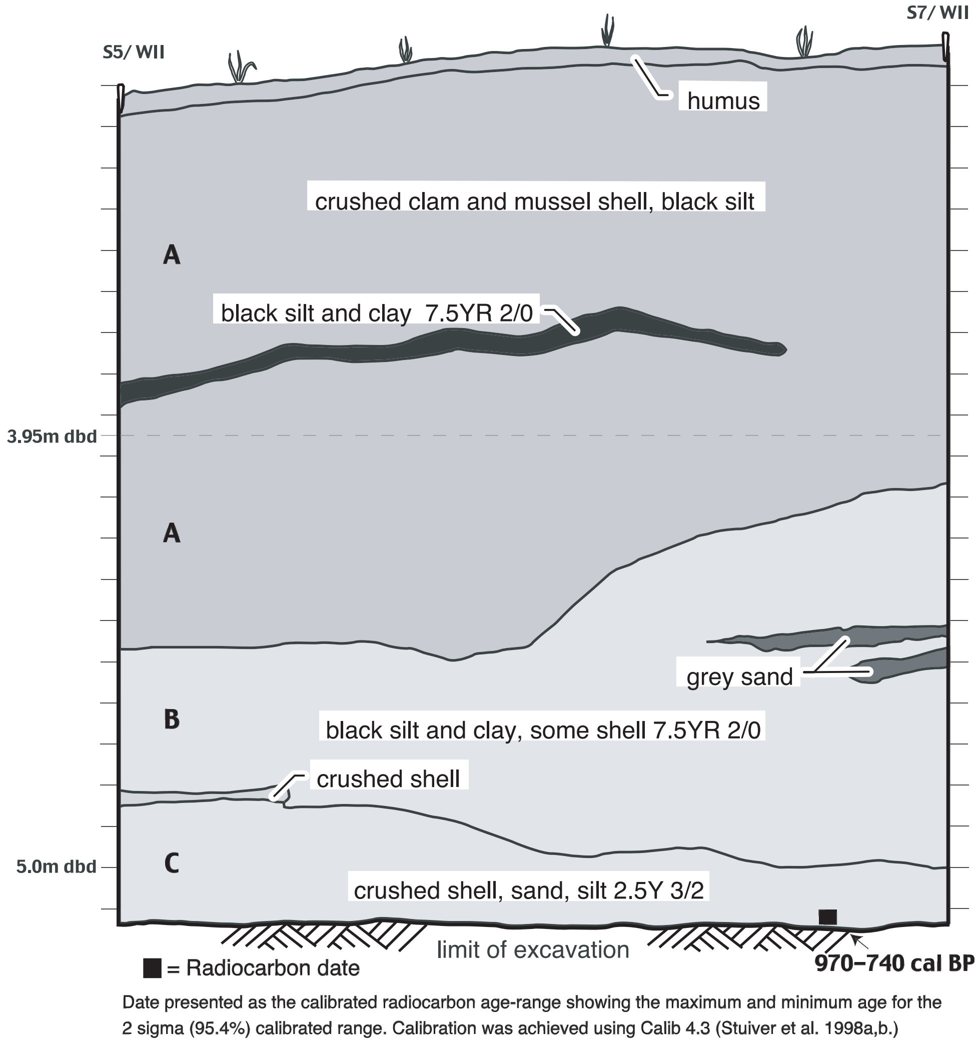


Figure 64. Stratigraphic profile at Himayis (S 5-7 W 11-13, east wall).

nate this small assemblage, comprising 91.2% of the total. Only two abrasive stone fragments and a fragment of historic glass are of other materials. Although the actual numbers are small, bone points, bipoints, and fragments of such tools make up the most common categories (accounting for 58.8% of the total), as at Ts'ishaa. Most or all of these would have been parts of composite fishing gear.

Artifacts of bone and antler

Barbed bone point (1) This small reworked artifact, measuring (2.9) x 0.8 x 0.4 cm, is missing only a small area at its tip (Fig. 65, lower row). One clearly defined barb is evident along one side. It appears to be the tip portion of a barbed bone point that has been reworked after breakage. The base of the object has been sawn from each face perpendicular to the axis, then snapped to length, leaving a central ridge. Deep incisions run nearly the length of each face, from the barb to the base, suggesting that the object was being sectioned in width. It was snapped from the groove on one side, but did not break to the opposing groove, which was left intact. It would appear that a small barbed point was being made from a fragment of a larger barbed artifact.

Bone points (9) Three points are characterized by an abrupt tip, with greatest width near the tip (although two have their greatest width closer to the centre than the norm for this type). All are roughly rounded rectangles in cross-section, with sides contracting to flat or slightly wedged bases. The largest, missing only a small area at the tip, is (5.4) x 0.7 x 0.4 cm. Two others are complete (3.2

Table 9. Artifacts from Himayis (DfSi-17) No.=34.

	1999	2001	
Bone and Antler			
barbed bone point	1		
bone points			
abrupt tip	3		
small wedge-based	1		
fragments	5		
bone bipoints	6	1	
tips of pointed bone tools	3		
bone awls	2	2	
harpoon valve	1		
possible fish hook shank	1		
misc. worked bone	2		
large whalebone harpoon fragment	1		
whalebone wedge		1	
worked whale bulla	1		
Total bone & antler			31 (91.2%)
Stone			
abrasive stones	1	1	
Total stone			2 (5.9%)
Historic materials			
glass fragment		1	
Total historic materials			1 (2.9%)

x 0.7 x 0.4 and 3.3 x 0.6 x 0.4 cm). These objects likely served as arming points in composite harpoon heads, although other uses, such as barbs on composite fishhooks, are also possible.

One small wedge-based point was also recovered. It is a thin, finely finished point of bird bone which has a sharp tip and a polished narrow wedge-shaped base. It is complete at 3.4 x 0.3 x 0.1 cm.

Five point fragments are of land mammal bone. All are fairly large, with several clearly being from points of substantial size. All come to a blunt point, which presumably is the base of the artifact.

Bone bipoints (7) The four complete examples are slender, symmetrical, finely finished objects of bird bone or land mammal bone which are sharply pointed at both ends (Fig. 65, lower row). Two are 4.9 cm in length, while two are 4.1 cm. One of the larger examples is markedly indented around its centre, presumably for attachment of a line. The three incomplete examples are all slightly stouter bipoints of land mammal bone. All three are markedly asymmetrical, taking the form of elongated scalene triangles. All objects in this category would have served as gorge hooks for taking fish or waterfowl.

Tips of pointed bone tools (3) Three relatively small and thin pointed fragments presumably came from small bone points or bipoints. They could also be tips of other tools such as awls, but seem too slight for such a purpose.

Bone awls (4) All four objects in the category are splinters of land mammal bone which have been sharpened to a point at one end (Fig. 65, upper row). One complete example, 5.9 cm in length, has been worked to a long tapering rounded sharp tip at one end, while the other end is the natural bone splinter. A longer and narrower bone splinter, 7.8 cm in length, has been modified only at its sharpened tip, which is placed asymmetrically at the end of one side. Two other fragments are also rough splinters with one sharpened end.

Harpoon valve (1) One small, wide, flaring, bluntly pointed bone object (3.2 x 1.0 x 0.4 cm) is identified as a small ancillary valve for a two-piece harpoon head. It lacks any channel for the foreshaft socket, but its general shape and flaring base suggest identification as a valve. Similar objects were relatively common at Yuquot (Dewhirst 1980:243–8), particularly in the earlier levels. They are recorded, but rare, at Ts'ishaa. The more common channelled or slotted valves of later period Nuu-chah-nulth sites were not found at Himayis, although this is likely due to the small size of the assemblage.

Possible fishhook shank (1) This narrow elongated artifact of polished sea mammal bone, (9.2) cm in length, is missing its distal end (Fig. 65, upper row). It is a rounded square in cross-section, 0.7 cm in thickness. The intact, presumably proximal, end is a flattened circle, with a shallow encircling groove just below it, presumably for line attachment. One possibility is that this is a fishhook shank which is now missing its distal end, although other interpretations are possible.

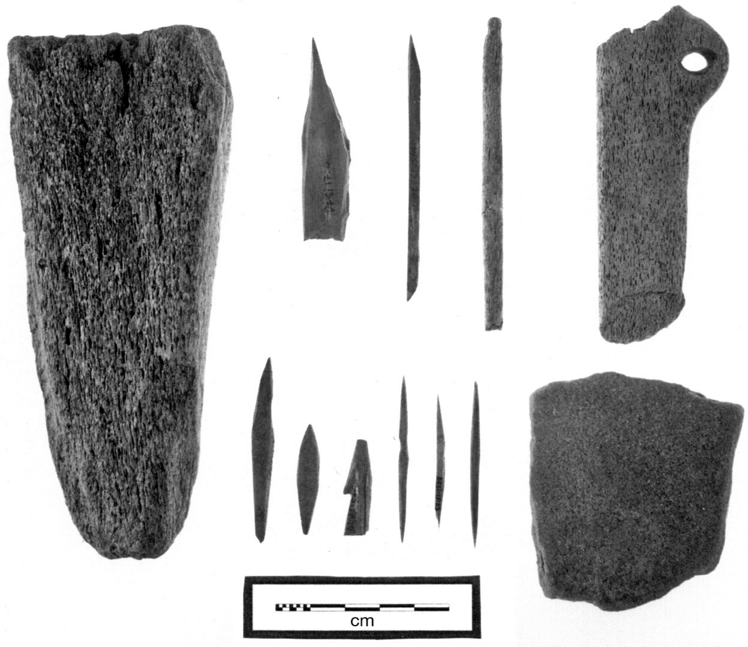


Figure 65. Himayis artifacts (clockwise from left: whalebone wedge, two bone splinter awls, possible fishhook shank, large whalebone harpoon fragment, abrasive stone, three bone bipoints, barbed bone point, two bone points).

<u>Miscellaneous worked bone</u> (2) An elongated fragment of worked sea mammal bone is oval in cross-section and has one rounded end. The other end is missing. The second object is a small fragment of land mammal bone with a deep sawn groove down its length.

<u>Large whalebone harpoon fragment</u> (1) This well-made, highly-polished artifact of sea mammal bone appears to be the base of what would have been a very large, presumably barbed, one-piece harpoon head (Fig. 65, upper right). It takes the form of an elongated rectangle, with a semi-circular line guard projecting from one side. The line guard is biconically perforated with a central hole for line attachment. In cross-section, the object is essentially rectangular, with flat polished faces and sides. It is (9.8) cm in length, 3.8 cm in width (across the line guard), and 1.3 cm thick (at the line guard). The complete object would have been very large, with an estimated length in the range of 25 to 30 cm.

Dewhirst (1980:295) illustrates a very similar artifact from Zone III at Yuquot. That object also has a rectangular base and a projecting biconically-drilled line guard. It is complete at 30.1 cm in length, with three large isolated barbs along one side. Large barbed whalebone harpoons also came from Shoemaker Bay II (McMillan and St. Claire (1982:100) and Ch'uumat'a, on western Barkley Sound (McMillan and St. Claire 1996:34–35).

<u>Whalebone wedge</u> (1) This complete wedge (measuring 15.1 x 6.2 x 2.1 cm) is based on a split section of whalebone (Fig. 65, left). It has relatively straight sides which converge to a slightly rounded bit. It is roughly made, with little finishing evident. The flattened butt shows evidence of battering, which has compressed the bone and knocked off several small flakes.

<u>Worked whale bulla</u> (1) The thinner outer edge of this whale auditory bulla appears to have been chipped away, leaving only the hard, dense bone at its centre. Apparent flaking scars are evident along a ridge where the thinner bone was removed. One end of this object is blackened by burning.

A nearly identical artifact came from the main village of Ts'ishaa. Similar objects were found in some number at Ozette, where it was first suggested that these hard bones served as crude scraping tools (Fisken 1994: 375–6).

Artifacts of stone

Abrasive stones (2) Both are fragments of sandstone abraders. The largest has been ground flat on both faces and on its one intact edge. The other is a very small fragment with rounded sides, but with both faces ground flat.

Artifacts of historic materials

Glass fragment (1) This is a piece of clear window glass, 0.2 cm in thickness. It is obviously recent, coming from the upper stratum, just under the surface. It likely dates to Benson's use of the area, rather than the aboriginal occupation, although occasional Tseshaht use of this site continued into quite late times.

Faunal Remains

No detailed analysis has been conducted on the shell from Himayis, nor on the vertebrate fauna except for one column sample. Field notes indicate that vertebrate remains, particularly fish, were abundant. At least one large concentration of whale elements was exposed. One fragment, a vertebral process, was identified through DNA analysis as humpback whale (Watt 2003). This came from toward the bottom of the 1999 unit, but well above the radiocarbon date of 970 to 740 cal BP.

The column sample collected from the 1999 unit was examined for microfauna, particularly small fish remains (Appendix E). A total of 3403 faunal elements was recovered, with those of fish comprising 99% of the total. Herring dominate the identified fish species, at nearly half (46.97%) of the total, followed by anchovy, greenling, salmon and rockfish. This suite of fish closely parallels the fish assemblage from the main village of Ts'ishaa. Herring, anchovy, greenling, and rockfish would have been available in the rocky nearshore environment around Benson Island. Salmon becomes more abundant in later deposits, as is documented in the upper layers of EA 2 at Ts'ishaa.

Chapter Seven: SUMMARY AND DISCUSSION

Cultural Summaries

Ts'ishaa Main Village

This large archaeological site, with its distinct house platforms and deep shell midden deposits, was clearly once the location of a major Nuu-chah-nulth village. Oral traditions, particularly as recounted by knowledgeable Tseshaht people to the anthropologist Edward Sapir in the early twentieth century, provide extensive information on this village, including the names and histories of major social groups and chiefs and detailed description of the *taayii hawilh*'s house which once stood there (Chapter Two). For approximately two millennia, this was the major village of the Tseshaht ancestors. Then, as a result of the extensive changes in Native life in the decades following first contact with Europeans, the Tseshaht dramatically expanded their territory and Ts'ishaa was reduced to a summer fishing and sea mammal hunting location.

In contrast to the rich ethnographic details, the archaeological record seems relatively meagre. It does, however, document details about everyday life. The people who lived at this location relied extensively on the sea for their survival, with the vast bulk of the food that sustained them available from the immediate intertidal and subtidal locations around their rocky island home. California mussel was a major part of their diet, as evidenced by the huge shellfish accumulations, of which that species is the primary constituent (Appendix C). Fishing clearly was a paramount activity, with rockfish and other fish species which were available immediately off the rocky shores dominating the faunal assemblage (Appendix D). The artifacts confirm this reliance on fishing in the culture, as over half of all recovered implements are small bone points, bipoints, or the fragments of such tools, which are almost all parts of composite fishing gear.

The loss of implements of wood, bark, root, and other perishable materials from the archaeological record, however, greatly limits our understanding of the past. It is evident from Nuu-chah-nulth ethnography that the great majority of all implements were made of such materials. Where waterlogged conditions have preserved artifacts of otherwise-perishable materials, such as at Ozette and at the Nitinat Lake sites (Eldridge and Fisher 1997), these form the vast majority of recovered items. Sites such as Ts'ishaa provide only a glimpse into past material culture, with common artifacts such as bone points representing only part of composite tools that also included wood and bark.

The oral histories tell of the great whalers who once lived at Ts'ishaa, and nearby rocks and reefs were known as favoured whaling locations. Archaeology confirms the importance of whaling, with whale elements found throughout the midden deposit. The discovery of a partially-intact mussel shell harpoon cutting blade embedded in the back of a whale skull demonstrates that active whaling was taking place over 500 years ago, and likely throughout the occupation of this portion of the site. DNA analysis indicates that most of the whales taken were humpbacks, a conclusion also reached through examination of whalebone from other major sites in Barkley Sound (Monks et al. 2001). The large stack of whalebones on the lowest terrace of EA 2 may have been a memorial to the whaler's successes, placed just above the beach in front of the house.

Remains of other sea mammals affirm the maritime lifeways of the people who lived at Ts'ishaa. Fur seals were a major part of the diet, as is the case for virtually all major excavated Nuu-chah-nulth village sites (McMillan 1999:140; Crockford et al. 2002:152). Although these animals today only appear along this coast during their annual migrations, discovery of newborn and juvenile fur seal bones at Ts'ishaa indicates that these animals were being taken from a local breeding population (Crockford et al. 2002). Remains of several species of porpoise and dolphin were found in some abundance, indicating that the inhabitants of Ts'ishaa had well-developed marine hunting skills and technology. Sea otters, while of great significance historically, only rarely occur in the archaeological faunal assemblage.

Himayis

Tseshaht oral history tells us that this site was first occupied later than the main village. Overcrowding at Ts'ishaa led chiefs to send their slaves and other lower-class people to establish a new residential area nearby. The initial occupation, at the southern end of the site today, occurred about a thousand years ago. Continued growth led to expansion northward along the beach, until nearly the entire space to Ts'ishaa was filled. This low-lying area was less suitable for habitation and the archaeological deposits are shallow and more recent.

Although this residential area is known to have been low-status, little evidence of this can be seen in the archaeological remains. The artifact yield is very low and is lacking any status items, yet it represents the same types of items as the main village, with bone points and bipoints comprising over half the total. Detailed faunal analysis is restricted to the column samples (Appendix E), which reveal a similar range of fish species as at the main village. Fishing was clearly a dominant subsistence activity, but bones of whales and other sea mammals, generally associated with high-status activities, were also found.

Ts'ishaa Back Terrace

This small site area on an elevated landform behind the main village provided information on human use of this region at an earlier time, when sea levels were perhaps three to four metres above the present tides. A series of radiocarbon dates establishes the age of these deposits as from roughly 3000 to 5000 cal BP. An upper black silt layer contains the greatest number of artifacts and features encountered. Shell deposits range from traces only to the deep 2.5 m deposit on the eastern slope, yet where they occur they span the same age range despite greatly differing rates of accumulation. The initial occupation was on a surface that varies laterally across the excavated area, from a red-brown clay to a grey-brown silt-clay, which sits directly on bedrock at the back of the excavated area. Stone artifacts and a small quantity of other cultural materials were found in the upper portion of this matrix. Dates of up to about 5800 cal BP came from the clay, although it is not certain that this earliest date refers to human presence.

The occupation of this area appears to have been very different from that at the later village. The area encompassed and the average depth of deposit are much smaller, suggesting only occasional use by a small group. No evidence of house structures was detected. Instead, this area may have served primarily as a burial location. A number of burials, from different time periods, were encountered, including one case where the human remains had been placed under a large rock cairn which would have been prominently visible on the land surface. However, people seem also to have lived at least temporarily at this location. Many of the abundant chipped stone implements are simple expedient tools for immediate use, and the numerous flakes present demonstrate that tool manufacture was taking place at that location. The deep shell accumulation at the eastern end also indicates that some subsistence activities were taking place there.

Unlike in other areas of the site, stone dominates the back terrace artifact assemblage. Quickly-made tools such as choppers, along with unmodified flakes, show use of free-hand percussion on larger rocks, while a bipolar reduction technique was used for chert, vein quartz, and other pebble-sized materials (Magne, Appendix B). Most are simple expedient tools made of locally available materials. Major exceptions, however, occur in the upper layers, where they may be associated with use of this area for burials. These include the large lancelate biface made of obsidian from southern Oregon, the two large ground slate "bayonet-type" points, and the five large bone points with shallow barbs. In addition, an Oregon obsidian blade-like flake and a finely-decorated abrasive stone fragment came from the lower matrix, just below a layer dated to about 4600 cal BP.

Although shell does not occur across the entire back terrace, where midden deposits are present they consist overwhelmingly of California mussel, followed very distantly by several species of barnacles and clams (Appendix C). Fish, particularly rockfish, greenling, and ling cod, dominate the vertebrate fauna, although not to the extent of the later component (Appendix D). Herring was also a major resource in the diet, as shown by examination of the column samples (Appendix E). All these resources could have been obtained from the rocky shoreline and nearshore waters in the immediate site vicinity. Advanced sea hunting technology is also indicated by the fairly abundant remains of whales and dolphins. In addition, the people who once lived in this early part of the site kept dogs, in two distinct size ranges (Appendix D). The status of these animals as pets is indicated by two partial skeletons which may represent deliberate burials.

Intrasite Spatial and Component Comparisons

Within the main village site, the three excavation areas intersected different types of archaeological deposits. The EA 1 trench strata consisted primarily of loose shell, much of it largely intact. The density of both faunal elements and artifacts was much lower than in EA 2. A very rapid accumulation rate is indicated for these deep shell deposits (McKechnie, Appendix E). This appears to have been a dump area, possibly between two house locations. By contrast, in EA 3 and the lower trench of EA 2 there is evidence of possible house floors. This is suggested by more compacted surfaces with less shell, more abundant artifacts and fauna, and presence of such features as intact hearths.

Although sampling may be an issue, a few anomalies in artifact spatial distributions are evident. One example is that, of the 190 bone bipoints recorded, 170 came from EA 2, while none came from EA 3. Even compensating for their differing contributions to the artifact total, this is a significant difference. It is interesting in this regard that EA 2 also had by far the greatest density of fish bones at the site (Appendices D and E). EA 3 appears to be somewhat distinct, containing most of the decorative shell (dentalium and Olivella beads). It also differs by type of harpoon valve, as four of the five valves with a slotted point bed came from that location, while none of the more common channelled valves occurred there. While these apparent differences may not be meaningful, it is possible that they represent different social groups, as were known through oral tradition to have occupied these areas.

Artifact distributions provide limited evidence for temporal change over the 2000 year occupation span of the village. Faunal remains, however, show a late shift in emphasis on some species. The upper levels of EA 2, dating to about the last 500 years, show a fairly marked difference from the lower layers of that trench and from EA 1, in that sea mammals and birds comprise a much greater portion of the total assemblage, with a corresponding drop in the importance of fish (Appendix D). Fur seal elements are particularly abundant, indicating a late period emphasis on that resource. A marked shift is also evident within the fish category, as salmon remains, which elsewhere in the site comprise less than 3% of the total fish elements, jump to 27% of the total (Appendix D).

Much more pronounced change is evident when the early component on the back terrace is compared to the later village. This is particularly evident in the artifact assemblage, where stone comprises 68.8% on the back terrace, compared to 10.6% in the village, and chipped stone (including flakes) accounts for 43.4%, compared to only 0.7% in the later deposits. The chipped schist knives, choppers, and cores in the early component have few or no parallels in the later village. Similarly, implements such as the large ground slate points and the large bone points with shallow barbs are unique to the early portion of the site. Except for the common occurrence of small bone points and abrasive stones, these two assemblages seem markedly dissimilar.

Examination of faunal remains also suggests differing patterns between the two areas. Land mammals are much more prominent in the earlier period; in fact, 84% of the total land mammal sample from the site came from the back terrace (Appendix D). The vast majority of dog remains came from this area, suggesting that this animal played a greater role in Native life during the earlier period. Fur seals were an important part of the Native economy throughout the entire 5000 year occupation span at this location, but became increasingly important over time, with the lowest occurrences in the back terrace and the highest in the upper levels of EA 2. At all time periods, fish elements dominate the vertebrate fauna, although the relative proportion is somewhat reduced for the back terrace because of the importance of mammals.

California mussel played a major role in the diet at all time periods at this site and its shell comprises the vast majority of the midden deposits (Appendix C). This marked emphasis on mussels is also characteristic of other "outside" Nuu-chah-nulth sites such as Yuquot (Clarke and Clarke 1980). Barnacles and clams are the next most important shellfish categories, but in quantities far below mussels. Clams become more important over time, with relatively low occurrence in the back terrace and highest occurrence in the upper levels of the village site. This may reflect environmental change over time, as higher sea levels at the time the back terrace was occupied would have resulted in more rocky shores suitable for mussel and barnacle collection, while the emerging land at more recent times would have exposed suitable beach habitat for clams (Sumpter, Appendix C). Sea urchins and chitons also become more evident in the diet in later times, and species diversity in general is much greater in the village deposits than the earlier back terrace.

Discussion

The extensive ethnographic information, the rich and detailed oral histories that refer to Ts'ishaa, and the archaeological data collected through the research of the Tseshaht Archaeological Project can be integrated to present a more complete picture of Tseshaht culture and history than would otherwise be possible. We know details of the large plank houses that once stood at this site and the painted designs that once adorned them, as well as the names of great whaling chiefs who once lived there. The excavation units across the site provided information on distinct social groups (*ushtakimilh*) known to have occupied different parts of the site. The site itself can be seen as part of a cultural landscape, a set of lands and resources that were the *hahuulhi* of a particular Nuu-chah-nulth chief.

Throughout the entire 5000 year occupation span of this site, the people who lived there were heavily dependant on intertidal and near-shore resources. The diet relied heavily on California mussels collected from the rocky shoreline and on near-shore fish such as rockfish, greenling, ling cod, and perch. The numerous herring and anchovy likely also were harvested close to the shore, where they congregated in kelp beds. The large sea mammals found at the site could also have been taken in the area immediately surrounding Benson Island. Ethnographic accounts identify important fur seal hunting areas in the outer islands of the Broken Group, and sea lions seasonally congregate today in great numbers on favoured rocks near Ts'ishaa. Even whales could have been taken close to the site, as ethnographic accounts identify the rocks immediately west of Benson Island as major whaling and sea otter hunting locales. In all, the faunal remains from Ts'ishaa indicate that the site residents were intensively exploiting a range of resources available in the immediately surrounding area.

This faunal pattern suggests that the people of Ts'ishaa occupied a relatively small and culturally constrained territory, with the vast majority of resources of all kinds coming from a small area around their main village. The ten large village sites or site clusters identified for the Broken Group islands (Haggarty and Inglis 1985:37–38) could be interpreted as representing as many as ten separate political units occupying this archipelago, each with its own restricted territory. This fits well with the ethnographic information, which documents the original Tseshaht territory as being restricted to the islands between Benson and Turret (Fig. 9), in the southwestern portion of the Broken Group, while the remaining Broken Group islands were in the territories of other independent Nuu-chah-nulth local groups (Chapter Two).

Occupation of such a restricted territory would mean that there would have been no need for a seasonal pattern of residence, as all resources could have been obtained in a short journey from one central location. The main village would have been occupied year-round. Faunal remains, however, provide only limited support for this conjecture, primarily because relatively few seasonal indicators are represented in the faunal assemblage. Only spring and summer occupation can be demonstrated for the early component on the back terrace, but this occupation was clearly more limited and of a different nature than later use of the main village. The Ts'ishaa village deposits provided evidence for a more seasonally extended occupation, with strong indicators for spring and summer but some evidence of winter as well (Appendix D). The ethnographic accounts clearly establish Ts'ishaa as a year-round community, with all economic resources within the local group's territory being exploited from this permanent base (Chapter Two).

Limited evidence for trade may also reflect this focus on use of resources from a restricted territory. Overwhelmingly, artifact production was based on locally available raw materials. The abundant chipped stone artifacts in the early component are primarily based on materials that would have been available in the immediate vicinity of the site, although a few rock types, such as schist, might have been brought in from sources to the southeast of Barkley Sound (Appendix A). The major exceptions are the three artifacts of obsidian, which were all traced to sources in southern Oregon, with the earliest (a microblade core ridge flake) showing that such long-distance trade existed by about 4600 cal BP. Even fewer indicators of trade exist in the late component, although this may partially reflect the limited use of stone in artifact manufacture. Several mammal species present, such as wapiti (elk) and beaver, were not available in the immediate vicinity of Ts'ishaa but could have been obtained from the mainland shores of Barkley Sound. Their small numbers in the faunal assemblage indicate that they played only minor roles in the diet, but they may have been sought more for their use in tool production (Hodgetts and Rahemtulla 2001). Evidence for this includes a beaver incisor cutting tool and a number of large antler artifacts, including waste materials from on-site tool manufacture.

Access to a wider resource base, possibly indicating use of a larger territory, is suggested by a marked shift in faunal frequencies in the upper layers of EA 2, dating to within the last 500 years. Sea mammals and birds are much more common relative to earlier layers, with a corresponding drop in the importance of fish (Appendix D). Fur seals, although an important part of the diet at all time periods, make up the greatest portion of the total in these layers, indicating a particular economic focus on hunting that species. A marked shift also occurs within the fish as salmon leap to 27% of the fish total, while for the site as a whole they comprise only 2%. In contrast to other fish species, salmon are represented only by postcranial elements, suggesting that they were brought to the site as preserved fish that had been caught and processed elsewhere. If these were river-caught fish taken during their spawning runs it would indicate that the people of Ts'ishaa at that time had access to locations along the shores of Barkley Sound, or major ties of trade or kinship with people who resided there.

The dramatic expansion of Tseshaht territory and consequent shift in seasonal settlement pattern that occurred rapidly after contact with Europeans is not evident in the archaeological record at Ts'ishaa. The historic period is minimally represented at this site. Only a few artifacts of introduced European materials were recovered, and these could have been left by the early twentieth century Euro-Canadian occupants. The possibility that Ts'ishaa was largely abandoned prior to European arrival does not fit with our knowledge of Tseshaht amalgamations. Expansion of Tseshaht territory to the upper shores of Barkley Sound did not occur until the final decades of the eighteenth century, as oral traditions indicate that European firearms played a role in the conflict. Even after Ts'ishaa no longer served as a year-round centre, the Tseshaht continued to use it as a summer fishing and sea mammal hunting location. Historic accounts indicate that the Tseshaht continued to camp at both Ts'ishaa and Himayis into the twentieth century, even after Benson had taken up residence there (Chapter Three). Yet, despite extensive excavation across the site and little evidence for major disturbance of the upper layers, that part of the archaeological picture is missing.

Several mid-Holocene occupations are now known for Barkley Sound. A number of the earliest radiocarbon dates from the Ts'ishaa back terrace cluster around 5000 cal BP (age ranges of 5260–4870, 5320–4870, 5310–4830 cal BP at two sigma, 95% probability), with one slightly older date (5920–5650) which may or may not be cultural. A very similar date (5320–5050) was recently obtained from a charcoal sample taken in a probe into a raised landform at one end of Kiix7in village (DeSh-1), on the east side of Barkley Sound near Bamfield (Sumpter et al. 2002). On the west side of the sound, Ch'uumat'a (DfSi-4) has basal deposits from an elevated area at the back of the site which date to about 4500 cal BP (McMillan and St. Claire 1996). Ts'ishaa and Kiix7in now have the oldest radiocarbon dates for archaeological sites from Nuu-chah-nulth territory, although only Ts'ishaa and Ch'uumat'a have excavated data for this period. All three early site components are on elevated landforms immediately adjacent to later large village sites and indicate occupation of the area at a time of somewhat higher sea levels (Chapter Five).

The artifact assemblages from the early components at Ts'ishaa and Ch'uumat'a, plus those from the Little Beach site near Ucluelet (with dates equivalent to the lower levels at Ch'uumat'a), appear markedly dissimilar to those from the later village sites. Traits shared by all three sites that distinguish them from later assemblages include abundant chipped stone tools, including large bifaces, and cairn burials. Materials from these three sites show a resemblance to the late Charles and Locarno Beach stages in the Strait of Georgia region (McMillan 1998a; 2003). Certainly the large faceted ground slate points and large bone points with shallow barbs from the upper layers of the Ts'ishaa back terrace find their closest parallels in the Locarno Beach stage.

Several explanations could be advanced for this apparent culture change between the earlier components and the later village sites. Cultural replacement is one possibility, with the ancestors of the Barkley Sound Nuu-chah-nulth arriving from further north on the coast about 2500 BP and displacing or absorbing earlier populations. Later Nuu-chah-nulth population movements are known to have involved absorption of other populations (McMillan 2003), which would mean that the modern communities could still trace an ancient heritage in that area. However, a decline in the importance of the chipped stone technology and the shift away from midden interment under cairns are features of the later precontact period along much of the British Columbian coast and don't necessarily involve population movements or replacements. The Hoko River site, on the Olympic Peninsula, has a situation similar to Ts'ishaa, with a Locarno Beach-like earlier component and a distinctly different later occupation (Croes 1995). Croes (1995:227–228) argues that the shifts in bone and stone artifact assemblages represent stages in economic adaptation, while he uses the preserved basketry in the waterlogged portion of the site to make the argument for direct ethnic continuity from the earlier occupation to the historic inhabitants of the area. We still have too little excavated data of the requisite age from Nuu-chah-nulth territory to resolve this issue.

At the main site area, Ts'ishaa clearly shows that a large Nuu-chah-nulth village stood at this location for at least 2000 years. A lifestyle highly adapted to the maritime resources of their outer coast home is evident throughout this time. Ethnographic accounts that indicate the importance of fishing and sea mammal hunting are confirmed and given greater detail through study of the excavated faunal remains. The artifacts recovered can be placed in the West Coast culture type, believed to be the archaeological remnant of Nuu-chah-nulth culture (Mitchell 1990; McMillan 1998b). Most of the key traits that identify this culture type are well represented at Ts'ishaa: numerous bone points and bipoints; single barb points; bone and antler harpoon valves, including self-armed and ancillary valves; bone splinter awls; sea mammal bone foreshafts; ground stone fish hook shanks; ground mussel shell tools; and abrasive stones. The absence or rarity of flaked stone tools or detritus, as at Ts'ishaa village, is also seen as an identifying trait. The West Coast culture type, however, was defined on assemblages from Yuquot and Hesquiat further north in Nuu-chah-nulth territory, and some differences seem to exist in Barkley Sound. Ground stone celts are considered one of the defining traits of the culture type (Mitchell 1990:356), yet none were found at the Ts'ishaa main village, nor at the major site of T'ukw'aa on the western side of Barkley Sound (McMillan and St. Claire 1992). In the Barkley Sound sites, stone celts are limited to the older deposits, while more recent periods contain only celts of mussel shell (McMillan and St. Claire 1996:57). Small numbers of ground slate points and chipped stone tools also occur in the late deposits of both Ts'ishaa and T'ukw'aa, distinguishing these sites further from the Yuquot and Hesquiat assemblages. While clearly part of the same cultural pattern, some regional differences seem to characterize the Barkley Sound sites.

National Parks and Indigenous Histories

Background

The relationship between indigenous peoples and national parks has been fraught with tensions and conflicting needs, not just in Canada but in many places throughout the world (West and Brechin 1991; Stevens 1997). North American Aboriginal groups have strongly criticized past parks policies that focused almost exclusively on the abundant natural resources while neglecting the human history of the park (Keller and Turek 1998). Such policies have resulted in a distorted or misleading view of modern Native communities in areas adjacent to the park, the traditional activities carried out within the park, and the history of relations between Native people and the more recent arrivals in the area. Native cultures simply disappeared from the picture presented to park visitors, their presence not even evident in the names assigned to the land. Past policies which ignored Native heritage, however, are changing. Keller and Turek (1998:233) describe a series of stages in the relationship between parks and Aboriginal communities in the United States, from neglect of tribal cultures and needs, to Aboriginal resistance and protest, to a new commitment to cross-cultural cooperation and increasing interpretation of Aboriginal culture and history within the parks.

The relationship between Aboriginal peoples and national parks in Canada has also changed dramatically over the past few decades. Brechin et al. (1991:26) note a revised Parks Canada policy that "now stresses the importance of protecting living cultural heritage as part of the national park mandate." Expansion of the national park system, particularly in northern Canada, has required Parks Canada to negotiate new types of agreements with the Aboriginal stewards of the land. Many protected areas were designated national park reserves, pending final settlement of comprehensive Aboriginal land claims. In contrast to earlier parks in the Canadian system, where no allowance was made for continuing Aboriginal rights, the newer parks developed plans for on-going Aboriginal use and management of the land and resources within the park. A planning document for the national park system refers to "a new type of national park where traditional subsistence resource harvesting by Aboriginal people continues and where cooperative management approaches are designed to reflect Aboriginal rights and regional circumstances" (Parks Canada 1997:10). Many of the newly-established northern parks have entered into co-management agreements with the affected Aboriginal groups (Stevens 1997:57).

Such relationships also raise the issue of "who owns the past?" (e.g. Layton 1989; Zimmerman 1994; Watkins 2000). Native groups in various areas are entering agreements to ensure that they have a strong voice in the management of their heritage sites and the interpretation of their history within the park. Such interpretations must reflect Native perspectives, particularly as maintained through oral traditions. Despite rejection of such traditions as "non-scientific" throughout much of anthropology's history (Thomas 2000:91–101), there is renewed interest today in respecting oral histories as primary data sources and integrating them with archaeology to understand the past more fully (e.g. Whiteley 2002). A Nuu-chah-nulth perspective can be seen in a position paper by the Mowachaht-Muchalaht First Nations, who seek recognition that they are authorities in the interpretation and dissemination of knowledge concerning their past. They state: "Our own histories, passed down through oral tradition from generation to generation, constitute our record of the 'true' past" (Mowachaht-Muchalaht First Nations 2000:15–16). Although they do not reject the historic and archaeological data, they seek to ensure that their voices, reflecting their ways of knowing, are heard.

Pacific Rim National Park Reserve

Pacific Rim National Park Reserve came into being through a federal-provincial agreement signed in 1970 and renegotiated in 1987 (Parks Canada 1997:13). Because the entire area of the park is subject to the comprehensive Aboriginal claims of the Nuu-chah-nulth Tribal Council and the Ditidaht First Nation, it was proclaimed a national park reserve pending resolution of those claims. All the islands of the Broken Group are claimed by the Tseshaht First Nation in these treaty negotiations. Despite these unresolved Aboriginal claims on lands within the park, the Tseshaht and other affected Nuu-chah-nulth groups feel that they have little input into planning and management in the park (Peepre and Dearden 2002:342). By contrast, at Gwaii Haanas National Park Reserve on the northern British Columbia coast Parks Canada has entered into a co-management agreement with the Haida Nation, resulting in a level of Native involvement that is much higher than that at Pacific Rim (Peepre and Dearden 2002:343). In fact, the present superintendent of that park is a Haida.

Pacific Rim is a popular park, with many boaters, kayakers, and others using the Broken Group islands. The large number of park visitors has raised concerns among the Tseshaht of threats to their heritage sites and reserve lands in the Broken Group. Moreover, despite the popularity of their traditional homeland, the Tseshaht have not significantly benefited from increased employment through tourism (Peepre and Dearden 2002:342). However, Parks Canada has taken some initiatives to increase employment opportunities for Nuu-chah-nulth people in the park and to enhance awareness of Native heritage. The park is also committed to promoting Aboriginal tourism ventures (Budke 2000; Peepre and Dearden 2002:342). Although a number of tourism initiatives have been developed within the park (Budke 2000:33), none yet involve the Tseshaht or the Broken Group islands. Also, such initiatives have tended to involve transportation or accommodation, while little has been offered to parks visitors in the way of cultural experiences, performances, or arts.

Despite the paucity of cultural programs, park employees report a significant public interest in learning more about the Aboriginal cultures in the park area (Budke 2000:32). Cooperative endeavours such as the Tseshaht Archaeological Project provide an effective way to introduce park visitors to Native heritage. In total, in the three summers of excavation at Ts'ishaa, 2254 park visitors were given guided tours of the site by a Tseshaht interpreter and were introduced to both archaeological research and Tseshaht culture and history (Fig. 66). The public education potential of such programs is clearly considerable.

A basic problem is that the Nuu-chah-nulth presence in Barkley Sound has been downplayed or ignored in recent history. Many islands in the Broken Group, such as Benson, Clarke, Wouwer, Cooper, Cree, Hankin, and Jaques, are named for recent Euro-Canadian settlers (Scott 1972), while the Nuu-chah-nulth names have disappeared from the official maps. Since the creation of the park, the emphasis has been on the natural environment and an attempt to provide a "wilderness" experience for the park visitors. To the Tseshaht, however, these islands are not a wilderness but a homeland. Numerous traces of their past presence are evident across the present landscape. Eighty shell middens in the Broken Group alone (Haggarty and Inglis 1986:247) mark former village or camp sites, while rock-wall fish traps in the inter-tidal zones and culturally modified trees inland testify to past native use of every portion of the park. It is vital that interpretation programs incorporate the human role in the park's ecosystem and history, and recognize traditional activities and the cultural landscapes which reflect them. In addition to enhanced interpretation of Aboriginal culture in the park programs, other initiatives might include wider use of Aboriginal place names within the park and recognition of Aboriginal knowledge in the management of park resources.

As the origin place of the Tseshaht in their oral traditions, Ts'ishaa continues to play an important role in Tseshaht culture. This was emphasized during the excavation, as the project provided an opportunity for a number of Tseshaht people to investigate their heritage, as well as to learn about archaeological research. In addition, several groups of Tseshaht people made the boat journey from Port Alberni to the village of their ancestors while the research reported here was underway. Tseshaht crew members met these visitors with drumming and singing on the beach, and the welcome song was heard at Ts'ishaa perhaps for the first time in over a century (Fig. 67). This place is where their ancestors once lived, the location at which their large houses once stood and where famed whaling chiefs directed communal activities. Although the Tseshaht today do not occupy their traditional territories in the Broken Group, the site of Ts'ishaa continues to provide a vital link to their cultural identity and history as a people.

Figure 66. Luke George, Tseshaht and Parks Canada interpreter, discusses Tseshaht history and archaeological research with site visitors.

Figure 67. Tseshaht visitors to Benson Island singing the welcome song on the beach in front of Ts'ishaa.

References Cited

Allen, S.E., C. Vindeirinho, R.E. Thomson, M.G. Foreman, and D.L. Mackas
2001 Physical and Biological Processes over a Submarine Canyon During an Upwelling Event. *Canadian Journal of Fisheries and Aquatic Sciences* 58(4): 671–684.

Arcas Consulting Archeologists Ltd.
1991 Archaeological Investigations at Little Beach Site, Ucluelet, B.C. Report to Archaeology Branch, Victoria.

1998 Archaeological Investigations in Ucluelet Traditional Territory, 1994–1997: Final Report. Report prepared for the Ucluelet Band, Ucluelet, B.C. (copy filed with the Archaeology Branch, Victoria).

1999 Archaeological Investigations at Tsawwassen, B.C., Volume 4. Report to Ministry of Transportation and Highways, Burnaby, B.C.

Arima, Eugene and John Dewhirst
1990 Nootkans of Vancouver Island. In *Handbook of North American Indians*, Vol. 7, *Northwest Coast*, edited by Wayne Suttles, pp. 391–411. Smithsonian Institution, Washington.

Arima, E.Y., D. St. Claire, L. Clamhouse, J. Edgar, C. Jones and J. Thomas
1991 *Between Ports Alberni and Renfrew: Notes on West Coast Peoples*. Canadian Ethnology Service, Mercury Series Paper 121, Canadian Museum of Civilization, Hull, PQ.

Banfield, A.W.F.
1974 *The Mammals of Canada*. University of Toronto Press.

Barnett, Homer G.
1955 *The Coast Salish of British Columbia*. University of Oregon Press, Eugene.

Blenkinsop, George
1874 Report to J.W. Powell, Indian Commissioner. Manuscript, National Archives of Canada, RG10, v. 3614, f. 4105, Ottawa.

Boas, Franz
1966 *Kwakiutl Ethnography* (edited by Helen Codere). University of Chicago Press, Chicago.

Bobrowsky, P.T. and J.J. Clague
1992 Neotectonic Investigations on Vancouver Island (92B,F). In *Geological Fieldwork 1991*, pp. 325–329. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 1992–1, Victoria.

Borden, Charles E.
1970 Culture History of the Fraser Delta Region: An Outline. In *Archaeology in British Columbia: New Discoveries*, edited by Roy L. Carlson, pp. 95–112. *BC Studies* 6–7 (Special Issue).

Bouchard, Randy
1971 A Proposed Practical Orthography for Nootka-Nitinat. Unpublished manuscript, British Columbia Indian Language Project, Victoria.

Boxwell, J., I. Hutchinson, J. Clague, P. Bobrowsky, and G. Lopez
2000 Diatom Biostratigraphy as a Tool to Detect Tsunamis in Kakawis Lake, Vancouver Island. Poster display, Annual Meeting of the Cordilleran Section of the Geological Society of America, Vancouver (copy in Department of Geography, Simon Fraser University, Burnaby, BC)

Boyd, Robert
1990 Demographic History, 1774–1874. In *Handbook of North American Indians*, Vol. 7, *Northwest Coast*, edited by Wayne Suttles, pp. 135–148. Smithsonian Institution, Washington.

Brechin, Steven R., Patrick C. West, David Harmon, and Kurt Kutay
1991 Resident Peoples and Protected Areas: A Framework for Inquiry. In *Resident Peoples and National Parks*, edited by P.C. West and S.R. Brechin, pp. 5–28. University of Arizona Press, Tucson.

Brown, Robert (editor)
1896 *A Narrative of the Adventures and Sufferings of John R. Jewitt*. G. Wilson, London.

Budke, Isabel
2000 Aboriginal Tourism in Pacific Rim National Park Reserve: A Framework for Cooperation. Unpublished Master of Resource Management thesis, School of Resource and Environmental Management, Simon Fraser University.

Burley, David V.
1989 *Senewelets: Culture History of the Nanaimo Coast Salish and the False Narrows Midden*. Memoir No. 2, Royal British Columbia Museum, Victoria, B.C.

Carlson, Roy L.
1994 Trade and Exchange in Prehistoric British Columbia. In *Prehistoric Exchange Systems in North America*, edited by Timothy G. Baugh and Jonathon E. Ericson, pp. 307–361. Plenum Press, New York.

Carter, Lionel
1973 Surficial Sediments of Barkley Sound and the Adjacent Continental Shelf, West Coast Vancouver Island. *Canadian Journal of Earth Sciences* 10:441–459.

Clague, John J.
1997 Evidence for Large Earthquakes at the Cascadia Subduction Zone. *Reviews of Geophysics* 35: 439–60.

Clague, John, John R. Harper, R.J. Hebda, and D.E. Howes
1982 Late Quaternary Sea Levels and Crustal Movements, Coastal British Columbia. *Canadian Journal of Earth Sciences* 19: 597–618.

Clarke, Louise R. and Arthur H. Clarke
1980 Zooarchaeological Analysis of Mollusc Remains from Yuquot, British Columbia. In *The Yuquot Project Volume 2*, edited by W.J. Folan and J. Dewhirst, pp. 37–57. National Historic Parks and Sites Branch, Parks Canada, Ottawa.

Crockford, Susan J., S. Gay Frederick, and Rebecca J. Wigen
2002 The Cape Flattery Fur Seal: An Extinct Species of *Callorhinus* in the Eastern North Pacific? *Canadian Journal of Archaeology* 26(2): 152–174.

Croes, Dale R.
1995 *The Hoko River Archaeological Site Complex: The Wet/Dry Site (45CA213), 3000–1700 B.P.* Washington State University Press, Pullman, WA.

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

Drucker, Philip
1935–36 Unpublished field notes. Smithsonian Institution, Anthropological Archives, MS 4516, pt. 23, vol. 13. Washington, DC.

1951 *The Northern and Central Nootkan Tribes*. Bureau of American Ethnology Bulletin 144, Smithsonian Institution, Washington.

1963 *Indians of the Northwest Coast*. The Natural History Press, Garden City, NY.

1965 *Cultures of the North Pacific Coast*. Chandler Publishing, San Francisco.

Eldridge, Morley and Tal Fisher
1997 Archaeological Data Recovery from Wetsite Components at the Ditidaht Sites of *wikpalhuus* (295T, DeSf-9) and *hit'ilhta7sak* (296T, DeSf-10), Nitinat Lake, B.C. Unpublished report to Archaeological Services, Parks Canada, Victoria.

Fisken, Marian
1994 Modifications of Whale Bones. Appendix D in *Ozette Archaeological Project Research Reports, Volume II, Fauna*, edited by Stephan R. Samuels, pp. 359–377. Reports of Investigations 66. Department of Anthropology, Washington State University, Pullman, and National Park Service, Seattle.

Friele, Pierre A.
1991 Holocene Relative Sea-Level Change; Vargas Island, British Columbia. Unpublished M.Sc. thesis, Department of Geography, Simon Fraser University.

Friele, Pierre A. and Ian Hutchinson
1993 Holocene Sea-Level Change on the Central West Coast of Vancouver Island, British Columbia. *Canadian Journal of Earth Sciences* 30: 832–840.

Gleeson, Paul F.
1980 *Ozette Woodworking Technology*. Project Reports No. 3, Laboratory of Archaeology and History, Washington State University, Pullman, WA.

Golla, Susan
1987 He Has a Name: History and Social Structure Among the Indians of Western Vancouver Island. Unpublished Ph.D. dissertation, Columbia University, New York.

2000 Legendary History of the Tsisha?ath: A Working Translation. In *Nuu-chah-nulth Voices, Histories, Objects and Journeys*, edited by Alan L. Hoover, pp. 133–171. Royal British Columbia Museum, Victoria.

Haggarty, James C.
1982 The Archaeology of Hesquiat Harbour: The Archaeological Utility of an Ethnographically Defined Social Unit. PhD dissertation, Department of Anthropology, Pullman WA.

Haggarty, James C. and Richard I. Inglis
1985 Historical Resources Site Survey and Assessment, Pacific Rim National Park. Unpublished report, Parks Canada, Calgary.

Hatler, David F., R. Wayne Campbell, and Adrian Dorst
1978 *Birds of Pacific Rim National Park*. Occasional Papers of the British Columbia Provincial Museum No. 20, Victoria.

Hodgetts, Lisa and Farid Rahemtulla
2001 Land and Sea: Use of Terrestrial Mammal Bones in Coastal Hunter-Gatherer Communities. *Antiquity* 75:56–62.

Holland, Stuart S.
1964 *Landforms of British Columbia: A Physiographic Outline*. British Columbia Department of Mines and Petroleum Resources Bulletin 48, Victoria.

Huelsbeck, David R.
1994 The Utilization of Whales at Ozette. In *Ozette Archaeological Project Research Reports, Volume II, Fauna*, edited by Stephan R. Samuels, pp. 265–303. Reports of Investigations 66. Department of Anthropology, Washington State University, Pullman, and National Park Service, Seattle.

Hutchinson, Ian
1992 *Holocene Sea Level Change in the Pacific Northwest: A Catalogue of Radiocarbon Dates and an Atlas of Regional Sea-Level Curves*. Occasional Paper No. 1, Institute of Quaternary Research, Simon Fraser University, Burnaby, BC.

Hutchinson, Ian and Alan D. McMillan
1997 Archaeological Evidence for Village Abandonment Associated with Late Holocene Earthquakes at the Northern Cascadia Subduction Zone. *Quaternary Research* 48:79–87.

Inglis, Richard I. and James C. Haggarty
1986 Pacific Rim National Park: Ethnographic History. Unpublished report, Parks Canada, Calgary.

James, Malcolm A.
2001 X-Ray Fluorescence Analysis, X-Ray Flourescence Laboratory, Simon Fraser University. Report to A. McMillan, Simon Fraser University.

Jewitt, John R.
1967 *Narrative of the Adventures and Sufferings of John R. Jewitt, Only Survivor of the Crew of the Ship Boston, During a Captivity of Nearly Three Years Among the Savages of Nootka Sound*. Ye Galleon Press, Fairfield, Washington. (Reprint of the 1815 manuscript).

Jones, Olive R. and Catherine Sullivan
1989 *The Parks Canada Glass Glossary for the Description of Containers, Tableware, Flat Glass, and Closures*. Studies in Archaeology, Architecture and History, National Historic Parks and Sites, Canadian Parks Service, Ottawa.

Keller, Robert H. and Michael F. Turek
1998 *American Indians and National Parks*. University of Arizona Press, Tucson.

Kent, Susan
1975 An Analysis of Northwest Coast Combs With Special Emphasis on Those from Ozette. M.A. research paper, Department of Anthropology, Washington State University, Pullman, WA.

Kirk, Ruth with Richard Daugherty
1978 *Exploring Washington Archaeology*. University of Washington Press, Seattle.

Kool, Richard
1982 Northwest Coast Indian Whaling: New Considerations. *Canadian Journal of Anthropology* 3(1);31–44.

Koppert, Vincent A.
1930 *Contributions to Clayoquot Ethnology*. Catholic University of America, Anthropological Series No. 1, Washington.

Krajina, Vladimir J.
1969 Ecology of Forest Trees in British Columbia. *Ecology of Western North America* 2(1):1–146.

Layton, Robert (editor)
1989 *Conflict in the Archaeology of Living Traditions*. Unwin Hyman, London.

Lee, J. Charlene and N. Bourne
1977 Marine Resource Inventory of Pacific Rim National Park. Unpublished report prepared for Parks Canada, contract VAN5-281/1, Pacific Biological Station, Nanaimo.

Lynn, Rebecca
2003 Flotation Analysis: A Report on Botanical Remains Recovered from Unit S56–57/W50–52, Site DfSi 16, Benson Island. Paper prepared for A. McMillan, Simon Fraser University.

Mackie, Alexander P.
1992 Nuu-chah-nulth Culture History: Is Something Missing? Unpublished paper presented at the 45th Northwest Anthropological Conference, Simon Fraser University, Burnaby, BC.

Magee, Bernard
1794 Log of the *Jefferson*. Unpublished manuscript. Photocopy held in Special Collections, University of British Columbia Library, Vancouver.

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

McKenzie, Kathleen H.
1974 Ozette Prehistory: Prelude. Unpublished M.A. thesis, Department of Archaeology, University of Calgary.

McMillan, Alan D.
1998a Changing Views of Nuu-chah-nulth Culture History: Evidence of Population Replacement in Barkley Sound. *Canadian Journal of Archaeology* 22(1): 5–18.

1998b West Coast Culture Type. In *Archaeology of Prehistoric Native America*, edited by Guy Gibbon, pp. 879–881. Garland Publishing, NY.

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

2003 Reviewing the Wakashan Migration Hypothesis. In *Emerging from the Mist: Studies in Northwest Coast Culture History*, edited by R.G. Matson, Gary Coupland, and Quentin Mackie, pp. 244–259. UBC Press, Vancouver.

McMillan, Alan D. and Ian Hutchinson
2002 When the Mountain Dwarfs Danced: Aboriginal Traditions of Paleoseismic Events Along the Cascadia Subduction Zone of Western North America. *Ethnohistory* 49 (1):41–68.

McMillan, Alan D. and Denis E. St. Claire
1982 *Alberni Prehistory: Archaeological and Ethnographic Investigations on Western Vancouver Island*. Theytus Books, Penticton, B.C.

1992 The Toquaht Archaeological Project: Report on the 1992 Field Season. Unpublished Report Submitted to the British Columbia Heritage Trust and Archaeology Branch, Victoria, and the Toquaht Band, Ucluelet.

1994 The Toquaht Archaeological Project: Report on the 1994 Field Season. Unpublished Report Submitted to the Toquaht Nation, Ucluelet, and Archaeology Branch, Victoria.

1996 The Toquaht Archaeological Project: Report on the 1996 Field Season. Unpublished Report Submitted to the Toquaht Nation, Ucluelet, and the B.C. Heritage Trust and Archaeology Branch, Victoria.

Meidinger, D. and J. Pojar (editors)
1991 *Ecosystems of British Columbia*. Research Branch, B.C. Ministry of Forests, Victoria.

Mitchell, Donald H.
1971 Archaeology of the Gulf of Georgia Area, a Natural Region and its Culture Types. *Syesis* vol. 4, supplement 1, Victoria.

1990 Prehistory of the Coasts of Southern British Columbia and Northern Washington. In *Handbook of North American Indians,* Vol. 7: *Northwest Coast*, edited by Wayne Suttles, pp. 340–358. Smithsonian Institution, Washington.

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

Mowachaht-Muchalaht First Nations
2000 Yuquot Agenda Paper. In *Nuu-chah-nulth Voices, Histories, Objects and Journeys*, edited by Alan L. Hoover, pp. 11–32. Royal British Columbia Museum, Victoria.

Muller, J.E.
1980 Geological Outline of the Nootka Sound Region, with Notes on Stone Artifacts from Yuquot, British Columbia. In *The Yuquot Project Volume 2*, edited by W.J. Folan and J. Dewhirst, pp. 3–14. National Historic Parks and Sites Branch, Parks Canada, Ottawa.

Olson, Ronald L.
1927 Adze, Canoe, and House Types of the Northwest Coast. *University of Washington Publications in Anthropology* 2(1), Seattle.

O'Reilly, P.
1883 Letter to the Superintendent General of Indian Affairs. In *Annual Report of the Department of Indian Affairs, 1882*, pp. 100–101. MacLean, Roger and Co., Ottawa.

Parks Canada
1997 *National Parks System Plan* (3rd ed.). Department of Canadian Heritage, Ottawa.

Peepre, Juri and Philip Dearden
2002 The Role of Aboriginal Peoples. In *Parks and Protected Areas in Canada: Planning and Management* (2nd ed.), edited by Philip Drearden and Rick Rollins, pp. 323–353. Oxford University Press.

St. Claire, Denis E.
1975 Report on the Archaeological Survey of the Barkley Sound Area. Report on file, Archaeology Branch, Victoria.

1981 Tape recorded ethnographic interviews with Robert Sport and Adam Shewish, Port Alberni. Copies on file at Royal British Columbia Museum, Victoria.

1982 Tape recorded ethnographic interviews with Ernie Lauder, Port Alberni. Copies on file at Royal British Columbia Museum, Victoria.

1983 Tape recorded ethnographic interviews with Mabel Taylor, Margaret Shewish, and Adam Shewish, Port Alberni. Copies on file at Royal British Columbia Museum, Victoria.

1984a Tape recorded ethnographic interviews with Ella Jackson, Bamfield. Copies on file at Royal British Columbia Museum, Victoria.

1984b Tape recorded ethnographic interviews with John Jacobson and Martin Edgar, Bamfield. Copies on file at Royal British Columbia Museum, Victoria.

1991 Barkley Sound Tribal Territories. In *Between Ports Alberni and Renfrew: Notes on Westcoast Peoples*, E.Y. Arima at al., pp. 13–202. Canadian Museum of Civilization, Mercury Series, Canadian Ethnology Service Paper 121, Hull, PQ.

1998 Niismak̲matsukwukw Ts'ishaa7ath̲: "Talking About Ts'ishaa7ath̲ Land History". Report to the Ts'ishaa7ath̲ First Nation, Port Alberni.

Sapir, Edward

1910–1914 Nootka Field Notebooks, Vols. I–XXIV. Originals in Boas Collection W2a–18, American Philosophical Society Library, Philadelphia. (Microfilm copy, reel 26, Human History Division, Royal British Columbia Museum, Victoria).

1922 Sayach'apis, a Nootka Trader. In *American Indian Life*, edited by Elsie Clews Parsons, pp. 297–323. B.W. Huebsch, New York.

Sapir, Edward and Morris Swadesh

1939 *Nootka Texts: Tales and Ethnological Narratives, with Grammatical Notes and Lexical Materials*. Linguistic Society of America, Philadelphia.

1955 *Native Accounts of Nootka Ethnography*. International Journal of American Linguistics, Vol. 21, No. 4, Pt. 2. (AMS Press Reprint, New York, 1978).

Schulting, Rick J.

1995 *Mortuary Variability and Status Differentiation on the Columbia – Fraser Plateau*. Archaeology Press, Simon Fraser University, B.C.

Scott, R. Bruce

1972 *Barkley Sound: A History of the Pacific Rim National Park Area*. Sono Nis Press, Victoria.

Southon, John and Daryl Fedje

2003 A Post-Glacial Record of ^{14}C Reservoir Ages for the British Columbia Coast. *Canadian Journal of Archaeology* 27(1): 95–111.

Sproat, Gilbert Malcolm

1987 *The Nootka: Scenes and Studies of Savage Life*, edited by Charles Lillard. Sono Nis Press, Victoria. (Originally published as *Scenes and Studies of Savage Life*. London 1868).

Stevens, Stan (editor)

1997 *Conservation Through Cultural Survival: Indigenous Peoples and Protected Areas*. Island Press, Washington, DC.

Stewart, Hilary

1973 *Artifacts of the Northwest Coast Indians*. Hancock House Publishers, Saanichton, B.C.

Stuiver, M., P.J. Reimer, E. Bard, J.W. Beck, G.S. Burr, K.A. Hughen, B. Kromer, F.G. McCormac, J. van der Plicht, and M. Spurk

1998a INTCAL98 Radiocarbon Age Calibration 24,000–0 cal BP. *Radiocarbon* 40:1041–1083.

Stuiver, M., P.J. Reimer, and T.F. Braziunas

1998b High-precision Radiocarbon Age Calibration for Terrestrial and Marine Samples. *Radiocarbon* 40:1127–1151.

Sumpter, Ian D., Daryl W. Fedje, and Fred K. Sieber Jr.

1997 1995/96 Archaeological Resource Management Programme: Pacific Rim National Park Reserve. Report on file, Archaeological Services, Parks Canada, Western Region, Victoria.

Sumpter, Ian, Denis St. Claire, and Stella Peters

2002 Mid-Holocene Cultural Occupation of Barkley Sound, West Vancouver Island. *The Midden* 34(4):10–11.

Suttles, Wayne

1989 Productivity and its Constraints: A Coast Salish Case. In *Coast Salish Essays*, pp. 100–133. Talonbooks, Vancouver.

Swadesh, Morris

1949 Nootka Ethnographic Field Notes. American Philosophical Society Library, Franz Boas Collection of American Indian Linguistics, W2a–16, Philadelphia.

Swan, James C.

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

Thomas, David Hurst
2000 *Skull Wars: Kennewick Man, Archaeology, and the Battle for Native American Identity*. Basic Books, NY.

Thomson, Richard E.
1981 *Oceanography of the British Columbia Coast*. Department of Fisheries and Oceans, Ottawa.

Turner, Nancy J.
1995 *Food Plants of Coastal First Peoples*. UBC Press, Vancouver.

Turner, Nancy J. and Barbara S. Efrat
1982 *Ethnobotany of the Hesquiat Indians of Vancouver Island*. Cultural Recovery Papers No. 2, British Columbia Provincial Museum, Victoria.

Wagner, Henry R.
1933 *Spanish Explorations in the Strait of Juan de Fuca*. Fine Arts Press, Santa Ana, California.

Wallbank, Jean Buck
1991 Benson Island. Digital Communications, Mission, B.C. (copy in possession of authors).

Waterman, T.T.
1920 *The Whaling Equipment of the Makah Indians*. University of Washington Publications in Anthropology, vol. 1, no. 1.

Watkins, Joe
2000 *Indigenous Archaeology: American Indian Values and Scientific Practice*. AltaMira Press, Walnut Creek, CA.

