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SEASONALITY, SHELL MIDDEN LAYERS, AND COAST SALISH SUBSISTENCE ACTIVITIES AT THE CRESCENT BEACH SITE, DgRr 1

by

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ABSTRACT

This dissertation is concerned with the analysis of a late portion of the Crescent Beach shell midden (DgRr 1) situated on Boundary Bay in the southern Fraser River Delta of British Columbia. The basic objectives of this study are the recovery and analysis of shell midden layers and their constituents to obtain information on Coast Salish subsistence activities, and to initiate a better understanding of shell midden formation.

The cultural history of the Strait of Georgia region is viewed as a 5,000 year long Tradition of Coast Salish Cultures. To place the archaeological materials from Crescent Beach in their proper cultural ecological perspective, the environmental, ethnographic and archaeological setting of the site and surrounding region is examined. The historic ecological communities of Boundary Bay are reconstructed and the abundance and availability of species of economic value determined. Ethnographic Coast Salish Culture and economic strategies are examined and possible settlement patterns reconstructed for Boundary Bay. To assist in identifying subsistence activities at Crescent Beach a shell midden model is presented outlining the systemic and archaeological transformation processes responsible for the site's development. In light of this model and the above environmental and ethnographic data the most probable seasons of site occupation are suggested.

Archaeological data were recovered by the hand trowel excavation of a block of shell midden layers and the matrix, provenienced within a 0.25 m^2 unit, was waterscreened through a 1.45 mm mesh screen. In total some 24 m^3 of shell midden weighing 28.8 t were excavated. Recovery of midden constituents was accomplished through a multiple tier sampling

system. Radiocarbon estimates of 1350 to 480 B.P., place the 31 layers recovered from Crescent Beach in the Developed Coast Salish Culture.

Seasonality dating of shellfish growth patterns and analysis of layer constituents indicate the site was a shellfish and herring harvesting camp occupied in February and March. Layers recovered from Crescent Beach reflect shellfish and herring processing (steaming, sorting, refuse discard, and meat preservation) as well as the immediate consumption of other foods. Artifacts indicate the manufacture, mostly in bone and antler, of tools used in fishing, woodworking and hide processing, the latter two activities conducted at the site.

Procurement of shellfish, crab and most fish species probably took place along the 3 km stretch of beach south of the site where present ecological communities contain identical resources as found in the site. Petroglyphs and a fort-lookout site also attest to the use of this area. Shellfish were the most common faunal remain, followed by a much lesser quantity of fish, waterfowl and some large mammals.

In addition to the Crescent Beach site, the Deep Bay site (DiSe 7) and Shoal Bay site (DcRt 1) may also be seasonal shellfish and herring harvesting camps, and it is suggested that Whalen II (DfRs 3) and the Locarno Beach site (DhRt 6) may have had similar uses. This evidence and the fact additional seasonal sites dating to the Locarno Beach Culture have been identified indicates the Proto-Coast Salish had a specialized economic system by 3,500 B.P. and possibly earlier. Indications of social ranking are also evident by this time.

The approach followed in this study indicates accurate information on economic strategies may be obtained from shell middens. Where research is interested primarily in seasonality, settlement pattern and subsistence the controlled excavation of small blocks of shell midden layers, fine mesh water screening, and analysis of small numbers of shell samples will be adequate. This has important implications for the study and resource management of the shell middens of the Strait of Georgia region.

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1.0 INTRODUCTION

This study concerns the analysis of a late portion of the Crescent Beach shell midden (DgRr 1) situated on Boundary Bay in the southern part of the Fraser River Delta, B.C. (Figures 1-1, 1-2). The basic goals of this investigation were to obtain information concerning Coast Salish subsistence activities at Crescent Beach, and to develop an understanding of the formation of shell midden layers. To meet these goals a cultural ecological approach was used including a thorough evaluation of relevant environmental, historic, ethnographic and archaeological data. Also essential was the implementation of rigorous field methods including the wide area excavation of the shell midden by stratigraphic layers, waterscreening through fine mesh screens, the comprehensive analysis of fauna and other elements from layer samples, and seasonality studies of shellfish remains. The results of this study indicate that such an approach permits the accurate recovery of information on seasonality of occupation, subsistence activities, and site formation processes. Crescent Beach and several other similar sites are identified as seasonal shellfish and herring harvesting settlements which were important components of Coast Salish economic systems. It is suggested that a specialized economic system was established among the Proto-Coast Salish people by 3,500 B.P. and perhaps earlier.

The native peoples of the Northwest Coast attained cultural complexity and population densities seldom equalled among known fishing, hunting, and food gathering societies (Borden 1975:112; Drucker 1963:1-3; Fladmark 1975:1; Suttles 1968:56). Driver and Massey (1957:173) state that "Northwest Coast culture competes with that of the Arctic for the status of being the most distinctive and at the same time the most foreign of any in North America". Characteristic of Coast Salish cultures in the Strait of Georgia Lower Fraser River Valley were; permanent villages of more than a thousand

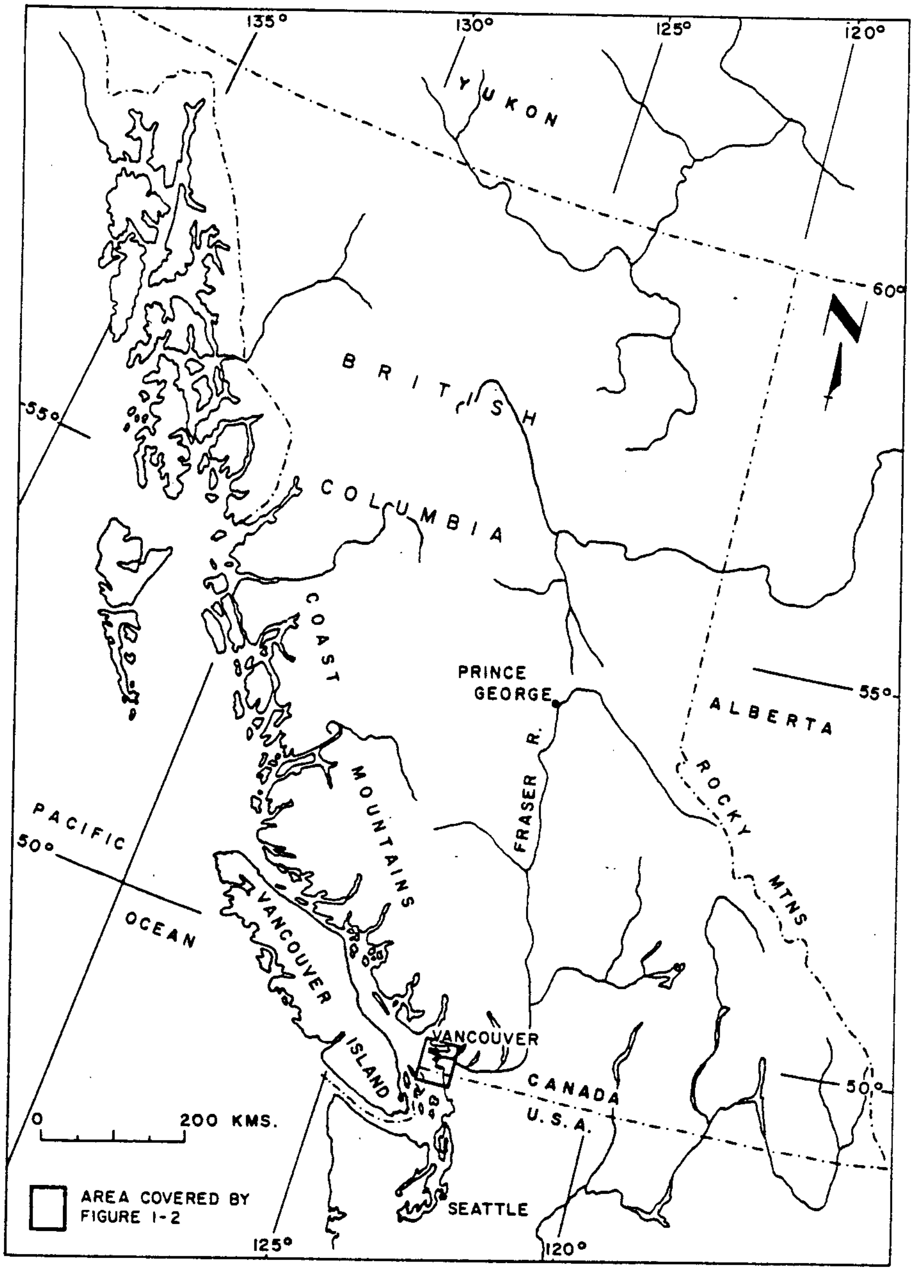


Figure 1-1. British Columbia.

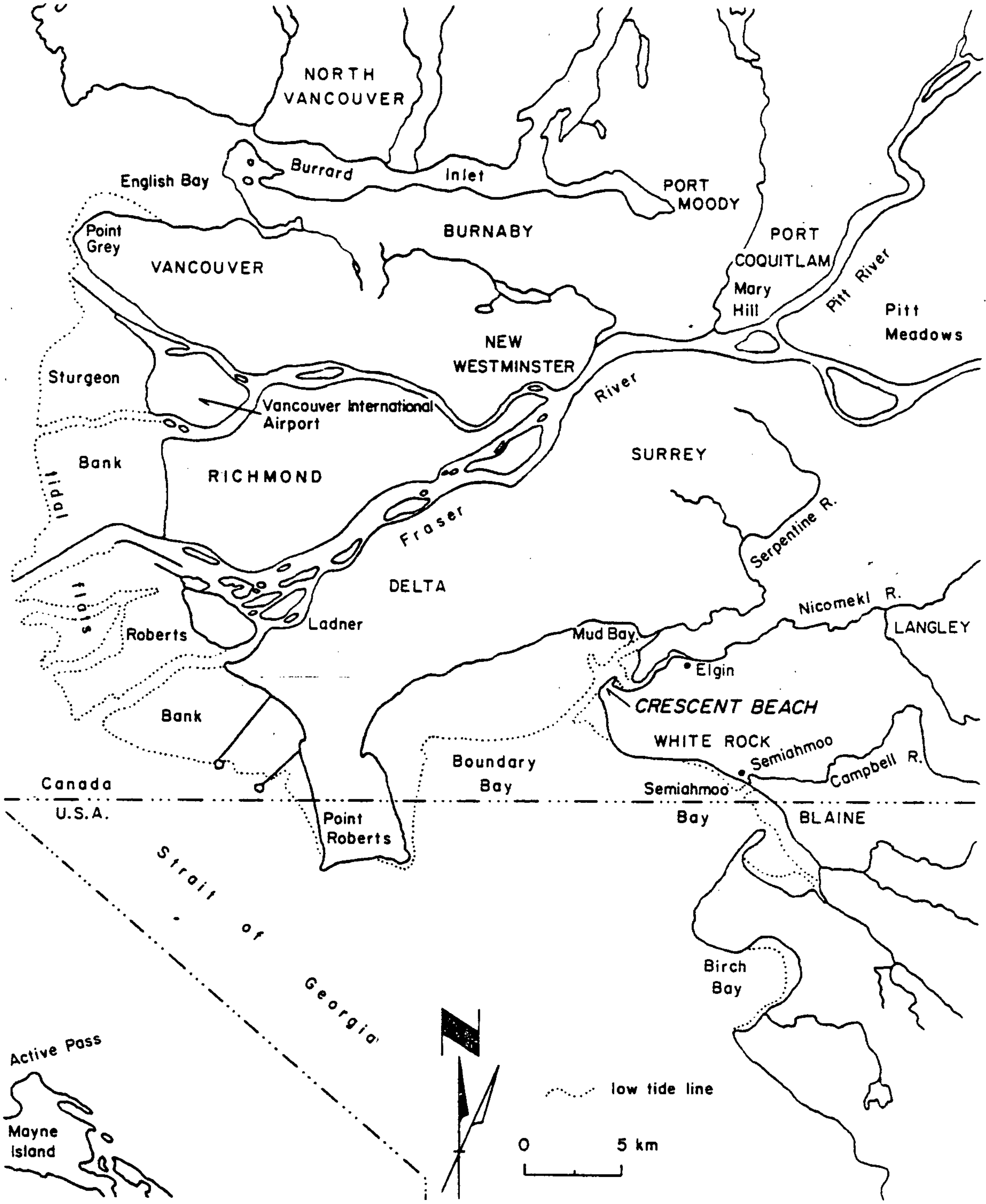


Figure 1-2. Fraser Delta and Crescent Beach Site.

people living in large cedar plank houses, and often with smaller permanent or temporary cedar plank houses at important summer and autumn resource locations; social stratification including a large upper class and a small group of slaves; well developed specialization in various economic and craft activities including fishing, hunting, woodworking, and other manufactures; social units extending beyond the village; elaborate ceremonialism, and one of the world's distinct art styles (Lomax and Arensberg 1977:670; Suttles 1968).

Suttles (1968:56) further adds that "...these features of Northwest Coast cultures and demography are generally thought to have been made possible or even inevitably produced, by the richness of the habitat of the area and in the efficiency of the subsistence techniques of its people". While there is general agreement that culture and subsistence were related, there is some disagreement as to the nature of this relationship (see Drucker 1963; Drucker and Heizer 1967; Matson 1981; Orans 1975; Piddocke 1965; Suttles 1960, 1968; Vayda 1961). Regardless, the annual round with its exploitation of specific resources at set locations at set times of the year was clearly defined and well established in the southern Strait of Georgia area ethnographically (Suttles 1974:105).

The origins and development of Coast Salish culture are not well understood, in large part due to the scarcity and poor quality of archaeological information on subsistence and seasonality (Matson 1974:113, 1981:85). Different origin theories and supporting data (in most cases poor) have been reviewed by Mitchell (1971:67-70) who argues that on the whole there is good indication of cultural continuity between subsequent archaeological cultures. Recent work has shifted from the once popular migration model (Drucker 1963:20-21; Borden 1950a:26, 1962:19) to concentrate on environmental (Fladmark 1975:293-7), or cultural factors, commingling and diffusion of traits (Borden 1975:118) allowing for more local cultural development. More recent researchers have, with some qualifications, tended to follow Mitchell's continuity model (Burley 1979; Monks 1977; Matson 1976). Recently Adams (1981:362-3) has pointed out the abandonment of migration theories by ethnologists to account for the ethnographic diversity of the Northwest Coast, realizing this diversity rests "...atop a deep material culture which, despite many fine stylistic differences, basically suggests an overwhelming similarity and continuity".

As Matson (1974, 1981) has suggested, there can be little hope of clarifying our understanding of the development of Northwest Coast culture without attempting to improve our knowledge of seasonality and subsistence in the archaeological cultures spanning the 8-9,000 year history of this area. Both Borden (1975) and Fladmark (1975) rely on archaeologically reported subsistence patterns, which is surprising when we take into account the fact that only two published studies and a handful of unpublished reports contain any detailed analysis of subsistence from the more than 100 sites excavated in this area (Boehm 1973a, 1973b; Boucher 1976; Calvert 1980; Conover 1978; Matson 1976; Monks 1977). The weakness of depending on such a data base is evident in arguments presented by Borden (1950a:24) suggesting that Locarno Beach cultures were dependent upon sea mammal hunting. Although type site material has not yet been examined, preliminary analysis of Locarno Beach faunal remains from Musqueam N.E. (DhRt 4) indicates sea mammals never represent more than 2% of all fauna by weight and less than 1% by count (Ham 1974:8,9). In fact, based upon what meager information has been reported to date, only in the earliest pre 5,000 B.P. cultures do we find any degree of sea mammal use (see Figure 2-22).

If the analysis of archaeological subsistence patterns on the Northwest Coast is still in its infancy, seasonality studies are even less developed. Suttles (1968:56) has indicated the nature of seasonal subsistence activities may be to a great extent responsible for the success of Northwest Coast cultural development. It has also been suggested that variation in seasonal activities may result in different artifact assemblages at sites from similar time periods (Abbott 1972:274; Binford and Binford 1966:239; Clark 1975:16; Mitchell 1971b:50; Newell 1973; Taylor 1948:189; Thomson 1939). However, little attention has been paid to how this might be reflected in local cultural history sequences (see Abbott 1972:273-4), even though aberrant assemblages do exist.

It has been widely demonstrated that fairly accurate seasonality interpretations may be obtained from some marine mollusc shells from the Northwest Coast (Ham and Irvine 1975; Ham 1976; Keen 1979) as well as elsewhere (Barker 1964; Clark II 1968, 1974a, 1974b, 1979a, 1979b; House and Farrow 1968; Koike 1973, 1980; Pannella and MacClintock 1968). Research using these techniques is meeting with a varied degree of success in this area, and in view of the importance of seasonal movement to local economic strategies, continued research into seasonal indicators of site occupation is paramount.

Basically this study will analyse the seasonality and composition of a late period faunal assemblage in light of predictions generated from ethnographic sources and from the reconstructed availability and abundance of local resources. If Suttles' model applies to earlier periods, a tight fit between seasonality and resources should be evident with a clear indication as to which resources were procured, and which were not. I will show as this study progresses, that this expectation is strongly supported by the data from the Crescent Beach site.

Several goals must be attained, or at least approached, to obtain realistic results, including: demonstrating control over environmental variables, consideration of the ethnographic and archaeological contexts, isolation of depositional units, and the correlation of these units with seasonality and recovered cultural elements. Artifact density was low at this portion of the Crescent Beach site, but will also play an important role in the interpretation of activities at the site.

Chapter 2 presents the background to the site, including environmental variables, ethnographic culture, and the historic and prehistoric settlement of the area. Chapter 3 outlines the theoretical basis of this study, including subsistence studies, shell midden development and seasonality dating. Based on the review of environmental and ethnographic data in Chapter 2, possible seasons of site occupation are presented in Chapter 4. Analysis of midden constituents, including artifacts, fauna and layers is presented in Chapter 5, and site subsistence strategies are summarized in Chapter 6. The evidence for shellfish and herring harvesting and other specialized sites in the Strait of Georgia is also reviewed, and it is argued that a specialized economic system was well established among the Proto-Coast Salish by 3,500 years ago. Support for this hypothesis is obtainable in light of the good preservation of shell midden constituents, current archaeological theory and method, and the approach used in this study.

2.0 THE BOUNDARY BAY AREA

Boundary Bay is situated on the inactive southern front of the Fraser River Delta and faces southwards into the Strait of Georgia (Figure 1-2). Rectangular in shape and approximately 13 km by 8.5 km, Boundary Bay, including its eastern extension of Mud Bay, covers some 110 km². Headlands on either side of Boundary Bay are composed of unconsolidated Pleistocene deposits rising 60 to 90 m above sea level (see Figure 2-2, 2-3). Along the northwestern and northern margins of the Bay, approximately 4,400 ha of alluvial lowlands are drained by a dendritic pattern of streams and sloughs (Figure 2-7). To the northeast and facing Mud Bay lies the active delta of the Serpentine and Nicomekl Rivers whose 6,400 ha valley is also composed of low lying alluvial deposits. At the mouth of the Nicomekl River below the Pleistocene White Rock Uplands, on old beach and more recent accretion spit deposits, is the archaeological site of Crescent Beach.

The lowest low tides in Boundary Bay expose approximately 6,100 ha of tidal flats composed mainly of "...sand with lesser amounts of silty and sandy muds..." (Kellerhals and Murray 1969:68). Swinbanks and Murray (1978:1) point out the uniqueness of these tidal flats in that unlike most tidal flats, there is very slight variation in grain size with the result that flora/faunal zonation is primarily controlled by elevation and exposure. Current sources of sediment in Boundary Bay include the Pleistocene Uplands at the head of the Bay, the eroding Mud Bay saltmarsh, the Serpentine and Nicomekl Rivers, and Fraser River silts brought into the Bay by the gyral currents of the Southern Strait of Georgia (Kellerhals and Murray 1969:68; Taylor 1970:4-5).

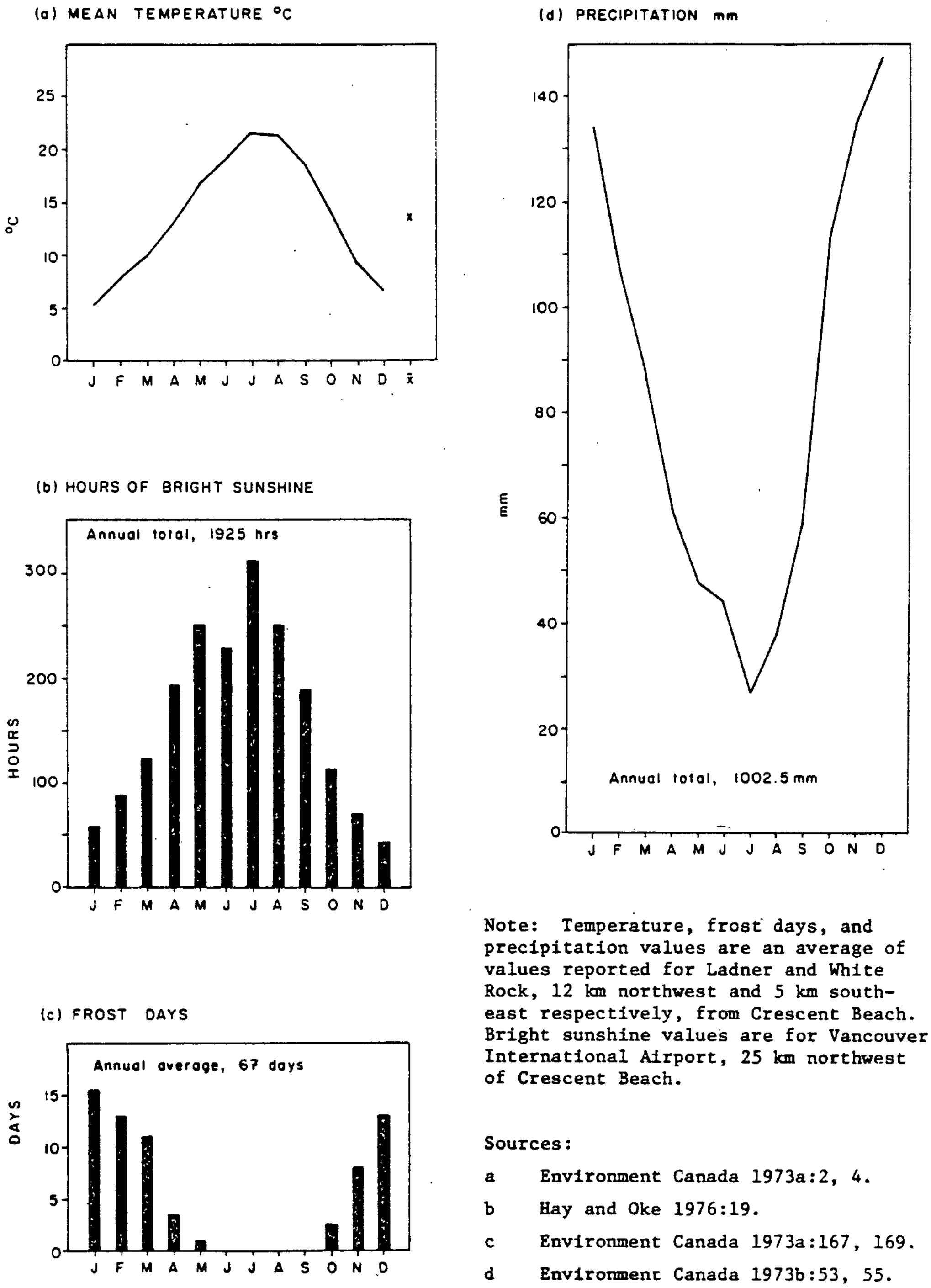
Boundary Bay may be considered a natural system (Church and Rubin 1970: 16) and combined with its drainage basin contains a wide range of distinct microenvironments. These ecological communities and their resources are discussed in Section 2.4 of this chapter while the following sections cover the climatology, oceanography, geological history and cultural history of the Boundary Bay and Crescent Beach area.

2.1 CLIMATE

Technically the climate of the Fraser River Delta is classified as Köppen Mediterranean type (Csb), but has been described as a modified maritime type (Hoos and Packman 1974:30). The climate of this area is influenced by several factors including; the presence of the land-sea boundary, the Olympic Mountains and Vancouver Island Ranges to the southwest and west, the Coast Mountains to the north, and the Fraser River Valley to the east, all interacting with atmospheric circulation patterns on a seasonal basis (Hoos and Packman 1974:30).

During winter a southwesterly air flow brings moist Pacific storms as does a secondary storm track from the Gulf of Alaska. Bringing increased precipitation, winter storms from the warm Pacific Ocean modify local temperatures so that winters are mild (Figure 2-1a), although 72% of the annual precipitation is received between October and March. Normally the Coast Mountains block the flow of cold Arctic Air masses onto the coast except in rare cases when air temperature may drop as low as -20°C (White Rock) (Environment Canada 1973a:123). Periods under Arctic cold air are usually short lived and as the high pressure is eroded away by a Pacific storm, precipitation may be in the form of snow which will on occasion remain for a day or two. An annual average of 7 days of snowfall is recorded for Ladner and 8 for White Rock (Environment Canada 1973b:283, 285).

In the summer an expanded Pacific anticyclone normally diverts Pacific storms well offshore while upper winds are dry and local wind flows dominated by land-sea breeze circulations (Hay and Oke 1976:7; Hoos and Packman 1974:31). This exerts a cooling effect which prevents high temperatures and results in warm dry summers. On occasion the area experiences hot spells as well



Note: Temperature, frost days, and precipitation values are an average of values reported for Ladner and White Rock, 12 km northwest and 5 km south-east respectively, from Crescent Beach. Bright sunshine values are for Vancouver International Airport, 25 km northwest of Crescent Beach.

Sources:

a Environment Canada 1973a:2, 4.

b Hay and Oke 1976:19.

c Environment Canada 1973a:167, 169.

d Environment Canada 1973b:53, 55.

Figure 2-1. Climatic Summaries for Crescent Beach.

as periods cf wet, cool weather. Ladner has a recorded August temperature maximum of 35°C as well as a July minimum of 1°C (Environment Canada

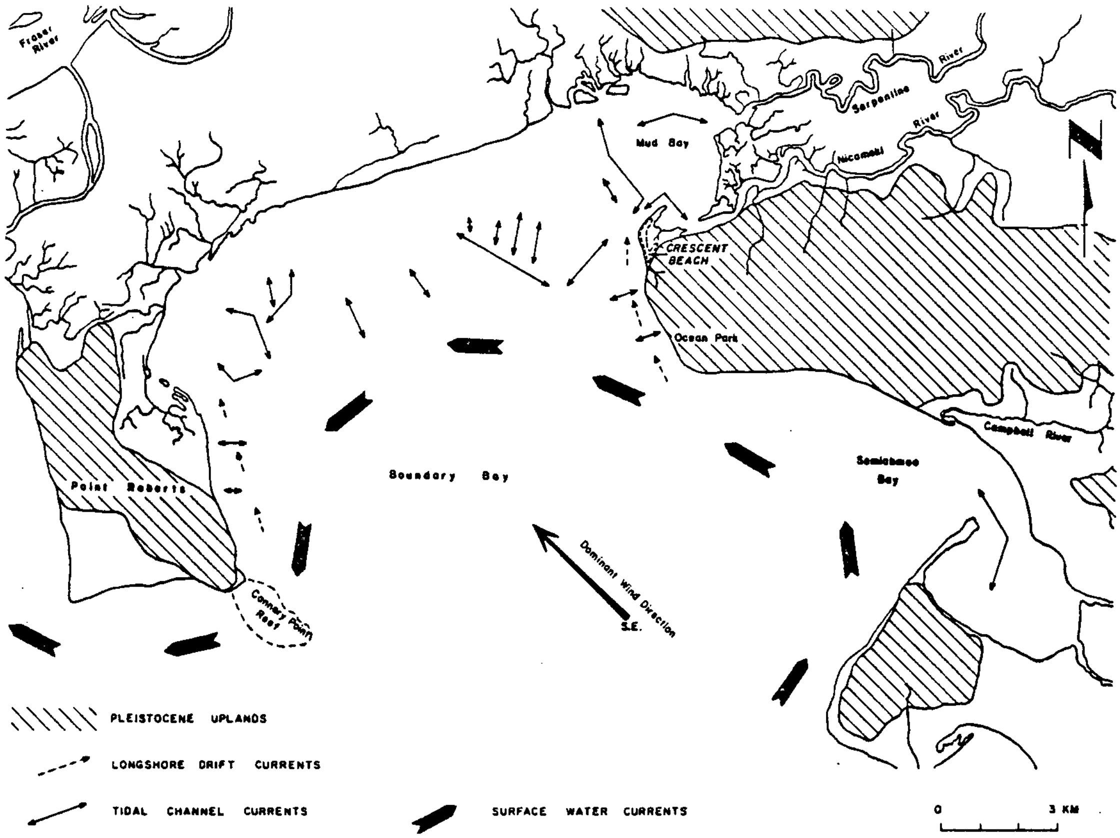
1973a:68,119), while White Rock has recorded a maximum 24 hour rainfall of 47 mm for August, a month with a mean precipitation of 42.7 mm (Environment Canada 1973b:55,87).

Overall the climate of the Boundary Bay area is milder and drier than that of the northern portions of the Fraser Delta and the Vancouver area. Sunny skies are common, while Vancouver is experiencing rain as moisture laden clouds are forced over the northshore mountains, and have earned Boundary Bay the name of "Sunshine Belt".

2.2 WINDS, CURRENTS AND TIDES

Surface wind patterns in the southern Strait of Georgia are strongly influenced by local topography (Hoos and Packman 1974:38; Waldichuk 1957:418). Southeasterly winds circulating in a counter-clockwise direction predominate throughout the year except for early and late summer when northeasterly winds increase in frequency (Waldichuk 1957:417-9).

Augmented by wind circulation as well as influenced by Coriolis and centrifugal forces, surface waters in the southern Strait of Georgia also circulate in a counter-clockwise direction (Church and Rubin 1970:8, 9; Waldichuk 1957:386). This counter-clockwise circulation moves across Boundary Bay from east to west (Figure 2-2). Along the eastern and western margins of the Bay longshore drift currents carry sediments northwards into the Bay resulting in accretion spits at both Crescent Beach and Beach Grove (Swinbanks and Murray 1978:2). Unconsolidated Pleistocene deposits at the head of Boundary Bay are the prime source for this material (Kellerhals and Murray 1969:68, 73; Swinbanks and Murray 1978:2). Within Boundary Bay the main currents are the alternating north-south filling and draining of tidal flats via foreshore channels (Church and Rubin 1970:9, 14) and the southward flow of the submerged channel of the Serpentine and Nicomekl Rivers (see Figures 2-6,2-7).



Sources: Church and Rubin 1970, Kellerhals and Murray 1969, North et al. 1979, U.S. Dept. of Commerce, Marine Chart 18421, Waldichuk 1957.

Figure 2-2. Wind and Ocean Currents in Boundary Bay.

The tidal pattern of the Strait of Georgia is characteristic of the Pacific coast of North America consisting of diurnal and semidiurnal tides (Hoos and Packman 1974:77). Known as a mixed semidiurnal pattern, they consist of two highs and two lows of unequal amplitude each day. The lows are most different during periods of spring tides, becoming reduced and eliminated by the next neap tide period. The two sets of low tides then cross over so that the low low tides of one fortnight become high low tides of the next fortnight. There is seasonal variation in the times and magnitudes of the tides, the lowest low tides occur near midday during the early summer around the summer solstice, while low tides during the winter occur around midnight (Dayton 1971:355; Evans 1972:417; Hoos and Packman 1974:77).

2.3 GEOLOGICAL HISTORY

Boundary Bay is part of the Fraser Lowlands, a triangular shaped area some 120 km by 90 km, consisting of low lying gently rolling hills of drift generally under 155 m in elevation separated by wide alluvium filled valleys, and occupying the 70 million year old sedimentary Fraser Lowland Basin (Figure 2-3) (Armstrong 1981:1). On the north the Fraser Lowland is bounded by the Coast Mountains and on the east and southeast by the Cascade and Chuckanut Mountains, some rising 1650 m above the valley floor (Armstrong 1981:1; Blunden 1975a:1; Halstead 1977:6). Its western edge borders the sheltered waters of the Strait of Georgia. Following a late glacial and postglacial valley the entire northern length of the Fraser Lowland, the Fraser River terminates at the Strait of Georgia in a growing delta 31 km long by 24 km wide (Armstrong 1981:1). Boundary Bay is recent in age, having formed when the Fraser Delta reached Point Roberts (formerly an island), thus preventing further Fraser River discharge on the southern delta front.

Prior to 70 million years ago the Coast and Cascade Mountain areas of southwestern British Columbia formed an arc of volcanic islands. Since the Cretaceous, the basin has been a low coastal plain with streams and rivers flushing sediments from the surrounding uplifting hills and mountains (Blunden 1975:2). Repeated glacial advances from mountain valleys across the Fraser Lowland during the late Pleistocene destroyed most of the geological record from the latter part of the Tertiary as well as the early Pleistocene (Armstrong 1975:377; Blunden 1975a:8).

The most extensive local geological records of the Late Pleistocene are found in many of the hills in the western Fraser Lowland (Mary Hill, Point Grey, Point Roberts, Surrey and White Rock Uplands), which are composite hills, each made up of a series of older hills of unconsolidated

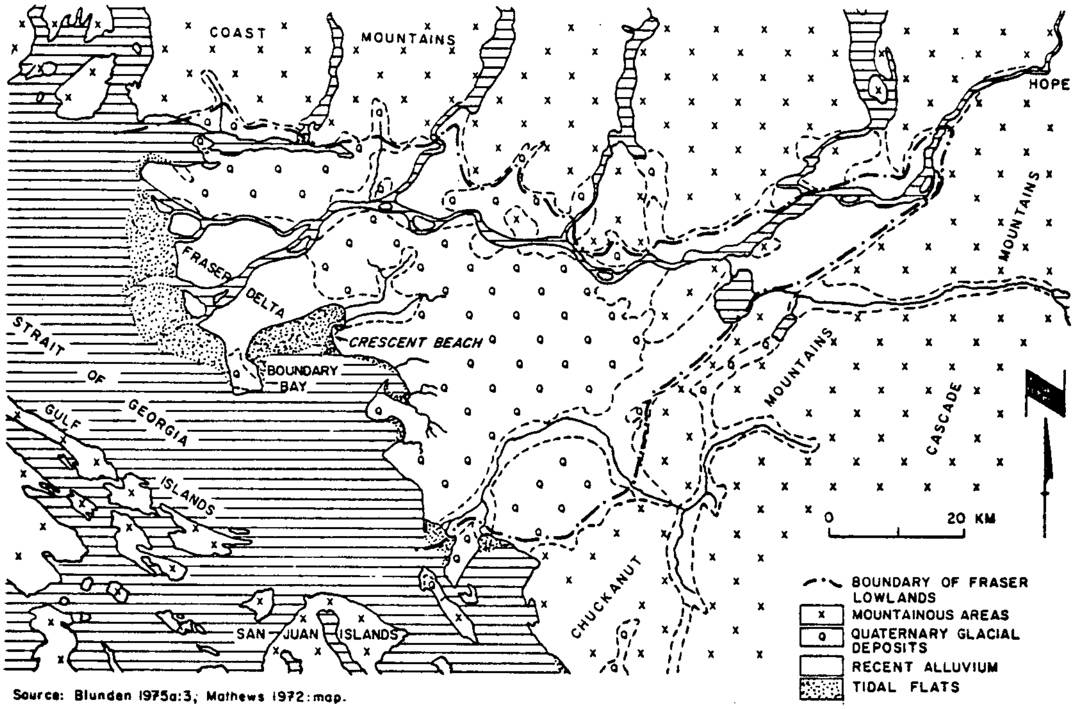


Figure 2-3. Extent of the Fraser Lowlands, Southwestern British Columbia and Adjacent Washington State.

Pleistocene materials. Armstrong (1981) has recently published descriptions of these deposits in the Fraser Lowland, a summary of which is presented in Table II-I.

Early in the Fraser Glaciation, as the glaciers began to grow in the mountains, outwash streams and rivers may have blanketed most of the Strait of Georgia and adjacent areas with as much as 75 m of sands and silts known as Quadra deposits (Clague 1976, 1977). The entire area may have been a wide plain with many braided streams. Vegetation was similar to that found today along the coast of Alaska suggesting a much cooler climate than we now have (Armstrong and Hicock 1975:102; Clague 1976:808). With the advance of the Fraser Glaciation (classical Wisconsin) most of these sediments were scoured from the Strait of Georgia, although remnants form dominant local features such as the uplands at Point Roberts, and

Climatic Period	Deposits	Age (years B.P.)
Post Glacial	Fraser River Sediments	present - 9,000
	Salish Sediments	present - 12,000
Fraser Glaciation	Capilano Sediments	11,000 ? - 13,000
	Vashon Drift	13,000 - 18,000
	Quadra Sand	18,000 - 26,000
	Coquitlam Drift	19,000 - 23,000
Olympic Interglacial Interval	Cowichan Head Formation	25,800 - 36,200
	Cowichan Head Formation (?)	40,000 - 58,800
(Major Glaciation)	Semiahmoo Drift	62,000
(Major Nonglacial Interval)	Highbury Sediments	pre-middle Wisconsin
(Major Glaciation)	Westlynn Drift	pre-Sangamon

From Armstrong 1981:3

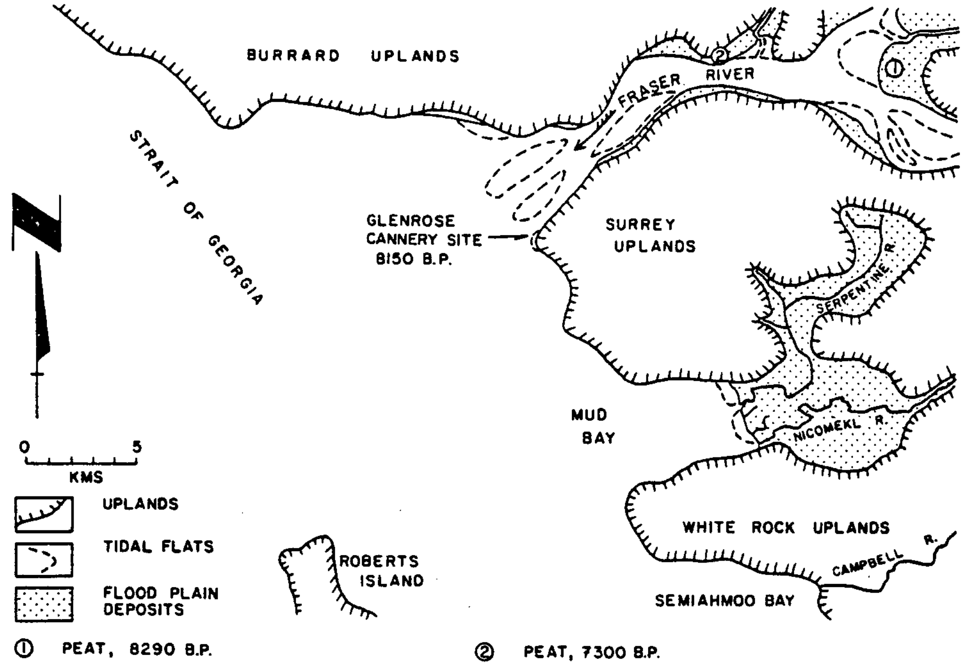
Table II-I. Late Pleistocene and Recent Geological Chronology of the Western Fraser Lowlands.

Ocean Park (Armstrong and Clague 1977:1479). During the maximum extent of the Fraser Glaciation the entire Fraser Lowland was mantled by ice that extended through Juan de Fuca Strait to the Pacific Ocean (Clague 1981:14; Heusser 1973:284; Mathews et al., 1970:691).

Wastage of the western ice margin had commenced by 14,460 B.P. and the ice was gone from the Western Fraser Lowlands by 12,690 B.P. and from the Fraser Canyon by 11,400 B.P. (Heusser 1973:291; Mathewes 1973:2090; Mathewes et al., 1970:1056). Following deglaciation the area was subjected to isostatic, eustatic and tectonic changes in relative sea levels which are not fully understood. The reader is referred to Armstrong (1981) for a summary of present knowledge, while it should be noted that the land was submerged below the sea at least once between 13,000 and 11,000 B.P. By 9,000 B.P. the western Fraser Lowlands are thought to have been emergent to approximately 10.6 m below current sea level while present sea levels were obtained by about 5,000 B.P. (Armstrong 1981:32; Mathews et al., 1970:696-7).

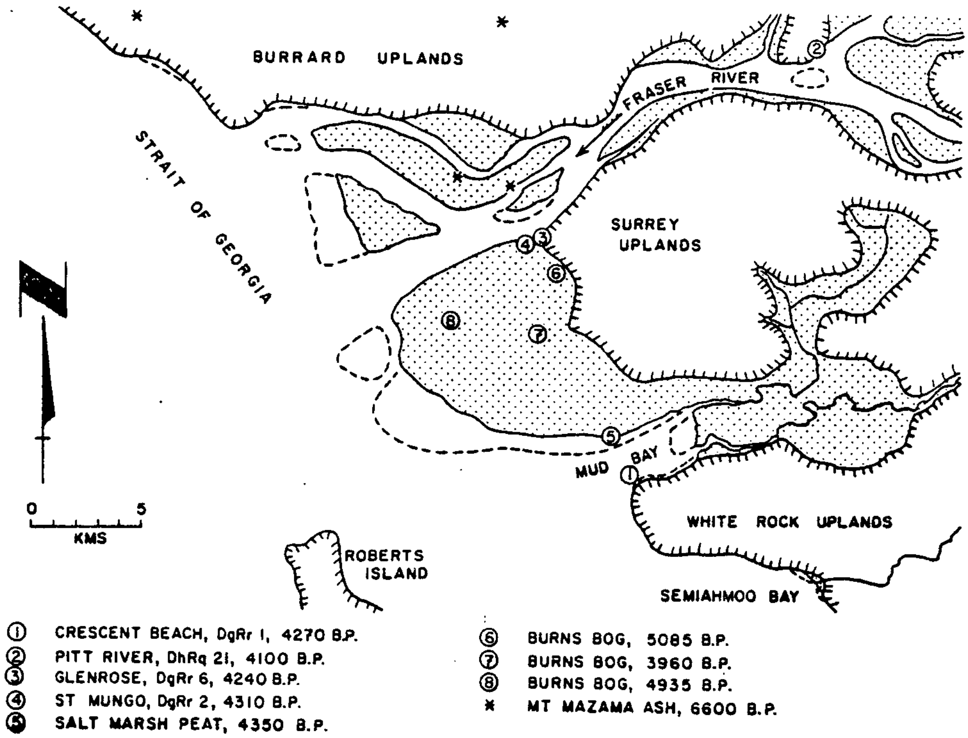
Before 10,000 B.P. the Fraser River had found its way through the Port Mann Gap and over the next 2-3,000 years filled in several large settling basins upstream from New Westminster (Armstrong 1981:25-9; Blunden 1975a:18; Mathews and Shepard 1962:1432) (for a description of the immediate post-glacial period see Mathews 1977). During the early part of the post-glacial period the sediment load of the Fraser River was many times higher than it is at present. In a study of depositional landforms of Interior Plateau river valleys, Church and Ryder (1972:3063) determined that the erosion and deposition which resulted in alluvial fans was complete by 6,600 B.P. Sediments in the Fraser and Thompson River valleys are up to 225 m thick while Mazama Ash (deposited 6,600 B.P.) is found at an average depth of only 2 m indicating most sedimentation took place before this date (Church and Ryder 1972:3063-4; Ryder 1978:63-4). The intact state of these depositional landforms indicate that erosion since 6,600 B.P. has been slight, and that the Fraser River has been carrying sediment loads similar to those of today (Church and Ryder 1972:3068). Lower silt levels after 6,600 B.P. would have been beneficial to salmon stocks throughout the Fraser River system.