Watt, Kathy
2003 Species Identification of Whale Bones from Barkley Sound, Vancouver Island, British Columbia. Honours thesis, Department of Archaeology, Simon Fraser University.

Wessen, Gary C.
1994 An Account of the Ozette Shellfish Taxa. Appendix C in *Ozette Archaeological Project Research Reports*, Vol. 2, *Fauna*, edited by Stephan R. Samuels, pp. 333–358. Reports of Investigations 66, Department of Anthropology, Washington State University, Pullman, WA and National Park Service, Seattle.

West, Patrick C. and Steven R. Brechin (editors)
1991 *Resident Peoples and National Parks*. University of Arizona Press, Tucson.

Whiteley, Peter M.
2002 Archaeology and Oral Tradition: The Scientific Importance of Dialogue. *American Antiquity* 67(3):405–415.

Zimmerman, L.J.
1994 Sharing Control of the Past. *Archaeology* 47(6):65–68.

Appendix A:
Regional Geology, Geoarchaeology, and Artifact Lithologies from Benson Island, Barkley Sound, British Columbia

by Michael C. Wilson

Departments of Geology and Anthropology, Douglas College, New Westminster, BC, and
Department of Archaeology, Simon Fraser University, Burnaby, BC

Introduction

This paper considers the lithologic character, geological context, and archaeological significance of artifacts and possible artifacts recovered from the Ts'ishaa site, from both the Main Village and Back Terrace areas. The west coast of Vancouver Island is complex in terms of bedrock geology and has also been glaciated, therefore a wide variety of lithic materials is locally available. Through glacial and fluvial action they are often found in combination in detrital deposits. Reliable identification of artifact lithology and probable lithic sources depends upon an understanding of regional geology as well as proper interpretation of the relationships between metamorphic and igneous rocks. Inasmuch as thin-sectioning for microscopic work was not feasible for this sample, identifications were made on the basis of hand-specimen examination, the limitations of which are outlined below. The Ts'ishaa sample includes examples identified as basalt, andesite, gabbro, diorite, granodiorite, granite, obsidian, slate, phyllite, schist, biotite gneiss, nephrite, hornfels, quartzite, chert, argillite, sandstone (greywacke), and jet.

Discussion of Rock Types and Identification Problems

Rocks fall into three major groupings: igneous, sedimentary, and metamorphic. Subdivision of rock types in these major classes is based upon (1) *texture* and (2) *composition*. Texture combines two considerations: (1) *granularity/crystallinity*, the size and shape of constituent minerals and/or particles making up the rock, and (2) *fabric*, the arrangement, orientation and geometrical relationships among the constituents of the rock and, where relevant, the degree of glassiness. Whereas "composition" in minerals is the chemical formula, in rocks the term refers to the *percentage occurrence* of the various minerals. Thus most rock types are arbitrarily divided segments of a continuum, analogous to segments of the colour spectrum, and there can be as many occurrences on a boundary between adjacent categories as there are in the "centre" of any category. It is therefore not surprising that a geologist may experience difficulty in putting a "precise" name on a rock. Rock in a single outcrop may grade compositionally from one type to another (*e.g.*, from granite to granodiorite). In fact, that could happen within a single hand specimen, if an analyst were to measure percentage composition carefully in several areas of the specimen. The same is true of texture because these characteristics, too, are continuously variable. In practice, a geologist must therefore name a specimen based upon an "averaged" impression of its overall characteristics. For certain rock types it is not possible to give a full diagnosis without some knowledge of larger-scale contextual features. Migmatites and agmatites, for example, exhibit mixing of textural types, either through partial melting or incomplete mixture of magmas, and their true nature is best assessed from outcrops.

Determination of "sources" from an archaeological perspective also demands comparable understandings of geological context. For example, sedimentary rocks identified as breccia and conglomerate include clasts (transported grains) of varied provenance and lithologies so that a large basalt clast (igneous) might have been derived by a flintknapper not from its original igneous setting but from a gravel deposit or even from a conglomerate derived from the lithification of a gravel deposit.

A continuum also exists between metamorphic rocks and their protoliths (rocks of origin), such that it may be difficult to find unanimity among analysts as to the name of a rock specimen. Such disagreements are, however, of minor consequence. Mudstones (sedimentary) become metamorphosed to slates and thence to phyllites and schists; however, the hazy zone between sedimentary and metamorphic rocks is the domain of "argillite." Reports from the region under consideration use the terms "mudstone" and "argillite" interchangeably because of the low grade of metamorphism represented.

Direct visual examination is frequently sufficient for identification of the general type of rock (*e.g.*, granite, volcanic tuff, sandstone, chert, etc.) used for stone artifacts. However, in order to identify the precise source of the rock, a much closer determination of texture and composition using more sophisticated means must be undertaken. Petrological examination under a binocular microscope may be sufficient to reveal both, but in other cases a petrographic thin section may be necessary to allow such determinations. The overall appearance of a rock sample is suggestive of a given texture and composition, but actual percentages, grain relationships and estimates of glassiness require grain-by-grain examination of minerals and/or contained rock fragments (clast composition). Thus there is no "diagnostic test" for a particular rock type. The diagnoses reported below were made from hand specimens under low magnification, with limitations of both time and access to the material. Thin-sectioning was not feasible and all identifications are offered as provisional estimates. The categories selected are accordingly in some cases broader than those used in comparable reports by other authors.

Vancouver Island Bedrock Geology

British Columbia is situated on the western margin of the North American tectonic plate and this is, in terms of plate movements, the "leading edge" of the continent. Much of the geology of British Columbia is therefore tied to activity along the plate margin. Offshore from southern British Columbia, including Vancouver Island, the margin is a subduction zone, with oceanic crust slipping beneath the continent at a steep angle (Hyndman *et al*. 1990). Partial melting of rocks in this subducted plate provides magma that feeds the linear Cascade Volcanic chain, inland from the coast. This same magma source has also produced, in the past, major intrusive bodies or batholiths of felsic (silica-rich) igneous rocks such as granite and granodiorite. North of Vancouver Island the plate margin becomes a transform boundary; that is, it has strike-slip or lateral movement. Given the dynamic setting it is understandable that activity along the plate margin has been different in the past.

Through much of British Columbia one sees a history of augmentation of the North American plate through collision with, and accretion of, formerly separate island arcs, uplifted ocean floor fragments, and microcontinental masses. These "exotic terranes" had their own distinctive geological histories before joining the North American plate, whereas after their docking they shared in the subsequent geological history (Clowes *et al.* 1987; Hyndman *et al.* 1990; Gabrielse *et al.* 1991; Monger *et al.* 1982, 1991; Tipper *et al.* 1991; Wheeler *et al.* 1991; Wheeler and McFeely 1991; Monger 1993; Monger and Journeay 1994, 1998; Journeay and Monger 1998).

Vancouver Island makes up the major part of the Insular Belt, one of the westernmost of several geologically distinct elements of the Canadian segment of the Cordillera, and in plate-tectonic terms is dominated by the Wrangellia terrane (Brandon 1989a:1521; Monger 1993). The geological history of the Insular Belt includes both the history of Wrangellia before its "docking" with North America and its history subsequent to docking. This history is marked by two igneous complexes, each of which includes both volcanic units and associated plutonic masses (intrusions, such as batholiths) (Carson 1973; Muller 1980a, b). The two complexes, respectively, are of middle Paleozoic and Jurassic ages, the latter being much more extensive than the former, and were preceded by a metamorphic (gneiss-migmatite) terrane. Each complex is topped by an erosional unconformity and overlain by clastic sediments, respectively of Permo-Pennsylvanian and Cretaceous ages. In the first sequence, the Paleozoic (Late Devonian) Sicker Group represents a volcanic island arc with lavas, tuffs, and sedimentary rocks that were subsequently metamorphosed. The island arc sequence was eroded to a lowland and was succeeded by Carboniferous to Permian clastic and carbonate sediments (Buttle Lake Group) and local Triassic argillites (Monger and Journeay 1998, part 2:1). This sequence was rifted apart in the Triassic (Muller 1980a, b), when new basaltic lava was extruded, at first under water (as pillow lavas) and then onto an emerging land mass, likely a large oceanic platform (Muller 1980b:6; Monger and Journeay 1998, part 2:1). The Triassic basalts (Karmutsen Formation) were then carpeted with marine carbonates (Quatsino Formation) and clastic sediments (Parsons Bay and Harbledown Formations). The second igneous complex was emplaced in the Jurassic period when a new chain of volcanoes appeared. This time the volcanic rocks ranged from basalt through andesite to dacite, suggesting a volcanic chain alongside a subduction zone. These rocks, comprising the Bonanza Group, were in turn eroded and were covered by Cretaceous marine sediments (Muller 1980b:6–7). The sequence was then covered along the west coast by Tertiary clastic sediments. Smaller intrusions (plutons) of Tertiary age are also present as part of the Coast Plutonic Complex (Late Cretaceous and Tertiary), which is better represented on the British Columbia mainland (Monger *et al.* 1982). Wrangellia docked with the North American plate in mid-Cretaceous times (Monger and Journeay 1998, part 5:1).

Small areas of Vancouver Island's west and south coasts are linked to a "Pacific Belt" of Mesozoic mélange units (heterogeneous, sheared assemblages of rocks of mixed origins), more extensively represented in Alaska and the western states of the continental U.S. This belt locally comprises narrow fault slices such as the Pacific Rim Complex, Pandora Peak unit, and Leech River schist (Brandon 1989a: 1521–1522) that, in contrast to the Insular Belt, are made up of deformed late Jurassic and Cretaceous continental slope and possible trench deposits (clastics, chert and tuff, some metamorphosed to schist), bounded to the south and west by Eocene oceanic basalts and associated intrusives of mafic igneous rocks (i.e., dominated by dark ferromagnesian minerals) (Muller 1977a:Sheet 3; Hyndman *et. al.* 1990:315; Monger and Journeay 1998, part 2:2). Muller (1977b) interpreted portions of this assemblage as oceanic trench deposits and they have at times been assigned to distinct exotic terranes (Pacific Rim/Leech River and Crescent terranes) associated with subduction underplating along the west ("outboard") margin of the Wrangellia terrane during the Eocene epoch (Clowes *et al.* 1987). The Pacific Rim terrane extends along the west coast of Vancouver Island, largely offshore, but includes a small portion of the coast north of Barkley Sound (separated from Wrangellia by the West Coast Fault) and an east-west trending band near the southern end of Vancouver Island (bounded to the north from Wrangellia by the San Juan Fault and to the south from the Crescent terrane by the Leech River Fault). The Crescent terrane makes up a second narrow band offshore from the Pacific Rim, but also makes up the extreme southern tip of Vancouver Island, south of the Leech River Fault (Hyndman *et al.* 1990:315). Brandon (1989a, b) disagreed with the identification of these bands as terranes, reinterpreting them as mélanges produced by submarine slumping onto an older volcanic basement. He argued that they were formed in the Washington State area on the "inboard" side of Wrangellia prior to its docking and then were displaced northwestward to a location west of a portion of Wrangellia by faulting (lateral, or transcurrent offset). The terrane view appears, however, to have prevailed (*e.g.*, Monger 1993).

Based upon this overview, potential bedrock lithic types on western Vancouver Island include a full range of igneous intrusives (from granite to gabbro) and extrusives (from rhyolite to basalt), metamorphics from low to high grade (argillite through schist to gneiss), and both clastic and carbonate sedimentary rocks (sandstone, shale, limestone, chert). Not only do they occur as bedrock outcrops, but these rock types can also be expected to occur widely as redeposited clasts up to cobble or even boulder size in surficial deposits of glacial, fluvial, and other origins.

Barkley Sound Area Bedrock Geology

Islands in Barkley Sound display bedrock of the Wrangellia terrane, with the West Coast Fault crossing the mouth of the Sound and with Pacific Rim and Crescent terrane rocks forming bands offshore, separated by the Tofino Fault (Hyndman *et al.* 1990:315). Local Wrangellian rocks include limestones of the Upper Triassic Quatsino Formation, Jurassic mafic intrusives and metamorphics of the Westcoast Complex (hornblende-plagioclase gneiss, quartz diorite, agmatite, amphibolite), and younger Jurassic felsic intrusives of the Island Intrusions (granodiorite, quartz diorite, granite, and quartz monzonite) (Carson 1973). Agmatite is a breccia-like migmatite produced by incomplete mixing of coeval mafic and felsic magmas. Bedrock in areas immediately around Barkley Sound also includes Triassic volcanics of the Karmutsen Formation (basalts up to 6 km thick, pillow lava, breccia, and tuff), Jurassic volcanics and clastics of the Bonanza Group (basaltic through andesitic to rhyolitic lava, tuff, breccia, minor argillite, and greywacke), and Tertiary felsic intrusives of the Sooke Intrusions (quartz diorite, trondhjemite, agmatite, and porphyry). Even greater diversity of rock types is found within a few tens of kilometres away from the Sound (Carter 1973:442; Muller 1977:Sheet 2; Monger and Journeay 1998, pt. 2:1). Tertiary sediments are found locally on the coastal plain, capping the sequence described above, and form a widespread unit offshore in the Tofino sedimentary basin, which extends almost to the end of the continental shelf. These sediments are generally mudstones and sandstones of Eocene to Pliocene age (Carter 1973:442). Northward from Ucluelet through Tofino to Vargas Island a narrow band of rocks of the Pacific Rim Complex is exposed and is separated from the Wrangellian rocks by the West Coast Fault (Brandon 1989:1523; Hyndman *et al*. 1990:315).

The outermost islands within the Sound are underlain by the Quatsino Formation and the Westcoast Complex, so local rock types in the Broken Group should include limestone and chert as well as intrusive igneous rocks (quartz diorite and agmatite) and metamorphics (hornblende-plagioclase gneiss and amphibolite). Limestones in the Barkley Sound area tend to be highly altered from the influence of nearby intrusions. Quatsino Formation limestones are dominantly calcilutites (i.e., carbonate muds) with ammonites and other fossils and the formation represents shallow-water continental shelf deposition, representing a large oceanic platform with minimal siliciclastic input (Monger and Journeay 1998, pt. 2:1). Any chert in these rocks would be of replacement origin (diagenetic) rather than being of primary precipitation, and therefore could be diagnosed as such using thin sections. On Cree, Howell, Wouwer, Benson and Clarke Islands in the Broken Group, complexly deformed and metamorphosed but still well-bedded limestones and silty argillites are in contact with Westcoast Complex amphibolite-gneiss (Muller 1974:21). Nearby, where the Quatsino limestones come into contact with the intrusives (quartz diorite), the limestones are altered into coarse marble and skarn (lime-bearing silicates) (Dolmage 1920:15B; Carson 1973:7). Associated diorite and granodiorite dikes are metamorphosed to gneisses that exhibit garnet, tremolite and actinolite (Dolmage 1920:15B). Karmutsen volcanics have also been influenced locally by contact metamorphism (Kunioshi and Liou 1976). Migmatitic rocks of the Westcoast Complex underlie most of the islands of Barkley Sound and a coastal strip about 8 km or more wide between Bamfield and Port Renfrew (Muller 1974:21). These rocks began as sediments and volcanics of the Paleozoic Sicker Group and the Triassic Vancouver Group (which includes the Quatsino Formation) and were intensely deformed and recrystallized under heat and pressure at considerable depths to migmatites, some evolving further through partial or complete melting to become granitic rocks by the end of the early Jurassic. They include a range from agmatite and amphibolite gneiss to biotite-hornblende quartz diorite, often with several different textural types in a single outcrop. Usually, light-coloured quartz diorite or granodiorite intrudes dark fine-grained amphibolite, diorite or gabbro (Muller 1974:21). Their deformation appears to have been tied to the history of a volcanic island arc that was distinct from the North American plate. Once the arc (as part of Wrangellia) was accreted to the leading edge of the North American plate, these rocks underwent uplift and erosion to expose the intensely deformed rocks of the intrusive "roots" of the arc (Muller 1977:Sheet 3).

The Pacific Rim Complex may extend under a portion of Barkley Sound but is well represented by outcrops not far to the north (Ucluelet to Vargas Island). As a mélange, the sequence includes a wide variety of sedimentary lithologies as blocks of various sizes and shapes in a finer-grained matrix. The sequence is resolved into three units: (i) the Ucluth Formation, lower Mesozoic arc-volcanics; (ii) unit 1, Lower Cretaceous mudstone-rich mélange; and (iii) undated sandstone-rich mélange. The Ucluth Formation has been hydrothermally metamorphosed to the greenschist grade, with epidote, chlorite, calcite and white mica as metamorphic minerals, and has been cut by diorite intrusions. The name "greenschist" is a general term based upon the minerals present (especially chlorite) and is not restricted to schist as a rock type. From the metamorphism the Ucluth volcanics and associated intrusives tend to have a patchy green appearance from the epidote. The entire sequence has been affected by very low temperature – high pressure metamorphism (with prehnite, lawsonite, calcite and white mica) and is also extensively cut by dikes. The Ucluth Formation is taken to be "basement" rock coeval with the Karmutsen basalts and Quatsino limestone of Wrangellia and consists of fragmental volcanics with interbeds of limestone and rare ribbon chert. Unit 1A is dominated by black mudstone but includes interbeds of chert, sandstone, and green tuff as well as exotic blocks, mostly derived from the Ucluth Formation but also including Jurassic pillow basalt and rare ultramafite (serpentinized clinopyroxenite). Unit 1B, which is laterally equivalent, is more chaotic with interbeds of mudstone, turbidite sandstone, conglomerate, pebbly mudstone, and rare ribbon chert. Unit 2, which overlies Unit 1 gradationally, is dominated by massive, thick-bedded sandstone with minor mudstone and rare ribbon chert and no exotic blocks (Brandon 1989a:1523–1526, 1528; 1989b).

Quaternary History, Landscape Evolution and Surficial Deposits

Vancouver Island is dominated geomorphically by the Island Mountains, which rise to elevations between 1,000 and 2,000 m. Most of the island was glaciated during the Pleistocene, with ice extending across the Georgia Depression from the mainland and, in the southern part of the Island, flowing in a generally southwestward direction (Clague 1989; Jackson and Clague 1991:276). Local icecaps on peaks in the Island Mountains gave rise to ice tongues that extended down valleys that are now fjords or are occupied by finger lakes. As a result of glacial scouring, the island's west coast is deeply cut by fjords and evidence of scouring extends beyond the modern shoreline onto the marine platform. Past ocean transgressions associated with isostatic depression reached more than 50 m above modern mean sea level, but sea-level lowering at the height of glaciation also exposed large areas of the continental shelf that are now submerged. Glaciation therefore also affected lands now below sea level, because they were above sea level near times of glacial maximum.

Barkley Sound, which is formed by the coalescence of several fjords, is continuous westward with glacially scoured basins and valleys on the continental shelf (Carter 1973). This means that glacial deposits such as tills and outwash are present or have been winnowed to gravel lag deposits on the continental shelf and would include a wide variety of clast lithologies from sources to the east-northeast, where igneous, metamorphic, and sedimentary sources were all available. Tertiary sediments and rocks were once widespread along the west coast of Vancouver Island and many were conglomeratic, derived from erosion of rising mountains to the east along the "backbone" of the island. They were largely stripped off by glacial action but are still present below sea level (Muller 1974:23; Carter 1973:442). They are in turn overlain by unconsolidated sediments of Quaternary (Pleistocene and Holocene) age.

Glaciers covered this area of the west coast to a height of about 240 m at the last maximum (Vashon Stade of the Fraser Glaciation; ca. 15,000 yr BP) and striae indicate a fairly uniform southwesterly flow direction, essentially perpendicular to the coastline (Muller 1973:35). Muller (1980b:8) suggested that the maximum glaciation was older, likely early Wisconsinan (>37,000 BP), but dates from beneath till on the west coast of Vancouver Island show that it occurred just after 16,000 yr BP (Clague *et. al.* 1980, 1988; Ward *et. al.* 2003). Expansion of the Cordilleran ice sheet in southwestern British Columbia did not begin until after 19,000 yr BP, although lowland glacier tongues were present already adjacent to the Coast Range between 22,000 and 20,000 BP (Armstrong *et. al.* 1965; Mathews *et. al.* 1970; Clague *et. al.* 1980, 1988; Roberts 1991). Maximum expansion of ice to the west coast of Vancouver Island was of brief duration, perhaps only 1000 to 2000 years (Ward *et. al.* 2003). Ice coalesced in Barkley Sound from lobes that advanced down Alberni, Effingham, and Pipestem inlets; then extended southwestward about 30 km onto the continental shelf. Outwash plains extended southwestward from the ice front during both advance and retreat phases, so two bodies of outwash gravel are separated by intervening till and stony marine clays, the younger outwash unit being about 12,000–11,000 yr old (Carter 1973:443).

Extensive deposits of sand and gravel occur along the southwestern coast of Vancouver Island and represent material eroded from the island's varied bedrock units. The percentage of sand and gravel as opposed to finer sediments (silt/clay) rises northward and southward from Barkley Sound, with deposits seaward from the Sound being typically less than 75% sand and gravel. A small area in the floor of the Sound immediately northwest of the Broken Group rises to >98% sand and gravel but these sediments are still dominantly sandy. Many of the marine cobble deposits appear to represent tills winnowed by bottom currents and by wave action at lower stands of sea level whereas the sandier areas are to be found out from the mouths of formerly glacier-fed rivers (Milliman 1976). The main body of sediment in the floor of Barkley Sound is an olive-green organic-rich mud (silty clay), occasionally rich in H_2S, likely from organic decomposition in locally oxygen-poor conditions (Carter and Murray 1969:13; Carter 1973:447).

The banks and outer shelf beyond Barkley Sound are also mantled locally by sands and gravels, with a trend from poorly sorted gravels on the inner shelf to well sorted sands near the shelf margin. Gravel clasts from the shelf surface exhibit surface textures consistent with glaciation and are lithologically equivalent to those in glacial drift on land, indicating winnowing from till (Carter 1973:448–449). Pebble and cobble surface characteristics include crescent-shaped percussion scars and angular pits, striations, and faceting. Quartz sand grains also display conchoidal fractures of widely varying sizes, some with stepping, from crushing (Carter 1973:451). Conchoidal fracturing of pebbles and cobbles is also a diagnostic characteristic of tills, producing pseudo-artifacts (Wilson and Burns 1999:216–218), and such is to be expected here as well. Tsunamis have also occurred many times along this tectonically active coastline during the Holocene (Clague 1997) and have had the power to move boulders inland from offshore gravel deposits, as well as to flake them through impact. These "floaters" could be expected almost anywhere on surfaces within several or even many metres of past or present sea levels.

Relative sea level change along the Pacific Coast of British Columbia is a complex product of (i) eustatic (absolute) sea level fall and rise, (ii) isostatic depression and rebound of the land in response to ice loading and unloading, (iii) migration of isostatic forebulges from arching of land in response to nearby loading and unloading, (iv) local to regional tectonic influences such as movement on fault zones, and (v) geoidal effects (gravitational influences) of ice masses upon nearby bodies of water. The sea level curve for the Haida Gwaii region (Queen Charlotte Islands) differs from that of southern Vancouver Island in that Haida Gwaii is much more strongly influenced by forebulge effects as well as being in a different tectonic setting (strike-slip or transform fault boundary as opposed to the Cascadia subduction zone to the south) (Josenhans *et. al.* 1995, 1997; Fedje and Josenhans 2000; Fedje *et. al.* 2001). Relative sea levels at the close of the Pleistocene on western Vancouver Island were much higher than at present, reaching a limit of about 32–34 m above modern sea level at Hesquiat Harbour, where wood from marine silt 25 m amsl was dated to 13,000±110 yr BP (GSC-2976; Clague *et. al.* 1982:611). Evidence from a variety of sites suggested emergence of 1 m or less in the last 1500 years and some 2–4 m in fewer than 4000 years (*ibid.*:612). Data from Clayoquot Sound and Ucluth Peninsula (Barkley Sound) extended this information, indicating a pattern of early postglacial falling sea level, then a mid-Holocene transgression followed by renewed emergence. Marine silts thought to be coeval with those from Hesquiat are 50 m asl at Tofino (Friele and Hutchinson 1993; Bobrowsky and Clague 1992:326). The evidence suggests late Pleistocene to mid-Holocene emergence (*ca.* 13,000 to 8000 yr BP), with sea level falling to the modern level by 10,000 BP and exposure of lands now below sea level between 10,000 and 6,000 BP. A slow transgression (relative sea level rise) began about 8000 ^{14}C yr ago, passing modern sea level shortly after 6000 yr BP and culminating around 3000 yr BP at no more than 10 m above modern sea level. This was followed by a slow regression (emergence) from about 3000 BP to present. Submerged stumps in the Tofino area have been dated to 7900±100 yr BP (GSC-5106) and 7070±120 yr BP (AECV-1205C; Bobrowsky and Clague 1992:325), documenting the early Holocene period of emergence. The pattern differs from that of rapid isostatic rebound, then submergence, noted along southern British Columbia and Washington coasts, and might suggest migration of a proglacial forebulge. Isostatic recovery of the west coast of Vancouver Island appears to have been largely complete by 10,000 to 8,000 yr BP, marking a period when elastic rebound of the land exceeded eustatic sea level rise before the later Holocene events of submergence and emergence documented at Clayoquot and Barkley Sounds (Bobrowsky and Clague 1992:325–326; Friele and Hutchinson 1993:838–839). It is cautioned that even over relatively short distances the emergence curves could differ as a result of tectonic factors (folding and faulting).

Soils and Sediments on Benson Island

A red brown silty clay unit at the base of the sampled deposits is associated with the early component on Benson Island. The upper portion of red brown silty clay contains carbonaceous material interpreted as charcoal stringers (barely into it) dated to 5050 radiocarbon years BP (calibrated range 5900–5650 years BP). The colour and texture change laterally from bright red-brown clay to brown silty clay. Such colours could be either of pedogenic origin or from groundwater influence. In the former instance they would represent a downward-developing zone of residual iron oxides as would be left in a podzolic soil profile (spodosol) through leaching of other more mobile chemical compounds under forested conditions. In the latter instance they could reflect the influence of oxygenated groundwater upon previously reduced iron oxides or sulphides associated with former shallow marine sediments or waterlogged soils on land. The lateral color change may be related to the difference in clay content and hence a difference in porosity. The unit reaches 1 m or more in depth but its base was not reached in excavation. Likely the color horizon does not coincide perfectly with the texturally defined depositional unit into which it was developed; so, for example, the silty clay unit may extend considerably below the lower boundary of the color horizon, which is probably determined by water table and an oxidation/reduction boundary.

If strictly pedogenic, these colors and their relative intensity suggest that the back terrace was forested at some time in the past with a coniferous cover; but the development of these colors would postdate the charcoal streaks or stringers, possibly by a considerable amount. It is sparsely treed today with broken coastal forest but perhaps supported a more continuous forest in the past with large trees along the water's edge, which was closer to the ridge than today. The back terrace was once a shoreline from which sea level has retreated (a regression). Although salt water *per se* would not enhance tree growth, coastal lowlands can benefit from downslope flow of groundwater and the underground "pooling" of freshwater above sea water, as the two tend not to mix without turbulence.

There is, therefore, a clay to silty clay mantle directly over bedrock on the back terrace under the cultural deposits. Much of the area of Pacific Rim National Park is mantled by outwash deposits over till and stony clay (Muller 1973:35), so there could be such deposits at depth here beneath the silty clays. The silty clays could be of marine origin, with minor aeolian reworking on emergence, then surface stability with development of the forest cover. The carbonaceous stringers could be burned roots or even marine organics. The date on the carbon, when considered in light of the Tofino emergence curve (Bobrowsky and Clague 1992:326), suggests that the silty clay may have been near sea level *ca*. 5000 yr BP and might have been submerged for a time during the mid- to late Holocene transgression. However, Friele and Hutchinson (1993) argue that the Tofino curve applies to Barkley Sound, suggesting little or no transgression after 5000 BP.

Artifact Lithologies at Ts'ishaa

The lithic assemblage from Ts'ishaa is characterized overall by expedient use of local materials, most of which would be classed as of "poor to medium quality" from the standpoint of the flintknapper. Phaneritic igneous rocks (i.e., those with visible crystals: granite, granodiorite, diorite, and gabbro), while clearly flaked, would have presented obstacles to flintknapping in terms of their degree of crystallinity, with cleavage of feldspar, amphibole, and pyroxene crystals influencing shock-wave propagation. Aphanitic rocks (i.e., those with extremely fine crystalline texture: rhyolite, andesite, and basalt) would have been preferable from this standpoint and were used when available, but there is clearly no predominance of such types in the assemblage; thus it appears that local availability and expediency prevailed over other issues. Similarly, metamorphic rocks include both macroscopically crystalline types (gneiss and schist) as well as a few examples of finer-grained rocks (hornfels, quartzite and argillite), with even the more coarsely crystalline examples flaked into choppers. Sandstone abraders in the sample are mostly litharenites (greywackes), a lithology widely found in Vancouver Island sequences and likely widespread also in cobbles carried in by fluvial or glacial agency from areas to the east of Barkley Sound. Green chert was obtainable in the surrounding region (see below) and is represented by cores and debitage. Vein quartz is of ubiquitous occurrence in association with hydrothermal activity along fracture zones and was available locally. Hornfels and quartzite are non-foliated metamorphic rocks often associated with contact metamorphism. Such metamorphism has been documented in proximity to intrusions in the Barkley Sound area and even in the Broken Islands, so both materials may be available locally. More clearly exotic materials (obsidian and schist) are treated in the next section.

Dewhirst (1980:120–121) reported from the Yuquot sample (Nootka Sound, west coast of Vancouver Island) evidence for the making of stone celts from rounded, tabular basalt beach cobbles that were flaked, then ground to shape. Beach stones of similar character were also used as wedges (*ibid*.:126–128). Remaining cortex on many Ts'ishaa specimens also indicates frequent use of beach cobbles as raw material.

Many of the Vancouver Island sandstones are both texturally and compositionally immature and thus belong within the greywacke subgroup. Compositional immaturity is often signalled by relatively high feldspar percentages reflecting igneous source rock for the sands and relatively short distances of transport. Feldspar percentages could not be assessed readily for the specimens at hand given the lack of freshly broken surfaces but their "dirty" appearance (i.e., the abundance of dark rock fragments, likely chert) signalled that they were litharenites (=greywackes), as was the case at Yuquot.

Black mudstones of Unit 1 in the Pacific Rim Complex, Ucluelet to Vargas Island, are metamorphosed to a degree and therefore approach "argillite" status (Brandon 1989a). Argillites also occur in the general region, if not locally, in Triassic rocks (Monger and Journeay 1998, pt. 2:1). Also present within the Pacific Rim sequence are cherts and what has been described as green tuff. Brandon (1989:1529) has pointed out that "tuff" is a misnomer for these fine-grained volcanics, which are not pyroclastic but are sedimentary rocks made up of metavolcanic and metaplutonic clasts. "Tuffs" in this instance can be grouped according to three distinct source rocks: (i) microcrystalline basalt altered to chlorite; (ii) plagiophyric andesite with plagioclase partially altered to chlorite; and (iii) medium-grained diorite with minor epidote. Additional study may reveal that some of these "tuffs" are represented at Ts'ishaa, but their identification would require source-area sampling and petrographic thin-section comparisons.

Rock Lithologies as Evidence of Trade from Non-local Sources

Rock lithologies can serve as a guide to past trade or human movements when materials can be related back to their sources. Typically it is expected that these are "bedrock" sources, as is indeed often the case. Nevertheless, for each material there is actually a zone of detrital dispersal through natural erosional processes, so what is viewed as a "point source" is actually a more dispersed occurrence. For example, glaciers will have distributed a material in a "train" from its source, a realization that has led to important economic mineral discoveries in formerly glaciated areas. The "train" of glacial erratics can be followed upflow to establish the location of the source, which may remain hidden beneath glacial drift. Similarly, rivers redistribute material and cobble-sized clasts may be found long distances from the source. The vectors of movement can be plotted as *detrital dispersal vectors* and an outline can be drawn surrounding the zone of probable detrital distribution, or *detrital dispersal envelope* (Wilson 1990:68–69).

Non-local materials include schist, obsidian, nephrite, and jet, of which only the schist specimens were examined by the author. Obsidian samples from the site have been identified as coming from three sources in south-central Oregon (*see* artifact descriptions, Chapters 4 and 5, this volume). The fact that obsidian is unavailable locally, coupled with the chemical "fingerprint" identifying the source, is clear proof that trade and importation of exotic lithic materials did occur at Ts'ishaa. Nevertheless, the predominance of local rock types suggests that such activities were not a major economic concern.

Nephrite, like obsidian, is a material that was widely traded on the Northwest Coast as well as in other areas of western North America. It is not possible at present to speculate as to a source for the Ts'ishaa nephrite sample, which comprises 3 celt fragments. There appears to be no local source.

Schist is another rock type not available in local bedrock and unlikely to have been found in displaced clasts such as glacial erratics. Some 17 examples of schist or phyllite artifacts were recovered from the site, 14 from the back terrace and three (including a phyllite chopper and a schist knife) from the main village area. Additional pieces of schist were frequently observed during excavations on the back terrace but showed no evidence of modification into tools. Specimens from the back terrace exhibit silvery sheens, occasionally weathered to brown, and range from phyllite (N=1, #868) to low-grade schist with small muscovite crystals barely visible to the naked eye. One has small, equant (blocky) weathered porphyroblasts (crystals of newly formed minerals in a more finely crystalline groundmass) that may have been garnets but are now altered to pseudomorphs (#742). Two others exhibit small equant grey porphyroblasts, *ca.* 1 mm in diameter (#453, 806). Some are slightly darker grey, indicating lower muscovite content, and one of these (#597) exhibits very small white lath-shaped porphyroblasts. One specimen from the main village area (#842) is greenish and is identified as chlorite phyllite.

Given that schist and phyllite do not occur in the bedrock geology of the Benson Island, these materials could have been imported through human activity. Schist and phyllite may have been traded or carried along the coast from bedrock sources in the Pacific Rim Complex (Ucluth Formation) of the Ucluelet-Vargas Island trend discussed above, or in the Pacific Belt southeast of Barkley Sound (Leech River Schist). The Ucluth and Leech River rocks are both correlative with the Mesozoic Pacific Rim Complex of the Pacific Rim terrane, which accreted to the North American plate (Muller 1973:36–37; 1974:21; 1977). Ucluth Formation metamorphics are described as having a patchy green appearance from epidote (Brandon 1989a, 1989b) and schist *per se* does not appear to be present (Muller 1973:30, 36). To the southeast, the Leech River Schist is a shear-folded metagreywacke-slate complex with some metavolcanics, found south of the San Juan Fault, which follows the north slope of San Juan River valley.

The metavolcanics are chlorite-actinolite schist with minor quartz and plagioclase. Schists in this zone are "usually light coloured, greenish or grey, fine grained rocks, frequently weathering brown on exposed surfaces" (Clapp 1912:39). Metamorphism in the San Juan block rises in grade (degree) southward toward Leech River Fault, from phyllitic greywacke and slate in the north to garnetiferous quartz-biotite schist which, locally near Leech River fault, exhibits porphyroblasts of andalusite and staurolite, reaching the lower blueschist grade. The blueschist facies is identified through the presence of the mineral glaucophane and indicates high pressures but relatively low temperatures, typical of rapid subsidence of cool oceanic crust into subduction zones. If a source in the Ucluth Formation is ruled out, this gradation in the landscape may make it possible through detailed sampling and comparison to link site materials with specific zones of the Leech River Schist.

A common rock type in the Leech River complex is a "black, schistose slate," the color of which is derived from both magnetite and graphite. Some occurrences "are so carbonaceous, black, and lustrous, as to resemble graphitic coal" (Clapp 1912:39). Such a material might be identified in an archaeological sample as "jet." However, this metamorphic material would be considerably more dense than the more easily worked lithified lignites otherwise identified as "jet." The "jet" specimen from Ts'ishaa is light, not dense. Muller (1980b) discussed jet of the latter type from Yuquot and suggested on circumstantial grounds that it might have originated in Jurassic or Cretaceous coal deposits from Vancouver Island (Nanaimo Basin). The specimen from Ts'ishaa could be of similar origin.

A Tertiary conglomerate near Owen Point includes large redeposited blocks (clasts) of chert, a "ribbon-chert" characteristic of the Pacific Rim Complex (Muller 1974:23; Brandon 1989). Similar cherts are found in bedrock close to Barkley Sound in the Pacific Rim Complex between Ucluelet and Vargas Island. They are well exposed on Frank Island, Box Island, and smaller islands between Wickaninnish Bay and Schooner Cove, as well as on both sides of Ucluelet Inlet. Typical occurrences have chert beds 2.5 to 5 cm (occasionally more than 15 cm) thick, abruptly lensing laterally, and interbedded with thin laminae of black argillite (mudstone). Fresh surfaces are light green, grey, black, or (rarely) reddish brown; while weathered surfaces are bright white to grey. These cherts may represent siliceous tuffs deposited on deep slopes or the ocean floor near a volcanic island arc and may be of Jurassic age (Muller 1973:33). Given the presence of cherts and black argillites in this zone, the area might profitably be examined for possible quarry sites; however, these materials are widely distributed and could have been readily available at coastal wave-cut outcrops, regularly renewed by storm activity.

Concluding Comments

The Barkley Sound area is geologically complex and presents a varied tableau of rock types representing the three major rock groups. Not only are varied types available from in-place bedrock; there are also significant detrital cobble deposits of glacial and fluvial origin, some of which are likely reworked from even earlier (Tertiary) conglomerates. Locally available lithic materials are well suited to expedient use but also include cherts and fine-grained igneous rocks with good flaking qualities.

The Ts'ishaa lithic sample can be broadly divided into four categories (i) rocks from the immediate site vicinity; (ii) rocks from the surrounding Barkley Sound area; and (iii) rocks regionally available in southwestern Vancouver Island, and (iv) extra-regional rocks such as obsidian (Table 1). Most of the sample likely belongs in the first category, given that detrital cobbles from glacial deposits extend the variety available from local bedrock. The quest for good-quality chert may have extended to the surrounding Barkley Sound area but chert does occur in conglomerates and as Quaternary detrital cobbles. Reworking and transport in glacial settings do tend to create flaws in chert (cones of percussion from "shatter marks" reflecting impact in transport) so bedrock sources may have been sought in areas such as Ucluelet Inlet. The quest for litharenites (greywacke-type sandstones) likely also led to areas surrounding the Sound, if certain surface textures were specifically sought for optimal use in abrading. Further afield, it has been demonstrated that Ts'ishaa obsidian specimens came from Oregon sources. A less distant but nevertheless exotic origin is likely for the nephrite.

The schist specimens may reflect trade from (or travel to and from) the zone of the Leech River Schist in southern Vancouver Island. Direct comparisons of archaeological specimens with samples from the Leech River Schist may provide additional insight as the the dynamics of lithic procurement, trade, and use in the region. A potentially productive line of inquiry for future research would be to undertake a comparative study of Ts'ishaa schist specimens with samples from the Leech River Schist and, if these comparisons warrant further investigations, to examine coastal outcrops of the latter for evidence of quarrying. Similar work may be possible in the case of the cherts, which must first be analyzed in thin section to determine whether they are of primary deposition or replacement origin. Given their resistance to abrasion, it is likely that chert pebbles and cobbles occur widely in detrital deposits, so specification of source(s) may be difficult.

Table 1. Potential bedrock availability of lithic materials represented at Ts'ishaa.*

Lithic Type	Benson Island/ Broken Group	Barkley Sound	Regional, S.Vancouver I.	Extra-regional
IGNEOUS				
basalt		Karmutsen Fm.; Bonanza Gp.; Pacific Rim Complex	X	X
gabbro	Westcoast Complex	Westcoast Complex	X	X
andesite		Bonanza Gp.	X	X
diorite	Westcoast Complex	Westcoast Complex; Sooke Intrusions	X	X
granodiorite		Island Intrusions	X	X
granite		Island Intrusions	X	X
obsidian				Oregon (sources identified)
METAMORPHIC				
slate		Pacific Rim Complex	Associated with Leech River Schist	X
phyllite		Pacific Rim Complex	Associated with Leech River Schist	X
schist		?Pacific Rim Complex	Leech River Schist	X
gneiss	Westcoast Complex	Westcoast Complex	X	X
nephrite			?	X
hornfels	?contact metamorphics	Contact metamorphics around intrusions	X	X
quartzite	?contact metamorphics	Contact metamorphics around intrusions	X	X
SEDIMENTARY				
chert	Quatsino Formation	Quatsino Formation; Pacific Rim Complex	X	X
argillite (~metamorphic)	Quatsino Formation	Quatsino Formation; Bonanza Group; Pacific Rim Complex	X	X
sandstone (greywacke/litharenite)		Bonanza Group; Tofino Basin; Pacific Rim Complex	X	X
jet (lithified lignite)			?Jurassic/Cretaceous of Nanaimo Basin	X

* detrital sedimentary sources for boulders, cobbles or pebbles (glacial drift, alluvium, tsunami "floaters", etc.) are more widespread and are not considered in this table.

References Cited

Alley, N.F., and S.C. Chatwin
1979 Late Pleistocene History and Geomorphology, South-western Vancouver Island, British Columbia. *Canadian Journal of Earth Sciences* 16(9): 1645–1657.

Armstrong, J.E.
1981 *Post-Vashon Wisconsin Glaciation, Fraser Lowland, British Columbia*. Geological Survey of Canada Bulletin 322. 34 p. Ottawa.

Armstrong, J.E., D.R. Crandell, D.J. Easterbrook, and J.B. Noble
1965 Late Pleistocene Stratigraphy and Chronology in Southwestern British Columbia and Northwestern Washington. *Geological Society of America Bulletin* 76(3): 321–330.

Atwater, T.
1989 Plate Tectonic History of the Northeast Pacific and Western North America. In *The Eastern Pacific Ocean and Hawaii*, edited by E.L. Winterer, D.M. Hussong, and R.W. Decker, pp. 21–72. Geological Society of America, *Geology of North America*, Volume N. Boulder, CO.

Bobrowsky, P.T., and J.J. Clague
1992 Neotectonic Investigations on Vancouver Island (92B, F). In *Geological Fieldwork 1991*, British Columbia Geological Survey Branch Paper 1992–1: 325–329.

Brandon, M.T.
1989a Deformation Styles in a Sequence of Olistostromal Melanges, Pacific Rim Complex, Western Vancouver Island, Canada. *Geological Society of America Bulletin* 101: 1502–1542.

Brandon, M.T.
1989b Origin of Igneous Rocks Associated with Mélanges of the Pacific Rim Complex, Western Vancouver Island, Canada. *Tectonics* 8(6): 1115–1136.

Carson, D.J.T.
1973 *The Plutonic Rocks of Vancouver Island, British Columbia: Their Petrography, Chemistry, Age and Emplacement*. Geological Survey of Canada Paper 72–44. 70 p. Ottawa.

Carter, L.
1973 Surficial Sediments of Barkley Sound and the Adjacent Continental Shelf, West Coast Vancouver Island. *Canadian Journal of Earth Sciences* 10: 441–459.

Carter, L., and J.W. Murray
1969 Topography and Bottom Sediments in Barkley Sound and the Adjacent Continental Shelf, Southwestern British Columbia. In *Report of Activities, Part A: April to October, 1968*. Geological Survey of Canada Paper 69–1A: 12–14.

Clague, J.J.
1989 Cordilleran Ice Sheet. In *Quaternary Geology of Canada and Greenland*. Geological Survey of Canada, Geology of Canada, vol. 1, pp. 40–42. [Also Geological Society of America, Geology of North America, vol. K-1.]

1991 Quaternary Glaciation and Sedimentation. Chapter 12 in *Geology of the Cordilleran Orogen in Canada*, edited by H. Gabrielse and C. Yorath, pp. 419–434. Geological Survey of Canada, *Geology of Canada*, Volume 4.

1994 Quaternary Stratigraphy and History of South-coastal British Columbia. In *Geology and Geological Hazards of the Vancouver Region, Southwestern British Columbia*, edited by J.W.H. Monger, pp. 181–192. Geological Survey of Canada Bulletin 481.

1997 Evidence for Large Earthquakes at the Cascadia Subduction Zone. *Reviews of Geophysics*, 35: 439–460.

Clague, J.J., J.E. Armstrong, and W.H. Mathews
1980 Advance of the Late Wisconsinan Cordilleran Ice Sheet in Southern British Columbia Since 22,000 yr B.P. *Quaternary Research*. 13: 322–326.

Clague, J.J., and B.D. Bornhold
1980 Morphology and Littoral Processes of the Pacific Coast of Canada. In *The Coastline of Canada*, edited by S.B. McCann, pp. 339–380. Geological Survey of Canada Paper 80–10.

Clague, J.J., J.R. Harper, R.J. Hebda, and D.E. Howes
1982 Late Quaternary Sea-level and Crustal Movements, Coastal British Columbia. *Canadian Journal of Earth Sciences* 19: 597–618.

Clague, J.J., I.R. Saunders, and M.C. Roberts
1988 Ice-free Conditions in Southwestern British Columbia at 16,000 Years B.P. *Canadian Journal of Earth Sciences* 25:938–941.

Clapp, C.H.
1912 *Southern Vancouver Island*. Geological Survey of Canada Memoir 13. Ottawa.

Clowes, R.M., M.T. Brandon, A.G. Green, C.J. Yorath, A. Sutherland Brown, E.R. Kanasewich, and K. Spencer
1987 LITHOPROBE – Southern Vancouver Island: Cenozoic Subduction Complex Imaged by Deep Seismic Reflections. *Canadian Journal of Earth Sciences* 24: 31–51.

Dewhirst, J.
1980 *The Yuquot Project, Volume 1. The Indigenous Archaeology of Yuquot, a Nootkan Outside Village*. Parks Canada, History and Archaeology, 39. 358 p. Ottawa.

Dolmage, V.
1920 Barkley Sound, Vancouver Island. *Geological Survey of Canada, Summary Report, 1919, pt. B.*: 18B-20B. Ottawa.

Donaldson, J.A.
1980 Lithology of Stone Artifacts and Associated Rock Fragments from the Yuquot Site. In *The Yuquot Project*, edited by W.J. Folan and J. Dewhirst, Volume 2, pp. 15–22. National Historic Parks and Sites Branch, Parks Canada, History and Archaeology, no. 43. Ottawa.

Fairchild, L.H., and D.S. Cowan
1982 Structure, Petrology, and Tectonic History of the Leech River Complex Northwest of Victoria, Vancouver Island. *Canadian Journal of Earth Sciences* 19: 1817–1835.

Fedje, D.W. and H. Josenhans
2000 Drowned Forests and Archaeology on the Continental Shelf of British Columbia, Canada. *Geology* 28: 99–102.

Fedje, D.W., R.J. Wigen, Q. Mackie, C.R. Lake, and I.D. Sumpter
2001 Preliminary Results from Investigations at Kilgii Gwaay: an Early Holocene Archaeological Site on Ellen Island, Haida Gwaii. *Canadian Journal of Archaeology* 25(2): 98–120.

Friele, P., and I. Hutchinson
1993 Holocene Sea-level Change on the Central West Coast of Vancouver Island. *Canadian Journal of Earth Sciences* 30: 832–840.

Fulton, R.J.
1984 Quaternary Glaciation, Canadian Cordillera. In *Quaternary Stratigraphy in Canada – A Canadian Contribution to IGCP Project 24*, edited by R.J. Fulton, pp. 39–47. Geological Survey of Canada Paper 84–10.

Gabrielse, H., J.W.H. Monger, J.O. Wheeler, and C.J. Yorath
1991 Part A. Morphogeological Belts, Tectonic Assemblages, and Terranes. Ch. 2 in *Geology of the Cordilleran Orogen in Canada*, edited by H. Gabrielse and C.J. Yorath, pp. 15–28. Geological Survey of Canada, *Geology of Canada*, Volume 4. [Also Geological Society of America, *Geology of North America*, Volume G-2].

Holland, S.
1976 *Landforms and British Columbia: A Physiographical Outline*. Second edition. British Columbia Department of Mines and Petroleum Resources, Bulletin 48. Victoria, BC.

Hutchinson, I.
1992 *Holocene Sea Level Changes in the Pacific Northwest: A Catalogue of Radiocarbon Dates and an Atlas of Regional Sea Level Curves*. Institute for Quaternary Research, Simon Fraser University, Discussion Paper no. 1. 100 p. Burnaby, BC.

Hyndman, R.D., C.J. Yorath, R.M. Clowes, and E.E. Davis
1990 The Northern Cascadia Subduction Zone at Vancouver Island: Seismic Structure and Tectonic History. *Canadian Journal of Earth Sciences* 27: 313–329.

Isachsen, C.
1984 *Geology, Geochemistry and Geochronology of the Westcoast Crystalline Complex and Related Rocks, Vancouver Island*. Msc. Thesis, University of British Columbia, Vancouver, BC. 144 p.

Jackson, L.E., Jr. and J.J. Clague
1991 The Cordilleran Ice Sheet: One Hundred and Fifty Years of Exploration and Discovery. *Géographie physique et quaternaire* 45(3):269–280.

Josenhans, H., D.W. Fedje, K. Conway, and J.V. Barrie
1995 Post Glacial Sea Levels on the Western Canadian Continental Shelf: Evidence for Rapid Change, Extensive Subaerial Exposure, and Early Human Habitation. *Marine Geology* 125:73–94.

Josenhans, H., D.W. Fedje, R. Peinitz, and J.R. Southon
1997 Early Humans and Rapidly Changing Holocene Sea Levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada. *Science* 277:71–74.

Journeay, J.M., and J.W.H. Monger
1998 *Interactive Geoscience Library, Digital information for the Coast and Intermontane Belts of southwestern British Columbia*. Geological Survey of Canada Open File 3276. CD-ROM. Ottawa.

Kunioshi, S., and J.G. Liou
1976 Contact Metamorphism of the Karmutsen Volcanics, Vancouver Island, British Columbia. *Journal of Petrology* 17: 73–99.

Luternauer, J.L., K.W. Conway, J.J. Clague, and B. Blaise
1989 Late Pleistocene Terrestrial Deposits on the Continental Shelf of Western Canada: Evidence for Rapid Sea-level Change at the End of the Last Glaciation. *Geology* 17: 357–360.

Massey, N.W., P.J. Desjardins, and E.C. Grunsky
1994 *Geological Compilation Vancouver Island (NTS 92B, C, E, G, K, L and 102I)*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Open File 1994–6. Scale 1:250,000.

Mathews, W.H., J.G. Fyles, and H.W. Nasmith
1970 Postglacial Crustal Movements in Southwestern British Columbia and Adjacent Washington State. *Canadian Journal of Earth Sciences* 7: 690–702.

Milliman, J.D.
1976 Sand and Gravel Deposits off Southwestern Vancouver Island, British Columbia. In *Report of Activities, Part A*. Geological Survey of Canada Paper 76–1A: 23–26. Ottawa.

Monger, J.W.H.
1993 Canadian Cordilleran Tectonics: from Geosynclines to Crustal Collage. *Canadian Journal of Earth Sciences* 30(2): 209–231.

Monger, J.W.H.
1996 The Origin and Evolution of Canada's Western Mountains. In *Life in Stone: A Natural History of British Columbia's Fossils*, edited by R. Ludvigsen, pp. 25–44. UBC Press, Vancouver, BC.

Monger, J.W.H., and J.M. Journeay
1994 Basement Geology and Tectonic Evolution of the Vancouver region. In *Geology and Geological Hazards of the Vancouver Region, Southwestern British Columbia*, edited by J.W.H. Monger, pp. 3–25. Geological Survey of Canada Bulletin 481. Ottawa.

Monger, J.W.H., and J.M. Journeay
1998 Basement Geology and Tectonic Evolution of the Vancouver region. In *Interactive Geoscience Library, Digital Information for the Coast and Intermontane Belts of Southwestern British Columbia*, edited by J.M. Journeay and J.W.H. Monger. Geological Survey of Canada Open File 3276. CD-ROM. Ottawa. [Reprinted with modifications from Monger and Journeay 1994.]

Monger, J.W.H., R.A. Price, and D.J. Templeman-Kluit
1982 Tectonic Accretion and the Origin of Two Major Metamorphic and Plutonic Welts in the Canadian Cordillera. *Geology* 10: 70–75.

Monger, J.W.H., J.G. Souther, and H. Gabrielse
1972 Evolution of the Canadian Cordillera: a Plate Tectonic Model. *American Journal of Science* 272: 577–602.

Monger, J.W.H., J.O. Wheeler, H.W. Tipper, H. Gabrielse, T. Harms, L.C. Struik, R.B. Campbell, C.J. Dodds, G.E. Gehrels, and J. O'Brien
1991 Part B. Cordilleran Terranes; in Upper Devonian to Middle Jurassic Assemblages. Chapter 8 in *Geology of the Cordilleran Orogen in Canada*, edited by H. Gabrielse and C. Yorath, pp. 281–327. Geological Survey of Canada, *Geology of Canada*, Volume 4.

Muller, J.E.
1973 Geology of Pacific Rim National Park. In *Report of Activities, April to October 1972*. Geological Survey of Canada Paper 73–1A: 29–37. Ottawa.

1974 Victoria Map-area (92B, C), Pacific Rim National Park, Vancouver Island, B.C. In *Report of Activities, April to October 1973*. Geological Survey of Canada Paper 74–1A: 21–23. Ottawa.

1975 Victoria Map-area, British Columbia (92B). In *Report of Activities, April to October 1974*. Geological Survey of Canada Paper 75–1A: 21–26. Ottawa.

1976 Cape Flattery Map-area (92C), British Columbia. In *Report of Activities*. Geological Survey of Canada Paper 76–1A: 107–112. Ottawa.

1977a *Geology of Vancouver Island*. Geological Survey of Canada, Open File 463. 3 sheets, 1:250,000. Ottawa.

1977b Evolution of Pacific Margin, Vancouver Island, and Adjacent Regions. *Canadian Journal of Earth Sciences* 14: 2062–2085.

1980a *The Paleozoic Sicker Group of Vancouver Island, British Columbia*. Geological Survey of Canada Paper 79–30. 24 p. Ottawa.

1980b Geological Outline of the Nootka Sound Region, with Notes on Stone Artifacts from Yuqout, British Columbia. In *The Yuquot Project*, edited by W.J. Folan and J. Dewhirst, Volume 2, pp. 3–14. National Historic Parks and Sites Branch, Parks Canada, History and Archaeology no. 43. Ottawa.

Parrish, R.R., and V. McNicoll
1992 U-Pb Age Determinations from the Southern Vancouver Island Area; British Columbia. In *Radiogenic Age and Isotope Studies, Report S*. Geological Survey of Canada Paper 91–2: 87–108.

Roberts, B.L.
1991 Modeling the Cordilleran Ice Sheet. *Géographie physique et quaternaire* 45(3):287–299.

Rusmore, M.E., and D.S. Cowan
1985 Jurassic-Cretaceous Units along the Southern Edge of the Wrangellia Terrane on Vancouver Island. *Canadian Journal of Earth Sciences* 22: 1223–1232.

Shouldice, D.H.
1971 Geology of the Western Canadian Continental Shelf. *Bulletin of Canadian Petroleum Geology* 19: 405–436.

Sutherland Brown, A.
1966 Tectonic History of the Insular Belt of British Columbia. In *Tectonic History and Mineral Deposits of the Western Cordillera*, pp. 83–100. Canadian Institute of Mining and Metallurgy, Special Volume 8.

Tiffin, D.L., B.E.B. Cameron, and J.W. Murray
1972 Tectonics and Depositional History of the Continental Margin off Vancouver Island, British Columbia. *Canadian Journal of Earth Sciences* 9: 280–296.

Tipper, H.W., H. Gabrielse, and G.J. Woodsworth
1981 *Tectonic Map of the Canadian Cordillera and Adjacent Parts of the United States of America*. Geological Survey of Canada Map 1505A, scale 1: 2,000,000.

Valentine, K.W.G.
1971 *Soils of the Tofino-Ucluelet lowland of British Columbia*. Canada Department of Agriculture, British Columbia Soil Survey, Report no. 11.

Wagner, F.J.E.
1959 *Paleoecology of the Marine Pleistocene Faunas of Southwestern British Columbia*. Geological Survey of Canada Bulletin 52. 67 p.

Ward, B.C., M.C. Wilson, D.W. Nagorsen, D.E. Nelson, J.C. Driver, and R.J. Wigen
2003 Port Eliza Cave: North American West Coast Interstadial Environment and Implications for Human Migrations. *Quaternary Science Reviews* 22:1383–1388.

Wheeler, J.O., R.B. Campbell, J.E. Reesor, and E.W. Mountjoy
1972 *Field Excursion X01-A01, Structural Style of the Southern Canadian Cordillera*. 24th International Geological Congress, Montreal, Guidebook X01-A01. 118 p.

Wheeler, J.O., and P. McFeely (compilers)
1991 *Tectonic Assemblage Map of the Canadian Cordillera and Adjacent parts of the United States of America*. Geological Survey of Canada Map 1712A, scale 1:2,000,000.

Wheeler, J.O. and Committee (compilers)
1991 *Terrane Map of the Canadian Cordillera*. Geological Survey of Canada Map 1713A, scale 1:2,000,000.

Wilson, M.C.
1990 Archaeological Geology in Western Canada: Techniques, Approaches, and Integrative Themes. In *Archaeological Geology of North America*, edited by N.P. Lasca and J. Donahue, pp. 61–86. Geological Society of America, Decade of North American Geology, Centennial Special Volume 4.

Wilson, M.C., and J.A. Burns
1999 Searching for the Earliest Canadians: Wide Corridors, Narrow Doorways, Small Windows. In *Ice Age Peoples of North America*, R. Bonnichsen and K.L. Turnmire eds., pp. 213–248. Center for the Study of the First Americans, Oregon State University Press, Corvallis, OR.

Yole, R.W.
1969 Upper Paleozoic Stratigraphy of Vancouver Island, British Columbia. *Geological Association of Canada, Proceedings* 20: 30–40.

Yorath, C.J., A.G. Green, R.M. Clowes, A. Sutherland Brown, M.T. Brandon, E.R. Kanasewich, R.D. Hyndman, and C. Spencer
1985 Lithoprobe, Southern Vancouver Island: Seismic Reflection Sees through Wrangellia to the Juan de Fuca Plate. *Geology* 13: 759–762.

Appendix B: Analysis of Lithics from the Ts'ishaa Back Terrace

by Martin Magne

Cultural Resource Services, Parks Canada, Calgary, Alberta

Introduction

Tseshaht Project co-director Alan McMillan provided initial analysis sheets for 120 items and boxes containing a total of 119 items (one artifact, a large obsidian biface, was held back). Only chipped stone objects are included in this analysis. All came from the earlier component, on the back terrace portion of the site. The materials were unpacked and examined individually for an assessment of cultural origin or lithic technological origin. This followed a similar assessment by Michael Wilson. Several items were deemed to be non-cultural, while several more were thought to be fire-cracked rock. The most questionable items were removed from the analysis and not considered further. Several items removed clearly displayed recent chipping, a few of these with obvious shovel or trowel polish marks. The result was a final total of 96 chipped stone items appraised to be artifacts. Of these, a very few may yet be non-technological; however, the analyst has insufficient familiarity with the geological context of the site, the nature of the native beach rock and the cultural fire-cracked rock, to judge further.

The artifacts were sorted into 17 major classes and 12 raw material types across five major layers (A through E). 53 of these are considered debitage or unmodified lithic raw material, while the other 43 are considered to be tools or intentionally modified (through deliberate retouch or use) lithic materials. The raw material classes assigned by McMillan and Wilson were initially employed, then simplified here for purposes of obtaining general trends within the assemblage. Quantitative measures of all items were taken for maximum length, maximum width perpendicular to the length measure, and maximum thickness. Weights were not taken but volume was calculated as a proxy. The dimensions of the obsidian biface were estimated from a photocopied drawing supplied to the analyst.

Raw Materials

The ten raw material groups and their relative abundance across the entire assemblage are as follows:

Andesite:	10%	(10)
Basalt:	13%	(12)
Diorite:	2%	(2)
Gabbro:	4%	(4)
Gneiss:	17%	(16)
Green Chert:	15%	(14)
Hornfels:	3%	(3)
Metamorphic:	1%	(1)
Obsidian:	2%	(2)
Quartzite:	3%	(3)
Schist:	15%	(14)
Vein Quartz:	16%	(15)
Total :		96

The lithic assemblage is therefore dominated by metamorphic rocks, secondly by igneous rocks, and finally by sedimentary cherts. Two obsidian pieces were recovered, both from Oregon sources: Glass Buttes (the lanceolate biface) and Newberry Caldera (the microblade core ridge flake).

Artifact Classes

The 17 artifact classes employed are basic "lumped" rather than "split" groups, as follows:

1. Biface (n=1): Large bifacially flaked, lanceolate obsidian biface not examined by the analyst but included in this analysis in frequencies of tool types and raw materials.
2. Bipolar Bashed Pebble (n= 3): small pebbles, one each of gneiss, green chert and quartzite, exhibiting bashing at both ends of the longitudinal axis but with no large flake detachments.
3. Bipolar Core (n = 3): small pebbles exhibiting crushing at both ends of the longitudinal axis, with large flakes detached that would have been

suitable for use. Two of these are made of vein quartz and one is of diorite.