By 8,000 B.P., the Fraser River began building its delta past New Westminster into the Strait of Georgia (Armstrong 1981:25-9; Blunden 1975b:12; Johnston 1921:44; Mathews and Shepard 1962:1433). Around 5,000 B.P., extensive tidal flats became emergent including most of the areas in the eastern Fraser Delta now occupied by sphagnum bogs (see Figure 2-4, 2-5) (Hebda 1977:155-7). Hebda (1977:170, 172) has suggested that by 4,000 B.P. the actual delta front (-10 m level) may have reached the lower slopes of the Point Roberts Uplands blocking Fraser River flow into Boundary Bay,



Sources: Armstrong 1977:9, Blunden 1975a:18, 1975b:12, Mathews and Shepard 1962:1432, Matson 1976:18.

Figure 2-4. Approximate Extent of the Fraser Delta, 8,000 to 7,000 B.P.



Sources: Blunden 1975b:5, 12, Calvert 1970:57, Hebda 1977 pp. 100, 122, 144, Kellerhals and Murray 1969:76, Matson 1976:18, Patenaude, pers. comm., Percy 1976:7.

Figure 2-5. Approximate Extent of the Fraser Delta, 5,000 to 4,000 B.P.

although evidence from Crescent Beach suggests that discharge into the Bay may have continued until as late as 2,500 B.P.

It is anticipated that the construction of the northward trending accretion spit at Crescent Beach did not begin until after Boundary Bay had been formed, as the southward flow of the Fraser River may have interfered with any spit building by longshore drift (see Figure 2-2). The cultural materials recovered by this study date after 1,400 B.P. and rest directly on spit sands near the base or origin point of the spit (Ham and Broderick 1976:4-5).

Another site which may shed some light on spit development is Beach Grove (DgRs 1) located on the western side of Boundary Bay. Ball (1979:49) has reported dates between 3,200 and 1,100 B.P. from the northern portion of this site while additional dates of 1,600 to 1,390 B.P. have been reported for the southern portions (Smith 1964:56-7). These dates suggest north to south development of the sands (spit or bar?) underlying the cultural materials at Beach Grove which could only occur if the Fraser River was still flowing into Boundary Bay.

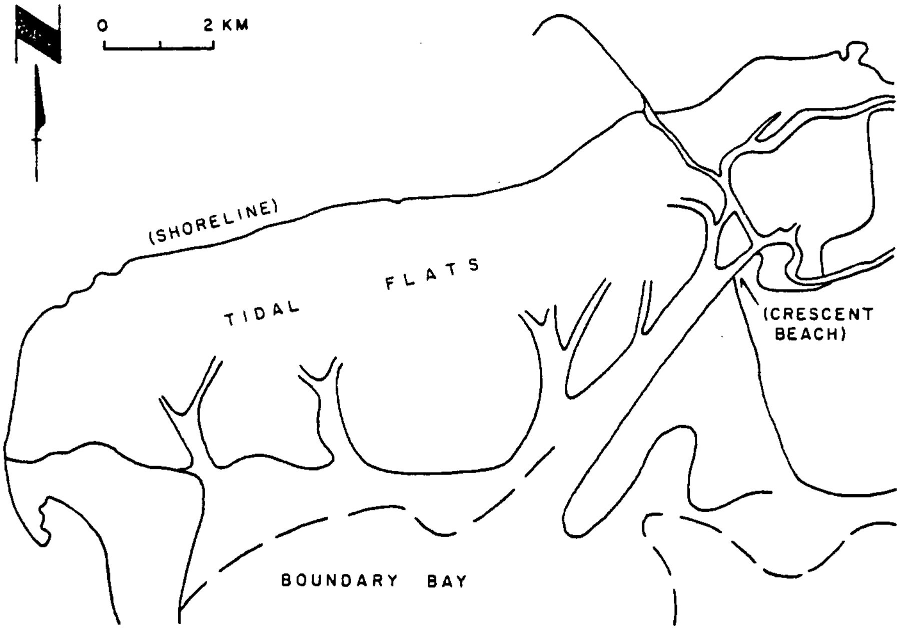
The archaeological evidence then suggests a much later date for creation of Boundary Bay, perhaps between 3,000 and 2,000 B.P., although this date should be verified and refined with geological investigation. It is interesting to note that mention of Point Roberts as an island is made in both Katzie and Musqueam traditions (Jenness 1955:2; Suttles 1982, pers. comm.).

By the time Boundary Bay finally became closed off from direct Fraser River flow, there were probably already extensive sand flats, especially in the central and eastern portions of the Bay. Since the formation of the Bay, approximately 1 km of salt marsh has been eroded by currents from the eastern portion of the Bay, and redeposited in the western portion so that the Beach Grove site which originally faced the waters of the Bay is now 1 km from the sea (Kellerhals and Murray 1969:83-4). With the exception of the above erosion and deposition, much of Boundary Bay appears to be in equilibrium and I suspect there has been minimal environmental change in the Bay for the last 1,000 years. Extensive tidal flats were noted by early explorers in the Bay (Meany 1957:181-2; Newcombe 1923:60), while a map drawn prior to 1912 by Thompson (1913:46) is nearly identical to present maps (see Figure 2-6). Thompson's description of faunal communities is basically the same as those described by later researchers (Kellerhals and Murray 1969; Swinbanks and Murray 1978). The approximate configuration of the Fraser Delta at the beginning of the Historic Period is provided in Figure 2-7.

2.4 ECOLOGICAL COMMUNITIES

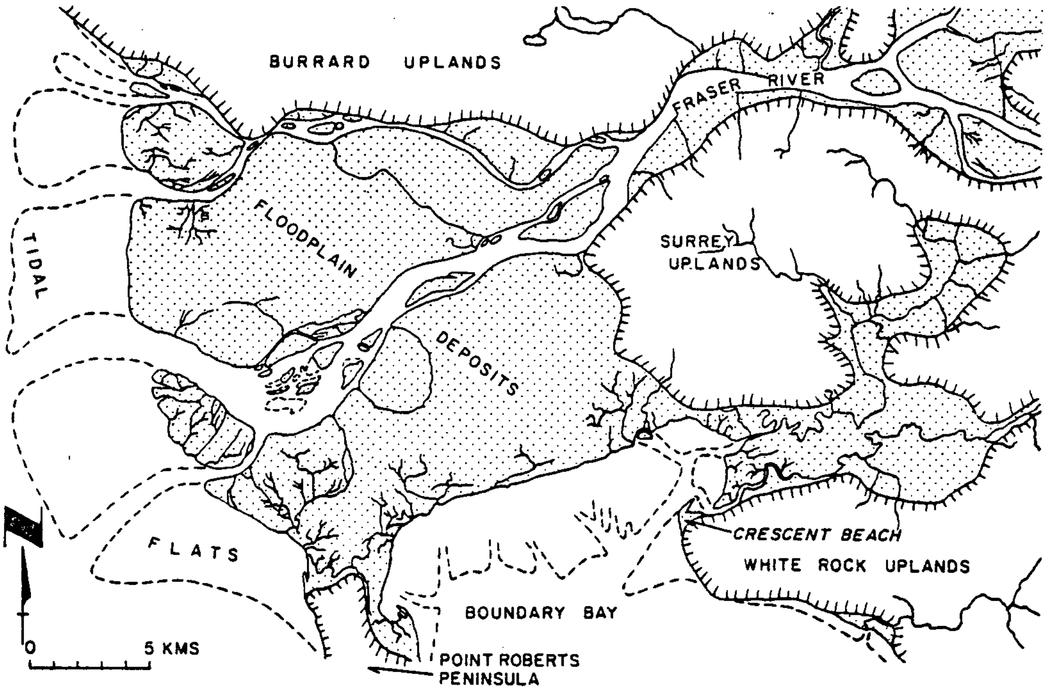
As the glaciers retreated from the Fraser Lowlands the area was quickly colonized by lodgepole pine (*Pinus contorta*), buffalo berry (*Shepherdia canadensis*), willow (*Salix* sp.) and alder (*Alnus* sp.) while the climate was probably cooler and wetter than present (Mathewes 1973:2099). After 10,500 B.P. *Pinus contorta* decreases and Douglas Fir (*Pseudotsuga menziesii*) becomes dominant suggesting warmer temperatures although moisture was still abundant. Well before 6,600 B.P., palynological data indicate that climatic conditions and vegetation were probably similar to the present (Mathewes 1973:2099,2100). Mathewes (1973:2101) argues that there is insufficient evidence to support the occurrence of a Hypsithermal interval in the western Fraser Lowlands, possibly because of the wide tolerance of the vegetation of the area and the modifying effect of the ocean.

Hebda (1977:155-7) has outlined a successional sequence of saltmarsh-sedge-shrub-sphagnum communities which develop on the alluvial lowlands of the Fraser Delta with sphagnum communities present by 2,900 B.P. In the Pitt Meadows area sphagnum bog deposits have been dated at 8,290 B.P. some



(from: Thompson 1913, Plates XIII and XIV)

Figure 2-6. Tidal Flats of Boundary Bay as Mapped by Thompson ca. 1912.



Reconstructed from: Kellerhals and Murray 1969, North et al. 1979, Thompson 1913.

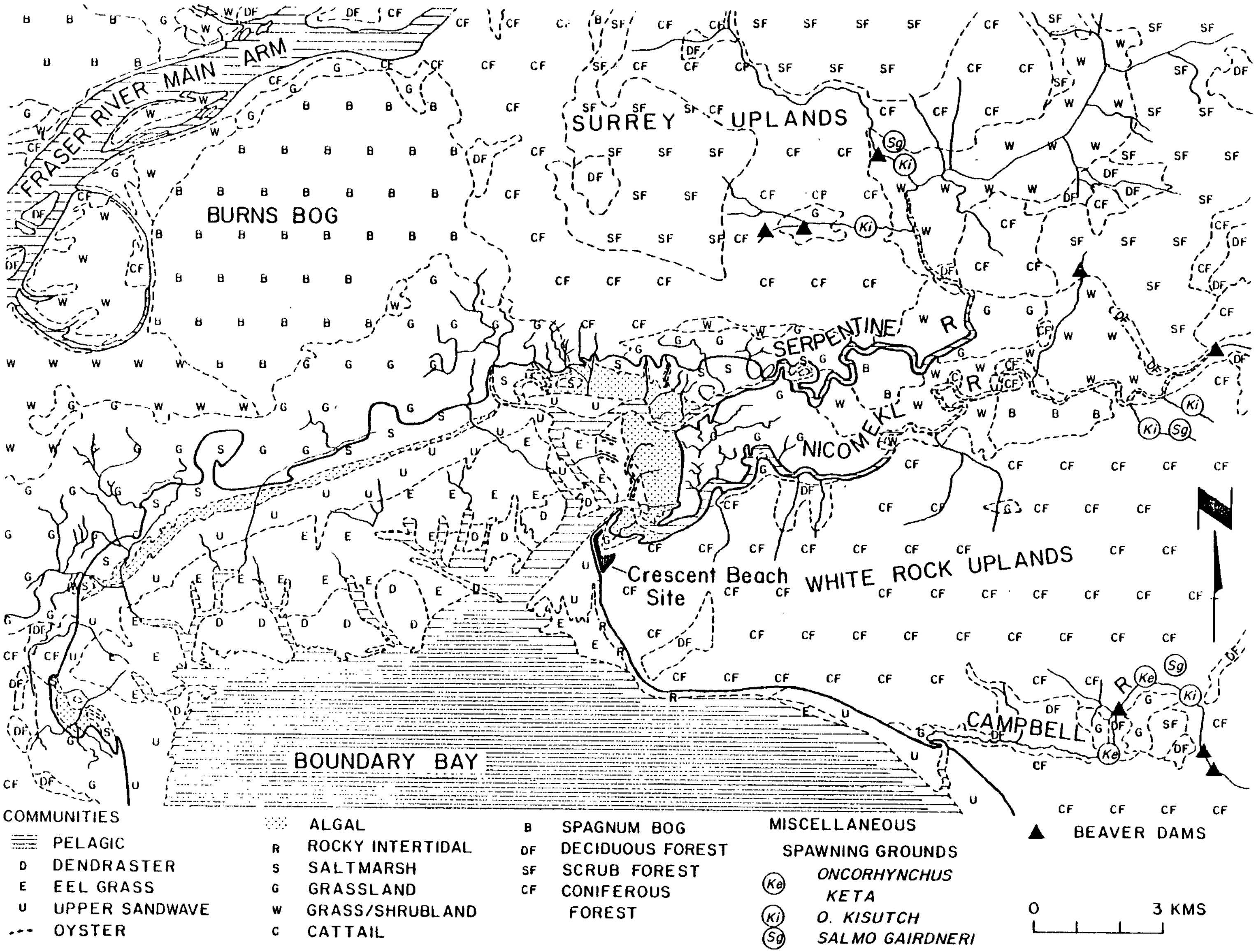
Figure 2-7. Approximate Extent of the Fraser Delta, A.D. 1858-1880

10.5 m below present sea level (Armstrong 1977:9).

Thus the major ecological communities in the western Fraser Lowlands noted at the time of European contact were present by at least 3,000 B.P. and probably even earlier. As Boundary Bay had formed by at least 2,500 B.P., it is possible to hypothesize what resources would have been available to prehistoric Coast Salish in Boundary Bay, although it may not be possible to precisely locate or determine the extent of these communities. The remainder of this section discusses current knowledge about these communities and their resources using information from published and unpublished sources as well as field observation. The distribution of the fifteen major ecological communities of Boundary Bay which lie within a 14-16 km radius of the Crescent Beach site are presented in Figure 2-8.

Some of these communities are now all but extinct (grassland), others have been heavily disturbed (forests) and a few have had minimal damage, or still have intact portions (intertidal communities and bogs). An attempt is made to determine the range of species available prior to the disturbances associated with European contact using a variety of sources including; modern and historic ecological studies (Biggs 1976; Campbell et al. 1972; Church and Rubin 1970; Forbes 1972; Hoos and Packman 1974; Kellerhals and Murray 1969; Kistritz 1978; Northcote 1974; Swinbanks and Murray 1978; Webb 1976; Rathbun 1900; Stafford 1917; Thompson 1913; Weymouth 1915), reconstructed vegetation maps and accounts of early explorers and settlers (North et al. 1979; Johnson 1958; Lang 1967; McKelvie 1947; Meany 1957; Newcombe 1923; Pearson 1958; Treleaven 1978), fisheries records and paleobotanical studies (Environment Canada, 1925-1970; Hebda 1977; Mathewes 1973).

Species availability and abundance are presented for each ecological community in Figures 2-9 to 2-16 based upon the references provided in each Figure. Although the ecological studies which were consulted tended



Sources: Kellerhals and Murray 1969, North et al. 1979, Thompson 1913 and references in text.

Figure 2-8. Boundary Bay Ecological Communities (ca. 1850).

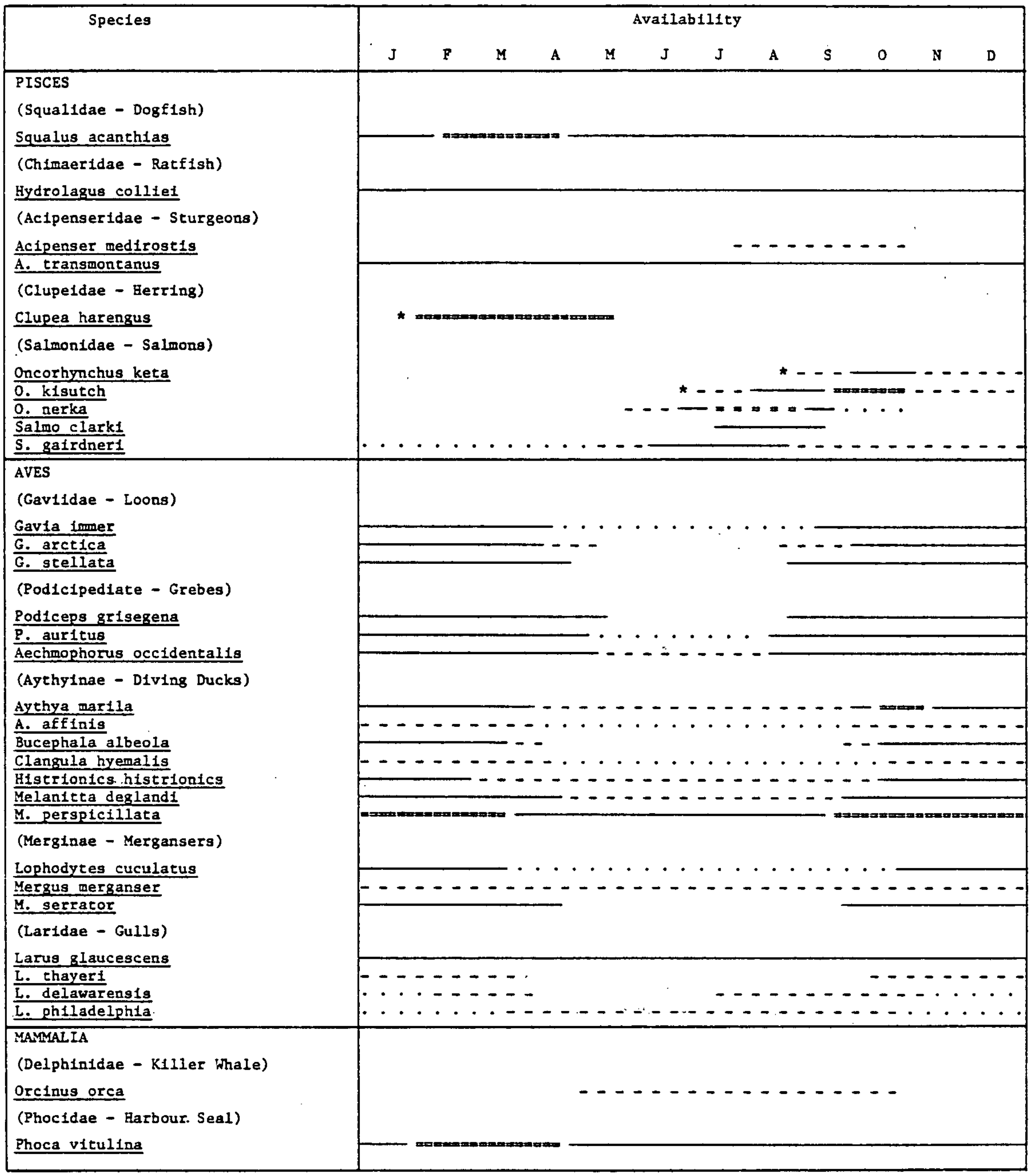
to follow a 5 or 6 part ranking of species abundance, I have used a 4 part scheme in this study to accommodate the more poorly reported species. Shellfish abundance basically follows the descriptions given by Thompson (1913:46) who found 18 km^2 of commercially productive shellfish beds in Boundary Bay.

In most cases I have tried to segregate species to the community from which the Coast Salish may have obtained them. This problem exists only for a few groups of species such as some ducks, shorebirds and fishes which may be found in different communities depending upon tidal stage. Similar are salmon and sea run trout which may pass through several communities en route to their spawning grounds, yet were probably obtained further downstream at weir sites. As a rule exotic or introduced species are not discussed. Standard references used for species nomenclature include the following; Hart (1973) and Scott and Crossman (1973) for fish, Godfrey (1966) for birds, Banfield (1974) for mammals, and Hitchcock and Cronquist (1973) for plants.

Boundary Bay Pelagic Community

The pelagic region of the sea is defined by Carefoot (1977:12) as that area extending from the low water tide mark and includes all offshore or open water areas. The Pelagic Community of Boundary Bay extends from the edge of the tidal flats some 2 km south of Crescent Beach to the open waters of the Strait of Georgia 15 km further south, an area of approximately 53 km^2 (Figures 2-8, 2-9).

Ecologically, the sheltered Boundary Bay is complex with a myriad of food webs consisting of marine plants, polychaete worms, crustaceans, molluscs and small fish which are preyed upon by larger fish as well as by birds and sea mammals. During the summer there is an excessive buildup of silt due to outflow from the Serpentine and Nicomekl Rivers. Winter storms and wave action remove this fine sediment permitting dinoflagellate blooms in the spring (Hoos and Packman 1974:81). Many species of fish spawn in the



===== very common ——— common - - - - - frequent · · · · · rare * rearing populations also

Sources: Aro and Shepard 1967, Banfield 1974, Campbell et al. 1972, Church and Rubin 1970, Godfrey 1966, Hart 1973, Hoos and Packman 1974, Northcote 1974, Scott and Crossman 1973, Taylor 1970.

Figure 2-9. Pelagic Community Species Availability and Abundance.

Bay in the spring including the Pacific herring (Clupea harengus), midshipmen (Porichthys notatus), sculpins (Enophrys bison, Hemilepidotus hemilepidotus, Leptocottus armatus) and flatfish (Lepidosetta bilineata, Platichthys stellatus), their young benefitting from the warming waters and increasing food supplies. This concentration of spawning fish is an important food source for thousands of diving ducks (Aythyinae) which migrate through the Bay in the spring, as well as for larger fish such as dogfish (Squalus acanthias) and ratfish (Hydrolagus colliei).

There is also a resident population of harbour seal (Phoca vitulina) in Boundary Bay estimated at 250-275 individuals (Church and Rubin 1970:17; Taylor 1970:24). The presence of this population was also reported in early biological studies of the bay (Stafford 1917:105). Numbers increase in late February and March as transient seals follow the spawning herring into the Bay. Many of the seals move to the mouth of the Fraser River in late April during the eulachon (Thaleichthys pacificus) run, returning to Boundary Bay for the summer where they haul up on secluded sandbars, the females giving birth to pups in late July and early August (Taylor 1970:25). The killer whale (Orcinus orca) frequents the Bay, and occasionally other dolphin and whale species (Church and Rubin 1970:17; Taylor 1970:24).

One of the most important economic resources of Boundary Bay is the July-August run of sockeye salmon (Oncorhynchus nerka) which follows the gyral current through the southern part of the Bay passing over the shallow reefs off Cannery Point en route to the mouth of the Fraser River (see Figure 2-2) (Rathbun 1900:266). During the late summer, sea-run cutthroat trout (Salmo clarki) appear in the eastern portions of Boundary Bay to feed, spawning between November and May in small streams in the area (Northcote 1974:20-2; Taylor 1970:23). Steelhead (S. gairdneri) as well as coho and chum salmon (O. kisutch and O. keta) enter the bay in late summer and autumn, spawning on tributaries of the Nicomekl, Serpentine and Campbell Rivers (see Figure 2-8) (Environment Canada 1925-1970).

Several species of Aythyinae are common in the deeper waters of Boundary Bay during the autumn and spring migrations while some species winter in the bay (Taylor 1970:18). Most common are the scaups (*Aythya marila* and *A. affinis*), the oldsquaw (*Clangula hyemalis*) and the scoters (*Melanitta deglandi* and *M. perspicillata*) (Taylor 1970:18). Small flocks of bufflehead (*Bucephala albeola*) were observed loafing offshore in late April of 1980. Also very common are several species of gulls, especially Bonaparte's Gull (*Larus philadelphia*) which roost in large rafts of up to 26,000 individuals on Boundary Bay south of Crescent Beach between October and March (Campbell *et al.*, 1972:154-5). Modern gull populations may reflect urbanization of the Vancouver area and the proximity of Boundary Bay to city garbage dumps. Numerous other species of sea birds abound in the Bay including loons, cormorants, grebes and mergansers (Taylor 1970).

The seasonal availability and abundance of the above species as well as several other varieties of wildlife common to this community are indicated in Figure 2-9.

Dendraster Community

This community occupies the lower sand wave zone of Swinbanks and Murray (1978:31, 47), from 1.5 m above the lowest low tide mark into the subtidal, and is thus continuously submerged except during the lowest low tides (see area 'D', Figure 2-8). Covering an area of approximately 1,000 ha, this community is characterized by large sand waves and an absence of vegetation cover (Kellerhals and Murray 1969:83; Swinbanks and Murray 1978:31). Species common to this community include the sand dollar (*Dendraster excentricus*), starfish (*Pisaster ochraceus*), polychaete worms (*Arenicola* sp.), and the burrowing sea anemone (*Anthopleura artemisia*) (Kellerhals and Murray

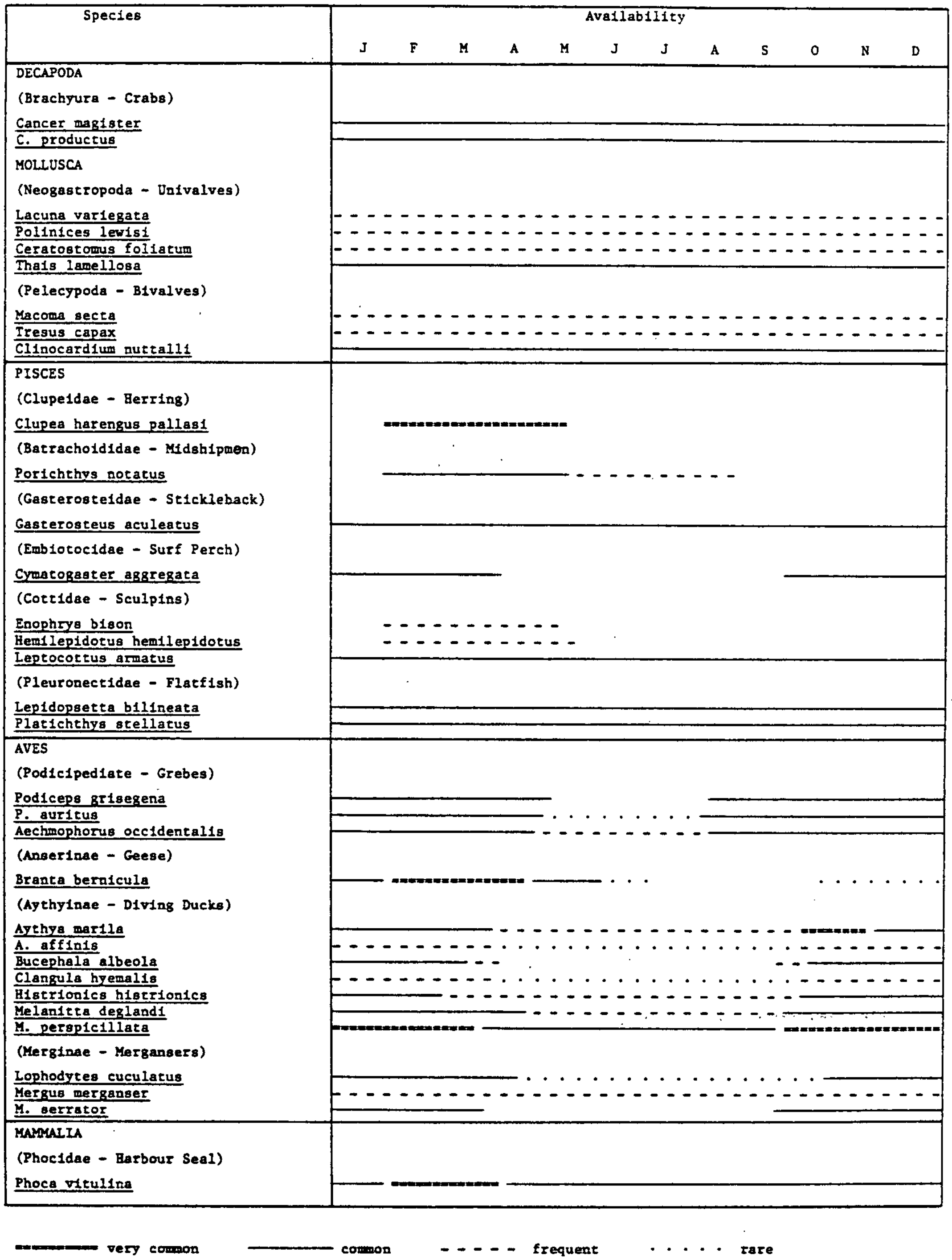
1969:83; Swinbanks and Murray 1978:31-2; Taylor 1970:24; Hoos and Packman 1974:85-6). Species of economic value include the crab (Cancer magister) and the bivalve molluscs Tresus capax (horse clam), Saxidomus giganteus (butter clam) and Macoma secta (sand clam) (Hoos and Packman 1974:85-6; Kellerhals and Murray 1969:83; Thompson 1913:48, Plate XIII). With the exception of C. magister, none of these species is very abundant, in addition to the fact that they are seldom available to human predation as this community is only rarely exposed.

Eelgrass Community

This community which also occupies the lower tidal flats extends over some 2,100 ha from about 3.5 m above the lowest tide mark into the subtidal zone and is one of the most productive ecological communities in Boundary Bay (see area 'E', Figures 2-8, 2-10) (Church and Rubin 1970:6; Swinbanks and Murray 1978:47). The eelgrass (Zostera sp.) beds are basically flat except in the upper reaches of the tidal channels which cross through the zone producing broad, shallow water filled depressions (Swinbanks and Murray 1978:28).

Plants are abundant in this community including several species of Zostera and sea lettuce (Ulva sp.) (Forbes 1972:44; Kellerhals and Murray 1969:83; Swinbanks and Murray 1978:28-9; Taylor 1970:12). Z. americana, the dominant eelgrass of the upper part of this zone dies back in the winter, sprouting from seedlings during the spring (Swinbanks and Murray 1978:7). Zostera rhizomes and stalks were eaten by the Straits Salish and possibly other Coast Salish, used sometimes as flavouring during steaming of other foods, and also made into cakes and dried for winter (Turner 1975:101-2).

Widespread in this community are burrowing shrimp (Upogebia sp. and Callianassa sp.), polychaete worms (Proxillela sp., Abarenicola sp.) and the burrowing sea anemone Anthopleura artemisia (Kellerhals and Murray



Sources: Godfrey 1966, Grifith 1967, Hart 1973, Hoos and Packman 1974, Kaiser C.W.S., Kellerhals and Murray 1969, Kozloff 1973, Lamb 1980, pers. comm., Stafford 1917, Swinbanks and Murray 1978, Taylor 1970, Thompson 1913, Webb 1976, Weymouth 1915.

Figure 2-10. Eelgrass Community Species Availability and Abundance.

1969:83; Swinbanks and Murray 1978:25, 29-30, 38). Crustaceans present in this community, in addition to Cancer magister, include the rock crab C. productus and the kelp crab Pugettia sp. (Hoos and Packman 1974:88; Kellerhals and Murray 1969:83). At present and historically the major crab fishing areas of Boundary Bay are below Ocean Park immediately south of Crescent Beach. In the late spring crabs (C. magister) are numerous in the shallower waters when the females molt and then mate (Hoos and Packman 1974:85; Ricketts and Calvin 1968:166-7; Stafford 1971:105; Weymouth 1915:129). Univalves present include whelks and leafy hornmouth (Thais lamellosa, Cerastostoma foliatum), moon snails (Polinices lewisi) and numerous tiny Nassarius mendicus (Kellerhals and Murray 1969:83; Swinbanks and Murray 1978:31). Among the bivalves, Clinocardium nuttalli is very common while Tresus capax and Macoma secta are present, as is the starfish Pisaster ochraceus (Kellerhals and Murray 1969:83; Thompson 1913:45, Plate XIV). Thompson (1913:45) indicates that the largest and densest Tresus beds were located south of Crescent Beach off Ocean Park at the low tide level.

The eelgrass beds are important to a number of the fish species found in Boundary Bay. Taylor (1970:23) indicates several which show very definite associations with the eelgrass beds including Gasterosteus aculeatus, Syngrathus griseolineatus, Cymatogaster aggregatus, Clevelandia ios, Leptocottus armatus, and Platichyhys stellatus. Clupea harengus spawn on the eelgrass in Boundary Bay between February and the end of May. Various runs spawn on different beds with varying intensity in the bay during this period (Church and Rubin 1970, Table 2; Webb 1976:13, 31). Leptocottus armatus and Lepidopsetta bilineata are common year around in the beds while several opportunistic feeders from the rocky intertidal could be expected to be feeding on spawning Clupea and their spawn, especially, Porichthys notatus, Enophrys bison, and H. hemilepidotus (Andrew Lamb, Environment Canada, March 1980, pers. comm.).

Spawning Clupea are an attractive source of food for many wintering and migrating Aythyinae, among them Aythya sp., Bucephala sp., Clangula hyemalis and Melanitta sp. (Gary Kaiser, Canadian Wildlife Service, March 1980, pers. comm.), while the Zostera itself is a key food for northward migrating Branta bernicula which are common from January until the end of April (Hoos and Packman 1974:156, Forbes 1972:17). Many species make up the complex food web of the eelgrass beds. Availability and abundance of the economically important ones are detailed in Figure 2-10.

Upper Sand Wave Community

This community occupies the extensive intermediate sandy tidal flats of Boundary Bay and covers an area of some 1,600 ha, 3.7 to 2.7 m above the lowest tide mark (see area 'U', Figure 2-8) (Swinbanks and Murray 1978:61). These unvegetated flats are dominated by very low amplitude sand waves which only seem to be active during the winter, and even then are apparently in dynamic equilibrium (Kellerhals and Murray 1969:75; Swinbanks and Murray 1978:8, 24). The shallow wave troughs are filled with water, and the area is characterized by numerous shallow and variable dendritic drainage channels which are subject to erosion on the ebb tide (Kellerhals and Murray 1969:70; Swinbanks and Murray 1978:38).

Fauna in this community consists largely of the lugworm Abarenicola pacifica and the burrowing shrimp Callianassa californiensis, and associated with it the tiny bivalve Crypotomya californica (Swinbanks and Murray 1978: 26, 28). Thompson (1913:48, also Plate XIII) reports that Macoma nasuta was found throughout these tidal flats of Boundary and Mud Bays. Besides Macoma the only wildlife species of any economic value in this community would be the various shorebirds which might be here during low tide. Some of these species are presented in Figure 2-11 for the Algal Mat Community where they would be more common.

Oyster Community

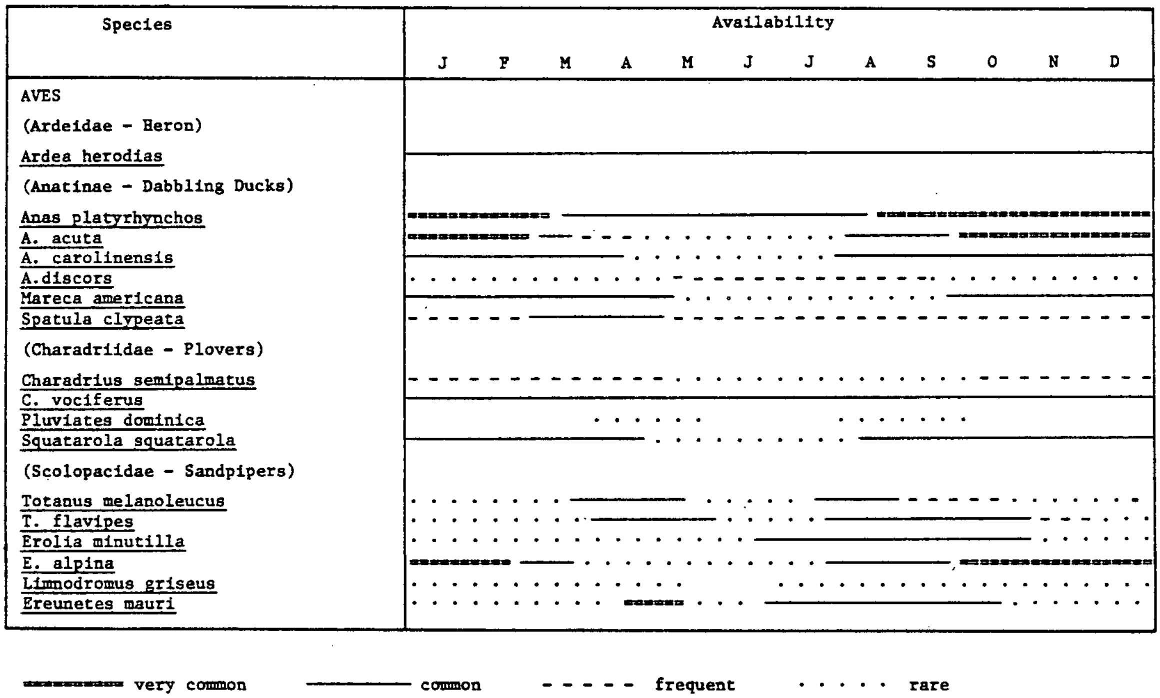
Occupying the firm silty sands of the intermediate tidal flats of Mud Bay, at the mouth of the Nicomekl and Serpentine Rivers, is a distinct community containing both native and exotic species of oysters (see area 'O', Figure 2-8) (Kellerhals and Murray 1969:75, 78, 82). *Crassotrea virginica* from New Brunswick and Connecticut were introduced into the beds in 1904 while the Japanese Oyster, *C. gigas*, was introduced in 1936 (Kellerhals and Murray 1969:78, 82; Stafford 1917:106). These oyster beds accounted for 50% of British Columbia's oyster production until farming operations were closed down due to coliform bacterial pollution in the early 1960s (Hoos and Packman 1974:86; Taylor 1970:27). Extensive beds of oyster shells may still be observed in the northeastern portion of the Crescent Beach area resulting from this industry (see Figure 2-32). Other common fauna in this community include barnacles (*Balanus* sp.), *Thais lamellosa*, the bay mussel *Mytilus edulis*, and *Macoma nasuta*, while rooted flora is lacking (Kellerhals and Murray 1969:78, 83; Quayle 1970:43; Thompson 1913:48, also Plate XIII).

Originally *Ostrea lurida* in Mud Bay was sparsely distributed about the edges and deeper parts of the sloughs and occasionally along the low tide level, and here and there in pools and sheets of low tide water held back by slightly raised sand rims, or by mats of eelgrass (Stafford 1917:105, 107; Thompson 1913:46). Cultivation of *O. lurida* in the early part of the 20th century resulted in more densely populated beds, but achieved only a moderate increase in the size of the beds (Stafford 1917:107). Located in the intermediate tidal zone, this community and its fauna would be exposed to aboriginal predation throughout most of the year.

Algal Mat Community

This community in the uppermost (4.0-3.7 m) part of the intertidal flats of Boundary Bay extends over approximately 850 ha (see stipled area, Figure 2-8). This community is characterized by seasonal growths of blue green algal mats which reach their fullest development between late summer and early winter, and are dominated by Microcoleus sp. and Phormidium sp. with lesser amounts of Enteromorpha sp. and Rhizoclonium sp. (Kellerhals and Murray 1969:74, 81-2; Swinbanks and Murray 1978:21). The algal mats die back in the winter as storms smother them with sand resulting in annual stratification of organic rich and sandy laminae (Swinbanks and Murray 1978:21). Very similar appearing laminae were observed in the basal sandy deposits underlying the midden layers excavated in 1976 at Crescent Beach (see area 2, Figure 2-32).

Fauna is scarce in this community with Callianassa californiensis and the polychaete worm Spio sp. found in shallow depressions (Swinbanks and Murray 1978:22, 26). Other rare fauna includes the bivalve Mya sp., as well as Mytilus edulis and Balanus glandula colonizing driftwood (Kellerhals and Murray 1969:81-2). A variety of shorebirds utilize the littoral, depending upon tidal stage, including several species of sandpipers and plovers (Charadriidae and Scolopacidae) which feed on polychaete worms and burrowing shrimp (Hoos and Packman 1974:164). Also common are several species of dabbling ducks (Anatinae) which loaf in water up to 15 cm. deep, especially in tidal margins adjacent to saltmarsh where they feed on vegetation and sedge seeds (Church and Rubin 1970:23; Hoos and Packman 1974: 157-161; Gary Kaiser, C.W.S., March 1980, pers. comm.; Kistritz 1978:19). One of the more evident species of Boundary Bay is the great blue heron, Ardea herodius, commonly seen fishing in tidal pools and along the shallow tidal margins, and nesting in densely wooded areas adjacent to Crescent



Sources: Campbell et al. 1972, Church and Rubin 1970, Godfrey 1966, Hoos and Packman 1974, Northcote 1974, Taylor 1970.

Figure 2-11. Algal Mat Community Species Availability and Abundance.

Beach and Beach Grove (Hoos and Packman 1974:166; Taylor 1970:21). The seasonal abundance and availability of these species is presented in Figure 2-11, some of which may be found in other intertidal communities depending on tidal stage.

Rocky Intertidal Community

Although the smallest ecological community in Boundary Bay, consisting of a few hundred ha, the Rocky Intertidal Community is perhaps one of the most diverse and densely populated. This community is located south of Crescent Beach at the foot of the White Rock Uplands below Ocean Park (see area 'R', Figure 2-8). The following description is based upon observations made between March and May of 1980 during low tides which exposed all of the community as well as extensive portions of the adjacent Eelgrass Community.

The Rocky Intertidal Community may be divided into two areas, the southern part which is completely covered with large boulders, cobbles and rocks; and the northern portion where the boulder/cobble beach is interrupted by patches of sandy/cobble beach. The upper parts of both areas were found to be sparsely to moderately populated with the barnacles Chthamalus dalli and Balanus glandula, occasional Mytilus edulis and Ostrea lurida while Littorina sitkana was very common. This area also contains several petroglyphs which have been pecked into boulders along the beach (see Chapter 2.7).

The lower portion of the southern part of this community was densely populated with Thais lamellosa and Pisaster ochraeus while chiton (Mophalia muscosa) and limpets (Acmea sp.) were frequent. Midshipmen (Porichthys notatus) were very common beneath rocks where males were guarding eggs laid by the females. Midshipmen move into the intertidal zone in March, spending the rest of the year in deeper waters of the bay (Andrew Lamb, March 1980, pers. comm.). The occasional Cancer magister was also noted under rocks but were much more common along the edge of the eelgrass channel at the foot of the Rocky Intertidal Community.

The lower portion of the northern part of the Rocky Intertidal Community was found to be much more diverse. Many boulders were densely covered with Ostrea lurida while Balanus cariosus, B. glandula, Mytilus edulis and Thais lamellosa were also frequent. Cancer magister were also frequent here where they were found burrowed into the sand under the boulders and rocks. Sandy patches between the boulders were found to be densely populated with the clams Protothaca staminea, Saxidomus giganteus, Tresus capax, and rarely Macoma secta. The sand dollar Dendraster excentrius was also common while Clinocardium nuttalli was widespread, often lying on the surface. The lower edge of this community next to the eelgrass channels was continuously patrolled by seagulls (Larus sp.) and crows (Corvus caurinus) at low tide.

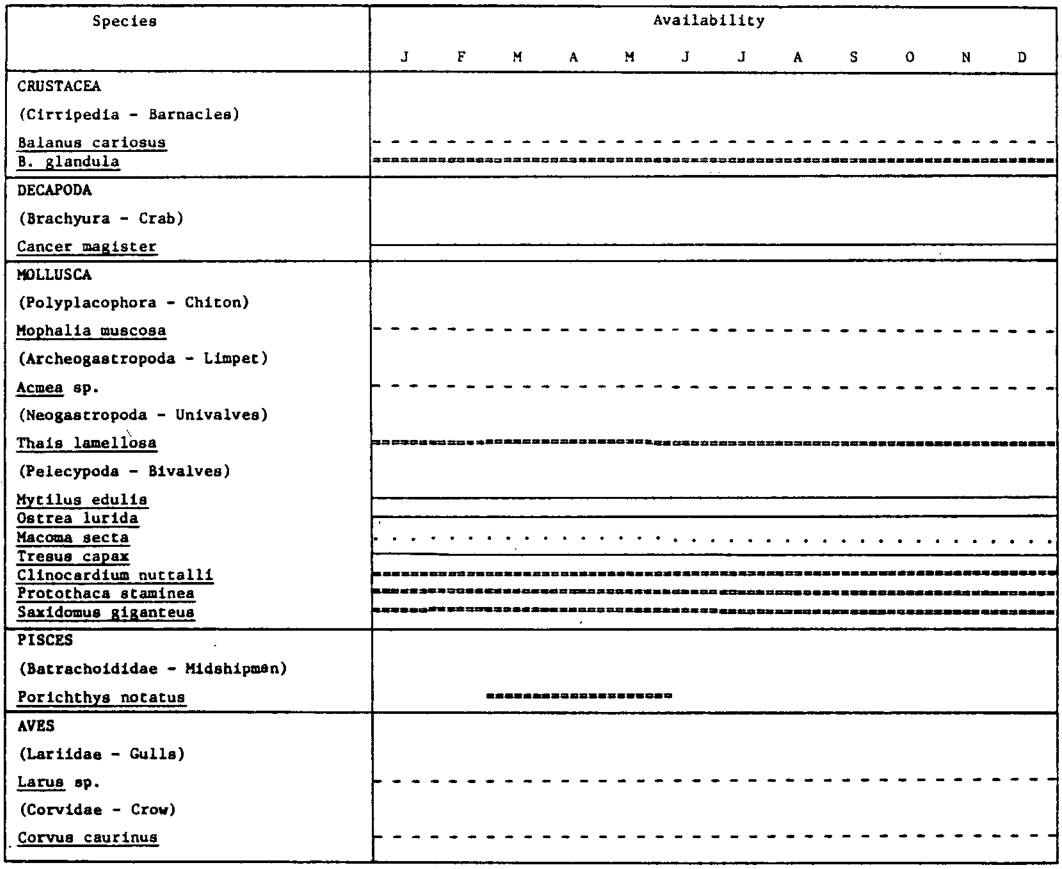
The availability and abundance of species of economic importance in this community are presented in Figure 2-12. Most species are more readily accessible during the spring and early summer when the lowest tides occur in the daytime. This is also the time of year when practically all species are spawning so that overall biomass is much greater than at other seasons. In general, observations made in 1980 and 1981 are in agreement with those reported in the early 1900s (Thompson 1913:45-8).

Saltmarsh Community

In most cases this community is bounded by the Algal Mat Community on one side and the Grassland Community on the other, and formerly extended over an estimated 1,000 ha prior to historic disturbance (see area 'S', Figure 2-8). This area includes that classified by North et al. (1979) as saltmarsh dominated by saltgrass, saltwort and sedges. Periodically this low-lying community is innundated by winter storm waves and high tides which deposit substantial amounts of debris (Forbes 1972:49; Hebda 1977:60).

The outer part of the saltmarsh consists of irregular hummocks of halophytes which give way to the halophyte mats of the inner marsh on a sustratum consisting of "...poorly stratified massive brown peat and silty clay..." while slough bottoms are sandy (Kellerhals and Murray 1969:72). The outer portions are dominated by the saltwort Salicornia virginica, arrowgrass Triglochin maritima, and sandspurry, Spergularia maritima; the the landward portions by orache, Atriplex patula, gumweed, Grindelia integrifolia, dock, Rumex crispus, yarrow, Achillea millefolium, and Aster sp.; while the saltgrass Distichlis spicata is abundant throughout (Forbes 1972:49-50; Hebda 1974:60; Kistritz 1978:19; Swinbanks and Murray 1978:20).

Seeds of the sedge Carex lyngbyei, and the bullrushes Scirpus validus



▬▬▬▬ very common ——— common - - - - - frequent . . . . . rare

Sources: Thompson 1913; (additional community observations made in April and May 1980).

Figure 2-12. Rocky Intertidal Community, Species Availability and Abundance.

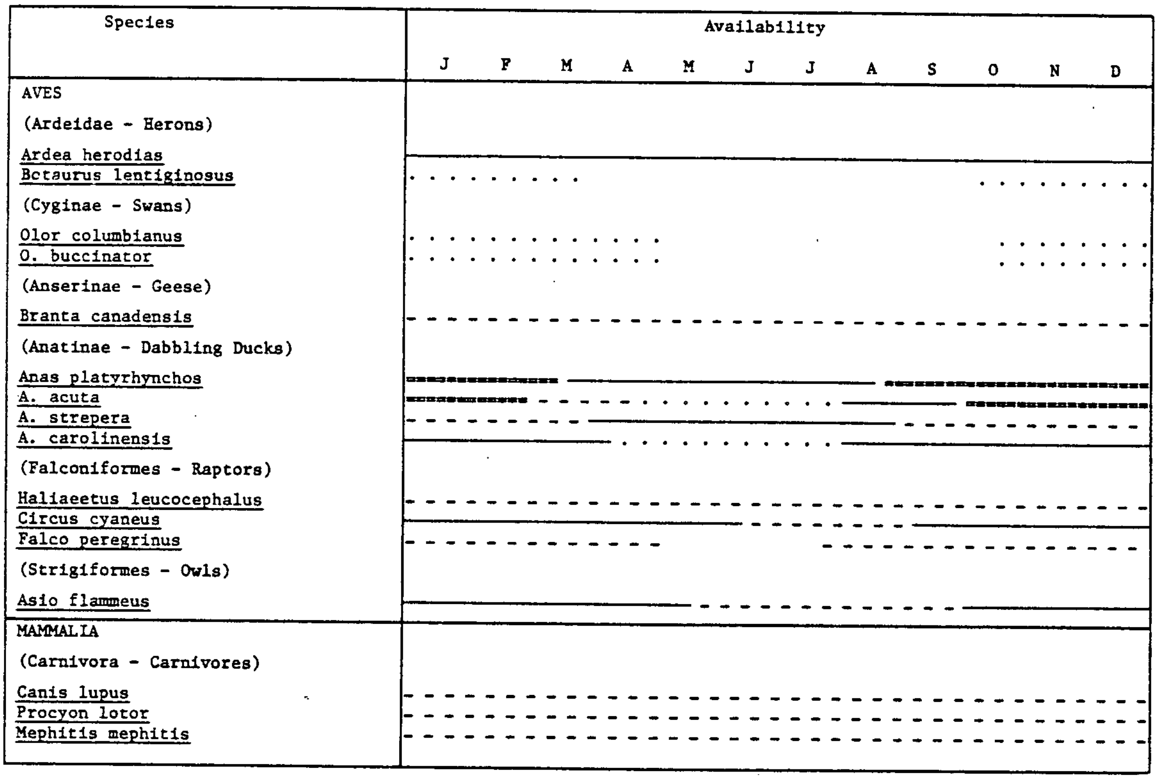
and S. americanus provide an important seasonal food source for Anas platyrhynchos, A. acuta and A. carolinensis (Kistritz 1978:19). Slough channels are important rearing habitats for Oncorhynchus sp. as well as other fish species and is a frequent feeding area for Ardea herodius (Hoos and Packman 1974:166; Kistritz 1978:19). The shore crab Hemigraspus oregonensis is abundant along the marsh perimeter and around tidal channels and pools while Mya sp. and Mytilus edulis are occasionally found in the outer marsh (Kellerhals and Murray 1969:81; Swinbanks and Murray 1978:20). Townsends' Vole (Microtus townsendii) is common while mammalian predators would have included raccoon (Proycon lotor), wolf (Canis lupus) and the striped skunk (Mephitis mephitis) (Banfield 1974; Cowan and Guiguet 1965). Visits from raptors and owls (Falconiformes and Strigiformes) would be common while there would also be rare occurrences of swans (Cyginae) (Godfrey 1966).

Many of the grasses in this community were used by the Coast Salish in mat and basketry manufacture while the leafy base of Triglochin maritima was eaten by some groups in the late summer (Turner 1979:28, 136, 1975:73). The wood of the crabapple Pyrus fusca was used for bows, wedges, and digging sticks while its fruit was gathered in the autumn (Turner 1975:243, 1979:202). The availability and abundance of economically important species from this community are presented in Figure 2-13.

Grassland Community

There is no modern equivalent to this community. Its prehistoric distribution is based upon that reconstructed by North et al. (1979) and is estimated to have extended over several thousand ha (see area 'G', Figure 2-8). This community was apparently composed of two sub-communities, the wetgrass prairie of bunchgrass, rushes, sedges and reeds, and the red top prairie dominated by Agrostis stolonifera (Hebda 1977:29-31; North 1980). Flooding of the grasslands was frequent, especially during freshet periods (North 1980). Raised areas were probably covered with Pyrus fusca as early settlers in the Nicomekl-Serpentine River Valleys reported that this species was abundant (Lang 1967:129). Grassland areas above the Campbell River may have contained Camas sp. (Suttles 1974:59), while early settlers reported an abundance of the ruffed grouse (Bonasa umbellus), a species which was probably common throughout this community (Treleaven 1978:24).

Insectivores and small rodents would have been common as would the snowshoe hare (Lepus americanus) (Banfield 1974, Cowan and Guiguet 1965).



═══════ very common ——— common - - - - - frequent . . . . . rare

Sources: Banfield 1974, Campbell et al. 1972, Godfrey 1966, Hoos and Packman 1974, Kistritz 1978:19, Cowan and Guiguet 1965.

Figure 2-13. Salt Marsh Community Species Availability and Abundance.

Preying on these small animals and birds would have been several species of Falconiformes and Strigiformes and the timber wolf (Canis lupus) (Godfrey 1966; Cowan and Guiguet 1965:280; Treleaven 1978:13). The white-fronted goose (Anser albifrons) would occasionally feed in the grassland areas (Gary Kaiser, C.W.S., March 1980, pers. comm.), and rarely the swan, Olor buccinator (Godfrey 1966). John Work reported that beaver (Castor canadensis) and wapiti (Cervus elaphus) were numerous on the prairies of the Nicomekl-Serpentine River Valleys, and they may have occasionally frequented the grasslands at the head of Boundary Bay as well (McKelvie 1947:23; Pearson 1958:16-7). Availability and abundance of wildlife species from this community are summarized in Figure 2-14.

Grass and Shrub Community

As with the previous Grassland Community, the distribution of this community also follows that reconstructed by North *et al*. (1979), and is estimated to have covered several thousand ha (see area 'W', Figure 2-8). Hebda (1977:29, 31) describes this community as mainly grass with willow, hardtack, crabapple and wild rose (*Salix* sp., *Spirea douglasii*, *Pyrus fusca*, *Rosa* sp.) occurring in clumps among the grasses or in thickets. John Work who journeyed up the Nicomekl River in December 1824 commented on the dense growth of willow along the river banks (McKelvie 1947:22).

Early settlers in the Nicomekl-Serpentine River Valleys reported a wide range of wildlife including salmon and trout, geese, ducks and grouse, raptoral birds, beaver, muskrat, raccoon, wolves, cougars, bear, martin, mink, skunk, river otter, wapiti and deer (Johnson 1958:130; Lang 1967:73, 88, 133; Pearson 1958:12, 18-9, 81; Treleaven 1978:7, 12, 13). As the majority of these species and some others could be found in most of the communities in the Nicomekl-Serpentine River Valleys, Figure 2-14 represents a composite list of available species for the area. Although salmon and steelhead spawning beds are located in the Forest Communities, fishing weirs would have been placed on the lower reaches of the Serpentine, Nicomekl and Campbell Rivers and their tributaries, areas located in the Grassland and Grass and Shrub Communities and are thus included in Figure 2-14. Currently and historically chum (*Oncorhynchus keta*) spawning is only recorded on the Campbell River, while coho (*O. kisutch*) and the steelhead (*Salmo gairdneri*) spawn on all three streams (Environment Canada, 1925-1970). It is not known whether or not this pattern reflects the prehistoric one. Many of the other species common to these communities would have very definite associations with stream banks and adjacent areas.

Species	J	F	M	A	M	J	J	A	S	O	N	D
PISCES												
(Salmonidae - Salmons)												
Oncorhynchus kisutch								- -	- -	- -	- -	- -
O. keta									- -	- -		
Salmo gairdneri	·	·				- -	- -	- -	- -	- -	·	·
AVES												
(Cyginae- Swans)												
Olor buccinator	·	·	·	·						·	·	·
(Anserinae - Geese)												
Anser albifrons	·	·	·	·						·	·	·
(Falconiformes - Raptors)												
Accipiter gentilis	·	·	·						·	·	·	·
A. striatus	- -	- -	- -	·	·	·	·	·	- -	- -	- -	- -
Buteo jamaicensis	—	—	- -	- -	- -	- -	- -	- -	- -	—	—	—
B. lagopus	—	—	- -						- -	- -	—	—
Haliaeetus leucocephalus	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Circus cyaneus	—	—	—	—	- -	- -	- -	—	—	—	—	—
Falco peregrinus	- -	- -	- -	- -				- -	- -	- -	- -	- -
F. columbarius	·	·	·	- -				- -	- -	- -	- -	- -
F. sparverius	- -	- -	- -	- -	·	·	·	·	- -	- -	- -	- -
(Galliformes - Grouse)												
Bonasa umbellus	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
(Strigiformes - Owls)												
Tyto alba	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Nyctea scandiaca	·	·									·	·
Asio flammeus	—	—	- -	- -	- -	- -	- -	- -	- -	- -	—	—
MAMMALIA												
(Leporidae - Snowshoe Hare)												
Lepus americanus	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
(Rodentia - Rodents)												
Castor canadensis	—	—	—	—	—	—	—	—	—	—	—	—
Ondata zibethica	—	—	—	—	—	—	—	—	—	—	—	—
(Carnivora - Carnivores)												
Canis lupus	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Ursus americanus	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Procyon lotor	—	—	—	—	—	—	—	—	—	—	—	—
Martes americana	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Mustela ermina	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
M. frenata	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
M. vison	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Spilogale gracilis	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Mephitis mephitis	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Lontra canadensis	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Felis concolor	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
(Cervidae - Deer & Wapiti)												
Odocoileus hemionus	—	—	—	—	—	—	—	—	—	—	—	—
Cervus elaphus	—	—	?						?	—	—	—

========== very common   ———— common   - - - - - frequent   . . . . . rare

Sources: Banfield 1974, Environment Canada 1925-1970, Godfrey 1966, Johnson 1958, Kaiser C.W.S., Lang 1967, McKelvie 1947, Cowan and Guiguet 1965, Pearson 1958, Treleaven 1978.

Figure 2-14. Grassland Community Species Availability and Abundance.

Cattail Community

The distribution of this community is based upon North *et al*. (1979) who have indicated its presence at locations along the Nicomekl River (see area 'C', Figure 2-8). Less extensive stands of the cattail *Typha latifolia* undoubtedly were also present, although it is unlikely that this community extended over more than 1-2000 ha. Forbes (1972:36) indicates that as a rule pure stands of *T. latifolia* leave a sterile understory although he found grasses, sedges and bullrushes occupying hummocks.

T. latifolia leaves and stems collected in the late summer were used by the Coast Salish in making mats, as well as twine, baskets, capes and hats (Turner 1979:148-152). These mats were widely used for covering canoes, temporary mat lodges and for lining walls in the plank house (Suttles 1974: 241). As this community would have been found scattered throughout the two previous ones, species which might be found here are included in Figure 2-14. The muskrat (*Ondatra zibethica*) inhabits cattail marshes year around if they do not freeze (Banfield 1974:199).

Sphagnum Bog Community

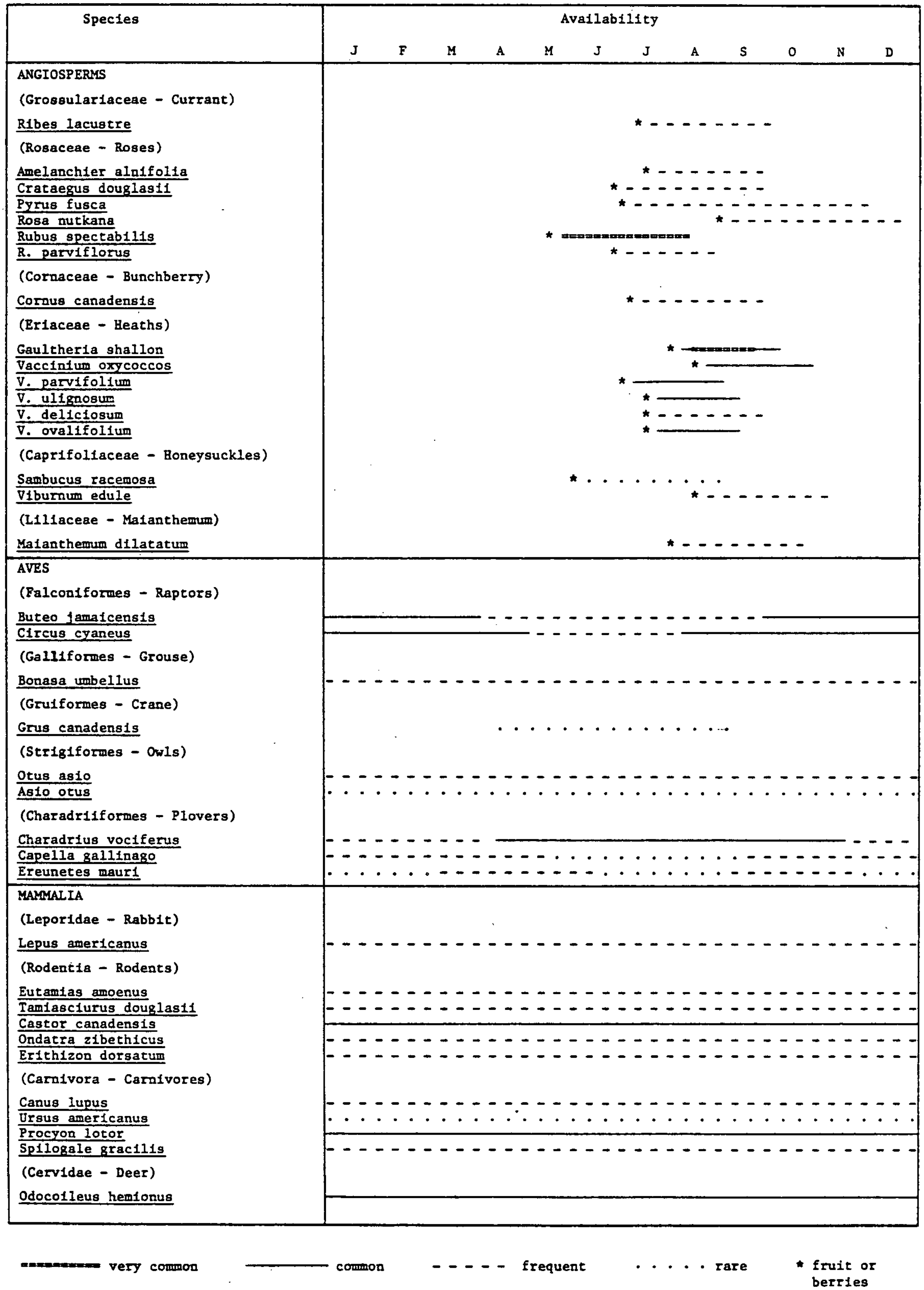
A unique feature of the Fraser Delta is a series of raised sphagnum bogs, the largest, Burns Bog has been the focus of three recent studies (Biggs 1976; Hebda 1977; Hebda and Biggs 1981). The extent of Burns Bog as well as two lesser bogs in the Nicomekl-Serpentine River Valleys follow North *et al*. (1979) and cover several thousand ha (see area 'B', Figure 2-8).

Hebda (1977:155, 161-4) indicates that the initial development of Burns Bog began around 5,000 B.P. and presents a general model of bog growth for the Fraser Delta characterized by an initial salt marsh colonization phase, a wet grassland phase, a shrub phase and a sphagnum bog phase. As the Nicomekl-Serpentine bogs are surrounded by a shrub community, it may be that this model applies equally well for these bogs.

Biggs (1976:141-7) has summarized the vegetation of Burns Bog which includes a range of plants whose fruits were used by the Coast Salish including hawthorn (_Crataegus douglasii_), crabapple (_Pyrus fusca_), cranberry (_Viburnum edule_), saskatoon (_Amelanchier alnifolia_), salal (_Gaultheria shallon_), and several species of _Rubus_ and _Vaccinium_. Accounts from early settlers in the Nicomekl-Serpentine Valley indicate that Coast Salish people from as far away as Vancouver Island gathered blueberries (_Vaccinium_ sp.) from bogs in the area in the late summer (Lang 1967:68; Treleaven 1978:19). Wildlife in the bog include Falconiformes, Strigiformes, _Lepus americanus_, _Castor canadensis_, _Canis latrans_, _Vulpes vulpes_, _Procyon lotor_, _Mephitis mephitis_, _Ursus americanus_ and the mule deer, _Odocoileus hemionus_ (Biggs 1976:86-96, 168-171). Both _Canis latrans_ (coyote) and _Vulpes vulpes_ (fox) are not indigenous to the Fraser Lowlands, their current presence perhaps linked to the demise of the timber wolf (_Canis lupus_) in the area (Dalquest 1948:224-7). Suttles (1981, pers. comm.) has indicated the absence of Halkomelem or Straits names for these animals, while neither animal was mentioned by early settlers (see above). A summary of the availability and abundance of various plants and animals of economic importance from this community is presented in Figure 2-15.

Woodland Forest Community

This community is based upon the distributions of the four woodland communities of North _et al_. (1979) including the early successional stages of the coniferous forests (see area 'DF', Figure 2-8). Common species of plants include maple (_Acer macrophyllum_ and _A. circirnatum_), alder (_Alnus rubra_), cottonwood (_Populus_ sp.), willow (_Salix_ sp.), birch (_Betula_ sp.), wild cherry (_Prunus_ sp.) and _Pyrus fusca_, as well as several species of horsetail (_Equisetum_ sp.) and ferns (Polypodiaceae). Some conifers are also



Sources: Biggs 1976, Campbell *et al*. 1972.

Figure 2-15. Sphagnum Bog Community Species Availability and Abundance.

present including; cedar (Thuja plicata), hemlock (Tsuga heterophylla), Sitka spruce (Picea sitchensis), and Douglas Fir (Pseudotsuga menziesii).

Many of these plants were important food sources to some Coast Salish peoples at different times of the year depending upon local availability and group preferences. Commonly eaten in the spring were the young shoots of Equisetum sp., and of the ferns Athyrium filix-femina and Pteridium aquilinum; the rhizomes of Polystichum munitum; the sap of Alnus rubra; the cambium of Populus sp. and possibly of other species as well (Turner 1975:42, 44, 56, 64-5, 119, 226).

Various parts of all of the tree species common to this community were important to the Coast Salish for literally hundreds of uses including flavouring and smoking foods, for dyes and glues, and for the manufacture of a range of items from paddles and canoes, bowls and spoons, bows, arrows and spears, cordage, mats and baskets, to clothing and housing (see Turner 1979). The western red cedar Thuja plicata was probably the single most important species.

Wildlife species inhabiting this and the other forest communities are included in Figure 2-16. As the distribution of forest types would vary to some extent, depending upon forest fires and stages of plant succession, no attempt has been made to separate species accordingly. Most common would be Odocoileus hemionus which may reach densities of up to 7.7 deer per km^2 five to ten years after a burn, while a climax forest will support but 0.8 deer per km^2 (Cowan 1956:552).

Populations of most other species as well as their predators display similar density fluctuations. The second most common species in this area was probably Castor canadensis which extensively dammed many of the upper reaches of tributaries of the Nicomekl and Serpentine Rivers (see Figure 2-8). The locations of these dams are from North et al. (1979) while those on the Campbell River were reported in Fisheries Reports on spawning grounds in the 1920s and 1930s (Environment Canada 1925-1970).

Scrub Forest Community

This community is composed of the four scrub forest types reconstructed by North *et al*. (1979)(see area 'SF', Figure 2-8). Most common species are *Salix* sp., the skunk cabbage (*Lysichitum americanum*), *Alnus rubra*, Polyodiaeae, hemlock (*Tsuga heterophylla*), *Prunus* sp., and Lodgepole pine (*Pinus contorta*), while some *Thuja plicata*, hazel (*Corylus cornuta*), *Pseudotsuga menziesii*, *Acer circirnatum*, peavine (*Lathyrus* sp.), and clover (*Trifolium* sp.) were also present.

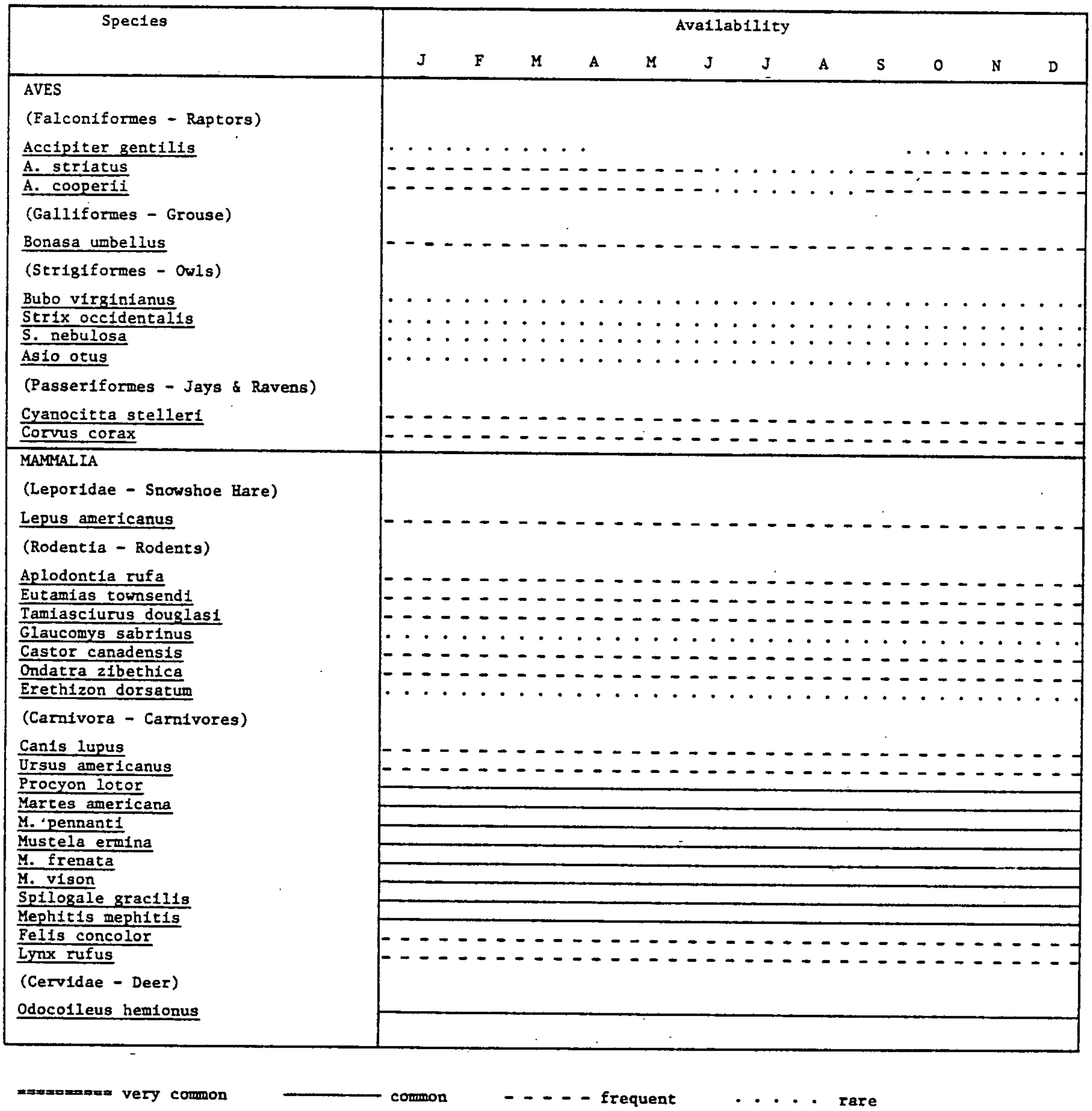
Important economic species not discussed in the previous community include *Pinus contorta*, *Corylus cornuta*, and *Lysichitum americanum*. The cambium of *Pinus contorta* was eaten by some Coast Salish although perhaps more important was the use of the trees' pitch for waterproofing canoes and baskets and for fixing stone projectile points to arrow and harpoon shafts (Turner 1975:65, 1979:103-5). The sucker shoots of *Corylus cornuta* were used for making arrow shafts and some groups used them for making rope (Turner 1979:200-201). Leaves of *Lysichitum americanum* were widely used for lining steam cooking pits, lining baskets, for drying berries on, in fact used whenever food was to be covered or protected (Turner 1979:121-2). *L. americanum* is not restricted to this community and is even now found wherever poor drainage occurs. Wildlife which might be found frequenting this community are presented in Figure 2-16.

Coniferous Forest Community

North *et al*. (1979) reconstructed a total of 9 vegetation types which are combined into the Coniferous Forest Community of this study (see area 'CF', Figure 2-8). The most common species are *Thuja plicata*, *Tsuga*

Species	Availability (J F M A M J J A S O N D)
SPENOPSIDA	
(Equisetaceae - Horsetails)	
Equisetum hyemale	shoots / stalks
E. fluviatile	shoots / stalks
E. palustre	shoots / stalks
E. pratense	shoots / stalks
PTEROPSIDA	
(Polypodiaceae - Ferns)	
Pteridium aquilinum	shoots / rhizomes
Blechnum spicant	shoots / rhizomes
Polypodium glycyrrhiza	rhizomes
P. hesperum	rhizomes
Athyrium filix-femina	shoots / rhizomes
Polystichum munitum	rhizomes
Dryopteris austriaca	rhizomes
D. filix-mas	rhizomes
GYMNOSPERMS	
(Taxaxeae - Yew)	
Taxis brevifolia	(wood used in various manufactures)
(Cupressaceae - Red Cedar)	
Thuja plicata	(wood, bark, roots used in manufactures)
(Pinaceae - Pines)	
Abies grandis	(limited use of wood in manufactures)
Picea sitchensis	cambium (pitch used as glue)
Pinus contorta	cambium? (wood and pitch used)
Pseudotsuga menziesii	(various parts used widely in manufacture)
Tsuga heterophylla	cambium
ANGIOSPERMS	
(Salicaceae - Willows)	
Populus tremuloides	cambium
P. trichocarpa	cambium
Salix sp.	(used in various manufactures)
(Betulaceae - Birches)	
Alnus rubra	sap cambium
Betula papyrifera	(wood and bark sometimes used)
Corlylus cornuta	(various parts used in manufacture) nuts
(Urticaceae - Nettle)	
Urtica dioica	(stems used for making rope, twine)
(Berberidaceae - Oregon Grape)	
Berberis nervosa	berries
(Rosaceae - Roses)	
Crataegus douglasii	berries
Prunus sp.	(bark used in manufacturing)
Pyrus fusca	fruits
Rubus spectabilis	shoots berries
R. parviflorus	shoots berries
(Aceraceae - Maples)	
Acer macrophyllum	cambium (leaves used in cooking)
A. circirnatum	(wood used in manufactures)
(Leguminosae - Clover)	
Trifolium sp.	rhizomes
(Cornaceae - Dogwood)	
Cornus nuttalli	(bark used as dye)
(Ericaceae - Salal)	
Gaultheria shallon	berries
(Caprifoliaceae - Cranberry)	
Viburnum edule	berries
(Araceae - Skunk Cabbage)	
Lysichitum americanum	(leaves used in cooking)

Figure 2-16. Forest Communities Species Availability and Abundance.



Sources: Banfield 1974, Campbell et al. 1972, Johnson 1958, Lang 1967, Cowan and Guiguet 1965, North et al. 1979, Pearson 1958, Treleaven 1978, Turner 1975, 1979.

Figure 2-16 cont'd. Forest Communities Species Availability and Abundance.

heterophylla, Picea sitchensis, Pseudotsuga menziesii, Acer circirnatum, and Salix sp., while Pinus contorta, Acer macrophyllym, Populus sp., Pyrus fusca, dogwood (Cornus sp.), grand fir (Abies grandis), and yew (Taxis brevifolia) are also present. Also common are Gaultheria shallon, Lysichitum americanum, Polypodiaceae, Oregon grape (Berberis sp.), Viburnum edule, and Crataegus douglasii.

The economic importance of many of these species has been discussed in the two previous communities and detailed discussions of each species are presented in Turner (1979). In addition, the wood of *Taxis brevifolia*, *Cornus* sp., and the roots of *Picea sitchensis* were used in manufactures (Turner 1979:100, 117-8, 212-3). The berries of *Viburnum edule*, *Crataegus douglasii*, *Berberis nervosa* and *Gaultheria shallon* were eaten, as were many of the Polypodiaceae found in this community (Turner 1975:44-59, 116, 127, 140, 194). Wildlife productivity is much lower than in the two previous communities, although some of the species outlined in Figure 2-16 will on occasion be found here as well. Several plant species found in this community are important winter browse food for *Odocoileus hemionus* including *P. menziesii*, *T. plicata*, *B. nervosa*, *Pteridium aquilinum*, and *G. shallon* (Cowan 1956:555).

Practically all the lowland areas of this study are composed of fine alluvial silts so that spawning grounds on the Serpentine, Nicomekl and Campbell Rivers are located near or in forested areas where the streams cut through glacial gravels. Several species of scavengers could be expected to frequent these areas in the autumn including raptors and *Ursus americanus*.

Summary

Examination of species availability and abundance presented in Figures 2-9 to 2-16 indicates marked seasonal fluctuation. Approximately 140 species of fish, birds, mammals, and plants of economic value would have been present at various times of the year with abundance ranging from rare to very common (see Figure 2-17). Some very common and common species would be available in sufficient quantities that actual harvesting of these resources could take place. These resource crops could have included herring, salmon and steelhead runs, deer and wapiti herds, migrating waterfowl, berries, and probably to a similar extent, some shellfish species. Some resources would only be available in certain seasons while others would be more readily

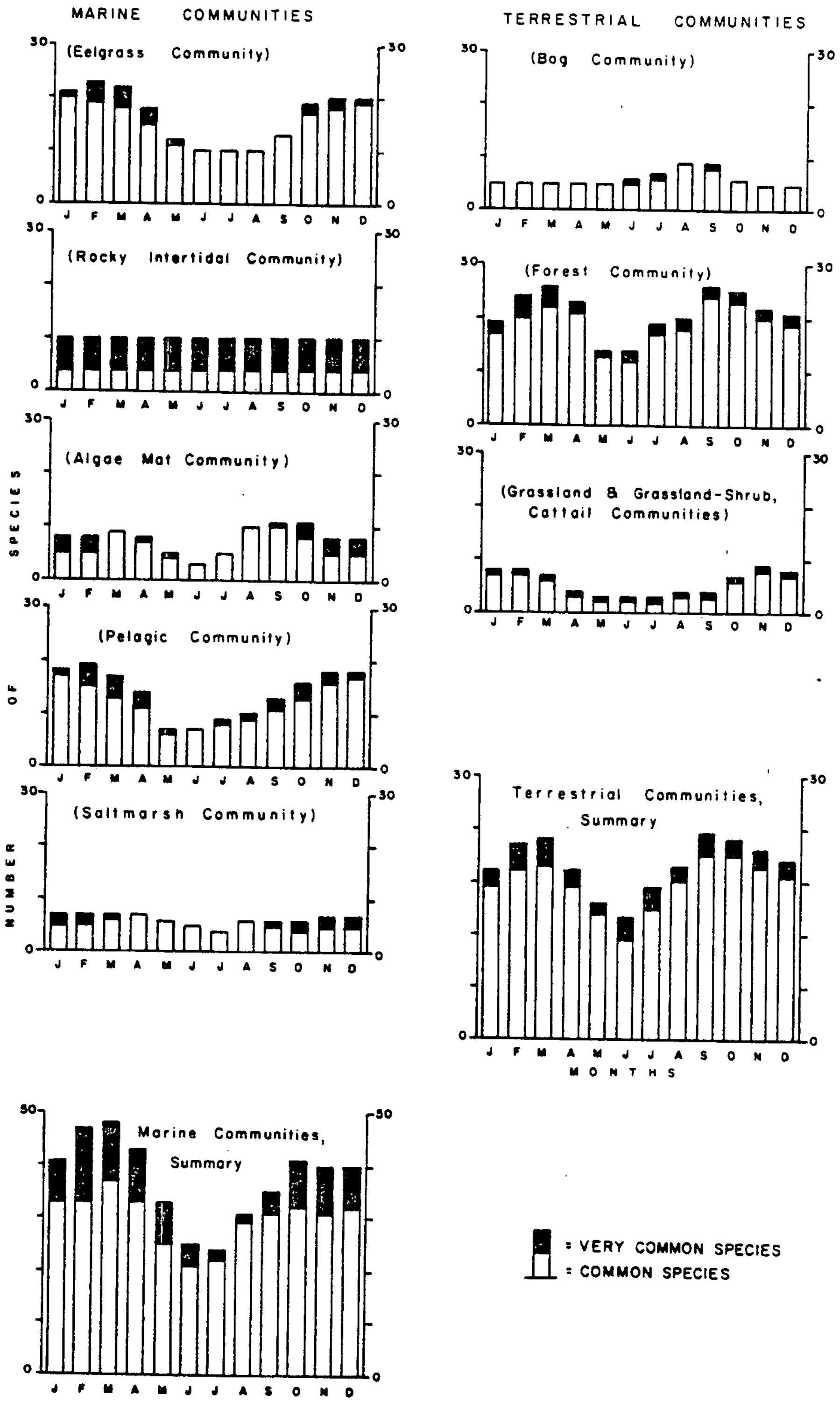


Figure 2-17. Ecological Communities and Seasonal Resource Abundance.

available, or available in greater numbers seasonally. Many resources would require monitoring, either to determine their arrival (i.e., herring runs), or to watch for optimal harvesting time (berries).

Some communities display increases in species availability and abundance in the same seasons, while overall both marine and terrestial communities peak at about the same time (see Figure 2-17). A few communities do not follow this trend such as the Bog Community (late summer berries), and the Algae Mat Community (late summer migrating shorebirds). Clearly, a human population depending upon these communities would have had to make scheduling choices as to what resources they might harvest in some seasons.

Although there must always be some doubt, in general I am confident about the nature of the communities reconstructed above. This is derived from the close correspondence between modern, historic (see below), paleobotanical and geological sources, all of which suggest minimal environment change in the Boundary Bay area over the past 1,000 years. The data generated above will be used in conjunction with ethnographic information to make hypotheses concerning the nature of the archaeological record at Crescent Beach. The following sections of this chapter will review the human settlement of this area.

2.5 EUROPEAN CONTACT AND SETTLEMENT

The earliest recorded visit by Europeans to Boundary Bay is that of the Spanish Expedition under Eliza, who in July of 1791 named Point Roberts, Isla de Zepeda, and noted the large numbers of Indians who were probably gathered to reef-net sockeye off Cannery Point (Wagner 1933: 186). The absence of soundings and an accurate shoreline on a chart made by Narvaez at that time suggests the Spanish did not enter Boundary Bay, but rather passed by its mouth (see Hastings 1975:59). This chart also indicates a settlement near the mouth of the Campbell River at the present site of the Semiahmoo Reserve.

The following June the area was again visited by the Spanish under Galiano and simultaneously by an English expedition led by Captain Vancouver who named the peninsula Cape Roberts (Newcombe 1923:60). Vancouver reported that the "...shoals attached to the shores...prevented our reaching within four or five miles of their head" (Meany 1957:181-2). Menzies who was with Vancouver described Boundary Bay and the summer reef net village;

> "...a large shoal water Bay till they came to a conspicuous White Bluff/of a moderate height forming the Western point of it & which afterwards obtained the name of Cape Roberts. Here they landed to dine near a large deserted Village capable of containing 4 or 500 Inhabitants,.." (Newcombe 1923:60).

Although Simon Fraser arrived at the mouth of the Fraser River in July, 1808 (Lamb 1960:105), there was no further recorded European contact with Boundary Bay until December 1824 when a Hudson's Bay Company party passed through the Bay and up the Nicomekl to the Salmon, and thence to the Fraser River in search of a possible site for a trading post (Johnson 1958:5-6; Nelson 1927:7-8). John Work, who was with the party, described the area around the head of Boundary Bay as "...low & flat (and) the bay appears to be shallow" (McKelvie 1947:22). The party found navigation of the Nicomekl River difficult as it was nearly choked with driftwood and willows, for "...tho' the Indians had cut roads through it for their canoes yet they were too narrow for our boats" (McKelvie 1947:22). Work reported "...appearances of beaver being pretty numerous in this river" and evidence of wapiti in the prairie areas of the upper part of the valley (McKelvie 1947:22-3).