4. Bipolar Flake (n = 4): Debitage, with no signs of retouch or utilization but with flake scars and/or crushing at opposite ends of the longitudinal axis indicating simultaneous removal. Two exhibit cortex.
5. Chipped Schist (n = 11): Small pieces of thin schist with intentional retouch.
6. Chopper (n = 3): Large flakes or core fragments with large, rough retouch and large use-wear flakes indicating chopper usage. Two of these are made of andesite, another of gneiss.
7. Cobble Chopper (n = 3): Large chopper tools with remnant cobble exteriors, large, rough retouch and large use-wear flakes indicating chopper usage. One of these is made of gneiss, one of andesite, and one of hornfels. Several of the larger items not considered artifacts and therefore removed from analysis may fall into this category.
8. Flake (n = 48): This is unmodified debitage, the single most abundant class of artifact. The items are mostly small flakes, a few with obvious cortex; however cortex could not be reliably identified on a large number of these and therefore was not recorded. The largest number (12) are made of vein quartz, with 10 of green chert, 9 each of basalt and gneiss, 3 of andesite, 2 of hornfels, 2 of quartzite, 1 of gabbro.
9. Large Core (n = 3): Large items with no obvious use-wear but exhibiting flake removals sufficiently large to have served as tools or tool blanks. Two are of andesite and one of gabbro.
10. Large Retouched Flake (n = 4): Large deliberately produced flakes with some retouch. Three of these have some remnant cortex. One is made of diorite, one of gneiss, one of gabbro, and one of basalt.
11. Large Spall (n = 1): Large flake spall with evident cortex, made of gabbro. This item appears to have been flaked from a large cobble but may in fact be a fire-spall.
12. Microblade Core Ridge Flake (n = 1): This artifact is entirely out of place with the rest of the assemblage, but it is almost certainly a ridge flake produced in the early stages of manufacturing Denali-type (or Campus-type) microblade cores, or it is a biface edge spall removed with a directed longitudinal blow. It is made of obsidian sourced to the Newberry Caldera, but the assemblage contains no microblades or obsidian debitage.
13. Schist Knife (n = 3): Pieces of schist intentionally modified to have at least one longitudinal chipped edge and circumferential shaping.
14. Small Core (n = 2): Small pebbles with no obvious use-wear but exhibiting flake removals sufficiently large to have served as tools or tool blanks. One each are made of andesite and green chert.
15. Split Cobble Chopper (n = 4): Medium-sized cobbles with remnant exterior faces that have been split and then modified into heavy chopping tools, or that have been used sufficiently to produce large flake scars. Two are made of gneiss, one of andesite, and one of a fine-grained metamorphic rock.
16. Split Pebble (n = 1): A basalt pebble that has been split but exhibits no obvious simultaneous bipolar crushing. This item may in fact be fire-spalled as well.
17. Utilized Flake (n = 1): A single large flake of basalt exhibiting use-wear retouch that is not regular enough to be considered intentional retouch.

Discussion

Apart from the obsidian biface and microblade core ridge flake, the lithic assemblage is unremarkable. Nonetheless, some general patterns may be observed. The most abundant tool raw material is gneiss, followed by vein quartz, then equal amounts of green chert and schist. The schist and gneiss are highly friable rocks so one would expect that the uses to which these were put were relatively light. The tool classes other than one large retouched flake are only found in Layers A through C so it appears that the later occupations were more intensive. In fact only three artifacts in total are found in layers D and E. Frequencies of artifacts decline sharply from top to bottom: Layer A has 59 items, Layer B has 24, Layer C has 11, Layer D has two and Layer E only one.

An interesting trend is for the larger artifacts to be found in the lower levels of the site. As seen in Figure 1, the mean volume (LxWxT) increases sharply from Layer A through B and C. Layer D has higher mean volume than Layers A and B. The meaning of this pattern is unclear to the analyst since the layer assignments may not be consistent across the site. It may indicate, however, that the heavier items are working their way downwards. This certainly calls into question the cultural validity of the lower levels. The lowest two levels

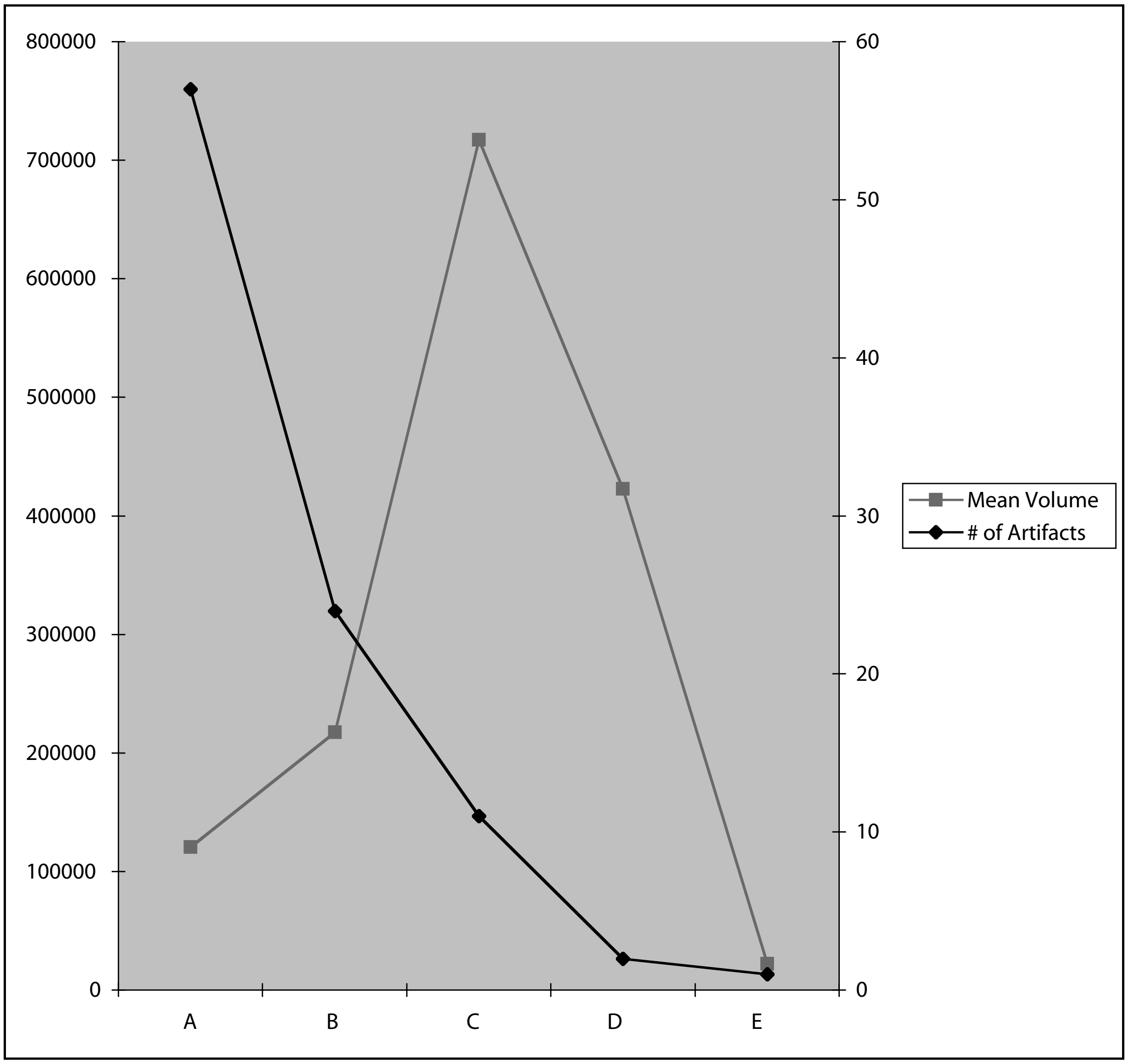


Figure 1. Artifact frequencies and mean volumes by major layers.

contain only three items of gneiss and gabbro so those may be questionable as well.

Some tool/debitage patterns with respect to raw materials are notable (Table 1, Figure 2). First, all of the schist materials appear to be tools or tool fragments, while both obsidian items are tools or tool fragments. Vein quartz and chert are far more abundant in the debitage than in the tool classes. In the other raw material classes frequencies are simply too low to allow reliable generalizations, although andesite is more than twice as common in tools than in debitage (n=7 vs. n=3), basalt three times as common in debitage than in tools (n=9 vs. n=3). Taken at face value, these patterns indicate manufacture and export of quartz, chert and basalt tools, but import of obsidian, andesite and schist tools. There is the possibility, of course, that the obsidian, and site and/or schist manufacturing events took place at the site but at locations other than where the excavation units were placed. Also, as any schist that did not display evidence of chipping was not collected, the debitage for that raw material class would be greatly under-represented.

Summary

A total of 96 lithic artitacts from Ts'ishaa were analysed. These were sorted into 17 classes of tools (n=43, including cores) and debitage (n=53) across 10 general raw material categories. The most remarkable items in the assemblage are made of obsidian, one being a large lanceolate biface and the other an apparent microblade core ridge flake.

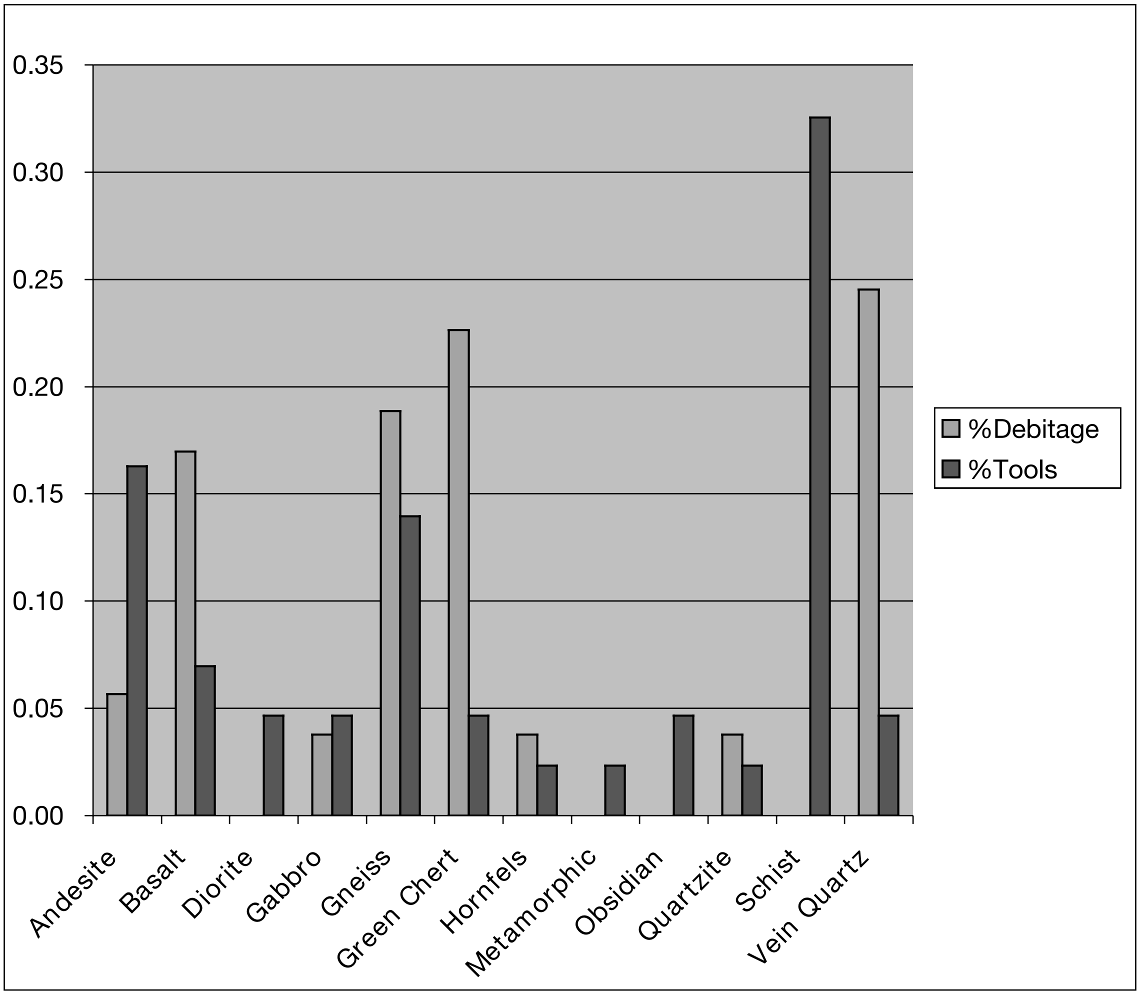


Figure 2. Graphical representation of relative amounts of debitage and tools by raw materials.

No other obsidian artifacts are represented. Other than that the assemblage seems rather typical. The reduction technology includes bipolar flaking of chert, vein quartz and other pebble- sized materials, as well as free-hand percussion of larger rocks. Many of the bipolar cores and flakes may in fact result from their use as "wedges," but use-wear analysis would be necessary to verify that. A trend is apparent for very large artifacts to be found in lower levels, which is perhaps a result of downward gravitational movement through loosely consolidated midden. Possible import/export trends may be present in the form of import of andesite, obsidian and schist tools in concert with export of basalt, quartz, and green chert tools.

Table 1. Frequencies of debitage and tools by raw material types.

Raw Material	#Debitage	#Tools	Total
Andesite	3	7	10
Basalt	9	3	12
Diorite		2	2
Gabbro	2	2	4
Gneiss	10	6	16
Green Chert	12	2	14
Hornfels	2	1	2
Metamorphic		1	1
Obsidian	0	2	2
Quartzite	2	1	3
Schist	0	14	14
Vein Quartz	13	2	15
TOTAL	53	43	96

Table 2. Lithic artifacts examined in this study.

Cat #	Artifact Type	Deb/ Tool	Raw Material	Level Layer	L	W	T	Volume	Comments
724	biface	tool	obsidian	6A	127.4	36.1	8.4	38632.8	Glass Buttes, Oregon
930	bipolar bashed pebble	tool	f.g. metamorphic, poss. quartzite	8B	64.5	32.0	13.0	26832.0	
905	bipolar bashed pebble	tool	green chert	4A	39.2	23.3	22.6	20641.9	
771	bipolar bashed pebble	tool	gneiss	4B	21.8	15.1	13.2	4345.2	
745	bipolar core	tool	vein quartz	4A	37.0	32.5	15.9	19119.8	
823	bipolar core	tool	vein quartz	4A	44.7	30.9	19.6	27072.1	
782	bipolar core	tool	f.g. diorite	3A	53.0	44.4	15.4	36239.3	water-rolled
988	bipolar flake	deb	vein quartz	9B	20.5	16.8	5.2	1790.9	with cortex
926	bipolar flake	deb	green chert	8A	22.4	11.5	8.3	2138.1	
968	bipolar flake	deb	green chert	6A	47.2	14.3	7.2	4859.7	
803	bipolar flake	deb	gneiss	5B	70.6	38.6	16.2	44147.6	bipolar, with cortex
453	chipped schist	tool	schist	1A	33.6	21.5	3.3	2383.9	
454	chipped schist	tool	schist	3A	51.9	19.0	9.1	8973.5	chipped and ground
597	chipped schist	tool	schist	4A	52.0	33.4	3.0	5210.4	
733	chipped schist	tool	schist	3A	43.9	31.5	5.0	6914.3	
743	chipped schist	tool	schist	4A	24.7	22.1	3.8	2074.3	
762	chipped schist	tool	schist	5A	89.1	57.2	5.9	30069.5	
766	chipped schist	tool	schist	5A	72.4	44.4	4.9	15751.3	
779	chipped schist	tool	schist	7C	50.2	43.0	2.8	6044.1	utilized
806	chipped schist	tool	schist	5B	56.6	37.6	3.5	7448.6	
807	chipped schist	tool	schist	5B	24.5	17.9	2.1	921.0	
868	chipped schist	tool	schist	1A	42.3	34.5	6.3	9193.9	
817	chopper	tool	gneiss	6A	141.7	132.4	52.7	988708.9	
873	chopper	tool	andesite	9C	176.3	129.0	57.0	1296333.9	
918	chopper	tool	andesite	7A	133.8	116.0	69.7	1081799.8	heavily water-rolled, poss. natural
943	cobble chopper	tool	hornfels	8B	113.8	109.1	54.6	677890.7	heat spalling
897	cobble chopper	tool	gneiss	7C	127.8	115.8	51.0	754761.2	
829	cobble chopper	tool	andesite	2A	131.9	95.9	42.1	532531.7	in cairn over immature burial (F 18)
596	flake	deb	vein quartz	2A	29.8	12.8	6.6	2517.5	
765	flake	deb	vein quartz	5A	18.5	13.1	3.2	775.5	
767	flake	deb	vein quartz	5A	14.0	9.2	3.2	412.2	
813	flake	deb	vein quartz	6B	9.0	7.0	1.7	107.1	
853	flake	deb	vein quartz	1A	13.8	11.0	3.6	546.5	
854	flake	deb	vein quartz	2A	13.8	6.1	3.9	328.3	
870	flake	deb	vein quartz	4A	14.0	10.8	3.6	544.3	
894	flake	deb	vein quartz	7A	18.9	15.0	3.7	1049.0	
915	flake	deb	vein quartz	4A	8.3	8.1	2.3	154.6	
932	flake	deb	vein quartz	4A	16.6	9.1	3.0	453.2	
969	flake	deb	vein quartz	2A	19.2	17.6	3.3	1115.1	
970	flake	deb	vein quartz	2A	16.8	12.8	4.2	903.2	

Table 2 continued.

Cat #	Artifact Type	Deb/ Tool	Raw Material	Level Layer	L	W	T	Volume	Comments
949	flake	deb	quartzite	9B	25.6	18.1	3.5	1621.8	
985	flake	deb	quartzite	9B	47.0	17.2	4.3	3476.1	below date of 4080±70
850	flake	deb	hornfels	9B	43.3	31.2	7.1	9591.8	
896	flake	deb	metamorphic, poss. hornfels	6C	60.9	35.0	11.4	24299.1	
738	flake	deb	green chert	3A	12.5	7.2	1.5	135.0	
769	flake	deb	green chert	6A	15.8	11.8	5.0	932.2	water rounded
774	flake	deb	green chert	5B	20.3	13.5	3.6	986.6	
802	flake	deb	green chert	5A	49.4	41.0	14.7	29773.4	
849	flake	deb	green chert	3A	19.9	18.2	7.4	2680.1	water-rolled
862	flake	deb	green chert	2A	23.1	7.8	3.0	540.5	possibly bipolar
864	flake	deb	green chert	4A	18.3	16.0	3.9	1141.9	
885	flake	deb	green chert	4A	17.2	6.9	2.8	332.3	
911	flake	deb	green chert	3B	75.2	27.5	17.9	37017.2	
914	flake	deb	green chert	4A	16.8	7.0	1.7	199.9	
754	flake	deb	f.g. gneiss	6B	69.5	37.7	15.5	40612.3	below date of 3000±70 (in 5B)
778	flake	deb	gneiss	7D	55.5	28.1	19.9	31035.0	
846	flake	deb	gneiss	9B	27.8	19.4	5.1	2750.5	
866	flake	deb	metamorphic, poss. gneiss	10E	45.7	40.3	12.2	22468.9	from dark brown silt-clay at base – date from this level of 4430±80
882	flake	deb	gneiss	3A	23.8	18.7	4.8	2136.3	
890	flake	deb	gneiss	7C	76.7	39.8	13.8	42126.7	
983	flake	deb	gneiss	5A	47.1	16.4	8.2	6334.0	
987	flake	deb	gneiss	7A	54.1	31.7	22.3	38243.8	8A has date of 4080±70
989	flake	deb	gneiss	8A	44.4	41.1	11.3	20620.7	
960	flake	deb	gabbro	6A	35.2	25.9	6.6	6017.1	
744	flake	deb	basalt	4A	49.6	43.3	12.0	25772.2	
775	flake	deb	basalt	5B	27.5	10.5	4.5	1299.4	
818	flake	deb	basalt	7A	37.0	26.9	8.3	8261.0	
884	flake	deb	basalt	4A	29.7	24.9	4.6	3401.8	
886	flake	deb	basalt	4A	36.4	28.8	9.8	10273.5	
887	flake	deb	basalt	4A	21.0	15.4	3.5	1131.9	
901	flake	deb	basalt	4A	33.7	20.4	6.9	4743.6	
946	flake	deb	basalt	8B	30.7	25.8	5.1	4039.5	date of 4080±70 from 8A
986	flake	deb	poss. basalt	9B	43.2	17.4	6.5	4885.9	
312	flake	deb	f.g. igneous, poss. andesite	4B	51.9	40.5	12.3	25854.0	
551	flake	deb	f.g. igneous, poss. andesite	1A	64.1	30.0	13.9	26729.7	
594	flake	deb	f.g. igneous, poss. andesite	6B	96.7	71.1	35.8	246138.2	recent damage
314	large core	tool	gabbro	6C	194.5	184.2	87.6	3138436.4	
804	large core	tool	porphyritic andesite	5B	164.7	141.9	102.5	2395520.3	heavily water-rolled – poss. natural?
852	large core	tool	andesite	12B	152.9	140.6	77.6	1668224.6	

Table 2 continued.

Cat #	Artifact Type	Deb/ Tool	Raw Material	Level Layer	L	W	T	Volume	Comments
808	large re-touched flake	tool	gneiss	5A	123.0	73.1	38.7	347963.3	with cortex
563	large re-touched flake	tool	gabbro	8D	164.9	139.6	35.4	814909.4	with cortex
820	large re-touched flake	tool	f.g. diorite	7C	123.0	74.1	46.2	421080.7	with cortex
899	large re-touched flake	tool	basalt	8C	145.3	105.5	38.1	584040.6	
550	large spall	deb	gabbro	7C	127.7	101.9	59.7	776854.0	
942	microblade core ridge flake	tool	obsidian	8B	39.9	6.7	3.3	882.2	Newberry Caldera, Oregon
742	schist knife	tool	schist	4A	84.7	56.1	5.4	25659.0	
759	schist knife	tool	schist	5A	76.7	59.0	5.6	25341.7	
812	schist knife	tool	schist	6B	71.1	34.2	5.2	12644.4	
827	small core	tool	green chert	7A	23.4	19.0	14.8	6580.1	
916	small core	tool	f.g., poss. andes-ite	15–17C	31.4	26.6	14.5	12111.0	water-rolled – found in shovel test deep into basal deposit – cultural?
929	split cobble chopper	tool	metamorphic, poss. gneiss	7A	169.7	113.9	56.0	1082414.5	
919	split cobble chopper	tool	andesite	7A	120.5	118.0	51.2	728012.8	
549	split cobble chopper	tool	f.g. metamorphic	7C	143.6	121.5	47.8	833985.7	
758	split cobble chopper	tool	f.g.metamorphic, prob. gneiss	4A	161.0	127.7	55.3	1136951.4	
948	split pebble	tool	fg greenish basalt	9A	80.0	61.8	22.9	113217.6	8A has date of 4080±70
799	utilized flake	tool	f.g. basalt	5A	138.0	66.3	41.7	381530.0	battered end – pick-like – with cortex

Appendix C: An Analysis of Three Shellfish Assemblages from Ts'ishaa, Site DfSi-16 (204T), Benson Island, Pacific Rim National Park Reserve of Canada

by Ian D. Sumpter

Cultural Resource Services, Western Canada Service Centre, Parks Canada Agency, Victoria, B.C.

Introduction

This report describes and analyzes marine shellfish recovered from three archaeological excavation units at the Tseshaht village of Ts'ishaa (DfSi-16). The mollusc materials were collected from two different areas investigated in 1999 and 2001. The source areas are located within the village proper and on an elevated landform positioned behind the village. The two areas contain stratified cultural deposits dating to the late and middle Holocene periods, respectively.

With an emphasis on mollusc species identification and quantification, this preliminary analysis examines discarded shellfood remains that were collected and processed by the site occupants for approximately 5,000 years. The data, when reviewed together with the recovered vertebrate fauna materials, will contribute to our understanding of past ecosystems and subsistence patterns in the Barkley Sound area. Furthermore, the analyses of both invertebrate and vertebrate remains will augment interpretations regarding local food resource availability, habitat exploitation, food procurement strategies, scheduling of human and food resources, and pre-contact economics.

This study comprises four sections. It commences with a description of the field and post-field procedures used in the identification and quantification of the invertebrate samples. The second section consists of descriptions and comparisons of the assemblages, highlighting intra-site and temporal patterns. Other quantitative and interpretative studies are presented in the third section with discussions exploring grain size distributions, bivalve umbo counts, dietary contributions of different shellfish species, intertidal habitats exploited, and species ubiquity. The fourth section includes a conclusion.

The marine mollusc assemblages discussed below were obtained using a vertical column sampling strategy. During the 3-year archaeological project, column sampling, plus a second shell data collecting method, hand-collection/screen sampling, were used to recover seven shellfish data sets for investigating the site's invertebrate materials. The analysis reported here focuses on three column assemblages collected by the researcher during the 1999 (Unit S14–16/W25–27) and 2001 (Units S56–57/W50–52, S62–64/W62–64) excavations only.

Procedures and Methods of Quantification and Identification

The primary purpose of collecting and examining the Ts'ishaa shellfish remains was to sample, identify, and quantify the marine invertebrate species for each major stratigraphic layer. Sets of quantitative information were compiled through out the analysis in order to accomplish these objectives. In addition, the data sets were used to explore other interpretative studies, such as: to examine patterns in intertidal shell gathering strategies and subsistence through time and space; to identify particular habitats exploited for shellfish gathering; to make intra-site comparisons between the late and early temporal components; and to contribute information on shell midden site formation processes by examining the grain-size distributions of specific shell species per stratigraphic layer and excavation area.

This section describes the procedures used for processing the marine shell samples in the field and laboratory and the methods of species identification and quantification. While the discussion below focuses on the three 1999 and 2001 column assemblages, information pertaining to all seven column and hand-collection/screen sample data sets are presented for interest to other researchers.

Field and Laboratory Processing of Column and Hand-Collection/Screen Samples

Four vertical column and three hand-collection/screen sample assemblages of various sizes and volumes were collected during the 3-year excavation project at Ts'ishaa for the purpose of analyzing shellfish and small vertebrate remains. All column and hand-collection/screen samples were removed by trowel.

Two of the four columns (1999 Unit S14–16/W25–27, 2000 Unit N2–4/W102–104) were collected at the same time that their respective units were being excavated; two (2001 units S62–64/W62–64 and S56–57/W50–52) were removed after excavations were completed. In most cases, the sediment samples were collected in 10 cm levels (at maximum) to the base of each matrix layer, thus eliminating concerns regarding stratigraphic mixing and ensuring uncontaminated samples for later inter-layer comparisons. In the field the samples were stored in plastic zip-lock bags for later water screening through a series of nested hand screens comprising four mesh sizes: 25 mm (1"), 12.5 mm (½"), 6.3 mm (¼"), and 3 mm (⅛"). The objective of processing the shellfish assemblages through the nested screens was to quantify relative abundance of shellfish taxa, to interpret grain size distributions of selected invertebrate species, and to examine breakage patterns and taphonomic processes by level and stratigraphic layer. One column, from 1999 Unit S14–16/W25–27, was water screened and sorted on site for public interpretation purposes. The two 2001 columns were washed and processed in the Parks Canada archaeology lab, Victoria. Unit N2–4/W102–104 column sample, recovered from the west end of the village midden in 2000, was not examined.

Due to time constrains and the rich abundance of shell material, not all level samples from the 1999 and 2001 column assemblages were examined (Table 1). Approximately 50% or more level samples (odd number only) in columns S62–64/W62–64 and S56–57/W50–52 from the elevated landform behind the village were studied. In column S14–16/W25–27, located in the central portion of the village midden proper, only 12 of 37 level samples were analyzed because of the depth of cultural deposits (3.5 m dbs). Table 1 summarises column sample and volumetric data for those assemblages discussed in this study.

The three column samples were placed so that they would intersect all shell-bearing stratigraphic layers within their corresponding excavation units. The two early component column samples from units S62–64/W62–64 and S56–57/W50–52 intersected four (A–D) and two (B–C) stratigraphic layers, respectively. Late component column sample, S14–16/W25–27, intersected six of seven stratigraphic layers extending through its unit (A–C, E–G). Stratigraphic layers in the midden deposits were not continuous between excavation units, and as such stratigraphic Layer A located in the main village midden does not correspond with an upper-lying Layer A on the elevated landform deposit behind the village.

Three hand-collection/screen grab sample data sets were also collected for marine mollusc species identification and quantification. These assemblages included: two recovered from the village midden proper, 1999 Unit S14–16/W25–27 and 2000 Unit N2–4/W102–104; together with screen materials recovered from 2001 Unit S62–64/W62–64, positioned on an elevated landform behind the village midden proper. All hand-collection/screen grab samples were collected from three excavation units that measured 2 x 2 metres. Most levels measured 10 cm thick, but in some cases they varied in volume according to the thickness and configuration of the matrix layer.

The hand-collection/screen sample shellfish assemblages comprised mostly whole shell specimens, valves with hinges and umbones, and samples of gastrapods, univalves, and barnacles that were troweled or hand collected during excavation or grabbed from the ¼" sifting screen. Following collection, the hand collected/screen specimens were placed into their respective marked provenience bags (paper) and stored for later identification. In using this strategy, larger and whole shell specimens are well represented, while smaller and more friable molluscs tend to be under represented. The potential biases and subsequent results and misinterpretations from using this judgemental sampling technique have been stressed elsewhere by Northwest Coast archaeologists (Frederick 2002, pers comm.; Hanson 1991; Muckle 1986).

Table 1. Ts'ishaa shellfish column sample and volume data.

Column Sample	# of Levels Examined	Sample Volume (x 1000 cm^3)	Level Sample Size	Sample Fraction by Vol	# of Major Stratigraphic Layers in Column	Vertical Depth of Column (m dbs)	Analytical Sample Wt (g)
S14–16/W25–27	12	71.9	25 x 25 x 10	33%	6	3.50 m	32,964.8
S56–57/W50–52	13	12.9	10 x 10 x 10	52%	2	2.49 m	5,812.3
S62–64/W62–64	5	20	20 x 20 x 10	55%	4	0.88 m	4,885.2

In the laboratory, all selected column sediment samples were weighed prior to processing. The samples were then dumped into the top of four stacked 8-inch diameter sieves (25 mm, 12.5 mm, 6.3 mm, 3 mm), gently shaken, and washed. The contents from each sieve was placed onto newspaper and air-dried for later sorting and weighing. Sieved materials measuring less than ⅛" (3 mm) were not examined. All dried samples were then hand sorted and the constituents separated into three groups: shell, vertebrate fauna, and non-fauna. Non-fauna material comprised rocks, rootlets, and charcoal. Found artifacts were collected and submitted for cataloguing. The constituents from each mesh size were then weighed and the information recorded on shell data record code sheets. Non-fauna materials were discarded after weighing. Vertebrate fauna were weighed, with weights documented on the shell data sheets, bagged by grain size, and then stored for later identification.

Method of Identification

All shell remains from Ts'ishaa were identified using a Parks Canada comparative collection and an assortment of reference texts on marine invertebrate taxonomy, including: Harpo (1997), Coan et al. (2000), Quayle (1960), Cornwall (1970), Griffith (1967), and Morris (1996). In general, the identification of whole shells, valves with hinges and umbone, and large fragments with exterior markings were usually easily completed; decreasing fragment size, however, reduced identifiability and consumed more time. Where identification allowed, taxonomic classification was made to the species-, genus-, and family-levels. In some cases, more generalised categories were used, for example, unidentified clam and unidentified shell.

In conjunction with species identification, data recording activities included documenting the state of specimen completeness, evidence of burning, and the presence of exterior exfoliation or erosion.

Methods of Quantification

In this analysis, mollusc taxon weights and bivalve umbo counts were quantified first for each level selected for examination and then values totalled by stratigraphic layer. As mentioned above, due to time constraints and the size of column samples collected, only 33% to 55% of each column by volume was subject to identification and analysis. Small, broken, and washed shell fragments measuring less than ⅛" and calcite/calcium carbonate debris accumulated as a result of sample handling and processing were not examined, but were saved for later inspection.

Shellfish remains were quantified using shellfish weights and relative frequency. Quantification measures of bivalve species are also supported with umbo (or beak) counts. While some researchers have identified problems with using shellfish weight and umbo count as shellfish quantification variables (Calvert 1980; Classen 1998), the application of these variables with column sample data is deemed a more reliable representative unit of measurement than relying on 6.3 mm (¼") hand-collection/screen shell data.

All shellfish remains were weighed on an electronic scale with a minimum capacity of 0.1 grams. Shell taxa were recorded by stratigraphic unit and by column sample assemblage, thus allowing for intra-stratigraphic layer, intra-assemblage, and intra-site comparisons.

Descriptions and Comparison of Column Shellfish Assemblages

The following section presents a description and comparison of the three column shellfish assemblages. A general description for the over-all site assemblage is first given, followed by a more detailed examination of intra-assemblage variations by inclusive shellfish groups. This is then succeeded by a detailed discussion of each individual assemblage.

Site Assemblage Variation

A total of 43.7 kg of shellfish was examined, identified, and analyzed during this study (Table 2). Over 75% of this material by weight is associated with the 1999 column sample from Unit S14–16/W25–27, located in the main village midden. Radiocarbon dates collected in the vicinity of 1999 column S14–16/W25–27 indicate that this part of the site was first occupied approximately 1800 years before present. The 1999 column is temporally affiliated with the later period of Mitchell's (1990) West Coast Culture Type. The remaining 24.5% of the shellfish materials are from two column assemblages recovered in units S56–57/W50–52 and S62–64/W62–64. Excavated in 2001, the two latter units were located on an elevated landform positioned behind the main village. The two 2001 units yielded radiometric dates ranging 2960–4850 calibrated years before present.

Table 2. Relative frequencies of Ts'ishaa column sample shellfish remains (≥3 mm) by mollusc taxa family.

COMPONENT	Late Component Assemblage						Early Component Assemblages					
COLUMN SAMPLE	S14–16/W25–27						S56–57/W50–52		S62–64/W62–64			
STRATIGRAPHIC LAYER	A	B	C	E	F	G	B	C	A	B	C	D
MOLLUSC TAXA FAMILY												
Glycymerididae (Bittersweet Clam)	<0.1%											
Mytilidae (Mussel)	78.4%	85.5%	92.3%	95.3%	86.3%	84.2%	92.5%	93.4%	91.8%	95.9%	95.6%	95.2%
Pectinidae (Scallop)				<0.1%								
Carditidae (Cardita Clam)	<0.1%											
Cardiidae (Cockle)	<0.1%		<0.1%	<0.1%	0.2%							
Veneridae (Venus Clam)	3.4%	2.2%	0.7%	0.6%	1.4%	1.2%	0.3%	0.1%		0.8%		
Mactridae (Horse Clam)	0.9%		0.3%		0.5%	0.1%				<0.1%		
Hiatellidae (Nestling Saxicave Clam)	<0.1%		<0.1%	<0.1%	<0.1%		<0.1%					
Unidentified Clam	3.3%	1.7%	0.7%	0.3%	5.1%	3.3%	1.3%	0.9%	4.7%	1.4%	0.6%	0.3%
Haliotidae (Abalone)	0.1%	0.7%	0.2%		<0.1%	<0.1%	<0.1%	<0.1%				
Fissurellidae (Keyhole Limpet)	<0.1%		<0.1%			<0.1%				<0.1%		
Turbinidae (Turban Snail)	<0.1%	2.2%	<0.1%	<0.1%	<0.1%	0.7%	0.1%			0.6%		
Acmaedidae ("True" Limpet)	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%		<0.1%		
Littorinidae (Periwinkle)	<0.1%			<0.1%		<0.1%	<0.1%			<0.1%		
Lacunidae (Lacuna Shell)	<0.1%		<0.1%	<0.1%		<0.1%						
Cerithiidae (Bittium Snail)	<0.1%			<0.1%								
Calyptraeidae (Slippersnail)			<0.1%	<0.1%						<0.1%		
Muricidae (Rocksnail)			<0.1%	<0.1%			<0.1%					
Nucellidae (Dogwinkle)	<0.1%	0.1%	0.1%	0.1%	<0.1%	0.2%	0.1%	0.1%		0.1%	<0.1%	0.4%
Buccinidae (Whelk)				<0.1%				<0.1%				
Columbellidae (Amphissa & Dove Shell)	<0.1%		<0.1%	0.1%						<0.1%		
Pyramidellidae (Pyramid Snail)	<0.1%		<0.1%									
Indeterminate Marine Snail	<0.1%	<0.1%	<0.1%	<0.1%	0.8%	0.1%	<0.1%	<0.1%		<0.1%	0.1%	<0.1%
Lepidochitonidae (Lined Chiton)			<0.1%									
Mopaliidae (Chiton)	0.1%	0.2%	0.1%	0.2%	<0.1%	0.1%	<0.1%	0.2%		<0.1%		
Acantitochitonidae (Chiton)	<0.1%		0.1%	0.3%	<0.1%	0.1%	<0.1%					
Archaeobalanidae/ Balanidae (Acorn Barnacle)	12.6%	5.2%	4.9%	2.7%	4.2%	8.5%	5.3%	4.5%	3.5%	0.9%	3.3%	3.0%
Scalpellidae (Gooseneck Barnacle)	0.5%	0.5%	0.1%	0.1%	<0.1%	0.1%	0.3%	0.3%		0.1%	0.1%	0.6%
Strongylocentrotidae (Sea Urchin)	0.3%	1.7%	0.2%	0.1%	<0.1%	0.1%	<0.1%	0.3%				
Unidentifiable Shell	0.3%	0.2%	0.1%	0.2%	1.3%	1.2%	0.1%	0.2%		0.2%	0.4%	0.6%
Total Shellfish Remains Weight 100%	**11,784.6 g**	**1,329.8 g**	**8,745.7 g**	**6,593.5 g**	**1,198.2 g**	**3,313.0 g**	**2,943.6 g**	**2,868.5 g**	**17.0 g**	**3,964.6 g**	**796.3 g**	**107.3 g**

In total, 57 marine mollusc species (excluding three general unidentifiable categories) were identified in the three assemblages, indicating that the site occupants exploited a number of intertidal shellfoods and habitats. The site assemblage includes: 12 marine bivalves, 35 univalves (including 25 marine sea snails), five species of chitons, three sea urchins, and two barnacles. The relative contributions of the shellfish taxa to the column sample weight data are presented in Tables 11, 12, 13. The high proportion of mussel *(Mytilus)* in the shellfish remains weight data however obscures the contributions of other smaller and lighter mollusc taxa. Of the 57 identified species, 44 contribute less than 0.1% of the total site shell sample weight. Due of the disproportionate amount of weight represented by California mussel *(Mytilus californianus)* relative to other mollusc shells, relative frequencies by weight of remains for the Family taxonomic level are presented in Table 2.

In both early and late cultural components, California mussel is by far the most dominant shell. This heavily exploited mollusc species contributes between 87% and 96% of the shellfish remains weight in the three column assemblages (Table 3). Lower frequencies of this shell are found in the late component assemblage from the village midden, Column S14–16/W25–27. In this column, mussel weight values range between 78% in Layer A to a maximum high exceeding 95% in Layer E. Tables 2 and 3 show that all stratigraphic layers in both early column assemblages contain high proportions of mussel with values approximating or exceeding 92% of the column shellfish by weight.

Barnacles *(Archaeobalanidae/ Balanidae)* represent the second largest contributor to weight data in both late and early period columns. Table 2 reveals that higher frequencies of acorn barnacle occur in Late Column S14–16/W25–26, ranging

Table 3. Relative frequencies of Ts'ishaa column shell weight data by major shell groups (≥3-mm mesh).

Late Component							
	1999 Column Sample S14–16/W25–27						
Layer	A	B	C	E	F	G	**Totals**
Major Shell Group	%	%	%	%	%	%	%
Mussel	78.4	85.5	92.3	95.3	86.3	84.2	86.6
Clam	7.6	3.8	1.8	0.9	7.2	4.7	4.3
Marine Snail	<0.1	2.2	0.1	0.2	0.8	1.0	0.3
Limpet&Abalone	0.1	0.7	0.2	<0.1	<0.1		0.1
Chiton	0.2	0.2	0.2	0.5	0.1	0.2	0.2
Scallop				<0.1			<0.1
Barnacle	13.2	5.7	5.0	2.8	4.2	8.6	7.9
Sea Urchin	0.3	1.7	0.2	0.1	<0.1	0.1	0.3
Unid Shell	0.3	0.2	0.1	0.2	1.3	1.2	0.3
Shell Totals 100%	**11,784.6 g**	**1,329.8 g**	**8,745.7g**	**6,593.5g**	**1,198.2g**	**3,313.0g**	**32,964.8 g**
Bone Wt	6.1g	74.4g	39.4g	13.4g	16.1g	25.0g	174.4g
Non-Fauna Wt							

Early Component								
	2001 Column Sample S56–57/W50–52			**2001 Column Sample S62–64/W62–64**				
Layer	B	C	**Totals**	A	B	C	D	**Totals**
Major Shell Group	%	%	%	%	%	%	%	%
Mussel	92.5	93.4	92.9	91.8	95.9	95.6	95.2	95.8
Clam	1.6	1.0	1.3	4.7	2.2	0.6	0.3	1.9
Marine Snail	0.2	0.1	0.2		0.7	0.1	0.4	0.6
Limpet & Abalone	<0.1	<0.1	<0.1		<0.1			<0.1
Chiton	<0.1	0.2	0.1		<0.1			0.2
Barnacle	5.6	4.7	5.2	3.5	1.0	3.4	3.6	1.5
Sea Urchin	<0.1	0.3	0.1					0
UnidShell	0.1	0.2	0.1		0.2	0.4	0.6	0.2
Shell Totals 100%	**2,943.6g**	**2,868.7g**	**5,812.3g**	**17.0g**	**3,964.6g**	**796.3 g**	**107.3 g**	**4,885.2g**
Bone Wt	11.4g	17.9g	29.3g	0.6g	18.2g	7.4g	5.2g	31.4g
Non-Fauna Wt.	564.9g	1,910.3g	2,475.2g	1,892.4g	860.4g	1,086.7g	415.3g	4,254.8g

from 2.7% in Layer E to 12.6% in Layer A. Mean weights for acorn barnacle in the two early assemblages include 4.9% in Column S56–57/W50–52 and 2.7% in Column S62–64/W62–64.

Clams comprise the third most abundant shell group in all three assemblages. The two prominent clams include unidentifiable clam and those belonging to the *Veneridae* Family. Two identified *Veneridae* family species include the butter clam *(Saxidomus gigantea)* and native littleneck clam *(Protothaca staminea)*, with butter clam being the most dominant. The unidentifiable clam material comprises a high number of incomplete clam valves missing large portions of their hinges and/or diagnostic landmarks such as the umbo. Butter clam, coupled with lesser quantities of horse clam *(Tresus)*, probably represent the major contributors to this group. Table 3 indicates that clams are most abundant in the late component, contributing over 4% of shellfish weight in Column S14–16/W25–27. Clam frequencies in the two early columns range between 1.3% and 1.9% only.

The most diverse class of marine shells, with regard to the number of species present, are gastropods. A total of 25 marine snails were identified to the genus level in the three column samples (Tables 11–13). Interestingly, 80% or more of the snails are present in the late component column sample; only 32% occur in the two early shellfish assemblages. In terms of weight, only two marine snail families account for over 0.1% of the total stratigraphic layer sample weight – *Turbinidae* and *Nucellidae* (dogwinkles) (Table 2). Turbin snails (predominantly *Astrea gibberosa)* are most plentiful in Late Column S14–16/W25–27 Layers B and G. The highest relative frequency of dogwinkles occur in Early Column S62–64/W62–64 Layer D.

Intra-assemblage shellfish weight comparisons in more inclusive categories or groups retain a similar pattern. These groupings are presented in Table 3. California mussel is by far the most frequently occurring shellfish material in all stratigraphic layers, in all three assemblages. Barnacle (predominantly *Archaeobalanidae*/*Balanidae*, but also including *Pollicipes polymerus* [gooseneck barnacle]) appears to be a second favourite, particularly in Late Column S14–16/W25–27 Layer A. The highest frequencies of clam are also found in the late period shellfish assemblage. Clams occur most often in Layers A and F and less frequent in the middle portion of the stratigraphic column. In Early Column S62–64/W62–64, Table 3 shows that clams tend to decrease in frequency as one proceeds down through the stratigraphic layers. This pattern, however, may be more a sampling factor than reality, in view of the low shellfish weights for both Layers A and D. The data suggest that sea urchins are more common in Late Column S14–16/W25–27, particularly in Layer B (1.7%). Sea urchin is present in only one of two early column samples. All other shell groups in the columns afford frequencies of less than one percent.

Intra-assemblage Variation

Further important information on shellfish data can be gleaned by examining the distributions and patterns of mollusc variability between stratigraphic layers and column assemblages. Intra-assemblage variations are examined below by investigating major shell groups or classes at the taxon level. Seven major shell groups are discussed (Table 3), including Mussel, Clam, Marine Snail, Limpet & Abalone, Chiton, Scallop, and Barnacle. Species data for each major group are presented in Tables 4–10.

California mussel *(Mytilus californianus)* is the most frequent mussel species in both cultural components and in all three columns. Only traces of the foolish mussel *(Mytilus trossulus)* were identified. The latter species was observed in only one stratigraphic layer in each of the two early period columns, contributing less than 0.1% of the layer weight (Table 4). In Late Column S14–16/W25–27, foolish mussel was found to be more frequent, occurring in four of six stratigraphic layers. It is possible that the distribution of this fragile mussel species may be an effect of preservation, sampling, or environmental change. The British Columbia crenella *(Solamen columbianum)* is rare at Ts'ishaa, with only a single specimen being recovered in Late Column S14–16/W25–27 Layer A.

Relative frequencies of barnacle *(Thoracica* order), the second most abundant major shellfish group by weight, are summarised in Table 5. The Suborder Balanomorpha represents weight data for all recovered *Archaeobalanidae* and *Balanidae* Family (acorn barnacle) specimens, dominated by *B. nubilus*, and including lesser quantities of *Semibalanus cariosus*, *B. glandula*, and possibly other species. Due to time constraints, quantitative data on acorn barnacles were not collected at the species-level.

Acorn barnacle is by far the most frequent barnacle in all three columns, with high values occurring in all stratigraphic layers. Slightly

Table 4. Relative frequencies by weight of shellfish remains within Mussel *(Mytilidae)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/ W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Mussel Group	%	%	%	%	%	%	%	%	%	%	%	%
Mytilus californianus	99.9	99.9	99.9	99.9	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0
Mytilus trossulus	<0.1	0.1	<0.1	<0.1				<0.1		<0.1		
Solomen columbianum	<0.1											
Wt of all mussel (100%)	9,234.8 g	1,136.6 g	8,068.8 g	6,284.6 g	1,033.5 g	2,790.5 g	2,723.3 g	2,678.8 g	15.6 g	3,802.5 g	760.9 g	102.2 g
Group Wt Totals	**28,548.8 g**						**5,402.1 g**		**4,681.2 g**			

Table 5. Relative frequencies by weight of shellfish remains within Barnacle *(Thoracica)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Taxa	%	%	%	%	%	%	%	%	%	%	%	%
Archaeobalanidae/Balanidae	95.9	91.9	97.5	96.9	98.6	98.7	95.3	94.6	100.0	88.2	97.4	84.2
Pollicipes polymerus	4.1	8.1	2.5	3.1	1.4	1.3	4.7	5.4		11.8	2.6	15.8
Wt of all barnacle (100%)	1,553.2g	75.6g	441.1g	183.7g	50.9g	285.4g	165.0g	136.2g	0.6g	39.9g	26.6g	3.8g
Group Wt Totals	**2, 589.9 g**						**301.2 g**		**70.9 g**			

lower proportions of acorn barnacle in Early Column S62–64/W62–64 layers B and D reflect increased quantities of goose barnacle *(Pollicipes polymerus)*. The latter observation, however, may be influenced by the small barnacle sample weight.

Clams represent the third most frequent shell group. Table 6 reveals that unidentified clam, most likely comprising mostly broken butter clam and some horse clam valves without identifiable landmarks, are the most abundant material in this group. Unidentified clams occur in all stratigraphic layers, in all columns. Greater quantities of butter clam *(Saxidomus gigantea)*, the largest identified clam taxon, are found in Late Column S14–16/W25–27. Frequencies of this specimen range between 16% and 19% in the middle and lower midden layers, and from 42% and 54% in upper layers A and B. The low occurrence of butter clam in the two early column assemblages is somewhat surprising. Relative proportions of butter clam to others in the Clam Group in the deep 2001 Column S56–57/W50–52 are very low, ranging from 4% in upper Layer B to less than 1% in lower Layer C. In the shallower 2001 Early Column S62–64/W62–64, butter and native littleneck *(Protothaca staminea)* clams are present in Layer B only.

Horse clam (predominantly *Tresus capax)*, the second most common identified clam by weight, has much higher weights in Late Column S14–16/W25–25. Present in four of six stratigraphic layers, larger quantities of horse clam occur in layers A and C, comprising 12% to 16% of the Clam Group weight respectively. Small quantities of native littleneck clam *(Prothaca staminea)*, the third largest identified clam species, are present in the two early columns. Larger quantities of this clam are found in Late Column S14–16/W25–27, with the highest relative frequencies in layers C and E. Rare or absent in the two early assemblages, but more common in Late Column S14–16/W25–27, are the two bivalves, Nuttallii cockle *(Clinocardium nuttallii)* and nestling saxicave *(Hiatella* sp.). Trace amounts of purple-hinged rock scallop *(Crassadoma gigantea)* and carpenter's candita *(Glans carpenteri)* were found only in Late Column S14–16/W25–27. A bivalve species not recovered in the column samples, but present in the hand-collection/screen grab sample, is the Pacific gaper horse clam *(Tresus nuttallii)*. Samples of this

Table 6. Relative frequencies by weight of shellfish remains within Clam and Scallop *(Bivalvia)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/ W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Taxa	%	%	%	%	%	%	%	%	%	%	%	%
Saxidomus gigantea	42.2	53.6	16.6	16.1	18.0	19.1	4.1	<0.1		26.1		
Clinocardium nuttallii	0.7		2.0	1.3	2.8							
Tresus capax	6.7		10.6									
Tresus sp.	4.8		5.4		6.9	2.6				1.1		
Protothaca staminea	2.3	2.6	24.2	47.1	1.2	7.3	13.9	8.7		9.3		
Glycymeris septentrionalis	0.5							0.7				
Hiatella sp.	<0.1		0.5	0.3	0.3		<0.1					
Glans carpenteri	<0.1											
Unidentified clam	42.8	43.8	40.7	34.6	70.8	71.0	82.0	90.7	100.0	63.4	100.0	100.0
Crassadoma gigantean				0.6								
Wt of all clam/ scallop (100%)	900.9 g	50.9 g	156.5 g	62.8 g	86.6 g	155.7 g	46.0 g	30.0 g	0.8 g	87.0 g	4.9 g	0.3 g
Group Wt Totals	**1,413.4 g**						**76.0 g**		**93.0 g**			

clam species were observed in both 1999 and 2000 hand-collection/screen materials.

The higher frequencies of clam in the late column assemblage, relative to their abundance in the two early assemblages (Table 3), is interesting and possibly suggests that clams may not have been as important economically to the early site occupants as perhaps they were during later times. While this subsistence pattern may be plausible and requires further investigation, shellfish resource availability in Barkley Sound during the middle Holocene period may in fact have been influenced by environmental factors, such as beach habitat development and sea level change. If relative sea level in Barkley Sound reached 3 to 4 m above present levels, and remained at this elevation from about 6000 to 4800 cal BP, as proposed by Friele (1992; Friele and Hutchinson 1993), then the proportions of rocky shore to sediment beach would have been very high with less land mass affording more protected habitat. Subsequent drops in mean sea level following the standstill would likely have resulted in improved beach development and marine biomass productivity. As such, shoreline habitat conducive for producing larger bivalve populations may not have been established again until the late Holocene. Among the marine snails remains, there is an obvious difference between the late and early assemblages (Table 7). Late Column S14–16/W25–27 contains a more diverse sea snail assemblage, of which a significant proportion likely entered the site in an incidental or inadvertent manner. Interestingly, this late period pattern may relate to changes in technology and/or an increase in kelp being discarded on site. Moreover, local environmental and marine conditions during the late Holocene may have been more favourable for producing larger concentrations of kelp offshore. In the late column assemblage, 13 of 25 identified taxa contribute less than 0.1% to the Marine Snail Group by weight. Only a combined total of 11 identified marine snails were found in both early assemblages. Five of the 11 taxa contributed less than 0.1% of the column weight.

The most common marine snail in all three columns is the channelled dogwinkle *(Nucella canaliculata)*. This taxon occurs in all stratigraphic layers, in both cultural components, except Early Column S62–64/W62–64 Layer A. The second most abundant snail is the red turban snail *(Astrea gibberosa)*. This snail is also found in all columns, but most frequently in Late Column S14–16/ W25–27, and particularly layers B and G. Red turban snail is not as common in the early assemblages. It is present in moderate to high amounts in Column S56–57/W50–52 Layer A and Column S62–64/W62–64 Layer B only. The third ranking snail in all three columns is indeterminate marine snail. This category represents those individuals not identifiable to the family or genus level. Also included in this indeterminate category are marine snail opercula, most of which almost certainly

Table 7. Relative frequencies by weight of shellfish remains within Marine Snail *(Gastropoda)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Taxa	%	%	%	%	%	%	%	%	%	%	%	%
Nucella canaliculata	13.5	2.4	47.6	21.4	<0.1	7.3	34.5	48.5		6.9	20.0	99.9
Nucella emarginata			1.6				5.2	6.1		0.7		
Nucella lamellosa			4.8	43.8		11.8	<0.1	12.1		1.8		
Nucella lima			11.9									
Nucella sp.	<0.1							<0.1				
Astrea gibberosa		94.9	7.9	7.1	4.1	74.5	46.6			85.9		
Tegula funebralis	62.2	2.4										
Tegula pulligo	5.4		10.3									
Ceratostoma foliatum					<0.1							
Crepidula sp.			<0.1							<0.1		
Crepidula adunca			<0.1	<0.1						2.2		
Crepidlula nummaria				<0.1								
Amphissa columbiana			2.4							0.7		
Amphissa sp.			0.8	0.9								
Lirularia sp.	<0.1											
Littorina sitkana	<0.1			<0.1			<0.1			<0.1		
Littorina scutulata	2.7					<0.1						
Bittium eschrichtii	<0.1											
Bittium sp.			2.4	<0.1								
Ocinebrina lurida				<0.1			<0.1					
Ocinebrina interfossa			<0.1									
Searlesia dira				<0.1				<0.1				
Alia gausapala	<0.1		<0.1	<0.1								
Lacuna variegata	2.7		<0.1	<0.1		<0.1						
Turbonilla sp.	<0.1											
Indeterminate marine snail	13.5	0.3	10.3	26.8	95.9	6.4	13.8	33.3		1.8	80.0	<0.1
Wt of all marine snails (100%)	3.7 g	29.5 g	12.6 g	11.2 g	9.8 g	33.0 g	5.8 g	3.3 g	0.0 g	27.7 g	1.0 g	0.4 g
Group Wt Totals	**99.8 g**						**9.1 g**		**29.1 g**			

belong to the red turban snail. Traditionally, the Nuu-chah-nulth and other Northwest Coast native groups used the operculum of the latter snail species for decorative purposes. Two marine snails not found in the three column data sets, but were recovered in the hand-collection/screen samples in adjacent excavation units, include Lewis's moonsnail *(Polinices lewisii)* in Unit S14–16/W25–27 and the baetic olive *(Olivella baetica)* in Unit S62–64W62–64.

Differences in shell content are also obvious in the Limpet & Abalone Group (Table 8). Four limpets in the two early assemblages occur in only trace amounts (<0.1%). Eight limpet species were recovered in the late column sample; most of which occur in larger quantities than those in the early assemblages. The ribbed limpet *(Lottia digitalis)*, the most common limpet, is present in a number of layers in Late Column S14–16/W25–27, but in very small amounts. In Late Column S14–16/W25–27 Layer E, indeterminate limpet *(Lottiidae)* material makes up almost 67% of the sample. Two rare limpet species include the shield limpet *(Lottia pelta)* in Late Column S14–16/W25–27 Layer C, and the fenestrate limpet *(Tectura fenestrata)* in Early Column S62–64/W62–64 Layer B only.

Northern abalone *(Haliotis kamtschatkana)* was recovered in two of the three assemblages. In the Late Column S14–16/W25–27, over 34 g of abalone were found in five of six stratigraphic layers; whereas only 0.6 g of the shell was recovered in Early Column S56–57/W50–52 layers B and C. Seven of nine limpet species from the Ts'ishaa shell assemblage are referenced as having been primary or secondary sources of food (Wessen 1994). Northern abalone was consumed as a food, however its primary function was for decorative or ceremonial purposes.

In the sixth major shellfish group, Chiton, the most abundant species are the black katy

Table 8. Relative frequencies by weight of shellfish remains within Limpet and Abalone *(Gastropoda)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Taxa	%	%	%	%	%	%	%	%	%	%	%	%
Acmaea mitra			0.6									
Lottia digitalis	<0.1	<0.1	1.3	<0.1			<0.1	<0.1		25		
Tectura persona	2.2		2.5	33.3								
Tectura scutum	<0.1			<0.1								
Lottia pelta			<0.1									
Tectura fenestrata										25		
Lottiidae	<0.1	<0.1	<0.1	66.6	<0.1	<0.1	<0.1			25		
Diodora aspera	<0.1					<0.1						
Fissurellidea bimarculata			<0.1			<0.1				25		
Haliotis kamtschatkian	97.8	99.9	95.5		99.9	99.9	99.9	99.9				
Wt of all limpet/abalone (100%)	9.0 g	8.8 g	15.7 g	0.3 g	0.3 g	1.3 g	0.2 g	0.7 g	0.0 g	<0.1 g	0.0 g	0.0 g
Group Wt Totals	**35.4 g**						**0.6 g**		**<0.1 g**			

(Katharina tunicata) and giant Pacific or gumboot *(Cryptochiton stelleri)* chitons (Table 9). Both taxa are dominant in the Late Column S14–16/W25–27 assemblage, occurring in five or more of the six stratigraphic layers. Black katy is the most abundant chiton in the late period assemblage, yielding high relative proportions (56% to 75%) in five of six layers. These two chiton species were recovered in much smaller quantities however, in the two early columns. In Early Column S56–57/W50–52, the black katy chiton was common throughout. In Early Column S62–64/W62–64, this chiton was observed in Layer B only.

The giant Pacific chiton, a less common species, was recovered in Early Column S56–57/W50–52 Layer B only. The largest quantity of giant Pacific chiton in Late Column S14–16/W25–27 occurs in Layer E. The mossy chiton *(Mopalia muscosa)* was found in both the Late Column S14–16/W25–27 and Early Column S62–64/W62–64 assemblages, but in very small amounts. Mossy chiton comprised only 1.3% of the group's weight in the Late Column S14–16/W25–27 Layer E and less than 0.1% in Early Column S62–64/W62–64 Layer B. Less than 0.1 g of unidentified lined chiton *(Tonicella* sp.) was recovered, this being limited to Late Column S14–16/W25–27 Layer C. Indeterminate chiton *(Mopaliidae* family) occur in low frequencies in each Late Column S14–14/W25–26 stratigraphic layer, and is less common in the two early columns. Wessen (1994) states that both the mossy and black katy chitons were traditionally taken by the Makah and other Nuu-chah-nulth groups as primary food sources. The giant Pacific chiton was pursued as a secondary food source (Wessen 1994:169; Swan and Ellis 1981).

The seventh and final major shellfish class discussed here is the Sea Urchin Group (Table 10). The extremely friable nature of this shellfish has resulted in spines being the primary recovered material, supplemented with small numbers of test and jaw fragments. This group is dominated by the purple sea urchin *(Strongylocentrotus purpuratus)* and indeterminate sea urchin *(Strongylocentrotus* sp.), both being recovered in almost identical quantities. The indeterminate urchin remains are grey in colour, which may possibly represent modification by natural or cultural processes. As such, the latter could not be identified to the species-level. Both sea urchin species were recovered in all stratigraphic layers in Late Column S14–16/W25–27. Very low quantities of sea urchin were found in Early Column S56–57/W50–52, with almost all remains coming from lower Layer C. Sea urchin was not found in Early Column S62–64/W62–64 samples. Green sea urchin *(Strongylocentrotus droebachiensus)* is present in very small amounts in Late Column S14–16/W25–27 layers A and G only. The gonads of all three sea urchin species were traditionally collected as primary prey (Wessen 1994; Ellis and Swan 1981).

In reviewing the above shell assemblages, the preliminary analysis suggests some interesting shellfish use patterns between the two temporal periods. Column weight data show an increase in two economically important shellfish groups on

Table 9. Relative frequencies by weight of shellfish remains within Chiton *(Polyplacophora)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/ W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Taxa	%	%	%	%	%	%	%	%	%	%	%	%
Cryptochiton stelleri	28.6		40.6	63.2	18.2	28.3	53.8					
Katharina tunicata	67.6	75.0	56.3	30.3	72.7	70.0	46.2	79.7		99.9		
Mopallia muscosa				1.3						<0.1		
Tonicella sp.			<0.1									
Mopaliidae	3.8	25.0	3.1	5.2	9.1	1.7		20.3		<0.1		
Wt of all chiton (100%)	18.2 g	3.2 g	19.2 g	31.0 g	1.1 g	6.0 g	1.3 g	6.4 g		0.2 g		
Group Wt Totals	**78.7 g**						**7.7 g**		**0.2 g**			

Table 10. Relative frequencies by weight of shellfish remains within Sea Urchin *(Strongylocentrotidae)* Group.

	Late Component						Early Component					
	1999 Column Sample S14–16/W25–27						2001 Column Sample S56–57/W50–52		2001 Column Sample S62–64/W62–64			
Layer	A	B	C	E	F	G	B	C	A	B	C	D
Taxa	%	%	%	%	%	%	%	%	%	%	%	%
Strongylocentrotus purpuratus	30.9	52.9	82.2	49.3	<0.1	13.8		38.4				
Strongylocentrotus droebachiensus	0.6					<0.1						
Strongylocentrotus sp	68.5	47.1	17.8	50.7	99.9	86.2	100.0	61.6				
Wt of all sea urchin (100%)	34.9 g	22.5 g	20.8 g	7.3 g	0.3 g	2.9 g	<0.1 g	7.3 g				
Group Wt Totals	**88.7 g**						**7.3 g**		**0.0 g**			

site, clams and barnacles, during later occupation. In the late period, clams increase to 4.3% from a mean of 1.6% during the early period; barnacles increase to 7.9% from a mean of 3.4 per cent. With the data in hand, it is difficult at this time to determine whether this relationship may be in response to dietary or environmental change.

A second observation with respect to inter-assemblage variation is species diversity. In the Late Column S14–16/W25–27 assemblage, 56 shellfish species were identified in its six stratigraphic layers. These species encompassed: 12 bivalves, 34 univalves (including 25 marine snails), five chitons, three sea urchins, and two barnacles. Layer C yielded the highest number of different species, producing 37 shellfish taxa. Layers A and E yielded 36 and 31 species, respectively. Column S14–16/W25–27 Layer B contained only 16 different shellfish species.

In Early Column S56–57/W50–52, 23 different shellfish species were found in stratigraphic layers B and C. These included: five bivalves, 11 univalves (including eight sea snails), three chitons, two sea urchins, and two barnacles. Eighteen species were recovered in upper Layer B, whereas lower Layer C yielded 17. In Early Column S62–64/W62–64, 22 shellfish taxa were observed in its four stratigraphic layers: five bivalves, 12 univalves (including eight marine snails), three chitons, and two barnacles. All 22 species were present in thicker Layer B. Only two to four different taxa were noted in thin stratigraphic layers A, C, and D. Evidence for scallops were not found in the two early column assemblages.

Column Assemblage Descriptions

Each column sample assemblage is discussed individually below. Relative frequencies for all shellfish species identified in each column sample assemblage are presented in Tables 11–13.

Late Component, Column S14–16/W25–27 Assemblage (Main Village, Excavation Area 1)

A total of 32,964.8 g of shellfish remains were examined and analyzed from this column assemblage (Table 11), of which 32,854.7 g (99.7%) were identified to the species, genus, or family level. The single 25 x 25 x 350-cm vertical column sample was collected from the NW corner of a 2 x 2-m unit excavated in 1999. The column comprised 37 level samples, most of which measured 25x25x10 cm in volume. Due to time constraints however, only 12 level samples (71.9 cubic decimetres) were examined (33% sampling fraction by volume). In addition to the mollusc remains, other recovered faunal materials included <0.1 g of fringed tubeworm, 3.7 g of terrestrial snail, and 192.0 g of bone. On average, each examined column level sample (≥3 mm) yielded 458.5 g of shellfish remains and 2.7 g of bone per 1 cubic decimetre (1000 cm^3).

Unit S14–16/W25–27 is one of five 2 x 2-m units excavated in a 2 x 10-m trench in the central part of the village midden (Excavation Area 1). The 1999 column intersected six of seven distinct midden stratigraphic layers (A–C, E–G) observed in its excavation unit. In addition to the column sample, a second shellfish data set was collected during excavation and comprised both hand-collection and screen (¼") materials. The hand-collection data set was examined in 1999–2000 by the researcher, and the results summarised elsewhere (McMillan and St. Claire 2000).

Fifty-six identified species of bivalve and univalve molluscs, chitons, sea urchins, and barnacles are present in the Column S14–16/W25–27 assemblage. Mussels are the most common, encompassing almost 87% of the column by weight (Table 3). Barnacles are the next dominant group (7.9%). Clams, including cockles, account for only 4.3% of the assemblage's shellfish weight. All other major shell groups (marine snail, limpet, chiton, scallop, and sea urchin) contribute less than 1% to the sample weight each.

California mussel *(Mytilus californianus)* is the most dominant shell taxon, comprising 86.6% of the shellfish remains by weight (Table 11). Unidentified clam and butter clam are the most common clam materials, together making up 3.5% of the total sample weight. All other bivalve species contribute to less than 0.8% combined. Column Layer A, which encompasses 36% of the shellfish assemblage by weight, contains the highest frequency of California mussel (32%) and clams (64%) (Figure 1).

In the Marine Snail Group, red turban snail *(Astrea gibberosa)*, channelled dogwinkle *(Nucella canaliculata),* and frilled dogwinkle *(Nucella lamellosa)* are the most dominant species, encompassing over 76% of the group's weight combined. The highest proportions of marine snails were encountered in stratigraphic layers B (30%) and G (33%) (Figure 1). Within the Limpet & Abalone Group, northern abalone *(Haliotis kamtschatkana)* is the chief shell, comprising almost 97% of the group weight. 43% of all abalone was recovered in Layer C. The mask limpet *(Tectura persona)* is the most prevalent limpet found. Traces amounts of various small marine snails were recovered from two midden layers positioned midway down the stratigraphic profile, layers C and E (Table 11).

In the Barnacle Group, various subspecies of acorn barnacle contribute to more than 96% of the group weight. Although none of this family were identified or quantified to the species-level, three dominant species were observed: *Balanus nubilus*, *Semibalanus cariosus*, and *B. glandula*. The gooseneck barnacle *(Pollicipes polymerus)*, a primary food source, is also present (3.5% of group weight). Although the gooseneck barnacle was found in all six layers of Column S14–16/W25–27, it never exceeds 8% of the group's layer weight (Table 5). The majority (60%) of barnacle material was recovered in Layer A (Figure 1).

In the Chiton Group, the giant Pacific *(Crytochiton stelleri)* and black katy *(Katharina tunicata)* are most common chiton species. Recovered in almost equal quantities, higher proportions of giant Pacific chiton were found in stratigraphic Layer E, whereas the majority of black katy chiton was recovered in Layer A (Figure 1).

With respect to the Sea Urchin Group, purple sea urchin and indeterminate sea urchin are the most popular. Almost 40% of the purple sea urchin was recovered in Layer C, whereas over 53% of the indeterminate sea urchin material was found in stratigraphic Layer A.

The relative contributions of the seven major shellfish groups by stratigraphic layer for the Late Period Column S14–16/W25–27 is presented below in Figure 1.

Early Component, Column S56–57/W50–52 Assemblage (Elevated landform)

A total of 5,812.3 g of shellfish remains were retained for analysis from this assemblage (Table 12). Of this sample, 5,804.0 g (99.9%) were identified. The assemblage comprises a

Table 11. Relative frequency of shellfish taxa and data weight by layer (≥3 mm), Late Period Column S14–16/W25–27.

STRATIGRAPHIC LAYER	A	B	C	E	F	G	Taxa Totals	
TAXA								
Bivalvia	%	%	%	%	%	%	Wt	%
Mytilus californianus	78.4	85.4	92.3	95.3	86.3	84.2	28,545.8	86.6
Mytilus trossulus	< 0.1	< 0.1	< 0.1	< 0.1			2.9	< 0.1
Solamen columbianum	< 0.1						< 0.1	< 0.1
Saxidomus gigantea	3.2	2.1	0.3	0.2	< 0.1	0.9	488.9	1.5
Clinocardium nuttallii	< 0.1		< 0.1	< 0.1	0.2		13.1	< 0.1
Tresus capax	0.5		0.2				76.7	0.2
Tresus sp	0.4		0.1		0.5	0.1	61.6	0.2
Protothaca staminea	0.2	0.1	0.4	0.4	0.1	0.3	101.4	0.3
Glycymeris septentrionalis	< 0.1						4.5	<0.1
Hiatella sp	<0.1		<0.1	<0.1	<0.1		1.4	<0.1
Glans carpenteri	<0.1						<0.1	<0.1
Unidentified Clam	<0.1	1.7	0.7	0.3	5.1	3.3	665.4	2.0
Crassadoma gigantea				<0.1			0.4	<0.1
Gastropoda								
Nucella canaliculata	<0.1	0.1	0.1	<0.1	<0.1	0.1	12.0	<0.1
Nucella emarginata			<0.1				0.2	<0.1
Nucella lamellosa			<0.1	0.1		0.1	9.4	<0.1
Nucella lima			<0.1				1.5	<0.1
Nucella sp	<0.1						<0.1	<0.1
Astrea gibberosa		2.1	<0.1	<0.1	<0.1	0.7	54.8	0.2
Tegula funebralis	<0.1	<0.1					3.0	<0.1
Tegula pulligo	<0.1		<0.1				1.5	<0.1
Ceratostoma foliatum					<0.1		<0.1	<0.1
Crepidula sp			<0.1				<0.1	<0.1
Crepidula adunca			<0.1	<0.1			<0.1	<0.1
Crepidula nummaria				<0.1			<0.1	<0.1
Amphissa columbiana			<0.1				0.3	<0.1
Amphissa sp			<0.1	<0.1			0.2	<0.1
Lirularia sp	<0.1						<0.1	<0.1
Littorina sitkana	<0.1			<0.1			<0.1	<0.1
Littorina scutulata	<0.1					<0.1	0.1	<0.1
Bittium eschrichtii	<0.1						<0.1	<0.1
Bittium sp			<0.1	<0.1			0.3	<0.1
Ocenebra lurida				<0.1			<0.1	<0.1
Ocenebra interfossa			<0.1				<0.1	<0.1
Searlesia dira				<0.1			<0.1	<0.1
Alia gausapala	<0.1		<0.1	<0.1			<0.1	<0.1
Lacuna variegata	<0.1		<0.1	<0.1		<0.1	0.1	<0.1
Turbonilla sp	<0.1						<0.1	<0.1
Indeterminate marine snail	<0.1	<0.1	<0.1	<0.1	0.8	0.1	16.4	<0.1
Acmaea mitra			<0.1				0.1	<0.1
Lottia digitalis	<0.1	<0.1	<0.1	<0.1			0.2	<0.1
Tectura persona	<0.1		<0.1	<0.1			0.7	<0.1
Tectura scutum	<0.1			<0.1			<0.1	<0.1
Lottia pelta			<0.1				<0.1	<0.1
Lottiidae	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1
Diodora aspera	<0.1					<0.1	<0.1	<0.1
Fissurellidea bimarculata			<0.1			<0.1	<0.1	<0.1
Haliotis kamtschatkana	0.1	0.7	0.2		<0.1	<0.1	34.2	0.1
Polyplacophora								
Cryptochiton stelleri	<0.1		0.1	0.3	<0.1	0.1	34.5	0.1
Katharina tunicata	0.1	0.2	0.1	0.1	<0.1	0.1	39.9	0.1
Mopalia muscosa				<0.1			0.4	<0.1
Tonicella sp.			<0.1				<0.1	<0.1
Mopaliidae	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.9	<0.1
Echinoidea								
Strongylocentrotus purpuratus	0.1	0.9	0.2	0.1	<0.1	<0.1	43.8	0.1
Strongylocentrotus droebachiensus	<0.1					<0.1	0.2	<0.1
Strongylocentrotus sp	0.2	0.8	<0.1	0.1	<0.1	0.1	44.7	0.1
Cirripedia								
Archaeobalanidae/Balanidae	12.6	5.2	4.9	2.7	4.2	8.5	2498.2	7.6
Pollicipes polymerus	0.5	0.5	0.1	0.1	<0.1	0.1	91.7	0.3
Unidentified Shell	0.3	0.2	0.1	0.2	1.3	1.2	110.1	0.3
Total Marine Invertebrates Wt (100%)	**11,784.6 g**	**1,329.8 g**	**8745.7 g**	**6,593.5 g**	**1,198.2 g**	**3,313.0 g**	**32,964.8 g**	**100%**
Fringed tube worm Wt			< 0.1 g	< 0.1 g			< 0.1 g	
Terrestrial snail Wt	0.4 g	1.1 g	2.2 g	< 0.1 g			3.7 g	
Bone Wt	23.7 g	74.4 g	39.4 g	13.4 g	16.1 g	18.3 g	192.0 g	

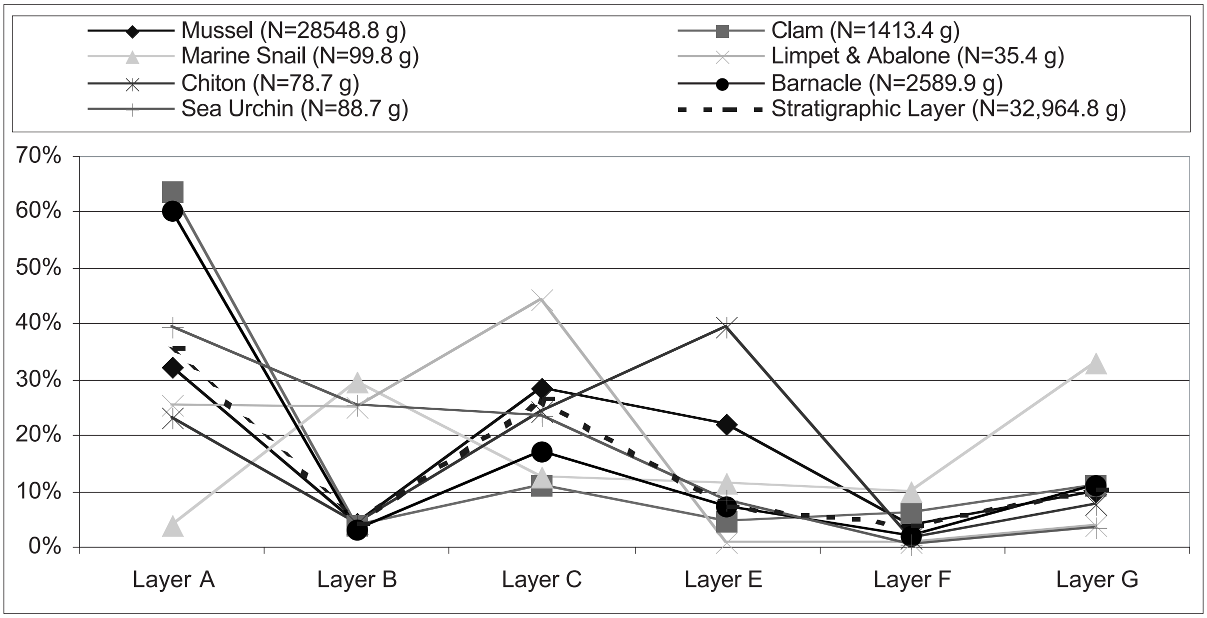


Figure 1. Relative contribution of major shellfish groups by stratigraphic layer, Late Period Column S14–16/W25–27 assemblage.

Table 12. Relative frequency (%) of shellfish taxa and data weight by layer (≥3 mm), Early Period Column S56–57/W50–52 assemblage.

STRATIGRAPHIC LAYER	B	C	Taxa Totals	
TAXA				
Bivalvia	%	%	Wt	%
Mytilus californianus	92.5	93.4	5,402.1	92.9
Mytilus trossulus		<0.1	<0.1	<0.1
Saxidomus gigantea	0.1	<0.1	1.9	<0.1
Protothaca staminea	0.2	0.1	9.0	0.2
Glycymeris septentrionalis		<0.1	0.2	<0.1
Hiatella sp	<0.1		<0.1	<0.1
Unidentified Clam	1.3	0.9	64.9	1.1
Gastropoda				
Nucella canaliculata	0.1	0.1	3.6	0.1
Nucella emarginata	<0.1	<0.1	0.5	<0.1
Nucella lamellosa	<0.1	<0.1	0.4	<0.1
Nucella sp		<0.1	<0.1	<0.1
Astrea gibberosa	0.1		2.7	<0.1
Littorina sitkana	<0.1		<0.1	<0.1
Ocenebra lurida	<0.1		<0.1	<0.1
Searlesia dira		<0.1	<0.1	<0.1
Indeterminate marine snail	<0.1	<0.1	1.9	<0.1
Lottia digitalis	<0.1	<0.1	<0.1	<0.1
Lottiidae	<0.1		<0.1	<0.1
Haliotis kamtschatkana	<0.1	<0.1	0.6	<0.1

STRATIGRAPHIC LAYER	B	C	Taxa Totals	
TAXA				
Polyplacophora	%	%	Wt	&
Cryptochiton stelleri	<0.1		0.7	<0.1
Katharina tunicata	<0.1	0.2	5.7	0.1
Mopallidae		<0.1	1.3	<0.1
Echinoidea				
Strongylocentrotus purpuratus		0.1	2.8	0.1
Strongylocentrotus sp	<0.1	0.2	4.5	0.1
Cirripedia				
Archaeobalanidae/ Balanidae	5.3	4.5	286.1	4.9
Pollicipes polymerus	0.3	0.3	15.1	0.3
Unidentified Shell	0.1	0.2	8.3	0.1
Total Marine Invertebrate Wt (100%)	**2,943.6 g**	**2,868.7 g**	**5,812.3 g**	**100%**
Fringed tube worm Wt	<0.1 g		<0.1 g	
Terrestrial snail Wt		0.5 g	0.5 g	
Bone Wt	11.4 g	23.9 g	35.3 g	
Non-Fauna Wt	564.9 g	2,649.2 g	3,214.1 g	

single 10 x 10 x 249-cm vertical sediment column collected midway along the south wall of 1 x 2-m Excavation Unit S56–57/W50–52. This unit, excavated in 2001, was located towards the front of an elevated landform situated behind the village midden. The column consisted of 25 level samples. The upper 24 level samples measured 1 cubic decimetre (1000 cm^3) in volume; the basal level measured 900 cubic centimetres. Due to time constraints, only the 13 odd-numbered level samples (12.9 cubic decimetres) were examined (52% sampling fraction).

The column encompassed all three stratigraphic layers (A, B, C) observed in the 1 x 2-m unit. Layer A is a thin shell-free Ah soil horizon that caps upper midden Layer B. Almost 51% of the shellfish sample weight was from Layer B. In addition to the shellfish remains, other sample constituents included: fringed tubeworm (<0.1 g), terrestrial snail (0.5 g), vertebrate fauna (35.3 g), and non-fauna material (3,214.1 g) (Table 12). On average, each examined column level sample (≥3 mm) yielded 450.6 g of shellfish remains, 2.7 g of bone, and 249.3 g of non-fauna material per 1 cubic decimetre (1000 cm^3).

Twenty-three species of bivalve and univalve molluscs, chitons, sea urchins, and barnacles were identified in the assemblage (Table 12). Mussels are the most prevalent group, contributing 92.9% of the column sample weight. Next is the Barnacle Group, representing 5.2% of the total assemblage weight (Table 3). Clams are less frequent, making up only 1.3% of the total sample weight. The Marine Snail, Limpet, Chiton, and Sea Urchin groups are also poorly represented, each consisting of less than 0.2% of the total sample weight. Scallops are not present in the column assemblage.

In the Mussel Group, California mussel *(Mytilus californianus)* is the most common mussel taxon (Table 4). It encompasses almost all the group by weight, except for <0.1% of foolish mussel *(Mytilus trossulus)* in Layer C. Just over 50% of all mussel was recovered in upper Layer B (Figure 2). In layers B and C, *Archaeobalanidae* and *Balanidae* materials make up 94.6% and 95.3% of the Barnacle Group shell weight respectively (Table 5). Column Layer B yielded approximately 55% of the barnacle material.

Four identified clam species and an unidentifiable category are present in the Clam Group. Of these five however, only three clams exceed 1% of the group by weight: butter, littleneck, and unidentified clam (Table 6). Almost 61% of all clam occurred in Layer B (Figure 2). Unidentified clam, which more than likely contains a high proportion of broken butter and possible horse clam valves without hinges or umbones, is the most prevalent clam material in both stratigraphic layers. In layers B and C, unidentified clam remains comprise 82.0% and 90.7% of the group shell weight respectively (Table 6).

The relative frequency values for the other major shell groups in Early Column S56–57/W50–52 are summarised in Tables 7–10. Within the Marine Snail Group, the most common taxa are the red

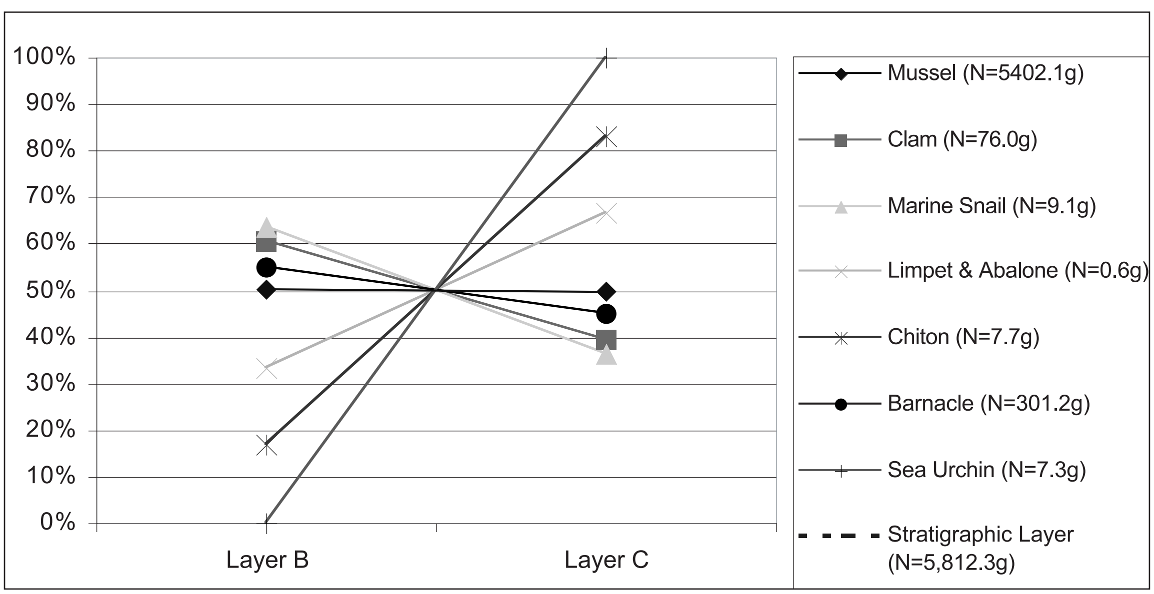


Figure 2. Relative contribution of major shellfish groups by stratigraphic layer, Early Period Column S56–57/W50–52 assemblage.

turban snail (46.6%) in Layer B and the channelled dogwinkle (48.5%) in Layer C. Limpets are poorly represented, with northern abalone comprising more than 99% of the Limpet & Abalone Group weight for each layer. The giant Pacific (53.8%) and black katy (46.2%) represent the chiton remains in Layer B. The dominant chiton species in Layer C is the black katy *(Katharina tunicata)* (79.7%). Indeterminate sea urchins dominate the Sea Urchin Group.

The relative contributions of all major shellfish groups by stratigraphic layer in the Early Period Column S56–57/W50–52 assemblage are presented in Figure 2.

Early Component, Column S62–64/W62–64 Assemblage (Elevated landform)

Of the 4,885.2 g of mollusc remains examined in this assemblage, 4874.4 g (99.8%) were identified to species, genus, or family (Table 13). The assemblage was collected from a single 20 x 20 x 88-cm vertical sediment column positioned midway along the north wall of 2 x 2-m Excavation Unit S62–64/W62–64. The unit was excavated approximately 11 m southwest of Unit S56–57/W50–52 in 2001, on an elevated landform positioned behind the main village. Eleven sediment samples from nine levels make up the column. Nine of the 11 sediment samples measured 20 x 20 x 10-cm in size; two measured less: 20 x 20 x 4 cm and 20 x 20 x 8 cm. Due to time constraints, only the five odd-numbered level samples (20 cubic decimetres total) were examined (55% sampling fraction by volume).

The column sample intersected all four distinct stratigraphic layers (A, B, C, D) occurring in its adjoining 2 x 2-m excavation unit. (A second shellfish assemblage, comprising hand-collected samples of level/screen marine vertebrate remains, was collected but is not reviewed here). Stratigraphic layers B and C encompass the largest proportions

Table 13. Relative frequency of shellfish taxa and data weight by layer (≥ 3 mm), Early Period Column S62-64/W62-64 assemblage.

STRATIGRAPHIC LAYER	A	B	C	D	Taxa Totals	
TAXA						
Bivalvia	%	%	%	%	Wt (g)	%
Mytilus californianus	91.8	95.9	95.6	95.2	4,681.2	95.8
Mytilus trossulus		<0.1			<0.1	<0.1
Saxidomus gigantea		0.6			22.7	0.5
Tresus sp		<0.1			1.0	<0.1
Protothaca staminea		0.2			8.1	0.2
Unidentified Clam	4.7	1.4	0.6	0.3	61.2	1.3
Gastropoda						
Nucella canaliculata		<0.1	<0.1	0.4	2.5	0.1
Nucella emarginata		<0.1			0.2	<0.1
Nucella lamellosa		<0.1			0.5	<0.1
Astrea gibberosa		0.6			23.8	0.5
Crepidula sp		<0.1			<0.1	<0.1
Crepidula adunca		<0.1			0.6	<0.1
Amphissa columbiana		<0.1			0.2	<0.1
Littorina sitkana		<0.1			<0.1	<0.1
Indeterminate marine snail		<0.1	<0.1	<0.1	1.3	<0.1
Lottia digitalis		<0.1			<0.1	<0.1
Tectura fenestrata		<0.1			<0.1	<0.1
Lottiidae		<0.1			<0.1	<0.1
Fissurellidea bimarculata		<0.1			<0.1	<0.1
Polyplacophora						
Katharina tunicata		<0.1			0.2	<0.1
Mopalia muscosa		<0.1			<0.1	<0.1
Mopaliidae sp.		<0.1			<0.1	<0.1
Cirripedia						
Archaeobalanidae/Balanidae	3.5	0.9	3.3	3.0	64.9	1.3
Pollicipes polymerus		0.1	0.1	0.6	6.0	0.1
Unidentified Shell		0.2	0.4	0.6	10.8	0.2
Total Marine Invertebrate Wt (100%)	**17.0 g**	**3,964.6 g**	**796.3 g**	**107.3 g**	**4,885.2 g**	**100%**
Terrestrial snail Wt		0.9 g			0.9	
Bone Wt	0.6 g	18.2 g	7.4 g	5.2 g	31.4 g	
Non-Fauna Wt	1,892.4 g	860.4 g	1,086.7 g	415.3 g	4,254.8 g	

of the assemblage shellfish weight, comprising 81.2% and 16.3% respectively (Figure 3). In addition to the shellfish remains, other column sample constituents included terrestrial snails (0.9 g), vertebrate fauna (31.4 g), and non-fauna material (4,254.8 g) (Table 13). On average, each examined column level sample (≥3 mm) yielded 244.3 g of shellfish remains, 1.6 g of bone, and 212.7 g of non-fauna material per 1 cubic decimetre (1000 cm^3).

Twenty-two species of bivalve and univalve molluscs, chitons, and barnacles are identified in Early Column S62–64/W62–64. Major shellfish groups include Mussel (95.8%), Clam (1.9%), and Barnacle (1.5%) (Table 3). Other major shell classes, Marine Snail, Limpet & Abalone, Chiton, and Barnacle, contribute less than 1% of the sample by weight each. Sea urchins and scallops were not observed in the column samples.

California mussel *(Mytilus californianus)* is the most frequent species in the Mussel Group by weight. This shell represents the entire Mussel Group except for a trace of foolish mussel *(Mytilus trossulus)* recovered in Layer B (Table 4). Over 81% of the mussel material was recovered in thick Layer B (Figure 3).

Within the Clam Group (Table 6), only three were identified to the species-level. The three identified clam species occur in Layer B only. Butter clam is the most common identified clam (26.1% of layer weight). Other identified clams in Layer B include native littleneck (9.3%) and horse clam (1.1%). As in the other assemblages, unidentified clam represents the most abundant material in this group, comprising 65.8% of the group weight. Unidentified clam material makes up 63.4% of the Layer B clam by weight and 100% of layers A, C, and D.

The abundance of barnacles in this column assemblage is very low by comparison to the other two assemblages (Tables 3 and 5). *Archaeobalanidae* and *Balanidae* materials are the most common, comprising 92% of the group by weight. Small amounts of gooseneck barnacle *(Pollicipes polymerus)* were recovered in three layers, most of which occurred in lower stratigraphic layer D. The largest quantities of barnacle occur in Layers B (56.3%) and C (37.5%) (Figure 3).

Eight identified marine snails are present in the assemblage's Marine Snail Group, almost all being restricted to Layer B (Table 13). The red turban snail *(Artrea gibberosa)* is the most abundant, encompassing 81.7% of the group by weight. Smaller amounts of dogwinkle *(Nucella canaliculata* 6.9%, *N. lamellosa* 1.8%) and slippersnail *(Crepidula adunca* 2.2%) can also be found in Layer B. The channelled dogwinkle *(Nucella canaliculata)* and indeterminate marine snail represent the only snails in lower layers C and D.

Only three species in the Chiton Group are

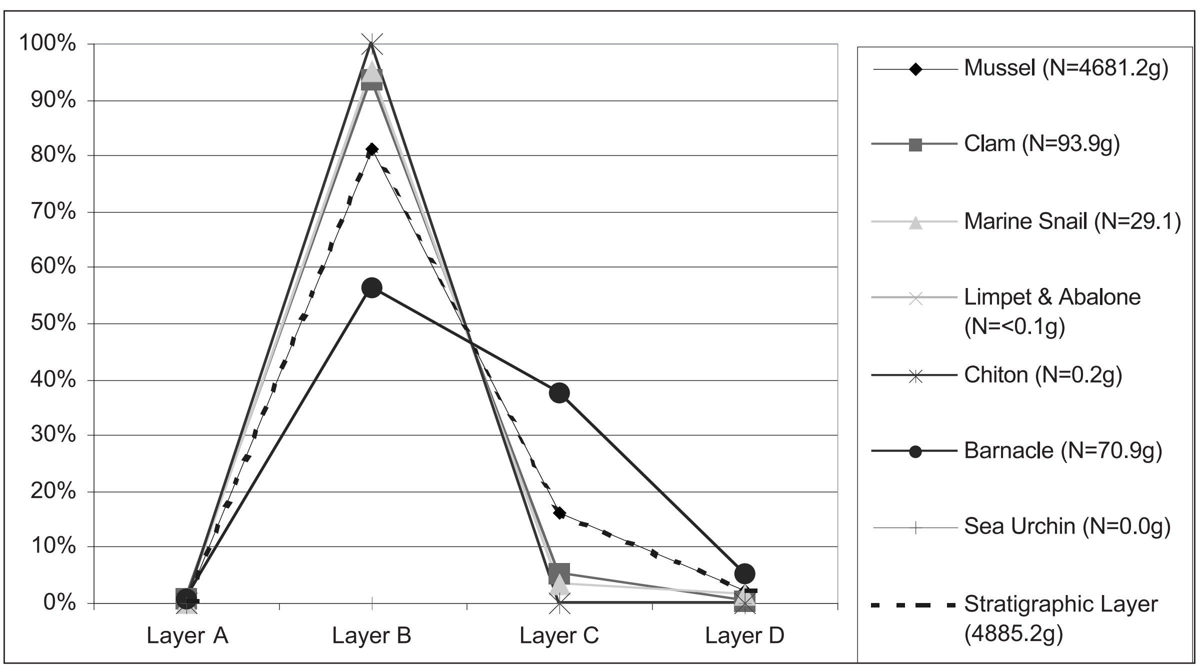


Figure 3. Relative contribution of major shellfish groups by stratigraphic layer, Early Period Column S62–64/W62–64 assemblage.

present in Column S62–64/W62–64: black katy *(Katharina tunicata)*, mossy chiton *(Mopalia muscosa)*, and indeterminate chiton *(Mopallidae)*. All three taxa occur in extremely low quantities and are present in Layer B only. The most abundant chiton by weight is the black katy chiton at 0.2 g (Table 13). The mossy chiton and indeterminate chiton contribute less than 1% to the Chiton Group weight (Table 9). Only trace amounts of four limpet species, ribbed *(Lottia digitalis)*, 2-spot keyhole *(Fissurellidae bimarculata)*, fenestrate limpet *(Tectura fenestrata)*, and indeterminate limpet *(Lottiidae)* were observed in this column, each weighing less than 0.1 gram.

The relative contributions of all major shellfish groups by stratigraphic layer in the Early Period Column S62–64/W62–64 assemblage are presented below in Figure 3.

Other Quantitative and Interpretative Studies

In the preceding section, the taxonomic compositions of three shellfish assemblages were examined. In addition, the researcher carried out further analytical and quantitative studies to enhance the understanding and interpretation of the three shellfish data sets. These other studies relate to: grain size distributions (stratigraphic texture), bivalve umbo counts, dietary contributions, habitat exploitation, and species ubiquity. Each is discussed below.

Grain Size Distributions

This discussion examines the grain or mesh size distributions of shellfish taxa in the stratigraphic layers of each column assemblage. With the view that various shellfish taxa enter the archaeological record in different sizes, this study explores the relationship between shell taxa and grain size distributions (stratigraphic texture). The benefits in comparing specific taxa and grain size classes, and the information generated concerning site formation processes has been highlighted recently in the archaeological literature (Classen 1998), particularly Ford (1992) and other shell midden researchers on the Northwest Coast (Hanson 1991, Keen 1990, Muckle 1986).

The data below represent relative abundances and weights of selected shellfish groups passed through a series of nested sieves. Four mesh size classes were used to entrap the shellfish specimens: 25 mm (1"), 12.5 mm (½"), 6.3 mm (¼") and 3 mm (⅛"). The shellfish data sets include the same column matrix samples discussed in the previous section, with one exception: Level 35 sediment sample from 1999 Column S14–16/W25–27, Layer G. Time restrictions did not allow for the sorting of constituents in this large 3-mm mesh sample. The three column shellfish data sets and their respective sample weights include: 1999 Late Period column S14–16/W25–27 assemblage, 31,683.3 g; 2001 Early Period column S56–57/W50–52 assemblage, 5,812.3 g; and 2001 Early Period column S62–64/W62–64 assemblage, 4,885.2 g.

A general description highlights the grain size distribution patterns as calculated for four shell groups from each column assemblage. The grain size distributions are presented as line graphs based upon proportional (%) weight data of each shell within the four size classes. The shellfish groups include: California mussel, barnacles, clam, and all shell.

California Mussel. The California mussel *(Mytilus californianus)* is one of the most prevalent rocky shore mollusc species present in the open, exposed environs of Barkley Sound. Shell weight data in the preceding section indicate that the taxon is the most significant contributor to all column assemblages, thus emphasising its dietary and economic importance. The relative value of this mussel species does not change through time. It is the most common shell in all midden layers, in each column assemblage. California mussel comprises 87% to 96% of the shellfish assemblages by weight (Tables 11, 12, 13). This subsistence and exploitation pattern is characteristic of invertebrate assemblages found at open coast archaeological sites along the Northwest Coast.

Traces of a second *Mytilus* species, the foolish mussel *(Mytilus trossulus)*, were also identified in the samples, but this taxon was limited to less than 3.0 g by total sample weight. Large quantities of fragmented indeterminate *Mytilus* material were present in the samples. Extremely friable, these pieces often measured less than 2 mm thick. In view of the insignificant numbers of foolish mussel quantified (shell weights, umbo counts) and observed in the assemblages, the indeterminate mussel remains were combined with the California mussel data.

Figure 4 illustrates the distributions of California mussel by grain size (mesh size) for each of the three column assemblages. The graphs show that the shell entered the midden deposits in all four grain sizes, with the highest proportions found

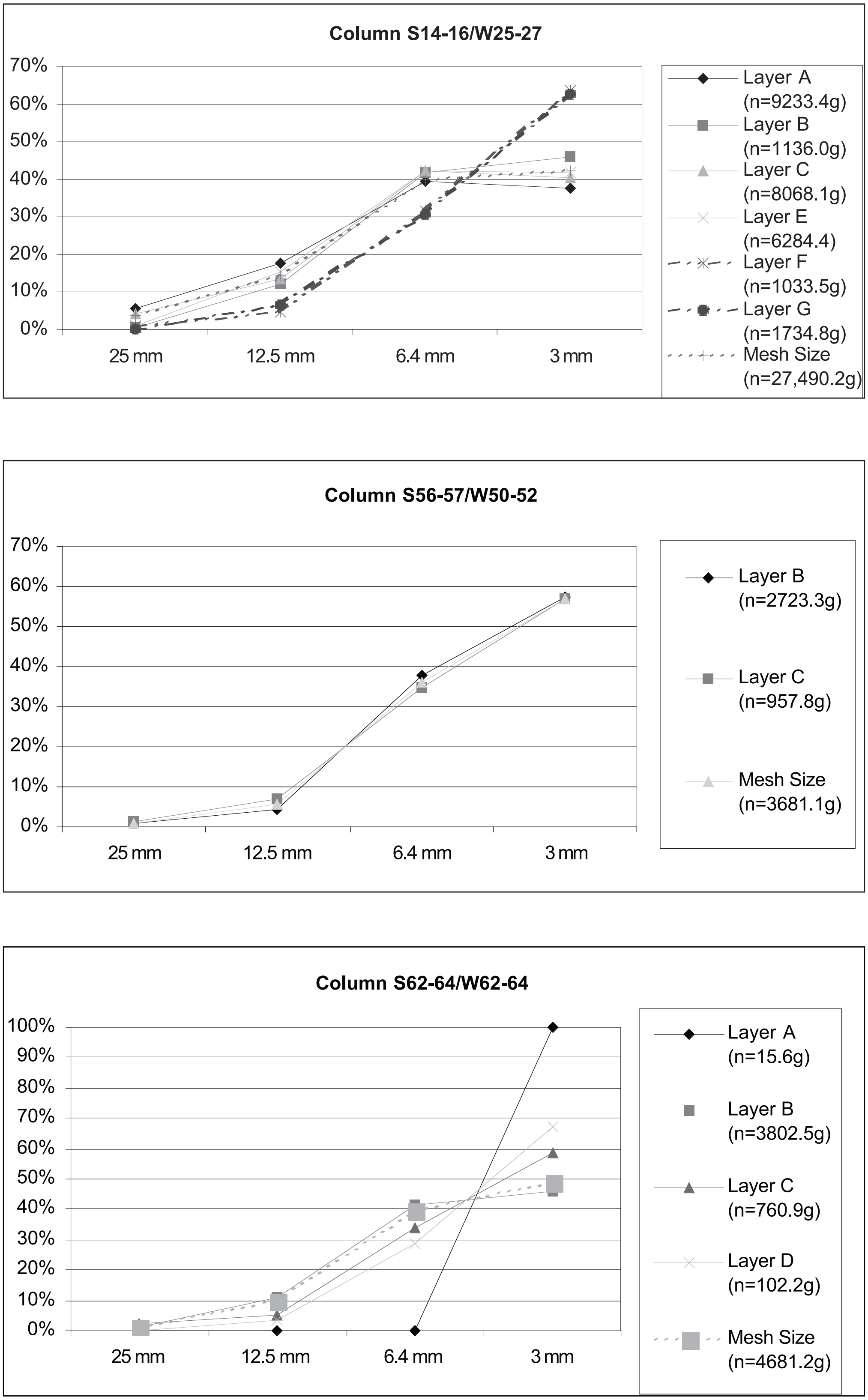


Figure 4. Grain size distributions of California mussel *(Mytilus californianus)* by stratigraphic layer, all assemblages.

in the 3-mm mesh. In some layers, California mussel was not recovered in the largest fraction, 25-mm mesh. In one instance, Early Column S62–64/W62–64 Layer A, fragments of mussel were present in the 3-mm mesh only. Because of the very fragile nature of the California mussel, no specimens were recovered whole.

Variations in shell grain size patterns are evident when the late and early assemblage distributions and frequencies are compared. The data indicate that larger mussel valve fragments are more frequent in the Late Column S14–16/W25–27 assemblage. Almost 18% of the mussel material in this column is 12.5 mm in size and larger; over 82% measures 6.4 mm or less. Surprisingly, upper Layer A in Column S14–16/W25–27 contained the highest proportion (23.4%) of mussel fragments measuring 12.5 mm or larger. This pattern may indicate that the upper layer of cultural deposits in this particular location of the midden received larger, more complete mussel specimens and/or was subjected to less trampling and other post-deposition processes. The largest quantity of small-size (3-mm mesh) mussel materials were found in the lower reaches of the midden, in layers F and G. Together, both layers yielded over 62% of the total column mussel sample weight. The high occurrence of smaller sized mussel material in these lower layers may be due to sediment compaction or food processing activities.

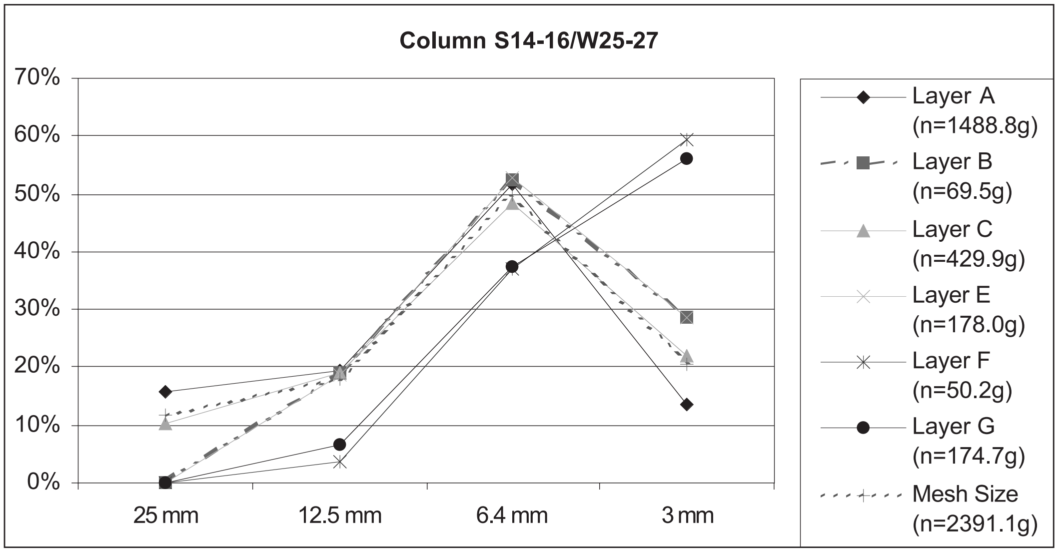
Different breakage or depositional patterns concerning California mussel can be found in the two early period column assemblages: the texture of mussel in all stratigraphic layers tend be more fragmented, containing higher amounts of smaller materials measuring 6.4 mm in size or less. In Early Column S56–57/W50–52, over 93% of the California mussel was recovered from the two smaller meshes, 57.1% in the 3-mm mesh alone. The two midden layers found in Column S56–57/W50–52 are very simiIar in texture, with values for the two smaller fraction materials ranging from 94.9% and 91.6% in layers B and C respectively. In Early Column S62–64/W62–64, 11.3% of this mussel shell was captured in the two larger fraction sizes; 88.7% was recovered in the two smallest meshes (49.9% in 3-mm mesh only). The highest quantities of 3 mm mesh mussel in Column S62–64/W62–64 were recovered in upper Layer A (100%) and lower Layer D (67.5%). These values may be the result of post-deposition crushing or compaction. Furthermore, frequencies in Layer A may be skewed by its low sample weight (15.6 g).

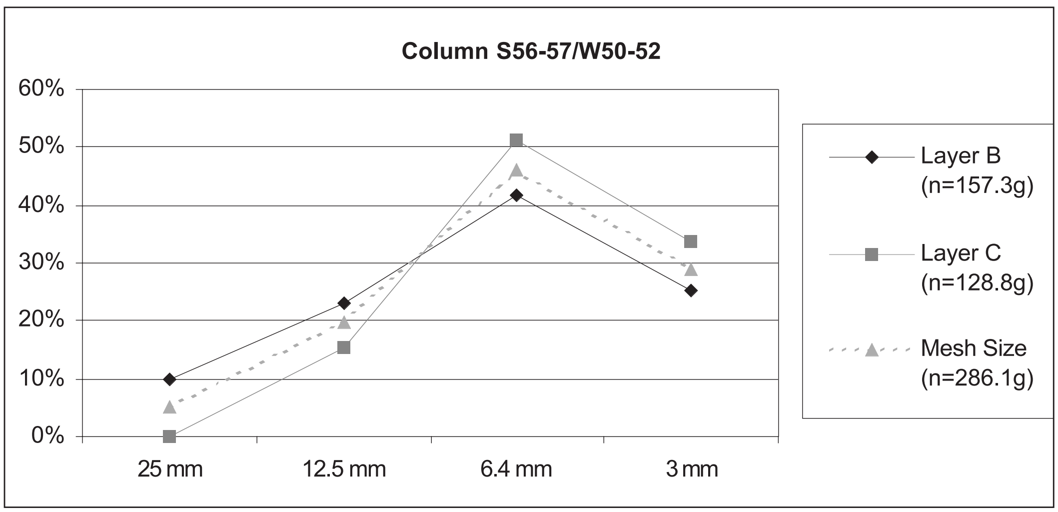
Acorn Barnacle Acorn barnacles, comprising species of the *Archaeobalanidae* and *Balanidae* families, are the second largest shell group by weight at Ts'ishaa after California mussel. At present, acorn barnacles can be found in abundance over the broad range of microenvironments and exposed, outside rocky shores in the sound. Based on Makah and Nuu-chah-nulth ethnohistoric data, Wessen (1994b:354) relates that traditionally, the acorn barnacle was a secondary prey species, a main food resource "collected in more casual, fortuitous, and less systematic manners" (Wessen 1994a:148). Acorn barnacles would have also likely entered the site area inadvertently as by-products of other activities.

Although barnacle specimens in the assemblage were not identified or quantified to the genus- or species-level, observed species included: *Balanus nubilus, Semibalanus cariousus*, *B. glandula*, *B. crenatus*, and probably other species. The acorn barnacle remains, comprising basal, body, and opercular plates, are largely fragmented.

Relative frequencies for this shell group vary between assemblages, ranging from 7.6% of the total shellfish weight in the Late Column S14–16/W25–27 assemblage, to 1.3% in the Early Column S62–64/W62–64, hinting that the dietary importance of barnacle may be possibly changing through time. The grain size distributions of acorn barnacles by layer for each assemblage are presented in Figure 5. Acorn barnacle remains are present in all stratigraphic layers sampled, and most often measure less than 25 mm in size. In all assemblages, barnacle materials were most common in the 6.4 mm mesh size.

When we examine the Late Column S14–16/W25–27, almost 50% of the acorn barnacles were found in the 6.4-mm size class. High values for remains in this fraction size occur in the upper four layers, ranging from 49% to 53% of the sample weight data. Figure 5 indicates that the quantity of barnacle remains in the 3-mm mesh size class tend to increase through time, possibly suggesting that more smaller sized specimens in the lower layers of Column S14–16/W25–27 were entering the site, or that the acorn barnacle materials in these lower layers are more susceptible to degradation from post-depositional processes caused by natural (organic acids, increased ground water, poorer preservation, sediment compaction) or cultural (i.e., trampling) factors. The abundance of larger sized barnacle materials, 12.5- and 25-mm meshes, were found to vary by layer. Materials in the two larger meshes range from 3.8% in





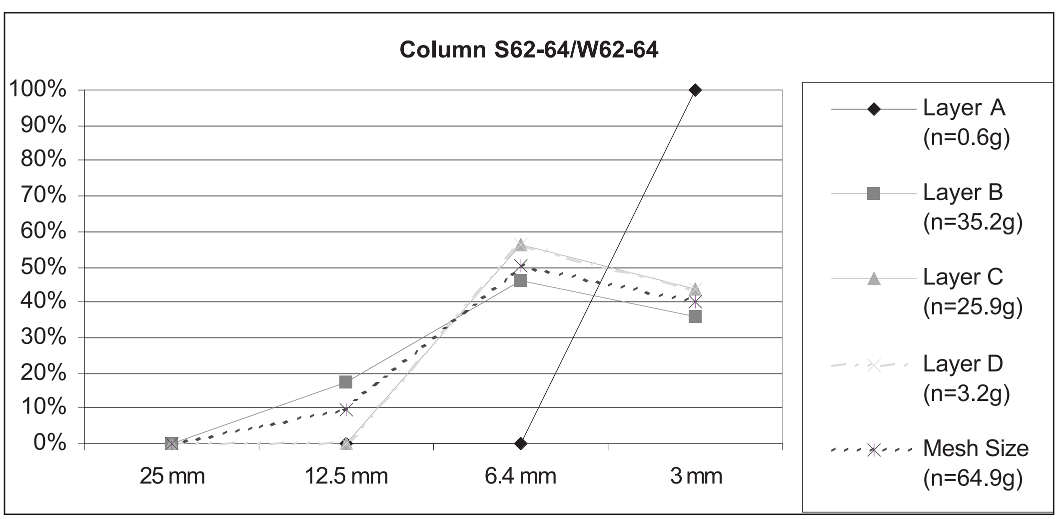


Figure 5. Grain size distributions of acorn barnacle *(Archaeobalanidae, Balanidae)* by stratigraphic layer, all assemblages.

Late Column S14–16/W25–27 Layer F to 35% in Layer A.

Some differences in the grain-size distributions of barnacle materials in Early Column S56–57/W50–52 layers B and C are evident. Over 32% of Layer B barnacle is 12.5 mm or larger, decreasing to 15.5% in lower Layer C. In total, 75% of all acorn barnacles in Column S56–57/W50–52 were recovered in the two smallest size meshes. In the second early assemblage, Column S62–64/W62–64, over 90% of the barnacle remains were recovered from the two smallest meshes. The largest sized barnacle in this column was recovered from the 12.5 mm mesh. The 12.5 mm barnacle material contributes over 17% of Layer B barnacle by weight. A very small amount of acorn barnacle (0.6 g) in Layer A was recovered from the 3-mm mesh.

Clams The third most frequent invertebrates at Ts'ishaa are clams. The most dominant species is the butter clam *(Saxidomus gigantea)*. Other notable clams in the site assemblages include the horse *(Tresus capax, Tresus sp.)* and native littleneck *(Protothaco staminea)* clam. Past biophysical studies reveal that butter and native littleneck clams are the most abundant sediment beach-dwelling clam species in the Broken Group Islands (Lee and Bourne 1977:30). Butter, horse, and native littleneck clams inhabit mud and gravel beaches and bars found in less exposed environments in the sound.

A marine resource inventory conducted in Pacific Rim Park Reserve during the mid-1970s revealed that nearby Clarke Island represents one of nine major bivalve population sites in the Broken Group Islands (Lee and Bourne 1977). On Clarke Island, native littleneck and butter clams can be found on gravel beaches and bars in substantial to moderate quantities. Lee and Bourne report that the northwest corner of Clarke Island is the only site in the Broken Group Islands Unit yielding a high percentage of legal-sized butter clams (1977:30).

The clam data examined here comprises the combined weight values of three identifiable species (butter clam, horse clam, native littleneck clam) and one unidentifiable category (most likely butter and horse clams). These weights are lumped together in order to enhance the sample size caused by the low counts of key clam species, and to minimise skewing due to species identification problems.

Figure 6 shows the distributions of clams by mesh size for each assemblage. The graphs reveal that clams entered the deposit in all four sizes. All three identified shell species are robust and vary from moderate to large in size. Nevertheless, complete clam valves were limited to a very small number of specimens (butter and native littleneck clams) in the Late Column S14–16/W25–27 assemblage. No complete butter and native littleneck clams were recovered in Early Columns S56–57/W50–52 and S62–64/W62–64. No whole horse clams were observed.

Variations in clam shell-grain size patterns are evident when the early and late assemblage distributions and frequencies are compared. Fraction size data shows that larger clam valve fragments are more common in the Late Column S14–16/W25–27 assemblage. Almost 72% of the clams by weight in the late assemblage were recovered in the two largest mesh sizes, with 52.7% found in the 25 mm mesh size alone. The upper three stratigraphic layers (A, B, C) in the late assemblage contain the highest relative frequency of large fraction materials, decreasing in values as one proceeds down through the cultural stratum. A high proportion of 12.5-mm material (61.6%) can be found in Layer F.

Smaller clam fragments are more abundant in the two earlier assemblages, with most material being recovered in the 12.5- and 6.4-mm meshes. Different distribution patterns can be seen in Early Column S56–57/W50–52 layers B and C. Most noteworthy is the high proportion of larger, 25-mm mesh size clam specimens (32.4%) in upper Layer B. Almost 55% of the clam samples in Column S56–57/W50–52 were recovered in the two largest meshes. Figure 6 show that Early Column S62–64/W62–64 contains the least amount of larger sized clam material. Over 54% of the clam in this column was recovered in the two smallest meshes. The small clam sample sizes from these two early assemblages however, limit the level of confidence.

All Shell The grain size distributions or sediment textural attributes for all shell from the three column assemblages and their affiliated stratigraphic layers are graphed in Figure 7. The data reveal that only small proportions of all shell were found in the two largest sized meshes (25 mm, 12.5 mm). In Late Column S14–16/W25–2, only 21% of all shell recovered measured 12.5 mm or larger. Distribution values for the same larger-sized materials in the two early period columns are much smaller, encompassing 8% and 12% of the two samples by weight respectively.

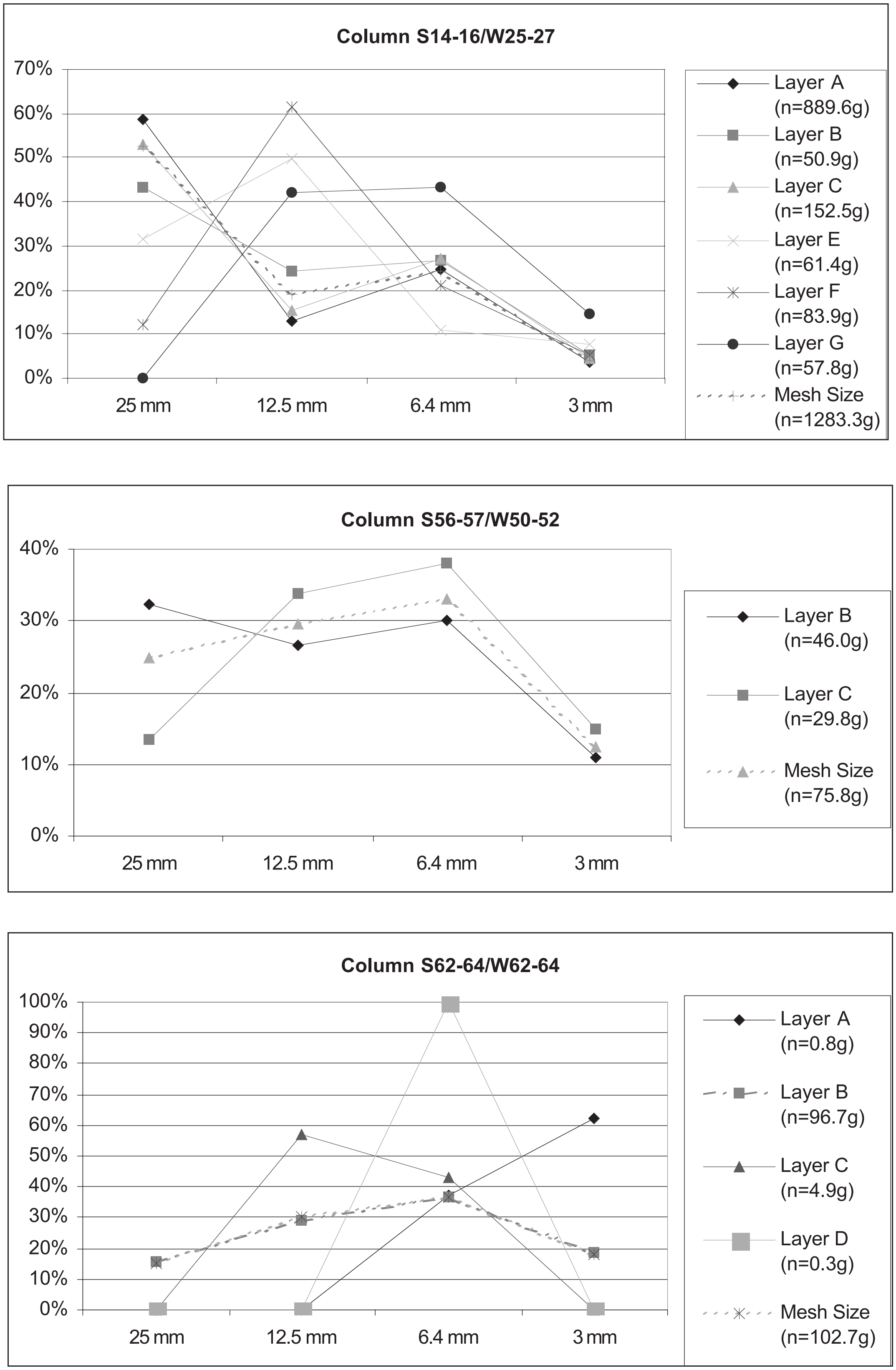
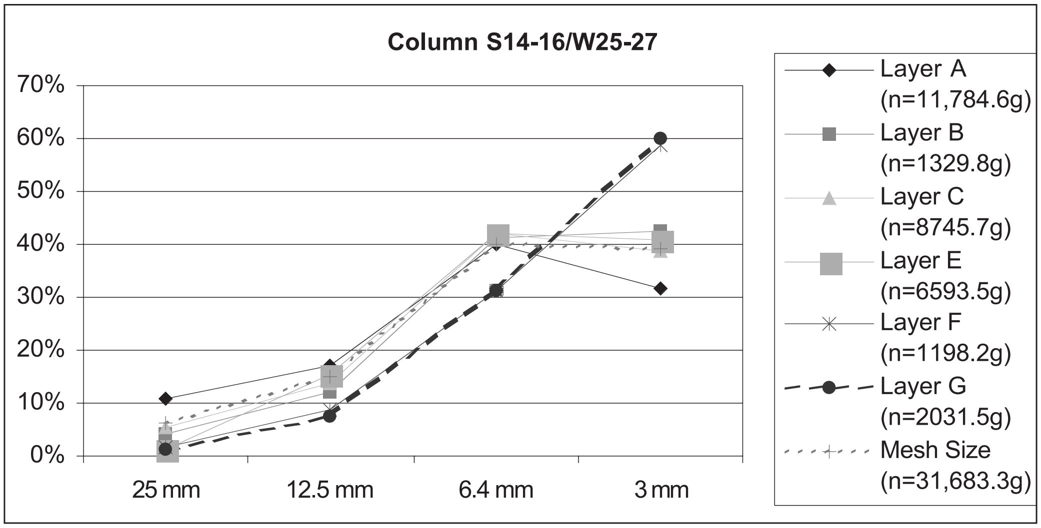
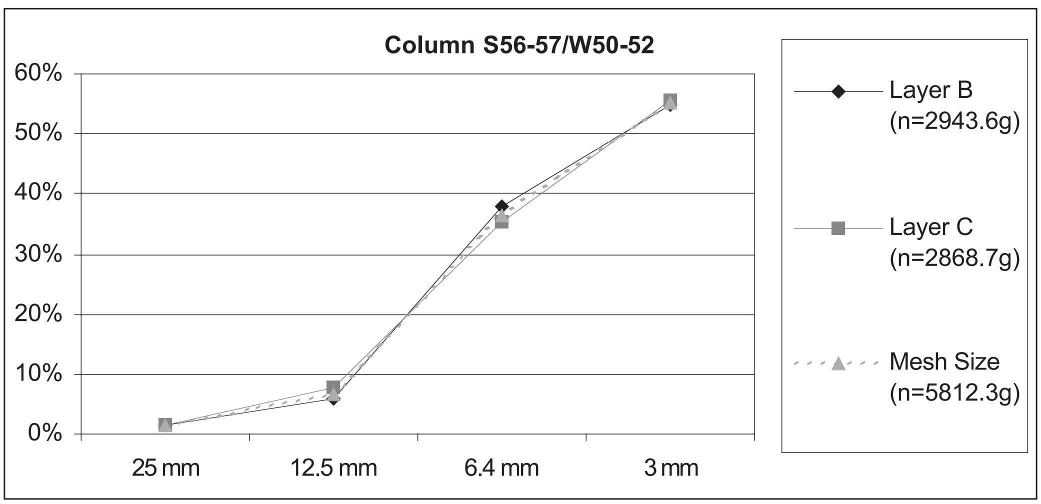


Figure 6. Grain size distributions of clams *(Saxidomus gigantea, Tresus capax, Tresus sp., Protothaca staminea,* unidentified clam) by layer, all assemblages.





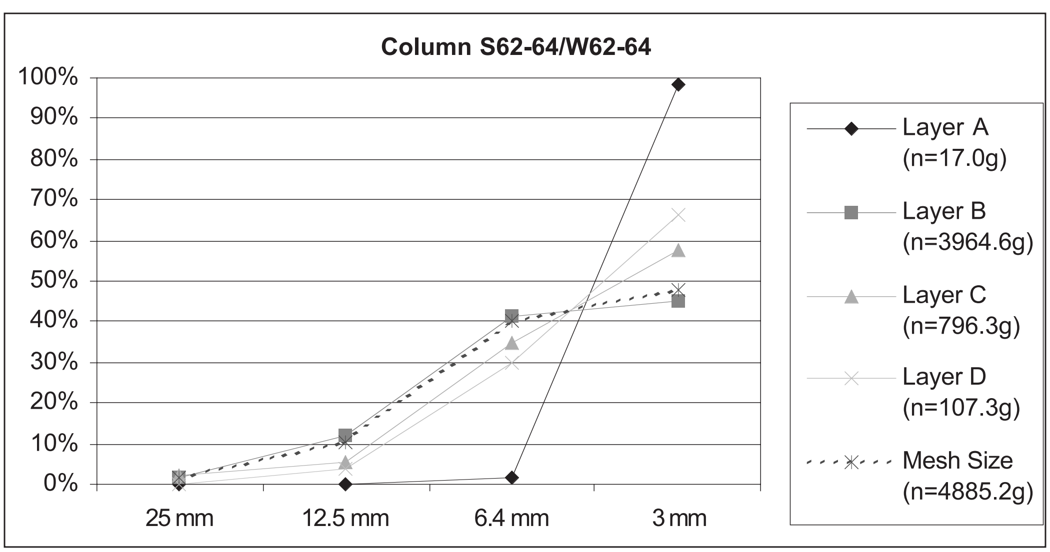


Figure 7. Grain size distributions of all shell by stratigraphic layer, all assemblages.

The majority (79.1%) of shellfish in Late Column S14–16/W25–27 was caught in the two smallest meshes, in almost equal proportions (Figure 7). This pattern changes however in the lower reaches of the column's stratigraphic profile. There is a sharp increase in the quantity of 3-mm size materials in lower layers F and G. Layer A, in Late Column S14–16/W25–27, contains the highest frequency of 25-mm mesh materials (11%) of all three assemblages.

The texture of shell in the two early assemblages tends to be finer. Higher proportions of 3-mm mesh size material were found in these two columns, comprising 47.9% and 55.2% of the samples by weight. In Column S56–57/W50–52, only 8.2% of the sample ended in the two larger meshes. Slightly higher contributions (12.2%) were noted for these same mesh sizes in Early Column S62–64/W62–64. The higher frequencies of 3-mm size shell in the two early assemblages reflect the larger amounts of fragile, small California mussel fragments. The extremely high value (98.2%) for finer materials in Column S62–64/W62–64 Layer A is questionable however, due to its very small sample size (17.0 g).

A pattern of increasing, finer grain materials is evident as one proceeds down through the strata in all three columns (Figure 7). Further analysis of this pattern is necessary. These results may reflect one or a combination of natural and/or cultural factors occurring during or after site formation (i.e, chemical weathering from acidic groundwater, shell robustness, age, sediment compaction, trampling, or refuse disposal patterns).