In 1827 the Hudson Bay Company established the original Fort Langley at Derby (see Figure 2-19), the first European settlement in the Lower Mainland, and over the next 30 years a number of squatters and trappers lived in the area, their abandoned log cabins reported by later settlers

(Lang 1967:13; Nelson 1927:5-6; Treleaven 1978:10). In 1840, after fire destroyed the original post, Fort Langley was rebuilt near the mouth of the Salmon River (Nelson 1927:15).

In 1859 the new provincial capital was established at New Westminster, and with the subsequent legal surveys of the Lower Mainland numerous pre-emptions were made. Among the earliest was one by Samuel Handy who in 1861 pre-empted and settled on 160 acres on the Nicomekl some 4 km from its mouth (Lang 1967:12-3; Treleaven 1978:9-12). The Serpentine - Nicomekl Valley attracted many farmers and by 1874 there were 14 names on the Provincial Voters List for the Mud Bay area (Pearson 1958:20). A network of trails existed from Semiahmoo Bay to Brownsville (opposite New Westminster) by 1865, which by 1875 had been replaced by wagon roads (Draper 1943; Treleaven 1978:15, 18).

The first reported European settler at Crescent Beach was Alexander Annadale who pre-empted land in 1864 and lived there for at least a part of the 1860s (Pearson 1958:24; Treleaven 1978:13). Another pre-emption was made in 1871 to J.B. Musselwhite R.E. who sold his grant to Walter Blackie who apparently was already living at Crescent Beach in an 1860s vintage log house on the beach front (Lang 1967:13-4, 41-2; Pearson 1958: 24-5; Treleaven 1978:13). Although logging of the area around Elgin began in 1875, no reference could be found to logging at Crescent Beach until 1934 (Lang 1967:13, 132), early photographs show stands of large timber (see Lang 1967:41 and Treleaven 1978:75).

After the road from Elgin was completed in 1883, Crescent Beach became a popular picnic spot under protest from Walter Blackie (Lang 1967:145; Pearson 1958:45, 157; Treleaven 1978:13, 36, 50). In 1909 the sea level route of the Great Northern Railroad was opened through Crescent Beach and shortly after the area was "surveyed" (sub-divided?)

(Lang 1967:24, 73; Pearson 1958:41; Roy 1968:57). In 1912 the Crescent Hotel opened on the beach front at the foot of Beecher Street and Crescent Beach became a popular holiday resort (Lang 1967:43, 73). In more recent years holiday homes have gradually been replaced by permanent residences.

North et al. (1979), in their reconstruction of the original vegetation of the Fraser Delta, divided Crescent Beach into two communities, grassland and coniferous forest. This corresponds to descriptions made by early settlers who reported marshland areas where the "...farmers grazed their dry cows" (Lang 1967:133), and with early photographs which show stands of conifers (Lang 1967:41; Treleaven 1978:75). Over 100 years of modern settlement at Crescent Beach have erased any sign of the original vegetation.

2.6 ETHNOGRAPHIC CULTURES

When Europeans arrived in the late 1700s, the lower Fraser River Valley and the shores of the Strait of Georgia, Puget Sound, and part of Juan de Fuca Strait were peopled by speakers of Coast Salish languages (Boas 1887:288, 1889:9). Mitchell (1971b:19-29), examining linguistic and ethnographic data, has outlined four main cultural groups in this area including:

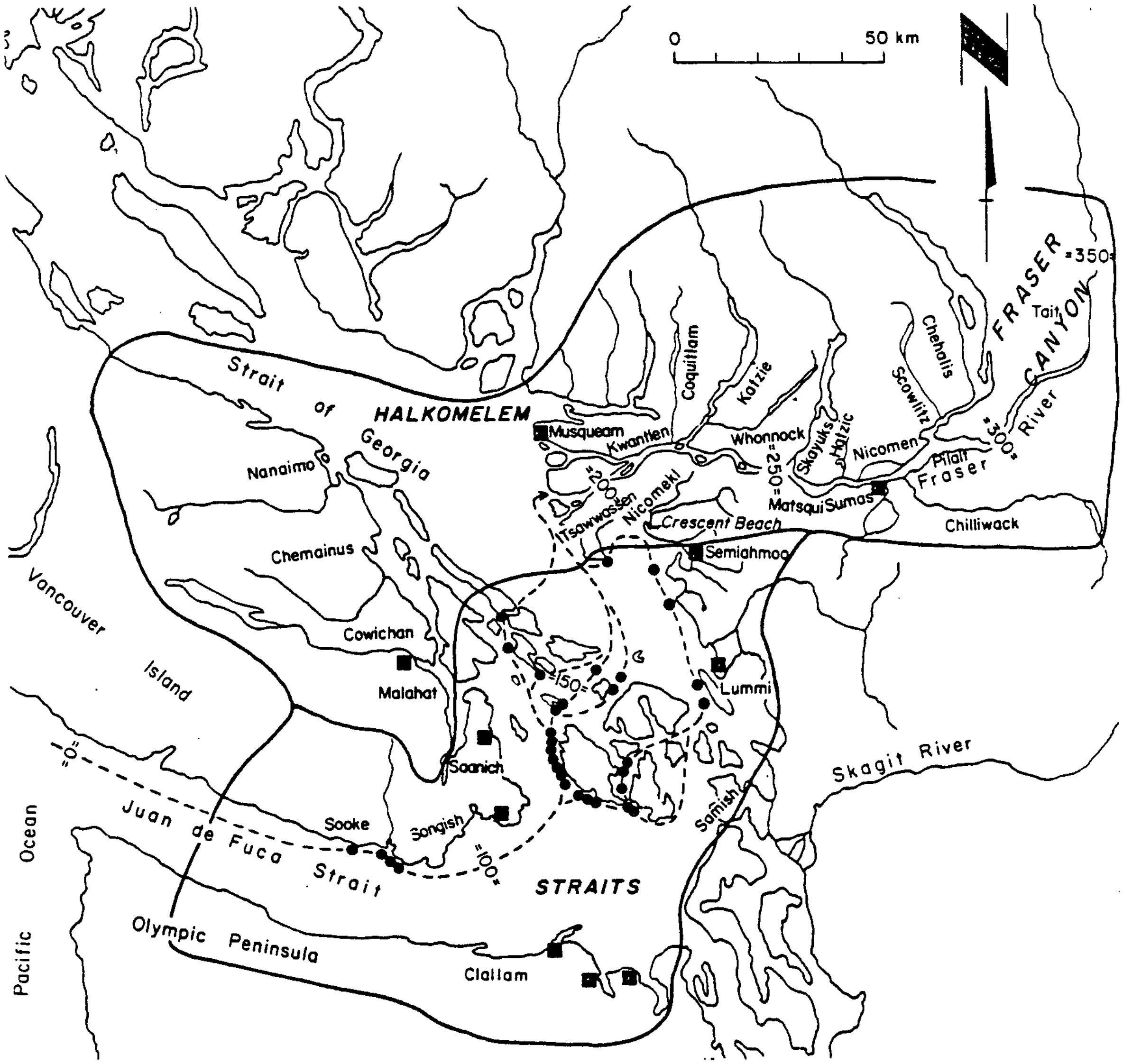
> 1) Northern Gulf diversified fishermen, tapping, by a variety of means, the smaller of the two streams of fish approaching the Fraser. They rely largely on the relatively small salmon runs in lesser rivers and creeks north of the Fraser.
>
> 2) Central and southern Gulf river fishermen, relying strongly on the Fraser River salmon runs and catching the fish in the Fraser River or its tributaries. This type might be further divided into those who remain on or near the river year around, away from salt water, and those at the river's mouth, some of whom winter away from the river.
>
> 3) Straits reef-net fishermen, obtaining an important part of their food from the larger, southern stream of Fraser River salmon, catching these fish with a special form of net while the salmon are still in salt water.
>
> 4) Puget Sound diversified fishermen, with no direct access to

> Fraser River runs and relying mainly on the lesser runs in local rivers and streams.

It is Mitchell's second and third groups (see Figure 2-18) which are of primary interest here as Boundary Bay was used by members of both. The "central and southern Gulf river fishermen" spoke dialects of the Coast Salish Halkomelem language and occupied the Fraser River Valley from the lower Canyon to the Delta and the opposite shore of the Strait of Georgia (Cowichan in early literature) (Boas 1889:10, 1894:454; Hill Tout 1902:355; Latham 1848:156; Scouler 1848:234; Wilson 1866:278). Those Halkomelem groups who remained on the river away from salt water are the Upper Stalo reported on by Duff (1952). To the south of the Halkomelem were the "straits reef-net fishermen" who occupied the Gulf Islands, San Juan Islands, as well as both shores of the Strait of Georgia into Juan de Fuca Strait and spoke dialects of a closely related Coast Salish language known as Straits (Lku'ngEn in early literature) (Boas 1889:10, 1890:11; Suttles 1960:304, 1974:6) (see Figure 2-18). The remainder of this section describes subsistence activities, habitations, manufactures, society and seasonal rounds of the Straits and Halkomelem peoples.

Fishing

Like other Coast Salish, the Halkomelem and Straits speakers were fishermen supplementing their diet with hunting and gathering, but they were fishermen with a difference for they held access to the salmon runs of the Fraser River, especially the sockeye (Oncorhynchus nerka) (see Figure 2-18), up to 90% of this run approaching the river through Juan de Fuca Strait (Ricker 1966:66). Within 60 km of entering the Strait and for the next 300 km through the southern Strait of Georgia and up the Fraser River to the Canyon, first Straits fishermen with reef nets, and then Halkomelem with trawl nets and dip nets waited for their arrival



Sources: Barnett 1975, Boas 1894, Duff 1952, Hill Tout 1902, Jenness n.d., Stern 1934, Suttles 1949, 1955, 1974, 1977, Wilson 1866, Rozen pers. comm.

Figure 2-18. Ethnographic Halkomelem and Straits Territories.

(Barnett 1975:86-7; Duff 1952:62-3; Jenness n.d., pp. 7-8; Suttles 1955:22, 1974:114). Detailed descriptions of dip nets, trawl nets, and reef nets may be found in Suttles (1955:21; 1974:143-5, 155-161) and in Duff (1952: 62-3, 69-70). On odd numbered years the sockeye run would have been greatly enlarged by the Fraser River run of pink (O. gorbuscha) (Neave 1966:72; Rathbun 1900:288-9).

Ritual surrounded the arrival of these important runs, all Halkomelem and Straits performing the first salmon ritual for the sockeye, and some Straits performing this rite for pinks as well (Barnett 1975:89-90; Boas 1890:17, 1894:461; Hill Tout 1902:358, 411, 1904:330; Jenness 1955:35, n.d., pp. 27-8, 116; Suttles 1955:22, 1974:175). The Katzie also performed a ritual when the sockeye were late (Jenness 1975:75), while both Jenness (n.d., p. 115) and Barnett (1975:89) refer to a ritual performed by the Nanaimo, their ritualist rubbing red ochre on a petroglyph of a fish at Jack Point (near Nanaimo) when the chum salmon (O. keta) were late in arriving (see Hill and Hill 1974:113-4).

In addition to having access to the Fraser River runs of sockeye and pink, individual Halkomelem and Straits groups occupied the drainages of one or more of the smaller rivers, streams and creeks flowing into the Fraser and Strait of Georgia. Harpoons, leisters, gaffs, trawl nets and dip nets, weirs and traps were used to catch springs, coho, chum salmon, and steelhead (O. tshawytscha, O. kisutch, O. keta, Salmo gairdneri) which run into most of these streams (Barnett 1975:79-87; Boas 1889:20; Duff 1952:62-3, 67, 70; Jenness 1955:8, n.d., pp. 9-10, 24; Suttles 1955:22-3, 1974:133-151; Wilson 1866:283). In the summer fish were sun dried on raised frames while in the autumn they were smoked, the preserved fish being stored in baskets (Barnett 1975:62; Duff 1952:66-7; Jenness 1955: 8, n.d., p. 26; Suttles 1974:142). Halkomelem and some Straits fished for sturgeon (Acipenser sp.) using harpoons, trawl nets, weirs, and a hook and line while the herring rake and dip net were used for eulachon (Thaleichthys pacificus) (Boas 1894:460; Duff 1952:68-9, 71; Jenness n.d., pp. 22-3). More important to Straits groups were halibut (Hippoglossus stenolepis) and rock cod (Sebastes sp.) which were caught with a hook and line (Boas 1889:19-20; Jenness n.d., pp. 21-2; Suttles 1974:114-8, 124-6). Members of both groups with access to coastal beaches took herring (Clupea harengus) with herring rakes and other fish which they could harpoon from their canoes at low tide (Curtis 1970:56; Jenness n.d., pp. 7-10, 23; Suttles 1974:126-132).

Various species of shellfish were also gathered and dug with digging sticks, dried and smoked for winter (Barnett 1975:61; Jenness n.d., p. 30; Suttles 1974:65-9; Wilson 1866:283; see Hawthorn 1956:Pl. 10 for an illustration of a Kwakiult clam basket and digging stick). Shellfish harvesting was not restricted just to daytime periods of low tide, but also took place at night during the winter by moonlight and pitchwood torches (Matthews 1955:258, 280; Rozen 1978:179, 1982, pers. comm.). Clams were steamed open by placing them over heated rocks and covering them with kelp, fir boughs or mats, and sand while the meat was rinsed of sand and skewered on sticks which were stuck around a fire to dry (or placed over a bed of coals), and then strung on a line of cedar bark to be stored (Barnett 1975:61; Elmendorf 1960:133; Haeberlin and Gunther 1930:23; Regan 1917:27; Suttles 1974:66).

Although fish, especially salmon, was the most important food source for the Halkomelem and Straits, a variety of other foods were also used (Barnett 1975:15, 78; Boas 1889:7; Hill Tout 1904:316, 1905:234; Jenness 1972:347; Suttles 1974:114). Included were waterfowl, sea and land mammals, and various plant foods, the emphasis varying from group to group depending upon the distribution of these resources and a group's access to them.

Birds

Just as local fish resources are increased by anadromous fish runs, the bird populations of this area (on the Pacific Flyway) are also greatly increased during the fall and spring migration periods with many species wintering here (Hoos and Packman 1974:152). Suttles' Semiahmoo informant listed 27 kinds of birds which were hunted including diving ducks (Aythyinae), dabblers (Anatinae), geese (Anserinae) and swans (Cyginae) (Suttles 1974:70).

A variety of hunting techniques is reported, most used throughout the area, including: a raised net between two poles, or sometimes between two trees; a submerged net with sinkers and floats; hand nets (sometimes attached to a hand held pole); bows and arrows armed with blunt wooden or bone leister points; night hunting from a canoe with fire using leister armed spears; hand nets and clubs; sling shots armed with pebbles; and clubs (Barnett 1975:95-6, 98, 102-3; Duff 1952:72; Jenness n.d., pp. 15-7; Matthews 1955:250; Newcombe 1923:153; Suttles 1955:26, 1974:70-81; Wilson 1866:282). The raised net was popular on the coast (although good locations were limited) as was the submerged net, especially in the spring, to catch diving ducks feeding on herring roe (Jenness n.d., p. 16; Suttles 1974:72-3). Generally caught from autumn to spring, ducks were usually eaten fresh although they were sometimes preserved by roasting and drying (Suttles 1974:80).

Sea Mammals

Sea mammals were hunted by Halkomelem and Straits on salt water and some Halkomelem took seals (Phoca vitulina) on the lower Fraser River and in Pitt Lake (Jenness n.d., pp. 17-20; Suttles 1952:10, 18, 1955:25-6, 1974:106). Most commonly sought were seals, though both seals and porpoise

(Delphinidae) were hunted whenever they were found, while sea lions (Eumetopias jubata) were consistently hunted only by a Chemainus group and and whales (Cetacea) by a few Clallam and Saanich (Jenness n.d., pp. 17-20; Suttles 1952:10-1, 18). Harpoons, nets, and clubs were used for seals which were often hunted by 2-3 man crews in canoes on moonlit nights, while porpoise was hunted on calm days using harpoons (Barnett 1975:98-9, 102-3; Jenness n.d., pp. 8, 10, 17-20; Suttles 1952:10-1, 1955:25-6, 1974:106-9). Both seals and sea lions were attacked with harpoons and clubs if found on the beach while harpoons only were used for sea lions in the water (Barnett 1975:98-9; Suttles 1952:10, 12, 1955:25-6).

Land Mammals

Although both Straits and Halkomelem groups hunted deer (Odocoileus hemionus), wapiti (Cervus elaphus), and black bear (Ursus americanus), hunting was probably more important among the mainland peoples. Bows and arrows with detachable stone heads, spears, clubs, pitfalls, nets and snares were used for deer which were hunted in several ways including communal drives to waiting hunters at ambushes, nets or pitfalls, by pairs of hunters at night using a canoe and fire to distract deer along the shore, or by a single hunter either by stalking, ambushing, or using dogs to flush out the deer (Barnett 1975:96-7; Duff 1952:71; Jenness n.d., pp. 11-2; Suttles 1955:24-5, 1974:82). Wapiti were hunted using dogs, pitfalls, deer nets and bows and arrows with detachable stone heads (Barnett 1975:96-7; Jenness n.d., p. 12; Suttles 1955:25, 1974:91). Seasonal preferences were reported for both ungulates. Bucks and stags were hunted in the spring while does and hinds were hunted in the fall and the meat preserved by steaming and drying (Suttles 1974:82-3, 90, 94). The lower leg bones were sometimes saved for making arrowheads and duck spear points (Suttles 1974: 91).

Dogs were used for badgering bears which were hunted with bows and arrows, deadfalls and pitfalls, were ambushed on the salmon spawning grounds, and were smoked or otherwise flushed out of their winter dens (Barnett 1975:96-7; Suttles 1955:25, 1974:92-3; Wilson 1866:282). A baited trap with a deadfall was used for hunting small mammals such as marten and mink (Mustelidae), raccoon (Procyon lotor) and muskrat (Ondatra zibethicus), while beaver (Castor canadensis) were hunted with the bow and arrow and with a harpoon armed with a single three-piece head (Barnett 1975:99; Suttles 1955:25, 1974:96). Dogs were not eaten by either the Straits or Halkomelem who had at least one type, the small woolly one bred for its fur, and probably a larger one used for hunting (Barnett 1975:96-7; Suttles 1955:24, 1974:105).

Plant Foods

Plant foods may have ranked a poor third after fish and mammal among all Straits and Halkomelem although a range of plants was used as indicated in Chapter 2.4. The sprouts of salmonberry and thimbleberry (Rubus sp.), and of the horsetail (Equisetum sp.) were commonly eaten fresh while various bulbs and roots were dug with digging sticks, steamed and dried for winter including those of some ferns, the camas (Camassia quamash) among the Straits, and the wapato (Sagittaria latifolia) among the Halkomelem on the Fraser River (Barnett 1975:64, 67; Duff 1952:73; Jenness n.d., pp. 7, 10; Suttles 1955:27, 1974:58; Wilson, 1866:282). Probably any berry available in sufficient quantities was used, eaten fresh or boiled and fire or sun dried on either a raised frame, or on cedar planks, into berry cakes which were stored for winter use (see various species in Figures 2-15, 2-16) (Barnett 1975:63; Duff 1952:73-4; Hill Tout 1905:234; Jenness n.d., p. 8, 1955:8; Suttles 1955:27, 1974:63-4; Wilson 1866:282). Numerous plants were also important in manufacturing (see Material Culture below and Figure 2-16).

Habitations

Both the Straits and Halkomelem peoples used a rectangular cedar plank house as a permanent dwelling, 9-15 m wide and 15-60 m or more in length, its size varying according to the number of families to be accommodated (Barnett 1975:36-7, 41-3, 53-5; Boas 1889:22-3, 1890:11-3, 1894:456; Duff 1952:47-8; Hill Tout 1902:360, 1904:331-2; Jenness n.d., pp. 31-7, 1955:6-7; Lamb 1960:103-4; Suttles 1955:9, 1974:256-260). The following description provided by Jenness (1955:6-7) is typical;

> Each was a long barn-like structure with a roof that sloped gently from front to back. The frame was joined by two lines of square or rectangular posts, often carved, that were joined by cross-beams, and these cross beams overlain in turn by rafters. The walls were overlapping boards set horizontally between upright poles planted in the ground just outside the line of posts, so that they were really quite separate from the frame. Heavy planks overlapped each other on the rafters, giving a fairly rain-proof roof, even though every board was displaceable at need to let the smoke out. In the long side of the house facing the water were one or two doors; there was a door also at each end; and here and there a gap between the horizontal wall-boards served as a window, which could be closed at will with a rush mat.
>
> Every dwelling sheltered several families,...each family occupied, as a rule, the space between two of the upright posts and, in most Coast Salish villages, partitioned off its portion of the house with boards or rush mats to form a separate room. In some houses these partitions were permanent, in others they were removed at feasts.

Permanent villages consisted of one or more of these buildings, either alone, or attached in rows which sometimes stretched several hundred meters along the shore; most villages having one or two large houses and a number of smaller ones (Barnett 1975:21; Jenness n.d., pp. 4, 32-7; Suttles 1974:11, 23, 30, 43-5, 276). House fronts were sometimes painted with designs (Barnett 1975:54; Boas 1894:456; South 1970:37).

Many groups also had permanent plank houses at important resource locations such as camas beds, reef net stations, or salmon weir sites; the

Nanaimo, Cowichan, Songhees, Saanich, Semiahmoo, Samish and Lummi, and probably most Straits groups had permanent house frames at summer salmon fishing villages, transporting the planks from their main village (Barnett 1975:40; Jenness n.d., pp. 7, 40; Suttles 1974:166, 194-5, 200, 204, 260). The Musqueam, Katzie, Lummi and Samish and probably others had permanent structures consisting of plank or bark covered houses at autumn fishing weir sites (Barnett 1975:39-40, 53; Jenness 1955:8; Suttles 1955:10, 1974:39, 44, 150, 261). On shorter trips a more temporary type of shelter was widely used and consisted of rush mats placed over a pole frame (Barnett 1975:40; Jenness n.d., pp. 9, 41, 1955:7; Suttles 1974:12, 192, 261; Wilson 1866:288). The mat lodge was also used by fishermen who were reef net fishing (Suttles 1974:192, 200, 204).

A number of villages were stockaded to aid in defense against attack, or had fortifications nearby (see Figure 2-18) (Barnett 1975:38, 270; Boas 1889:37; Jenness n.d., p. 4; Suttles 1974:322-3; Wilson 1866:286). Stockaded villages or forts have been reported for the Clallam, Saanich, Samish, Lummi, Semiahmoo, Cowichan, Musqueam, and Sumas (Barnett 1975:20, 42; M. Kew, 1980, pers. comm.; James Point, 1973, pers. comm.; Stern 1934:101; Suttles 1974:12, 25, 30-1, 38, 43, 322-3; Wilson 1866:286). They have also been reported for other Coast Salish including the Squamish, northern Strait of Georgia groups and among the Puget Sound groups (Barnett 1975:23, 49. 50; Gunther 1927:191, 1972:63; Haeberlin and Gunther 1930:12, 15; Hill Tout 1900:490; Matthews 1955:113, 187, 200, 1959:26, 52). Although Suttles (1974:323) believes fortifications may be recent, the archaeological evidence may suggest otherwise (see Chapter 2.7 and Figure 2-29).

Society

Among both Straits and Halkomelem, villages consisted of one or more extended families, each as a rule occupying its own plank house. This house group was the most important and to a great extent the only social, economic, and political unit, and while residence was often, but not rigidly patrilocal, descent was reckoned bilaterally. (Barnett 1975:241-2; Duff 1952:76, 79, 84-5; Jenness n.d., pp. 1, 52, 1955:7; Suttles 1955:28, 1974:51, 273, 280, 290). In addition to its house, such a group also possessed through descent and kinship, certain ancestral names or titles, legends, songs and dances, as well as rights to certain resource locations, the majority of these rights generally held by the most important members of the family (Barnett 1975:241, 244; Jenness n.d., p. 51; Suttles 1974: 55-6).

Leadership within the family and village was provided by the most respected family heads known as siyam, of which there could be several in any particular house or village. Siyam held no political power beyond the support and respect of their families and other members of the community. Their influence was based on a range of factors such as prestige of their name and social position, as well as that of their ancestors, and their own demonstrated wisdom, ability, industry and generosity (Barnett 1975:243, 245; Duff 1952:80, 81; Jenness n.d., p. 55, 1955:6; Suttles 1974:271, 273, 277).

Society as a whole consisted of three classes including a large upper class of good people, a smaller lower class of worthless people and a still smaller group of slaves (Suttles 1958:504, 1974:271, 302-2; see also Barnett 1975:246-250). Fronto-lambdoidal cranial deformation was practised among the upper class, accomplished by binding bark pads to infants' heads (Barnett 1975:75; Boas 1889:12, 1890:20, 95-6; Duff 1952:90, 91; Gunther 1927:236, 253; Hill Tout 1902:366; Jenness n.d., p. 69; Matthews 1955:185, 202, 1959:6; Stern 1934:15, 73; Suttles 1974:286). The use of labrets by women is either denied or not mentioned for the Coast Salish (Barnett 1975:76; Haeberlin and Gunther 1930:40), although they were used by women (and sometimes men) and regarded as a sign of rank among the Haida, Tsimshian, Tlinglit and a few other northern coast peoples (Boas 1889:12; Drucker 1955:91, 196-7, 1965:41; Garfield and Wingert 1966:25; Keddie 1981; Krause 1970:96-100; Oberg 1973:83).

Material Culture

A variety of tools and implements, weapons, and hunting and fishing gear were manufactured by flaking stone, grinding slate and working bone, antler and shell (Barnett 1975:83-8, 98-102; Duff 1952:58-61; Jenness n.d., p. 14; Suttles 1955:24, 1974:223-5). Normally these are the cultural remains recovered from archaeological sites in this area, although it is acknowledged that these non-perishable remains represent but a minute portion of the material culture associated with Northwest Coast Cultures.

The bulk of manufactures were derived from various plant materials, which has been borne out by the excavation of water-saturated deposits which have preserved organic artifacts (see Croes 1976). Most important was wood-working, made possible by the red cedar (Thuja plicata) which was used for house planks and posts, canoes and paddles, boxes, and numerous other items (Barnett 1975:107-118; Duff 1952:51-3, 55-9; Jenness n.d., pp. 38-9; Suttles 1974:225-9, 248-253; Wilson 1866:288-290). The nature of local housing was discussed above. The use of the dugout canoe was universal as mobility on the Northwest Coast was all but impossible without some form of water transportation.

Lacking pottery, wooden boxes were used for water storage and cooking; heated rocks added to a half-filled box of water brought it to a rapid boil and was an important cooking method (Duff 1952:58, 74; Hill Tout 1905:234; Jenness n.d., p. 43; Suttles 1974:242). Cracked and broken cooking rocks are common at archaeological sites of all time periods in this area attesting to the antiquity of this cooking technique.

In addition to woodworking, a wide range of manufactures were made from other plant materials. Clothing, cordage, bags, baskets and mats among other items were made from cedar bark and roots, cherry bark, willow, nettle, cattails and tules or rushes to mention but a few (see Figure 2-16) (Barnett 1975:7-73, 121-2; Duff 1952:57-8; Jenness n.d., pp. 41, 45-9, 1955:7-8; Suttles 1974:231-244). Also important were blankets woven from dog and mountain goat hair and animal skins which were also prepared and used for clothing (Duff 1952:53, 57; Jenness n.d., pp. 45-9, 1955:7; Newcombe 1923:153-5; Suttles 1974:263, 265; Wilson 1866:288-9).

Seasonal Rounds - Halkomelem and Straits

The Fraser Delta area was occupied by Halkomelem groups, the Musqueam and Tsawwassen at the river mouth, Kwantlen, Coquitlam, Katzie and further upstream, the Nicomekl (see Figure 2-19). Several parts of this area were shared with outside groups who maintained summer villages at various resource locations; the Squamish in Burrard Inlet and English Bay, the Nanaimo and Cowichan at several places along the lower river, and the Saanich, Lummi and Semiahmoo on the eastern end of Point Roberts at Cannery Point (see references with Figure 2-19).

Boundary Bay and the Crescent Beach site (DgRr 1) lies within the territory occupied by the Nicomekl, whose lands extended from the Fraser River about Fort Langley, up the Salmon River and via a portage into the Nicomekl, Serpentine and Campbell River Valleys (Duff 1952:27; Hill Tout 1902:406; McKelvie 1947:22; Suttles 1949:3, 1955:9, 1974:28-9, 1977:1). Although this group has been called the Snokomish, it was recommended that

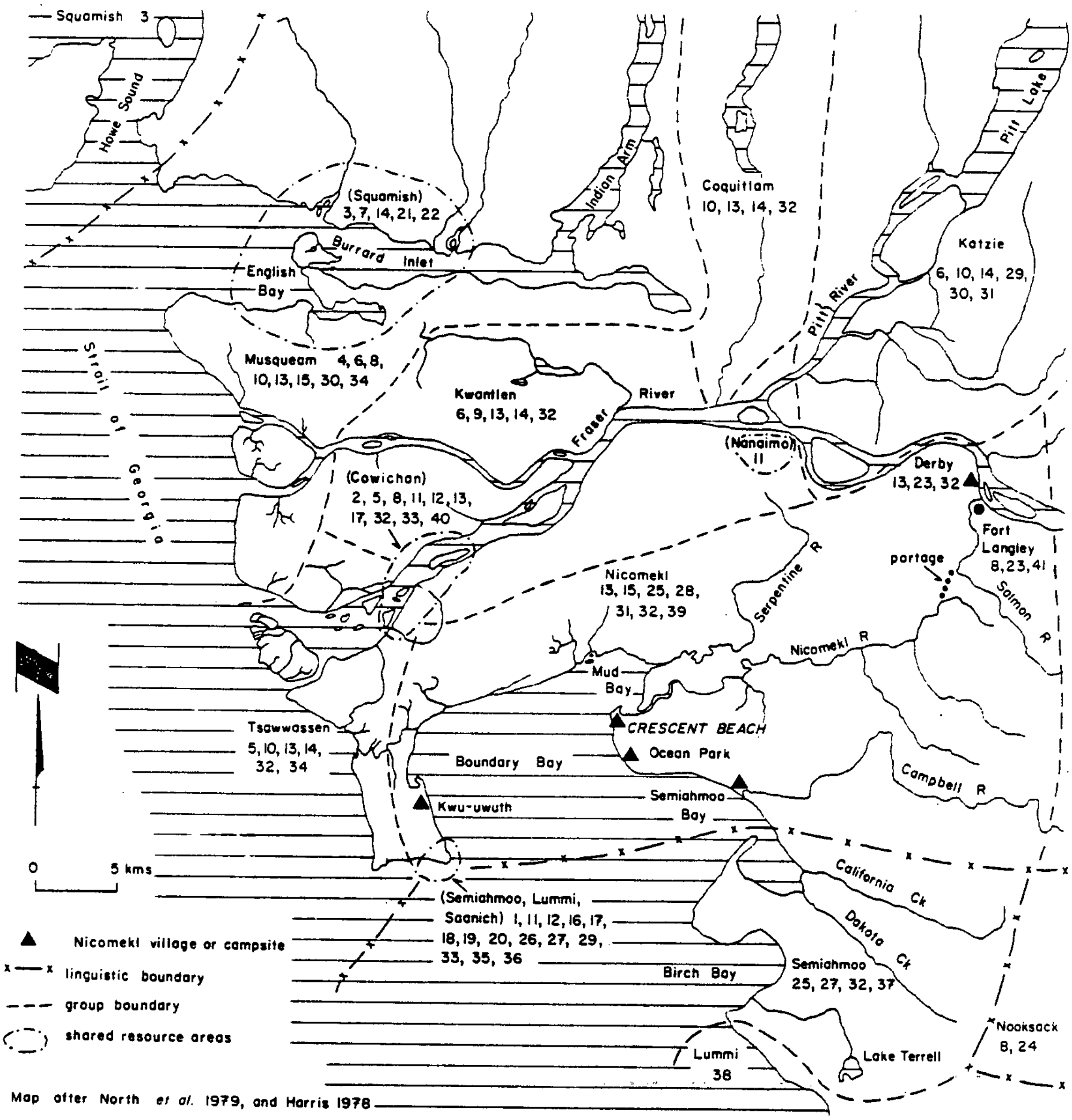
Nicomekl would be a more accurate name (Kew, Suttles, 1982, pers. comm.). This is in line with information which Suttles obtained from his oldest Semiahmoo informant that "...the original inhabitants of Mud Bay, where the Nicomekl has its mouth, were a tribe called snə'kʷəməš and that their river was called snəkʷəmáɬəɬ, now called Nicomekl..."(1955:12). Previous references to the Nicomekl include;

Snokwe'amEɬl (Hill Tout 1902:406),
Sna'koməɬ (Duff 1952:27, village name), and
Snokomish (Suttles 1949:3, 1955:9, 12, 1974:28-9, 1977).

The Nicomekl had a village on the Fraser at Derby, the original site of Fort Langley, and other villages (possibly seasonal) at Crescent Beach, Ocean Park, Kwu-uwuth at Point Roberts and at the mouth of the Campbell River (see Figure 2-19) (Duff 1952:27; Hill Tout 1902:406; Suttles 1949:3-4, 1955:12, 1974:28-9, 150, 1977:1-3). The Nicomekl settlement at the mouth of the Campbell River is presumably the habitation reported by the Spanish explorer Narvaez (see Chapter 2.7). The Nicomekl were decimated by smallpox by 1850 or before and only scattered references to them exist (Suttles 1974:29, 1977:3). It is possible however to outline seasonal rounds for two neighbouring groups, the Katzie and Semiahmoo, based on the works of Suttles (1955) and Jenness (1955) for the Katzie, and Suttles (1974) for the Semiahmoo. A hypothethical seasonal round will then be presented for the Nicomekl.

Katzie Seasonal Round

Beginning around mid-May small groups of 2 or 3 families began leaving the main Katzie villages moving to their deer, wapiti and goat hunting grounds where they lived in mat lodges. They also camped around the south end of Pitt Lake where they netted and harpooned sturgeon. Salmonberries were gathered in the early summer. By the end of July the Katzie gathered on the Fraser for the sockeye season and while waiting for the runs the men



1 Barnett 1975:20
2 Barnett 1975:22
3 Barnett 1975:31
4 Barnett 1975:33
5 Barnett 1975:5
6 Boas 1894:454
7 Bouchard & Kennedy 1974:1, 5-6
8 Duff 1952:20
9 Duff 1952:23
10 Duff 1952:24
11 Duff 1952:25
12 Duff 1952:26
13 Duff 1952:27
14 Duff 1964:25
15 Hill Tout 1902:406
16 Jenness n.d., p. 8
17 Jenness n.d., p. 10
18 Jenness n.d., p. 25
19 Jenness n.d., p. 26
20 Jenness n.d., p. 53
21 Kuipers 1969:33-39
22 Matthews 1955:8c, 40
23 Nelson 1927:5-6, 15
24 Smith 1950:332
25 Suttles 1949:3
26 Suttles 1949:7
27 Suttles 1949:8
28 Suttles 1977:1
29 Suttles 1977:3
30 Suttles 1955:8
31 Suttles 1955:9
32 Suttles 1955:12
33 Suttles 1955:13
34 Suttles 1974:6
35 Suttles 1974:21
36 Suttles 1974:23-25
37 Suttles 1974:27-33
38 Suttles 1974:33-34
39 Suttles 1974:28-29
40 Wilson 1866:286
41 McKelvie 1947:22

Figure 2-19. Ethnographic Groups, Fraser River Delta.

prepared their nets and the stagings for drying the fish. Sockeye were netted and sun dried throughout August. Whenever time permitted the women gathered large quantities of salal berries, huckleberries and other berries which were dried for the winter.

At the end of the Fraser River sockeye season, around the beginning of September, the Katzie moved to their autumn fishing sites. The South Alouette River formerly had an October run of sockeye, while both the North and South Alouette Rivers had autumn runs of coho, chum and steelhead, and in odd-numbered years pink salmon (Environment Canada 1925-1970). Throughout October the women preserved salmon, gathered wapato and picked cranberries and crab apples while the men continued fishing and hunting deer and other game, and from time to time returned with stores of preserved food to their main villages.

About November the Katzie returned to their main villages on the Fraser and at Pitt Lake. Netting of ducks and some hunting and fishing continued as well while the women were busy making clothing, mats and baskets, and weaving blankets. Late in the year chum salmon were speared at weirs and near their spawning grounds on the smaller streams, and the fish smoked in small plank smoke houses erected at these locations. The steelhead continued spawning throughout much of the winter (Environment Canada 1925-1970).

Throughout the Coast Salish area, early Fall was the traditional time for potlatches when supplies of stored food were plentiful (Jenness 1955: 8; Suttles 1974:313). During the winter months the women were busy with their manufactures while the men did some hunting (including beaver and bear) and fishing, but remained near their villages so they could attend the winter dances which were held nightly.

With the arrival of spring the sprouts of salmonberry and thimbleberry were sought and for a short period around April-May the eulachon runs arrived. These were caught with rakes similar to those used for herring and dried on sticks. After the eulachon runs the Katzie families again dispersed to their various early summer resource locations.

Semiahmoo Seasonal Round

The main Semiahmoo villages were at Semiahmoo Bay and Birch Bay. In the spring the sprouts of the horsetail as well as those of salmonberry and thimbleberry were eaten and herring were taken with herring rakes from the eelgrass beds where they spawned. The submerged net was also used at this time to catch diving ducks feeding on the herring roe. Trolling for spring and coho salmon was a common activity using herring as bait. In April and May the Semiahmoo harpooned sturgeon in Boundary Bay, during the daytime at low tide or on moonlit nights at any tide.

In May the camas blooms, and the Semiahmoo dug them from prairies near their winter villages or left their villages and travelled to the San Juan Islands for them. While the women dug and steamed camas the men probably trolled for salmon or halibut. In June, deer and wapiti were hunted on the mainland, especially around Lake Terrell. Bucks and stags were preferred at this time of year and the meat was dried for the winter. Shellfish were also gathered in the summer from various beds at Birch Bay, Semiahmoo Bay and in Boundary Bay and dried for the winter.

Late in June or early July during the lowest tides of the year, anchors for the reef-netting rigs were placed in preparation for the sockeye and pink salmon runs which began about the middle of July. The Semiahmoo had two reef net locations, one off Birch Point and the other at Cannery Point at Point Roberts which they shared with Saanich and Lummi fishermen. Most fishermen and their families stayed in mat lodges but there were a number of large plank houses at Cannery Point (Newcombe 1923:60). The fish were filleted by the women and sun-dried on large frames. Various kinds of berries were also gathered in the summer and sun dried into cakes. Crab-apples were gathered in August and stored in cattail bags to ripen in the winter.

After the sockeye and pink runs were over the Semiahmoo fished for spring, coho, and chum salmon using trawl nets and gaffs in California and Dakota Creeks or shared access to the Nicomekl weir on the Campbell River. After the Nicomekl became extinct the Semiahmoo built weirs on the Campbell and Nicomekl Rivers. Later in the autumn and during the winter beaver were hunted at Lake Terrell and both beaver and bear in the Serpentine and Nicomekl Valleys. Deer and wapiti were hunted in the autumn, concentrating on does and hinds. Ducks were also taken using pole nets at several locations including Semiahmoo Bay. As among the Katzie and other Coast Salish, autumn was the time for potlatches while winter was devoted to winter dances.

Nicomekl Seasonal Round

As the Nicomekl were extinct as a group by the mid 1800s, little information on them exists and I am indebted to Dr. Suttles for that which he has gleaned from his field notes. The Nicomekl had villages at Derby on the Fraser River, at the butt of Blackie Spit at Crescent Beach, and at the mouth of the Campbell River (Duff 1952:27; Hill Tout 1902:406; Suttles 1949:3, 1974:28-9, 150, 1977:1, 3). They also camped at Kwu-uwuth where they dug clams and harpooned sturgeon (Suttles 1949:4). In addition they had other camps (seasonal?) at Blackie Spit and Ocean Park south of Crescent Beach, as well as salmon weirs on the Nicomekl and Campbell Rivers (Suttles 1949:4, 1974:28-9, 150, 1977:1). Presumably they also had salmon weirs on the Salmon and Serpentine Rivers. However from here on we are dealing with speculation.

A few scattered references exist in historical sources which comment on the use of this area by the Coast Salish, but these activities cannot be directly attributed to the Nicomekl. Work mentions encountering two Indian boys in a lodge on the Nicomekl when he travelled up the river in December of 1824 (McKelvie 1947:22). Johnston (1958:13) reports the finding of old camp fires along the Salmon River which contained burnt beaver skulls, while Work reported numerous signs of beaver in the valley, as well as wapiti (McKelvie 1947:22-3). Lang (1967:68) mentions Indians fishing in the Nicomekl and Serpentine Rivers as well as gathering blueberries from the bog between the two rivers (see Figure 2-8). Pearson (1958:3) states that early settlers to the area observed tree burials at Blackie Spit as well as several burial huts in the Mud Bay area. One of Suttles' Semiahmoo informants reports seeing house ruins at Crescent Beach while another claimed there was a smokehouse there in the 1890s (Suttles 1974:258, 1977:1-2).

During the winter the Nicomekl probably casually hunted beaver and wapiti and perhaps deer in the Nicomekl, Serpentine and Salmon River Valleys. In the spring Fraser River groups would have participated in the eulachon fishery while those in Boundary Bay could have obtained herring and ducks. Early summer was probably spent hunting deer and wapiti in the valley and digging clams and harpooning sturgeon in Boundary Bay. In late July and August the Nicomekl would have netted sockeye and pink with other Halkomelem groups on the Fraser River and obtained blueberries and other berries from the Nicomekl-Serpentine bog. In the autumn they would have obtained salmon from their weirs on the Salmon, Serpentine, Nicomekl and Campbell Rivers. In fact the village at the mouth of the Campbell River may have been an autumn fishing weir camp like those of the Musqueam and Katzie, while the two Indian boys reported by Work may have been in a plank smoke house near a weir site, although as David Rozen (U.B.C.) has pointed out they could as easily have been on a spirit quest.

The above seasonal round is only one of many possible given the variety of resources within Nicomekl territories. It is likely that their activities were more like those of the Katzie than the Semiahmoo. Some doubt is, of course, cast by the fact that the very scant information we do have on the Nicomekl is separated from the archaeological record of this study by as much as 400 years. A hypothetical seasonal round for both the Nicomekl and the Semiahmoo is presented in Figure 4-6.