Also noteworthy is the strong similarities of matrix textural attributes (Figure 7), taxonomic content (composition), and shellfish weight (Table 2) in Early Column S56–57/W50–52 layers B and C. Key composition differences however include higher frequencies of non-fauna material (rock, charcoal, and rootlets) and small vertebrate fauna in upper Layer B, whereas lower Layer C contains higher quantities of fine mineral sediment (black silt).

Bivalve Umbo Counts

A third variable used to quantify the Ts'ishaa shellfish is the count of bivalve umbones. A bivalve features a pair of umbones or beaks, both located at the dorsal end of each valve. The umbo (plural, umbones) is positioned at the end of the hinge, behind the cardinal teeth area. As a major character on the bivalve shell, the umbo or beak is "the point of shell origin" (Coan et al. 2000:31). Umbo counts are introduced here to confirm the shellfish weight data. In order to obtain a count of bivalves present in the Tsi'shaa sample, the number of umbones for each species was calculated. This quantification method is preferred here as an alternative to the popular technique of establishing the minimal number of individuals (MNI). Classen (1998:106) highlights some of the problems affiliated with using MNI, including results that can be skewed by species preservation and sampling, but also the influential effects of trampling, food processing techniques, discard behaviour, leaching, and other chemical (acidic soil, ground water) processes.

The frequencies and proportions of bivalve umbones for each assemblage are summarised in Table 14. For comparative purposes, these values are tabulated side-by-side with their corresponding relative abundances of shell weight. The proportional data for the bivalve umbo counts and their respective weight data confirm the observation that California mussel is consistently the most prevalent shellfish species exploited at the site through time. Furthermore, the umbo count data show that clams are not under-represented or skewed in this study because of sampling factors.

Some interesting relationships between bivalve umbo counts and their respective weight data are evident in Table 14. In instances where a bivalve species is present in two or more columns, all species, with the exception of California mussel and unidentified clam, consistently score higher values in umbo count data. The most outstanding is the foolish mussel *(Mytilus trossulus)*. Umbo count data for this extremely fragile, fragmentary shell show a higher yield when compared to its respective weight values. The umbo count data suggest that larger quantities of foolish mussel likely entered the site than revealed by the shellfish weight alone. Other bivalves showing enhanced contributions to the shellfish assemblage when umbo counts are used include: butter, horse, native littleneck, and nestling saxicave *(Hiatella)* clams.

The relationship between umbo counts and shellfish weight data for California mussel in all three assemblages is strong. Values for the two quantitative variables differ by only 4.6 to 5.2 percent. The above mollusc consumption pattern (the relative importance of California mussel with less emphasis placed on the exploitation of clams and other shellfish groups) is typical of what one would expect at "outside" or open coast sites. A subsistence pattern, involving the dominant contribution to one's diet by one shellfood, is similar to that of

Table 14. Quantitative comparison of bivalve species present – umbo counts vs shellfish weight, all assemblages.

	Late Column S14–16/W25–27				Early Column S56–57/W50–52				Early Column S62–64/W62–64			
Bivalve Species	**Umbo Totals**		**Shellfish Wt**		**Umbo Totals**		**Shellfish Wt**		**Umbo Totals**		**Shellfish Wt**	
	N	%	Wt (g)	%	N	%	Wt (g)	%	N	%	Wt (g)	%
Mytilus californianus	2,302	90.1	28,545.9	95.3	603	97.6	5,402.1	92.9	257	93.5	4,681.2	98.1
Mytilus trossulus	67	2.6	2.9	<0.1	2	0.3	<0.1	<0.1	1	0.4	<0.1	<0.1
Solamen columbianum	1	<0.1	<0.1	<0.1								
Saxidomus gigantea	67	2.6	488.9	1.6	3	0.5	1.9	<0.1	7	2.5	22.7	0.5
Clinocardiium nuttallii	0	0	13.1	<0.1								
Tresus sp.	30	1.2	138.3	0.5					1	0.4	1.0	<0.1
Protothaca staminea	26	1.0	101.4	0.3	3	0.5	9.0	0.2	2	0.7	8.1	0.2
Glycymeris septentrionalis	1	<0.1	4.5	<0.1	1	0.2	0.2	<0.1				
Hiatella sp	25	1.0	1.4	<0.1	2	0.3	<0.1	<0.1				
Glans carpenteri	1	<0.1	<0.1	<0.1								
Unidentified Clam	36	1.4	665.4	2.2	4	0.7	64.9	1.1	7	2.5	61.2	1.3
Crassadoma gigantean	0	0	0.4	<0.1								
Column Totals	**2,556**	**100**	**29,961.8**	**100**	**618**	**100**	**5,478.1**	**100**	**275**	**100**	**4,774.2**	**100**

other "outer" sites on the north Pacific coast, such as the Kunghit Haida (Keen 1990), early Zone I occupation at Yuquot (Clarke and Clarke 1980:53), Chesterman Beach (Wilson 1990), Ch'uumat'a and T'ukw'aa (St. Claire 2002 pers comm.), and Yaquinna Head in Oregon (Minor 1989).

Dietary Contributions of Different Shellfish Species

This discussion investigates the dietary contributions of various shellfish to the site's mollusc assemblages. This is explored by converting shell weights into a nutritional unit or 'currency', edible meat weight. To determine meat weights in this study, the average meat weight to shell weight ratio is used, a method in which shell weights are multiplied by conversion factors derived for a particular taxon. The edible meat weights (g) for four major shellfish species and their respective relative contributions are reported below. The major shellfish species include only those taxa that were consumed as primary prey and whose relative contribution to the shellfish assemblage is greater than 1% of the total sample weight.

Four major shellfish were examined in Late Column S14-16/W25–27: California mussel *(Mytilus californianus)*, butter clam *(Saxidomus gigantea)*, unidentifiable clam, and acorn barnacle *(Archaeobalanidae, Balanidae)*. In the two early period columns, the meat yields from only three major shellfish categories were investigated: California mussel, unidentifiable clam, and acorn barnacle.

The shellfish conversion factors used in this study are derived from formulae and archaeological data established by other researchers in a number of areas on the North Pacific coast, including Alaska (Erlandson 1989; Moss 1989), British Columbia (Clarke and Clarke 1980; Ham 1982), and California (Erlandson 1994). Conversion index values have been averaged where multiple sources for a specific taxon are available. The conversion factor for the unidentifiable clam category, which most likely comprises broken butter and horse clams without umbones or other landmarks (majority of their hinge), represents a mean value for *Saxidomus gigantea* and *Tresus capax* combined.

Estimated meat weights for four major shellfish from Late Column S14–16/W25–27 are presented in Table 15. Calculations show that California mussel is prominent in the column assemblage, making up 89.5% of the total edible shellfish meat yield. Unidentified clam, acorn barnacle, and butter clam contribute 4.2%, 3.9%, and 2.4% respectively.

Meat yield estimates for the major shellfood species in Early Columns S56–57/W50–52 and S62–64/W62–64 are provided in Tables 16 and

Table 15. Meat weight (g) of major shellfish taxa from Late Period Column S14–16/W25–27.

Species	Layer A	Layer B	Layer C	Layer E	Layer F	Layer G	Total meat wt (g)	% Total	Conversion Factor
Mytilus californianus	3,693.4	454.4	2,027.2	2,513.8	413.4	1,116.2	**10,218.4**	89.5%	0.40
Saxidomus gigantea	209.1	15	14.3	5.6	8.6	16.4	**269**	2.4%	0.55
Unidentifiable clam	277.6	16.1	45.9	15.6	44.1	79.6	**478.9**	4.2%	0.72
Archaeobalanidae, Balanidae	268	12.5	77.4	31.5	9	50.7	**449.1**	3.9%	0.18

Table 16. Meat weight (g) for major shellfish taxa from Early Period Column S56–57/W50–52.

Species	Layer B	Layer C	Total meat Wt (g)	% Total	Conversion Factor
Mytilus californianus	1089.3	1071.5	**2160.8**	95.7%	0.40
Unidentifiable clam	27.1	19.6	**46.7**	2.1%	0.72
Archaeobalanidae, Balanidae	27.8	23.2	**51.0**	2.3%	0.18

Table 17. Meat weight (g) for major shellfish taxa from Early Period Column S62–64/W62–64.

Species	Layer A	Layer B	Layer C	Layer D	Total meat Wt (g)	% Total	Conversion Factor
Mytilus californianus	6.2	1521	304.4	40.9	**1872.5**	97.1%	0.40
Unidentifiable clam	0.6	39.7	3.5	0.2	**44**	2.3%	0.72
Archaeobalanidae, Balanidae	0.1	6.3	4.7	0.6	**11.7**	0.6%	0.18

17. In the Column S56–57/W50–52 conversions, California mussel accounts for 95.7% of the meat weight, followed by acorn barnacle (2.3%) and unidentifiable clam (2.1%). California mussel meat weights are also predominant in Early Column S62–64/W62–64, comprising over 97% of the total weight. Unidentifiable clams and acorn barnacles make limited contributions: only 2.3% and 0.6% of the total shellfish meat weights respectively.

Despite the drawbacks that have been identified by researchers (Classen 1998:187–191; Moss 1989; Grayson 1984; Wessen 1994) with respect to analyzing the dietary contribution of different shell species to site subsistence activities, the data presented here indicate the potential yield and contribution of shellfish (particularly California mussel) as a food resource at Ts'ishaa. This preliminary analysis suggests, based on only a 33% sampling fraction by volume, that more than 11.4 kg of shellfish meat are represented in the Late Column S14–16/W25–27 sample from Excavation Area 1 in the main village (Table 15). If the entire column sample have been examined, it is conceivable that 30+ kg of shellfish meat may be represented by the remains of the four dominant shellfish from this 25 x 25 x 350-cm column alone, and 1920 kg (4,224 pounds) in the adjoining 3.5 m deep, 2 x 2-m excavation unit.

Column sample data from the terrace behind the village midden indicate that the strong focus on California mussel harvesting, with a lesser emphasis on the collection of clams and barnacles, dates back to earlier site occupation (3000–5000 BP). An examination of the three major species from the Early Column S56–57/W50–52 shell sample (52% sample fraction) produced a converted meat yield totalling 2.25 kg (Table 16). Had 100% of the 2.49-m-deep, 10 x 10-cm column been examined, potential meat yields of as much as 4.5 kg may be represented. Following this formula for the three shell species, it is conceivable that 900 kg (1,980 lb) of shellfish meat from the adjoining 1 x 2-m unit may have been consumed.

Excavation Unit S62–64/W62–64, positioned 11 m upslope from Unit S56–57/W50–52 on the elevated landform, revealed shallow cultural deposits overlying bedrock. An examination of mollusc materials from the Early Column S62–64/W62–64 assemblage sample (55% sampling fraction) suggests that over 1.9 kg of meat were acquired from the three shellfish species (Table 17), and possibly 3.5 kg of meat from the entire 88-cm deep, 20 x 20-cm column. Using these conversion factors, it is estimated that the shell-rich sediments excavated from adjacent 2 x 2-m Unit S62–64/W62–64 may have represented, at minimum, over 350 kg (770 lb) of edible meat.

Habitat Exploitation

A major factor contributing to intra-assemblage differences in faunal remains is the exploitation of various habitats by the site occupants (Calvert 1980). Past exploitation of numerous micro-environmental zones in the open, "outside" sections of coast surrounding Ts'ishaa is indicated by the diverse collection of intertidal mollusc taxa present in the shellfish assemblages.

Three habitat types have been identified for the Broken Group Islands area (Lee and Bourne 1977; see also Haggarty and Inglis 1985). Based on substratum materials and wind exposure, the intertidal habitats and their shore classes include:

1. Exposed Habitats:
   Rock & Boulder Beaches: rocky shore substratum intertidal zone exposed to the rigorous conditions of heavy surf; high salinity; constant water temperature.
   Exposed sub-tidal habitat types include: rocky shores;
2. Semi-Exposed Habitats:
   Boulder Beaches and Rocky Shores: boulder beach and rock substratum on the outer islands subject to some surf action; high salinity; slight water temperature fluctuations.
   Gravel, Sand, and Shell Beaches: gravel, sand, and shell beaches located on the shores of the inner islands subject to less wave action; high salinity; slight fluctuations in water temperature.
   Semi-exposed sub-tidal habitat types include: gravel and shell shores with isolated boulders; cobble, boulder, and rock shores; and rocky shores;
3. Protected Habitats:
   Boulder Beaches and Rocky Shores: rock shores found in NE shore of inner islands, some bays, and along the shores of clustered islands; boulder beaches common in sheltered bays and in channels between islands; less wave action; lower salinity; some temperature variation;
   Cobble Beaches: sheltered cobble substratum subject to less wave action, lower salinity; some temperature variation;
   Shell and Sand Beaches: sheltered shell and/or sand substratum intertidal zone subject to less wave action, lower salinity; some temperature variation;
   Sand/Shell/Gravel Beaches: protected sand, shell, and gravel beaches common in pocket beaches and along sheltered shores; lower salinity, some temperature variation;
   Sheltered subtidal habitats include Sand and mud flats and Sand, mud, gravel, and shell slopes.

Table 18 lists the shellfish species recovered at Ts'ishaa and their related intertidal habitats based on exposure and shore class. The distributions of the three intertidal habitats in original Tseshaht territory are shown in Figure 8. Data reveal that various beach types and habitats within the Broken Group Islands were harvested for bivalves and univalve species.

The Ts'ishaa shellfish assemblage indicates that rocky shores in exposed, semi-exposed, and sheltered habitats were the primary focus of shellfish exploitation through the duration of site occupation. Shellfish taxa consumed as primary and secondary food sources from these environments were predominantly infauna invertebrates, including: California mussel, barnacles (acorn, gooseneck), sea urchin, selected marine snails, chitons, limpets, and abalone. Some smaller marine snails would have entered the site unintentionally, having been attached to seaweed and kelp, others in the stomach of sea mammals and fish. The meat of some species would have been gathered for food and the shells used for decorative or utilitarian purposes.

The shellfish weight data suggests that rocky shore and boulder beach habitats produced over 98% of the mollusc remains during the early period (pre-3000 BP) of site occupation (Table 3). In later times, the focus on rocky shore (infauna) shell-foods continued (~96% of shell by weight), but with an increase in the consumption of sediment-dwelling (epifauna) bivalves, particularly butter clams, native littleneck clams, and horse clams. Interestingly, this slight change in the Ts'ishaa shellfish subsistence pattern during the late Holocene coincides with receding sea-evels in the Barkley Sound area (Friele 1992, McMillan 1999). It is possible that this increase in epifauna species at this time reflects the development and increased biological productivity of sediment beaches.

Species Ubiquity

The fifth and final variable examined in this study is species ubiquity: the number of proveniences in which a shell taxon is present. Graphic indices showing the number of stratigraphic layers in which each shellfish species was identified are presented in Figures 9, 10, and 11. Each index plots the number of layers containing species x on the y-axis and the total weight of the shell taxon on the other. Multiple species are plotted on one graph for comparison of ubiquity.

The ubiquity index for Late Column S14–16/W25–27 in Figure 9 indicates that 14 (24%) of 59

Table 18. Shellfish habitat categories in the Broken Group Islands, Barkley Sound.

Taxa	Exposed Rock & Boulder Beachs	Semi-exposed Boulder Beaches & Rocky Shores	Semi-exposed Gravel, Sand, & Shell Beaches
Bivalvia			
California mussel, *Mytilus californianus*	X	X	
Foolish mussel, *Mytilus trossulus*			
Butter clam, *Saxidomus gigantea*			
Nuttall's cockle, *Clinocardium nuttallii*			
Fat Gaper clam,*Tresus capax*			X
Horse clam, *Tresus sp*			X
Native littleneck clam *Protothaca staminea*			X
Western bittersweet clam, *Glycymeris septentrionalis*			X
Nestling Saxicave clam, *Hiatella sp*	X	X	
British Columbia cranella, *Solamen columbianum*			
Carpenter's candita clam, *Glans carpenteri*			
Purple-hinged rock scallop, *Crassadoma gigantea*	X	X	
Gastropoda			
Channelled dogwinkle, *Nucella canaliculata*	X	X	
Striped dogwinkle, *Nucella emarginata*	X	X	
Frilled dogwinkle, *Nucella lamellosa*	X	X	
File dogwinkle,*Nucella lima*		X	
Dogwinkle *Nucella sp*	X	X	
Red turban snail, *Astrea gibberosa*	X	x	
Black turban snail,*Tegula funebralis*	X	X	
Dusky turban, *Tegula pulligo*	X	X	
Leafy hornmouth, *Ceratostoma foliatum*	X	X	
Slippersnail,*Crepidula sp*	X	X	
Hooked slippersnail*Crepidula adunca*	X	X	
White slippersnail,*Crepidula nummaria*		X	
Wrinkled amphissa, *Amphissa columbiana*		X	
Topsnail, *Lirularia sp*	X	X	
Sitka periwinkle, *Littorina sitkana*	X	X	
Checkered periwinkle, *Littorina scutulata*	X	X	
Threaded bittium snail, *Bittium eschrichtii*			
Bittium snail, *Bittium sp*			
Lurid rock shell,*Ocenebra lurida*	X	X	
Sculptured rock shell,*Ocenebra interfossa*	X		
Dire whelk, *Searlesia dira*	X	X	
Dovesnail, *Alia gausapala*	X	X	
Variegated lacuna shell, *Lacuna variegata*			
Pryramid snail, *Turbonilla sp*			
Whitecap limpet, *Acmaea mitra*	X	X	
Fingered limpet,*Lottia digitalis*	X	X	
Mask limpet, *Tectura persona*	X	X	
Plate limpet, *Tectura scutum*	X	X	
Shield limpet, *Lottia pelta*	X	X	
Fenestrate limpet,*Tectura fenestrata*	X	X	
Limpet, *Lottiidae*	X	X	
Rough keyhole limpet, *Diodora aspera*	X	X	
2-spot keyhole limpet,*Fissurellidea bimaculata*	X		
Northern abalone, *Haliotis kamtschatkana*	X	X	
Polyplacophora			
Giant pacific chiton, *Cryptochiton stelleri*	X	X	
Black katy chiton, *Katharina tunicata*	X	X	
Mossy chiton, *Mopalia muscosa*		X	
Lined chiton, *Tonicella sp*	X	X	
Mopaliidae	X	X	
Echinoidea			
Strongylocentrotus purpuratus	X	X	
Strongylocentrotus droebachiensus	X	X	
Strongylocentrotus sp	X	X	
Cirripedia			
Acorn barnacle, *Archaeobalanidae, Balanidae*	X	X	
Gooseneck barnacle, *Pollicipes polymerus*	X	X	

Protected Boulder Beaches & Rocky Shores	Protected Cobble Beaches	Protected Shell and/or Sand Beaches	Protected Sand/ Shell/ Gravel Beaches
X			
X			X
		X	X
		X	X
			X
		X	X
		X	X
X			X
			X
X			
X	X		
X			
X			
X			
X			
X	X		
X	X		
X	X		
X	X		X
X			X
X			X
X	X		X
X	X		
X	X		
X	X		
X	X		
X	X		
X			
X			
X	X		
			X
X			
X	X		
X	X		
X	X		
X	X		
X	X		
X	X		
X	X		
X			
X			
X			
X			
X			
X			
X			
X			
X			
X	X		

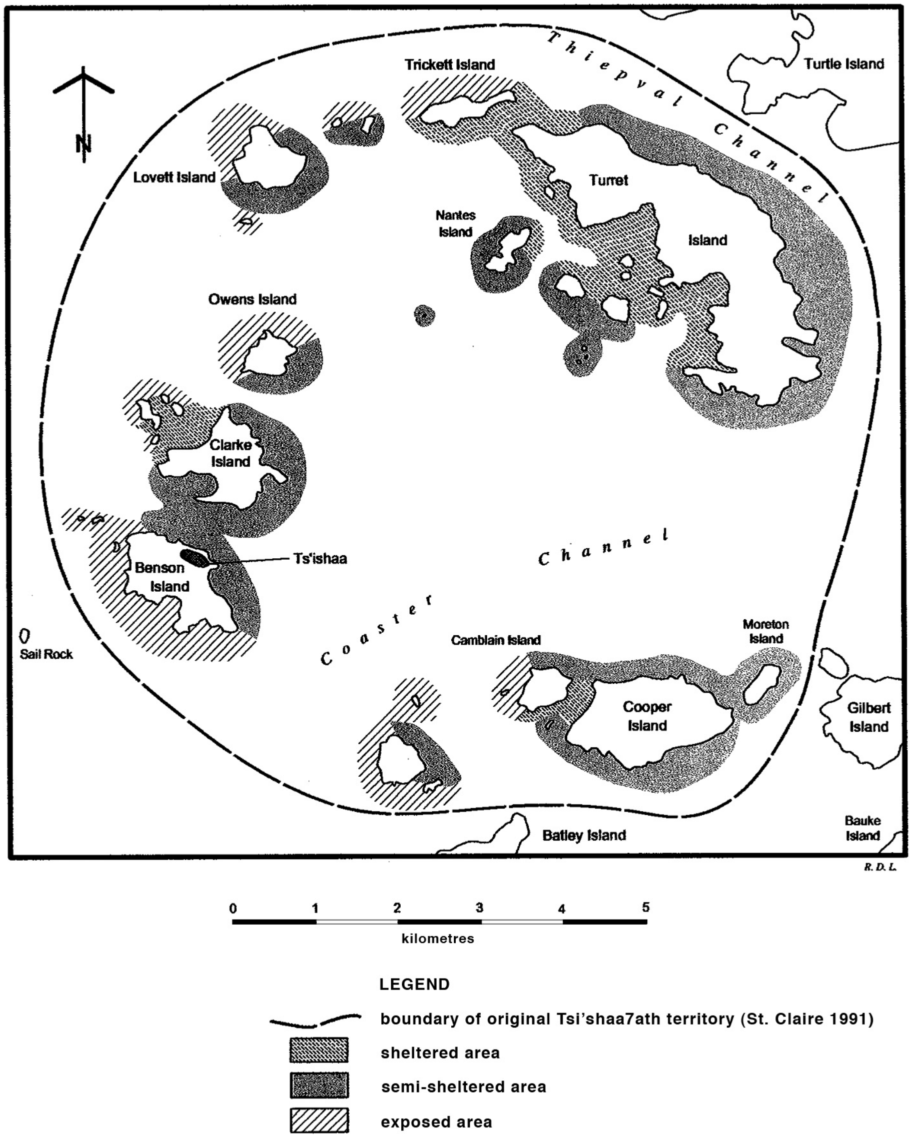


Figure 8. Map showing distribution of intertidal exposure types in the original territory of the Tseshaht local group (after Lee and Bourne 1977).

shell species, including three general unidentifiable categories, are present in all six stratigraphic layers. The highly ubiquitous species, ranked by total sample weight, include: California mussel, acorn barnacle, unidentifiable clam, butter clam, unidentified shell, native littleneck clam, gooseneck barnacle, indeterminate sea urchin, purple sea urchin, black katy chiton, indeterminate marine snails, channeled dogwinkle, indeterminate chitons *(Mopaliidae* family), and indeterminate limpets *(Lottiidae* family). All of these species or families, with the exception of the channeled dogwinkle, indeterminate marine snail, and unidentified shell, represent primary or secondary prey.

Nine shell taxa (15%) in Late Column S14–16/W25–27 were recovered in four or five stratigraphic layers. This moderate group included: additional primary/secondary prey foods, horse clam *(Tresus* sp.), foolish mussel *(M. trossulus)*, basket cockle *(Clinocardium nuttallii)*, giant Pacific [gumboot] chiton *(Cryptochiton stelleri)*; and shells used for decorative or utilitarian purposes, red turban snail *(Astrea gibberosa)*, northern abalone *(Haliotis kamtschatkana)*, and horse clam. Thirty-six (61%) identified shell species in this column were observed in one to three stratigraphic layers only. The latter are predominantly univalves and sea snails, taxa that would have entered the site in an inadvertent or incidental manner. Excluding the fat gaper horse clam, *Tresus capax*, all shellfish taxa in the lower ubiquity groups (1–3 layers) weighed less than 5.0 grams.

Interpretations regarding species ubiquity in Early Column S56–57/W50–52 (Figure 10) are simplified in that only two stratigraphic layers are represented. Thirteen of the 25 (52%) shellfish species (including three general unidentifiable categories) found in this column were recovered in both thick layers. Dominated by California mussel (92% of group weight), other primary and secondary prey shellfoods in this group include: varying quantities of acorn barnacles, unidentified clam, native littleneck clam, black katy chiton, indeterminate sea-urchin, and butter clam. Some materials likely used for decorative or other utilitarian purposes in this group include abalone and dye shells *(Nucella)*. In Column S56–57/W50–52, 12 identified shellfish taxa were recovered in only one of two statrigraphic layers: three chitons, purple sea urchin, six marine snails, a limpet, and blue mussel. Of the 12 species, only three *(Astrea gibberosa, Stronglyocentrotus purpuratus,* and *Mopaliidae)* in this group weight more than 1.0 gram.

Only three of 26 (11.5%) shellfish in Early Column S62–64/W62–64 occur in all (four) stratigraphic layers (Figure 11). Species ranking very high in the ubiquity index for this column include California mussel, acorn barnacle, and unidentified clam. Four taxa are present in three of the four layers: unidentified shell, goose barnacle *(Pollicipes polymerus)*, channelled dogwinkle, and indeterminate sea snail. The goose barnacle, deemed as primary prey by many Nuu-chah-nulth, Ditidaht, and Makah peoples, is often plentiful amongst the California mussel community. Nineteen species in this column were found in one layer only, Layer B, 16 of which are rocky shore dwellers. The three sediment beach (epifauna) species include the butter, native littleneck, and horse clams. Fifteen of the 19 taxa in Layer B weight less than 1.0 gram. The Column S62–64/W62–64 shell data should be viewed with caution however, as two of four layers (A and D) contain small sample weights (17.0 g and 107.3 g respectively).

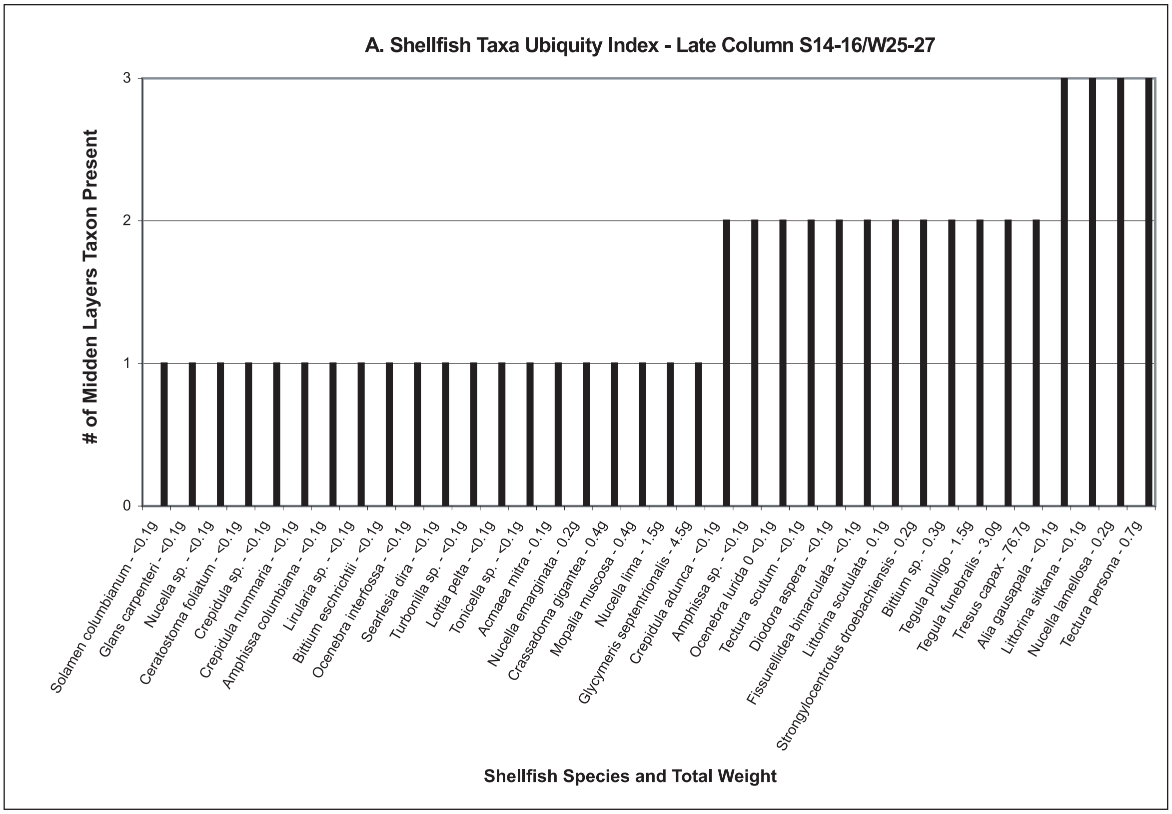
Summary And Conclusions

A preliminary analysis of shellfish materials from the village of Ts'ishaa has revealed insights into the human exploitation of marine molluscs in south-central Barkley Sound, the traditional territory of the Tseshaht First Nation. The study demonstrates that, in those areas of the site subject to invertebrate faunal sampling, California mussel *(Mytilus californianus)* was the predominant shell species harvested and consumed through the duration of occupation. The shellfish diet was supplemented with lesser quantities of acorn barnacle and clam, particularly butter, horse, and native littleneck clams. Other bivalves, univalves, chitons, and sea urchin also contributed to the daily fare, but in minor amounts.

The primary quantification variable used in this study is shell weight. Although biases are introduced into the analysis by using shell weight, a number of other quantitative studies were conducted to help mitigate these sampling factors and to support the report's interpretations. These additional interpretive studies included: grain size distributions, bivalve umbo counts, shellfood dietary contributions, habitat exploitation, and species ubiquity.

Examination of the shell weight data revealed that California mussel comprised an extremely high proportion of marine shell material in all three column assemblages sampled. Data from late period Column S14–16/W25–27 show that California mussel made up almost 87% of the assemblage by weight. During earlier times (pre-3000 BP), however, information suggests a stronger focus was placed on the consumption of this species. Analyses of the two early period column samples show higher values of California mussel with respect to relative abundance (93% and 96%). (As an interesting footnote, a comparison of the shell weight data between two column samples [S14–16/W25–27, S62–64/W62–64] and their affiliated hand-collection/screen data sets by the researcher yielded contrasting results).

Investigations pertaining to grain size distribution patterns of specific shell categories enhanced our understanding of shell breakage, refuse disposal patterns, site formation, and possible post-deposition processes at the site. The relationship of four shell groups (California mussel, barnacle, clam, and all shell) and their grain size distributions between stratigraphic layers and assemblages were explored using multiple-sized sieve meshes. The research was productive in illustrating correlations between taxon-specific breakage patterns and grain size distributions. Not surprisingly, California mussel, the most fragile member of the large bivalves, was most common (82% to 93%)



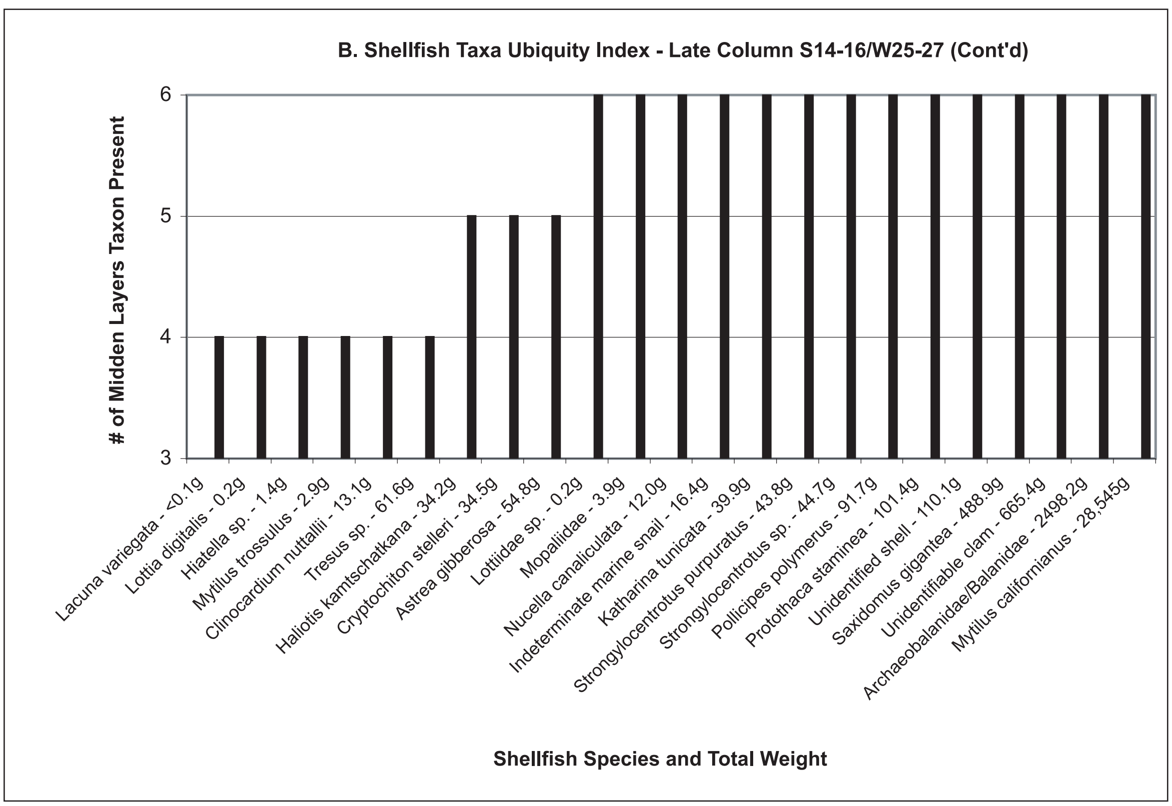


Figure 9. Shellfish Taxa Ubiquity Index – Late Column S14–16/W25–27.

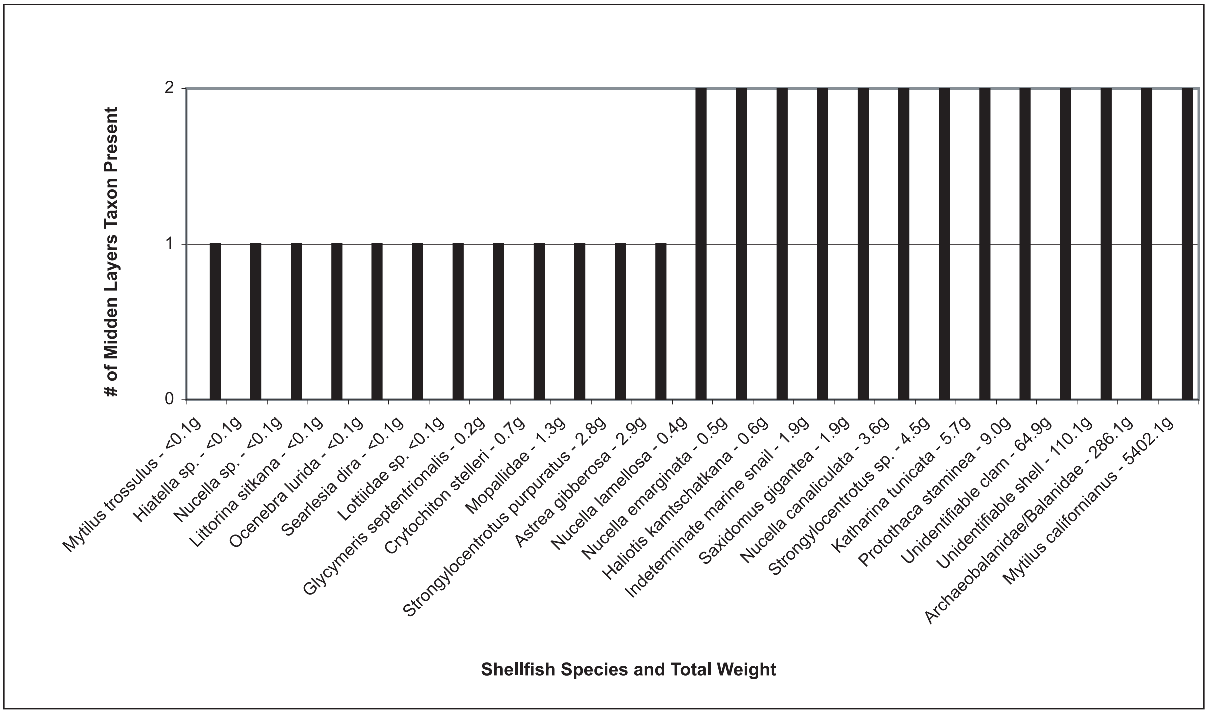


Figure 10. Shellfish Taxa Ubiquity Index – Early Column S56–57/W50–52.

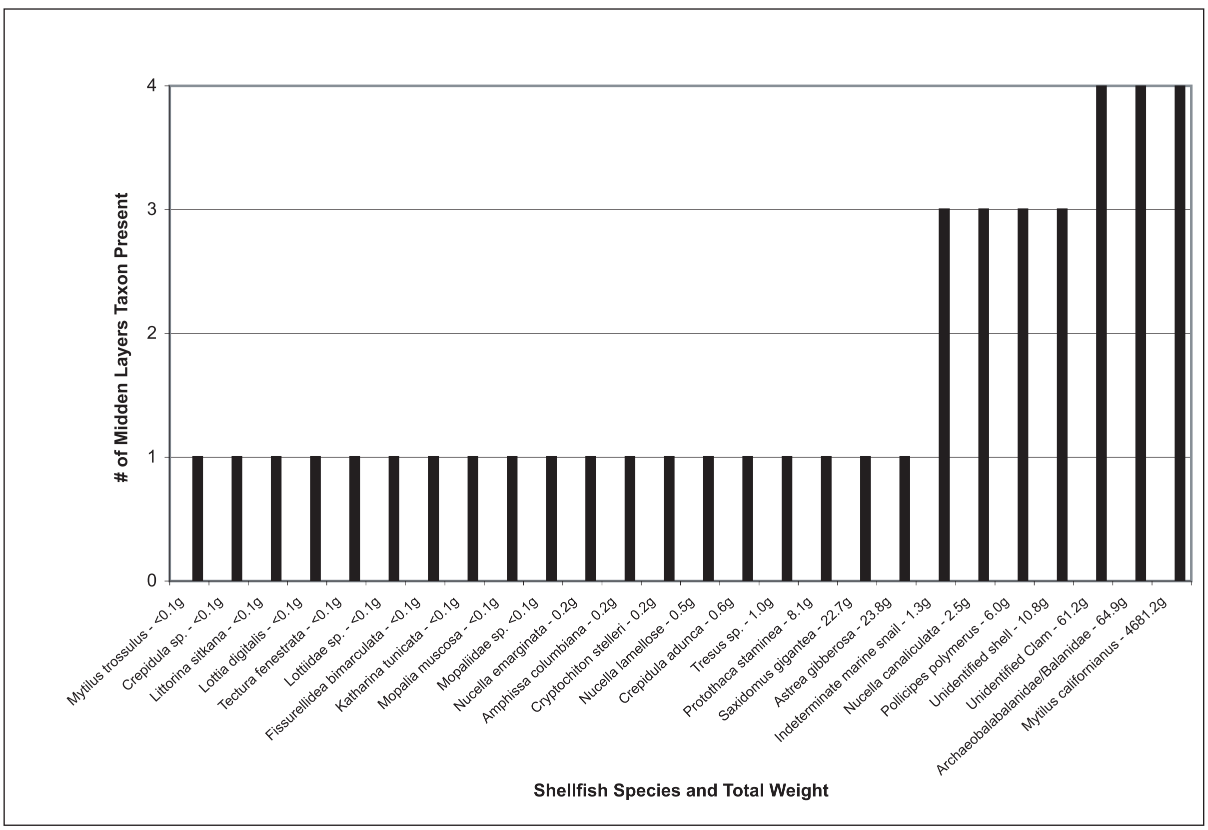


Figure 11. Shellfish Taxa Ubiquity Index – Early Column S62–64/W62–64.

in mesh sizes measuring less than 12.5 mm (½"), in all assemblages. Larger mussel shell specimens (≥12.5 mm [½"]) were most frequent in the Late Column S14–16/W25–27 samples, particularly in the upper midden stratum.

Acorn barnacle occurred most often in the 6.3-mm [¼"] size, in all assemblages. Clams, the most robust of all shell groups, yielded the largest quantity of larger-sized materials. Studies show that proportions of larger-sized clam material (>½") were much higher in the later assemblage (72%), than in two earlier assemblages (45%–55%). With respect to the grain-size distributions for all shell assemblages, values measured close to those of the California mussel: 79% of all shell from Late Column S14–16/W25–27 measured less than 12.5 mm (½"); 87.9% of same sized materials from Early Column S62–64/W62–64; and 93.3% in Early Column S56–57/W50–52. The proportions of small (3 mm, ⅛") all shell material varied between the late and early period assemblages: 42.1% – late period column; and 48.9% and 57.1% – Early Column S62–64/W62–64 and Early Column S56–57/W50–52 respectively.

Furthermore, the grain-size distribution information showed the potential for data loss and sampling biases by researchers when they limit their examinations of faunal remains to 6.3-mm (¼") mesh material only. Significant proportions of shell material were recovered in the 3-mm [⅛"] mesh during this research: 41% of the total shell by weight – Late Column S14–16/W25–27 sample; 48% – Early Column S62–64/W25–27 sample; and 56% – Early Column S56–57/W50–52 sample. Similar concerns are valid with respect to the loss of vertebrate fauna. Between 63% and 69% of all bone material from the three column assemblages were found in the ⅛" mesh screen.

The counting of bivalve umbones was investigated as an alternative quantitative measure. Column bivalve umbo counts were in most cases found to have a good relationship with a specimen's weight proportion data. Differences in the two values for the California mussel were found to vary between 4.6% and 5.2%, and less than 2.6% for all other bivalves. With the exception of three cases, umbo counts yield a higher value, suggesting that bivalve umbo counts may reflect a more realistic and less biased shell quantification method. The umbo count technique also tends to reflect a more accurate contribution of lightweight bivalve species (i.e., *Mytilus trossulus)* to the assemblage that may otherwise be distorted by heavier bivalve species (i.e., *Mytilus californianus).*

The conversion of shell weight into estimated edible meat weights was explored. Shell/meat yield estimates indicate that specific marine molluscs, particularly the California mussel, were a major contributor to the Ts'ishaa subsistence base. The heavy exploitation of this specific marine resource is supported by on site field observations – in some areas within the village, shells heaps have accumulated to depths greater than 4 metres. The Ts'ishaa data indicate a potential for high yield estimates of edible shellfish meat during both early and late cultural components. Prior to 3000 BP, the California mussel, may have contributed 96% to 97% of all primary prey shellfish meat. In later times, sample data from the central part of the village hint at a decrease in the consumption of this species, supplemented with higher yields of clam and barnacle meat.

This study revealed that a wide array of marine mollusc species (57) entered the site. The species illustrate that a number of intertidal habitats in the Broken Group archipelago were the focus of shell gathering activities. The shellfish material, however, indicate a strong emphasis was placed on the exploitation of outside, exposed, and semi-exposed rocky shore shellfoods (particularly California mussel) by the site occupants for the past 5,000 years. In addition to California mussel, other primary and secondary prey harvested for consumption included: acorn and gooseneck barnacles, selected marine snails, limpets, chitons, and sea urchin. Assortments of shell species were also obtained from these environmental zones for decorative, ceremonial, and/or utilitarian purposes: abalone, the operculum of the red turban snail, and dogwinkle. In more sheltered environs in the archipelago, a variety of clams could be found on mud, sand, and gravel beaches. Past shellfish inventories in the Broken Group Islands have shown that some beaches produce a high yield of intertidal bivalve species, particularly native littleneck, butter, and horse clams. A number of these productive beaches would have been only hours from Ts'ishaa by canoe.

The final quantitative variable examined as part of this study was shellfish species ubiquity, the number of proveniences in which a particular taxon was recovered. Index data revealed that three shell categories, California mussel, acorn barnacle, and unidentified clam, were present in all stratigraphic layers, in all column samples. Further investigation of this variable is warranted as it offers the possibility to identify patterns in diet, refuse disposal behaviour, and other cultural activity within the site.

Finally, an examination of marine shell taxonomic richness or species diversity over time proved interesting. Preliminary site data revealed that an average of 25.5 shellfish species were harvested during the middle Holocene. In the late Holocene major changes in shell resource procurement are evident, with up to 56 identified shell taxa entering the site. Such a significant increase in shellfish diversity over the past 3000 to 2500 years may reflect several factors, such as technological improvements, the use and exploitation of additional habitat, or environmental change.

References Cited

Calvert, Sheila G.
1980 A Cultural Analysis of Fauna Remains From Three Archaeological Sites In Hesquiat Harbour, B.C. Ph.D. Dissertation, Department of Anthropology and Sociology, University of British Columbia, Vancouver.

Clarke, Louise R. and Arthur H. Clarke
1980 Zooaarchaeological Analysis of Mollusc Remains from Yuquot, British Columbia. In: *The Yuquot Project*, Volume 2, pp. 37–58. History and Archaeology Series No. 43, National Historic Parks and Sites Branch, Parks Canada, Environment Canada, Ottawa.

Classen, Cheryl
1998 *Shells*. Cambridge University Press, Cambridge.

Coan, Eugene V., Paul V. Scott, and F. R. Bernard
2000 Bivalve Seashellls of Western North America: Marine Bivalve Mullusks from Arctic Alaska to Baja California. Santa Barbara Museum of Natural History Monographs Number 2, Santa Barbara.

Cornwall, Ira E.
1970 *The Barnacles of British Columbia*. British Columbia Provincial Museum Handbook No. 7, Victoria.

Ellis, David W. and Luke Swan
1981 *Teachings of The Tides: Uses of Marine Invertebrates By The Manhousat People*. Theytus Books, Nanaimo.

Erlandson, Jon M.
1989 Analysis of the Shellfish Assemblage. In: *The Hidden Falls Site Baranof Island, Alaska*, pp. 131–158, edited by Stanley Davis. Alaska Anthropological Association Monograph Series**,** Anchorge.

1994 *Early Hunter-Gatherers of the California Coast*. Plenum Press, New York.

Ford, Pamela J.
1992 *Interpreting The Grain Size Distributions of Archaeological Shell. In: Deciphering A Shell Midden*, pp. 283–326, edited by Julie K. Stein. Academic Press Inc., San Diego.

Friele, Pierre A.
1992 Holocene Relative Sea-level Change: Vargas Island, British Columbia. M.Sc. Thesis, Simon Fraser University, Burnaby.

Friele, Peirre A. and Ian Hutchinson
1993 Holocene Sea-Level Change on the Central West Coast of Vancouver Island, British Columbia. *Canadian Journal of Earth Sciences* (30), pp. 832–840.

Griffith, L.M.
1967 *The Intertidal Univalves of British Columbia*. British Columbia Provincial Museum Handbook No. 26, Victoria.

Haggarty, James C. and Richard I. Inglis
1985 Historical Resources Site Survey and Assessment, Pacific Rim National Park. National Historic Parks and Sites Branch, Environment Canada, Parks Service, Ottawa.

Ham, Leonard C.
1976 Analysis of Shell Samples. In: *The Glenrose Cannery Site*, pp. 42–81, edited by R.G. Matson. Archaeological Survey of Canada Paper No. 52, National Museum of Man Mercury Series, National Museums of Canada, Ottawa.

Hanson, Diane K.
1991 Late Prehistoric Subsistence in the Strait of Georgia Region of the Northwest Coast. Ph.D. Dissertation, Archaeology, Simon Fraser University, Burnaby.

Harbo, Rick M.
1997 Shells & Shellfish of the Pacific Northwest. Harbour Publishing, Madeira Park.

Keen, Sharon
1990 Shellfish Faunal Analyses From Sixteen Archaeological Sites In The Southern Queen Charlotte Islands. Report Submitted to British Columbia Heritage Trust, Victoria.

Lee, J. Charlene and N. Bourne
1977 Marine Resource Inventory of Pacific Rim National Park – 1976. *Fisheries & Marine Service Manuscript Report* No. 1436, Research and Resource Services, Pacific Biological Station, Nanaimo.

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

McMillan, Alan D. and Denis E. St. Claire
1994 The Toquaht Archaeological Project: Report of the 1994 Field Season. Unpublished Report Submitted to the Toquaht Nation, Ucluelet, and the Archaeology Branch, Victoria.

2000 Excavation at Ts'ishaa and Hmayis: Report of the Tseshaht Archaeology Project, 1999. Report submitted to Tseshaht Nation, Port Alberni, and Parks Canada (Ucluelet, Victoria).

2001 Excavation at Ts'ishaa: Report of the Tseshaht Archaeological Project, 2000. Report submitted to Tseshaht Nation, Port Alberni, and Parks Canada.

Minor, Rick
1989 Archaeology of the North Yaquinna Head Shell Middens, Central Oregon Coast. *Resource Series* No. 3. U.S. Department of the Interior, Bureau of Land Management, Oregon State Office, Portland.

Mitchell, Donald
1990 Prehistory of the Coasts of Southern British Columbia and Northern Washington. In: *Northwest Coast, Handbook of North American Indians*, Volume 7, pp. 340–358, edited by Wayne Suttles. Smithsonian Institute, Washington.

Morris, P.A.
1996 *A Field Guide to Pacific Coast Shells*. 2nd Edition, Peterson Field Guide Series, Houghton Mifflin, Boston.

Moss, Madonna L.
1989 Archaeology and Cultural Ecology of the Prehistoric Angoon Tlingit. Ph.D. Dissertation, Department of Anthropology, University of California, Santa Barbara.

Muckle, Robert
1986 Archaeological Considerations of Bivalve Shell Typhonomy. M.A. Thesis, Simon Fraser University, Burnaby.

Quayle, D. B.
1978 *The Intertidal Bivalves of British Columbia*. British Columbia Provincial Museum Handbook No. 17, Victoria.

Wessen, Gary C.
1994a Subsistence Patterns As Reflected By Invertebrate Remains Recovered At The Ozette Site. In: *Ozette Archaeological Project Research Reports, Volume II, Fauna*, pp. 93–196, edited by Stephen R. Samuels. Report of Investigations 66, Department of Anthropology, Washington State University, Pullman, and National Park Service, Pacific Northwest Regional Office, Seattle.

1994b Appendix B: The Ozette Shellfish Computer Code. In: *Ozette Archaeological Project Research Reports, Volume II, Fauna*, pp. 321–358, edited by Stephen R. Samuels. Report of Investigations 66, Department of Anthropology, Washington State University, Pullman, and National Park Service, Pacific Northwest Regional Office, Seattle.

Wilson, Ian
1990 Archaeological Investigations at DgSl 61, Chesterman Beach, West Coast Vancouver Island. Report Prepared for Archaeology Branch, Victoria.

Appendix D: Analysis of the Vertebrate Fauna from Ts'ishaa Village, DfSi-16, Benson Island, B.C.

by Gay Frederick and Susan Crockford

Pacific Identifications Inc. Victoria, B.C.

Introduction

The vertebrate fauna collected as level samples from five excavation units at DfSi-16, Tsi'ishaa Village, have been identified in whole or in part and are presented as an integrated sample in this report. Earlier reports have detailed the individual units and site areas (Crockford 1999; Frederick 2001, 2002 and 2003). The excavation units provide samples from three different areas of the site: one unit (S14-16 W25-27) from the 1999 trench through the main midden area near the centre of the site; two contiguous units (N2-4 W102-104; N4-6 W102-104) from the 2000 trench through the midden ridges at the western end of the site; and two units (S58-60 W64-66; S62-64 W62-64) from the back terrace area excavated in 2001. Vertebrate fauna from all levels of the back terrace units, odd-numbered levels of the 2000 units and selected levels of the 1999 units were identified.

Methods of Collection

In each area of the site units were excavated using 10 centimeter arbitrary levels (numbered) combined with designation of cultural layers (lettered). All deposits were trowelled and screened through ¼" mesh in the field, with all vertebrate faunal remains retained in the screens or found during excavation bagged for identification. Deposit column and fine screen samples were collected for analysis of small fauna, but this report deals only with the level bag vertebrate fauna.

Methods of Identification

Identifications to the least inclusive taxon possible were made by Gay Frederick (2000 and 2001 samples) and Susan Crockford (1999 samples) using the comparative faunal collection at the Zooarchaeology Laboratory, Department of Anthropology, University of Victoria. Bird, fish, land and sea mammal remains were identified with data recorded directly into a Paradox 35 database. In addition to taxa identification, information on element, element portion, sex, age, size class and modifications was recorded. Confidence codes indicating certainty of identification are used, Code 22 indicating certainty to species (e.g., *Oncorhynchus keta*), Code 21 certainty to at least genus (e.g., *Oncorhynchus sp.* or *Oncorhynchus cf. keta*), Code 20 certainty to family only (e.g., Salmonidae), Code 10 a limited-confidence identification to family (e.g., cf. Salmonidae), Code 11 a best guess and Code 00 indicating a confidence assessment is not applicable (eg.Unidentified Fish).

The faunal data has been quantified using Numbered of Identified Specimens, Number of Specimens and Minimun Number of Individuals. Only the former two measures have been used in integrating the sample. Given the small sample sizes for birds and mammals, these were felt to be the most appropriate measures.

Chronology of Site Areas and Stratigraphic Units

Each of the three areas of the site were occupied at different, sometimes overlapping, time periods and the deposits of both trenches can be broken into major stratigraphic groupings. The oldest deposits at the site are those of the back terrace, with ^{14}C dates of 4470 ± 70 RCYBP to 3000 ± 70 RCYBP. Differences through time within these deposits are seen and described in Frederick 2002 and 2003, but relative to other areas of the site, the fauna are internally consistent and the samples are treated as a unit here. A number of human burials associated with cairns were found in this area of the site.

The deposits of the 1999 trench have an initial occupation date of 1800 ± 60 RCYBP and a second date of 1490 ± 60 RCYBP near the base of cultural Layer C. Layer D, immediately below, is a thin sand layer that appears to cap earlier layers and the deposits have been divided at this layer for comparative purposes, treating Layers A, B and C as an upper younger unit and Layers D, E, F and G as a lower older unit.

The deposits of the 2000 trench have been divided into three stratigraphic units: an upper one of Layers A and B, relatively horizontal, low shell layers perhaps representing living floors, dating within the past 500 years; a middle one of Layer C, the thick heavy shell dump layer with dates between about 900 RCYBP and 500 RCYBP; and an initial lower unit of Layers D and D*, also heavy shell layers, with an initial ^{14}C date of 1230±90 RCYBP and upper dates around 900 RCYBP. The sequence appears to be continuous, with the two excavation units discussed here cutting through the seaward edge and slope of the middle terrace.

As there are no terminal dates for the upper unit of the 1999 trench, it is not clear how these deposits overlap in time with the lowest layers of the 2000 trench. Otherwise, the tables are laid out in a temporal sequence from the back terrace to upper trench 2000.

Vertebrate Faunal Species Identified

Table 1 lists the taxa identified in the sample, including at least 31 species of birds, 7 species of land mammal, 2 commensal species, 9 species of sea mammal plus whale and 24 species of fish. A brief description of the natural history of each species recovered, including size information, habitat preference, food habits, seasonal movements and also indicating any skeletal identification problems, is presented in Appendix I.

The Identified Sample

A total of 48,962 vertebrate faunal specimens from DfSi-16 was examined. Table 2 lists the Number of Identified Specimens (NISP) for the total identified site level sample and also includes totals for unidentified bone and total Number of Specimens (NSP) for major taxa groupings. Table 3 gives the relative frequencies of NSP for major taxa by site area and stratigraphic unit.

Fish constitute 93% of the vertebrate faunal remains (NSP 45,333) while sea mammals constitute 3% (NSP 1,541) and birds, land mammals and commensal mammals each make up only 1% of the sample Bird NSP 583; Land Mammal NSP 484; Commensal Mammal NSP 296). An additional 1% of the sample (NSP 674) could only be identified as mammal and <1% (NSP 51) could not be identified to a specific taxon (Table 2 and 3). Note that Feature 7A in the 1999 A/B/C stratigraphic unit is excluded from all totals and tables in this report. It was collected as a bulk sample and then screened through smaller mesh than the level samples. Including the counts with the level counts would introduce mesh size bias. Feature 7A included an additional 8616 bones, of which 8506 are anchovy and herring (Crockford 1999). All other feature samples discussed in earlier reports are included in the totals and tables.

It is clear that fish remains are by far the most frequently occurring vertebrate faunal remains by NSP in all areas and time periods at DfSi-16. It is also clear that the dominance of fish is considerably less in the oldest back terrace area (71%) and in the most recent 2000 A/B deposits (65%) than in the other stratigraphic units (91% to 98%). In the back terrace sample, land mammal (6%) and commensal mammal (5%) are more strongly represented than in any other area of the site, while birds (8%) and especially sea mammal (21%) remains are more frequently occurring in the most recent deposits (Table 3).

The dominance of fish remains at over 90% by NSP is especially clear in the 1999 samples and the lower two stratigraphic units of the 2000 trench, despite highly variable total bone sample sizes, ranging from NSP 3,683 to NSP 17,167 (Table 3).

The higher frequency of unidentified mammal in the back terrace sample (9% versus 3% and < 1%) reflects the more fragmentary nature of some of the bone in this area. It is also clear that the 1999 trench deposits contain far less bone than the 2000 trench deposits. A more exact comparison cannot be made at this time as not all level samples in these units were identified, but the depth of deposit is roughly comparable, suggesting a far greater density of bone in the 2000 trench deposits.

The overall pattern, strongly emphasizing fish, is maintained if one looks at only those remains identified to at least family taxonomic level. The differences between the back terrace fauna and the other site areas' fauna is very apparent (Table 4). It is worth noting here that 84% (NISP 294) of the total land mammal sample is from the back terrace area, despite the fact that these deposits produced only 11% by NSP (5345) or 12% by NISP (2356) of the total vertebrate faunal sample. If both land and commensal mammals are counted, that percent rises to 88% (NISP 569). Clearly, these deposits represent a focus of exploitation or activity different from other site areas.

Table 1. DfSi-16 taxa list, taxa identified to at least family, ID confidence code at least 20.

BIRDS	
Loon *sp.*	*Gavia sp.*
Common Loon	*Gavia immer*
Pacific Loon	*Gavia pacifica*
Red-Throated Loon	*Gavia stellata*
Horned Grebe	*Podiceps auritus*
Short-tailed Albatross	*Phoebastria albatrus* formerly *Diomedia albatrus*
Northern Fulmar	*Fulmaris glacialis*
Shearwater *sp.*	*Puffinus sp.*
Sooty Shearwater	*Puffinus griseus*
Pink-footed Shearwater	*Puffinus creatopus*
Flesh-footed (formerly Pale-footed) Shearwater	*Puffinus carneipes*
Short-tailed (formerly Slender-billed) Shearwater	*Puffinus tenuirostris*
Gull *sp.*	*Larus sp.*
Black-legged Kittiwake	*Rissa tridactyla*
Tern *sp.*	*cf. Sterna sp.*
Common Murre	*Uria aalge*
Marbled Murrelet	*Brachyrhamphus marmoratus*
Rhinocerus Auklet	*Cerorhinca monocerata*
Pigeon Guillemot	*Cepphus columba*
Cormorant *sp.*	*Phalacrocorax sp.*
Pelagic Cormorant	*Phalacrocorax pelagicus*
Brandt's Cormorant?	*Phalacrocorax cf. penicillatus*
Goose *sp.*	Anserinae
Goose *sp.*	*Anser sp.*
Goose *sp.* Brant	*Branta bernicla*
Canada Goose	*Branta canadensis*
Duck *sp.*	Anatidae
Diving Duck	*Aythya sp.*
Dabbling Duck	*Anas sp.*
Mallard	*Anas platyrhynchos*
Surf Scoter	*Melanitta perspicillatus*
Bufflehead	*Bucephala albeola*
Bald Eagle	*Halieetus leucocephalus*
Sharp-shinned Hawk	*Accipiter striatus*
Belted Kingfisher	*Ceryle alcyon*
Northwestern Crow	*Corvus caurinus*
Band-tailed Pigeon	*Columba fasciata*
Varied Thrush	*Ixoreus naevius*
LAND MAMMALS	
Mule Deer	*Odocoileus hemionus*
Elk	*Cervus elaphus*
Raccoon	*Procyon lotor*
River Otter	*Lontra canadensis*
Marten	*Martes americana*
Mink	*Mustela vison*
Beaver	*Castor canadensis*

COMMENSAL MAMMALS	
Domestic Dog	*Canis familiaris*
Deer Mouse	*Peromyscus maniculatus*
SEA MAMMALS	
Eared Seal	Otariidae
Fur Seal	*Callorhinus ursinus*
Northern Sealion	*Eumatopias jubata*
California Sealion	*Zalophus californianus*
Harbour Seal	*Phoca vitulina*
Elephant Seal?	*cf. Mirounga angustirostris*
Sea Otter	*Enhydra lutris*
Porpoise/Dolphin *sp.*	Delphinidae/Phocoenidae
Harbour Porpoise	*Phocoena phocoena*
Dall's Porpoise	*Phocoena dalli*
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*
Whale *sp.*	Cetacea
FISH	
Dogfish Shark	*Squalus acanthias*
Ratfish	*Hydrolagus colliei*
Skate *sp.*	*cf. Raja sp.*
Pacific Herring	*Clupea pallasi*
Northern Anchovy	*Engraulis mordax*
Salmon *sp.*	*Oncorhynchus sp.*
Chinook ? Salmon	*Oncorynchus cf. tshawytscha*
Pacific Cod	*Gadus macrocephalus*
Pacific Hake	*Merluccius productus*
Plainfin Midshipman	*Porichthys notatus*
Rockfish *sp.*	*Sebastes sp.*
Lingcod	*Ophiodon elongates*
Greenling *sp.*	*Hexagammos sp.*
Kelp Greenling	*Hexagrammos deccagrammus*
Rock Greenling	*Hexagrammos lagocephalus*
Sculpin *sp.*	Cottidae
Cabezon	*Scorpaenichthys marmoratus*
Red Irish Lord	*Hemilepidotus hemilepidotus*
Irish Lord *sp.*	*Hemilepidotus sp.*
Staghorn Sculpin	*Leptocottus armatus*
Surf Perch *sp.*	Embiotocidae
Pile Perch	*Damalichthys vacca*
Striped Sea Perch	*Embiotica lateralis*
Flatfish *sp.*	Pleuronectiformes
Halibut	*Hippoglossus stenolepis*
Petrale Sole	*Eopsetta jordani*
English Sole	*Parophrys vetulus*
Rock Sole	*Lepidosetta sp.* could be either *L. bilineata* or *L. polyxystra*
Bluefin Tuna	*Thunnus thynnus*

Table 2. DfSi-16, identified site level sample of vertebrate fauna NSP and NISP totals, confidence code of at least 20.

COMMON NAME	SPECIES	SITE TOTAL
BIRDS		
Loon *sp.*	*Gavia sp.*	8
Common Loon	*G. immer*	9
Pacific Loon	*G. pacifica*	6
Red-Throated Loon	*G. stellata*	1
Horned Grebe	*Podiceps auritus*	1
Albatross *sp.*	*Phoebastria sp.*	3
Short-tailed Albatross	*Phoebastria albatrus*	14
Northern Fulmar	*Fulmaris glacialis*	4
Shearwater *sp.*	*Puffinus sp.*	7
Sooty Shearwater	*Puffinus griseus*	19
Pink-footed Shearwater	*Puffinus creatopus*	3
Flesh-footed Shearwater	*Puffinus carneipes*	4
Short-taild Shearwater	*Puffinus tenuirostris*	1
Shearwater/Fulmar	Procellaridae	1
Gull *sp.*	*Larus sp.*	11
Black-legged Kittiwake	*Rissa tridactyla*	7
Tern *sp.*	*cf. Sterna sp.*	3
Common Murre	*Uria aalge*	12
Marbled Murrelet	*Brachyrhamphus marmoratus*	4
Rhinocerus Auklet	*Cerorhina monocerata*	1
Pigeon Guillemot	*Cepphus columba*	1
Cormorant *sp.*	*Phalacrocorax sp.*	11
Pelagic Cormorant	*Phalacrocorax pelagicus*	9
Brandt's Cormorant?	*Phalacrocorax cf. penicillatus*	1
Goose *sp.*	Anserinae	15
Goose *sp.*	*Anser sp.*	28
Goose *sp.* Brant?	*cf. Branta bernicla*	5
Canada Goose	*Branta canadensis*	13
Duck *sp.*	Anatidae	20
Diving Duck	*Aythya sp.*	1
Dabbling Duck	*Anas sp.*	1
Mallard	*Anas platyrhynchos*	10
Surf Scoter	*Melanitta perspicillatus*	1
Bufflehead	*Bucephala albeola*	1
Bald Eagle	*Halieetus leucocephalus*	14
Sharp-shinned Hawk	*Accipiter striatus*	1
Belted Kingfisher	*Ceryle alcyon*	1
Northwestern Crow	*Corvus caurinus*	2
Band-tailed Pigeon	*Columba fasciata*	1
Varied Thrush	*Ixoreus naevius*	1
	TOTAL BIRD NISP	**256**
Unidentified bird		327
	TOTAL BIRD NSP	**583**
FISH		
Dogfish Shark	*Squalus acanthias*	429
Ratfish	*Hydrolagus colliei*	
Skate *sp.*	*cf. Raja sp.*	1
Pacific Herring	*Clupea pallasi*	401
Northern Anchovy	*Engraulis mordax*	328
Salmon *sp.*	*Oncorhynchus sp.*	360
Chinook Salmon?	*Oncorynchus cf. tshawytscha*	5
Pacific Cod	*Gadus macrocephalus*	17
Pacific Hake	*Merluccius productus*	436
Plainfin Midshipman	*Porichthys notatus*	38
Rockfish *sp*	*Sebastes sp.*	14,385
Lingcod	*Ophiodon elongates*	1,448
Greenling *sp.*	*Hexagammos sp.*	1,038
Kelp Greenling	*Hexagrammos deccagrammus*	775

Table 2 Continued.

Rock Greenling	*Hexagrammos lagocephalus*	31
Sculpin *sp.*	Cottidae	15
Cabezon	*Scorpaenichthys marmoratus*	292
Red Irish Lord	*Hemilepidotus hemilepidotus*	79
Irish Lord *sp.*	*Hemilepidotus sp.*	4
Staghorn Sculpin	*Leptocottus armatus*	1
Surf Perch *sp*	Embiotocidae	366
Pile Perch	*Damalichthys vacca*	314
Striped Sea Perch	*Embiotica lateralis*	119
Flatfish *sp.*	Pleuronectiformes	154
Halibut	*Hippoglossus stenolepis*	181
Petrale Sole	*Eopsetta jordani*	598
English Sole	*Parophrys vetulus*	2
Rock Sole	*Lepidosetta sp.*	23
Bluefin Tuna	*Thunnus thynnus*	20
	TOTAL FISH NISP	**22,100**
Unidentified fish		23,233
	TOTAL FISH NSP	**45,333**
LAND MAMMALS		
Mule Deer	*Odocoileus hemionus*	45
Elk	*Cervus elaphus*	1
Raccoon	*Procyon lotor*	40
River Otter	*Lontra canadensis*	187
Marten	*Martes americana*	1
Mink	*Mustela vison*	74
Beaver	*Castor canadensis*	3
	TOTAL LAND MAMMAL NISP	**351**
Unidentified land mammal		133
	TOTAL LAND MAMMAL NSP	**484**
COMMENSAL MAMMALS		
Domestic Dog	*Canis familiaris*	294
Deer Mouse	*Peromyscus maniculatus*	2
	TOTAL COMMENSAL MAMMAL NISP	**296**
	TOTAL COMMENSAL MAMMAL NSP	**296**
SEA MAMMALS		
Eared Seal	Otariidae	16
Fur Seal	*Callorhinus ursinus*	250
Northern Sealion	*Eumatopias jubata*	19
California Sealion	*Zalophus californianus*	1
Harbour Seal	*Phoca vitulina*	43
Elephant Seal?	*cf. Mirounga angustirostris*	1
Pinneped	Unspecified Pinnepedia	159
Sea Otter	*Enhydra lutris*	6
Porpoise/Dolphin *sp.*	Delphinidae/Phocoenidae	52
Harbour Porpoise	*Phocoena phocoena*	19
Dall's Porpoise	*Phocoena dalli*	6
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	48
Whale *sp.*	Cetacea	254
	TOTAL SEA MAMMAL NISP	**874**
Unidentified sea mammal		667
	TOTAL SEA MAMMAL NSP	**1,541**
UNDETERMINED MAMMAL	**TOTAL NSP**	**674**
UNDISTINGUISHED BONE	**TOTAL NSP**	**51**
	TOTAL IDENTIFIED BONE NISP	**23,881**
	TOTAL NSP (ALL BONE)	**48,962**

Table 3. DfSi-16, vetebrate fauna major taxa by site area and strata, relative frequency, NSP*.

Strat Unit	Bird (%)	Fish (%)	Sea Mammal (%)	Land Mammal (%)	Comm. Mammal (%)	Unid. Mammal (%)	Unid. Taxa (%)	Total (%)	Total NSP
2000 A/B	8	65	21	2	0	3	<1	**99**	**1,080**
2000 C	2	95	2	<1	<1	<1	<1	**99**	**16,373**
2000 D/D*	<1	98	2	<1	<1	<1	<1	**100**	**17,167**
1999 A/B/C	1	91	5	<1	<1	3	0	**100**	**3,683**
1999 D/E/F/G	1	97	1	1	0	<1	<1	**100**	**5,313**
Back Terrace	1	71	8	6	5	9	<1	**100**	**5,346**
Site %	**1**	**93**	**3**	**1**	**1**	**1**	**<1**	**100**	
Total NSP	**583**	**45,333**	**1,541**	**484**	**296**	**674**	**51**		**48,962**

*Excludes Feature 7A in 1999 A/B/C which contained an additional 8,616 bones, of which 8,506 are anchovy and herring. This feature has been excluded from future tables because it was collected as a bulk sample and then screened through smaller mesh than the level samples. Including the counts with the level counts would introduce mesh size bias. Feature 7A material is excluded from all tables in this report. All other feature samples discussed in earlier reports are included in the totals in this and all subsequent tables.

Table 4. DfSi-16, identified vertebrate fauna. Major taxa by site area and strata, relative frequency, NISP.

Strat. Unit	Bird (%)	Fish (%)	Sea Mammal (%)	Land Mammal (%)	Commensal Mammal (%)	Total (%)	Total NISP
2000 A/B	7	66	26	1	0	**100**	**535**
2000 C	2	95	3	<1	<1	**100**	**7,606**
2000 D/D*	<1	98	2	<1	<1	**100**	**8,659**
1999 A/B/C	1	92	6	<1	1	**100**	**1,754**
1999 D/E/F/G	1	97	1	1	0	**100**	**2,356**
Back Terrace	1	71	8	10	9	**99**	**2,967**
Total %	**1**	**93**	**4**	**1**	**1**	**100**	
Total NISP	**256**	**22,100**	**874**	**351**	**296**		**23,877**

Land Mammals

Of the 484 land mammal specimens, 351 were identified to species, including Coast Deer, Elk, Raccoon, River Otter, Mink, Marten and Beaver (Table 2, 5 and 6). River Otter is the most frequently occurring land mammal at 53% (NISP 187), Mink is next at 21% (NISP 74), then Coast Deer with 13% (NISP 45) and Raccoon with 11% (NISP 40). Beaver is 1% (NISP 3) and Elk and Marten <1% each (NISP 1 each). The samples from all site areas and strata except the back terrace are very small, less then 20 specimens. In contrast, 294 specimens were identified from the back terrace sample. As explained in earlier reports, this high land mammal frequency is primarily the result of the recovery of partial and nearly complete River Otter and Mink skeletons (Frederick 2002, 2003). At least one River Otter skeleton (Feature #19, Level 9, EU S58-60 W 64-66) seems to have been deliberately interred, and the same may be true for three partial mink skeletons. The skeleton of the large male river otter was found in anatomical alignment indicating it had been placed on its back, with a loose circle of fairly large stones surrounding the skeleton.

It may well be that these partial and almost complete otter and mink skeletons, as well as the dog skeletons from this areas (see below) are deliberate burials associated with the human burials in this area of the site. In this regard, it is worth noting that "land" otter and mink are both important figures in southern Northwest Coast mythology.

The sample sizes for the other site areas/strata are so small as to make the percentages meaningless. The restricted number of species represented reflects the island location while the three fragments of beaver teeth and the one fragment of elk rib are clearly imports.

Mule deer are represented by adult, subadult and juvenile individuals. Adult, sub-adult, juvenile and foetal or newborn raccoons are present, and

Table 5. DfSi-16, land mammals, taxa by site area and strata, relative frequency of NISP.

Strat. Unit	Mule Deer (%)	Elk (%)	Raccoon (%)	River Otter (%)	Mink (%)	Marten (%)	Beaver (%)	Total(%)	NISP
2000 A/B	29	0	0	29	43	0	0	**101**	**7**
2000 C	20	10	10	30	20	0	10	**100**	**10**
2000 D/D*	85	0	8	8	0	0	0	**101**	**13**
1999 A/B/C	43	0	0	14	14	14	14	**99**	**7**
1999 D/E/F/G	80	0	0	15	5	0	0	**100**	**20**
Back Terrace	4	0	13	60	23	0	<1	**100**	**294**
Total %	**13**	**<1**	**11**	**53**	**21**	**<1**	**1**	**99**	
Total NSP	**45**	**1**	**40**	**187**	**74**	**1**	**3**		**351**

Table 6. DfSi-16, land and commensal mammals, site area and strata by species, relative frequency of NISP.

Strat. Unit	Muledeer (%)	Elk (%)	Raccoon (%)	River Otter (%)	Mink (%)	Marten (%)	Beaver (%)	Deer Mouse (%)	Dog (%)	Total (%)	NISP
2000 A/B	29	0	0	29	43	0	0	0	0	**101**	**7**
2000 C	18	9	9	27	18	0	9	0	9	**99**	**11**
2000 D/D*	52	0	5	5	0	0	0	0	38	**100**	**21**
1999 A/B/C	16	0	0	5	5	5	5	5	58	**00**	**19**
1999 D/E/F/G	80	0	0	15	5	0	0	0	0	**100**	**20**
Back Terrace	2	0	7	31	12	0	<1	<1	48	**100**	**569**
Site %	**7**	**<1**	**6**	**29**	**11**	**<1**	**<1**	**<1**	**45**	**98**	
Total NISP	**45**	**1**	**40**	**187**	**74**	**1**	**3**	**2**	**294**		**647**

river otters are represented by adults, sub-adults and juveniles. Mink on the other hand, are represented only by adults.

Commensal Mammals

Commensal mammals are represented by the Domestic Dog and the Deer Mouse. It is possible that the deer mouse (NISP 2) is a local forest inhabitant rather than a true commensal. Two hundred and ninety-four dogbones were identified, 274 of these from the back terrace. If included with land mammals, dogs form 48% of the back terrace sample (Table 2 and 6). The back terrace dog sample includes two discrete clusters of bones in anatomical alignment, partial skeletons possibly representing deliberate burials. Also three left mandibles were recovered from the back terrace area that display an interesting pattern of cut marks suggestive of deliberate dispatch of the dogs. The cut marks are short, sharp cuts across the basal border of the horizontal ramus in the area between M1 and the mental foramen (Frederick 2002). Again, the other site areas' sample sizes are too small to provide meaningful relative frequencies for those samples. The sample contains all ages of dogs.

Eighteen (55%) of the 33 skeletal elements of dog that could be compared with Crockford's Type 1 and Type 2 means and ranges for specific measurements, fit within the size range of Crockford's Type 1 small Northwest Coast dog, or are slightly smaller (Appendix II). The larger Type 2 dog is also represented. Eleven measurable elements from the articulated partial rear legs in Unit S58-60 W 64-66 place this individual in the Type 2 size category. The overwhelming concentration of dog remains in the older back terrace area compared to other areas of the site is particularly interesting. It suggests that the inhabitants responsible for these older deposits viewed and treated dogs in a different manner from the later site inhabitants. While the Type 1 specimens clearly represent a small Northwest Coast dog of the type ethnographically associated with the Salish wool dog it is not possible to determine from the structure of the skeletal remains, the nature of the Benson Island dogs' coats. Their size range does however, raise the possibility that these may have been long haired "wool dogs" kept separate and treated differently from other dogs. Their presence could push the known time depth of a small Type 1 dog back beyond 4000 RCYBP on the Northwest Coast.

Sea Mammals

One thousand five hundred and forty-one specimens were identified as sea mammal. Of these, 874 were identified to species, genus or family, including Fur Seal, Northern Sea Lion, California Sea Lion, Harbour Seal, cf. Elephant Seal, Sea otter, Harbour Porpoise, Dall's Porpoise, Pacific White-sided Dolphin and whale (Table 2 and 7). While the whale bones from the excavation units discussed here have not been identified to species, a number of skeletal elements in other units have been at least tentatively identified using DNA analysis. Of these, 13 samples are identified as Humpback Whale and the fourteenth, a complete mandible from the 2000 trench, is identified as Gray Whale (McMillan, pers. comm. 2003). It is likely that the fragmentary whale bones recovered from all areas of the site reflect a similar pattern of concentration on humpback whale.

Of the identified sea mammals, fur seal and whale are the most frequently occurring specimens, each at 29% (NISP 250 and 254 respectively) of the total sample. Unspecified Pinniped is next at 18% (NISP 159). It is likely that most of these fragments are in fact fur seal. No other taxonomic category forms more than 6% of the sample, with Dolphin/Porpoise sp. at 6% (NISP 52), Pacific White-sided Dolphin and Harbour Seal each at 5% (NISP 48 and 43 respectively), Northern Sea Lion and Harbour Porpoise at 2% (NISP 19 for each) and Dall's Porpoise at 1% (NISP 6). Only 6 specimens of Sea Otter were recovered, and a single specimen each of California Sea Lion and probable Elephant Seal were identified (Table 7).

There is a definite increase through time in the relative frequency of fur seal remains, from 13% in the back terrace sample to 49% in the 2000 A/B sample. Of interest is the pattern presented by Cetacea remains. The highest relative frequencies are in the oldest deposits, with 57% in the back terrace and 53% in the 1999 D/E/F/G sample. These patterns are amplified if one groups the data into larger taxonomic groupings of Pinnipeds, Dolphins/Porpoises, Sea Otter and Cetacea (Table 8). The emphasis in the older deposits on Cetacea and Dolphins/Porpoises is clearer, while the general increase in relative frequency of Pinnipeds through time is upheld. It should be pointed out here that the pattern of whale remains may have a great deal to do with the nature of the deposits, the way in which large whale bones enter the archaeological record and the fragmentation patterns of large chunks of whale bone. In other words the high frequency in the older deposits may represent a few large bones that are highly fragmented, rather than an increased frequency of element occurrence. This is an ongoing problem in the quantification of whale bone in Northwest Coast sites. Similarly the low frequency of whale remains in the most recent deposits 2000 A/B may have more to do with the nature of these deposits, potential living floors, than the actual frequency of occurrence of whale remains in deposits of this time period. This becomes clear when one looks at the fauna recovered from units close to the present beach on a lower terrace. Here several

Table 7. DfSi-16, sea mammals, site area and strata by taxa, relative frequency of NISP.

Taxa	2000 A/B (%)	2000 C (%)	2000 D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	NISP
Fur Seal	49	26	38	34	16	13	**29**	**250**
Northern Sea Lion	1	1	1	9	0	3	**2**	**19**
California Sea Lion	0	0	1	0	0	0	**<1**	**1**
Ottarid	4	1	2	1	0	2	**2**	**16**
Harbour Seal	4	7	5	11	6	1	**5**	**43**
Elephant Seal	0	0	0	0	3	0	**<1**	**1**
Pinniped Unspecified	39	16	31	21	0	1	**18**	**159**
Sea Otter	0	1	1	1	0	1	**1**	**6**
Harbour Porpoise	0	2	4	2	19	0	**2**	**19**
Dall's Porporise	0	1	2	1	0	0	**1**	**6**
Pacific W-s Dolphin	0	4	4	0	0	14	**5**	**48**
Porpoise/Dolphin Sp.	0	11	3	2	3	9	**6**	**52**
Cetacea	2	32	8	19	53	57	**29**	**254**
Total %	**99**	**100**	**100**	**101**	**100**	**101**	**101**	
NISP	**138**	**197**	**162**	**101**	**32**	**244**		**874**

Table 8. DfSi-16, sea mammals, major taxa grouping by site area and strata, relative frequency by NISP.

Strat. and Area	Pinnipeds (%)	Dolphins/Porpoises (%)	Sea Otter (%)	Cetacea (%)	Total (%)	NISP
2000 A/B	98	0	0	2	**100**	**138**
2000 C	49	18	1	31	**99**	**194**
2000 D/D*	78	14	1	8	**101**	**162**
1999 A/B/C	75	5	1	19	**100**	**101**
1999 D/E/F/G	25	22	0	53	**100**	**32**
Back Terrace	19	23	1	57	**100**	**244**
Site Total (%)	**56**	**14**	**1**	**29**	**100**	**872**
NISP	**488**	**125**	**6**	**253**		

features of whale bone were uncovered comparable in age to the 2000 A/B sample. Both humpback and grey whale elements are present in Feature 57, located seaward of the units discussed here above a ^{14}C date of 690±60 RCYBP.

The higher frequency of porpoise and dolphin remains in the back terrace area is partially accounted for by the presence in those deposits of two clusters of aligned vertebrae of Pacific White-sided Dolphin, clearly deposited while still articulated. The spines have obviously been chewed by a small carnivore, displaying tooth punctures consistent in size and nature with those that would be made by a puppy. These vertebral column sections may well have been fed to the dogs.

Clearly, there is a focus at DfSi-16, from the initial occupation of the site, on fur seals, dolphins and porpoises and whales. Taking adults of these species would require considerable hunting skill and the use of efficient watercraft. While actual hunting of whales cannot be proven for the earlier deposits, it is proven for the later deposits at DfSi-16.

Although not discussed in this particular sample, a partial humpback whale skull with a California mussel shell harpoon blade imbedded in the occipital bone was recovered from Feature 57 in the 2000 trench, above the date of 690±60 RCYBP (McMillan and St. Claire 2001:39–40). Sea otters were apparently not a focus of exploitation at this site.

Additionally, the presence in these samples of fur seals of all age groups and both sexes, including newborn and still nursing infants, clearly demonstrates the presence in the general Barkley Sound area of fur seal pupping grounds well outside the known pupping range of the present fur seal population, indicating a local, non-migratory population in the nearby area (Crockford, Frederick and Wigen 2002). New born and/or young juvenile animals are recorded from all site areas/straigraphic units except 2000 A/B. In this sample, although no definitely nursing pups are recorded, both juvenile and adult individuals are present. The presence of newborn fur seals also confirms the presence of the site inhabitants on Benson Island during the summer months and hunting of these animals on the pupping grounds. Today, the Northern Fur Seal pupping season in the Bering Sea is narrowly constrained between early June and mid-July. It is possible that it may have been slightly longer and earlier in the more southerly, warmer waters off the west coast of Vancouver Island.

Birds

A small sample of bird remains was recovered from the DfSi-16 site. Of the 583 bird specimens examined, 256 were identified to species or genus (Table 2). At least 33 species of birds are present (Table 1). Grouping the species into larger taxonomic categories displays some patterns, even in this small sample (Table 9). In the site as a whole, geese are the most frequently occurring birds at 24% (NISP 61), followed by shearwaters and the Northern Fulmar at 16% (NISP 39) then ducks at 13% (NISP 34). Loons and grebes; albatross; alcids; cormorants; gulls, terns and kittiwakes; and eagles and hawks each form between 6% and 9% of the sample, while crows and other small forest birds each make up 1% of the sample. The earlier deposits at the site display less focus on geese and ducks, and a slightly greater emphasis on the pelagic species such as albatross and shearwaters and the diving birds such as cormorants and alcids. The sample sizes are, however, very small, so these apparent patterns may be unreliable. Birds do not appear to have been a major focus of exploitation.

None of the samples are large enough to show reliable patterns of skeletal elements represented.

Table 9. DfSi-16, identified birds, taxa by site area and strata, relative frequency of NISP.

TAXA	2000 A/B (%)	2000 C (%)	2000 D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	NISP
Loons and Grebes	6	12	0	10	5	14	**9**	**25**
Albatross	18	0	10	14	25	3	**7**	**17**
N. Fulmar, Shearwaters	0	16	10	38	25	10	**16**	**39**
Alcids	5	7	20	0	25	0	**7**	**18**
Cormorants	11	4	0	0	0	38	**8**	**21**
Gulls, Terns, Kittiwakes	8	9	10	5	20	0	**8**	**21**
Geese	24	31	30	14	0	10	**24**	**61**
Ducks	8	18	10	19	0	3	**13**	**34**
Eagles, Hawks	18	2	10	0	0	14	**6**	**15**
Crow	3	0	0	0	0	3	**1**	**2**
Small Forest Birds	0	2	0	0	0	3	**1**	**3**
Total %	**101**	**101**	**100**	**100**	**100**	**98**	**100**	
NISP	**38**	**138**	**10**	**21**	**20**	**29**		**256**

The presence of migratory birds allows some inferences to be made regarding season of exploitation and presumably occupation. Preferred habitats also allow some inferences to be made regarding where hunting may have been taking place. These topics are discussed below in the sections on Season of Exploitation and Habitats Exploited.

Fish

Fish remains form by far the greatest proportion of the faunal remains at DfSi-16, in all areas of the site. Of the 45,333 fish bones examined 22,100 were identified to species, genus or family (Table 2 and 10). For the site as a whole, Rockfish species are overwhelmingly the most frequently occurring taxon at 65% (NISP 14,385). The next most frequently occurring taxon is Greenlings at only 8% (NISP 1,844) followed by Lingcod at 7% (NISP 1,448), Surf Perches at 4% (NISP 799) and Petrale Sole at 3% (NISP 598). All other fish taxa are 2% or less of the site sample. While rockfish dominate in all areas and stratigraphic units of the site, there are some differences between the earliest back terrace deposits, the main midden trenches, and the most recent deposits of trench 2000 A/B. In the back terrace sample, there is a more broadscale distribution of emphasis, with rockfish (31%), Greenlings (23%) and Lingcod (13%) more evenly emphasized, and dogfish (9%), surfperches (6%) and anchovy (6%) more frequently occurring. At the same time, there is a lower or nonexistent emphasis on smaller flatfishes and offshore fishes such as Halibut, Bluefin Tuna, Pacific Cod and Pacific Hake.

In the middle and lower layers of the 2000 trench, the emphasis is very strongly on rockfish, while in the 1999 trench, the lower layers show a strong emphasis on rockfish but also more emphasis on lingcod as well. The higher frequency of herring and anchovy in the upper layers of the 1999 trench is undoubtedly related to the presence of Feature 7A (the 8000 plus anchovy and herring bones) in layer A. There is also a stronger emphasis on surf perches in these upper layers (Table 10).

The upper unit of the 2000 trench is distinguished from all other site areas and stratigraphic units by the much higher percentage of salmon remains. In all other areas and strata, salmon are 3% or less of the fish sample by NISP. In the 2000 A/B sample, salmon form 27% of the identified fish remains. This may represent a shift in exploitation strategy, a different season of occupation, or may simply reflect the different nature of these deposits as living floors rather than dump areas.

The most clearly marked pattern in the fish remains is the steady increase in rockfish percentages until the 2000 A/B sample. It is also clear that rockfish, greenling, surf perches and lingcod together are the most important of the larger fish resources for all areas except 2000 A/B . Together, they account for 84 % of the total site fish sample, and between 72 % (1999 A/B/C) and 91% (2000 C) of the different site area/ stratigraphic unit samples. Even with the strong emphasis on salmon in the 2000 A/B sample, these four taxa form 53% of that sample. All other species occur in much lower frequencies and sporadically. One must always keep in mind the under-representation of herring and anchovy in these level samples. While not well

Table 10. DfSi-6, fish taxa by site area and strata, relative frequency by NISP.

TAXA	2000 A/B (%)	2000 C (%)	2000 D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	NISP
Herring*	5	<1	1	13	<1	3	**2**	**401**
Anchovy*	0	<1	0	7	<1	6	**1**	**328**
Salmon	27	1	1	1	2	3	**2**	**365**
Surfperch	2	3	3	10	1	6	**4**	**799**
Cabezon	3	1	1	1	1	3	**1**	**292**
Other Sculpin	2	<1	<1	<1	<1	<1	**<1**	**99**
Lingcod	10	3	3	3	29	13	**7**	**1,448**
Greenling Sp.	14	4	8	10	7	23	**8**	**1,844**
Rockfish	27	81	70	49	48	31	**65**	**14,385**
Dogfish	1	1	1	1	2	9	**2**	**429**
Ratfish	1	1	1	2	1	1	**1**	**240**
Halibut	0	<1	<1	1	4	1	**1**	**181**
Petrale Sole	5	4	4	<1	<1	<1	**3**	**598**
Other Flatfish	1	1	1	<1	<1	<1	**1**	**179**
Pacific Cod	0	0	<1	0	<1	0	**<1**	**17**
Pacific Hake	1	1	4	<1	2	0	**2**	**436**
Bluefintuna	0	<1	<1	0	<1	0	**<1**	**20**
Plainfin Midshipman	<1	<1	<1	<1	<1	<1	**<1**	**38**
Other	0	0	0	<1	0	0	**<1**	**1**
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**	
NISP	**352**	**7,260**	**8,466**	**1,613**	**2,284**	**2,125**		**22,100**

*Herring and Anchovy are greatly under-represented in the level samples, especially as Feature 7A in the 1999 A/B/C unit is excluded from this table. The more than 8000 bones of herring and anchovy concentrated in that feature alone, indicates both the degree to which level samples do not reflect these species' frequency of occurrence and also the patchy and concentrated nature of their deposition in the site. A much better estimation of their presence and importance in the site fish fauna will be obtained from the column sample data presently being analysed by Iain McKechnie.

represented in the level samples, these species are clearly of considerable importance. A much better estimation of their presence will be obtained from the column sample data.

Also of some interest are the patterns exhibited when size categories are examined for rockfish and lingcod. Those specimens that were sufficiently complete and variable by size to be assigned to a size category were tabulated for both these taxa. Note that only the sample from Unit N 4-6 W 102-104 was analysed for the 2000 trench for these comparisons. The rockfish data show an increase in the frequency of smaller individuals from the older deposits through Layer C of the 2000 trench (Table 11). The sample from Layer A/B of the 2000 trench is much too small (NISP 3) to be meaningful. This increasing exploitation of smaller rockfish through time is accompanied by a decreasing frequency of medium sized individuals rather than a marked decrease in large and very large individuals, although the latter size category also declines slightly in frequency through time. This pattern may reflect heavy predation on the local rockfish population resulting in the availability of fewer and fewer large and medium sized fish. It might also reflect changing fishing techniques and/or exploitation of different ecological niches, shifting from the exploitation of deeper waters where the larger individuals are more abundant, to shallower, more protected habitats where the smaller individuals are more abundant.

The pattern for lingcod is less distinct and the sample sizes are smaller, but the data do suggest an increasing exploitation of large and very large lingcod through time (Table 12). In the back terrace sample, there is a roughly equal split between bones of medium sized and larger individuals. Through time, the percentage of medium individuals in the sample decreases while the percentage of larger individuals increases. Again, the sample for 2000 A/B is too small to be reliable (NISP 12). The pattern displayed by the back terrace sample is more typical of the catch one would expect if these fish are being taken in late winter to early spring during the lingcod spawning season, when the large females, the medium sized males and the

Table 11. DfSi-16, rockfish size category by site area and strata, relative frequency of NISP

Size Category	2000* A/B (%)	2000* C (%)	2000* D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	Site NISP
Extra Small/Very Small/ Small	66	85	87	78	61	58	**78**	**2,368**
Medium/Medium-Large	0	13	10	19	33	37	**18**	**546**
Large/Very Large/ Extra Large	33	2	3	3	6	5	**4**	**110**
Total %	**99**	**100**	**100**	**100**	**100**	**100**	**100**	
NISP	**3**	**701**	**1,359**	**121**	**194**	**646**		**3,024**

* Unit N4-6 W102-104 only.

Table 12. DfSi-16, lingcod size category by site area and strata, relative frequency of NISP.

Size Category	2000* A/B (%)	2000* C (%)	2000* D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	Site NISP
Extra Small/ Very Small/ Small	0	0	0	0	0	4	**2**	**15**
Medium/ Medium- Large	83	15	20	11	30	45	**35**	**234**
Large/Very Large/Extra Large	17	85	80	89	70	51	**63**	**420**
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**	
NISP	**12**	**55**	**69**	**64**	**106**	**363**		**669**

* Unit N4-6 W102-104 only

smaller juveniles are all to be found in the shallow lower intertidal waters. The higher percentage of bones of large and very large individuals, which by their size are presumed to be female, in the younger stratigraphic units may indicate a different pattern of exploitation of the deeper rocky inshore waters during late spring through early fall, when the large females are to found concentrated in these habitats.

Rockfish, greenlings, lingcod, surfperches, cabezon and other sculpins, petrale sole, other smaller flatfish, hake, Pacific cod, herring, anchovy and plainfin midshipman are each represented by a wide range of skeletal elements in all areas of the site where they occur. Both cranial and post-cranial elements are also identified for halibut and bluefin tuna, although there is a preponderance of vertebrae for these two species. Dogfish and ratfish, as expected, are represented by vertebrae for the former and teeth for the latter. In marked contrast to this general pattern of skeletal elements representing whole fish, salmon are represented only by postcranial elements, 98 % vertebrae and 2% elements such as those associated with the tail structure or the pectoral fin. This pattern excluding cranial elements is not the result of salmon cranial elements not being identified or surviving deposition and recovery. They are readily identified and equally as durable as, for example, small flatfish cranial elements. The pattern of exclusive representation by post-cranial elements strongly suggests that the salmon at DfSi-16 were consumed as preserved fish. In turn, this suggests that they are river-caught fish obtained off island, as there are no salmon spawning streams on Benson Island. The other alternative is a net fishery of sea fish congregating prior to entering the spawning streams flowing into Barkley Sound and Alberni Inlet.

Season of Exploitation

We are able to establish the season of resource exploitation for these deposits in terms of seasons definitely represented, using the data compiled in Appendix A. The presence of certain bird or fish species with restricted seasonal occurrences in the Barkley Sound area and the presence of very young mammals allow us to state season of exploitation for some resources with considerable confidence. However, establishing the presence of people on the site during those time periods, does not preclude their presence in other times with much less clear seasonal markers. The most frequently occurring species, rockfish, greenlings, lingcod and surf perches, are available year round and provide few clues as to their season of capture.

Back Terrace Deposits

The back terrace deposits contain several clear markers for summer occupation. These include the presence of albatross which are only in this area in summer, and the presence of very young raccoon, juvenile river otter and nursing age fur seal pups. The presence of two fulmar bones might suggest winter occupation, but while winter is when fulmar are most abundantly present in this area, they are also present at other times of the year. The few other birds found in the back terrace sample could all be taken at any time of year, although cormorants, loons and geese are more plentiful during the spring and fall migrations.

Herring are available inshore in great quantities in the spring during February through May spawning times, but could be obtained in lesser quantities at any time. Anchovy, while likely only sporadically available, would be most abundantly available in inshore waters from spring through the July and August spawning season, another summer marker. As mentioned above, the pattern of lingcod individual sizes represented suggests a late fall to early spring fishery, if the fish are all being caught in the same habitat area. There are no salmon streams on Benson Island, so the few salmon remains present must represent sea caught fish which could be taken anytime or river caught fish from off island. As mentioned above, all salmon remains are post-cranial elements, suggesting preserved fish. If one assumes the use of preserved salmon primarily during the winter season, the low frequency of salmon remains might also argue against a full winter occupation. Petrale sole and halibut are most accessible (in shallower waters) during spring and summer. Taken together, seasonal markers indicate at least spring and summer occupation of the back terrace, with summer most clearly marked. The fulmar, lingcod and presumably preserved salmon might indicate winter, but this is equivocal.

1999 Trench Deposits

The summer season is also definitely indicated for all the 1999 deposits, both the older and the more recent layers. It is similarly marked by the presence of albatross, shearwaters, terns, very young fur seal and anchovy. In addition, the presence of bluefin tuna in the older deposits is a strong summer marker, while the concentrated anchovy remains in Feature 7A are a strong summer marker for the upper layers. As for the back terrace area, herring likely mark spring. Petrale sole and halibut also support occupation during the spring and summer.

There is some possibility that winter occupation is also indicated, but it is weak. The Pacific cod in the lower layers might indicate a late winter/early spring exploitation, when cod move into shallower water. They could, however, equally represent individuals taken at other times of year with deep gear. The brant in the upper layers suggest a winter season of occupation, as they are rare off the west coast at any other time of year, but all other clear markers focus on spring and summer. Again, the low frequency of salmon remains argues against a winter occupation.

2000 C and 2000 D/D Deposits*

The summer season is also indicated for the 2000 D/D* and 2000 C layers, but there is a suggestion of a more extended season of occupation in these deposits. Summer is marked by the presence in both stratigraphic units of shearwaters, very young fur seal and bluefin tuna. Additionally, anchovy is present in the 2000 C deposits and albatross in 2000 D/D* deposits. Herring is present in both, marking spring, and petrale sole and halibut in both also suggest spring and summer exploitation. The presence of whale bone that is likely grey or humpback also suggests exploitation in the spring and summer. But in both 2000 C and 2000 D/D* there is a much stronger focus on migratory geese, suggesting a stronger spring and possibly fall focus as well. Additionally, brant is present in both stratigraphic units, suggesting winter exploitation as it is rare at any other time on the west coast. In 2000 C, the presence of fulmars also suggests winter, when they are most abundant on the west coast, while the presence of California sea lion in 2000 D/D* also supports winter occupation as these animals are present in northern waters in the winter months only. Finally, the presence in 2000 C deposits of sharp-shinned hawk also suggests a more extended period of occupation as they are not present in this area in the summer. This suggestion of winter or at least late fall occupation is somewhat contradicted by the continuing low frequency of salmon, if one assumes abundant salmon remains would be the result of preserved and imported river caught fish, rather than sea caught fish, as suggested by the skeletal element representation. Regardless of whether the salmon are river or sea caught, the low frequency of salmon remains reflects a real lack of focus on this resource. In general, the faunal remains from these two stratigraphic units, 2000 C and 2000 D/D*, suggest a wider season of occupation than the more spring/summer focused occupation of earlier deposits.

2000 A/B

This stratigraphic unit differs in comparison to other areas of the site in the presence of a much higher frequency of salmon remains, and an increased focus on fur seals. It is important also to remember the humpback and grey whale remains from this time period at the site, although they are not well represented in these excavation units. The presence of albatross and rhinoceros auklet mark the summer season of exploitation, while herring suggests spring exploitation. While no newborn or definitely still nursing fur seals are recorded for this time period, there are many juvenile fur seal bones as well as adult remains. This population structure may represent culling of the fur seal herd in late summer and autumn. The higher frequency of fur seal remains may also indicate hunting of the migratory animals moving north in spring as well. In other words, the later inhabitants of the site may well be exploiting both the local and the migratory fur seal populations. The presence of petrale sole also supports a spring and summer presence. The identification of both humpback and grey whale for this time period at the site suggests that these animals were being hunted when most abundant, during their spring northward migrations, but it is important to note that individuals of both species do linger all summer long off the coast of Vancouver Island.

In addition to these spring and summer markers, the 2000 A/B sample also contains a much higher relative frequency of salmon remains that likely do represent preserved and stored salmon being consumed in the winter, as the skeletal elements represented are all postcranial. They likely represent preserved river caught fish from off island. Also present in this sample is bufflehead duck, which has not been recorded off the west coast of the island in summer, but can be found there in fall through spring. Taken together, the seasonal indicators from this time period suggest a more seasonally extended period of occupation, with winter occupation included.

Habitats Exploited

It is clear from the faunal remains that from the first occupation of the site, the focus of exploitation activities has been on the marine and marine foreshore environments. Fur seals, dolphin/porpoise and whale remains are present in the earliest layers of the back terrace area, and continue to be present throughout the sequence. This indicates exploitation of the nearshore marine habitat on a sustained basis and likely included excursions well offshore also. The presence of albatross, fulmars, shearwaters and halibut throughout the sequence supports this at least occasional offshore focus, as may the sporadic occurrence of bluefin tuna, although ethnographic accounts report this species was taken in late summer and early fall in inshore waters (Crockford 1997b:20).

It is equally clear that the great majority of fish were obtained from the inshore marine habitat, especially the areas of relatively shallow water over rocky substrate that support kelp beds. Here would be found the rockfish, greenlings and surf perches that form the bulk of the faunal remains throughout the sequence. Clearly herring are also being exploited, likely during the spring spawning season when they congregate in great numbers in the shallow waters of sheltered bays and inlets in Barkley Sound. Also attracted inshore to feed on these concentrations of herring, would be a whole series of fish, sea mammals and birds, at which times they too would be particularly vulnerable to hunting by humans. This includes the hake, lingcod and petrale sole identified in the Ts'ishaa faunal samples. The spawning herring concentrations also attract humpback whales, Pacific white-sided dolphins, sea lions, harbour seals and fur seals, feeding on both the herring themselves and the larger fish as well. Loons, especially the Pacific loon, and cormorants, especially the pelagic cormorant, surf scoters and common murres all gather in larger numbers than usual to feed on spawning herring. The gulls and eagles are also attracted. It might well be that these species were taken most frequently by Ts'ishaa Village inhabitants during the spring season when all would be available inshore in predictable, concentrated locations. A similar but less regular pattern could be inferred for anchovy during the summer months.

Summary

In general, the faunal remains from Ts'ishaa Village present a picture of exploitation of local, nearshore habitats, with a clear focus on marine fish and mammals. The few land mammal remains present are what one would expect, if the site inhabitants had direct access only to the Benson Island fauna, and the great majority of the land mammal remains are in fact small fur bearers. Most of these river otters, mink and raccoon may not even have been intended as food, but may well be associated with the burials in the back terrace. Although a considerable number of species are represented by the 256 specifically identifed bird remains, like the land mammals, they form a small proportion of the faunal sample and are clearly not a major focus of exploitation at only 1% of the specifically identified sample. Those species present generally indicate exploitation of the nearshore marine habitat, with some exploitation of the offshore marine waters. Sea mammals are clearly more important in the food economy than land mammals, with fur seals and whales being the most important. Although sea mammals form only 4% of the specifically identified faunal remains by NISP, it is important to remember that these 872 bones represent some very large individual animals which would have provided considerable quantities of meat and fat. In reality, sea mammals may have been as important a food source as fish. Of special note, is the presence in the Ts'ishaa Village fur seal sample of newborn and young juvenile individuals, confirming the presence in prehistoric times of a non-migratory population of fur seals in the Barkley Sound region.

There is clear evidence of a spring and summer occupation at Ts'ishaa Village in all time periods, and the suggestion of a more extended stay in the middle and later layers of the site, probably including a winter presence in the most recent deposits.

Although there are clearly fluctuations in emphasis on particular species through time and space at Ts'ishaa Village, with the greatest differences being between the back terrace, the most recent layers, and the central layers of the site, there is also clearly some continuity at the site in terms of species exploited. At all time periods, rockfish are the most frequently occurring fish remains and fur seals the most important pinniped. Perhaps the greatest shift occurs in the more recent layers with the increased emphasis on salmon, fur seal and probably whale. The much greater frequency of small land mammals and dogs in the oldest, backridge area of the site, also sets this area apart. The dogs are of particular interest as the oldest deposits at the site include representatives of the small Type 1 westcoast dog, ethnographically associated with the south coast wool dog.

References Cited (Report and Appendices)

Ackerman, D.
1990 A reporter at large: albatrosses. *The New Yorker* Sept. 24: 61–88.

Angell, T. & K.C. Balcomb III
1982 *Marine Birds and Mammals of Puget Sound*. Washington Sea Grant, University of Washington Press, Seattle.

Banfield, A.W.F.
1974 *The Mammals of Canada*. National Museum of Natural Science, University of Toronto Press, Toronto.

Bigg, M. A.
1985 Status of the Stellar Sea Lion (Eumetopias jubatus) and California Sea Lion (Zalophus californianus) in British Columbia. *Special Publication of Fisheries and Aquatic Sciences 77*, Ottawa.

Burgner, Robert L.
1991 Life history of sockeye salmon (*Oncorhynchus nerka*). In: *Pacific Salmon Life Histories* (C. Groot and L. Margolis, eds.) pp. 3–117. University of British Columbia Press, Vancouver.

Calvert, S.G.
1980 *A cultural analysis of faunal remains from three archaeological sites in Hesquiat Harbour, B.C.* Ph.D. dissertation, U.B.C., Vancouver

Calvert, S.G. and S.J. Crockford.
1978 Appendix IV: Analysis of faunal remains. In: A.D. McMillan and D.E. St. Claire, *Alberni Prehistory: Archaeological and ethnographic investigationson western Vancouver Island*. Theytus Books, Penticton, B.C.

Campbell, R.W., Dawe, N.K., McTaggart-Cowan, I., Cooper, J.M., Kaiser, G.W. & M.C.E. McNall
1990 *The Birds of British Columbia. Vols I, II & III*. Royal B.C. Museum, Victoria, B.C.

Cass, A. J., Beamish , R.J. and G.A. McFarlane
1990 Lingcod (*Ophiodon elongatus*). *Can. Spec. Pub. Fisheries and Aquatic Sciences 109*. Ottawa.

Crockford, S.J.
1997a Osteometry of Makah and Coast Salish Dogs. *Publication No. 22, Archaeology Press*. Simon Fraser University, Burnaby.

1997b Archaeological evidence of large nothern bluefin tuna, *Thannus thynnus,* in coastal waters of British Columbia and northern Washington. *Fishery Bulletin* 95:11–24.

2000 *Preliminary Report on the Identification of Faunal Remains from DfSi 16, Benson Island, B.C. Unit S14-16/W25-27 (selected levels)*. Report submitted to A.D. McMillan and D.E. St. Claire.

Crockford, S.J., Frederick, G., and R. Wigen
1997 A humerus story: albatross element distribution from two Northwest Coast sites, North America. *Internat. Journal of Osteoarchaeology* 7**:**378.1–5.

2002 The Cape Flattery Fur Seal: An Extinct Species of *Callorhinus* in the Eastern North Pacific? *Canadian Journal of Archaeology 26:* 52–174.

Drucker, P.
1951 The Northern and Central Nootkan Tribes. *Smithsonian Institution Bureau of American Ethnology Bulletin 144*. Washington D.C.

Eschmeyer, William N., Earl S. Herald, and Howard Hammann.
1983 *A Field Guide to Pacific Coast Fishes of North America*. Houghton Mifflin Company, Boston.

Everitt, R.D., Fiscus, C.H. and R.L. DeLong.
1979 Marine mammals of northern Puget Sound and the Strait of Juan de Fuca. *NOAA Technical Memorandum ERL MESA-41*, Seattle.

Frederick, S.G.
2000 Preliminary Report on Vertebrate Faunal Remains from the Excavations at Ts'ishaa Village, Benson Island, DfSi 16. Appendix 1 in *Excavation at Ts'ishaa: report of the Tseshart Archaeological Project, 2000* by A.D. McMillan and D.E. St. Claire. Report to the Tseshart Nation and Parks Canada.

2002 *Report on the Vertebrate Faunal Remains from the 2001 Back Ridge Excavations at Ts'ishaa Village (DfSi 16), Benson Island*. Report submitted to A.D. McMillam and D.E. St. Claire.

2003 *Report on the Vertebrate Faunal RemansUnit S58-60 W64-66, Back Ridge Excavations at Ts'ishaa Village (DfSi 16) Benson Island and Summary Report Intergating Units S62/64 W62/64 and S58/60 W 62/64*. Report to A.D. McMillan and D.E. St. Claire.

Godfrey, W.E.
1979 The Birds of Canada. *National Museum of Canada Bulletin 203,Biological Series 73*, Ottawa.

Gustafson, C.E.
1968 Prehistoric use of fur seals: evidence from the Olympic coast of Washington. *Science* 161:49–51.

1975 *Distribution and aboriginal use of the sub-order Pinnipedia on theNorthwest Coast as seen from Makah Territory, Washington*. Ms on file, Washington State University, Washington Archaeological Research Section, Pullman.

Hart, J.L.
1973 Pacific Fishes of Canada. *Fisheries Research Board of Canada Bulletin 180*, Ottawa.

Healey, M.C.
1991 Life history of chinook salmon (*Oncorhynchus tshawytscha*). In: *Pacific Salmon Life Histories*, C. Groot and L. Margolis (eds.), pp.313–393. U.B.C. Press, Vancouver.

Heard, William R.
1991 Life history of pink salmon (*Oncorhynchus gorbuscha*). In: *Pacific Salmon Life Histories*, C. Groot and L. Margolis (eds.), pp. 121–230. U.B.C. Press, Vancouver.

Huelsbeck, D.R.
1983 *Mammals and Fish in the Subsistence Economy of Ozette*. Ph.D. dissertation. Washington State University, Pullman.

Huelsbeck, D.R., and M. Fisken
1983 *The utilization of whales at Ozette*. MS on file, Laboratory of Anthropology, Washington State University, Pullman.

Huelsbeck, D.R., and G.C. Wessen
1994 Twenty-five years of faunal analysis at Ozette. In: S.R. Samuels (ed.), *Ozette Archaeological Project Research Reports, Volume II: Fauna*. *Reports of Investigations* 66: 1–16. Department of Anthropology, Washington State University, Pullman and National Parks Service, Pacific Northwest Regional Office, Seattle.

Jensen, Albert C.
1965 Life history of the spiny dogfish. *US Fish and Wildlife Service Fishery Bulletin* 65:527–554.

Leatherwood, S., Reeves, R.R., Perrin, W.F. and W.E. Evans.
1988 *Whales, Dolphins, and Porpoises of the Eastern North Pacific andAdjacent Arctic Waters: A Guide to their Identification*. Dover Publications Inc., New York.

Lyman, R.L.
1988 Zoogeography of Oregon coast marine mammals: the last 3,000 years. *Marine Mammal Science* 4: 247–264.

1989 Seal and sea lion hunting: a zooarchaeological study from the southern Northwest Coast of North America. *Journal of Anthropological Archaeology* 8:68–99.

Manzer, J.I. and I.McT. Cowan.
1956 Northern fur seals in the inside coastal waters of British Columbia. *Journal of Mammalogy* 37: 83–86.

McTaggart-Cowan, I. & C.J. Guiget
1965 The Mammals of British Columbia. *Provincial Museum Handbook 11*, Victoria.

Miller, D.J. & J.J. Geibel
1973 Summary of Blue rockfish and Lingcod Life Histories; A Reef Ecology Study; and Giant Kelp (Macrocystis pyrifers) Experiments in Monterey Bay. *Calif. Fish &GameBul. 158.*

Nagtegaal, D.A.
1983 Identification and Description of Assemblages of Some Commercially Important Rockfishes *(Sebastes spp.)* off British Columbia. *Canadian Technical Reports of Fisheries and Aquatic Sciences 1183*. Department of Fisheries & Oceans, Nanaimo, B.C.

Nickerson, R.
1984 *Sea Otters: A Natural History and Guide*. Chronicle Books, San Francisco, CA.

O'Connell, Charles P.
1953 The Life History of the Cabezon *(Scorpaenichthys marmoratus (Ayres). California Fish and Game Bulletin 93.*

Olesiuk, P.F. and M.A. Bigg.
1988 *Seals and Sea Lions on the British Columbia Coast*. Department of Fisheries & Oceans Report, Nanaimo, B.C.

Olesiuk, P.F, Bigg, M.A., Ellis, G.M., S.J. Crockford, and R.J. Wigen.
1990 An Assessment Of the Feeding Habits of Harbour Seals (Phoca vitulina) in the Strait of Georgia, British Columbia, Based on Scat Analysis.*Canadian Technical Report of Fisheries and Aquatic Sciences 1730.*

Phillips, J.B.
1964 Life History Studies on Ten Species of Rockfishes. *Calif. Fish & Game Bull. 126.*

Robertson, C.J.R. and G.B. Nunn
1997 Towards a new taxonomy for albatrosses. In G. Robertson and R. Gales, Editors, *Albatross Biology and Conservation*, pp. 13–19. Surrey Beatty, Chipping Norton.

Salo, E.O.
1991 Life history of chum salmon (*Oncorhynchus keta*). In: *Pacific Salmon Life Histories*, C. Groot and L. Margolis (eds.), pp. 233–309. University of B. C. Press, Vancouver.

Sandercock, F.K.
1991 Life history of coho salmon (*Oncorhynchus kisutch*). In: *Pacific Salmon Life Histories*, C. Groot and L. Margolis (eds.), pp.397–445. U.B.C. Press, Vancouver.

Scheffer, V.B.
1950 Growth layers on the teeth of Pinnipedia as an indication of age. *Science* 112:309–311.

Schiavini, A.C.M., Lima, M. and L.M. Batalles.
1992 Growth structures of maxillary canines of the southern fur seal (*Arctocephalus australis*). *Marine Mammal Science* 8: 89–93.

Scott, S.L.
1983 *Field Guide to the Birds of North America*. National Geographic Society, Washington D.C.

Stewart, H.
1977 *Indian Fishing*. Douglas & Mcintyre, Vancouver & University of Washington Press, Seattle.

Trites, A.W. and M.A. Bigg.
1996 Physical growth of northern fur seals (*Callorhinus ursinus*): seasonal fluctuations and migratory influences. *Journal of Zoology of London* 238:459–482.

Von den Driesch, Angela
1976 A Guide to the Measurement of Animal Bones from Archaeological Sites. *Peabody Museum Bulletin 1*. Peabody Museum of Archaeology and Ethnology, Harvard.

Wilby, G. V.
1937 The Lingcod *Ophiodon elongates* Girard. *Bulletin of the Fisheries Research Board of Canada* 54. Ottawa.

Appendix I: Vertebrate Fauna Seasonal Availability and Habitat Summaries

This appendix contains a brief description of the natural history of each species recovered in the Ts'ishaa Village deposits, including size information, habitat preferences, migratory patterns, food habits and reproductive behaviour. Skeletal identification problems are also discussed.

FISH

Order Squaliformes

Family Squalidae
***Squalus acanthias* Spiny Dogfish.** The spiny dogfish is a small to medium-sized shark found commonly in B. C. waters whose cartilaginous vertebrae and a few other elements often survive in archaeological sites. Teeth and the two sharp dorsal spines are also frequently recovered. Dogfish are found in schools formed of similarly sized individuals, sometimes of the same sex (Jensen 1965:530). They occupy a variety of habitats in both shallow and deep water. There is some seasonal migration, but this appears to be poorly understood and may relate to a complicated combination of water temperatures and food availability (ibid:530–532). Dogfish eat a wide variety of prey, from fish to crabs, and predate heavily on schooling fish such as herring, capelin and anchovy. Dogfish are a good source of oil and Vitamin A (from the liver) (Hart 1973:46), and the skin can be tanned to produce a "sandpaper". The flesh is also quite edible.

Order Chimaeriformes

Family Chimaeridae
***Hydrolagus colliei* Ratfish.** Ratfish are a common cartilaginous fish that can reach a length of 38 inches. They are bottom feeders that prey on various small fishes as well as clams. In this species a single distinctive dorsal spine and six very unique teeth are the only elements that will be found in an archaeological site. Ratfish are found in shallow and very deep water, both inshore and offshore (Eschmeyer et. al. 1983: 59). Egg cases may be laid in the intertidal zone during the late summer and early fall (Hart 1973:67), although the seasonal information is conflicting (see Eschmeyer 1983: 59). Similar to dogfish, ratfish livers are a source of very high quality oil.

Order Clupeiformes

Family Clupeidae
***Clupea pallasi* Pacific herring.** Herring are a small schooling fish found commonly and in high numbers on the Pacific coast. They are concentrated in large numbers in shallow inshore waters during the spawning season, February through April/May, but may move inshore well in advance of actual spawning, as early as September/October. They are also present in smaller numbers in inshore and offshore waters at all times, and as many other fish species also do, herring migrate to the surface at night and return to greater depths during the day. Herring spawn in the intertidal zone, laying eggs on seaweed, eelgrass and any other available material (Hart 1973:97). At this time, herring attract a wide variety of predators into shallow inshore waters (such as larger fish, sea birds and marine mammals), making these animals easier prey for First Nations hunters. Both herring and herring eggs were harvested ethnographically in great quantities and preserved for later consumption, but the fish were also taken in all seasons as bait for the hook and line fishery of species such as salmon, cod, lingcod and rockfish (Stewart 1977). Herring were reportedly harvested during the spring spawning period in large numbers, with rakes, nets or tidal traps (Stewart 1977). They have a high oil content and were particularly relished as a fresh fish in the early spring (Drucker 1951: 41) but were also dried for later consumption. Herring were not cleaned prior to preparation and the bones were not removed (Drucker 1951: 65). Herring were thus an important resource not only due to their own food value, but also because of the roe fishery and the other animals which the herring attracted to the accessible inshore habitat.

Herring bones, while small, are quite distinctive and can be identified readily even in quite fragmented condition. Only some of the larger elements (e.g. dentary), bones from particularly large individuals and vertebrae with intact neural and haemal spines are apt to be retained in 1/4" screens. The bulk of herring remains present in archaeological deposits are collected in 1/8" screens. Thus if the relative abundance of herring in a site is to be successfully assessed, screening of deposits with 1/8" mesh is essential. Alternatively, representative bulk column samples that are screened in the lab can also be used.

***Engraulis mordax* Northern anchovy.** The anchovy is a small schooling fish (maximum reported length to about 8 inches (20 cm) in Canadian waters). Anchovies have been reported as occasionally abundant on the west coast of Vancouver Island since historic times. The preferred water temperature appears to be 14.5 and 18.5°C, which may account for their sporadic occurrence in B.C. waters. They often occur now in mixed schools along with juvenile sardine (pilchard) and/or mackerel. Anchovy move inshore during the spring and spawn in the evening in the upper water layers during July and August, when the water is warmest. Normal diurnal migration brings anchovies to the surface at night from their usual day-time position on the bottom. (Hart 1973:104–105). Their bones, both vertebrae and cranial elements, are distinctive and easily distinguishable from herring and smelts.

Order Salmoniformes

Family Salmonidae

***Oncorhynchus* sp. Salmons, Steelhead and Trouts.** Unfortunately, it is often not possible to identify the skeletal elements of members of this family specifically, therefore it is necessary to consider all members briefly. Most members of the genus are anadromous, spawning in fresh water but living most of their lives in marine waters.

***Oncorhynchus gorbuscha* Pink or Humpback Salmon.** Pinks average 1–2.5 kg in weight. Spawning takes place every other year, with some rivers having a run every year and others having a run on alternate years only (Heard 1991:121). Spawning tends to take place in the lower reaches of the rivers, sometimes even in areas of marine incursion (ibid:122). Coastal migration at the beginning of the spawning season starts in late summer, while the migration into the rivers begins approximately in late August and September.

***Oncorhynchus keta* Chum or Dog Salmon.** Chum are the second largest of the salmons, reaching as much as 15 kg (Hart 1973:112), averaging 4.5 to 6.8 kg (Eschmeyer et al. 1983:76). They spawn in both the lower and upper reaches of streams and rivers (Salo 1991:238). The timing of the spawning run is very broad, "beginning in early September and continuing in some streams as late as March" (ibid.). Male chum salmon develop very enlarged teeth during the spawning period (Hart 1973:112).

***Oncorhynchus kisutch* Coho or Silver Salmon.** Coho average 2.7 to 5.4 kg, with a maximum recorded weight of 14 kg (Hart 1973:116). They spawn in both small tributaries of large rivers and small coastal streams (Sandercock 1991:404). Coho spawn between November and January most commonly, but there is variation which can widen the period to November through March (ibid:409–410).

***Oncorhynchus nerka* Sockeye Salmon.** Sockeye salmon are usually about 2.3 to 3.6 kg with a maximum weight of 6.8 kg (Eschmeyer et al 1983:77). Sockeye spawn in lakes (Burgner 1991:5) and therefore are somewhat more restricted in the rivers they can use than the other species of salmon. They spawn during the late summer and early fall, but the exact timing of their entry into the rivers is variable depending on how far they have to travel up the river to the spawning area and the specific characteristics of the spawning area (usually related to water temperature) (Burgner 1991:18).

***Oncorhynchus tshawytscha* Chinook or King Salmon.** The Chinook salmon is the largest of the genus, averaging 4.5 to 6.8 kg and reaching as much as 60 kg (Eschmeyer et al.1983:78). Chinook spawn in both large rivers and small coastal streams (Healey 1991:316). The timing of the spawning runs is extremely complex, apparently as a result of the presence of two races or populations of Chinook which have different life cycles and spawning times. Some Chinook enter the rivers during the spring and early summer, while others enter during summer and fall (ibid:319). Not all rivers and streams have both runs present. The effect of this is that there are some Chinook running into the rivers at all times of the year.

***Oncorhynchus clarki* Coastal Cutthroat Trout.** Cutthroat trout range in size from 0.7–1.8 kg, although some individuals may reach 7.8 kg (Hart 1973:127). Some cutthroat are permanent residents in fresh water and others are anadromous. Cutthroats spawn in small streams, usually in February and March (ibid:128).

***Oncorhynchus mykiss* Steelhead or Rainbow Trout.** This species includes fish with two distinctive lifestyles. The rainbow trout is exclusively a fresh water resident, living in streams, rivers and lakes (Page and Burr 1991:55). The size of rainbow trout is variable depending upon where they are living, but the record appears to be 37 pounds

(Scott and Crossman 1973:189). The steelhead is anadromous, living for at least some period of their life in salt water. Steelhead spawn in coastal streams and rivers. There appear to be two populations; those that spawn in summer and those that spawn in winter (Hart 1973:129). Their size is variable, but most are under 4.5 kg (Eschmeyer et al. 1983:79) with a maximum of perhaps 19 kg (Hart 1973: 129).

Order Gadiformes

Family Gadidae True cods
Most members of this family are distinctive skeletally and present no identification problems. However, the Pacific cod (Gadus macrocephalus) and walleye pollock (Theragra chalcogramma) are quite similar. Some of their bones are distinctive to species but not all, and fragments are often not diagnostic. Pollock were not identified in the Ts'ishaa sample.

Gadus macrocephalus **Pacific or Gray Cod.** The Pacific cod is a schooling fish that reaches at least 1 meter in length. They are generally considered a deep water species but they do migrate seasonally. Cod move into comparatively shallow water in late winter and spring, where they congregate to spawn, and disperse to greater depths in the fall to feed (Hart 1973:223). Regardless of the depth of water they occupy, Pacific cod are bottom feeders that consume a variety of invertebrates, small schooling fish (such as herring, sandlance and pollock) and small flatfishes.

Merluccius productus **Pacific Hake.** The hake is a medium-sized cod that can reach lengths of up to 1 metre, although most are smaller. Hake are an abundant schooling fish in this area although they are not utilized commercially. They constitute an important food source for larger predatory fishes such as lingcod and dogfish (Hart 1973: 226) and marine mammals (Eschmeyer et al. 1983: 99). Hake normally prefer moderate depths but do come into shallower bays and inlets to feed, especially at night. They are one of a number of herring predators and would probably be attracted to inshore areas by the presence of spawning fish. They can be taken on hook and line or trawling.

Order Scorpaeniformes

Family Scorpaenidae
Sebastes sp. **Rockfishes.** This genus has about 32 species that might be present in southern B.C. waters. It is usually not possible to identify skeletal elements to species. Rockfish are variable in size; a few attain maximum lengths of about 1 metre, but the majority are 30–61 cm in length (Hart 1973). Several species may form group assemblages that occupy a certain specific habitat and thus may be caught together (Nagtegaal 1983). They feed on a number of other fishes and invertebrates, both on the bottom and in mid-water (Philips 1964). Rockfish live in a wide variety of habitats, such as rocky areas, kelp beds and areas of soft bottom, from shallow water to 457 m (Eschmeyer et al.1983:132). However, in general the smaller and younger individuals usually occupy shallower, more protected habitats while larger individuals are more often found in deeper waters.