2.7 PREHISTORIC CULTURES

Archaeological research into the prehistoric cultures of the Strait of Georgia, Lower Fraser River Valley and adjacent areas dates back to the 1890s to the early work of Harlan I. Smith and others (see Thompson 1978: 7-8). The work of over 40 scholars, greatly influenced by more than 30 years of research by the late Charles Borden, has provided us with a 9,000 year cultural history outlining the development of Coast Salish Culture (see Carlson 1979:3-12; Fladmark 1981; Mitchell 1971b:29-74; Burley 1979: 19-31). This section briefly examines the Cultural Traditions which span this period (Figure 2-20).

PROTOWESTERN TRADITION

Until 14,460 B.P., all of southern British Columbia was mantled by ice from the Fraser Glaciation (Figure 2-21) while to the south the unglaciated plateaus and river valleys of the western cordillera were populated by people belonging to the Protowestern Cultural Tradition (Borden 1969:8, 1979:964). A number of temporal and regional lithic type cultures belonging to this Tradition have been identified including the "Old Cordilleran, Windust, San Diequito, Mohave Lake, and Lind Coulee" cultures (Matson 1976:281; also Mitchell 1971b:59-60; Pettigrew 1974:40-1; Swanson 1961:142-3,

Cultural Tradition	Time Scale B.P.	A.D./B.C.	Local Cultures	Locations
Modern Coast Salish	present		numerous modern villages and reserves	(see Duff 1964:25-73)
- - - - - - -	200	1,800	- - - - - - - - - - - -	
Developed Coast Salish			Gulf of Georgia (Esilao) (Stselax) (San Juan) (Whalen II)	Fraser Canyon Fraser Delta San Juan Is. Boundary Bay
	1,000	1,000		
- - - - - - -			- - - - - - - - - - - -	
	2,000	0 AD/BC	Marpole	Strait of Georgia
			- - - - - - - - - - - -	
	3,000	1,000	Locarno Beach	Strait of Georgia
			- - - - - - - - - - - -	
Proto Coast Salish	4,000	2,000		
			Charles (Eayem) (St Mungo) (Mayne)	Fraser Canyon Fraser Delta Gulf Islands
	5,000	3,000		
- - - - - - -			- - - - - - - - - - - -	
	6,000	4,000	? Lithic Cultures ?	Strait of Georgia
			? Olcott Complex ?	Puget Sound
	7,000	5,000	Old Cordilleran Cultures (Mazama)	Fraser Canyon
Protowestern				
			(Glenrose III)	Fraser Delta
	8,000	6,000	(Bear Cove Early)	Northern Vancouver Is.
	9,000	7,000	(Milliken)	Fraser Canyon
	10,000	8,000		
- - - ? - - -	11,000	9,000	? - - - - - - - - - - - ?	
	12,000	10,000	Manis	Olympic Pen.

Sources: Borden 1970, 1975, Butler 1961, C. Carlson 1979, Carlson 1970, Gustafson et al. 1979, Matson 1976, Mitchell 1971b.

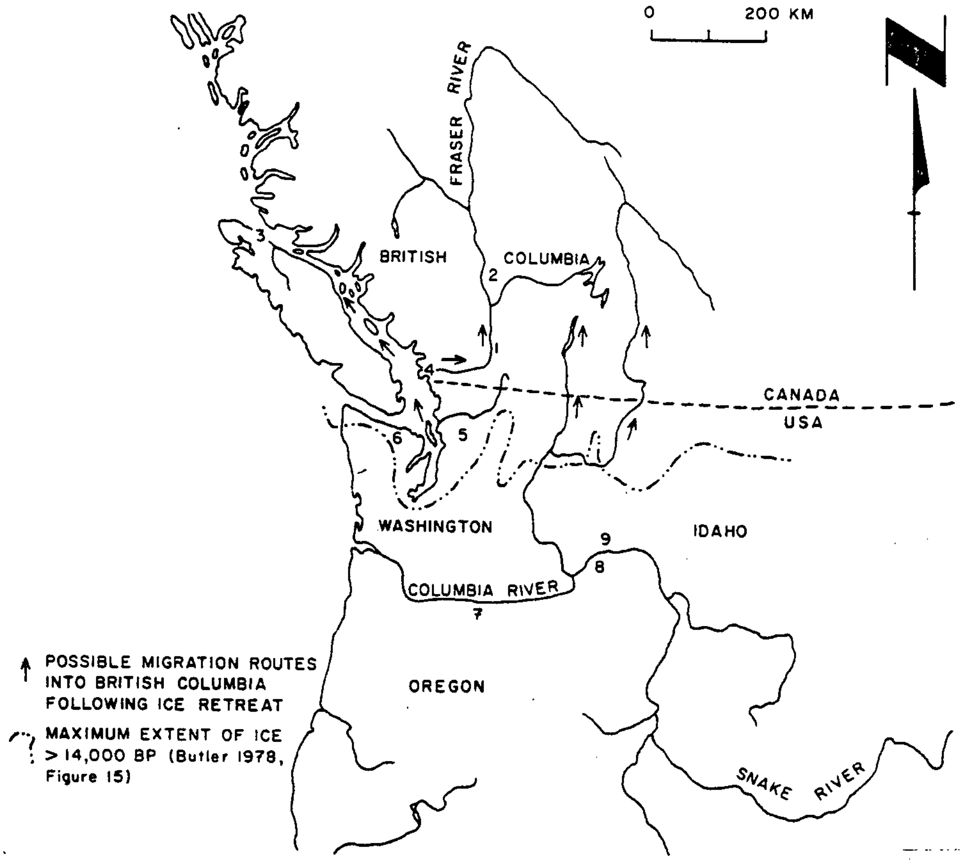
Cultural boundaries are approximate as considerable overlap exists between dated assemblages. See Figure 2-30.

Figure 2-20. Cultural History of the Strait of Georgia and Lower Fraser River Valley.

1962:153-7). Along the Lower Columbia River were people of the Old Cordilleran Culture who spread northward as the ice retreated (Borden 1979:965; Butler 1961:63-4; Warren 1968:27-8). By 8,000 B.P. southwestern British Columbia had been populated by descendents of these people to the north end of Vancouver Island on the coast and into the southern Interior Plateau (C. Carlson 1979:183, 190; Sanger 1969:192, 1970:112, 126). In addition to the Early Bear Cove and Lochnore III cultures, other local occurrences of this Tradition include the Milliken and Mazama Phases in the Fraser Canyon, Glenrose III in the Fraser Delta, and the Olcott Complex in Puget Sound (see Figure 2-21 references).

The most common artifacts from these early sites include: large asymmetric and symmetric biface knives, laurel-leaf points or knives (Cascade or Olcott points), formed and unformed flake scrapers, pebble tools, pebble cores, cortex spall tools, hammerstones, edge-battered cobbles, and large quantities of lithic detritus (Borden 1957:107, 113, 1961:4, 1962:10, 1969:8, 1975:63-70; Bryan 1965:175; C. Carlson 1979:183; Matson 1976:289-292). Less common are leaf-shaped shouldered points or knives, contracting stem points or knives, occasionally crude or well made macroblades, stone wedges and/or bipolar cores, anvil stones, abrasive stones, ground and polished steatite objects (Milliken Phase), quartz crystal, notched sinker stones, ochre, obsidian flakes (Milliken obsidian from Oregon), and a few ground stone fragments (Glenrose III) (Borden 1975:63-70, 107; C. Carlson 1979:183; Matson 1976:158, 289-292). Preservation of bone and antler artifacts is rare, C. Carlson reporting 1 piece each of worked bone and antler (1979:183), while Matson has reported several pieces of worked bone and antler as well as bone awls, antler wedges, and a unilaterally barbed bone point (1976:291-2).

The lack of preservation of faunal remains at the Milliken site has



1 Milliken (DjRi 3) 9000-7190 B.P. (Borden 1975:62)
2 Lochnore (EdRk 7) no C_{14} dates (Sanger 1969:192, 1970:112,126)
3 Bear Cove (EeSu 8) 8020 B.P. (Carlson 1979:183, 190)
4 Glenrose (DgRr 6) 8150-5730 B.P. (Matson 1976:17-18
5 Olcott (45SN14) no C_{14} dates (Butler 1961:47-49)
6 Manis (45CA218) 6000-12,000 B.P. (Gustafson et al. 1979:158, 162)
7 Five Mile Rapids (35WS1) 9785-6090 B.P. (Cressman et al. 1960:60,66)
8 Ash Cave (45WW61) 7940 B.P. (Butler 1962:71)
9 Marmes (45FR50) 10,810-7400 B.P. (Rice 1972:31)

Figure 2-21. Distribution of Some Old Cordilleran and Other Protowestern Tradition Cultures.

restricted our knowledge about subsistence activities, although from the presence of charred cherry pits Borden inferred the site was occupied during the salmon season in August and September, salmon being important as it was during ethnographic times (Borden 1961:4, 1962:10, 1975:63, 1979:966). Borden (1961:4, 1975:63) also reported stake molds which perhaps indicate that the salmon were being sun or air dried on raised frames similar to the practice of recent Salish (Duff 1952:66).

Fortunately preservation is somewhat improved on the coast. At Bear Cove, C. Carlson (1979:188) has reported 332 fish bones and fragments, 72% rockcod (Sebastes sp.), and 10% salmon with lesser quantities of Pacific cod, pollock, sculpin, greenling, dogfish and ratfish. Mammalian remains are dominated by sea mammals (78%), mostly porpoise and dolphin, with some northern fur seal, sea lion, sea otter and harbour seal. Land mammals consist mostly of deer with some dog and river otter while bird remains include loon, gull, and common murre. Carlson (1979:189) infers that the site occupants had watercraft and sea mammal hunting technology, and that the site was seasonally occupied although the season is not indicated.

The Glenrose III layers provide a glimpse of the subsistence activities of these early people in the Fraser Delta area. Wapiti, deer, and seal are most important with traces of beaver, mink, and unidentified bird remains (Imamoto 1976:26, 32). Salmon are the most common fish remains which also include stickleback, eulachon, starry flounder and sturgeon (Casteel 1976: 85-6). These layers also contain the earliest evidence of the use of shellfish, mostly Mytilus edulis although butter clam (Saxidomus giganteus), cockle (Clinocardium nuttalli), littleneck (Venerupis tenerrima) and barnacles (Balanus sp.) are also present, and a few pieces of sea mussel (M. californianus) suggesting contact with the outer San Juan Islands or Juan de Fuca Strait (Ham 1976:58-60). Combining seasonal indicators Matson infers that these deposits resulted from early summer and summer occupations by several canoe travelling nuclear families (1976:298-9).

With our present knowledge of these early people it is clear that by 8,000 B.P. and probably earlier they possessed the technologies and procurement strategies to obtain practically all the resources used by the

Coast Salish, although not necessarily the same technologies nor as wide a range. Some form of watercraft, perhaps dugouts, was used and probably some form of plank or bark covered frame dwelling, which may account for the presence of antler wedges at Glenrose. Although their implements and weapons were manufactured largely from pebble core and biface industries, a rarely preserved bone and antler industry was present as well as the first traces of a ground stone industry. Population density was probably low, and with the widespread similarity of archaeological cutlures from Puget Sound and the Fraser River to northern Vancouver Island, it is apparent that these groups may have exploited very similar types of resources, and travelled long distances in their annual round, frequently encountering other groups with whom they traded goods and ideas, and with whom they would have intermarried.

PROTO-COAST SALISH TRADITION

Beginning some 5,500 years ago and for the next 4,000 years we find a series of cultures which share many basic traits with Developed Coast Salish Culture. Subsistence reflects the importance of fish and land mammals (especially salmon and deer), followed by shellfish and waterfowl with a weak dependence upon sea mammals (see Figure 2-22). The archaeological fauna assemblages in Figure 2-22 are ranked from most common to least common as reported in the cited sources and should be regarded with caution. Very rarely preserved are plant foods which were probably at least as important as shellfish.

Preserved material culture reflects its origins in the earlier Proto-western Tradition (Borden 1975:72, 87; Matson 1976:285), and through successive cultures we can trace the development and increasing importance of ground stone, worked bone and antler industries at the expense of chipped stone (see Figure 2-23). By inference and some limited archaeological data, it is also during this time that woodworking and plant fiber industries develop. In the earliest Proto-Coast Salish cultures we may find the first evidence of ascribed status (see Figure 2-27 below).

The existence of a single, long tradition has been recognized by previous researchers (Adams 1981:362-3; Calvert 1970:75; Burley 1979:30-1, 102-3; Carlson 1975; Kidd 1965:189; Matson 1976:305, 1981:84-5; McMurdo 1974:161; Mitchell 1971b:61-74). In light of this cultural continuity throughout most of the area traditionally occupied by the Strait of Georgia Salish, I propose we consider these cultures as members of a Proto-Coast Salish Cultural Tradition.

Charles Culture Type

The earliest of these cultures are members of the Charles Culture Type composed of three local cultures including the Eayem, St. Mungo, and Mayne Phases which Borden grouped into his Charles Phase (Borden 1975:71-6, 97; Carlson 1970:115-7; Matson 1976:283). Mitchell (1971b:46-7) establishes the use of Culture Type to classify similar and temporally related assemblages in the Strait of Georgia and as I believe we may find regional classifications such as phases of value in dealing with local cultures, the Culture Type label is used for Borden's Charles Phase. Dated assemblages range from 5,490 to 3,280 B.P. and are found along the Lower Fraser River Valley and the Strait of Georgia (see Figure 2-24).

Artifact forms retained from earlier times include pebble tools, cortex spall tools, large and small biface knives and points, single-shouldered knives or points, stone wedges and/or bipolar cores, quartz crystal artifacts, large and small abrasive stones, bone awls, antler wedges, unilaterally barbed bone points, and an increase in decorative items of bone and stone (Boehm 1973a:50-2; Borden 1975:71-6; Carlson 1970:115; Matson 1976:289-292, 299; Percy 1974:256-9). New artifacts include contracting-stem points,

		Culture				
		Old Cordilleran	Charles	Locarno	Marpole	Gulf of Georgia
rank	1	L.M.	F.	L.M.	L.M.	L.M.
	2	F.	L.M.	F.	F.	F.
	3	S.M.	S.F.	S.F.	S.F.	S.F.
	4	B.	S.M.	B.	B.	B.
	5	S.F.	B.	S.M.	S.M.	S.M.
# sites		(1)	(3)	(3)	(7)	(6)

Key: L.M. - land mammal, dominated throughout by deer and wapiti, followed by beaver and bear.

F. - fish, dominated by salmon, followed by sturgeon on the river, herring and rockcod on the coast.

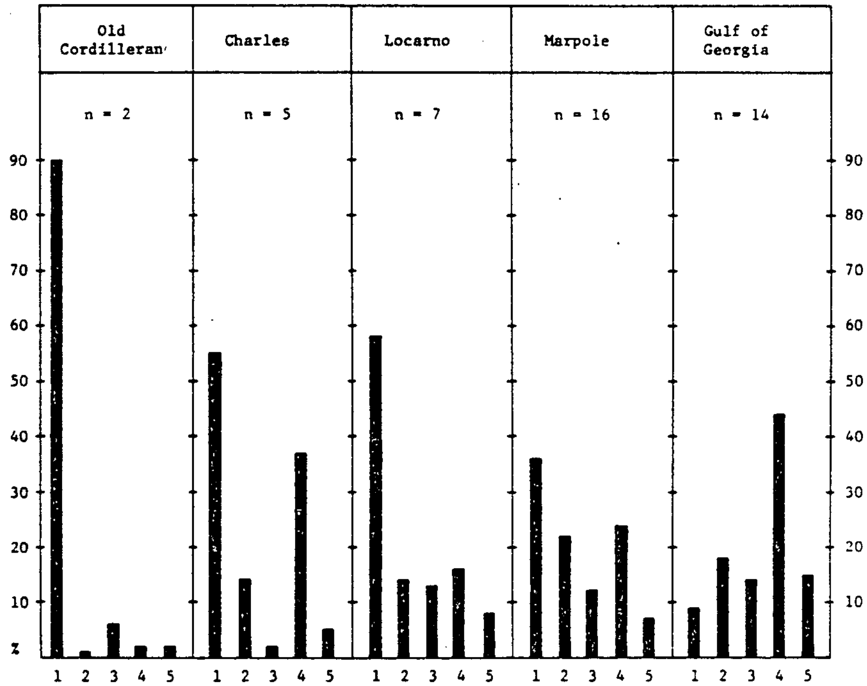
S.F. - shellfish, all types, except for Old Cordilleran (1 site) which is mainly Mytilus edulis.

B. - bird, dominated throughout by ducks, followed by geese.

S.M. - sea mammal, low frequency throughout, mainly seal.

Sources: Boucher 1976, Capes 1964, 1977, Boehm 1973a, 1973b, Ham 1974, 1976, this study, Imamoto 1976, Matson 1976, Mitchell 1971a, 1971b, Monks 1977.

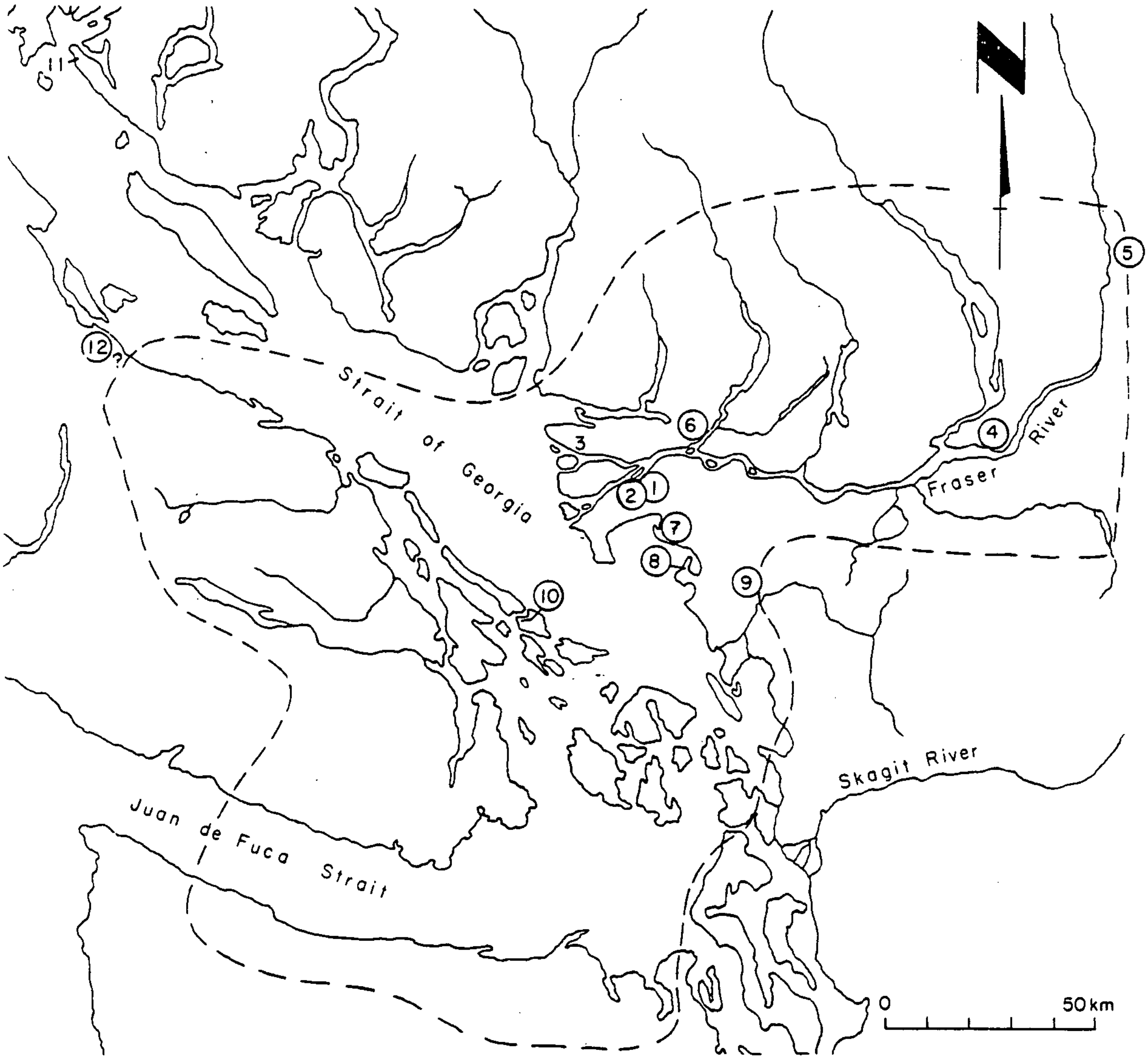
Figure 2-22. Distribution of Faunal Classes Through Time, Strait of Georgia Area.



Key: 1 = chipped stone, 2 = ground stone, 3 = pecked and ground stone, 4 = bone artifacts, 5 = antler artifacts.

Sources: Archer 1974, A.S.B.C. 1975, Boehm 1973a, Burley 1979, Capes 1964, C. Carlson 1979, Charlton 1977, Haggarty & Sendey 1976, Ham, this study, Kew 1955, LeClair 1976, Matson 1974, 1976, McMurdo 1974, Mitchell 1971a, 1971b, 1979, Monks 1976, 1977, Percy 1974, 1977, Seymour 1976, Spurling 1976.

Figure 2-23. Distribution of Industries Through Time, Strait of Georgia Area.



APPROXIMATE BOUNDARY OF STRAITS AND HALKOMELEM SPEAKERS AT CONTACT

(9) C^{14} DATED ASSEMBLAGE

1	DgRr 6	Glenrose (Matson 1976)	3280-4240 B.P.		7	DgRr 1	Crescent Beach (Percy 1974)	4270 B.P.
2	DgRr 2	St Mungo (Boehm 1973b)	3970-4310 B.P.		8	45WH17	Semiahmoo Spit (Grabert & Larsen 1975)	4100 B.P.
3	DhRs 1	Marpole (Burley 1979)	no dates		9	45WH37	Nooksack River (Grabert & Larsen 1975)	4180 B.P.
4	DhRk 8	Maurer (LeClair 1976)	3860-4780 B.P.		10	DfRu 8	Helen Point (Borden 1975)	3950-5420 B.P.
5	DjRi 5	Esilao (Borden 1975)	3790-5490 B.P.		11	EaSe 2	Bliss Landing (Beattie 1972)	no dates
6	DhRq 21	Pitt River (Patenaude pers. comm.)	3300-4390 B.P.		12	DiSe 7	Deep Bay (Monks 1977)	4860 B.P. ?

Figure 2-24. Distribution of Charles Culture Type Assemblages.

small end scrapers, chipped stone drills, chipped and ground slate knives and points, flat-pointed awls, large and small bone unipoints and bipoints, antler tine wedges, shell disc beads and shell adze blades, bilaterally barbed antler harpoons, bone blades or points, bone wedges, a few ground stone disc beads and ground stone adzes (Boehm 1973a:50-2; Borden 1975:71-6; Carlson 1970:115; Matson 1976:289-292; Percy 1974:256-9).

Extended burials and the use of labrets are also reported for Mayne phase materials by Carlson (1970:115; see also Keddie 1981:66), and by Beattie (1979:314) who reports labret wear on the teeth of an extended male burial from Bliss Landing (EaSu 2) (see also Beattie and Percy n.d.). Another male burial from Mayne Phase deposits at this same site exhibits lambdoidal cranial deformation (Beattie 1979:313). Lambdoidal cranial deformation of a male is also reported at Deep Bay (DiSe 7) where Monks (1977:354-368; Beattie 1979:308) recovered a cairn burial which he places in the "Lithic Culture Type" although the associated radiocarbon date of 4860 B.P. falls well within the range of the Charles Culture Type. Clearly, additional evidence is required to securely establish the presence of ascribed status in the Charles Culture. Mitchell (1971b:54) and Matson (1976:302) have suggested cranial deformation as a possible indicator of ranking, while ethnographically labrets were considered a sign of rank on the northern coast (see Ethnography above).

Carlson (1970:115) also reports the presence of a microblade industry for the Mayne Phase and other researchers have reported it for other Proto-Coast Salish Cultures (Borden 1962:16-7, 1970:109; Matson 1976:126-8; Mitchell 1968, 1971b:52, 57). Sanger (1968:111) has pointed out that Strait of Georgia microblade technology represents a different technology from the prepared core and blade industry of the Interior Plateau, a view often repeated by Magne (1980, 1981, pers. comm.).

Magne's argument is that a microblade-like blade may be fortuitously produced during the manufacture of chipped stone tools such as bifaces, and thus microblade industries should not be inferred unless microblade cores are also present. To test Magne's hypothesis, I examined the detritus from the experimental manufacture of 4 bifaces (1 basalt, 3 obsidian) and 1 obsidian bipolar core (see Magne 1981). A total of 5 blades were removed with mean measurements of 1.52 x 0.71 x 0.14 cm, comparing well with ranges of 1.50 to 1.70 cm x 0.57 to 0.69 cm x 0.14 to 0.19 cm reported by Magne (1979) for Interior Plateau microblades.

Review of the archaeological literature revealed the proverbial can of worms. Microblades are commonly reported from assemblages lacking microblade cores of the same material while many of the blades are of quartz crystal (Archer 1974:23-4; Beattie 1972:30; Borden 1962:Plate 7; Burley 1979:355-6, 582; Capes 1977:72; Carlson 1960:572, 574; Mitchell 1968:13, 1971b:47, 156, 1979:83; Monks 1977:98). Some reported microblade cores are in fact described as bipolar cores, many are of quartz crystal, some of which are reported as bipolar cores, some as quartz crystal cores, some as quartz crystal <u>pièces esquillées</u>, and thrown in for good measure are stone wedges and <u>pièces esquillées</u> of various materials, some apparently suited to production of microliths, others which are not, yet all exhibiting some degree of bipolar damage (Beattie 1972:30; Borden 1962:pl. 7i; Burley 1979:368, 582, 593-4; Capes 1977:72; Carlson 1960:572, 574; Haggarty and Sendey 1976:18, 27; Kenny 1974:277; Mitchell 1968:13; 1979:85, 87; Monks 1977:91).

Insofar as I could tell, the evidence for microblade cores consists of the following:

> one "problematic obsidian core fragment" from Cattle Point (Carlson 1960:574),

> three cores from Cadboro Bay (Mitchell 1968:13, also Borden 1962: Pl. 7j),
>
> one basalt core from the Royal Victoria Yacht Club, DcRt 8 (Mitchell 1968:13),
>
> one "not convincing" basalt keel-shaped microblade core from Glenrose I (Matson 1976:128),
>
> three cylindrical microblade cores of obsidian also from Glenrose I (Matson 1976:128),
>
> and one basalt core found "...out of situ in an area disturbed by bulldozing" at the Pitt River site (Patenaude 1982:7-8).

Seven of the ten cores, three from Cadboro Bay and four from Glenrose I are associated with dated Marpole assemblages. Thus, evidence for at least the manufacture of microblades would appear restricted to the Marpole Phase where even there it was rare, 2 out of 16 dated Marpole assemblages yielding microblade cores. We must also consider the very good possibility that prepared microblades were being traded from the Interior Plateau which would account for the fine obsidian microblades Borden (1962:Pl. 7a) reports from Whalen II, and probably some others from the Strait of Georgia as well. It is apparent that this issue requires a more detailed examination.

However, throughout the entire Proto-Coast Salish Cultural Tradition there appears to be consistent, although poorly reported evidence for a quartz crystal microlith or blade industry (originally noted by Carlson, 1954:21-2) which also sometimes includes materials of obsidian and basalt of various qualities. In the majority of cases these blades appear to have been produced using bipolar technology. Patenaude (n.d.) has described a bipolar quartz crystal blade industry from the Pitt River site which lends additional support to the above suggestion that the role of these artifacts in the Strait of Georgia area requires re-evaluation.

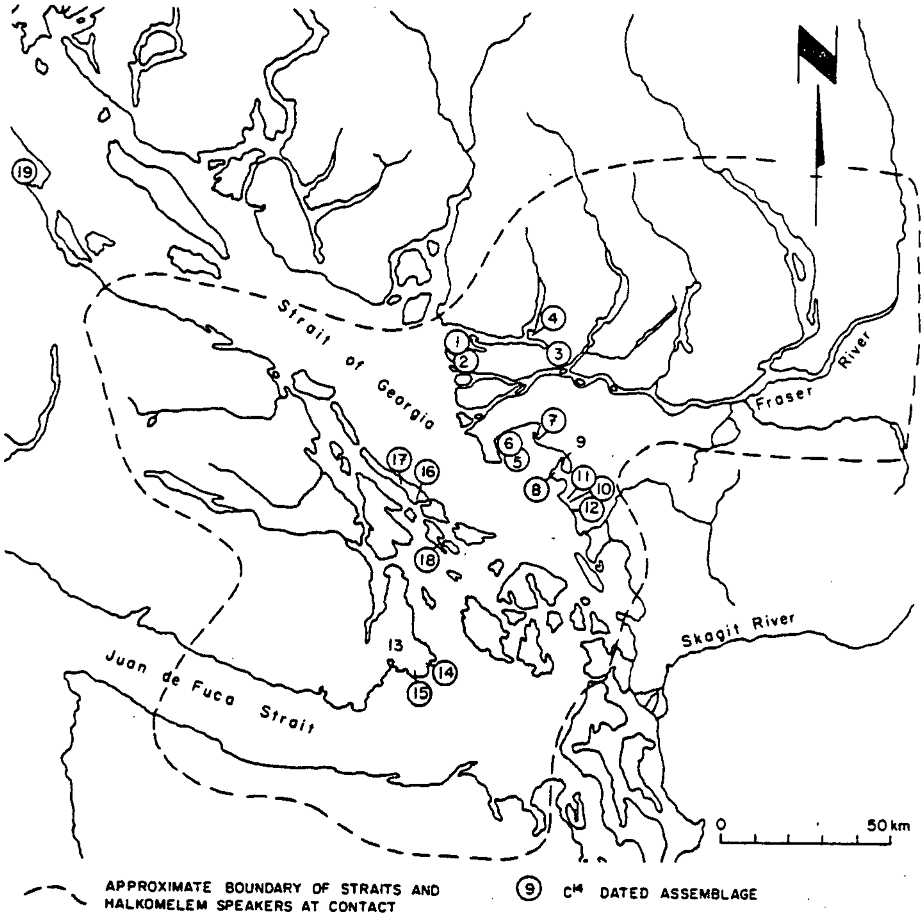
Flenniken (1981) has discussed the production of microliths from vein quartz pebbles using bipolar percussion at the Hoko River site (45CA213).

The lack of vein quartz materials, and to my knowledge the lack of "pie shaped split cobble cores" (Flenniken 1981:37) from the Fraser Delta area suggests some differences between the nature of this industry at Hoko River and the Delta sites. Flenniken (1981:56) does however point out the likely prehistoric existence of "...stone tools employed as bone, antler, and wood wedges (pièces esquillées) but bipolar cores are not the same tool". Unfortunately Flenniken's (1981:51-56) experimental studies of pièces esquillées failed to provide clues which would allow us to segregate them from exhausted bipolar cores. In addition to their possible use with bone, antler and wood as suggested by Flenniken, their possible connection with the pecked-ground stone industry should be investigated, in particular in pecking out stone bowls, sinkers and other items.

As with the microblade industry, bipolar core and stone wedge industries in the Strait of Georgia also require some specialized attention. It was not possible to segregate these two artifacts in the archaeological literature and thus the reason they are lumped together here. It seems though that one or both types are present in the Protowestern Tradition and persist through the following Proto-Coast Salish and Developed Coast Salish Traditions.

Locarno Beach Culture Type

Occupying the intermediate period of the Proto-Coast Salish Cultural Tradition is the Locarno Beach Culture Type named for the Locarno Beach site (DhRt 6), first excavated by Borden in 1948 (Borden 1950:14; Mitchell 1971b:56). Similar assemblages have been recovered from sites in the Fraser Delta and southern Strait of Georgia with radiocarbon dates ranging from 3520 to 2200 B.P. (Figure 2-25). Unfortunately most of these assemblages remain poorly reported including the type site and the large collection from Zone A of the Musqueam NE site (DhRt 4), although these assemblages contain some of the more intriguing artifacts from the region.



1	DhRt 6	Locarno Beach (Borden 1970)	2270–2450 B.P.
2	DhRt 4	Musqueam NE (Borden & Archer 1975)	2550–2970 B.P.
3	DhRq 21	Pitt River (Patenaude 1980, pers. comm.)	2630–2960 B.P.
4	DhRr 6	Belcarra (Charlton 1977)	1710 B.P. (rejected)
5	DgRs 14	Whalen Farm (Wilmeth 1977)	2450 B.P.
6	DgRs 1	Beach Grove (Ball 1979)	2810–3200 B.P.
7	DgRr 1	Crescent Beach (Trace 1977a, 1977b)	2350–3150 B.P.
8	45WH48	Simonarson (Montgomery & Grabert 1977)	3495 B.P.
9	45WH17	Semiahmoo Spit (Montgomery & Grabert 1977)	no dates
10	45WH9	Birch Bay (Grabert & Spear 1976)	3125 B.P.
11	45WH74	Blackwood Add. (Montgomery & Grabert 1977)	no dates
12	45WH1	Cherry Point (Schwartz & Grabert 1973)	2630 B.P.
13	DcRu 38	Quick's Pond (Mitchell 1971b)	no dates
14	DcRt 10	Willow's Beach (Kenny 1974)	2490–2630 B.P.
15	DcRt 13	Bowker Creek (Mitchell 1979)	2740–2910 B.P.
16	DfRu 23	Georgeson Bay (Haggarty & Sendey 1976)	2820 B.P.
17	DfRu 13	Montague Harbour (Mitchell 1971b)	2890–3160 B.P.
18	DeRt 2	Pender Canal (Mitchell 1971b)	2200 B.P.
19	DkSf 2	Millard Creek (Capes 1977)	3480–3520 B.P.

Figure 2-25. Distribution of Locarno Beach Culture Type Assemblages.

Mitchell (1971b:57) has provided a list of distinctive traits for the Locarno Beach Culture Type including:

> medium-sized chipped basalt points, many with contracting stems; microblades and cores (but see above); chipped slate or sandstone knives, or scrapers of generally ovoid or ulu shape; crude cobble, split cobble and boulder spall implements; large, faceted

> ground slate points and similar points of bone; thick ground slate knives, often only partially ground; small, well made celts, rectangular in plan and cross-section; Gulf Islands complex artifacts...(see also Duff 1956); labrets of several forms; earspools; grooved or notched sinkers; handstones and grinding slabs; heavy bone wedges; bilaterally barbed antler points; toggling harpoons of unarmed, one-piece toggling or composite form; antler foreshafts for above harpoons; sea mussel shell celts; clay lined depressions and alignment of vertically placed rock slabs;...

It has been suggested (Matson 1981, pers. comm.) that some researchers may be contemplating assigning some early Marpole assemblages to the late Locarno Beach Phase. I do not find this surprising and expect that future research and reevaluation of recovered collections may result in several realignments of local cultural phases. This is highly likely given the poor reporting of many assemblages and the noise created by our current lack of control over seasonality, settlement pattern, as well as variation in social status and dominance of various prehistoric family groups at various times and places.

Possible evidence of ascribed status during the Charles Culture was discussed above, while in the Locarno Beach Cultures this evidence is much more substantive, thanks to studies conducted by Beattie (1980). The presence of labrets as a Locarno Beach Culture trait has been pointed out above. Particularly interesting is that of the 7 crania examined by Beattie from Crescent Beach II; 5 male crania exhibit evidence of labret wear, one of which also has lambdoidal cranial deformation, as well as one additional male cranium with deformation but lacking signs of labret wear (Beattie 1980:190-206). One female cranium exhibits slight lambdoidal deformation but no labret wear (Beattie 1980:200). Also of interest is burial 5 from Crescent Beach II; a male with labret wear and lambdoidal cranial deformation, with which were associated 1 chipped stone point, 3 bone awls, 2 pebble core tools, 3 stone and 2 shell beads, 2 abraders, 2 retouched flakes, 8 utilized flakes and 3 fragments of worked bone

(Beattie 1980:197; Percy 1974:39). Grave goods were also associated with some of the other Crescent Beach II male burials including burial 3 (with labret wear), burial 8 (with labret wear), and burial 10 (an old male without labret wear or cranial deformation, but with 57 stone and 14 shell beads) (Beattie 1980:194, 201; Percy 1974:35, 39).

Other tantalizing examples of possible high status male burials from Locarno Beach deposits is a tightly flexed, eastward facing cairn burial from Montague Harbour I (Mitchell 1971b:147, burial 6). Haggarty and Sendey (1976:18, 66) report a cairn-like structure from Georgeson Bay I containing unsexed scattered human remains, ochre, a pointed bone fragment, a notched stone, quartz crystal, and a rectangular nephrite object, but rightly are reluctant to interpret this feature as a burial cairn. In addition, Capes (1977:66) reports a male burial with cranial deformation from the basal deposits of the Millard Creek site (DkSf 2).

It was pointed out earlier in this chapter that the bulk of the material culture of the Coast Salish consisted of items manufactured from perishable plant materials which are not preserved at most archaeological sites in this area, except under a few exceptional circumstances. Artifacts of plant materials recovered from water-saturated deposits at Musqueam NE (DhRt 4) in 1973 and 1974 indicate well developed cordage, basketry and woodworking industries dating back to 2970 B.P. (Borden and Archer 1975:1; Borden 1976a:235). Recovered material includes small baskets, large heavy duty utility baskets, large gauge (6-9 cm) netting, wrapped sinker stones, cordage of a variety of gauges, yew wood wedges, possible tool hafts, pieces of split cedar and numerous cedar chips (Borden 1976a). A test unit excavated at a portion of the Pitt River site (DhRq 21) in 1980 also encountered water-saturated deposits dating to 2930 B.P. containing carved wooden objects, basketry, and adzed stakes (Patenaude 1980, pers. comm.).

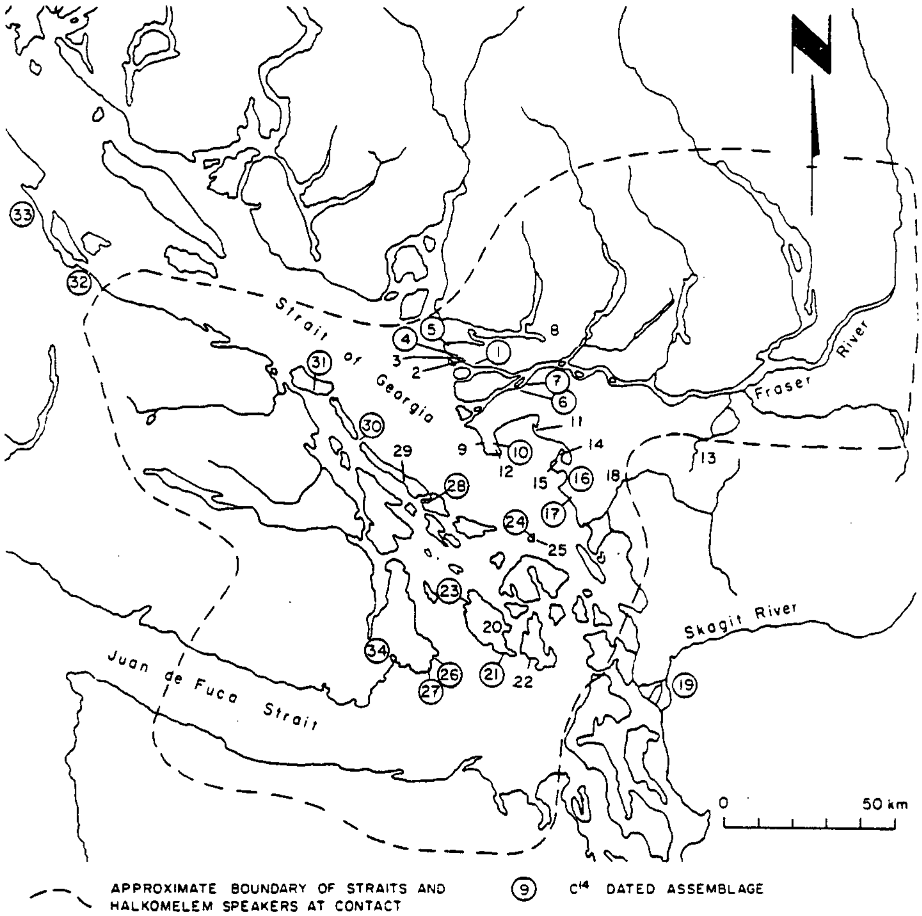
Croes and Blinman (1980:206, 208, 212, 247-9) have pointed out the distinctiveness of Strait of Georgia/Puget Sound cordage and basketry over the last 3000 years when compared to north coast and west coast material. This is supportive of the suggestion that we consider Strait of Georgia cultures over the last 5000 years as part of a continuous Proto-Coast Salish Cultural Tradition.

Marpole Culture Type

The last Proto-Coast Salish Culture is the Marpole Culture Type named for the Marpole Midden in Vancouver (DhRs 1) (Borden 1950:18; Burley 1979; Mitchell 1971b:52-6). With dates between 2630 and 1100 B.P., Marpole assemblages have been recovered throughout the southern Strait of Georgia (Figure 2-26).

Based to a great extent on its elaborate antler and pecked-ground stone art, Marpole Culture has sometimes been regarded as a classic stage or developmental plateau of Strait of Georgia cultures, followed by somewhat of a decline (Borden 1962:13, 1968:19, 1976b; Burley 1979:73; Mitchell 1971b:72). While there is no doubt that the art observed in early Proto-Coast Salish Cultures is greatly expanded upon in Marpole Cultures, Mitchell prefers to view the evidence as an early achievement, while later art at least equals that of Marpole (1971b:72). This stance is strongly supported by the ethnological collection of Coast Salish art recently displayed by the U.B.C. Museum of Anthropology (Visions of Power, October 1980-April 1981).