Family Hexagrammidae
This family consists of several genera including the greenlings, lingcod and combfish. The lingcod skeletal elements are quite morphologically distinct from the other members of this family. However, the remaining genera are often difficult to distinguish from each other and are generally lumped under the category "greenling" for quantification purposes. Some elements are quite distinctive however, and so the species identity of certain elements from an archaeological assemblage can often be determined

Hexagrammos sp. **Greenlings.** Greenlings are medium sized fish, usually under 61 cm in length (Eschmeyer et al. 1983:155). The species most likely to be present in the site area are the kelp greenling (*Hexagrammos decagrammus*), whitespotted greenling (*Hexagrammos stelleri*) and rock greenling (*Hexagrammos lagocephalus*). Greenlings are typically found in rocky areas in relatively shallow water, although the kelp and whitespotted greenlings can be found in kelp beds or sandy areas. There are no recorded seasonal movements. Both kelp and rock greenling were specifically identified in the Ts'ishaa samples.

Ophiodon elongatus **Lingcod.** Lingcod are the largest of the Hexagrammids, reaching maximum lengths of up to 1.5 metres (5 ft.) and weights of up to 45 kg. Its preferred habitat is rocky intertidal areas down to 40 fathoms or more, much the same habitat as the cabezon. Females are larger than males (up to 5 ft/70 lbs for females vs max. 32 in/22 lbs for males) and they tend to occupy progressively deeper and deeper water as they get larger. Small fish (less than 20 inches) usually occupy shallow water areas over sandy rather than rocky bottoms, likely a response to the cannibalistic tendencies of larger fish (Miller & Geibel 1973). Lingcod are aggressive predatory fish which feed on a variety of other fish such as herring, flatfish, rockfish, cods and smaller lingcod (Hart 1973: 468) and are taken readily on hook and line. Native strategies also included a wooden lure made specifically to entice fish to the surface where it could be speared (Stewart 1977). Lingcod spawn between November and March, usually in rocky subtidal and lower intertidal waters. Males mature at a much smaller size (18–29 inches) than females (27.5–30 inches).

Male lingcod guard the large masses of eggs which the females lay under rocks and in crevices, and thus medium sized males, large females and small immature lingcod of both sexes are all present in the intertidal zone during late winter-early spring. Large and very large fish are more often encountered at other times of the year in deeper waters over reefs (Cass et al. 1990; Miller & Geiber 1973). This size disparity between males and females and the apparent segregation by sex between habitats has important implications for interpreting archaeological lingcod remains. An assemblage representing only large and very large individuals probably indicates a fishery concentrated over deep rocky inshore waters between late spring and early fall. An assemblage representing small to very large individuals however most likely reflects a late fall-early spring fishery concentrated in intertidal waters over both sandy and rocky bottoms.

Family Cottidae

***Sculpin sp.* (undetermined).** Sculpins are a large family of fishes with many species (including a few freshwater types) present in B.C waters. Most of the species are skeletally distinctive and only a few bones, or fragmented ones, are not identifiable to species. There are many small to very small tidepool species and a few larger, intertidal ones. Several commonly occurring intertidal sculpin species are often represented in archaeological assemblages from our area and life history details of these are discussed individually below.

***Hemilepidotus hemilepidotus* Red Irish Lord.** The Red Irish Lord can reach lengths of about 50 cm., although the average size is closer to 25 or 30 cm. It is relatively common in inshore rocky habitat and intertidal areas and can be caught on hook and line (Eschmeyer 1983). Spawning occurs in intertidal waters during March in southern B.C. (Hart 1973: 503).

***Scorpaenichthys marmoratus* Cabezon.** Cabezon are the largest of the local sculpins, reaching a length of 76 cm and a weight of 14 kg (Hart 1973:541). Cabezon spawn in shallow to intertidal waters from January through March. O'Connell reports cabezon are found only on hard bottoms, not on sand or mud (1953:25), in shallow to moderately deep water (up to 50 fathoms), with larger individuals being the deepest dwelling. As for lingcod, during the spawning season both small juveniles and large mature fish occur together in rocky intertidal areas. Cabezon eat a variety of invertebrates and small fish, such as sculpins, rockfish and flatfish.

***Leptocottus armatus* Pacific Staghorn Sculpin.** The Staghorn Sculpin is one of the larger sculpins and can reach a length of 46 cm. It is very abundant in British Columbia in the intertidal area and at moderate depths. It prefers sandy, silty or muddy bottoms, often burying itself in the substrate so that only the eyes are showing. It is one of the few sculpins that will take bait and is regularly caught by hook and line (Eschmeyer et al. 1983:175; Hart 1973:518; Lamb and Edgell 1986:168).

Order Perciformes

Family Embiotocidae Surf perches

The surfperch family has a large number of members, three of which are common schooling fish in inshore B.C. waters. Although all perch bones cannot be identified to species, some elements (such as the inferior pharyngeals) are quite diagnostic. To make identification matters difficult, perch are viviparous (live- bearing) and the young of the two larger species approach the size of small individuals of the third (much smaller) species. All perch elements recovered archaeologically are therefore usually quantified together at the family level, although the exact species composition of each assemblage may vary. Only Striped Sea Perch and Pile Perch have been specifically identified in the Ts'ishaa Village sample.

***Cymatogaster aggregata* Shiner Perch.** The shiner perch is the smallest of our local species, reaching a maximum length of only 6 inches (15 cm), with females larger than males. Adults feed on mussels and barnacles. Shiners are especially common during the summer in shallow, inshore waters, moving to depths of up to 40 fathoms in the fall (Hart 1973:304–305).

Embiotoca lateralis **Striped Seaperch.** This perch reaches a length of 38 cm and small schools inhabit shallow waters in rocky areas and kelp beds (Eschmeyer et al. 1983:229). They feed on worms, mussels, crustaceans and herring eggs. They are strongly territorial and available year round.

Damalichthys vacca **Pile Perch.** The pile perch lives in small schools and reaches a maximum length of 44 cm. It is found in shallow water around rocks and kelp beds, where they feed on mussels (Eschmeyer et al. 1983:228). Like the striped seaperch, they are very territorial and show little seasonal movement (Hart 1973:312–313).

Family Scombridae
Thunnus thynnus **Bluefin Tuna.** The Bluefin Tuna is a sporadic visitor to the west coast of the island in the summer months. This huge fish, reaching sizes of over 7 feet in length and weighing more than 250 pounds, is a fast swimming open ocean fish that must have taken great skill to capture (Hart 1973:379). It is likely that it was taken opportunistically during sea mammal hunting expeditions, as nothing but a large harpoon would have enabled aboriginal hunters to dispatch fish of this size and speed. Bluefin feed on small schooling fish such as anchovy. The periodic movement of both species into waters off the west coast may be related to northward movements of warmer waters associated with El Nino events.

Order Pleuronectiformes Flatfishes (flounders) Right-eyed and Left-eyed

There are many species in this order found in southern British Columbia. Flatfish skeletons are easily identifiable to order, however, it is not as easy to make identifications to the species level. Frequently, the mouth parts are quite distinctive while vertebrae are less easily identified to species. Some species however, such as halibut, arrowtooth flounder and curlfin sole, are distinct in almost all elements. The result of this is that there is always a large flatfish category that could potentially include members of both the Bothidae (left-eyed) and Pleuronectidae (right-eyed) families. Consequently, flatfish are usually quantified at the order level, except for the few species which are entirely distinct (such as halibut). The few elements that are identifiable to species make it possible to discuss the utilization of specific habitats and associated fishing technology. Life history details of species identified in the DfSi-16 samples are discussed below.

Family Pleuronectidae
Eopsetta jordani **Petrale sole.** The Petrale sole is a deep-spawning species and thus has a seasonal migration pattern which is the reverse of most fish. It disperses to relatively shallow inshore waters (31–60 fathoms) in spring (March-April) after congregating for winter spawning (Nov-Feb) at depths of 140–250 fathoms (DiDonato & Pasquale 1970). One of the main spawning grounds is Esteban Deep off the central west coast of Vancouver Island. The Petrale sole can attain lengths of up to 70 centimetres (Hart 1973:608) and prey include sandlance, herring, invertebrates and small bottom

Hippoglossus stenolepis **Halibut.** The Pacific halibut is an extremely sexually dimorphic flatfish species, with females reaching almost 3 metres (over 200 kg) while males seldom exceed 1.2 metres (50 kg) (Hart 1973:614–616). Halibut, like petrale sole, are deep-water winter spawners. The spawning season runs from November through January at depths of 150 to 225 fathoms (275–412 m). Relatively small, immature fish (average 16 kg) are found between 30 and 225 fathoms and this size are generally available year-round. Mature fish (8–16 years for females, younger for males) make extensive migrations between their relatively shallow feeding grounds and deeper spawning areas. These bottom-dwelling fish are caught on specialized hooks that are size-dependent: large hooks can be taken only by large fish (Stewart 1977). Hook size thus effectively restricts the catch to this species and the few other flounders which attain a relatively large size (starry flounder and petrale sole). Halibut have distinctive skeletal elements, which permits their archaeological remains to be quantified separately from other species.

Lepidosetta sp. **Rock Sole.** Two species of Rock sole that have only recently been distinguished are found off the west coast of Vancouver Island. The skeletal differences between the northern species, *L. polyxystra* and the southern one *L. bilineata,* are not yet clearly defined. Both species inhabit the inshore waters of the continental shelf over sandy bottoms. The southern rock sole can be found to depths of 200 fathoms (339 metres) while the northern rock sole inhabits slightly shallower depths to 150 fathoms (246 metres), but both species are usually found at shallow depths between 20 and 30 fathoms (37 and 55 metres). In summer, the fish move into shallower depths. The southern rock sole reaches lengths up to 58 centimetres while the northern one is slightly larger, reaching lengths of 69 centimetres. (Hart 1973:621; Mecklenburg et al. 2002:837–838).

Parophrys vetulus **English Sole.** The English sole is a common medium sized flatfish reaching lengths of 57 centimetres. Juvenile fish are found in shallow water but as they grow they move into increasingly deeper waters, to 300 fathoms (550 metres). There is also a spring movement into shallower waters and a return to deeper waters in winter. Most fish are concentrated at less than 70 fathoms (128 metres), where they feed on small molluscs, marine worms, small crabs and shrimp (Hart 1973:628; Lamb and Edgell 1986:206).

Order Batrachoidiformes

Family Batrachoididae
Porichthys notatus **Plainfin Midshipman.** This fish is a common resident of the west coast of Vancouver Island from the intertidal zone to depths of 145 fathoms (265 metres). They spawn in the spring in shallow water or in the intertidal zone, scooping out the sand beneath rocks and attaching the eggs to the rock surface. The male guards the eggs until the young emerge, and would be vulnerable to capture during this time. Midshipmen are also known as "singing fish" for the humming, grunting sound that they make with their gasbladders. They reach lengths to 38 centimetres (Hart 1973:207).

MAMMALS

Order Rodentia

Family Castoridae
Castor canadensis Beaver. The beaver is Vancouver Island's largest rodent, although the Island subspecies (C. c. leucodontus), at about 18 lbs, is considerably smaller than the Rocky Mountain subspecies which can reach almost 100 lbs (McTaggart-Cowan & Guiget 1965;174). Beavers occupy slow-moving streams and lakes of all sizes, where lodges of tree branches are built. Young are born from late April to early July and the lodge usually houses a family composed of a pair of adults with the young of the year and of the previous year. Two-year olds leave the lodge at midsummer and often travel far from water in search of a new suitable lodge location (ibid. 170–173). These two years olds are probably more vulnerable to predation than the very young or fully adult individuals.

Family Cricetidae
Peromyscus maniculatus **Deer Mouse.** The little Deer Mouse is the only native mouse in the study region. It is classified here as a commensal species, as it frequently enters human habitations and takes up at least seasonal residence during the winter. It is omnivorous, feeding on a wide variety of seeds, nuts, fruits, insects, and even small crabs and limpets along the seashore and can be seen at any time of year McTaggart-Cowan and Guiguet 1965:177).

Order Artiodactyla

Family Cervidae Elk and Deer
Two members of this family occur on Vancouver Island, the blacktail deer (which is a coastal subspecies of the mule deer) and the elk. While the mule deer overlaps in distribution with the whitetailed deer in the interior of the province, on the coast any prehistoric deer is unlikely to be anything other than blacktail. In terms of geographic distribution, the coast black tail and the mule deer overlap only in a narrow range well inland from most coastal archaeological sites. However no attempt is made to distinguish these regional subspecies, as such distinctions are probably not taxonomically valid as applied to most skeletal elements; identification made to subspecific level is based on geographic range only, not skeletal difference.

In addition, many fragments which probably can be attributed to deer are in fact not species-distinctive. In these cases, the category of medium ungulate is used, because if these remains were encountered in areas where species such as goat and sheep occur it would not be possible to identify such fragments to species. The same is true to some extent for elk. However, for elk the main problem is distinguishing fragments of it from cow in historic levels. A very large ungulate category exists to quantify these ambiguous elk/cow elements.

Antler fragments recovered archaeologically often cannot be identified to species, unless relatively large, unaltered chunks are found. All male cervids possess antlers and in coastal sites either deer or elk could be the source of antler used for tools and decorative items.

Cervus elaphus **Elk.** Elk are the largest land mammals that were available to coastal First Nations people; males weigh up to 800 lbs. and females close to 500 lbs., with calves weighing about 40 lbs at birth (McTaggart-Cowan & Guiget 1965:358). They prefer a "parkland" type habitat, where mixed conifer/deciduous forests are interspersed with grasslands, and feed largely on grasses, shrubs and deciduous trees. Elk can be solitary but generally travel in small herds consisting of a bull and 4 to 20 cows. Calves are born in mid to late spring and twins often occur.

Odocoileus hemionus columbianus **Coast blacktail deer (mule deer).** The blacktail deer is a subspecies of the mule deer, a common coastal ungulate whose size varies considerably with habitat and forage type. Semi-dwarf races occur on coastal islands and large Vancouver Island specimens on the west coast and northern regions. Adult males may weigh from 110 to 250 lbs.; females, 70–140 lbs. Fawns (twins or triplets) are approximately 3–6 lbs at birth, with most born during the spring (although this can be quite variable). Many deer migrate to higher elevations during the summer months and descend to the coastal areas in the fall (McTaggart-Cowan and Guiget 1965:366–369).

Order Carnivora

Family Procyonidae

Procyon lotor **Raccoon.** The raccoon is a medium-sized nocturnal carnivore, occupying diverse habitats and foraging on a wide variety of foods. This omnivorous diet includes intertidal fish and invertebrates, small mammals and reptiles, birds and bird eggs. Raccoons on the coast forage almost exclusively on the beach, where they would have been easily accessible to native hunters. Young are born in the spring, usually a litter of 1 to 8. The Vancouver Island subspecies is generally smaller (to about 12 lbs) than the mainland subspecies which can reach weights of up to 22 lbs (McTaggart-Cowan & Guiget 1965).

Family Mustelidae

Enhydra lutris **Sea otter.** The sea otter is the largest of the mustelids. Size ranges from 50 to 80 lbs (McTaggart-Cowan & Guiguet 1965), with males usually larger than females. Their thick dense fur was likely always an attractive commodity. Pups are often born in the spring, although birth can occur at any season due to delayed implantation. Young usually remain with their mothers for the first year. The sea otter is exclusively marine and lives among offshore kelp beds. It consumes shellfish, crabs, sea urchins and fish (Nicherson 1984). Their bones are quite distinct from the river otter, as are the flattened molar teeth.

Mustela vison **Mink.** This medium-sized mustelid is semi-aquatic and occupies areas close to fresh or sea water. Like the raccoon, mink on the coast forage almost exclusively on the beach, eating intertidal invertebrates and fish, and thus would have been easily accessible prey for native hunters. Young are born from April to June. Males are larger than females (3 lbs. vs about 1.5 lbs) and the Vancouver Island subspecies is larger on average than the mainland subspecies (McTaggart-Cowan & Guiguet 1965).

Martes americana **Marten.** The marten is a fairly common but solitary resident in the coniferous forests of study area. Mice are their main food, but they also take voles, small birds, squirrels, hares and rabbits and even berries and insects. They will also forage along the seashore, taking crustaceans. Small litters of one to four young are born in late March and April. Juveniles reach adult size by about three and a half months old, but do not breed until two years old. Being curious animals, they are relatively easily trapped (Banfield 1974:315; McTaggart-Cowan and Guiguet 1965:300).

Lontra canadensis **River Otter.** The River Otter is a common and abundant mustelid along the west coast of Vancouver Island. In coastal areas they forage along the seashore, taking many different species of fish from the inshore waters and also eating crustaceans and small birds. The young, one to five, are born in March and April. Except for the Sea Otter, they are the largest of the mustelids, with adult males weighing up to 30 pounds and measuring more than four feet in length (Banfield 1978:341; McTaggart-Cowan and Guiguet 1965:330;).

Order Cetacea

Family undetermined Whales

Fragmented whalebone is often recovered in archaeological sites and is impossible to identify to species; only nearly complete elements and large chunks of skull can be more precisely identified

(Huelsbeck and Fisken 1983). Many species of toothed and baleen whale frequented B.C. waters in prehistoric times. Of these the ones most likely to be found off the west coast of Vancouver Island would be the gray whale and the humpback, now much reduced in numbers from their former abundance. The killer whale is also a common resident in Barkley Sound. Their population also may have been much higher prehistorically. In addition to these species, west coast waters previously attracted blue, fin, minke, sei, and right whales, although they are no longer of common occurrence (Huelsbeck 1983; Huelsbeck and Wessen 1994; Leatherwood et al. 1988; McTaggart-Cowan & Guiguet 1965). Several smaller species are less common, such as the beaked and pilot whales, and while few details of their distribution or habits are known (Leatherwood et al. 1988), they may also have been subject to native hunting activities.

Active hunting of whales is a specialized activity requiring unique equipment and skilled hunters, but occasional beached carcasses could be scavenged for bone and baleen by groups which did not normally actively pursue whales. Thus small amounts of whalebone recovered archaeologically does not necessarily indicate that active whaling was practiced by any prehistoric group. DNA analysis of a number of whale bone specimens recovered from the Ts'ishaa Village deposits has confirmed the presence of both grey whale and humpback in the faunal samples. A mandible from the 2000 trench has been identified as grey whale, while the other specimens, including ones from the backridge and the 2000 trench deposits, are humpback whale.

Family Eschrichtidae
***Eschrichtius robustus* Grey Whale.** The grey whale is one of the larger baleen whales, reaching lengths of up to 50 feet (15 metres) and weighing about 36.4 tons. The females are larger than the males. They are bottom feeders in relatively shallow waters over the continental shelf, commonly staying within six miles of the shore. They do not normally dive beyond 15 to 25 fathoms (75 –135 feet). They follow a regular migratory pattern between the northern summer feeding grounds in the Chukchi and Bering Seas and their wintering and calving grounds in the shallow lagoons of Baja California. The relatively slow moving northward annual migration passes the Barkley Sound area in April and early May, while the much more rapid southward migration passes Vancouver Island in December. During these times the whales are close inshore (Banfield 1978:270–272). While peak population densities off the west coast of the island are during the migration periods, some solitary animals linger along the west coast of Vancouver Island during the summer months as well (Banfield 1978:270; Letherwood et al. 1988; 72). This species was hunted almost to extinction in the early historic period but is now recovering in numbers.

Family Balaenopteridae
***Megaptera novaeangliae* Humpback Whale.** The humpback whale is of similar size to the gray whale, reaching lengths of 48 feet (14.3 metres) and weighing up to about 44 tons. As with gray whales, the females are larger than the males. In their arctic summer grounds they feed primarily on krill but they also feed on small schooling fish such as herring and capelin. Like the grey whale, they follow a migratory pattern between summering grounds in arctic waters and wintering grounds in more temperate seas off the west coast of Mexico. They pass northwards along the west coast of Vancouver Island in May and June, returning southward again in October and November. Some humpbacks remain to summer along the island's western shores. There are reports that there may once have been a resident population of humpbacks in Barkley Sound/ Alberni Inlet. They are a slow swimming whale, remaining close to shore and often entering bays and estuaries and are consequently vulnerable to human predation (Banfield 1978:279; Leatherwood et al. 1988:39–50). The west coast population levels were also reduced drastically by early historic overhunting.

Family Delphinidae Porpoises including:
***Phocoena phocoena* Harbour Porpoise**
***Phocoenoides dalli* Dall's Porpoise**
***Lagenorhynchus obliquidens* Pacific White-sided Dolphin.** Several species of porpoises and dolphins occur in B.C. coastal waters, but much of the archaeological skeletal material cannot be assigned to any one species because of its fragmentary nature. However, most intact elements, including vertebrae and ribs, can be identified to species. The Pacific white-sided dolphin (up to 2.2 metres) and the Dall's (up to 2.0 metres) are slightly larger than the Harbour porpoise, which attains a length of up to 1.8 metres (Leatherwood et al. 1988). All are reasonably common on the west coast of Vancouver Island, where they feed on squid and small schooling fish such as herring (Balcomb & Balcomb 1982).

Dall's porpoise are somewhat more abundant offshore than inshore at most times of the year (Everitt et al. 1979). Whitesided dolphins appear to be more common (and to be found in larger groups) in protected inside waters during the winter and move to outside waters during the summer (ibid.). The harbour porpoise is currently a year-round resident species in inshore waters, being especially common in more protected waters. Harbour porpoises are noticeably more shy of human contact than the other two species and are reported to be quite difficult to approach by boat (ibid.; Leatherwood et al. 1988). Porpoises of all kinds are elusive prey despite their relative abundance and active procurement involves specialized hunting strategies.

Order Pinnipedia

Family Otariidae Eared Seals

Three species of eared seal occur in B.C. coastal waters: *Callorhinus ursinus* (Northern fur seal), *Eumetopias jubatus* (Steller's or Northern sea lion) and *Zalophus californianus* (California sea lion). They all display strong sexual dimorphism, with females considerably smaller than males. Skeletal elements of these three can sometimes be difficult to distinguish, especially for fragmented or juvenile specimens. All species consume squid, octopus, rockfish and ratfish, as well as schooling fish such as herring, hake and sandlance.

***Eumatopias jubata* Steller's (Northern) Sea Lion.** Only Steller's sea lion currently breeds in B.C. waters (on a few isolated offshore rocky islets, such as the Scott Islands at the north end of Vancouver Island) and thus may be encountered all year long (Bigg 1985; Olesiuk and Bigg 1988). Mature males and breeding-age females are on the breeding rookeries during the summer available only to local hunters at that time. At other times of the year they are more widely dispersed and therefore more widely available. Hauling out places are located on the north eastern side of Benson Island today. Adult males are enormous, reaching 3.2 m in length and weighing 1,000 kg or more (Everitt et al. 1979). Adult females are only about 2 m long and weigh about 300 kg.

***Callorhinus ursinus* Northern Fur Seal.** Fur seals now enter B.C. waters only during their annual migration to and from their rookeries on the Pribilof Islands in Alaska (Olesiuk and Bigg 1988), although the Ts'ishaa Village archaeological data , as well as archaeological data from Hesquiat Harbour and the Ozette site on the Olympic Peninsula indicate that the pattern was different prehistorically (Calvert 1980; Crockford, Frederick and Wigen 2002; Gustafson 1968, 1975; Lyman 1994). Currently, adult breeding males remain in Alaska year-round, while females and juveniles migrate as far south as California. Pregnant females begin to pass through B.C. waters in early April, followed successively by mature but non-pregnant females, immature males, then immature females (2–4 yrs) (Trites and Bigg 1996). Breeding males stake out territories on the Alaskan rookeries and collect harems of pregnant females. Pups are born in June and July and mating occurs soon after (there is delayed implantation of the fertilized ovum in this species). About late October through November, all animals except the bulls begin their southward migration, passing through B.C. waters again during January and February (Manzer and McTaggart-Cowan 1956). A few immature animals may remain off the B.C. coast during winter and spring rather than migrate further south (Olesiuk and Bigg 1988).

The presence of very young juvenile individuals, under four months of age and therefore still nursing rookery animals, in the Ts'ishaa archaeological data shows that there was also a local non-migratory population of fur seals in the Barkley Sound region in earlier times. Undoubtedly local non-migratory west coast Vancouver Island population numbers were swelled by the annual northward migration of the larger Pribiloff herds in the spring.

Fur seals were once extremely abundant along the B.C. coast but a concerted slaughter by Russians and Europeans hunters on the northern breeding rookeries late in the 18th and early 19th century decimated the fur seal population. An international treaty signed early in the 20th century protected the animals on the breeding grounds, but pregnant females were still permitted to be taken during the pelagic hunt by aboriginal hunters for another 30 years (Everitt et al. 1979). Such devastation of the population may well have resulted in changes to both total range and migratory behaviour of this species and modern distribution patterns cannot be reliably used to interpret the prehistoric aboriginal harvest. More research on the age and sex composition, and seasonal distribution, of prehistoric fur seal populations off the B.C. coast is sorely needed.

Adult male fur seals are about the size of female Steller's sealion (2.5m/280 kg). Female fur seals are considerably smaller and weigh only 30–50 kg (ca. 1.7 m long). This discrepancy in size between the two makes it relatively easy to distinguish the sex of adult skeletal material, although in contrast to land mammal species, epiphyseal fusion of most elements does not take place until well after sexual maturity is reached (Trites and Bigg 1996). Thus "mature" adult status (i.e. breeding age) is most difficult to determine. Canine teeth, particularly the upper ones, can be reliably used to determine age by counting the prominent growth ridges (Scheffer 1950; Schiavini et al. 1992; Trites, pers. comm., U.B.C. Fisheries Centre, Vancouver).

***Zalpohus californianus* California Sea Lion.** While not as numerous as the previous two species, male California sea lions often winter in B.C. after leaving California rookeries at the end of the summer (McTaggart Cowan & Guiget 1965). Males attain a length of about 2.5 m and weigh up to 365 kg (about the size of male fur seals), while females are only about 1.6 m and 115 kg (Everitt et al. 1979).

Family Phocidae

***Phoca vitulina* Harbour seal.** The harbour seal is a common resident in B.C. waters, occurring most often in nearshore areas such as shallow bays, inlets and estuaries; they occasionally enter fresh water. Seals haul out on islands, exposed reefs, sandbars and mudflats to rest and to give birth. Pups are generally born in late May or June (Olesiuk and Bigg 1988). Harbour seals are very eclectic in their food habits but prey largely on schooling fish such as herring and hake, although a number of other fish and invertebrates are taken as well (Bigg et.al. 1990). Although generally distributed in small groups, harbour seals do congregate seasonally in areas of high food availability, such as river mouths during salmon spawning periods and in shallow bays where spawning herring concentrate (ibid.).

Harbour seals are not as sexually dimorphic as fur seals and sea lions and thus it is difficult to determine the sex of individuals from their skeletal elements. Males can weigh up to 300 lbs., with females being somewhat smaller (McTaggart-Cowan & Guiget 1965).

***Mirounga anustirostris* Northern Elephant Seal.** The Northern Elephant Seal is a very large Phocid, adult males weighing up to 2½ tons and measuring to 16 feet in length. They take their name from the male's long inflatable snout. Females are considerably smaller. They are comparatively rare today off the west coast of the island but were likely more common before the southern centers of population were decimated by hunting in the early historic period. Individual males are reported regularly but sporadically in the study area, individuals having been reported in both September and April (Banfield 1974:380; McTaggart-Cowan and Guiguet 1965:353).

BIRDS

Order Gaviiformes

Family Gaviidae

***Gavia sp.* Loons.** The three loon species which occur in coastal B.C. areas, the Red-throated, the Pacific and the Common loon, were all identified at Ts'ishaa Village. Generally, whole skeletal elements of these species are distinguishable, but fragmentary material is less distinctive. All three occupy similar habitats, where they are proficient divers, but there are slight differences in breeding and resident population distributions. All three species breed and nest on fresh water lakes.

***Gavia stellata* Red-throated Loon.** The red-throated loon is a fairly common resident in the Barkley Sound area, with a breeding population recorded for Nitinat Lake. Locally it is very abundant in the spring as migrant birds swell the overwintering populations. This loon breeds in small coastal lakes in May through August and forages on the ocean (Campbell et. al.1990(I):158). It prefers shallow inshore areas, where it feeds on small schooling fish such as sandlance and herring and some invertebrates (Angell and Bascomb 1982).

The red-throated is the smallest of the three local loons and is often distinguishable from the others skeletally on this basis, although there is some overlap with the Pacific loon, especially for fragmented material.

***Gavia pacifica* Pacific Loon.** The Pacific loon is an abundant spring and autumn migrant on the B.C. coast, with much smaller winter and summer population of non-breeding birds on the west coast of the island. Large numbers of Pacific loons congregate in herring spawning areas in the spring (Campbell et.al. 1990(I):160), made up of winter residents and northward migrating birds. Breeding areas are in the Yukon. This loon is generally slightly larger than the red-throated loon.

***Gavia immer* Common Loon.** The Common loon is the largest of the three species found on the west coast of the island. In the Barkley Sound region non-breeding birds are present all year, with flock numbers increased by northward migrations of breeding birds in spring (mid-March through June) and southward migrations in the fall (late August through November).

A breeding population is recorded for the Barkley Sound area (Campbell et al. 1990(I):162).

Order Podicipediformes

Family Podicipedidae Grebes. Four species of grebes are commonly found off the west coast of Vancouver Island, but only one was identified in the birds from Ts'ishaa Village, the Horned Grebe.

***Podiceps auritus* Horned Grebe.** Although the Horned grebe is not a coastal breeder, non-breeding birds can be seen widely distributed along the west coast of the island throughout the year with increased populations recorded during spring and fall migrations of breeding birds. The species is common along the coast in winter, with Clayoquot Sound just north of Barkley Sound recorded as an important wintering area (Campbell et al. 1990(I):168). It favours inshore marine waters, feeding on crustaceans and small fishes (Godfrey 1979:16).

Order Pelecaniformes

Family Phalacrocoracidae Cormorants. There are three species of cormorants which occur in coastal B.C., one of which is markedly larger than the other two. Non-breeding individuals of all three species are found year round in the Barkley Sound area, but only the Brandt's and the Pelagic breed in the area. All are efficient divers that feed on fish but local abundance varies somewhat between species. Skeletal elements of the Double-crested can usually be distinguished on the basis of its larger size, but it is often difficult to distinguish elements from the Brandt's and Pelagic, especially fragments, phalanges and vertebrae.

***Phalacrocorax auritus* Double-crested Cormorant.** The Double-crested cormorant is uncommon on the west coast of Vancouver Island but non-breeding individuals are recorded from Barkley Sound. The population is increased in spring and fall by migrating breeders (Campbell et al.1990(I):216–18). This is the largest of the cormorants and feeds on a variety of small fish, preferring foraging areas near estuaries and quiet bays (Angell & Bascomb 1982). It often roosts with both Pelagic and Brandt's cormorants on islets, floating logs and dead trees and in summer is primarily a bottom feeder, eating gunnels, surf perches , pricklebacks and sand lance (Campbell et al. 1990(I):218).

***Phalacrocorax pelagicus* Pelagic Cormorant.** The Pelagic cormorant is a common resident on the west coast of the island, breeding throughout its range on the B.C. coast. It prefers inshore waters in rocky coast areas where it is an efficient bottom-feeder, taking such prey as sandlance, gunnels and shrimp. Herring are also taken however, and large numbers of Pelagic cormorants congregate to feed at herring spawning sites during the spring (Campbell et.al. 1990:228).

***Phalacrocorax penicillatus* Brandt's Cormorant.** Brandt's is a less abundant cormorant species, resident in the Barkley Sound area year round, with breeding colonies recorded for Long Beach and Barkley Sound. The species avoids fresh or brackish waters and is more likely to be found in bays and narrows with strong currents and rocky shorelines (Campbell et al. 1990(I):224).

Order Anseriformes

Family Anatidae Geese

***Branta canadensis* Canada Goose.** Non-breeding Canada geese are resident year round off the west coast of the island but no breeding areas are recorded in Barkley Sound. Coastal populations are largest in October and November and again in April when local populations are swollen by migrant breeders (Campbell et al.1990(I):278). They are the largest of the geese which occur in B.C. and skeletal elements are often easily distinguished based on size, making fragmentary elements identifiable which might not be possible for other species. Canada geese forage on mudflats, along salt marshes and in estuaries for reeds, eelgrass and other vegetation (Angell & Bascomb 1982). The sub-species most likely to be found on the west coast of the Island are the Vancouver Canada Goose *B. c. fulva* and the larger Dusky Canada Goose *B. c. occidentalis* (Campbell et. Al. 1990(I):280–282)

***Branta bernicla* Brant.** The Brant is a small goose that was formerly a very abundant winter visitant to the west coast and an abundant spring migrant.

It breeds in the arctic and is rare off the coast in summer and autumn. Non-breeding birds are today rarely seen and it was likely never very abundant in the Barkley Sound region, the main migration corridors being along the east coast of the island or well off shore (Campbell et al. 1990(I):274).

Anser sp. **cf. Greater White-fronted Goose.** The Greater White-fronted goose was formerly a very abundant offshore transient during spring and fall migrations. There are both spring and fall records from Barkley Sound. This species nests in the Yukon River delta and winter in California, but a few non-breeding birds are recorded along the coast in both summer and winter (Campbell et al. 1990(I):262).

Order Anseriformes

Family Anatidae Duck sp.(undetermined)
A number of species of ducks, classified into several different genera, occur in B.C. waters. With a few exceptions, these species are often difficult to distinguish skeletally, depending on the element and its completeness. It is often possible to distinguish between some Diving Ducks (*Aythya sp.*) and some Dabbling Ducks (*Anas sp.*). Otherwise, size categories can be used to group duck remains. The few remains which can be identified to species give an indication of habitat utilization and seasonality of procurement.

The deposits reported on here contain three species of positively identified duck, Surf Scoter *Melanitta perspicillatus* , Bufflehead *Bucephala albeola*, and Mallard *Anas platyrhynchus*. Some other remains were determined to be dabbling (surface-feeding) ducks and some were diving ducks, although all three size categories of "ducks" were recognized (small, medium and large). Ducks are poor seasonal indicators on the southern B.C. coast, as many are residents as well as common fall/spring migrants (Campbell et al. 1990(I)).

Anas platyryhchus **Mallard.** The Mallard is common and present year round in Barkley Sound with both breeding and wintering populations. A dabbling duck, it forages in tidal marshes, estuaries and shallow water bays (Campbell et al. 1990(I): 290).

Bucephala albeola **Bufflehead.** The Bufflehead is a small diving duck that is a common migrant and winter visitant along the coast, but breeds primarily in the B.C. interior. It has been recorded in Barkley sound from September through May. It feeds in protected bays and estuaries in some numbers and large concentrations have been observed feeding on spawning herring shoals in late winter and early spring (Campbell et al. 1990(I):358)

Melanitta perspicillatus **Surf Scoter.** The Surf scoter is one of the most common ducks on the west coast of Vancouver Island, where large rafts of birds are commonly seen in both open and protected shallow waters. Very large concentrations feed on the spawning herring in spring. Although they do not breed in Barkley Sound, Surf Scoters are common there year round (Campbell 1990(I):340).

Order Charadriiformes

Family Alcidae Murres and Auklets
Cepphus columba **Pigeon Guillemot.** These small alcids are locally common to abundant resident breeders along the west coast of Vancouver Island (Campbell et al., 1990(II): 302; Godfrey 1979). It especially favours rocky coastlines, where it inhabits the nearshore zone and is regularly found in bays, inlets, surge narrows, coves and harbours.

Uria aalge **Common Murre.** This large fish eating alcid is a very common resident on the B.C. coast, preferring protected waters off straits, inlets, bays and channels. It can be very abundant in winter. Breeding colonies on rocky islets are recorded for Barkley Sound, as well as year round residency (Campbell et al, 1990(II):294). Like the ducks mentioned above, large flocks are attracted by shoals of spawning herring.

Brachyrhamphus marmoratus **Marbled Murrelet.** This little alcid is a common resident along the west coast of the island. Although no nests have yet been recorded, it is thought to breed throughout its coastal range. It is believed to nest on tree branches in old growth forest. It inhabits both protected and exposed coastal waters within 2 kilometres of land (Campbell et al. 1990(II): 308).

Cerorhinca moncerata **Rhinoceros Auklet.** The Rhinoceros Auklet is one of a number of medium sized alcids that are found along the west coast of the island. This species is common from spring through autumn, breeding in Barkley Sound and nesting in burrows. It is much less commonly seen on the coast in winter. It prefers feeding in open waters rather than within bays and estuaries, especially favouring areas of upwelling (Campbell et al.1990(II): 326).

Family Laridae

Larus sp. **Gulls.** The bones of the various gull species are very similar and thus difficult, if not impossible, to tell apart. No attempt has been made to determine species, although distinct size classes are obvious.

The most common small sized gull on the southern west coast of Vancouver Island is Bonaparte's Gull *L. philadelphia* which is present year round, although it does not breed in Barkley Sound. Non-breeding individuals of Franklin's Gull *L. pipixan* have also been found here in the summer, although this species is not common and Sabine's gull *Xema sabini* has been rarely recorded off Barkley Sound between March and November.

The Mew Gull *Larus canus* is by far the most common medium-sized gull found on the west coast of Vancouver Island, where it is present year round, with breeding colonies recorded just north and south of Barkley Sound. The Ring-billed Gull *L. delawarensis* has been recorded but is much less common, and Hermann's Gull *L. heermanni* is recorded as a June through November visitor to the region.

Of the larger gulls found in the study area, by far the most common is the Glaucous-wing gull *Larus glaucescens*. It is a resident of the coast, breeding in Barkley Sound. Non-breeding individuals of Western *L. occidentalis*, Herring *L. argentatus* and California gull *L. californicus* have also been recorded throughout the year on the west coast of the island. Thayer's gull *L. thayeri* has also been recorded in the region between September and February, while the Glaucous gull *L. hyperboreus* is a rare winter visitor, but has also been recorded in Barkley Sound between June and August (Campbell et al. 1990 (II): 228–273).

Rissa tridactyla **Black-legged Kitti-wake.** This small pelagic gull is an abundant offshore migrant in spring and autumn with some abundant summer populations and much lower winter populations. They have been recorded year round in Barkley Sound. Although pelagic, they are often found roosting on rocky headlands and islets in company with other gulls (Campbell et al. 1990 (II): 274).

Sterna sp. **Terns.** Three species of terns are found in the region of Barkley Sound, the Common *S. hirundo,* the Caspian *S. caspia* and the Arctic *S. paradisea*. None are common visitors to the Barkley Sound region, with the Caspian and Common terns recorded there in June through August and the Arctic observed in June through November. None are present between December through February (Campbell et al. 1990 (II):278–287).

Order Falconiformes

Family Accipitridae Eagles & Hawks

Haliaeetus leucocephalus **Bald eagle.** The bald eagle is a common west coast fish hawk The bald eagle feeds mainly on fish and is seldom far from water (Scott 1983:184). Numbers of bald eagles commonly congregate around salmon streams at spawning times and where herring balls and congregations of surface feeding fish occur. Most but not all of the skeletal elements can be distinguished from those of the Golden Eagle and can be identified to species. The bald eagle is a common seashore resident of the Barkley Sound area, with numbers particularly high in spring and summer (Campbell et al. 1990 (II): 14–19).

Accipiter striatus **Sharp-shinned Hawk.** This medium-sized hawk is a common spring and autumn migrant throughout B.C. In Barkley Sound, it has been recorded between September and February, but is not known to breed in the area (Campbell et al. 1990 (II): 24).

Order Procellariformes

Family Diomedeidae Albatrosses

Phoebastria albatrus **Short-tailed Albatross.** The short-tailed is the largest of the three north Pacific albatrosses (the other two being the Laysan's, *P. immutabilis* and the Black-footed, *P. nigripes*) and their bones are distinctive on size alone from these other two (Robertson and Nunn 1997). All albatrosses are strictly pelagic, marine birds who may spend up to five years at sea and do not usually breed until about 15 year of age. The short-tailed was formerly the most abundant albatross in the north Pacific but populations were decimated by feather-hunters on their remote island nesting grounds during the 1800's. Until that time, short-taileds were regular, common summer visitors to the west coast of B.C. (Campbell et al. 1990(I): 375). There are now a few hundred breeding pairs of this species but they are still considered endangered.

Albatross are gliding rather than "flapping" birds and depend on updrafts of air over water to stay aloft. Flat calm seas prevent these birds from flying and at these times they raft, often in groups, on the ocean surface. Under such conditions, albatrosses have to flap their extremely long wings to get airborn. This procedure often requires a run of several hundred metres before the birds actually get into the air, which would have made them especially vulnerable to predation by aboriginal hunters (Ackerman 1990). Short-tailed albatross are a commonly occurring bird in many archaeological sites from the west coast of Vancouver Island and the Juan de Fuca Strait (Calvert 1980; Crockford et al., 1997).

Family Procellaridae
Puffinus sp. **Shearwaters.** Shearwaters are gull-sized, strictly marine birds that resemble small albatrosses. They are common non-breeding summer visitors to offshore waters of the north Pacific and often occur in mixed flocks of related species. The sooty shearwater (*P. griseus*) is by far the most common and the most inclined to come close to shore, but can occur with (and is easily confused with), several closely related species: the pink-footed shearwater (*P. creatopus*); the short-tailed shearwater (*P. tenuirostris*); and the flesh-footed shearwater (*P. carneipes*). Also present off the west coast of the island, but rare, are the Black-vented Shearwater *P. opisthomelas* and Buller's Shearwater *P. bulleri*. None of the shearwaters except the Sooty Shearwater have been recorded near Barkley Sound between December and February, and the Sooty Shearwater is much more common between March and November, especially May through October (Campbell et al. 1990 (I): 188–199; Godfrey 1979).

Fulmarus glacialis **Northern fulmar.** The Northern Fulmar is a common offshore visitor in winter, fairly common at other times of year and can be locally abundant, especially in areas of upwelling or other kinds of turbulence (Campbell et al., 1990 (I):186). Storm-killed birds are frequently encountered on beaches during winter months.

Order Columbiformes

Family Columbidae
Columba fasciata **Band-tailed Pigeon.** The Band-tailed Pigeon is a fairly common resident on the southern B.C. coast, with spring and fall migrations swelling local populations. They are flocking birds, frequenting both deciduous and coniferous forests, preferring the forest edges and open clearings. In the Barkley Sound region they have been recorded today from March through November, but there are also breeding records from the Clayoquot Sound region (Campbell 1990 (II): 342).

Order Passeriformes

Family Corvidae
Corvus caurinus **Northwestern Crow.** The large Northwestern Crow is a common resident on the west coast of Vancouver Island, where it is often seen foraging along the seashore. It has been recorded in Barkley Sound at all seasons of the year (Campbell et al. 1990 (III):228).

Family Muscicapidae
Ixoreus naevius **Varied Thrush.** The Varied Thrush is a fairly common forest bird on the west coast of the island, with populations slightly elevated by migrants in the spring. It has been recorded in the Barkley Sound region year round. It thrives in both old growth and second growth coniferous forests and also forages along sandy beaches near the upper tideline for small invertebrates (Campbell et al.1990(III): 422).

Order Coraciiformes

Family Alcedinidae
Ceryle alcyon **Belted Kingfisher.** Although not that common, the kingfisher is a resident bird in the Barkley Sound area, both wintering and breeding here. It is often seen perched above a stretch of clear water waiting for the movement of an unlucky fish, when it will suddenly plunge headfirst into the water and emerge with a fish in its beak. Its nests are burrows in steep sandy banks (Campbell et al. 1990 (II):418). Belted Kingfishers were observed on Benson Island in 2001 by the senior author.

The information provided above was used to assess the season of exploitation and occupation suggested by the faunal remains from the three Ts'ishaa Village site areas, and to explore which coastal habitats were most frequently utilized.

Appendix II: Measurements of dog bones from Tsi'shaa Village, DfSi-16

Forty-one adult dog specimens from the Ts'ishaa Village site were complete enough to provide at least one measurement. The measurements are as named and described in Von den Driesch 1976. They are presented below by excavation unit, layer and level, and compared where possible with the mean and ranges of each measurement for Crockford's Type 1 small Northwest Coast Dog (Crockford 1997).

Table I. Measurements of dog bones from the back terrace of Tsi'shaa Village, DfSi-16. (Forty adult bones from the backridge area were sufficiently complete to provide at least one measurement each.)

Unit	Layer	Level	Element		Measurement (mm)	Type 1 Mean (mm)	Type 1 Range (mm)
S 62-64	**A**	2	Left mandible	#11	31.69	37.00	36.2–37.7
W 62-64				#12	26.75	32.4	28.8–35.1
				#14	21.47	20.5	18.1–22.2
				#17	19.08	20.3	16.7–24.0
				#19	21.85	21.4	18.2–25.0
				#20	17.38	18.1	15.6–21.6
		3	Left talus	GL	19.10	23.1	21.4–24.2
		4	Left humerus*	GLC	115.06	not measured	
				Bd	23.71	29.2	26.8–33.3
S 62-64	**B**	2	Left mandible	#11	36.77	37.0	36.2–37.
W 62-64				#14	19.80	20.5	18.1–22.2
			Left MC I	GL	17.86	not measured	
				Bd	5.17	not measured	
		3	Left MT V	Gbp	8.77	not measured	
			Axis vertebra	LCDe	35.89	41.0	36.9–44.0
				LAPa	37.15	44.4	38.2–47.4
				H	27.80	32.5	29.0–35.4
			Thor. Vert. #3	BPtr	27.83	not measured	
				BF(cr)	16.03	not measured	
				HF(cr)	9.25	not measured	
		4	Left scapula	SLC	23.19	23.4	18.7–26.1
			Left mandible	#13L	18.29	not measured	
				#13B	6.38	not measured	
S 62-64	**C**	7	Left Femur*	Bp	26.74	35.5	31.0–38.3
W 62-64				DC	13.10	17.4	15.5–19.3
				SD	9.52	12.1	10.6–13.6
S 62-64	**D**	5	Left innominate	GBA	20.73	not measured	
W 62-64			Right MT V	GBp	11.45	not measured	
		7	Left PM4 Up.	GB	8.16	not measured	
				L	15.25	not measured	
				B	5.90	not measured	
			Left Radius	Bd	20.10	21.1	17.0–24.9
			Left Radius	Bp	14.91	16.2	14.4–18.3
				SD	10.08	10.7	9.6–12.7
				Bd	20.81	21.1	17.0–24.9
				GL	125.62	136.0	123.0 –141.0
			Right MCII	GL	46.33	45.9	37.3–49.3
				GBd	7.81	6.2	5.0–7.6
						(Type 2 = 7.5	6.7–8.2)
		8	Left Tibia	SD	12.65	(Type 2 = 11.0	10.0–12.6)
				Bd	23.91	(Type 2 = 22.9	21.5–25.6)
S 58-60	**D**	6	Left MC IV	GL	52.47	53.8	44.8–58.2
W64-66				Bd	8.06	6.7	5.6–7.6
		8	Right Ulna	DPA	19.71	22.4	20.0–24.9
		8	**SW Corner**	**(one individual)**			
			Left Tibia	Bd	21.75	20.3	17.9–21.9
			Left Talus	GL	25.10	23.1	21.4–24.2
			Right Talus	GL	25.18	23.1	21.4–24.2
			L. Calcaneus	GL	43.64	38.4	34.9–40.7
			R. Calcaneus	GL	42.78	38.4	34.9–40.7

Table I. Continued.

Unit	Layer	Level	Element		Measurement (mm)	Type 1 Mean (mm)	Type 1 Range (mm)
			Left MT II	GL	57.80	55.2	49.2–58.2
				Bd	7.96	7.1	6.3–7.9
			Right MT II	GL	58.79	55.2	49.2–58.2
				Bd	8.06	7.1	6.3–7.9
			Left MT III	GL	64.57	63.1	55.5–67.0
				Bd	8.06	7.2	6.4–7.9
			Right MT III	GL	65.09	63.1	55.5–67.0
				Bd	8.22	7.2	6.4–7.9
			Left MT IV	GL	67.12	65.0	57.6–68.6
				Bd	7.59	7.0	6.1–7.9
			Right MT V	GL	60.16	55.7	48.5–58.6
				Bd	7.65	7.1	6.4–8.0
S 58-60 W64-66	**D**	9	Left Radius	Bp	14.84	16.2	14.4–18.3
		10	Right MT IV	GL	71.94	65	57.6–68.6
				Bd	8.955	7.0	6.1–7.9
			Right Tibia	Bd	22.76	20.3	17.9–21.9
		10	Left Scapula	SLC	21.73	23.4	18.7 –26.1
				BG	14.73	16.9	13.7–19.2
				GLP	24.92	27.1	22.9–31.2
		11	Lumbar 6	PL	24.26	24.0	22.4–24.8
				HFcd	11.35	11.7	10.4–12.6
	E	10	Left Radius	Bp	14.42	16.2	14.4–18.3
			Right Ulna	SDO	18.92	19.4	17.0–21.6
				DPA	22.14	22.4	20.0–24.9
			R. Mandible	# 11	38.47	37.0	36.2–37.7
				# 12	33.83	32.4	28.8–35.1
				# 20	18.55	18.1	15.6–21.6
			R. Lower M 1	L	22.57	(not given)	
				B	8.75		

(* marrow cavity infilled with cancellous bone)

Table II. Measurements of dog bones from other areas of Tsi'shaa Village, DfSi-16* 2000 Trench. Only one of the nine dog specimens from the 2000 trench could be measured.

Unit	Layer	Level	Element		Measurement (mm)	Type 1 Mean (mm)	Type1 Range (mm)
N 2-4 W 102-104	D	7	Right MT III	GL	64.5	63.1	55.5–67.0

*None of the 11 dog bones from the 1999 trench were sufficiently complete to measure.

Appendix E:
Column Sampling and the Archaeology of Small Fish at Ts'ishaa

by Iain McKechnie

Department of Archaeology, Simon Fraser University

Introduction

Archaeologists working on the Northwest Coast have periodically employed the use of core and column sampling (Casteel 1970, 1976a) to describe the taxonomic composition of fish recovered from small volumes of fine-screened archaeological deposit (Cannon 2000; Casteel 1976a; Coupland 1991; Fawcett 1991; Hanson 1991; Monks 1977; Moss 1989; Wigen and Eldon 1987). Although the controlled recovery and laboratory processing of these fine-screened (<6 mm) matrix samples is known to be an effective way to describe the composition of fish in a shell midden deposit, this type of analysis is rarely conducted in more than a single area of a site, and the results are not often explicitly compared to fauna identified from adjacent excavation units (but *see* Cannon 2000; Wigen and Eldon 1987). As a result, taxonomic frequencies of fine-screened fish remains are often not included in the spatial, temporal, and quantitative investigation of prehistoric subsistence practices on the Northwest Coast, despite the fact that fish are often the most numerous and ubiquitous vertebrate taxa present in shell midden deposits (e.g., Calvert 1980; Heulsbeck 1994; Wigen and Stucki 1988).

In this paper, I describe fish remains recovered from five fine-screened (<6 mm) column samples and compare this with the large assemblage of fish remains identified from excavation units at Ts'ishaa (Frederick and Crockford, this vol.). My purpose in doing so is to provide a broader assessment of the context and significance of the fauna recovered from the site as a whole. My column sample analysis is based an assemblage of 20,245 fine-screened fish remains and is compared to an assemblage of 45,333 fish specimens examined from ¼" excavation units, where fish account for the overwhelming majority of the fauna identified (66–98% NISP, Frederick and Crockford, this vol.).

Before comparing fauna from the units and columns, I first describe the methods I used to identify and quantify the column sample assemblage. I then explore how sample size affects the richness of fish taxa found in both the unit and column assemblages and how this variation is expressed among the different recovery methods. I show that large numbers of herring and anchovy are present throughout the examined deposits and this affects the composition of species throughout the entire faunal assemblage. I then demonstrate how the average body-size of the two most abundant fish species in the unit assemblage (e.g., rockfish and greenling) is smaller and recovered in different relative proportions in the fine-screened columns. I also quantify the temporal rate of midden accumulation and examine how shell and bone frequency vary within deposits. Collectively, the analysis of the fauna recovered from the fine-screened column samples reveals a fundamentally important aspect of the prehistoric Nuu-chah-nulth fishery in the Broken Group Islands of Pacific Rim National Park Reserve.

Methods

The site of Ts'ishaa is a large cultural shell midden deposit extending roughly 300 m across the northeast shoreline of Benson Island in Barkley Sound. Ethnographically documented as the location of two distinct village communities of the Tseshaht First Nation (Ts'ishaa, DfSi-16 and Himayis, DfSi-17), extensive excavation at the site sampled approximately 219 m^3 of cultural deposit from 35 excavation units (2x2 m) spanning between ca. 5000–250 years before present (cal yr BP, McMillan and St. Claire, this vol.). Vertebrate fauna was recovered using ¼" mesh screens in the field and fauna has been identified for five excavation units (*see* Frederick and Crockford, this vol.). The fine-screened fauna (≤6 mm) reported in this paper was collected from 'columns' of archaeological matrix sampled from within unit quadrants or directly adjacent to excavated units (e.g., Casteel 1976a). Column matrix samples consisted of bulk sediments removed in ten-centimetre levels of known volume (Table 1). The deposits containing identified fauna fall within the two chronological periods archaeologically documented at Ts'ishaa; 1) the 'back terrace' component which dates to between ca.

Table 1. Archaeological context of the ≥ 2 mm column sample fauna.

Column Sample	Approx. age range (cal yr BP)[a]	Column Dimensions	Screen Size (mm)	Examined Levels [n lvls.]	Layers	Depth (m)	Volume per level (litres) [b]	Total Vol. (litres)	NSP[c]	NISP[d]	NSP/ litre
N2-4/ W102-104	250–1500	20x20x10cm	3 & 6	1, 3, 5, 9, 13, 15, 17, 19, 23, 27, 31 [n=10]	A-E [n=6]	3.1	4.0	40	**6,267**	**2,876**	156.7
S14-16/ W25-27	250–1800	25x25x10cm	3 & 6	3, 7, 11, 15, 17, 19, 21, 25, 28, 31, 33, 35 [n=12]	A, B, C, E, F, G [n=5]	3.5	6.25	75	**4,874**	**1,956**	65.0
S5-7/ W11-13	250–1000	2 litres (bulk)	2	1-23, odd lvls. [n=12]	A-C [n=3]	2.3	2.0	24	**3,403**	**565**	141.8
S56-57/ W50-52	3000–5000	10x10x10cm	3 & 6	1-25, odd lvs. [n=13]	A, B [n=2]	2.5	1.0	13	**1,854**	**942**	142.6
S62-64/ W62064	3000–5000	20x20x10cm	3 & 6	1-9, odd lvs. [n=5]	A-D [n=4]	0.9	4.0	20	**1,557**	**704**	77.9
Totals				[n=52]				172	**17,955**	**7,043**	104.4

[a] Age range based on one or more calibrated radiocarbon dates from the adjacent excavation unit (Table 7).
[b] Volume calculated by dimensions of individual matrix sample (i.e., before excavation).
[c] Number of identified specimens positively identified to genus or above (e.g., rockfish, herring, etc.).
[d] The total number of examined skeletal specimens (including unidentified specimens).

Table 2. Archaeological context of the 1.5 mm column sample fauna.

Column Sample[a]	Approx. age range (cal yr BP)[b]	Screen size (mm)	Examined Levels [n levels.]	Volume per level (litres)[c]	Total Volume (litres)	NISP[d]	NSP[e]	NSP/ litre
N2-4/W102-104	300–1500	1.5	1,3,5,9,13,15,17, 19,23,27,31[n=10]	0.25	2.50	**465**	**2,057**	822.8
S56-57/W50-52	3000–5000	1.5	5, 15, 25 [n=3]	0.25	0.75	**68**	**234**	312.0
S62-64/W62-64	3000–5000	1.5	1, 5, 9, [n=5]	0.25	0.75	**77**	**318**	424.0
Totals			[n=16]		4.00	**610**	**2,609**	652.3

[a] Columns S14-16/W25-27 and S5-7/W11-13 were previously processed and did not retain 1.5mm specimens.
[b] Age range based on one or more calibrated radiocarbon dates from the adjacent excavation unit (Table 7).
[c] Volume calculated by dividing the screened matrix into portions representing 250cc of the original excavated volume.
[d] Number of identified specimens positively identified to genus or above (e.g., rockfish, herring, etc.).
[e] The total number of examined skeletal specimens (including unidentified specimens).

5000 and 3000 years before present and 2) the 'main village' component which dates to between ca. 1800 and 250 years ago (cal yr BP).

Three of the five column samples described in this paper were recovered from areas directly adjacent to excavation units with identified 6 mm fauna (Columns S62-64/W62-64 [back terrace]; S14-16/W25-27 [main village]; N2-4/W102-104 [main village]). Fauna from the two other column samples are from areas of the site that do not contain identified unit fauna (Column S5-7/W11-13 [Himayis]; S56-57/W50-52 [back terrace]). Although the column samples are from dispersed areas of this large site (see site map in McMillan and St. Claire, this vol.), the three columns from the main village are broadly contemporaneous with each other as are the two columns from the back terrace (Tables 1–4).

Bulk matrix from the column samples was wet-screened through nested geological sieves at the Parks Canada Laboratory (Victoria, BC). Due to the large number of skeletal elements encountered during this process, a limited number of individual column levels was selected for identification (Tables 1 and 2). Individual levels were selected to maximize the temporal and spatial coverage of the site and to ensure the stratigraphic independence of individual level assemblages (i.e., ≥10cm separated each examined level). Every odd level was identified for three of the five column samples (Columns S56-57/W50-52, S5-7/W11-13, S62-64/W62-64, Table 1). In the remaining two column samples (Columns N2-4/W102-104 and S14-16/W25-27), only select levels from stratigraphic layers defined in the adjacent excavation unit were analysed (Table 1). Faunal recovery from 1.5 mm mesh was limited to three column samples and fauna from these samples was further subdivided into portions representing 250 cc of the original excavated volume (Table 2).

Identification

I identified vertebrate fauna with the aid of a binocular dissecting microscope (6.3–40x) and the use of the extensive comparative fish collection at the University of Victoria Zooarchaeology Laboratory (Victoria, BC). Identification data was recorded by skeletal element in a *Paradox 35* database which noted relevant modification and provenience information. The completed database was converted to an *Excel* spreadsheet that was then imported into *SPSS* for statistical analyses. With the exception of fish spines, branchials, scales, and gill-rakers, identification was attempted for all skeletal elements recognizable to species or genus level. Confidence codes were assigned to each examined specimen to indicate the certainty of identification (for criteria, see Frederick and Crockford, this vol.). Using the same comparative collection, Rebecca Wigen conducted a review and verification of all identifications. Considerable effort was taken to employ the same procedures followed during the identification of the unit fauna (i.e., Frederick and Crockford, this vol.).

Quantification

Faunal remains described in this paper are quantified according to the number of individual specimens attributable to species/taxon (NISP, e.g., rockfish, herring, etc.) or the number of specimens identifiable to class (NSP, e.g., mammal, fish, etc.). Relative abundance refers to the percentage of skeletal specimens attributable to a particular taxon in relation to the total number of identified taxa (i.e., %NISP). Although the use of relative abundance is an imperfect measure of species frequency, it is the most widespread method of describing abundance in archaeological faunal assemblages (Grayson 1984). Clearly, significant differences exist in the number and durability of skeletal elements found in different fish taxa and calculating the specimen abundance will cause some species to be under or over-represented in a given assemblage (e.g., Rick et al. 2002). Some researchers attempt to compensate for this uncertainty by choosing to identify a limited number of skeletal elements from fish species (e.g., Leach 1997; Vale and Gargett 2002), but this strategy neglects to include a number of identifiable elements and does not easily facilitate comparisons with analyses which do not utilize this approach. In contrast, identifying the greatest possible number of elements and specimens most completely documents a given assemblage and can be subsequently modified to accommodate alternative approaches to quantification. The latter identification strategy was used during this analysis, principally in order to establish a comparable dataset with the larger unit assemblage

Results

The examined column sample assemblage contains 20,564 skeletal specimens from 52 discrete 10 cm levels representing an excavated volume of 172 litres (Tables 1–4). Fish comprise the overwhelming majority of skeletal specimens (NSP=20,245, 98.45%) In contrast, small numbers of specimens were identifiable as mammal (NSP=303, 1.47%) and bird (NSP=9, 0.04%). Fish specimens were found in every one of the 52 examined column sample level assemblages and vastly outnumber mammal and bird specimens. From the initial total, 6979 fish specimens were identified to species or genus (i.e., NISP) from 3 and 2 mm mesh (Tables 1 and 3). An additional 610 fish specimens (NISP) were identified to species from 1.5 mm mesh (Tables 2 and 4). However, since the 1.5 mm assemblage represents fauna identified from sub-sampled portions of individual levels and do not include specimens from the larger mesh sizes (Table 2), these data are evaluated and discussed separately. The low abundance and taxonomic richness of bird and mammal remains recovered from the column sample assemblage demonstrates the infrequent distribution of these animals in the deposits but also precludes the use of these data for evaluating species composition.

Table 3. Frequency and relative abundance (%NISP fish) of faunal specimens from fine-screen column sample deposits (Table 1). Species are grouped by class and listed in order of overall abundance.