Much of the stone sculpture from this area is poorly dated (Borden 1968:19; Burley 1979:72; Duff 1956:94; Mitchell 1971b:53-4, 72), while of 58 pieces reported by Duff (1975:168-177), 5 may be assigned date estimates between 3,000 and 1,000 B.P., while 5 more are associated with Marpole assemblages. Duff (1956:55-9) has discussed the ethnographic information



1	DhRs 1	Marpole (Burley 1979)	1510–2450 B.P.
2	DhRs 19	Liquid Air (Archer 1974, Percy 1977)	no dates
3	DhRt 4	Musqueam NE (Borden & Archer 1974)	no dates
4	DhRt 3	Musqueam N (Monks 1976)	1910–2350 B.P.
5	DhRt 5	Point Grey (Wilmeth 1977)	1970 B.P.
6	DgRr 2	St Mungo (Boehm 1973b)	1120 B.P.
7	DgRr 6	Glenrose (Matson 1976)	2030–2310 B.P.
8	DhRq 1	Noons Creek (Charlton 1977)	no dates
9	DgRs 11	English Bluff (A.S.B.C. 1975)	no dates
10	DgRs 1	Beach Grove (Burley 1979)	1390–2170 B.P.
11	DgRr 1	Crescent Beach (Trace 1977b)	no dates
12	DfRs 3	Whalen Farm (Seymour 1976)	no dates
13	45WH5	Sumas River (Grabert & Larsen 1975)	no dates
14	45WH17	Semiahmoo Spit (Montgomery & Grabert 1977)	no dates
15	45WH48	Simonarson (Montgomery & Grabert 1977)	no dates
16	45WH9	Birch Bay (Gaston & Grabert 1976)	1945 B.P.
17	45WH1	Cherry Point (Grabert & Larsen 1975)	2340 B.P.
18	45WH34	Nooksack River (Grabert & Larsen 1975)	no dates
19	45SK41	Soler (Thompson 1978)	2680 B.P.
20	45SJ2	Argyle Lagoon (Carlson 1960)	no dates
21	45SJ1	Cattle Point (Robinson & Thompson 1978)	1880–2310 B.P.
22	45SJ185	Richardson (Carlson 1960)	no dates
23	45SJ25	Garrison (Burley 1979)	1580–2100 B.P.
24		Fox Cove (Burley 1979)	1710 B.P.
25	45SJ105	Fossil Bay (Kidd 1969)	no dates
26	DcRt 15	Cadboro Bay (Burley 1979)	1810 B.P.
27	DcRt 10	Willow's Beach (Kenny 1974)	2490–2630 B.P.
28	DfRu 8	Helen Point (Burley 1979)	1100–2110 B.P.
29	DfRu 13	Montague Harbour (Mitchell 1971b)	no dates
30	DgRv 3	Dionisio Point (Mitchell 1971a)	1880–2160 B.P.
31	DgRw 4	False Narrows (Mitchell 1971b)	1710 B.P.
32	DiSe 7	Deep Bay (Monks 1977)	1910–2630 B.P.
33	DkSf 2	Millard Creek (Capes 1977)	1780 B.P.
34	DcRu 12	Maple Bank (Abbott 1980, pers. comm.)	2055–2245 B.P.

Figure 2-26. Distribution of Marpole Culture Type Assemmblages.

on the use of stone figurine bowls and other stone sculpture by Coast Salish ritualists in a wide range of purification and life crisis ceremonies. Care should be taken in associating scarcity of ethnographic information of stone sculpture with decline in use. To my knowledge, no ethnographer ever talked to a traditional Coast Salish ritualist, and given the nature of the use of these items including those representing guardian spirits, it is doubtful how much information would have been obtained.

Also present in Marpole assemblages are microblade cores (see above); triangular chipped stone knives and points, although they are not as frequent and point size decreases reflecting introduction of the bow and arrow; perforated stones; nipple-top hand mauls; nephrite celts in a range of sizes; uniformly thin ground slate knives; large quantities of ground disc beads; small to medium sized triangular and eared ground slate points with flat surfaces and faceted edges, as well as some medium size stemmed or notched, and large faceted or lenticular shaped ground slate points; several types of unilaterally barbed nontoggling harpoons (Marpole harpoons); large fixed unilaterally barbed antler points; a variety of toggling harpoons, all of which are rare; while missing are Gulf Islands complex artifacts, and some types of ground stone and bone points common in Locarno assemblages, while small bone points, arming tips and composite fish-hook barbs are more common in late deposits (Burley 1979:59-85; Matson et al, n.d., p. 65: Mitchell 1971b:52).

Also found in Marpole assemblages are many of the bone, antler and bipolar tools common throughout Proto-Coast Salish assemblages. As more assemblages are recovered archaeologists have found that most "diagnostic" traits are not exclusive to the phase or Culture Type they are supposed to define, which led Matson (1974) to attempt multivariate forms of analysis.

Matson (1974) was able to demonstrate fairly good agreement between the results of his cluster and scaling analysis and the established chronological sequence. In light of our lack of control over settlement pattern, seasonality, and variation in status (not to mention sample size), such agreement is at the very least reassuring. Future research will hopefully use more of this type of analysis although many collections must be re-examined first.

Evidence of high status individuals is widely evident in Marpole Culture with various forms of cranial deformation and labret wear present on both male and female remains (see Figure 2-27). Also present is a variety of burial practises as might be expected in a stratified society including flexed midden burials, cairn burials, burials with grave goods, and scattered human remains suggesting above-ground inhumation (Burley 1979: 86-7). Many burials are richly endowed with grave goods, several fine examples coming from the Beach Grove site (DgRs 1). Abbott (1962:48-54) has reported several, among them an infant burial containing copper fragments and 580 whole and 33 sectional Dentalium beads, and an adult male with a copper gorget covered with more than 80 Dentalium beads. Another burial from this same site was a double burial containing two steatite beads, a carved antler ring, a few Dentalium beads, and "...a profusion of clam shell disc beads..." which covered the burials from head to foot (Smith 1964:51). Beattie (1980:220) has noted evidence that these two young adult males may have been siblings. A cairn burial of an adult male from the Marpole site (DhRs 1), surmounted by a large seated figurine, was reported by Burley (1979:561). Hall and Haggarty (1981) have recently reported on Marpole interments at the Hill site (DfRu 4) which had associated labrets, disc beads, an earspool, and other artifacts.

Several Marpole Culture Type sites from the western Fraser Delta area

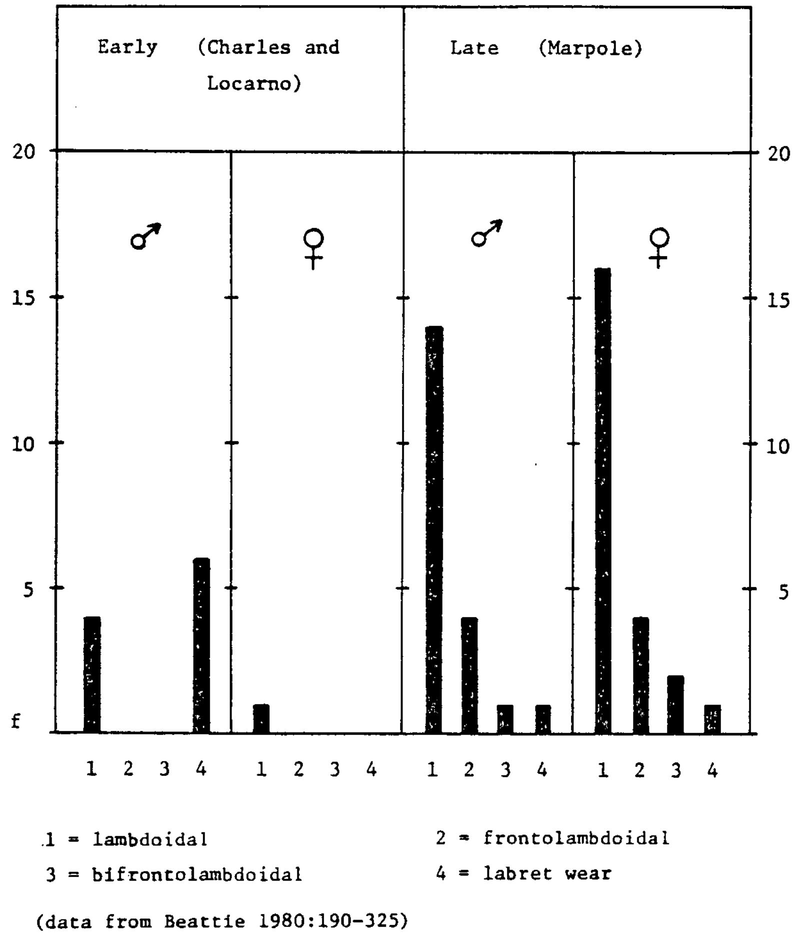


Figure 2-27. Distribution of Cranial Deformation and Labret Wear, Proto-Coast Salish Cultures.

may have been fortified villages, or were perhaps purposely placed in easily defendable locations. Five sites, Marpole, Liquid Air, Musqueam North, Point Grey and English Bluff are all situated between 15 and 40 m above sea level (see Figure 2-26, numbers 1, 2, 4, 5, and 9). It is not clear if these sites were the forerunners of late period trench embankment sites (see Figure 2-29). George MacDonald (1982, pers. comm.) has pointed out that it is during this time that defensive sites are noted on the north coast of British Columbia.

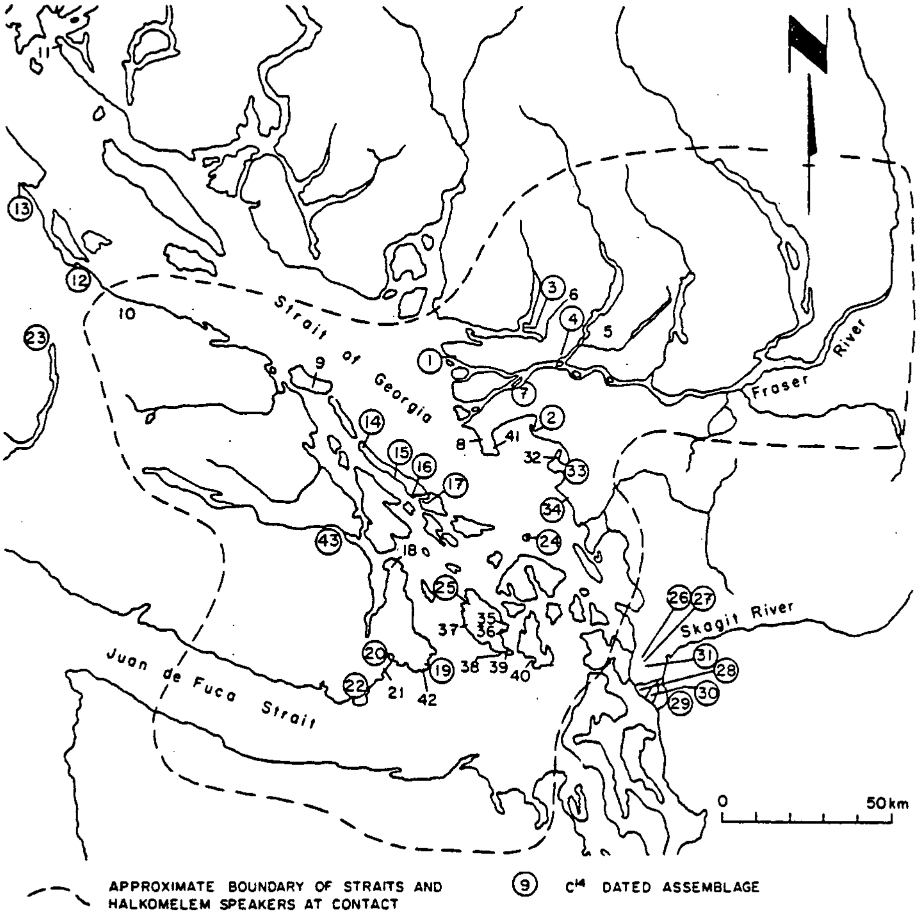
DEVELOPED COAST SALISH TRADITION

Gulf of Georgia Culture Type

In the millenia preceeding European contact, Coast Salish culture in the Lower Fraser River Valley and Strait of Georgia consisted of several local archaeological cultures which Mitchell (1971b:47) has called the Gulf of Georgia Culture Type, including the San Juan, Stselax, and Esilao Phases (Borden 1970, Carlson 1970). These cultures exhibit strong geographic correlation with the Straits and Halkomelem groups discussed above. An additional culture, the Whalen II Phase tentatively classed as Marpole Type by Mitchell (1971b:56), may represent a seasonal assemblage (see Chapter 6). Developed Coast Salish Culture is synonymous with ethnographically reported Coast Salish Culture, the culmination of the developments observed in the Proto-Coast Salish Cultures.

Dating between 1600 and 200 B.P. (Figure 2-28), Developed Coast Salish assemblages exhibit a continuation of many traits found in Proto-Coast Salish material culture, but with an increase in the percentage of bone artifacts and a decrease in those made of chipped stone (Figure 2-23). Not all assemblages conform to this generalization, either because of preservation, or because of the seasonal use of some sites and the restricted or specialized range of activities and artifacts at these sites.

Well in excess of 100 artifact types have been recovered from late assemblages which I have grouped into 8 major classes based on the archaeological literature and the ethnographic sources consulted above (Table II-II). Artifacts have been classed as very common (reported in 5 or more assemblages), common (3-4 assemblages), and uncommon (1-2 assemblages) based upon 18 reported late assemblages (see Table II-II references). I recognize fully that many of these artifacts are multipurpose, some have unknown uses, and that many assemblages are incompletely reported or contain very small samples. There is no doubt that future research will succeed in



1	DhRt 2	Stselax (Borden 1970)	660 B.P.
2	DgRr 1	Crescent Beach (Ham, this study)	480–1350 B.P.
3	DhRr 6	Belcarra (Charlton 1977)	1070–1620 B.P.
4	DhRq 21	Pitt River (Patenaude 1980, pers. comm.)	216–1190 B.P.
5	DhRp 11	Carruthers (Crowe-Swords 1974)	no dates
6	DhRq 1	Noons Creek (Charleton 1972)	no dates
7	DgRr 2	St Mungo (Boehm 1973b)	390–800 B.P.
8	DgRs 9	Tsawwassen Beach (A.S.B.C. 1975)	no dates
9	DgRw 4	False Narrows (Burley 1979)	no dates
10	DiSc 1	Little Qualicum R. (Bernick 1977)	no dates
11	EaSe 2	Bliss Landing (Beattie 1972)	no dates
12	DiSe 7	Deep Bay (Monks 1977)	460–900 B.P.
13	DkSg 2	Sandwick (Capes 1964)	400 B.P.
14	DgRv 3	Dionisio Point (Mitchell 1971a)	1400 B.P.
15	DfRu 13	Montague Harbour (Mitchell 1971b)	730–790 B.P.
16	DfRu 24	Georgeson Bay (Haggarty & Sendey 1976)	750 B.P.
17	DfRu 8	Helen Point (Carlson 1981, pers. comm.)	640–700 B.P.
18	DeRu 36	Towner Bay (Mitchell 1968)	no dates
19	DcRt 10	Willow's Beach (Kenny 1974)	270 B.P.
20	DcRu 12	Maple Bank (Abbott 1981, pers. comm.)	170–1460 B.P.
21	DcRu 2	Esquimalt Lagoon (Spurling 1976)	no dates
22	DcRv 1	Pedder Bay (Wilmeth 1978)	140–1580 B.P.
23	DhSe 2	Shoemaker Bay (McMillan 1981, pers. comm.)	500–820 B.P.
24	45SJ105	Fossil Bay (Kidd 1969)	1514 B.P.
25	45SJ24	English Camp (Thompson 1978)	820–1030 B.P.
26	45SK51	Pedersen (Thompson 1978)	1160–1190 B.P.
27	45SK53	Osterhof (Thompson 1978)	675–1120 B.P.
28	45SK33	Fishtown (Thompson 1978)	425 B.P.
29	45SK59A	Conway (Thompson 1978)	800–1270 B.P.
30	45SK37A	Tronsdal (Thompson 1978)	400–640 B.P.
31	45SK77	Niderost (Thompson 1978)	1080–1340 B.P.
32	45WH17	Semiahmoo Spit (Montgomery & Grabert 1977)	no dates
33	45WH9	Birch Bay (Grabert & Spear 1976)	1285 B.P.
34	45WH1	Cherry Point (Schwartz & Grabert 1973)	960–1300 B.P.
35	45SJ5	Moore (Carlson 1960)	no dates
36	45SJ4	Turn Point (Carlson 1960)	no dates
37	45SJ99	Lime Kiln (Carlson 1960)	no dates
38	45SJ1	Cattle Point (Carlson 1960)	no dates
39	45SJ3	Jekyll's Lagoon (Carlson 1960)	no dates
40	45SJ186	Mackaye (Carlson 1960)	no dates
41	DfRs 3	Whalen II (Borden 1970)	1580 B.P.
42	DcRt 1	Shoal Bay (Mitchell 1980)	no dates
43	DeRv 107	Cowichan Bay (Yip 1982)	780–1240 B.P.

Figure 2-28. Developed Coast Salish Assemblages.

	VERY COMMON	COMMON	UNCOMMON
Manufacture (including chipping, pecking, grinding, and sawing of stone, bone, antler, shell)	ground slate detritus bone detritus antler detritus chipped stone detritus *M. californianus* fragments hammerstones cobble cores/pebble tools bipolar cores/stone wedges sandstone saws small irregular abrasives shaped abrasives	quartz crystal materials slate rods abrasive slabs cobbles with flattened faces	anvil stones antler tine tip chipped stone gravers chipped stone drills abraded whale bone intervertebral disc
Woodworking (including pole and and plank manufacture as well as canoes, boxes, etc.)	serpentine celts or adzes antler wedges nipple and flat top hand mauls bone chisels or wedges *M. californianus* celts antler sleeve hafts bone drills		antler haft for beaver incisor antler hafts for chisels or adzes
Textiles (including skin working, matting, basketry and weaving)	split and sectioned bone awls deer ulna awls retouched flakes, scrapers utilized flakes bird bone awls, bird bone splinter awls distally incised eye, bone needles		antler awls cortex spall tools
Ceremonial-Decorative Items	*Dentalium* beads disc beads (stone/shell) bone blanket pins *Pecten* shell ochre	steatite pipes bone pendants	labrets antler pendants *Olivella* shell beads bird bone whistles bird bone tubes, beads earspool fragment
Hunting (including gear for bows and arrows, spears and lances, deer nets)	small barbed bone leisters for arrows large barbed bone leisters for spears wedge based blunt bird points	chipped stone side-notched points bone, antler harpoons with line guards, or line groove chipped stone corner-notched points	bone, antler rings fixed bone and antler unilaterally barbed points small, barbed antler points large bone spear (?) points side notched ground slate points stemmed, chipped stone arrow points stemmed, ground slate arrow points
Fishing (including gear for nets, composite fish hooks, fish spears, tanged/incised bone and antler harpoons, toggling harpoons [see below])	toggling harpoons bone bipoints bone unipoints thin, round bone and antler points basally thinned bone points	bird bone points notched sinker stones bone, antler harpoons with line guards, or line groove	bone, antler rings fixed, bone and antler unilaterally barbed points incised bone points
Toggling Harpoons (single 3 piece head harpoon used for salmon, trout, seal, sea lion, beaver)	slotted, channelled, and tapered antler harpoon valves thin, round bone and antler points triangular ground stone points small triangular chipped stone points wedge based bone points		large triangular chipped stone points basal notched ground stone points antler foreshafts corner notched ground slate points *M. californianus* points one piece slotted toggling harpoon
Food Preparation (including hand knives and other tools)	broken boiling stones leaf shaped bifaces stemmed bifaces chipped slate knives ground slate knives leaf shaped, ground stone, bone and antler knives		antler tine knife hafts perforated stone microblades

Sources: Beattie 1972, Boehm 1973a, Borden 1950, Calvert 1970, Capes 1964, Carlson 1954, 1960, 1970, Charlton 1977, Crowe-Swords 1974, Haggarty & Sendey 1976, Ham, this study, Kew 1955, Mitchell 1971a, 1971b, Monks 1977.

Table II-II. Developed Coast Salish Artifact Types.

refining this classification.

Most artifacts are as described by previous researchers, although a few warrant discussion here. Disc beads (under Ceremonial-Decorative Items) reported in a number of assemblages are relatively rare, except for late deposits from the Pitt River site (DhRq 21) where 76 beads were recovered (Patenaude n.d.). Five ground stone disc beads were also recovered from Layers A and B at Crescent Beach, in association with, or later than a date of 480 B.P. from Layer B (see Figure 5-8). Burley (1979:69) has suggested that disc beads should be expected in late period assemblages, while Jenness (n.d., p. 50) reported that women sometimes wore necklaces of small stone beads. Yip (1982) recovered disc beads from the Cowichan Bay site which dates between 780 and 1,240 B.P.

Overall there is a decrease in decorative items in late assemblages which may in part be related to possible changes in burial practises, and to the increase in use of wood and other perishable materials. It was noted above that the use of labrets was not observed among the Coast Salish at contact, and their presence in late assemblages are rare. A portion of a stone labret stem was recovered from Layer A at Crescent Beach, while labrets were also recovered from late deposits at the Pitt River Site (Patenaude n.d.), and the Cowichan Bay site (Yip 1982). The one reported earspool is a fragment of worked bone, also from Layer A at Crescent Beach, and is very similar to one reported by Duff (1956:D49).

Other artifacts requiring some discussion here are perforated stones, sometimes reported as perforated sinker stones. Matthews (1955:94) illustrates their use as described to him by August Jack Khahtsahlano, cedar dust beneath the stone being ignited from the friction of twirling a stick in the top half of the stone. The same use for these artifacts was indicated by a group of Musqueam elders while touring the U.B.C. Museum of Anthropology, calling the perforated stones "Indian matches" (Steve August to Valerie

Patenaude, February 21, 1977). A number of these artifacts in the U.B.C. collections were examined and found to have polished wear in one half of their biconical holes, but no evidence of carbon was observed.

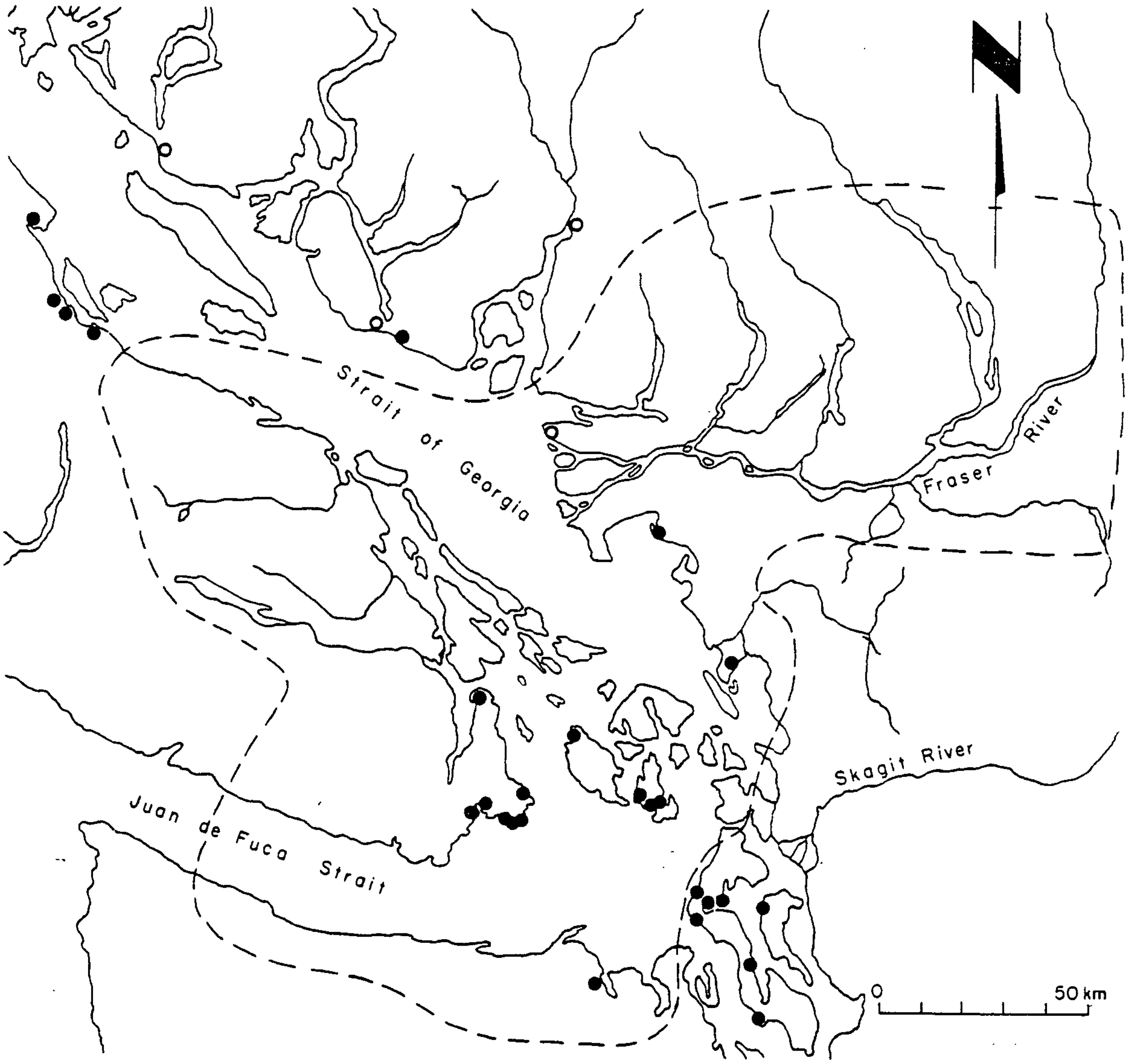
An undetermined number of artifacts was very likely traded, either as finished products, or as raw material. Artifacts which may fit into this group include Dentalium, Pecten, Olivella, and Mytilus californianus shells, whale bone blanks, steatite pipes, serpentine celts, small triangular side-notched chipped stone arrow points, microblades (Whalen II), and possibly others. In addition to the above shell species several others were apparently traded as well. Tresus capax, Venerupis tennerima, Saxidomus giganteus and Mytilus edulis have been identified from archaeological sites in the Interior Plateau (Ham 1975:180-2, n.d.). Locally, unmodified shell valves were used as spoons and ladles, as bowls to catch grease from roasting meat, and to transport live coals for starting fires (Barnett 1975:63-4, 74, 125; Elmendorf 1960:131, 135-6; Haeberlin and Gunther 1930:24; Jenness n.d., p. 43; Stern 1934:52). Duff (1952:95) reports that dried clams were an important item traded to the Upper Stalo by coastal groups. Coast Salish trade practises are not well known, but if their widespread social contacts are any indication, trade in raw materials and finished artifacts was no doubt very important throughout all of Coast Salish prehistory.

Burial practises of Developed Coast Salish Culture appear as varied as they were during the Marpole Phase. The archaeological evidence indicates several burial styles including; loosely flexed midden burials, sitting position and cairn midden burials, and scattered incomplete interments suggesting above ground burials; while all have relatively few grave goods (Burley 1979:337-8; Haggarty and Sendey 1976:66; Ham, this study; Mitchell 1971b:218-9; Monks 1977:355).

Borden (1970:112) has reported the historic use of small plank mortuary houses at Stselax while mortuary houses as well as tree burials have been reported for Crescent Beach and Mud Bay (Pearson 1958:3). Tree burials, canoe burials, mortuary houses, wooden grave figures and carved wooden coffins (Barnett 1975:217; Jenness n.d., p. 90; Suttles 1974:473-5) are all more compatible with designated burial grounds rather than with midden burials. These would be separate from midden-habitation areas and thus not as likely to be encountered during archaeological excavations. Suttles (1977:1) had indicated that the southeastern portion of Crescent Beach was a burial ground, a contention supported by a test unit excavated there in 1975 (see site description below). It is quite conceivable that late midden burials are those of people of much lower rank than those persons buried in tree burials or mortuary houses at designated family graveyards. Even though the archaeological information is scant, it does indicate a variety of burial practises as might be expected from a ranked society.

In the ethnographic portion of this chapter it was pointed out that cranial deformation was practised by anyone of good family in Coast Salish society, regardless of sex. Fronto-lambdoidal or the Cowichan type of cranial deformation appeared with Marpole crania (see Figure 2-27) and in the late period became the dominant form (Beattie 1980:45-6, 61). Matthews (1955: 202) reports that Tim Moodie from the Squamish village in North Vancouver who died in December 1936 was one of the last surviving Coast Salish with a deformed skull, apparently of the Cowichan type, while Suttles (1982, pers. comm.) indicated two of his Straits informants in the 1940s had deformed skulls.

Scattered throughout the Strait of Georgia are numerous trench-embankment structures which probably served as defensive sites (Figure 2-29). All of these sites appear to rest on bluffs facing the sea and are bounded on two other sides either by the sea or ravines. Trenches have been excavated



APPROXIMATE BOUNDARY OF STRAITS AND HALKOMELEM SPEAKERS AT CONTACT

● VERIFIED SITE

O REPORTED, NOT VERIFIED

Sources: Bryan 1963: Pl. 12, Mitchell 1968:41, Smith 1907:323, fieldnotes Box 9, files 2, 3, 4.

Figure 2-29. Distribution of Trench-Embankment Sites.

across the landward sides of these sites and the fill heaped up to form an embankment (Bryan 1963:75; Buxton 1969; Mitchell 1968:29-30, 41; Smith 1907: 323, fieldnotes, Box 9, files 2, 3, 4). Excavations at two of these sites by Mitchell (1968:32, 42, 44) revealed pcst-stake molds which he suggests may be the remains of posts which supported a plank wall similar to those of Coast Salish plank houses (see Spanish illustration in Gunther 1972:63).

Also associated with these sites are thin shell midden deposits and occasionally house outlines (Bryan 1963:73-4; Mitchell 1968:45; Smith field-notes, Box 9, files 2, 3, 4). Bryan (1963:77) concludes that these structures are post contact while Mitchell (1968:45) cautiously suggests they date to the late portion of the Gulf of Georgia Culture Type. Given their wide distribution, the scanty ethnographic information about them, and the fact that they are quite numerous (although poorly dated), we should be prepared for the possiblity that they may have been in use for most if not all of the time period represented by Gulf of Georgia Culture. Detailed study and archaeological dating of these sites will be somewhat hampered by the fact that many have been destroyed by modern development.

Summary, Linguistic and Physical Anthropology

In summary, it is apparent that people of the Old Cordilleran Cultures had populated the Strait of Georgia area by 8-9,000 years ago. Between 4,500 and 5,500 years ago we find evidence for the first signs of the development of Coast Salish Culture. Although there have probably been some small population movements in and out of the area, there is no indication of any massive population influx or replacement. Basically, the archaeological data to date favour in situ development of Coast Salish Culture, and even though many pages have been devoted to dislocation versus continuity, no one has presented any concrete evidence to support a foreign presence in the area prior to European contact. The reader interested in these arguments will find them thoroughly handled in several sources (see Burley 1979:94-118; Fladmark 1975:263-280; Mitchell 1971b:67-79). Following European contact and the introduction of guns, disease and whiskey, most groups shifted their boundaries to include desirable resource locations which belonged to their vanished neighbours. Such movements have been reported for the southern Kwakiutl, Kwantlen, Comox, Chilliwack, Sheshalt, Semiahmoo, Sooke, Clallam, and Lummi (Barnett 1975:24-5; Boas 1890:584, 1894:455; Duff 1952:21, 43-4; McMillan 1981:89; Suttles 1974:9-10, 29, 35).

Agreeing closely with the archaeological interpretations presented here are several linguistic studies which point to the Fraser Delta/southern Strait of Georgia/Puget Sound as the original homeland of the Salish speaking peoples (Jorgensen 1969:23, 90; Kincade and Powell 1976:91, 93; Suttles and Elmendorf 1963:45; Suttles 1979:27). These same studies suggest early separation of Coastal and Interior Salish although some contact has been maintained. Swadesh (1950) in an analysis of lexical relationships arrived at a separation date of 6,900 years, a value later revised to 5,500 years (Swadesh 1953:42). Although lexicostatistics have been rejected as being based on false assumption (Kinkade and Powell 1976:84), this latter date is closely compatible with our earliest radiocarbon estimates of 4780-5490 B.P. for assemblages belonging to the Charles Culture Type, the first of the Proto-Coast Salish Tradition Cultures (Figure 2-24).

I will leave evaluation of lexicostatistics to linguistic studies although an interesting test of divergence values would be comparison of Bella Coola cultural history to that of the Fraser Delta/Strait of Georgia. A divergence value of 5,500 years is suggested by Suttles and Elmendorf (1963:47) while Jorgensen (1969:45) argues the Bella Coola moved north from a southern point. Hill-Tout (1902:407) relates a Kwantlen belief about a group he argues may have been the ancestors of the Bella Coola, while Jenness (1955:88) has pointed out similarities between Bella Coola and Katzie cosmogenic myths. Boas (1891, 1897) also noted the Bella Coola language was more closely related to Coast Salish than Interior Salish as has Kuipers (1981:328) in a recent study. The possibilities are certainly intriguing and at the very least suggest closer ties between archaeologists and linguists would be mutually beneficial.

Additional support for continuity of Coast Salish populations in this area may be found in physical anthropology studies of Northwest Coast skeletal materials. Overall there is general agreement that the Coast Salish, Interior Salish, Nootka and Kwakiutl are of common population (Cybulski 1975:v; Finnegan 1972:91-2; Heglar 1957:70; last two sources cited in Beattie 1980:19, 22). Based on cranial morphology Beattie (1980:88-92, 165) makes a general conclusion that his Early (Charles and Locarno) and Late (Marpole and Late Period) samples tend to diverge less from Coast Salish samples than from any other. Although Beattie (1980:170) is not prepared to argue for or against a continuity model, there is some question as to whether his sample sizes were adequate to identify the range of variation present in the overall population. As Beattie (1980:28) points out, this unfortunate problem will probably always plague physical anthropologists.

One other item deserves a brief discussion at this point. A recurring issue in the cultural history of this area concerns the temporal overlap of various Proto-Coast Salish and Developed Coast Salish Cultures. An indication of the extent of this phenomenon may be obtained from Figure 2-30. Some lessening of temporal overlap would result if early Marpole assemblages were assigned to late Locarno cultures as mentioned above, and if Whalen II is included with Marpole Cultures following Mitchell (1971b:56). I included it with the Developed Coast Salish Cultures as I feel it is no more divergent than late materials from Crescent Beach. A persistent culture historian could probably make a case for placing the basal deposits of this study in Marpole as well.

Overall I feel this concern arises from our desire for neat tidy boundaries which would approve of a clear lineal development such as is represented by line (X) in Figure 2-30. This does not face up to the real issues involved however. When we take into account our near total ignorance

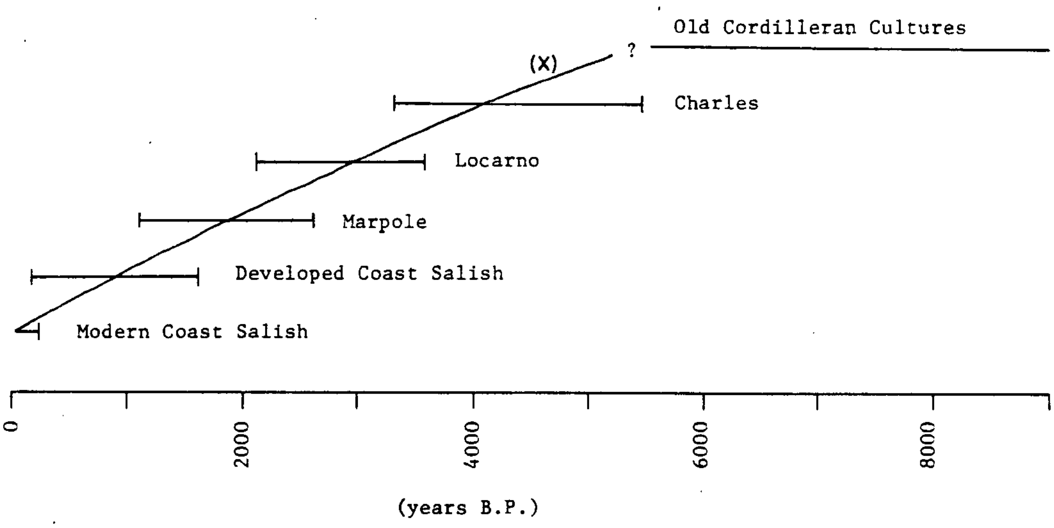


Figure 2-30. Temporal Overlap of Proto-Coast Salish and Developed Coast Salish Chronologies.

of settlement pattern, variations in seasonal activities and associated artifact assemblages, and factors such as cultural lag and the variation in wealth and status of various groups both ethnographically and prehistorically, it is doubtful such culture historical refinements will contribute much substantive information to our knowledge of the evolution of Coast Salish Culture.

2.8 THE CRESCENT BEACH SITE AND NEIGHBOURS

DgRr 1, The Crescent Beach Site

The Crescent Beach Site is situated at the mouth of the Nicomekl River approximately 6 km north of the Canada-U.S.A. border (Figures 1-1, 1-2, 2-31). The modern community of Crescent Beach is part of the Municipality of Surrey and occupies some 70 ha of lowland at the northwest tip of the White Rock Uplands. Originally shell midden mounds and other cultural deposits extended over some 18 ha, the majority of these deposits being now destroyed or seriously disturbed. Detailed area by area descriptions of cultural deposits at Crescent Beach may be found elsewhere (Ham 1977:62-81,

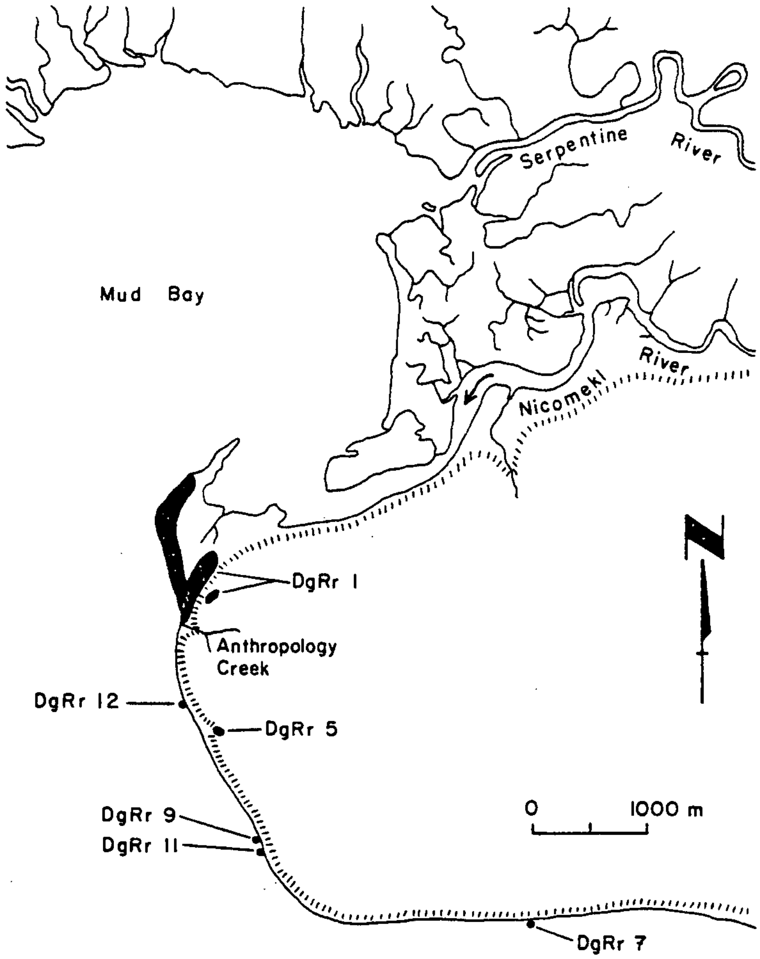


Figure 2-31. The Crescent Beach Site (DgRr 1) and Neighbours.

1978:6-8).

Harlan I. Smith visited this "...rich large shell-heap..." on August 7, 1915, and found that the northeastern deposits had already been destroyed during construction of the Great Northern Railway (Smith, fieldnotes: Box 10, file 5). Over the next 65 years urban growth has destroyed most remaining cultural deposits, the last surviving midden mounds having been leveled for a park early in 1980. During 1976 and 1977, observation of deposits exposed by water and sewer line excavations, examination of local garden plots and flower beds, as well as augering, coring and shovel testing made it possible to compile a map of the original extent of shell midden deposits (see Figure 2-32). At the south end of the Burlington Northern trestle (northeastern portion of Crescent Beach) is an extensive deposit of oyster and clam shells from a historic shellfish cannery which operated there until the early 1960s (Hoos and Packman 1974:86; Taylor 1970:27). Some portions of these deposits are as yet unvegetated (1976) while in adjacent areas substantial quantities of fill have been imported including shell midden material from other parts of Crescent Beach. (Figure 2-32 is based on a municipal contour map which is not necessarily tied into the same datum as this study).

The oldest dated deposits at Crescent Beach rest upon beach sands at the base of the White Rock Uplands. Materials associated with Mayne and Locarno Beach phases were recovered during excavations conducted by Percy in 1972 (1974, see location 1, Figure 2-32), by Ham in 1976 (Trace 1977a, 1977b, see location 2), and by Will and Trace in 1977 (Trace 1977b, see location 3). Shell midden deposits to the west of the above excavations are suspected of containing materials dating to the Marpole phase, although they have not been tested archaeologically except for a burial salvage conducted by Abbott and the U.B.C. Archaeology Club in 1958 (U.B.C. Books N6, A24; see location 6, Figure 2-32).

Late period deposits at Crescent Beach rest on accretion spit sands built by the northward moving longshore drift currents in Boundary Bay (Kellerhals and Murray 1969:68, 73; Swinbanks and Murray 1978:2). Test Unit A excavated near the foot of the spit deposits recovered cultural materials similar to late period materials from Musqueam (Ham and Broderick 1976:5, see location 4, Figure 2-32). Test Unit B excavated between Maple Street and the Burlington Northern Railway encountered poorly stratified dark humus with scattered shell, firecracked rock, ash, and several human burials including one with grave goods (Ham and Broderick 1976:6, see location 5, Figure 2-32). Although these deposits are undated it is suspected they

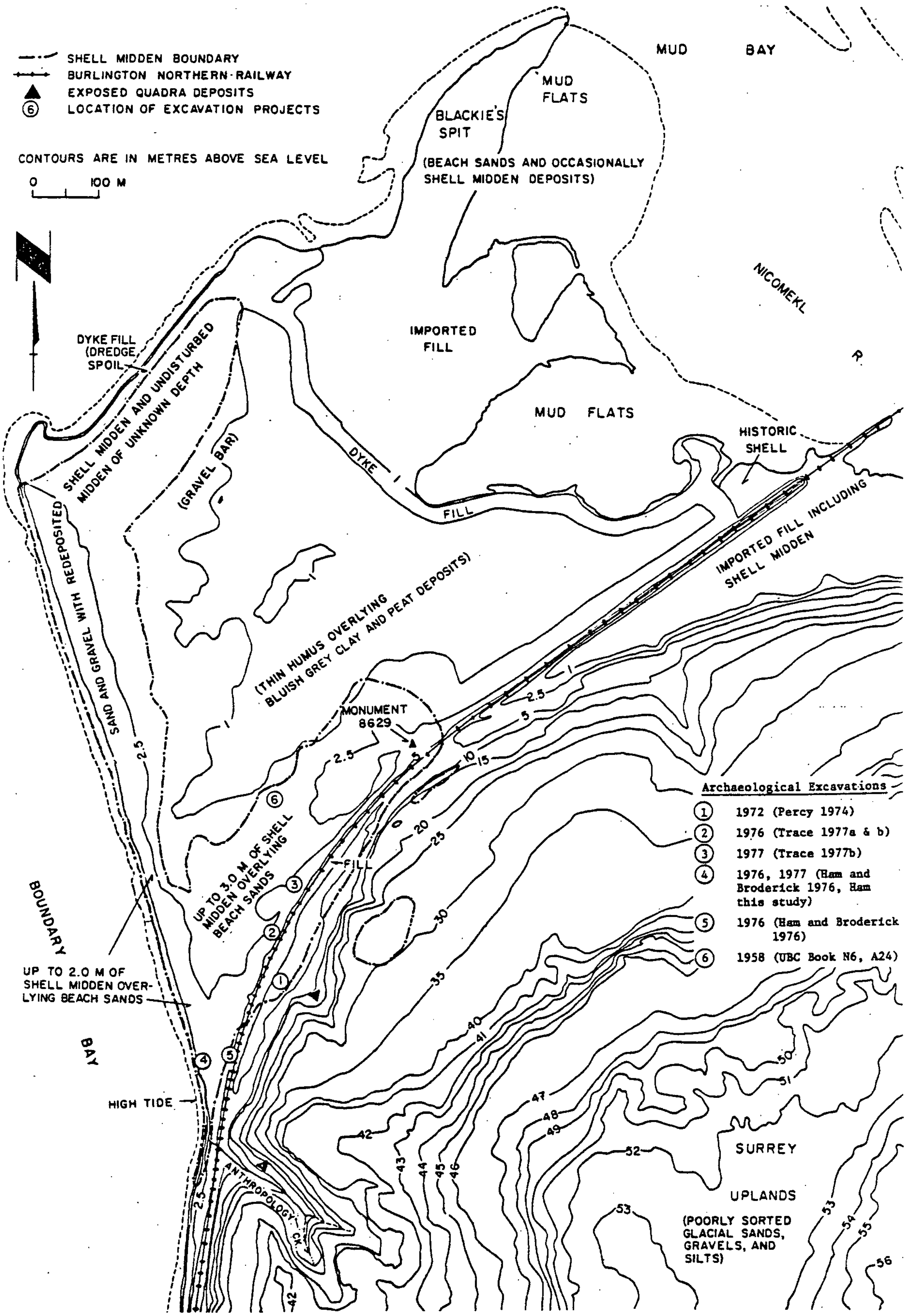


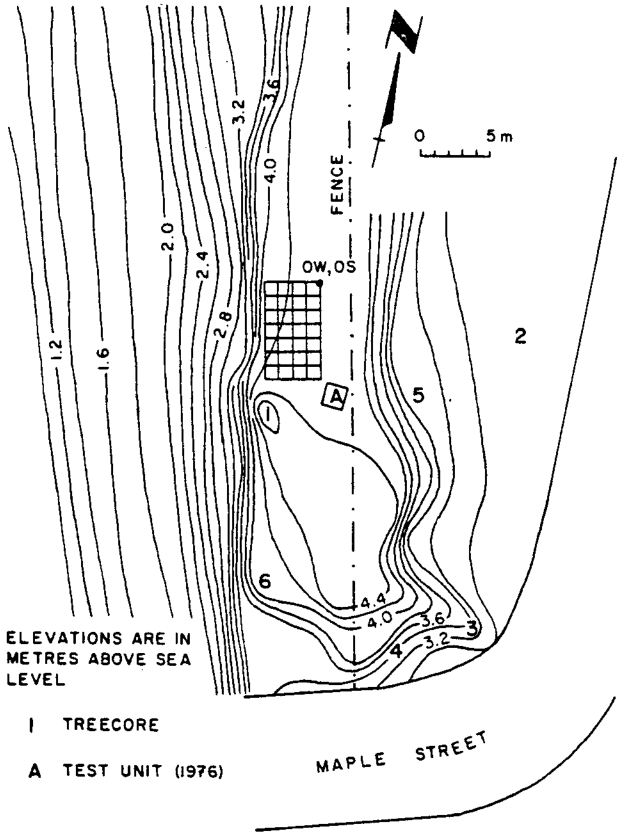
Figure 2-32. Surficial Deposits and Extent of Cultural Deposits at Crescent Beach.

might fall within the Marpole phase (Ham and Broderick 1976:5). The recovery of no less than four human interments in a 1.5 x 1.5 m test unit is interesting in light of Suttles' information that the southeastern portion of Crescent Beach was used as a burial ground (1977:1). Presumably the loose forest soil facilitated the excavation of graves.

The midden mound in the vicinity of Test Unit A was selected for this study as recovered artifacts (see Table II-III) were similar to those from late period deposits at Stselax (DhRt 2). In order to determine whether the contours of the mound were the result of prehistoric activities, or had resulted from historic disturbance, a series of six tree ring cores were removed from trees growing on the site (Figure 2-33). Dates between 1820 and 1904 were obtained indicating that the midden mound is the result of prehistoric refuse deposition, undisturbed by modern activities except for the south end destroyed by the construction of Maple Street. Overall, there is a good correlation between surface contours and the boundary of shell midden deposits at Crescent Beach (Figure 2-32).

The excavation of Test Unit A in 1976 encountered clearly defined stratigraphic layers of shell, broken cooking stones, ash, humus and sand to a depth of 2.16 m below the surface (see Figure 2-34). This test unit was excavated by hand trowel in 10 cm arbitrary levels and the matrix was sifted through 6.35 mm (¼") mesh screens (Ham and Broderick 1976:4). Yellow-brown beach sands mixed with some crushed shell were reached at approximately 2.05 m below the surface (ca. 2.24 m above sea level).

In total 28 artifacts of stone, bone, antler and shell were recovered from this excavation (see Table II-III). Included are chipped stone artifacts, and pecked/ground stone artifacts (Figure 2-35), bone and antler artifacts (Figure 2-36), a ground stone point and a fragment of a ground slate knife (Figure 2-37). Particularly useful for dating purposes is a cache(?) of at



Treecore No.	Species	year taken	number of rings	First Year of Growth (A.D.)
1	<u>Pseudotsuga menziesii</u>	1976	96±2	1880 (1878 - 1882)
2	<u>Acer macrophyllum</u>	1977	147±10	1830 (1820 - 1840)
3	<u>P. menziesii</u>	1977	116±2	1861 (1859 - 1863)
4	<u>P. menziesii</u>	1977	97±2	1880 (1878 - 1882)
5	<u>A. macrophyllum</u>	1977	143±10	1834 (1824 - 1844)
6	<u>P. menziesii</u>	1977	70±3	1907 (1904 - 1910)

All ages are minimum values as all cores missed the pith. Readings were provided by Marion Parker and Sandra Johnson of the Western Forest Products Laboratory, Vancouver. Parker, October 21, 1976, and Johnson, November 22, 1977.

Figure 2-33. Location and Age of Trees Growing in Excavation Area.

least four bone blanket pins recovered from arbitrary levels 13 and 14 (ca. 3 m a.s.l.) (Figure 2-36). Blanket pins have been reported from the late deposits at Stselax (DhRt 2) (Kew 1955:19, 34). In addition blanket pins have also been reported from late deposits at the St. Mungo Cannery Site (DgRr 2) and the Belcarra site (DhRr 6) (see Figure 5-12). Also of

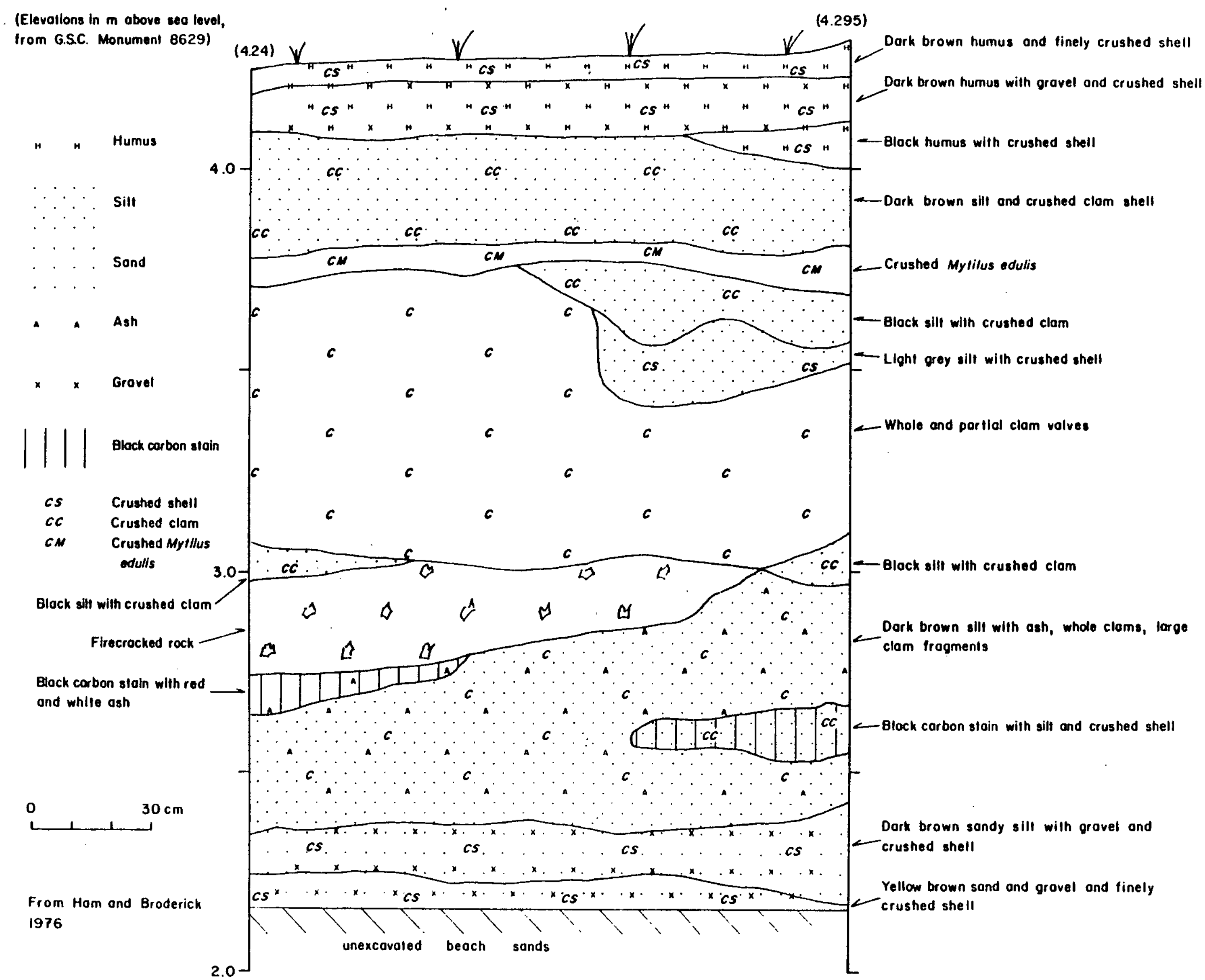


Figure 2-34. DgRr 1 Test Unit A, Profile of West Wall.

Artifact No.	Class	Provenience
4001	worked antler tine	A.L. 2
4002	sectioned bone	A.L. 2
4003	faceted ground stone point	A.L. 2
4004	antler wedge fragment	A.L. 2
4005	1929 penny (U.S.A.)	A.L. 2
4006	ground slate knife fragment	A.L. 2
4008	bipolar core/stone wedge	A.L. 4
4010	sectioned antler	A.L. 5
4011	composite toggling harpoon valve	A.L. 6
4012	abrasive stone	A.L. 9
4013	bone chisel/wedge	A.L. 10
4014	bifacial reduction flake	A.L. 13
4015	bone blanket pin (2)	A.L. 13
4016	worked whale bone (9)	A.L. 12-A.L. 13
4017	wedge based bone unipoint	A.L. 5
4019	worked bone fragment	A.L. 14
4020	worked whale bone (8)	A.L. 14
4023	bone blanket pin (2)	A.L. 13-A.L. 14
4024	bone blanket pin (2)	A.L. 14
4025	worked bone fragments (3)	A.L. 15
4026	bone blanket pin fragment	A.L. 14
4027	split bone awl	A.L. 15
4028	perforated stone	A.L. 15
4029	antler pendant	A.L. 18
4030	abrasive stone	A.L. 18
4031	heavy duty chopping tool	A.L. 21
4032	bifacial reduction flake	A.L. 21
4325	<u>Pecten</u> shell fragment	A.L. 21

A.L. = Arbitrary Level
( ) = number of fragments

Dropped or unused artifact numbers:
4007, 4009, 4018, 4021, 4022.

Table II-III. DgRr 1, Test Unit A Artifacts (n=28).

interest are two badly fragmented slabs of whale bone which may have been blanks for the manufacture of barbed points (cf, Figures 2-36 and 5-24). Originally 15 cm or more in length, and 0.7 cm thick these blanks appear to have been cut into rectangular shapes and were possibly traded from the West Coast.

Three artifacts from Test Unit A were examined as part of a study of

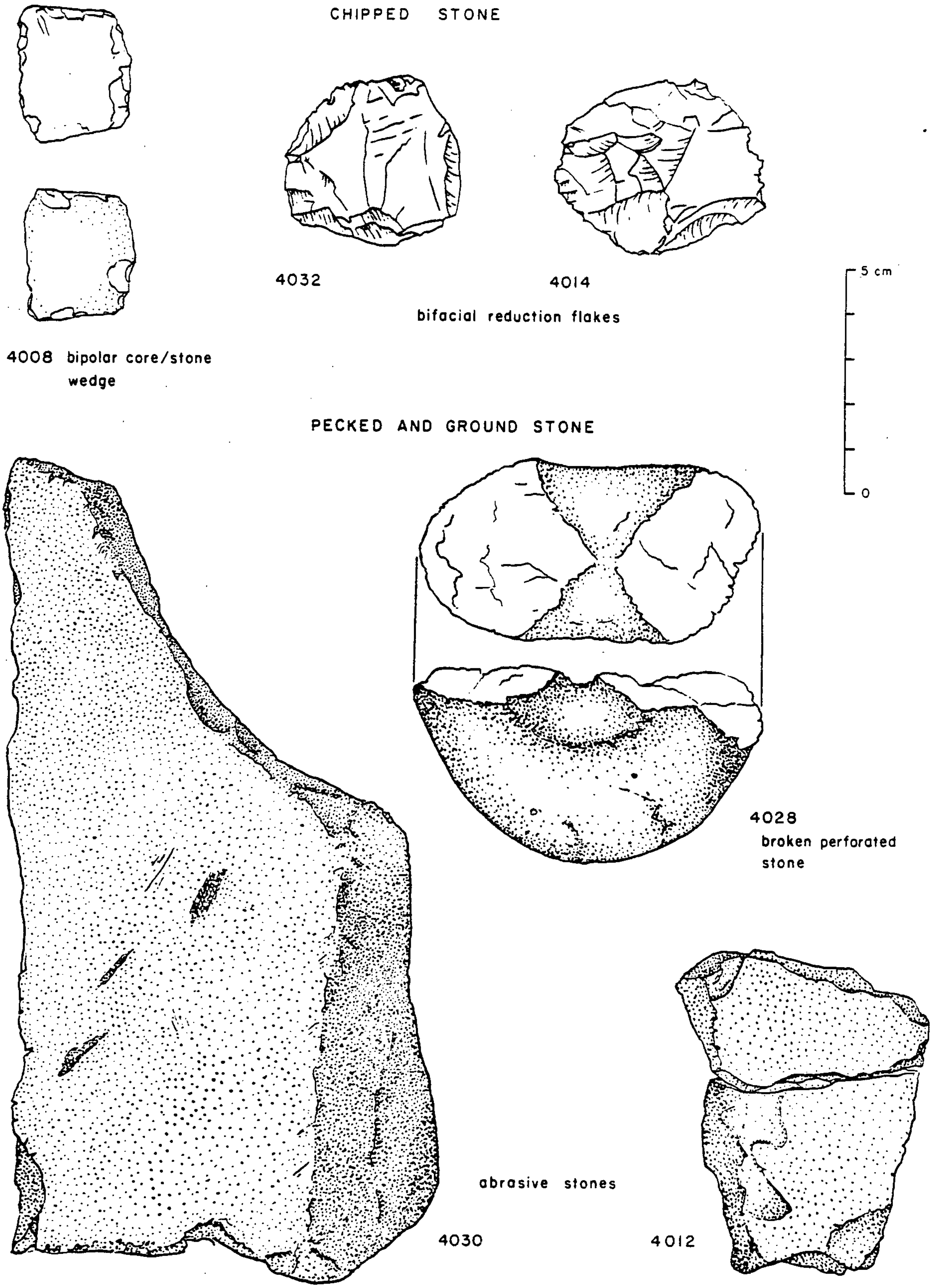


Figure 2-35. DgRr 1 Test Unit A. Chipped, Pecked and Ground Stone Artifacts.

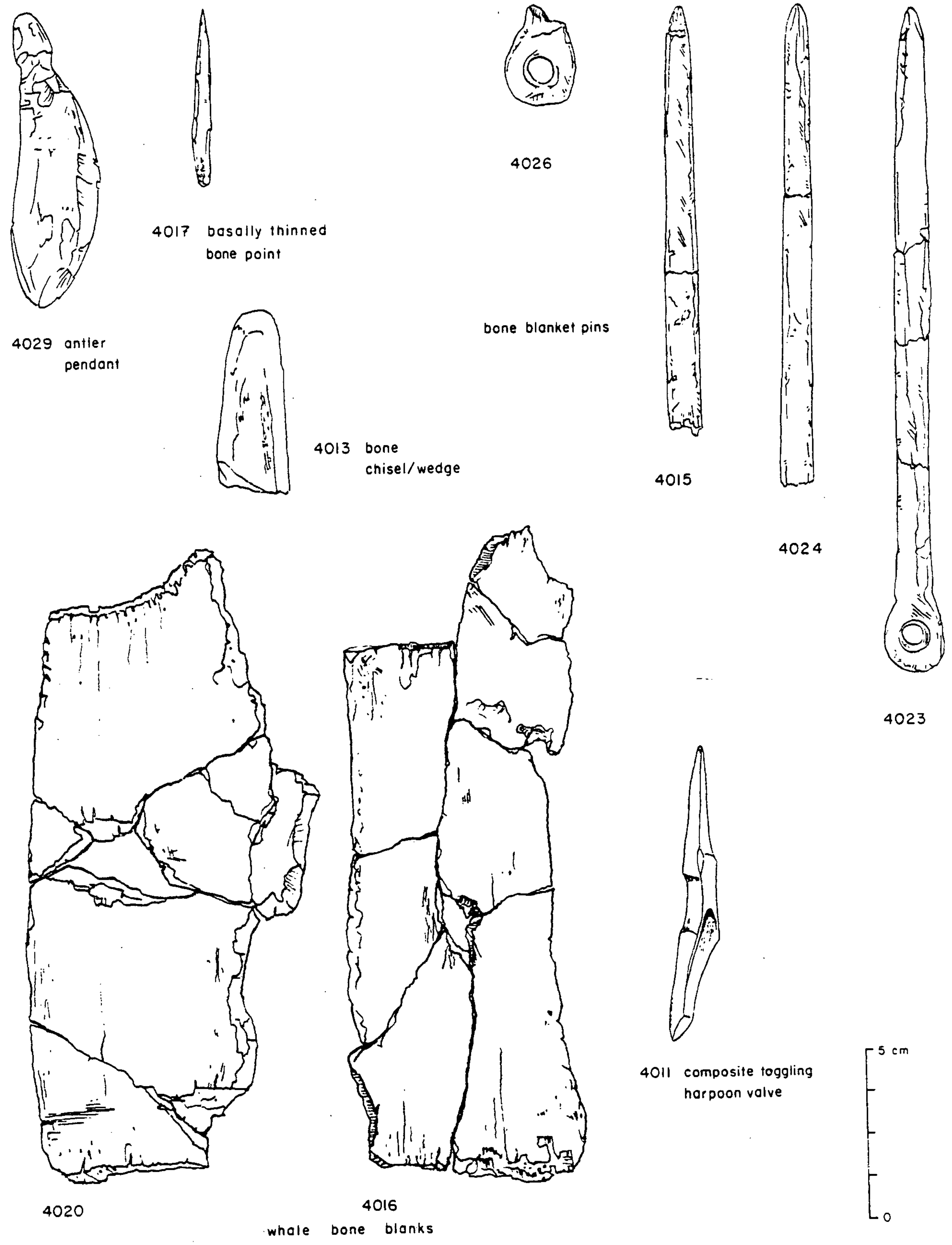


Figure 2-36. DgRr 1 Test Unit A. Bone and Antler Artifacts.

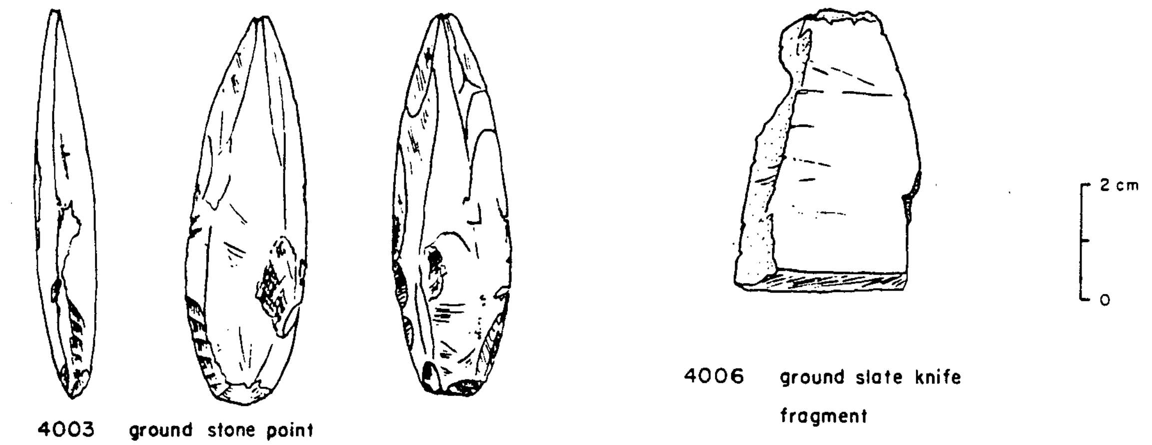


Figure 2-37. DgRr 1 Test Unit A. Ground Stone Artifacts.

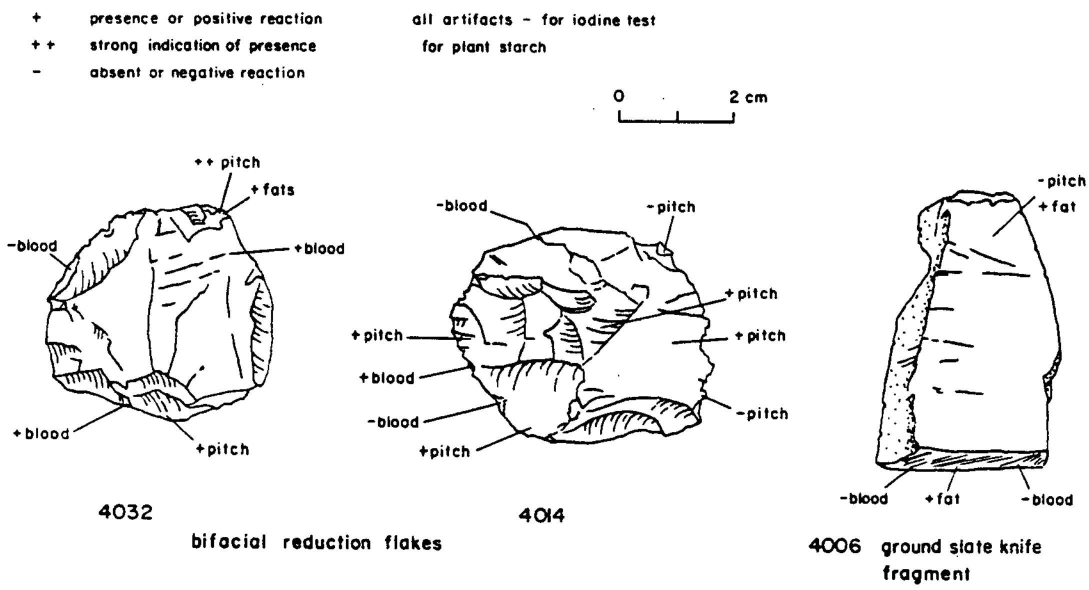


Figure 2-38. DgRr 1 Test Unit A. Artifact Residue Analysis.

blood, fat, resin, and starch residues on artifacts conducted by Broderick (1980). Benzidine was used to test for the presence of blood, Sudan III for resins and fats, and iodine for starch, following the techniques described by Broderick (1980).

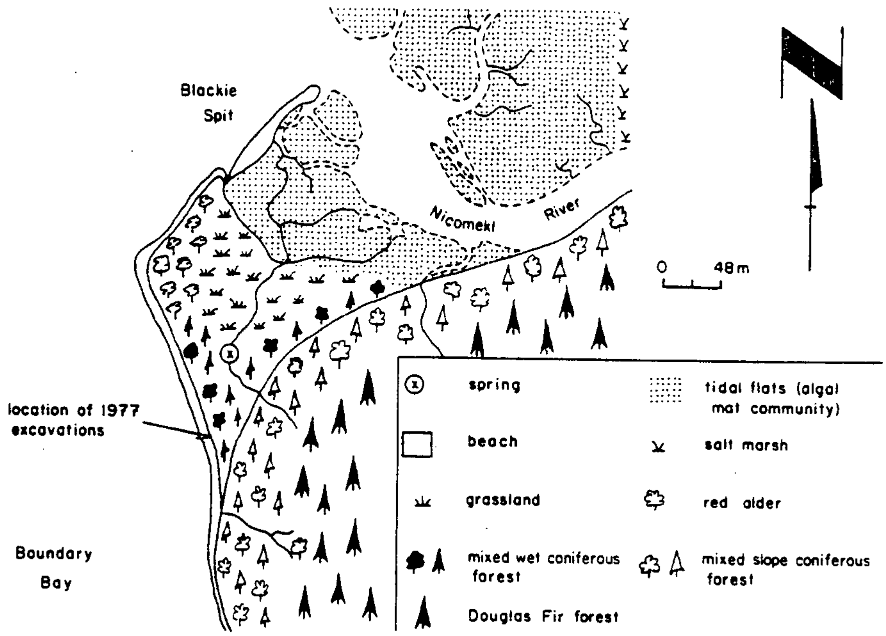
Test Unit A artifacts tested for residues included the two bifacial reduction flakes and the ground slate knife fragment (see Figure 2-38). All artifacts were negative for the iodine test for plant starches while the ground slate knife fragment yielded positve results for fats only. The bifacial reduction flakes gave positive results for both blood and tree pitch (resin) suggesting they may have been hafted tools.

A total of 31 pieces of lithic detritus was recovered, of which 90% were basalt, but also included were two pieces of quartzite and one piece of chert (Ham and Broderick 1976:16).

Faunal material was dominated by shellfish remains including Clinocardium nuttalli, Saxidomus giganteus, Tresus capax, Protothaca staminea, Mytilus edulis, Ostrea lurida, Thais lamellosa, Balanus sp., and Acmea sp. (Ham and Broderick 1976:17). Other faunal material included land and sea mammal, bird and fish remains, land snail (Helix sp.) turtle, Cancer sp., and Cervus elaphus (Ham and Broderick 1976:17).

Plant communities at Crescent Beach have been altered by historic activities although it is possible to reconstruct the original vegetation (see Figure 2-39). The main source for this reconstruction is North et al. (1979) whose map closely agrees with published photographs and historic descriptions of the area (Lang 1967: Treleaven 1978). Plants and animals native to these communities which might have been used by the Coast Salish are discussed above.

The top of the Surrey Uplands was covered by a Douglas Fir forest. Douglas Fir dominated the canopy and oregon grape the understory, while



Based on Lang 1967, North et al. 1979, Treleaven 1978, B.C. Airphoto A-2240-83 (1930).

Figure 2-39. Historic Vegetation at Crescent Beach.

salal was also present with minor occurrences of red cedar and hawthorn (North et al. 1979). The steep slopes of the uplands were vegetated by a slope coniferous forest with a canopy dominated by red cedar and broadleaf maple while western hemlock, alder, vine maple and ferns were also present with minor occurrences of Douglas Fir (North et al. 1979). The older shell midden deposits at Crescent Beach were vegetated with a mixed wet coniferous forest with red cedar and western hemlock dominating the canopy while other species included spruce, alder, willow, yew and ferns with minor occurrences of cottonwood and crabapple (North et al. 1979). This description of the vegetation in the central part of Crescent Beach is in agreement with early photographs which show heavy stands of timber (Lang 1967:41, 45; Treleaven 1987:75).

The north-central portions of Crescent Beach were grassland (Lang 967:133; North et al. 1979), while to the west at the base of Blackie's Spit were clumps of mature alders (Treleaven 1978:50). North of the grassland were tidal mud flats (Algal Community), while vegetation between the coniferous forests and the beach would have consisted of shrub growth including salmonberry, wild rose and ocean spray. Vegetation around Test Unit A included Douglas fir, broadleaf maple, wild rose, and giant wild rye grass while much of the area has been lawn for at least 50 years.

Suttles (1977:1) has reported that a spring was present at Crescent Beach and from general descriptions by residents it was located approximately as indicated in Figure 2-39. The area in the vicinity of the spring may have been rather marshy. In addition one small creek and at least two lesser ones flow off the uplands so that freshwater would have been easily obtained except perhaps during the driest portions of the summer. Anthropology Creek, just south of the area excavated by this study, was reduced to a trickle during July and August of 1981.

DgRr 5 The Indian Fort Site

Located on the bluff at the western edge of the Surrey Uplands approximately 1 km south of Anthropology Creek, this site was a fortification and lookout consisting of earth embankments, trenching, and scattered shell midden deposits (see Figure 2-31). These features were destroyed during the construction of a house in 1974, although it is possible to obtain some idea of the nature of the site. The only published references to the site are too general to be of any value here (Buxton 1969; Pearson 1958:3; Treleaven 1978:8), although some information may be obtained from Harlan Smith's fieldnotes on file at the National Museum of Man in Ottawa (Smith fieldnotes, Box 10, file 5, and Box 9, file 1).

Smith was informed of the site in 1913 by a G.H. Whyte of Calgary who had visited it in 1896 and 1906. On August 7, 1915 Smith visited the site and concluded "It should be restored by filling in paths made by cattle, and saved in a Dominion or Provincial Park". The Federal Government considered purchasing the site in the mid 1970's, but the lot was sold, developed and the site destroyed before any negotiations could be undertaken (George MacDonald, Bjorn Simonsen, July 1976, pers. comm.).

Situated approximately 37 m above sea level, the site is bounded by a steep cliff on the west overlooking Boundary Bay, and by ravines on the north and south sides. Across the eastern edge was an earth embankment about 2.4 m across its base (my estimate from Smith's photographs ca. 1 m high), and in front of the embankment a 3.6 m wide trench (appears about 2 m deep in Whyte's photographs). A deep cut ran through the embankment which may have had a wooden stockade along its top. Smith reports that there was some shell midden material "...inside on the north edge and in the ridge at east and south". The overall site dimension reported on the B.C. site form recorded by Don Abbott (B.C.P.M.) in 1964 is 18 x 24 m while the depth of deposit is unknown. The same site form reports a shallow rectangular depression within the site which suggests there may have been a plank house here. Perhaps this is the Nicomekl house outline remembered by Suttles' Semiahmoo informant (1974:258, 1977:1).

No excavations have been conducted at this site and according to the current residents a relic collector from Seattle obtained many artifacts from the site when the present house was constructed. Considering that the site was a grassy area fairly clear of trees when Whyte and Smith visited it in 1896, 1906 and 1915, it was probably in use during the early historic period as well as in precontact and perhaps earlier times. It is probably the Nicomekl camp at Ocean Park reported by Suttles (1974:28-9, 1977:1).

DgRr 7 White Rock Petroglyph

A large boulder (2.5 x 1.5 x 1.5 m) with a number of pecked holes and circles, this petroglyph was formerly situated on the beach near the western boundary of White Rock, some 4 km southwest of Anthropology Creek (Figure 2-31). Presently, it is in Petroglyph Park at Crescent Beach at the junction of Beecher St. and the Burlington Northern Railway. Photographs of DgRr 7 are published in Hill and Hill (1974:56). According to the B.C. site form it originally contained many more carvings when photographed in 1915, but has suffered from erosion and vandalism. No date is reported for its move to Crescent Beach.

DgRr 9 Ocean Park Beach Petroglyph

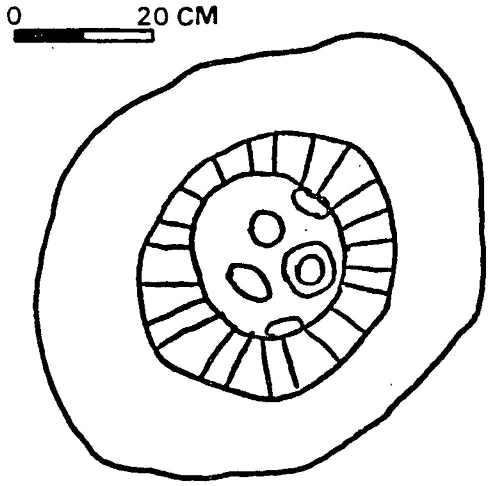
This petroglyph consists of a pecked face(?) surrounded by a sunburst on a small shiny boulder (0.6 x 0.6 x 0.36 m) and was found on the beach below DgRr 5 in 1957 (B.C. site form, Figure 2-31). At present this petroglyph is in the Surrey Museum at Cloverdale while photographs have been published in Hill and Hill (1974:56) and Treleaven (1978:119). A rough sketch of DgRr 9 from the B.C. site form is presented in Figure 2-40a.

DgRr 11 Thousand Steps Petroglyph

This petroglyph which consists of a fish-like design is pecked into a small boulder (ca. 1.20 x 0.48 m) and is located just south of the original location of DgRr 9 (Figure 2-31). Located in the summer of 1978, DgRr 11 is one of several newly discovered petroglyphs at Ocean Park (Leen 1979:3). A drawing of this fish-like design with a pecked out bowl for an eye is presented in Figure 2-40b.

DgRr 12 Sunburst Petroglyph

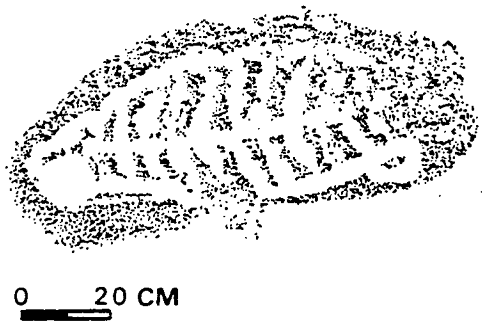
DgRr 12 is located about 700 m south of Anthropology Creek (Figure 2-31) and was discovered by Ann and Rene Savenye of Surrey in 1978 (White Rock Sun 1978:5). Also pecked into a small boulder (0.50 x 1.00 x 0.40 m) this petroglyph consists of a face and sunburst (see Figure 2-40c) and has also been reported by Leen (1979:3). Several other boulders in the vicinity



a) DgRr 9, Ocean Park Beach Petroglyph (from B.C. site form).

For approximate location of petroglyphs see Figure 2-31.

Figures b and c reproduced with permission of Daniel Leen.



b) DgRr 11, Thousand Steps Petroglyph.

c) DgRr 12, Sunburst Petroglyph.

Figure 2-40. Boundary Bay Petroglyphs.

of DgRr 12 have small bowl-like holes pecked into them (see Leen 1979:4, and B.C. site form).

3.0 ECONOMIC STRATEGIES, SHELL MIDDENS, AND SEASONALITY

The Theoretical Background

The ultimate energy source for organisms on earth is the small fraction of solar radiation manufactured into energy rich molecules by green plants, algae and phytoplankton (Gates 1971:89; Odum 1971:1-2). Bennett (1976:138-9) has divided human societies into two ideal types; the equilibrious type (in equilibrium with the environment) that rely primarily upon transformed sunlight as an energy source, and the disequilibrious type that uses new sources of energy based on technology and fossil fuels. In the equilibrious type of human society energy is obtained from the stored supplies in plants and animals; in fact, throughout most of human history subsistence depended upon hunting, fishing, and gathering activities (Lee and Devore 1968:3). Many of these cultures maintained human wants and needs at locally generated levels evolving into "...sustained-yield resource management systems maintained by sanctioned reciprocity" (Bennett 1976:275).

The archaeological study of subsistence activities is concerned with relations between human societies and their environment, an area of study commonly regarded as the ecological approach or cultural ecology paradigm (Binford 1962:219; Clarke 1968:40, 1972:7; Meighan _et al._, 1958:1; Steward 1973:30-42). It is the study of how human societies adapt to their environment, "...how and why humans use Nature, how they incorporate Nature into Society, and what they do to themselves, Nature, and Society in the process" (Bennett 1976:3). Also basic to the cultural ecology paradigm is the concept of human societies as open systems with the capacity to achieve new patterns and levels of organization in response to new information flow (Bennett 1976:259).

Bennett (1976:243) argues that the major issues concerning human relations with the environment are cultural, "...in the sense of human values concerning want satisfaction; or social in the sense of particular institutional arrangements involving greater or less impact on the physical environment". Because of this he feels cultural ecology should follow a conceptual scheme or framework which focuses on the "active mode" of the engagement between cultural systems and the environment, and he has outlined the basic features of the "behavioural adaptation" or "adaptive dynamics" framework (Bennett 1976: 245-6, 270). This approach may prove useful in examining Coast Salish adaptation as well as facilitate the transition to middle range and lower level archaeological theory concerning the remains of cultural systems. In short, "adaptive dynamics" is the behaviour by which a human society achieves its goals, satisfies needs and wants, and the consequences of this behaviour for the individual, society and the environment (Bennett 1976:270). In studying the "adaptive dynamics" of a society one must consider their ideology, transactional behaviour, strategic designs, and how their strategies are arranged in the temporal-spatial continuum, known as the environment (Bennett 1976:270-274).

Whatever the members of a society do (whether in personal or group activities and relationships, or in activities involving the environment), their behaviour is governed by ideological criteria. These may consist of cognitive maps, "...sets of values, precedents, models or styles..." or "...moral precepts..." which consciously or unconsciously guide the society along an idealized cognitive blueprint (Bennett 1976:273, 275).

Transactional behaviour concerns the "...reciprocal exchange of obligations, favours, and rewards in the course of role behaviour and social relations" (Bennett 1976:279). These types of behaviour focus on the exploitation of natural resources to influence interaction among individuals; the manipulation of social resources, the allocation of natural resources, and control of resource access (Bennett 1976:278-280). An important issue for cultural ecology is the existence of media of exchange, either nonmaterial (gestures, services, prestige) or material goods (raw materials or resources, manufactured or processed goods) (Bennett 1976:279).

Strategic designs are chains of strategies each consisting of "...specific acts with a predictable degree of success..." which enable a society to achieve their wants and needs (Bennett 1976:272). Human activities, whether harvesting and processing a resource crop or manufacturing a canoe, are conducted in a linear pattern step by step, basically one act or event at a time (Bennett 1976:283). Both ideological guidance and transactional behaviour are important in determining the success of any strategic design.

Time is important in considering "adaptive dynamics" as particular strategies take place in a temporal continuum and will be designed according to cultural or situational concepts (Bennett 1976:274). Solar energy is not received evenly over the earth's surface, but varies geographically and seasonally with the result that plants and other energy producers follow marked seasonal productivity cycles (Gates 1971:91-4; Odum 1971:77-8). Just as organisms living in a seasonal environment will migrate or disperse in order to avoid or better endure periodic food shortages (Fretwell 1972:79; Odum 1971:77), human societies dependent upon a seasonal environment must design their strategies to accommodate variation in food abundance.

Bennett (1976:310-311) has argued that human relations with other humans, and human relations with the environment are tightly interwoven, and urges that cultural ecology take both into account. Likewise, Suttles (1960:296, 1962:523-4) suggests that for Coast Salish society "...to have survived in a given environment for any length of time, its subsistence and prestige-gaining activities are likely to form a single integrated system by which the population adapted to its environment".

3.1 HALKOMELEM AND STRAITS ADAPTIVE DYNAMICS

In a series of papers, Suttles (1958, 1960, 1962, 1968, 1972), has presented a model of Halkomelem and Straits adaptive dynamics which is briefly summarized here and discussed in detail below: Ideological guidance reinforced a value system which provided the motivation for getting food in surplus quantities, storing food, and participating fully in the social system. Transactional behaviour was an important factor in a social system which provided the organization for subsistence activities and exchange enabling prestige acquisition. Strategic designs consisted of food getting techniques and technology adequate to harvest, process and store food and food surpluses. The environment was rich, but abundance was sporadic throughout the area, throughout the year and from year to year. These factors tied the Coast Salish to a fairly rigidly determined yearly round of subsistence activities.

Coast Salish society was stratified; a complex society with a social hierarchy in which some individuals and their families possessed greater status and prestige than others, while a much smaller group belonged to the low class and an even smaller group of slaves were the private property of certain upper class individuals (Suttles 1958:500, 504). Suttles (1958:499-500, 504) has compared the structure of Coast Salish society to an inverted pear with a large number of people in the upper or respectable class and a small number of people in the lower class. Attaining and retaining status and prestige occupied an important place in personal, intergroup and intragroup relations, and in relations with the environment (Suttles 1960:296, 1968:68), probably the major factor governing Coast Salish adaptive dynamics for the production of food surpluses could lead to the acquisition of the wealth necessary to validate prestige.