		Column Sample											
		N2-4/ W102-104		S14-16/ W25-27		S5-7/ W11-13		S56-57/ W50-52		S62-64/ W62-64		Total	NISP
Species	Common Name	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP[a]	Fish %[b]
Clupea pallasi	Pacific herring	1,404	49	1,096	57	449	48	300	54	473	68	**3,722**	53.33
Engraulis mordax	Anchovy	769	27	175	9	246	26	19	3	34	5	**1,243**	17.81
Sebastes sp.	Rockfish sp.	338	12	335	17	64	7	18	3	15	2	**770**	11.03
Hexagrammos sp.	Greenling sp.	121	4	129	7	88	9	149	27	137	20	**624**	8.94
Oncorhynchus sp.	Salmon	57	2	43	2	65	7	15	3	1	*	**181**	2.59
Embiotocidae	Perch sp.	58	2	44	2	8	1	26	5	23	3	**159**	2.28
Squalus acanthias	Dogfish shark	25	1	20	1	3	*	15	3			**63**	0.90
Ophiodon elongatus	Lingcod	14	*	11	1	2	*	11	2	3	*	**41**	0.59
Merluccius productus	Hake	25	1	6	*	6	1					**37**	0.53
Porichthys notatus	Plainfin midshipman	3	*	18	1					4	1	**25**	0.36
Hippoglossus stenolepis	Halibut	4	*	14	1	2	*	3	1	1	*	**24**	0.34
Anoplopoma fimbria	Sablefish	8	*	14	1					1	*	**23**	0.33
Pleuronectiformes	Flatfish sp.	7	*	3	*	1	*			1	*	**12**	0.17
Hemilepidotus hemilepidotus	Red Irish lord	3	*	7	*	2	*					**12**	0.17
Scorpaenichthys marmoratus	Cabezon	6	*	2	*	3	*					**11**	0.16
Hydrolagus colliei	Ratfish	3	*	5	*			1	*			**9**	0.13
Damalichthys vacca	Pile perch	7	*	1	*							**8**	0.11
Platichthys stellatus	Starry flounder	2	*					1	*			**3**	0.04
Eopsetta jordani	Petrale sole	1	*	2	*							**3**	0.04
Raja sp.	Skate sp.			1	*					1	*	**2**	0.03
Cymatogaster gracilis	Shiner perch	1	*							1	*	**2**	0.03
Cottidae	Sculpin sp.			1	*	1	*					**2**	0.03
Embiotica lateralis	Striped seaperch					1	*					**1**	0.01
Lepidopsetta bilineata	Rock sole	1	*									**1**	0.01
Gadus macrocephalus	Pacific cod			1	*							**1**	0.01
Aves	Unidentified bird	2		3								**5**	
Aves (lg)	Unident. Lrg. bird	1										**1**	
Aves (med)	Unident. med. bird	1		1		1						**3**	
Odocoileus sp.	Deer sp.							1				**1**	
Peromyscus sp.	Deer mouse			2						1		**3**	
Mustela vison	Mink							3				**3**	
Mammalia	Undet. Ind mamml.	1										**1**	
Callorhinus ursinus	Fur seal			2				2		3		**7**	
Phocoena phocoena	Harbour porpoise									1		**1**	
Pinnepedia	Pinnepedia, sm	2										**2**	
Delphinidae/Phocoenidae	Porpoise/Dolphin sp.			1								**1**	
Mammalia	Und. sea mamml.					1		1				**2**	
Mammalia	Undet.mammal	41		98		32		100		8		**279**	
Mammalia	Undet.mammal (sm)	1		1								**2**	
Amphibian	salamander sp.			5								**5**	
Unidentified bone	Unident.taxa							2				**2**	
	NSP Non-Fish	49		113		34		109		13		**318**	
	NISP FISH	**2857**		**1,928**		**941**		**558**		**695**		**6,979**	
	Unid. Fish	3361		2,833		2,428		1,187		849		**10,658**	
	NSP Fish	6218		4,761		3,369		1,745		1,544		**17,637**	
	TOTAL NSP	**6267**		**4,874**		**3,403**		**1,854**		**1,557**		**17,955**	
	Approx. age (cal yr BP)[c]	250–1500		250–1800		250–1000		3000–5000		3000–5000			
	Examined Volume (litres)	40 L		75 L		24 L		13 L		20 L		172 L	

* Less than 1% of identified fish (NISP).
[a] NISP = Number of identified specimens.
[b] % NISP = relative abundance of identified fish
[c] Age range based on one or more calibrated radiocarbon dates from the adjacent excavation unit (see Table 7).

Table 4. Frequency and relative abundance of faunal specimens from examined 1.5mm column sample deposits.*

		Column Sample							
		N2-4/W102-104		S56-57/W50-52		S62-64/W62-64		Total	NISP
Species	Common name	NISP	%	NISP	%	NISP	%	NISP[a]	Fish %[b]
Engraulis mordax	Anchovy	385	82.8	7	10.3	26	33.8	**418**	68.52
Clupea pallasi	Pacific herring	61	13.1	56	82.4	45	58.4	**162**	26.56
Embiotocidae	Perch sp.	5	1.1			3	3.9	**8**	1.31
Hexagrammos sp.	Greenling sp.	4	0.9	3	4.4			**7**	1.15
Oncorhynchus sp.	Salmon	5	1.1			1	1.3	**6**	0.98
Sebastes sp.	Rockfish sp.	3	0.6	1	1.5			**4**	0.66
Ophiodon elongatus	Lingcod			1	1.5			**1**	0.16
Gadidae	Gadid sp.					1	1.3	**1**	0.16
Stichaeidae	Prickleback sp.					1	1.3	**1**	0.16
Hemilepidotus hemilepidotus	Red Irish lord	1	0.2					**1**	0.16
Squalus acanthias	Dogfish shark	1	0.2					**1**	0.16
	Undet. Mammal	1						**1**	
	NISP Fish	465		68		77		**610**	
	Unid fish	1,591		166		241		**1,998**	
	NSP fish	2,056		234		318		**2,608**	
Approx. age range (cal yr BP) [c]		250–1500		3000–5000		3000–5000			
Examined Volume (Litres)		2.50L		0.75L		0.75L		4.00L	

*1.5mm estimates reported here should be considered highly tentative due to sampling effort that was disproportionately focused on column N2-4/W102-104, the small examined volume (4L), and sub-sampling that prevented the inclusion of specimens that were recovered in larger mesh sizes (Table 2).

[a] NISP = Number of identified specimens.

[b] % NISP = relative abundance of identified fish

[c] Age range based on one or more calibrated radiocarbon dates from the adjacent excavation unit (Table 7).

Assessing Sample Size and Sample Richness

A perennial question in faunal analysis is whether assemblages are large enough to adequately assess differences between them without these comparisons being unduly influenced by differences in sample size (e.g., Grayson 1984). To evaluate whether insufficient sample size (NISP) is a factor that prevents an effective comparison of the unit and column assemblages, I generated cumulative frequency curves illustrating the relationship between taxonomic richness and sample size in both assemblages (Figure 1). This was accomplished by cumulatively adding the identified fish specimens from individual level assemblages and recording the sample size at which new fish taxa are added to the assemblage (e.g., Lepofsky et al. 1996). This relationship was plotted according to the addition of identified specimens (NISP) recovered from each individual level assemblage (Figure 1a) as well as by adding numbers of individual level samples (Figure 1b). In order to equably compare taxonomic richness between the two assemblages, certain taxa identified beyond a genus level were collapsed into taxon-specific categories (Irish lords – *Hemilepidotus* sp.; perches – Embiotocidae; greenlings - *Hexagrammos* sp.; and salmon - *Onchorhynchus* sp.). Specimens not identified to genus level were not considered taxa (e.g., flatfish) with the exception of perch (Embiotocidae) and sculpins (Cottidae).

The result of this analysis illustrates that taxonomic richness in both assemblages appears to similarly plateau after reaching twenty taxa, indicating that a degree of sampling redundancy has been achieved (Reitz and Wing 1999:107). It also shows that species richness is numerically equivalent in both assemblages (n=21 fish taxa) despite the presence of many more identified specimens in the unit assemblage (NISP=22,100) than in the column assemblage (NISP=6,979). Moreover, even the comparatively tiny assemblage

(NISP=817) recovered exclusively from the 6 mm fraction of the column samples reaches 20 taxa and plateaus after the analysis of 22 individual level assemblages (Figure 1b).

Thus, after an initially dramatic increase in species richness, the rate at which new fish taxa are discovered becomes considerably reduced until the addition of more samples and specimens appears less likely to influence the richness of the assemblage. This is not to say that taxonomic richness has reached its theoretical maximum nor does it mean that the unit assemblage is more diverse than the column assemblage or vice-versa. For as Figure 1a suggests, richness can increase even after many thousands of specimens have been examined (e.g., ≈17,000 NISP). Another important aspect of the comparing the two assemblages is the observation that two taxa in each assemblage were not present in the other assemblage, effectively cancelling out the cumulative richness of both assemblages (n=23 fish taxa, Figure 1*). Nevertheless, despite considerable differences in recovery technique and sample size, this analysis indicates that the two assemblages contain a sufficiently large enough sample to reliably evaluate the taxonomic composition in each assemblage without those differences being the result of differences in sample size.

Assessing Relative Abundance and Ubiquity

The multitude of spatially and temporally distinct contexts represented by the column sample fauna and their proximity to units containing identified fauna provides an opportunity to evaluate the taxonomic composition of fish remains for the site as a whole. In the following discussion, I use these data to describe some of the basic characteristics of the fish assemblage and contrast this with the fish identified from the excavation units.

A considerable variety of fish taxa are present in both the unit and column assemblages, but only a limited number of these taxa have relative

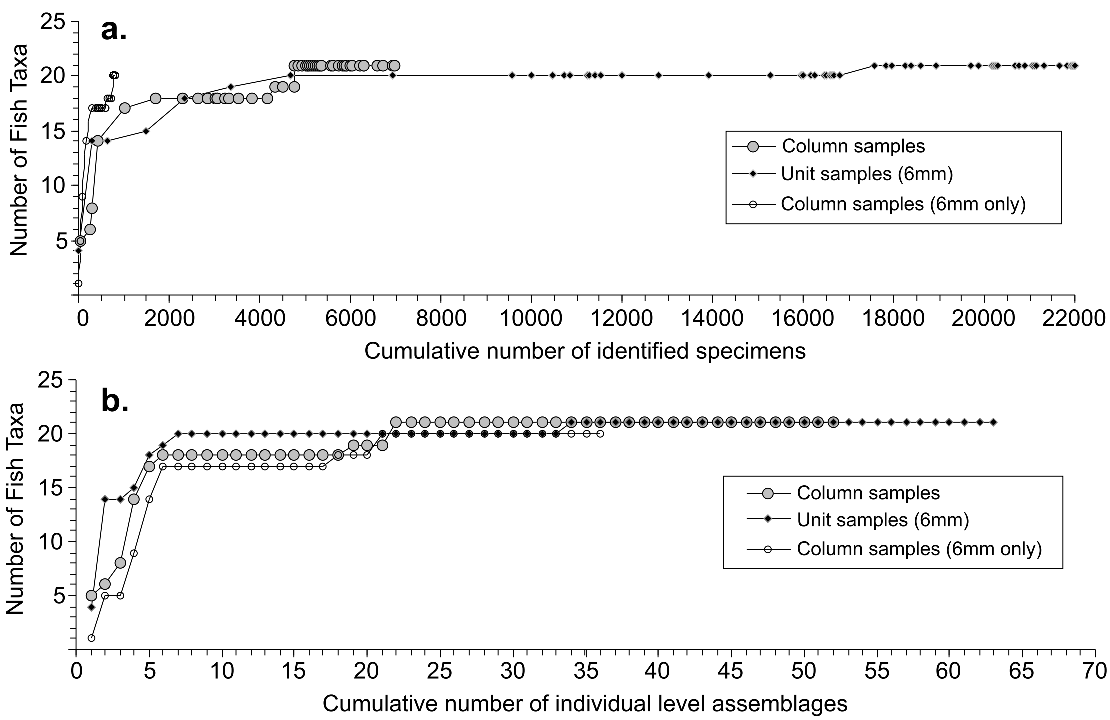


Figure 1. Cumulative frequency graphs showing the number of fish taxa* in relation to (a) the cumulative number of identified specimens grouped according to individual level assemblages and (b) the cumulative number of individual level assemblages (the same data but shown in different presentation formats). The separate lines represent fauna from the unit (6 mm), column assemblages (6+3 and 2 mm), and column sample fauna recovered exclusively from the 6 mm fraction (6 mm only). *Sablefish *(Anoplopoma fimbria)* and Starry flounder *(Platichthys stellatus)* were recovered in the column but not the unit assemblage. Conversely, Bluefin tuna *(Thunnus thynunus)* and English Sole *(Parophrys vetulus)*, were found in the unit assemblage but not in the column assemblage (Frederick and Crockford, this vol.).

abundance values of greater than 1% (Table 3, Frederick and Crockford, this vol.). For instance, the six most abundant taxa in the unit assemblage account for more than 88% (NISP) of the identified fish specimens (Frederick and Crockford, this vol.). In the column assemblage, the six most abundant taxa account for more than 95% (NISP) of the identified fish specimens (Table 3). This suggests that the bulk of the fishing activity at Ts'ishaa was focused on a relatively narrow range of taxa. As discussed below however, some of the taxa representing large proportions of the unit assemblage are not present in similar quantities in the column sample assemblage.

The six most abundant fish taxa recovered from the column samples are herring, anchovy, rockfish, greenling, salmon and perch respectively (Figure 2). These same taxa are also the six most abundant in each of the five individual column sample assemblages, though not all in the same rank order (Tables 3 and 4). The relative abundance of fish specimens in the column samples differs substantially from the unit assemblage (Figure 2). The latter is dominated by rockfish (65%, NISP) and followed distantly by greenling (8%), lingcod (7%), perch (4%), petrale sole (3%) and hake (2%) (Frederick and Crockford, this vol.).

Herring is by far the most abundant (53% NISP) and frequently occuring (98% ubiquity) fish taxa in column sample assemblage (Figures 2 and 3). It represents an average of approximately half (mean %NISP= 49±28) of the identified specimens from the 52 column sample level assemblages. Herring is also the most abundant of the identified specimens in each of the five column samples (mean %NISP = 55.2±8, Table 3). Thus, herring account for at least half of all the fish remains throughout the deposits at Ts'ishaa. The consistently dominant abundance and widespread use of this species suggests that herring was central to the subsistence practices of the residents of Ts'ishaa for the duration of human occupation of this site.

Anchovy is the second most abundant taxa in the column sample assemblage and is less ubiquitous and abundant than herring in all five columns (Table 3). However, in the 1.5 mm sub-sampled assemblage, anchovy is more abundant than herring which indicates that this small fish (<20 cm, Hart 1973) is recovered more readily in screen sizes smaller than 3 mm (Tables 4 and 5). In spite of this, it is difficult to evaluate the rank order abundance of anchovy in the 1.5 mm assemblage because; 1) sampling effort was disproportionately focused on a single column sample (N2-4/W102-104), 2) the sub-sampling procedure prevented the inclusion of specimens recovered from larger screen sizes and 3) collectively, these data only represent 4 litres of examined deposit (Tables 2 and 4). Irrespective of the inadequacies of the 1.5 mm assemblage however, the fact that anchovy is less abundant than herring in both the 1.5 mm and 3 mm fractions from the two back terrace columns samples provides evidence to suggest that anchovy were less abundant than herring between ca. 5000–3000 cal yr BP (Tables 3 and 4).

Rockfish dominate the assemblage of fauna

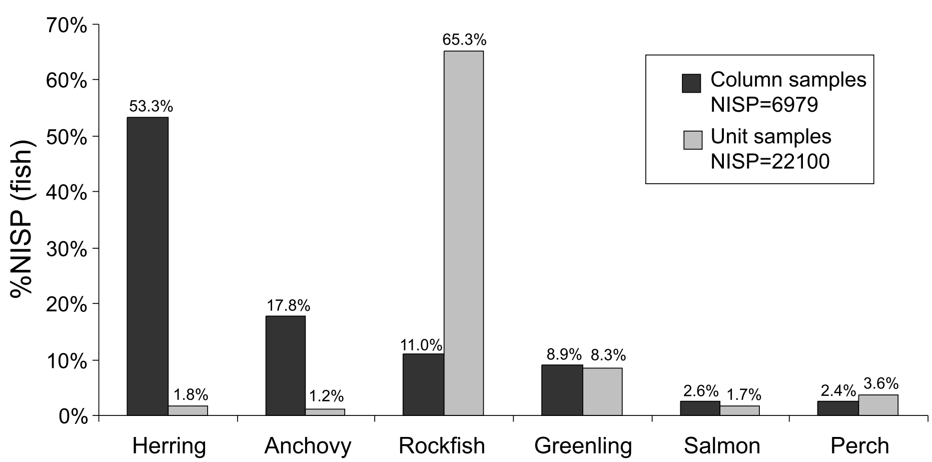


Figure 2. Relative abundance of the six most abundant fish taxa from the column samples (Table 3) compared with the same taxa identified from the excavation unit assemblage (Frederick and Crockford, this vol.). Rockfish, greenling, salmon, and perch represent pooled taxonomic categories (i.e., combined genus, species or family level identifications).

recovered from the excavation units (65% NISP) but are much less abundant in the column sample assemblage (11% NISP). This striking contrast is partially explained by the fact that 82% (NISP=11,863) of the rockfish in the unit assemblage was identified from two adjacent excavation units in the main village (Units N2-4/W102-104 and N4-6/W102-104). Thus, the high number of rockfish specimens recovered from this one area of the site produces a spatially uneven sampling distribution which is further compounded by the biasing effects of 6 mm mesh recovery. In the column sample assemblage, rockfish abundance is only marginally greater than the relative abundance of greenling (Figure 3).

Greenling represents a slightly higher relative percentage in the column assemblage (8.93%) than the unit assemblage (8.35%) despite the large increases in the abundance of herring and anchovy (Table 3). Greenling is also the second most frequently occurring taxon in the 52 individual column level assemblages (Figure 3) suggesting that it is consistently found in small volumes of deposit throughout the site.

Salmon is also found in an incrementally greater proportion of the column sample assemblage than in the unit assemblage and is present in 62% of the examined column sample levels (Figures 2 and 3). One of the reasons for the increased abundance may be the increased recovery of fragmented but highly identifiable salmon vertebrae (e.g., Wigen and Stucki 1988:108). For instance, vertebra in the column assemblage represents 83% (NISP=151) of the identified salmon specimens and 66% of these have intact vertebral centra (NISP=99). In the unit assemblage, 88% (NISP=295) of salmon vertebrae are intact suggesting that fragmentation partially explains the increased recovery for this taxon, a difference that amounts to a three fold increase in fragmented vertebrae. In spite of this taphonomic factor however, the abundance and ubiquity of salmon is only slightly exceeded when specimens from the 15 remaining taxa are combined and compared to salmon (Figure 3).

Perch is also a consistently low percentage of both the unit and column assemblages (Figures 2 and 3). Perch and salmon exhibit similar abundance values but perch is slightly more ubiquitous than salmon (Figure 3b). The recovery of perch in low frequencies suggests it was regularly utilized but did not represent a large percentage of the fish consumed at the site.

Some of the taxa that are abundant in the unit assemblage are prominently absent from the list of top six taxa in the column assemblage (Table 3; Frederick and Crockford, this vol.). In particular,

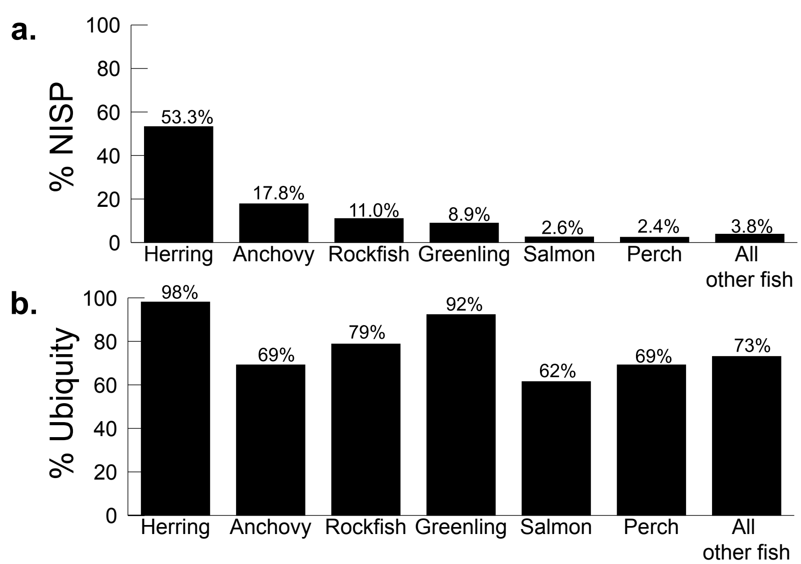


Figure 3. Relative abundance (a) and ubiquity (b) of the six most abundant fish taxa from the column samples (Table 3) Ubiquity measures the presence/absence of species in the 52 column sample levels. 'All other fish' refers to the combined percentage of the remaining 15 taxa in the column sample assemblage. Greenling, salmon and perch represent pooled taxonomic categories (i.e., combined genus, species or family level identifications).

the conspicuously low abundance of taxa such as lingcod, petrale sole, and hake suggests that a combination of increased body size, skeletal robusticity, visibility during field recovery, and low overall density (NSP/litre) contributed to the disproportionately high recovery and rank order abundance of these fish in the unit assemblage. There is a notable absence of sardine or 'pilchard' (*Sardinops sagax*) elements in both the unit and column assemblages. This is surprising given the unique skeletal morphology of this species, its historically documented presence along the southwest coast of British Columbia (e.g., Hart 1973:102; McFarlane and Beamish 2001), and the 5000 year record of human fishing activity represented at Ts'ishaa.

Assessing Recovery in Bones per Litre

The analysis of the fine-screened column samples indicates that a much higher density of fish specimens was recovered from the 3 mm mesh than from the 6 mm mesh. Estimating the magnitude of this difference is important because it helps to clarify the amount of faunal data missing from the excavation unit assemblage and provides a reference point from which to evaluate how separate rates of recovery affect the relative abundance of fish taxa. To characterize differences in recovery, I used the number of fish specimens per litre in each assemblage (calculated as the amount of excavated volume divided by the number of specimens) to compare the unit and column assemblages (Table 5).

Comparisons of the different mesh sizes provide evidence to suggest that a large proportion of the fish remains are absent from the unit assemblage (Table 5). For instance, among the four column samples that utilized nested 6 and 3 mm mesh, 88% of the fish specimens (NSP) and 86% of the *identified* fish specimens (NISP) were recovered in the 3 mm screens (Table 5). Thus, notwithstanding comparisons to the fauna collected directly from the excavation units, this estimate indicates that fewer than 15% of the fish remains are recovered during the use of 6 mm mesh. The considerable loss of fauna is similar to the differences observed for fish remains recovered from ¼" mesh in other archaeological contexts (e.g., Casteel 1972; Gordon 1993; Hanson 1991:158; James 1997; Stein et al. 1992:102).

Table 5. Estimates for numbers of fish specimens per litre recovered from the column and unit assemblages.*

Quantification	Unit samples (6mm only) [a]	Column samples (6mm only)	Column samples (3 + 6mm)[b]	2mm column samples [c]	1.5mm column sub-samples*	Column/unit ratio [d]
Total NSP/litre	1.828	12.04	96.41	140.3	652.0	**52.7**
Total NISP/litre	0.887	5.52	40.8	39.2	152.5	**45.9**
Herring/litre	0.016	0.87	22.11	18.71	40.5	**1,367.7**
Anchovy/litre	0.013	0.13	6.74	10.25	104.5	**509.3**
Rockfish/litre	0.580	2.67	4.77	2.67	1.0	**8.2**
Greenling/litre	0.074	0.74	3.62	3.67	1.75	**48.8**
Perch/litre	0.032	0.28	1.09	0.34	2.0	**33.9**
Salmon/litre	0.015	0.13	0.78	2.71	1.5	**53.3**
Examined volume (litres)	24,800	148	148	24	4	
Total NISP fish	22,100	817	6,038	941	610	
Total NSP fish	45,333	1,782	14,268	3,369	2,608	
Id rate (NISP/NSP)	46%	45%	42%	27%	22%	

*1.5mm estimates should be considered highly tentative due to sampling effort that was disproportionately focused on column N2-4/W102-104, the small examined volume (4L), and sub-sampling that prevented the inclusion of specimens that were recovered in larger mesh sizes (Tables 2 and 4).

[a] Data from Frederick and Crockford (this vol.).

[b] Excluding 2mm fauna from column S5-7/W11-13.

[c] Fauna recovered exclusively from column S5-7/W11-13 (Table 1).

[d] 3 and 6mm column fauna divided by 6mm unit fauna.

An even greater proportion of the fish remains appears to be absent from the excavation unit assemblage (Table 5). Corrected for volume, the total number of fish specimens (NISP and NSP) recovered from the 3 mm column samples is approximately 45 to 55 times greater than the 6 mm excavation samples (Table 5). Moreover, a greater number of fish specimens was recovered from the 6 mm column samples screens than in the 6 mm field screens (Table 5), indicating that differences in recovery extend beyond the differences in screen size. This latter result suggests that faunal recovery is considerably higher when sorting is conducted in controlled laboratory settings where it is possible to take greater care to sort small bones from the matrix. This roughly six fold increase is considerably larger than the differences observed between wet and dry screening at other sites on the Northwest Coast (i.e., Cannon 1991:6; Huelsbeck 1994:56).

At the species level, differences in the recovery of individual fish taxa are more variable but depict how particular taxa are differentially represented in both assemblages and in relation to each other (Table 5). Specifically, herring and anchovy exhibit the greatest disparity in recovery between the column and unit samples whereas rockfish exhibits the least. This result helps to account for the over-representation of rockfish and the under-representation of herring and anchovy in the unit assemblage. Greenling, perch and salmon are also recovered in much greater quantities in the 3 mm screen sizes than in the 6 mm screens. Despite the sheer scale of the increased recovery of fauna in the column sample assemblage relative to the unit assemblage, it is surprising that herring and anchovy appear to be the only two taxa to significantly increase in relative abundance in the column sample assemblage.

Correlating Recovery in the Unit and Column Levels

Although the quantification of column sample fauna is generally assumed to reflect the abundance and density of taxa in the surrounding matrix (e.g., Casteel 1976a), this assumption is rarely tested against data obtained from adjacent excavation units (Wigen and Eldon 1987). This notion is critical however, because estimates of the density and taxonomic composition of column sample fauna are often projected from small to large volumes of examined deposit (e.g., Fawcett 1991; Moss 1989). Consequently, extrapolating numbers and proportions of fish remains recovered from different mesh sizes may inaccurately characterize the variable or 'patchy' distribution of these specimens, particularly if this conversion is based on a small number of examined contexts (e.g., Maschner 1997:90; Wigen and Eldon 1987).

As discussed above, the use of multiple measures (abundance, ubiquity, and NSP/litre) and multiple examined deposits (individual level assemblages, column samples, and excavation units) provides a general way to assess the level of variation in the fish assemblage. However, in order to determine whether small scale patterns are similarly expressed in adjacent column and unit assemblages, I further examined the fine-grained association between the adjacent column and unit levels (i.e., arbitrary 10 cm increments). To accomplish this, I investigated whether the number of fish specimens per litre found in individual column sample levels is correlated with the number of fish specimens recovered in the adjacent excavation unit levels (Figure 4a–c).

The result of this analysis indicates that for the three columns adjacent to units with identified fauna (Columns N2-4/W102-104; S14-16/W25-27; and S62-64/W62-64), there is a significant positive relationship between the number of fish specimens present in the total number of comparable levels (Pearson's $R=0.764$, $p<0.01$, $n=23$). This suggests that the overall density of fish remains is similarly expressed between these two sampling strategies. However, on an individual basis, the density (NSP/litre) of fauna in the column and unit levels is significantly correlated in only two of the three cases (Figure 4a,b) The one instance in which there was not a significant relationship between the unit and columns was also the column which had the fewest number of paired levels ($n=5$, Figure 4c). In this respect, the lack of a significant correlation between the fauna recovered from individual column and unit levels in S14-16/W25-27 is most likely due to the small number of paired levels as opposed to a consistently different density of fish in adjacent arbitrary levels (Figure 4c).

Rockfish and Greenling Length in Different Screen Sizes

Archaeologists have generally observed that the use of smaller mesh sizes recovers smaller-bodied taxa more readily (e.g., Gifford 1916; Gordon 1993; James 1997; Shaffer 1992; Thomas 1969). In the Ts'ishaa column sample assemblage, the increased recovery of herring and anchovy clearly demonstrates an increased abundance for these small fish taxa (<25 cm, Hart 1973). However, it is difficult to know the size range of some of the other species found in the assemblage because many of these marine fish continue to grow throughout their often lengthy lifetimes (e.g., Munk 2001) and this makes singular estimates of body size a dubious proposition (Casteel 1976b:119). As discussed previously, both rockfish and greenling represent significant proportions of the unit and column assemblages but the abundance of rockfish is dramatically lower in the column assemblage whereas the abundance of greenling is incrementally larger in the column sample assemblage (Figure 2). To investigate whether these differences are related to the differential recovery of larger or smaller-bodied individuals, I used the allometric regression formulae developed by Orchard (2003), to estimate the lengths of rockfish and greenling by measuring select skeletal elements recovered from different mesh sizes in the column sample assemblage (Figure 5, Table 6).

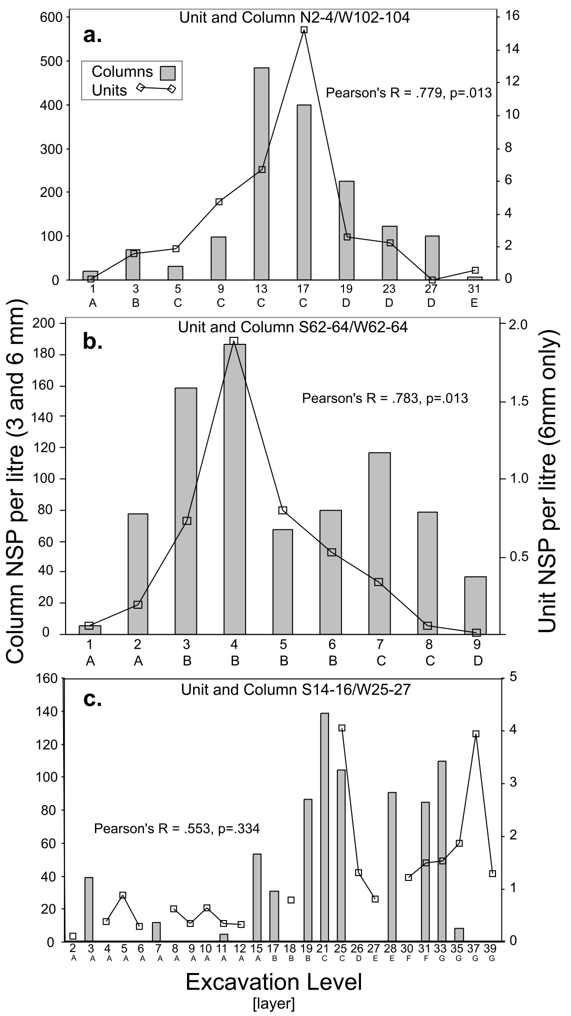


Figure 4. Fish specimen frequency (NSP/litre) in excavation unit and column sample levels for the three columns with associated excavation unit data; (a) N2-4/W102-104; (b) S62-64/W62-64; (c) S14-16/W25-27. Levels without bars or rectangles indicate the absence of quantified data. Excavation level numbers refer to arbitrary 10 cm levels (i.e., higher numbers represent deeper levels). Layers are stratagraphic 'natural layer' designations assigned in the field (McMillan and St. Claire, this vol.).

Briefly, these length estimations are based on skeletal measurements taken from a suite of modern fish specimens where the length of the fish and the size of the skeletal element is known and the relationship is evaluated for a sample of multiple individuals (>10). Linear regression is then used to generate equations capable of predicting total length based on the dimensions of individual skeletal elements (Orchard 2003:43–55). For rockfish and greenling, length estimates with high predictive accuracy are available for 16 skeletal elements (mean rockfish R^2=0.84±0.06; mean greenling R^2=0.96±0.03).

By measuring a total of 77 greenling and 129 rockfish elements which could be used to predict total length (TL), I generated estimates of the distribution of fish length for the different screen sizes throughout the column sample assemblage (Figure 5a–d). The result of these analyses illustrate a consistent difference in the average size-class of both rockfish and greenling, with smaller individuals recovered in smaller screen sizes (Figure 5a–b). This demonstrates that 6 mm mesh does not adequately represent the range of rockfish and greenling size-classes present in the deposits. Moreover, comparisons of mean length demonstrates that the average size of greenling is 5 cm smaller than rockfish, indicating that a substantial portion of the greenling length distribution is smaller than the mean length of rockfish (Figure 5c–d). This is further suggested by the differences in the mean length of greenling and rockfish in the separate screen sizes, where the greatest disparity in fish length is in the 6 mm fraction of the column sample assemblage (Table 6). Conversely, the greatest similarity in rockfish and greenling length is in the 3 mm mesh (Table 6). Combined with the relative abundance and ubiquity data (Figures 2 and 3), these differences indicate that the reason for the greater proportion of rockfish in the excavation unit assemblage is due to the preferential recovery of larger-sized rockfish relative to the smaller-sized greenling.

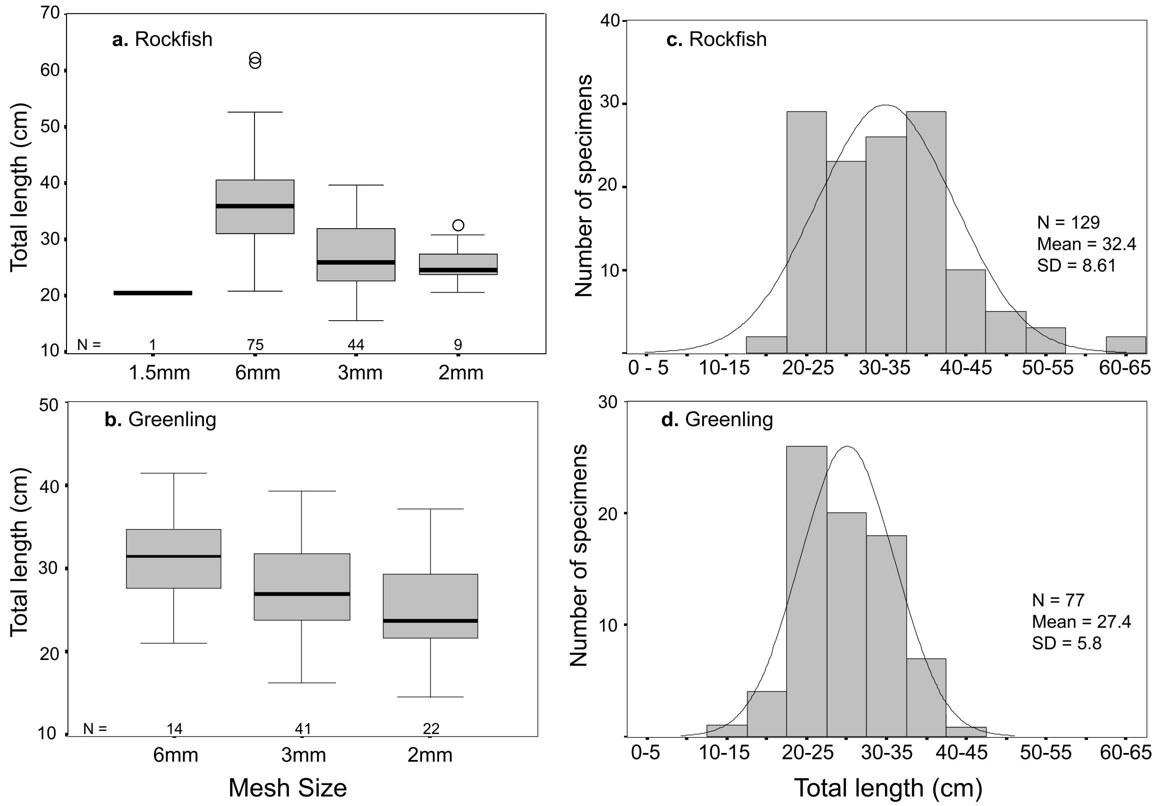


Figure 5. Fish size distribution for measured rockfish (a) and greenling (b) elements from the column sample assemblage recovered separate screen sizes (box-plots show median [line], the middle 50% of cases [box], cases which lie within 1.5 box lengths [wiskers], and outliers which lie beyond 1.5 box lengths [circles]). Rockfish (c) and greenling (d) mortality profiles for measurable specimens from all column screen sizes compared against a derived normal curve (Norusis 2000).

Table 6. Mean total lengths (cm) of rockfish and greenling recovered from different mesh sizes in the column sample assemblage.

		Mesh size				
Taxon	**Length (cm)**	**6 mm**	**3 mm**	**2 mm**	**1.5 mm**	**Total**
Rockfish	Mean	36.4	27.2	26.0	20.6	32.4
Greenling	Mean	30.2	27.9	24.7		27.4
Rockfish	max	62.4	39.6	32.8		62.3
Greenling	max	40.3	39.4	37.1		40.3
Rockfish	min	20.9	15.7	20.6		15.7
Greenling	min	21.0	16.3	14.6		14.6
Rockfish	Std. Dev.	8.2	5.9	4.0		8.6
Greenling	Std. Dev.	5.9	5.6	5.1		5.8
Rockfish	Count	75	44	9	1	129
Greenling	Count	14	41	22		77

Assemblage Formation and Taphonomy

The excavations at Ts'ishaa exposed rich deposits of molluscan and vertebrate fauna, but the archaeological expression of these remains varies among deposits, levels and within stratigraphic layers. Modelling the distribution of these ubiquitous constituents provides a basis for evaluating their formation and potential degradation over time. The following section explores the potential for such taphonomic factors to influence the faunal assemblage.

Exploring the Association Between Bone and Shell

Alkaline conditions created by the abundant presence of shell is considered to be an influential factor that structures the burial environment in shell midden deposits and is conducive to the preservation of bone (Linse 1992; Waselkov 1987:155). However, while the preservation of vertebrate fauna is generally ascribed to the presence of shell (e.g., Ames and Maschner 1999:89; Erlandson 2001:302), the fine-grained association between bone and shell is a rarely reported aspect of shell-midden archaeology. To investigate if the amount of recovered bone is related to the amount of shell in the surrounding matrix, I compared the number of fish specimens per litre (NSP/litre) to the amount of shell (grams/litre) using data collected from the 52 discrete column level samples (unpublished shell data kindly provided by Ian Sumpter). Thus, if there is a positive or negative relationship, this would be indicative of a taphonomic affect. Conversely, if there is not a detectable relationship, this would be suggestive of a random depositional sequence expected for human waste disposal practices (cf. Beck and Hill 2004).

The result of this analysis indicates that the frequency of bone fragments and the weight of shell in individual levels from the five column samples is not linearly related (Figure 6). This lack of a correlation suggests that the sequence of faunal deposition is not the result of chemical or taphonomic degradation, at least among the examined deposits containing identified fauna. Rather, this analysis appears to indicate that the depositional sequence of bone and shell is random. Thus, the patterning in shell and bone density cannot be explained by preservation factors alone. This suggests that human-mediated deposition is primarily responsible for the frequency of bone and shell in individual level assemblages.

The comparison of the amount of bone and

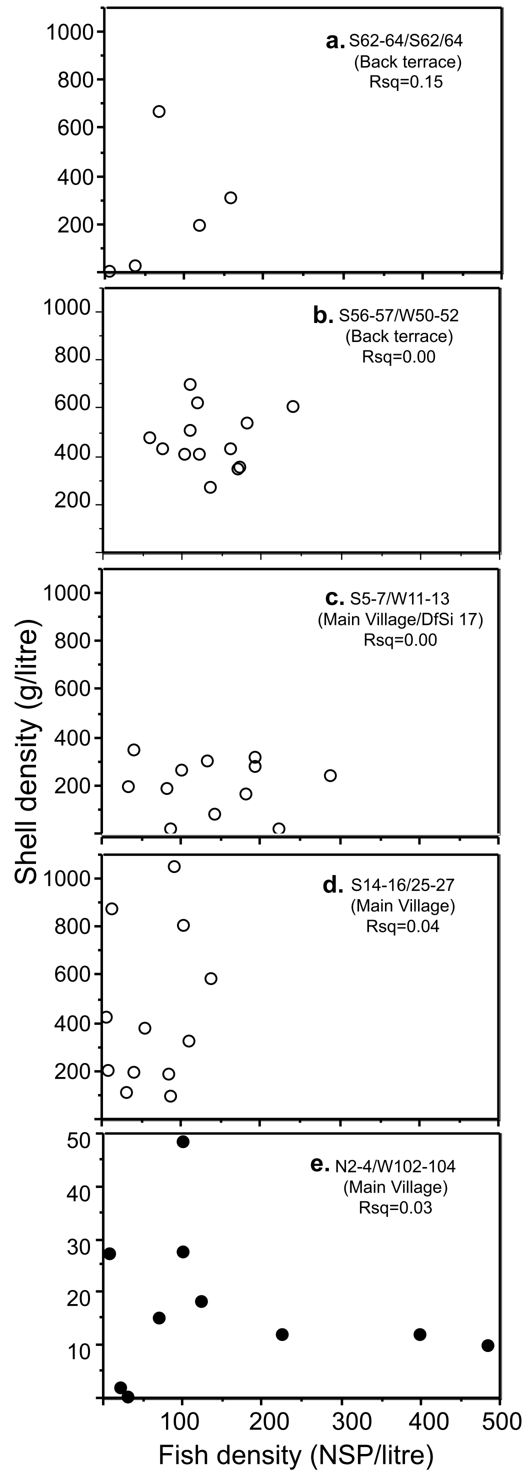


Figure 6. The relationship between shell density (g/litre) and fish density (NSP/litre) for each of the 52 examined levels grouped by individual column sample (Table 1). Note different scale on the y axis of column N2-4/W102-104, where shell data was collected only from the 6mm fraction (filled circles).

shell present in these spatially and temporally distinct areas of the site also provides an opportunity to evaluate whether the preservation of bone and shell in the older back terrace component of the site (ca. 3000–5000 cal yr BP) differs from the younger main village deposits (ca. 250–1800 cal yr BP). Based on a visual assessment of the plots in Figure 6, it is apparent that broadly similar densities of bone and shell are found in both components of the site. This suggests that chronological differences do not have an effect on the density of shell or fish specimens present in the midden deposits. In fact, only in a few of the 52 examined individual column sample levels, do deposits contain both a low density of both bone and shell (i.e., S62-64/W62-64, N2-4/W102-104).

Accumulation Rates and the Formation of the Faunal Assemblage

Comparisons of the age, rate of burial (accumulation) and density of fauna provides an additional way to asses whether human or taphonomic factors are responsible for the fauna preserved in the examined deposits. Rates of accumulation are produced by complex interplay between the regularity of deposition, the *in situ* deterioration of this material and the erosion or physical attrition of the deposits (Kidwell 1986). However, if bones or shells are subject to slower rates of accumulation, they should tend to be present in lower densities relative to younger or more quickly accumulating deposits (cf., Olszewski 1999). In shell midden contexts, several of these processes presumably affect and are affected by the deposition of vertebrate and molluscan fauna (i.e., the regularity of consumption and deposition, the preservational conditions of the burial environment and the human and animal use of the immediate landscape).

To explore how these factors may have affected the preservation and density of the fish assemblage at Ts'ishaa, I first estimated the accumulation rates for the five spatially separate deposits containing identified column sample fauna and subsequently examined whether the density of bone and shell varies with the differing rates of accumulation. To generate estimates of accumulation rates (cm/100 yr), I compared the age (cal yr BP) and depth below surface (cm) using the 26 ^{14}C dates directly associated with the column sample fauna (Table 7, Figure 7). I determined accumulation rates using correlation coefficients on the group of dates from the three columns dating to the main village occupation (S14-16/W25-27; N2-4/W102-104; and S5-7/W11-13) and individually for the two separate column sample deposits from the back terrace (S56-57/W50-52; S62-64/W62-64) (Figure 7). Each of the column deposits is associated with three or more radiocarbon ages with the exception of S5-7/W11-13 which is incorporated into the contemporaneous sample of 15 dates from the main village occupation (i.e., DfSi-17, Table 7).

This analysis indicates that midden accumulation occurred more rapidly over the past 1800 years in the main village (ca. 250–1800 cal yr BP) than in back terrace (ca 3000–5000 cal yr BP, Figure 7). Thus, midden deposits in the highly dispersed (>100 m apart) locations of the main village and Himayis (S5-7/W11-13), appear to have accumulated at similarly consistent rate of approximately 25 cm every 100 years (Figure 7). In contrast, the two columns from the older back terrace deposits accumulated at distinctly slower rates (≈11 cm/100 yr in col. S56-57/W50-52 and ≈1 cm/100 yr in col. S62-64/W62-64).

Despite considerable differences in accumulation rate, fish bone density (NISP/litre) is strik-

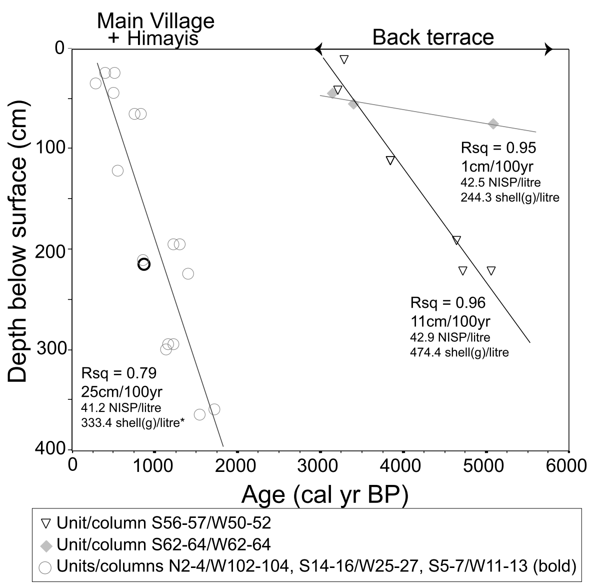


Figure 7. Age of column sample deposits measured against depth below surface based on associated radiocarbon dates (Table 7). Lines represent least squares regression and are shown with the corresponding correlation coefficients (Rsq value). Estimated accumulation rates (cm/100yr) and fish bone density (NISP/litre) are also shown for each group. Asterisk (*) denotes the absence of adequate shell data for column N2-4/W102-104.

ingly similar among these three separate deposits (Figure 7). On the one hand, this similarity provides reason to suspect that *in situ* degradation over time is not a factor influencing the preservation of the faunal assemblage. On the other hand, the differing rates of midden accumulation indicates that fish bone deposition is higher in areas of rapid accumulation. That is, more bones were deposited per unit of time in deposits with higher rates of midden accumulation.

Comparison of the three accumulation rates and the deposition of shellfish indicates that the deposit with the slowest rate of accumulation does have the lowest density of shell (244.3 g/litre, S62-64/W62-64, Figure 7). However, the deposit with the highest density of shell (S56-57/W50-52) does not have the fastest accumulation rate, suggesting that rate of accumulation is more complex than the quantity of shell deposited in a single location.

Another interesting aspect of this analysis is that three separate areas of the main village show a consistent pattern of midden accumulation over the same temporal interval (ca. 250–1800 cal yr BP). This suggests that the consumption and deposition of midden material was occurring relatively rapidly and on a consistently large scale throughout the site. This finding is consistent with a village occupation, where large quantities of food are

Table 7. Radiocarbon dates associated with the column sample deposits and used in the calculation of accumulation rates (Figure 7). Calibration achieved using Calib. 4.3 (Stuiver et al. 1998a–b). Marine samples were calibrated with a ΔR of 250±0 (100% marine), based on discussion in Southon and Fedje (2003).

Lab number	Site area[a]	Unit	Level/ layer	^{14}C age	Material	$\delta^{13}C$**	2 sigma range (cal yr BP)	Midpoint cal yr BP[b]	Depth below surface (cm)	Midpoint depth below surface (cm)
Beta-158744	BT	S56-57/W50-52	4B	3050±70	charcoal	-25	3440–3000	3220	35–45	40
CAMS-97186	BT	S56-57/W50-52	1B*	3100±35	charcoal	-25	3380–3210	3295	5–15	10
CAMS-97177	BT	S56-57/W50-52	11C*	3575±35	charcoal	-25	3980–3730	3855	105–115	110
CAMS-97176	BT	S56-57/W50-52	11C*	3585±40	charcoal	-25	3980–3730	3855	105–115	110
Beta-158747	BT	S56-57/W50-52	17+	4160±70	charcoal	-25	4850–4450	4650	165–235	190
CAMS-97181	BT	S56-57/W50-52	23C*	4210±35	charcoal	-25	4840–4620	4730	225–235	220
CAMS-97182	BT	S56-57/W50-52	23C*	4415±35	charcoal	-25	5260–4870	5065	225–235	220
Beta-158740	BT	S62-64/W62-64	5B	3000±70	charcoal	-25	3360–2950	3155	40–50	45
CAMS-N48305	BT	S62-64/W62-64	6B	3770±35	fur seal	-14.5	3470–3330	3400	50–60	55
Beta-158741	BT	S62-64/W62-64	7/8D	4470±70	charcoal	-25	5320–4870	5095	70–80	75
CAMS-97191	EA2	N2-4/W102-104	3B*	350±45	charcoal	-25	510–300	405	20–30	25
CAMS-97192	EA2	N2-4/W102-104	3B*	475±35	charcoal	-25	550–480	515	20–30	25
CAMS-85651	EA2	N2-4/W102-104	5C	1145±30	fur seal	-14.4	540–470	505	40–50	45
CAMS-85650	EA2	N2-4/W102-104	7C	1545±30	fur seal	-14.6	910–760	835	60–70	65
CAMS-97203	EA2	N2-4/W102-104	20D*	1385±35	charcoal	-25	1350–1260	1305	190–200	195
CAMS-97204	EA2	N2-4/W102-104	20D*	1300±35	charcoal	-25	1290–1170	1230	190–200	195
CAMS-97198	EA2	N2-4/W102-104	30D*	1230±35	charcoal	-25	1260–1060	1160	290–300	295
CAMS-97197	EA2	N2-4/W102-104	30D*	1310±35	charcoal	-25	1290–1170	1230	290–300	295
Beta-147074	EA2	N2-4/W102-104	31E	1230±90	charcoal	-25	1310–950	1130	300	300
CAMS-85649	EA2	N4-6/W102-104	7C	1470±30	fur seal	-14.4	830–680	755	60–70	65
CAMS-85648	EA2	N4-6/W102-104	21D	1595±35	fur seal	-13.4	950–800	875	210–220	215
CAMS-85647	EA1	S14-16/W25-27	4A	895±30	fur seal	-14.1	330–250	290	30–40	35
Beta-134655	EA1	S14-16/W25-27	25C	1490±60	charcoal	-25	1520–1290	1405	220–230	225
CAMS-85646	EA1	S14-16/W25-27	37G	2235±35	fur seal	-15.3	1620–1460	1540	360–370	365
Beta-134656	EA1	S14-16/W25-27	35-37G	1800±60	charcoal	-25	1870–1560	1715	350–370	360
Beta-134657	DfSi-17	S5-7/W11-13	24C	970±60	charcoal	-25	970–740	855	210–213	211

[a] BT=back terrace, EA1=1999 trench excavation, EA2=2000 trench excavation, DfSi-17=Hemayis.
[b] Midpoint of the 2 sigma calibrated range.
*^{14}C sample obtained from within column sample level.
**^{13}C values given without decimal places are the assumed values according to Stuiver and Polach (1977:335).

processed and consumed over a broad spatial area. This is further supported by the ethnographic information describing Ts'ishaa as a large prehistoric village site (Golla 2000; McMillan and St. Claire, this vol; St. Claire 1991).

This analysis has shown that deposits in separate areas of the site represent considerably different scales of temporal resolution (i.e., 10 vertical cm ≈40–1000 yrs). Despite these differences, the rate of accumulation does not appear to reflect the *in situ* degradation of the shell midden deposits but rather the intensity of deposition.

Conclusions

The recovery and analysis of the fine-screen column sample fauna provides significant insight into the taxonomic composition and depositional context of the fish assemblage recovered from the examined shell midden deposits at Ts'ishaa. Through my analyses, I have shown that the overwhelming majority (>85%) of the fish specimens present in the fine-screened (≤3 mm) deposits are absent from conventional ¼" recovery. Despite considerable recovery differences as well as difference in sample size, the assemblage of specimens identified from column and unit samples can be reliably compared and contrasted to assess the relative importance of different fish taxa over time and space. In this respect, the evaluation of the taxonomic composition of the column sample assemblage indicates that six taxa dominate the assemblage in all contexts and chronological periods, implying a focused utilization of fish resources throughout the 5000 year occupation of this site. This is further supported by the examination of the increased species-specific recovery rates as well as an analysis of the biasing effects of larger sized mesh on the recovery of smaller-sized rockfish and greenling. I have also shown that the density of fish remains can be measurably integrated between the small and large volumes of deposits in the column and unit samples. In relation to formation processes and taphonomy, I discovered that there is no apparent relationship between the amount of bone present and the amount of surrounding shell, at least for the deposits containing identified fauna. In addition, the age of the deposits does not appear to affect the density of fish remains recovered from the midden deposits. Thus, human-mediated deposition appears to be the primary factor responsible for the density and taxonomic composition of the fish remains at the site. Together, these data and analyses suggest that human participation in the prehistoric marine ecosystem of Barkley Sound was intensively focused on a narrow range of fish resources which vastly outnumbered all other vertebrates consumed at the site. This knowledge provides a basis for developing further interpretations which are being explored elsewhere (McKechnie, in prep).

In conclusion, this paper documents a vitally important aspect of the cultural and economic practices of the people who inhabited Ts'ishaa for the past 5000 years. In conjunction with the other research contributions in this volume, these conclusions expand our knowledge of the long-term human and ecological history embedded in the landscape of what is now Pacific Rim National Park Reserve.

Acknowledgements. I would like to acknowledge and thank the members of the Tseshaht First Nation and Parks Canada for the privilege of participating in the Tseshaht Archaeological Project. In particular, I would like to thank Ed Shewish and Ian Sumpter for their work in processing the column sample fauna. Without their efforts, this research would not have been possible. I additionally thank co-directors Alan McMillan and Denis St. Claire for providing the opportunity take part in the archaeology at Ts'ishaa and for encouraging this research contribution. I am grateful for the extensive advice, encouragement, and comments of Dana Lepofsky. I also thank Jon Driver, Shannon King, Alan McMillan, Teresa Trost, and Rebecca Wigen for comments and references. Thanks also to Seth Newsome and Tom Guilderson for radiocarbon dates. Lastly, I cannot understate my absolute gratitude for the time, patience, and invaluable assistance I received from Susan Crockford, Gay Frederick, and Rebecca Wigen during the elaborate course of my learning (fish) process. Rebecca Wigen, Quentin Mackie, and the Department of Anthropology at the University of Victoria kindly provided laboratory space for this research. Financial support was provided by the Department of Archaeology at Simon Fraser University. Rebecca Wigen's review of the column sample fauna was funded by a timely grant from Parks Canada. All mistakes are mine; thanks for reading this far.

References Cited

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

Beck, M.E., and M.E. Hill
2004 Rubbish, Relatives, and Residence: The Family Use of Middens. *Journal of Archaeological Method and Theory* 11(3):297–333.

Calvert, S.G.
1980 A Cultural Analysis of Faunal Remains from Three Archaeological Sites in Hesquiat Harbour, B.C. Ph.D. dissertation, University of British Columbia.

Cannon, A.
1991 *The Economic Prehistory of Namu: Patterns in Vertebrate Fauna*. Publication 19. Department of Archaeology, Simon Fraser University, Burnaby.

2000 Assessing Variability in Northwest Coast Salmon and Herring Fisheries: Bucket-Auger Sampling of Shell Midden Sites on the Central Coast of British Columbia. *Journal of Archaeological Science* 27:725–737.

Casteel, R.W.
1970 Core and column sampling. *American Antiquity* 35:465–467.

1972 Some biases in the recovery of archaeological faunal remains. *Proceedings of the Prehistoric Society* 38:382–388.

1976a Comparison of column and whole unit samples for recovering fish remains. *World Archaeology* 8:192–196.

1976b *Fish Remains in Archaeology and Paleoenvironmental Studies*. Academic Press, San Francisco.

Coupland, G.
1991 The Point Grey Site: a Marpole spring village component. *Canadian Journal of Archaeology* 15:73–96.

Erlandson, J.M.
2001 The Archaeology of Aquatic Adaptations: Paradigms for a New Millennium. *Journal of Archaeological Research* 9(4):287–350.

Fawcett, I.
1991 Faunal Analysis of Matrix Samples. In *The Economic Prehistory of Namu: Patterns in Vertebrate Fauna*, by A. Cannon, pp. 97–100. Publication 19. Department of Archaeology, Simon Fraser University, Burnaby.

Gifford, E.W.
1916 *Composition of California Shellmounds*. Publications in American Archaeology and Ethnology 12:1–29. University of California, Berkeley.

Golla, S.
2000 Legendary History of the Tsisha¿ath: A Working Translation. In *Nuu-chah-nulth Voices, Histories, Objects and Journeys*, edited by A.L. Hoover, pp. 133–171. Royal British Columbia Museum, Victoria.

Gordon, E.A.
1993 Screen size and differential faunal recovery: A Hawaiian example. *Journal of Field Archaeology* 20:453–460.

Grayson, D.K.
1984 *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Academic Press, New York.

Hanson, D.K.
1991 Late prehistoric subsistence in the Strait of Georgia region of the Northwest Coast. Ph.D. Dissertation, Simon Fraser University.

Hart, J.L.
1973 *Pacific Fishes of Canada*. Bulletin 180. Fisheries Research Board of Canada, Ottawa.

Huelsbeck, D.R.
1994 Mammals and fish in the subsistence economy of Ozette. In *Ozette Archaeological Project Research Reports Volume 2. Fauna*, edited by S. R. Samuels, pp. 17–91. Reports of Investigations. vol. 66. Department of Anthropology, Washington State University, Pullman.

James, S.R.
1997 Methodological issues concerning screen size recovery rates and their effects on archaeofaunal interpretations. *Journal of Archaeological Science* 24:385–397.

Kidwell, S.M.
1986 Models for fossil concentrations: paleobiologic implications. *Paleobiology* 12(1):6–24.

Leach, F.
1997 *A Guide to the Identification of Fish Remains From New Zealand Archaeological Sites*. Special Publication. New Zealand Journal of Archaeology, Kilbirnie.

Lepofsky, D., K.D. Kusmer, B. Hayden and K.P. Lertzman
1996 Reconstructing Prehistoric Socioeconomies from Palaeoethnobotanical and Zooarchaeological Data: An Example from the British Columbia Plateau. *Journal of Ethnobiology* 16(1):31–62.

Linse, A.R.
1992 Is Bone Safe in a Shell Midden? In *Deciphering a Shell Midden*, edited by J. K. Stein, pp. 327–345. Academic Press, San Diego.

Maschner, H.D.G.
1997 Settlment and subsistence in the later prehistory of Tebenkof Bay, Kuiu Island, Southeast Alaska. *Arctic Anthropology* 34(2):74–99.

McFarlane, G.A., and R.J. Beamish
2001 The reoccurrence of sardines off British Columbia characterize the dynamic nature of regimes. *Progress in Oceanography* 49:151–165.

McKechnie, I.
In prep. 5000 years of fishing at a village in the Broken Group Islands, Barkley Sound, British Columbia. MA Thesis, Department of Archaeology, Simon Fraser University, Burnaby, BC.

Monks, G.G.
1977 Examination of relationships between artifact classes and food resource remains at Deep Bay, DiSe 7. PhD. Dissertation, University of British Columbia, Vancouver, B.C.

Moss, M.L.
1989 Archaeology and cultural ecology of the prehistoric Angoon Tlingit. Ph.D. Dissertation, University of California, Santa Barbara.

Munk, K.M.
2001 Maximum Ages of Groundfishes in Waters off Alaska and British Columbia and Considerations of Age Determination. *Alaska Fishery Research Bulletin* 8(1):12–21.

Norusis, M.J.
2000 *SPSS 10.0 Guide to Data Analysis*. Prentice-Hall, Upper Saddle River, New Jersey.

Olszewski, T.D.
1999 Taking advantage of time-averaging. *Paleobiology* 25:226–238.

Orchard, T.J.
2003 *An application of the linear regression technique for determining length and weight of six fish taxa: the role of selected fish species in Aleut paleodiet*. International Series 1172. British Archaeological Reports, Oxford.

Reitz, E., and E. Wing
1999 *Zooarchaeology*. Cambridge University Press, Cambridge.

Rick, T.C., J.M. Erlandson, M.A. Glassow and M.L. Moss
2002 Evaluating the Economic Significance of Sharks, Skates, and Rays (Elasmobranchs) in Prehistoric Economies. *Journal of Archaeological Science* 29:111–122.

Shaffer, B.S.
1992 Quarter-inch screening: understanding biases in recovery of vertebrate faunal remains. *American Antiquity* 57:129–136.

Southon, J., and Fedje, D.
2003 A post-glacial record of ^{14}C reservoir ages for the British Columbia coast. *Canadian Journal of Archaeology* 27(1):95– 111.

St. Claire, D. E.
1991 Barkley Sound Tribal Territories. In *Between Ports Alberni and Renfrew: Notes on West Coast Peoples*, edited by E.Y. Arima, D.S. Claire, L. Clamhouse, J. Edgar, C. Jones and J. Thomas, pp. 13–202. Mercury Series 121. Canadian Ethnology Service, Canadian Museum of Civilization, Ottawa.

Stein, J. K., K. D. Kornbacher and J. L. Tyler
1992 British Camp shell midden stratigraphy. In *Deciphering a Shell Midden*, edited by J K. Stein, pp. 95–134. Academic Press, San Diego.

Stuiver, M. and H. A. Polach
1977 Discussion: Reporting of ^{14}C Data. *Radiocarbon* 19(3):355–363.

Stuiver, M., P.J. Reimer, E. Bard, J.W. Beck, G.S. Burr, K.A. Hughen, B. Kromer, F.G. McCormac, J.v.d. Plicht and M. Spurk
1998 INTCAL98 Radiocarbon Age Calibration 24,000–0 cal BP. *Radiocarbon* 40:1041–1083.

Stuiver, M., P.J. Reimer and T.F. Braziunas
1998 High-precision Radiocarbon Age Calibration for Terrestrial and Marine Samples. *Radiocarbon* 40:1127–1151.

Thomas, D.H.
1969 Great Basin Hunting Patterns: A quantitative method for treating faunal remains. *American Antiquity* 34:392–401.

Vale, D., and R.H. Gargett
2002 Size Matters: 3-mm Sieves Do Not Increase Richness in a Fishbone Assemblage from Arrawarra I, an Aboriginal Australian Shell Midden on the north Coast of New South Wales, Australia. *Journal of Archaeological Science* 29:57–63.

Waselkov, G.A.
1987 Shellfish gathering and shell midden archaeology. *Advances in Archaeological Method and Theory* 10:93–210.

Wigen, R.J., and A. Eldon
1987 Integrating Column Sample Data with Level Data: Some Examples from the Gulf of Georgia. Paper presented at the Canadian Archaeological Association, Victoria, BC.

Wigen, R.J., and B.R. Stucki
1988 Taphonomy and Stratigraphy in the Interpretation of Economic Patterns at Hoko River Rockshelter. In Research in Economic Anthropology, Supplement 3: *Prehistoric Economies of the Pacific Northwest Coast*, edited by B L. Isaac, pp. 87–146. JAI Press, Greenwich.