The relation between food, wealth and prestige should be clarified before proceeding with this discussion of Halkomelem-Straits adaptive dynamics. Food was not considered as wealth although it could be converted to wealth and prestige (Suttles 1960:301). Wealth consisted of objects such as blankets, shell ornaments, fine baskets, hide shirts, bows and arrows, canoes, slaves; utilitarian items of a relatively perishable nature (Suttles 1960:301). Wealth could be produced by specialists, or received from relatives in other communities in exchange for a gift of surplus food; a man acquiring a surplus of food could of course release some members of his household from food production to produce additional wealth items (Suttles 1960:298, 301). Prestige could be obtained or enhanced by several means: by sharing a temporary food surplus with the extended family and other members of your village; from sharing a gift of surplus food obtained from kin in another village with those in your own; by sharing access to owned resource locations, or sharing the technological means to extract resources; from directing food production; and ultimately of course, through giving gifts of wealth at a potlatch to validate changes in status or the exercise of inherited rights (Suttles 1960:299-300).

Among the upper class, ideology and enculturation provided "...the individual with the incentive to strive to prestige through display of supernatural power and the giving of property, the two being symbolically the same" (Suttles 1962:525). Individuals and families which through lack of inheritance, good advice and morals, good family ties, or simply through inability or laziness could not easily participate and were regarded as low class (Suttles 1958:500-505). Some activities such as hunting or woodworking were not as restricted by private ownership, so an individual could and often did obtain the necessary spirit powers and skills which might bring wealth and prestige (Suttles 1958:501). Upper class families not only had a good head start in preparing their offspring to seek spirit power and subsequently to participate in striving for prestige (under threat of being regarded as low class if they did not), but claimed that they alone held access to the necessary knowledge of Coast Salish morality (Suttles 1958: 501-2). Considerable attention was paid to providing children with the necessary training to ensure they did not bring disgrace upon their family heritage (see Barnett 1975:142; Boas 1894:463; Suttles 1974:393-6, 444-455).

The nature of Coast Salish villages was discussed briefly in Chapter 2.6 and some aspects of Coast Salish social relations hinted at in the above examination of food and wealth. At the time of European contact the Strait of Georgia area "...formed a social continuum within which the village was only one of several equally important social groupings", others based upon kinship, task groups and ceremonial groups (Suttles 1972:666). Suttles (1962:525, 1982, pers. comm.) has outlined eight major features of Coast Salish social organization in this area, including;

1. Village communities composed of one or more kin groups firmly identified with their locality by tradition.

2. Membership in house-kin groups through bilateral descent, with alternate or even multiple membership possible, making the individual potentially mobile.

3. Preference for local exogamy, establishing a network of affinal ties among communities.

4. Preference for patrilocal residence, having the result that, within the community, most adult males are native and most adult females outsiders--though bilateral affiliation always makes for some exceptions.

5. Leadership within the kin group partly through seniority and partly through ability, kin-group headmen having control (sometimes nominal, sometimes real) over especially productive resources within the territory of the kin group.

6. Sharing of access to resources among communities through affinal and blood kin ties - possibly leading to some change in residence.

7. Exchange of food for "wealth" (i.e., durable goods) between affinal relatives in different communities.

8. Redistribution of wealth through the potlatch.

Within a community, kin group leaders (generally those responsible for family owned resource locations, or often the owners of specialized technological gear) would organize the task groups necessary for harvesting a resource crop when it became available, drawing upon their own kin in the community as well as other community members, all of whom would benefit by the cooperative effort either through sharing or feasting (Suttles 1960:300, 1968:65). Providing there was not a conflict with a resource crop within their own territory, such a task group might be joined by kin from other communities as well. Otherwise, they could receive a supply of any surplus through affinal exchange, the donor receiving wealth in exchange. Considering the spatial and temporal variation of resources in Coast Salish territory, their transactional behaviour was not only adaptive in that it provided the mechanisms for organizing labour and coping with nature's imbalances, it could also be profitable, providing one followed the rules.

Within a Coast Salish village families could participate in a variety of strategic designs depending upon the nature of their local territory, the resource locations they or their kin might own, or upon the nature of those owned by relatives in other villages. However, the activities an individual family conducted were probably fairly restricted. Suttles (1974:50, 57) points out that the "...yearly round is fairly rigidly determined..." and that "...times and places were more or less fixed by the whole year's schedule of activities...". Likely once a strategic design was planned, and with a series of resource crops to harvest and process, little opportunity would be presented to deviate from plans, especially for families owning important resource locations.

We may divide strategies into two classes, those geared to harvesting and processing resource crops as they become available, and those related to more casual fishing, sealing, hunting, or manufacturing including any number of craft specializations. Many of these activities have been discussed in detail in Chapter 2.6. The first class of strategies requires concentrations of labour (clam digging, camas or wapato digging, reef netting for salmon, berry gathering) and some also require specialized technologies and knowledge (operation of reef nets, trawl nets, deer nets, duck nets, weirs). Resource crops, for various reasons, were not always available precisely when expected, which in addition to possible ritual intervention, would also lend time for the second class of strategies. Some resource crops such as berry patches could be checked occasionally, while others such as salmon or herring and eulachon runs could not, and would require people to be present at, or near enough to the resource location to harvest it when it became available as many are of short duration (camas, eulachon run).

Many of the second class of strategies would not necessarily result in the accumulation of a large surplus nor require large groups of cooperative labour. These more casual activities could include trolling for salmon, sealing, sturgeon fishing, deer or wapiti hunting, bark gathering, basket or mat making, canoe or box manufacturing. Many or all of these activities could be carried out from a winter or summer village or at a seasonal camp; activities which could be abandoned once organized labour was required for a major resource crop. Some part of the time waiting for a resource crop would be spent preparing gear, gathering firewood, and organizing processing and storage facilities and equipment. Ultimately, it was the surplus which was important as we may see from Suttles' (1974:67) statement about shellfish gathering, a statement no doubt true about other resource crops; "...it was evidently more profitable to go once a year to the best places and get a large supply than to spread one's shellfish gathering equally throughout the year". For some resources such a choice would not have been available, however. For a family to participate fully in Coast Salish society, surpluses of some kind would be needed.

It was noted above that strategies consist of specific acts conducted in a step by step fashion, basically, one event at a time. Two examples of Coast Salish strategies will be examined through their basic steps or events, one from each class defined above. The first will be a shellfish harvesting strategy. The excavation of test Unit A in 1976 revealed extensive layers of shellfish valves suggesting such activities might be responsible for these remains. The second strategy examined will be woodworking, specifically the manufacture of a wooden box for boiling water, an activity which could have occurred at just about any site.

Shellfish harvesting requires the organization of a cooperative pool of labour or task group to procure and process large quantities. The following description of a shellfish harvesting strategy is based largely upon Stern (1934:47-8) and Suttles (1974:65-9), but includes information from a number of other sources as well (Barnett 1975:61; Bouchard and Kennedy 1974:2-3; Eells 1887:215-6; Elmendorf 1960:133; Gunther 1927:207; Haeberlin and Gunther 1930:2-24; Jenness n.d., p. 43; Matthews 1955:258, 280; Reagan 1917:27; Rozen 1978:179; Swan 1972:85-6; Thompson 1913:43, 50; Wilson 1866:283).

Preparation for shellfish harvesting probably started while the families were still in their winter village; planning with other families on the approximate time to gather at the shellfish harvesting camp. During the winter items such as digging sticks would be manufactured or sharpened, storage and burden baskets woven or repaired, and old mats for use in covering steaming heaps collected together. However, as the shellfish harvesting strategy would be linked with other strategies in an overall strategic design, digging sticks and baskets may have been used before arriving at the shellfish harvesting camp, necessitating additional manufacture or repair to these items. A task group probably carried a supply of materials for repairing baskets wherever they went, while other tools such as digging sticks and the wooden skewers for roasting the clam meat could be obtained from the area around the site, or brought into the site from other resource areas. Other preparatory activities would include gathering sufficient quantities of firewood, beach cobbles and sand for steaming. All of these materials could be obtained from the beach and several days might be spent gathering them.

Disregarding exact seasonality for the present, this model of shellfish harvesting could be successfully implemented on any calm, sunny summer day with a sufficiently low tide about midday (although low tide could probably vary from mid morning to mid afternoon without hampering the success of a harvest). Shellfish harvesting during a low tide at night would require moonlight and pitchwood torches.

On the selected day, canoes would be loaded with digging sticks, baskets and fish spears, and a task group including men, women and children would paddle to the shellfish beds arriving on the ebbing tide. While waiting for the tide to fall enough to expose the shellfish beds, women and children would collect and pry mussels, dogwhelks, barnacles and other desired species off the rocks of the upper intertidal zone using their digging sticks. Meanwhile the men might spear crabs, flounders and other fish in tidepools, placing the collected shellfish and fish in baskets.

Once the shellfish beds and sand bars were exposed the men and women would dig for shellfish while the children would collect the shells into baskets, or forage the sandbars for stranded cockles and gather crabs from shallow tide pools. On the flood tide the task group would return to camp, their canoes loaded with baskets of shellfish, fish and crabs. It is difficult to estimate the quantity of material which could be collected by such a group.

Thompson (1913:50-1), describing shellfish gathering by Squamish women in Burrard Inlet, states that each woman could obtain about two baskets of cockles each weighing approximately 25 pounds during a tidal period. Larger quantities were probably obtained prehistorically when the men and children also assisted.

Arriving back at camp, the canoes would be unloaded and a large fire started to steam the shellfish open. Once a bed of hot coals was obtained the baskets of beach cobbles would be heaped on, and as soon as they were hot the shellfish added. These would be covered with old mats and the baskets of beach sand heaped over the lot. Seaweed or tree boughs were reportedly also used although it appears that when large quantities were being steamed on or near the beach, sand was used (Elmendorf 1960:133; Haeberlin and Gunther 1930:23).

Swan (1972:85-6) estimates 20-45 minutes to steam the clams open depending upon the quantity being processed. At this stage the sand and mats would be removed, the sand discarded and the mats if reuseable placed aside. The meat would be removed from the shells, rinsed of sand in a box of fresh water, and stuck on wooden skewers for roasting. Empty clam valves and any clappers, dead paired shells filled with sand (Bourne 1969), would be discarded. The skewers would be stuck in the ground angled towards a roasting fire, or leaned on a frame over the fire. Once one end of the skewer was roasted, it was turned around.

When the meat was roasted sufficiently it was removed from the skewers and strung on cedar bark, sun dried and placed in small mesh but well ventilated baskets for storage. Materials abandoned as waste would include sand, clappers, empty clam valves, beach cobbles, charcoal and ash, as well as any borken, discarded or lost digging sticks, skewers, or fragments of matting and basketry. Post holes around the roasting fire might also be evident as well as the charcoal and ash from the fire.

Most commonly preserved in large quantities were cockles (Clinocardium nuttalli) and horseclams (Tresus sp.) while other species were usually eaten immediately, either raw or after being steamed or roasted. Other shellfish obtained from the upper intertidal were also eaten immediately as were crabs and flatfish. These were roasted over a fire and the bones and crab shell discarded. Activities the next day would include sun drying previously roasted clam meat as well as returning to the shellfish beds if larger quantities were desired.

A common method of cooking food was in a bent wood box of water in which heated cobbles were added which brought the water rapidly to a boil cooking whatever food had been placed in the box (Duff 1952:48, 74; Hill Tout 1905:234; Jenness n.d., p. 43; Suttles 1974:242). The manufacture of wooden boxes for cooking or for food storage did not require the organization of labour which was necessary for shellfish harvesting, but rather, like other manufacturing strategies, was dependent upon the skill and spirit power of the woodworker (Suttles 1974:228-9), and thus belongs to the second class of strategies discussed above. References to the manufacture of wooden boxes may be found in most ethnographies on the Coast Salish (Gunther 1927: 224; Haeberlin and Gunther 1930:35; Hill Tout 1905:233; Jenness n.d., pp. 38, 43; Suttles 1974:225-228), although the most detailed account is that provided by George Hunt for the Kwakiutl (Boas 1921:60-81). Hunt's description has been followed here because of its detail, and because it does not appear to contradict local descriptions. Many steps are collapsed for sake of brevity and the initial strategy of obtaining the wood is not considered.

The woodworker was a specialist and used a variety of tools which he stored in baskets; these tools including antler and wooden wedges of various shapes and sizes, sea mussel and stone adze blades and their hafts or handles, bone chisels, hafted bone drills, wood hafted shell and stone knives, abrasive stones, handmauls and hammerstones (Barnett 1975:108-9; Elmendorf 1960:177-9; Jenness n.d., p. 38; Suttles 1974:226). The cedar boards selected for making a box would be split with wedges if they were too thick, then adzed and whittled smooth. A stone knife would be used to score the kerf lines which were then cut halfway through the plank, angled to fit flush against the side of the plank when it was bent. The plank was then turned over and the corners scored with a stone knife opposite the kerf. The wood was carved out at an angle on either side of the cut.

At this point several baskets of beach cobbles, seaweed and bundles of driftwood would be collected from the beach and a fire started. Once a good bed of coals was ready the cobbles were heaped on and while they were heating a series of narrow trenches was excavated beneath each kerf. When the cobbles were hot they were placed in these trenches, covered with seaweed and the plank laid across them, covered with more seaweed and old mats while water was poured into each trench. Local descriptions do not refer to trenches.

While the plank was steaming the woodworker would prepare the wooden pegs which joined the box together. When the plank was steamed sufficiently so that the kerfs were pliable, it was removed from the steaming mound, bent into shape, and tied together with a cedar bark cord. A bone drill was then used to drill holes through the corner joint and the wooden pegs were driven in with a hammerstone. Once the box sides were pegged together the cedar bark cord was removed. The plank for the bottom was then adzed and whittled smooth and fitted to the box sides. Holes were drilled at an angle from the sides into the bottom and wooden pegs driven through them. The box might then be sealed with pitch and perhaps fitted with cedar cord handles.

It would then be ready for use.

Wastes and debris from this activity would include cedar wood splinters and chips as well as those of some other trees as well. Occasionally materials such as worn-out baskets, cedar cordage and mats would be discarded, plus the charcoal, ash and broken cobbles from steaming activities. Cobbles could be abandoned, unless they were removed for reuse. Artifacts could include tools which were broken, discarded or lost, such as: antler wedges, wooden wedges, antler tool sleeves and hafts, bone chisels and drills, stone and shell adze blades, stone and shell knives, and abrasive stones.

It is not clear if the artifact assemblage discussed above is unique to the manufacture of wooden boxes, for more likely, they represent part of a woodworker's total tool kit. Hand woodworking tools from the 18th and 19th Centuries of Euroamerican culture in the eastern United States, for example, made up an enormous tool kit of both very specialized and general purpose tools (Sloane 1973). Also doubtful is whether a Coast Salish carpenter would restrict his activities to the manufacture of a single item. Thus, isolating various types of woodworking activities is somewhat more difficult than interpreting a steaming mound and a heap of empty cockle and butterclam valves. Nonetheless, a Coast Salish carpenter held an important position in Coast Salish strategic designs, in relation to technology, preservation, storage, transportation, shelter and wealth accumulation (perhaps sometimes helping a family make up for some of the surpluses it could not obtain by harvesting food energy alone).

The last aspect of Suttles' model concerned the richness versus fluctuation in abundance and availability of resources characteristic of the Coast Salish environment. This issue has been examined in Chapter 2 (see also Chapter 4), while archaeological methods for making seasonality inferences will be discussed in the section on seasonality below. The following section of this chapter will concentrate on the processes which pattern the refuse from the above strategies and result in the archaeological record.

3.2 SHELL MIDDENS AND SHELL MIDDEN LAYERS

The Nature of Archaeological Data

When a human society goes about implementing its various strategies for procuring food energy, or uses that energy in any manner, the local environment may be permanently altered. Whether an abandoned pebble tool or hand maul, a concentration of lithic detritus, a hearth, discarded piles of cooking stones, or heaps of clam shells; all of these are records of humans extracting and using energy and all have modified the local environment to some degree. These elements, which include artifacts, faunal remains, and features along with other vestiges of human activities, constitute the archaeological record. Before statements about the nature of human behaviour may be inferred from such elements and their context, some features of this record must be taken into account.

Although archaeological sites are records of past human behaviour, all are incomplete and often distorted records (to varying degrees) of the strategies and activities which may have occurred in the past (Adams 1968: 1190; Reid *et al*., 1975:209-210; Renfrew 1976:4; Schiffer 1976:12; Taylor 1948:113). The lack of preservation of elements of plant materials at most archaeological sites was discussed earlier, while numerous other factors may influence the presence or absence of other elements. Archaeological sites are also contemporary deposits often hundreds or thousands of years removed from the human activities which created them, while the material remains or elements examined by archaeologists are static (Binford and Bertram 1977:77; Schiffer 1975c:838; Willey and Sabloff 1980:250). The archaeological site itself however is far from static, but is a modern entity actively engaged in energy exchanges with the environment (see A Shell Midden Model below).

If archaeological data are accepted as contemporary and static, then archaeology is faced with accounting for the observed structure of the archaeological record, that is, determining what may have happened to elements between the time they entered a cultural system and the time they are recovered from the ground. The problem is to bridge the gap between static contemporary data and an extinct human society, and then make dynamic statements about that society (Binford 1977:6; Gould 1978:815; Schiffer and Rathje 1973:169). In approaching these problems archaeologists have focused attention on the formation processes of the archaeological record, what Binford (1977:7) has termed "...middle range theory".

Schiffer (1972, 1975a, 1976) has outlined the basis of behavioural archaeology, a snythesis of several models concerned with devising principles and methods for reliably reconstructing past behaviour from the archaeological record. This approach focuses on the formation processes of the archaeological record and attempts to explicitly distinguish between human and natural processes. These models are useful in making predictions as the explicit examination of formation processes may assist in reducing some of the distortions of the archaeological record (Reid _et al_., 1975:213).

Schiffer (1972:157) has separated the lifespan of items found in the archaeological record into two stages; the systemic context which "...labels the condition of an element (foods, fuels, tools, facilities) which is participating in a behavioural system", and, the archaeological context "...which describes materials which have passed through a cultural system, and which are now the objects of investigation of archaeologists". These stages are each characterized by two different types of transformation processes; those which explain the context of elements as a function of the depositional behaviour of a human society, known as c-transforms; and, those which explain the interaction over time between culturally deposited elements and the local environment, or n-transforms (Schiffer and Rathje 197-:170). The nature of c-transforms will be considered first.

Depending upon the strategies and activities conducted at a site, this cultural behaviour may modify elements or determine their means of entry into the archaeological context. Elements from which energy is extracted may be subjected to activities such as procurement, transport, processing, consumption, discard and storage (see Schiffer 1976:46). Figure 3-1 models the movement of shellfish through the systemic context at a shellfish harvesting camp. It will be noted that not all elements enter the archaeological record immediately, while some which do are no longer in their original condition. An element which could be discarded unmodified except for transportation to a different location would be clappers. Similarly, other non-food materials such as fragments of shell, very young individuals or barnacle encrusted shell valves may also be transported back to the site and discarded (see Nichol 1980:96). Modified elements would include empty shellfish valves, charcoal, broken steaming stones, shellfish meat, and other food consumed and excreted at the site. Elements modified and removed from the site include dried clam meat as well as baskets of empty shell valves saved for use as ladles or grease and fat collectors. Both of these elements could be consumed, used or exchanged at a later date and in fact some may have traveled substantial distances before entering the archaeological record.

Elements used to procure, process, transport or store energy may be involved in more complex activity cycles including procurement and manufacture, use, maintenance, recycling, curation or conservation, and finally discard (Schiffer 1976:46). Figure 3-2 presents a similar flowchart for the lifespan of a wooden box which enters the systemic context as a thick roughly split

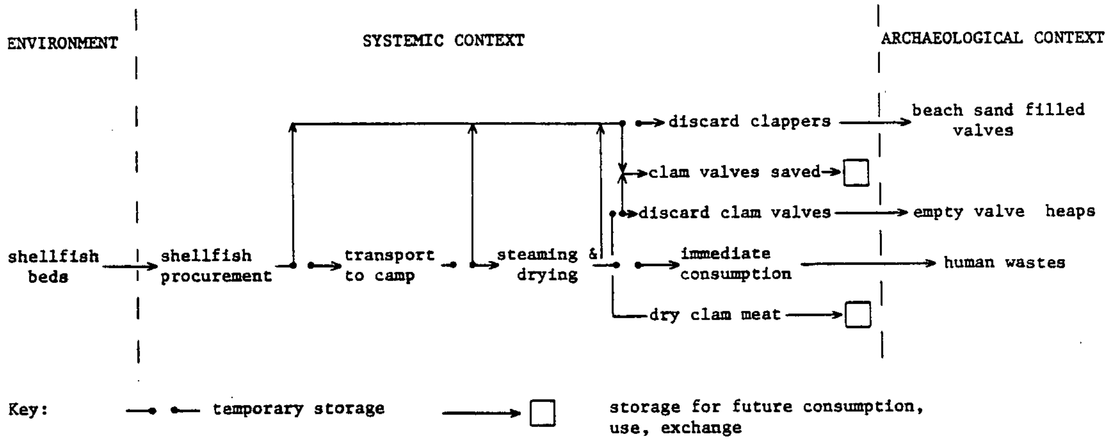


Figure 3-1. C-Transform Flowchart for Shellfish (adapted from Schiffer 1972).

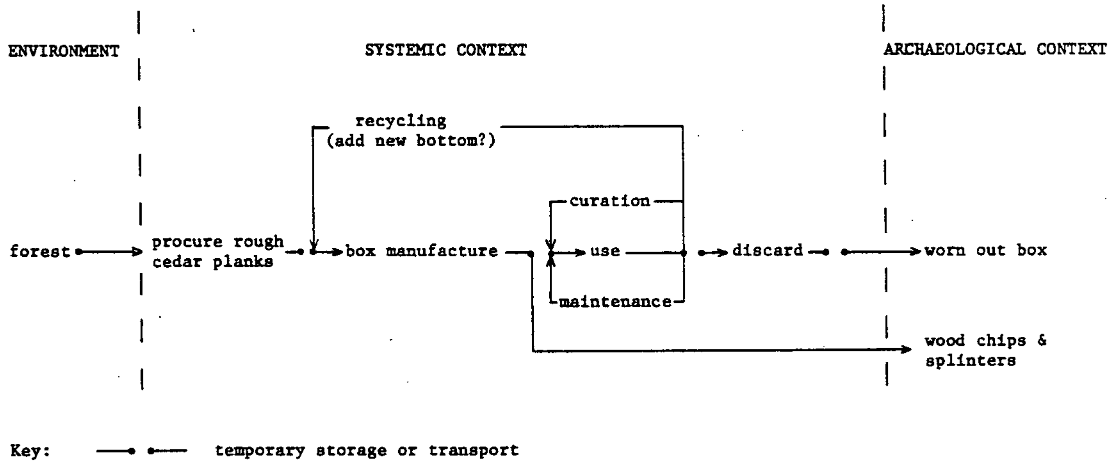


Figure 3-2. C-Transform Flowchart for a Bent Wood Cooking Box (adapted from Schiffer 1972).

cedar plank, and leaves as wood chips, splinters and fragments, and worn-out boxes. In reality, the systemic context of a manufactured element such as a box is more complex than illustrated, as it might be curated or saved and used at other sites before discarding (see Binford 1973:242).

We can see from these two examples that a variety of c-transforms representing different activities are responsible for the condition of material entering the archaeological context. Sand-filled clappers are transported and discarded, while most empty shell valves are output from activities associated with transportation, processing (steaming to open valves), meat removal and discard. Culling or scavenging of shell heaps for shell valves to be used or exchanged is a c-transform which prevents some elements from entering the archaeological context at a shellfish harvesting site. Similarly a c-transform designating a portion of beach as a latrine (see Suttles 1974:207) would prevent human wastes from forming archaeological refuse because of tidal flushing. In the case of a wooden boiling box, elements entering the archaeological context also vary because of different types of c-transforms. Adzing and whittling a plank results in wood chips and splinters, while use, curation and reuse would determine the time and place the box would be discarded when worn out.

The above models are useful in charting the course of an element through the systemic context and isolating specific c-transforms responsible for the state of the element when it enters the archaeological context (Binford 1978a:9-11, 459-497). However, every type of strategy consists of numerous elements and associated activities which may transform these elements. Another type of transformation model which may prove of value here is the behavioural chain model; "...the sequence of all activities in which an element (or set of elements) participates during its life within a cultural system" (Schiffer 1975b:106; 'set of elements' inserted by Rock 1975:24). Behavioural chain models appear to be useful in that they provide a framework for making specific hypotheses relating cultural activities and the archaeological record (Schiffer 1975b:112-3, 1975c:123, 1976:52). Basically, an attempt is made to match expected output from cultural activities with the observed archaeological record, a close fit supporting retention of a hypothesis and a poor fit resulting in rejection or modification (Schiffer

1976:52; see Mager 1975; Stier 1975). To date behavioural chain or linear activity models have received their widest application in studies of stone tool technology (see Magne 1981:3). In all these studies modeling has concentrated on certain elements (and associated or conjoined elements - Schiffer 1976:51) while in this study behavioural chains will be used to frame activities and output from specific strategies involving many conjoined elements.

Tables III-I and III-II present behavioural chain models for shellfish harvesting and wooden box manufacture. The model presented for shellfish harvesting is substantially the larger as it deals with several additional types of activities such as meal preparation and consumption while the box model deals only with manufacturing. In both cases the models represent the step by step activities discussed for the Coast Salish using the references provided with each table.

"Time" is used here as an estimation of how long the strategy might actually take. The entire chain of activities could be repeated at the same site, at a different part of the same site, or at another site. The other concept of time of interest in this study, seasonality, will be predicted independently of the ethnograpic data. "Activities" are, as requested by Schiffer (1976:49), expressed in terms of dynamic relationships among participating elements.

In Tables III-I and III-II, "events" represent the specific step by step sequence of acts in each activity although they may be generalized in many cases (i.e., replacing broken basket handles or strands may also have associated events like breaking and discarding a bone awl, or discarding the old handle). In a study concerned with isolating stages of stone tool manufacture from the analysis of lithic detritus Magne (1981:8) has defined an event as each act in the reduction sequence resulting in the removal of

Time	Activities	Events	Agent	Elements	Location	Wastes
	basket repair	replacing broken basket handles, strands, etc.	women	cedar roots, bark, bone awls	camp	bone awls, cedar root and bark fragments
day	digging stick sharpening	sharpening point on abrasive stones	men	digging sticks, abrasive stones	camp	digging sticks, abrasive stones
1 - 2	firewood collecting	placing driftwood in bundles	men-children	driftwood	beach to camp	driftwood
	cobble collecting	gathering cobbles in baskets	children-men	beach cobbles	beach to camp	cobbles
	sand collecting	scooping clam shells of sand into baskets	children-men	beach sand	beach to camp	sand
	skewer preparation	sharpening skewers on abrasive stones	men	wooden skewers	camp	wood fragments, abrasive stones
day 3	load canoes	place digging sticks, baskets, spears, in canoes	men, women, children	canoes, paddles, spears	camp to beach	
early a.m.	paddle to shellfish beds	paddling	men, women	canoes, paddles	Boundary Bay	
	upper inter-tidal zone collecting	collecting mussels, dogwhelks, barnacles	women, children	baskets, digging sticks	upper inter-tidal	baskets, digging sticks
mid a.m.	fishing	spearing flatfish, crabs in tidal pools	men	fish spears, baskets	tidal pools	spear heads
	crab collecting	collecting crabs in baskets	children	baskets	tidal pools	
midday	shellfish digging	digging clams	men, women	digging sticks, baskets	clam beds	digging
	cockle gathering	collect cockles from sand bars	women, children	baskets	sand bars	baskets
mid p.m.	load canoes	collect full baskets, digging sticks, spears into canoes	men, women, children	canoes, baskets of clams and fish, digging sticks, and spears	clam beds, sand	baskets
	paddle to camp	paddling	men, women	canoes, paddles	Boundary Bay	
late p.m.	prepare steaming fires	start fires, place firewood on fire, dump baskets of cobbles on hot coals	men, women, children	firewood, beach cobbles	camp	ash, charcoal, firebroken rocks
	steam clams	dump baskets of clams on hot cobbles	men, women, children	clams	camp	clam valves
		cover clams with old mats	men, women, children	old mats	camp	mats
		cover mats with clean beach sand	men, women, children	beach sand	camp	sand
+20-45 min	open steam-heap	remove sand, old mats	men, women	sand, mats	camp	sand, mats
	prepare clam meat	remove meat from clams, rinse in water, place on wooden skewers	men, women	clam meat, clam valves, box of water, wooden skewers	camp	clam valves, sand, skewers
	roast clam meat	prepare fire, stick skewers around fire	women	firewood, clam meat on skewers	camp	ash, charcoal, post holes
evening	prepare meal	roast flatfish, crabs, mussels over fire	women	flatfish, crabs, mussels, firewood	camp	flatfish bones, crab shells, mussel shells, hearth, charcoal, ash, postholes, clam valves
	have meal	eat shellfish such as littlenecks and whelks which are not to be preserved as well as fish, crab, mussels	men, women, children	clam meat, fish, mussel meat	camp	flatfish bones, crab shells, mussel shells, hearth, charcoal, ash, postholes, clam valves
	roast clam meat	turn skewers around	women	clam meat, skewers, fireweed	camp	ash charcoal, skewers
day 4	sun dry clam meat	take meat off skewers, thread on cedar bark cord, sun dry on mats	women	clam meat, skewers, cedar bark cords, mats	camp	skewers, postholes, cedar bark cord
	return to shellfish beds	paddle to shellfish beds	men, women, children	canoes, paddles	Boundary Bay	

Sources: Bouchard and Kennedy 1974, Eells 1887, Elmendorf 1960, Gunther 1927, Haeberlin and Gunther 1930, Jenness n.d., Reagan 1917, Stern 1934, Suttles 1974, Swan 1972, Thompson 1913, Wilson 1866.

Table III-I. Behavioural Chain Model of a Shellfish Harvesting Strategy.

(Location - camp or village, Agent - man, Time - 1 or more days)

Activities	Events	Elements	Wastes
plank selection and preparation	bring plank to camp	-	-
	split plank to size	wood, antler wedges, hand mauls	cedar fragments, wedges, mauls
	adze plank smooth	elbow adze?	cedar chips, adzes, antler hafts
	whittle off adze marks	stone knife, dogfish skin, sand	cedar chips, stone knives, sand, abrasive stones
	cut off rough ends	stone knife	cedar fragments, stone knives, abrasive stones
prepare kerfs and corners	score kerf lines	stone knife, wooden straight edge	cedar chips, stone knives, abrasive stones
	resharpen knife	stone knife, abrasive stone	cedar chips, stone knives, abrasive stones
	cut kerfs halfway through box	stone knife, abrasive stone	cedar chips, stone knives, abrasive stones
	turn plank	-	cedar chips
	score corners opposite kerfs	stone knife, wooden straight edge	cedar chips, stone knives, abrasive stones
	cut out corners	stone knife, abrasive stone	cedar chips, stone knives, abrasive stone
heat stones for steaming	collect baskets of cobbles from beach	baskets, beach cobbles	broken baskets, cobbles, firewood
	collect driftwood from beach	baskets, firewood	broken baskets, firewood
	-	firewood	charcoal, ash
	dump cobbles on	cobbles	unused cobbles
	collect baskets of seaweed	baskets, seaweed	broken baskets, seaweed
prepare steaming trenches	dig narrow trench for each kerf	digging stick	broken digging sticks
	fill trenches with hot cobbles	hot cobbles, wooden tongs	cobbles, wooden tongs
	cover trenches with seaweed	seaweed	seaweed
steam plank	place plank across trenches	plank	
	cover with seaweed and old mats	seaweed, old mats	seaweed, old mats
	pour water in trenches	water, water box	
prepare cedar pegs and cord	carve corner pegs	split cedar, stone knives	stone knives, antler wedges
	soak cedar cord in water	cedar cord, water, water box	
	remove mats, seaweed, and plank	plank, mats, seaweed	seaweed, mats, cobbles
bend plank	bend each section of plank	plank	
	tie cedar cord around box	box frame and cedar cord	cedar cord fragments
	drill holes through corner joint	bone drill, bone/antler haft	bone drills, bone/antler hafts
	drive cedar pegs through holes	cedar pegs, hammerstone	cedar pegs, hammerstone
	untie cedar cord	cedar cord, box frame	cedar cord fragments
prepare box bottom	adze bottom plank smooth	elbow adze	cedar chips, adzes, antler hafts
	fit to box frame	stone knife	stone knives, abrasive stones
	drill holes through bottom and sides	bone drill, bone/antler haft	bone drills, bone/antler hafts
	drive in cedar pegs	cedar pegs, hammerstone	cedar pegs, hammerstone
	seal box seams with pitch	pitch	

Sources: Boas 1921, Gunther 1927, Haeberlin and Gunther 1930, Hill Tout 1905, Jenness n.d., Suttles 1974.

Table III-II. Behavioural Chain Model for Manufacturing a Cedar Cooking Box.

flakes. A similar definition is followed here as it takes into account the actual transformation of an element resulting (as a rule) in some kind of refuse or waste.

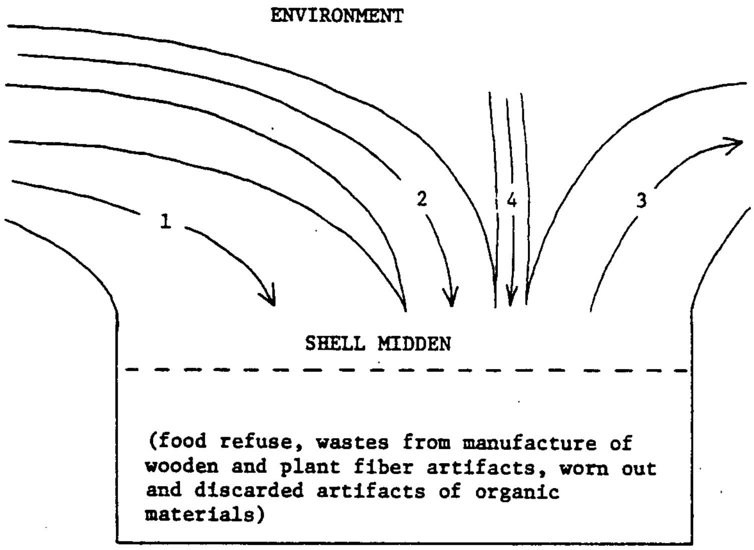
"Agent" refers to the person or persons most likely to be conducting the activity in question and while the activities of men and women are fairly explicit in the ethnographies, I have inferred occasions when children may have assisted. In the manufacture of a cooking box it was assumed that one man would probably make the box by himself. "Elements" include anything reported in the ethnographies corresponding to the activities under consideration, except that I have added obviously missing elements such as firewood, beach cobbles and baskets where appropriate. "Location" is a calculated guess as to the most likely place for these activities to take place.

The "waste" or refuse requires discussion as numerous c-transforms bear directly on how an element is discarded into the archaeological context (Binford 1978b:344-348; Schiffer 1976:30-34; South 1979:220-221). Normally, elements of no further use, such as lithic detritus, clam shells and artifacts worn out or broken beyond repair, are discarded. If discarded where they were used, they form "primary refuse", while elements transported and discarded away from their location of use form "secondary refuse" (Schiffer 1972:161, 1976:30). Other elements may be accidently lost and overlooked, or abandoned when people leave the site; elements thus entering the archaeological record without the aid of discard behaviour are "de facto refuse" (Schiffer 1972:160, 1976:33-34).

Artifacts which are being used on a sandy beach or a grassy area will stand a greater chance of being lost than if they are being used around a cleared area such as a hearth, especially if they are small. Schiffer (1976:32) has suggested that archaeologists should watch for traps which may attract disproportionate numbers of lost items. Piles of woodchips from woodworking activities like canoe manufacture would be excellent traps for artifacts (see photographs in Sendey 1977:35, 36). Differences may also exist between large permanent settlements and smaller temporary ones. Photographs of large villages show vast cleared areas while temporary sites usually have substantial amounts of herbaceous vegetation (Halpin 1981:22; Sendey 1977:11, 27, 31, 49, 53). Large bulky or heavy elements such as partially worked logs or boiling stones would be abandoned at a site.

Modification of many elements as well as their context may occur after discard as a result of subsequent cultural activities. Shell heaps might be scavenged for useable clam valves, or a fire built on the heap might char or burn some shells. Human burials would also modify cultural deposits (Schiffer 1976:31), although given the time period under study here, scattered human remains from above-ground cists (tree burials, canoe burials, mortuary houses?) should predominate (see Barnett 1975:217; Jenness n.d., p. 90; Suttles 1974:473-5). The excavation of holes for house posts or the removal of stakes from the ground would also mix elements. Trampling, either along paths or in front of houses could be a major factor altering discarded elements, while the examination of historic period photographs (see above, Halpin 1981; Sendey 1977) indicate that trampling was much more extensive at major villages than at temporary camps.

In summary, it is possible to present a general model of the flow of elements through a shellfish harvesting site (Figure 3-3). The greatest influx of elements would have been raw materials bought back to the site for processing (pathway 1); including food sources such as shellfish, fish, birds, and plant foods; plant materials for use in the manufacture or maintenance wood and plant fiber artifacts; and firewood. The next major source of elements would have been processed food, manufactured wood and plant fiber artifacts, and materials for their maintenance which were imported to the



Element Pathways

1 Elements imported into the site for processing (shellfish, fish, birds, mammals, plant foods, plant materials for basketry and wood working).

2 Processed elements imported into site (dried meat, fish and other foods, artifacts of plant materials.

3 Processed elements removed from the site (dried clam meat, fish, etc.).

4 Natural elements introduced during human occupations (dead leaves, insects, animals, birds, snails, slugs, wastes).

Figure 3-3. Element Flow Through a Shell Midden (Systemic Context).

site from other sites (pathway 2), and consumed, excreted, discarded or abandoned. If the site being studied should happen to be a main village, the input of these types of elements would dominate. As well as transporting elements to the site, elements would also be removed from it (pathway 3). These elements could have included dried shellfish meat, fish, and plant foods, and artifacts manufactured from wood or plant fiber materials.

A significantly smaller number of elements would have been introduced into the site by natural agents while humans were occupying it (pathway 4). Falling leaves, and insects, slugs and snails, insectivores, rodents, and birds using the site could contribute wastes and carcasses to the deposit, although they are only a foreshadowing of the natural processes which will take over once humans abandon a site. Finally, it may be noted from Figure 3-3, that far more elements are introduced into the site than are removed resulting in a residual element pool - or the refuse and wastes we commonly consider an archaeological deposit. It is the energy transformations that take place between this residual element pool and the natural environment which will be responsible for the structure of the archaeological site when it is excavated.

A Shell Midden Model

The term shell midden has been generally applied to any archaeological site containing visible shellfish remains, and is one of the more common types of archaeological sites, being found along most of the world's coast-lines as well as at inland locations where freshwater molluscs were used (Meighan 1969:415). The term originates from the Danish word kjoekkenmoedding or kitchen midden (literally kitchen refuse) used by 19th Century Danish archaeologists (Morlot 1861:291). These early studies were interested in diet, seasonality, culture history, midden structure and environmental reconstruction (Morlot 1861), research concerns which are also pertinent to modern shell midden studies. An extensive worldwide review of shell midden research may be found in Yesner (1977:13-91), while attention here will focus on structure-forming processes in the archaeological context.

Shell middens on the Northwest Coast as well as in other parts of the world range from well stratified sites to those with little or no discernible layering, while it must be noted that discussion of shell midden structure has been scarce until very recently. This is because most archaeologists have not attempted to segregate the layers and lenses in their sites, prefer-ring to take the easier route of excavating by arbitrary levels, often seriously mixing elements from otherwise distinct strata.

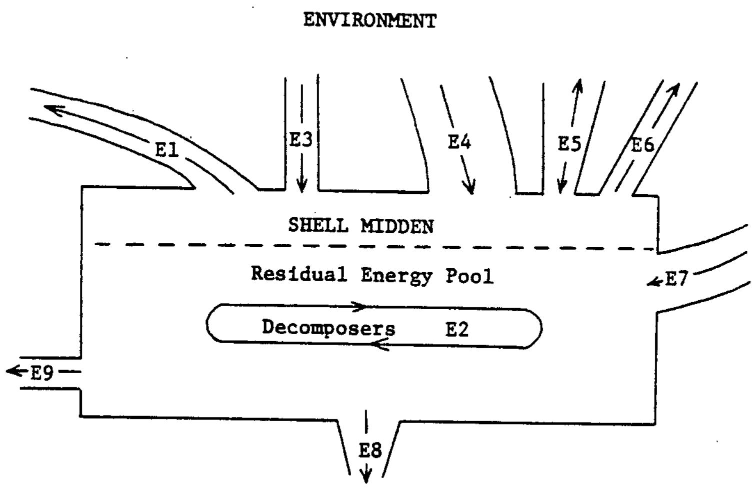
Morlot (1861:294, 301) reporting on Danish shell middens notes that black bands were sometimes observed around hearths, but that otherwise there was a general lack of stratigraphy. Several early shell midden studies in California also note the stratification in their sites. Of particular interest are the observations of Schumaker (1875:337) describing alternating bands of sand and shell refuse, and inferring that the observed structure was the result of seasonal occupations. Uhle (1907:14-39) reports ten major strata in the Emeryville shell middens while examination of his generalized section of the site suggests much more complex layering. Nelson (1909:335-336, 1910:374), although tempted to regard the definition of structure "...in a promiscuous mixture of more or less broken shell and other matter..." as unwarranted, does describe the presence of bedding planes resulting from species variation in different layers or lenses, as well as streaks of ash and beds of stones. One of the most commonly referenced California studies is that of Gifford (1916:1-2, 11) who noted layering in the midden he analyzed but avoided the finer units of stratification as being untypical of the mound in general. In the final report on the Emeryville shell midden, Schenk (1926:170) suggested that discrete lenses or layers might result from seasonal variation in the species which were being exploited - perhaps the earliest shell midden researcher to sample from within strata from a site. Subsequent research in California favoured the use of column sampling to obtain subsistence data, and as a general rule ignored any stratification which might be present (see Yesner 1977:34).

California archaeologists were not the only researchers who chose to ignore internal midden structure. Terrell (1967:42-47) for example discusses the complex stratigraphy of the Galatea Bay site in New Zealand, though both he and Shawcross were criticised by Coutts (1971:150-151) for ignoring much of this structure in their interpretations about the site.

A major step towards recognizing the importance of shell midden structure were the 1941 excavations conducted by Junius Bird in Chile. Bird (1943: 181) excavated narrow trenches to expose a block of midden on four sides, marked observed strata with pegs, and proceeded to remove and screen each layer, one at a time. With a few modifications, a similar approach was followed by this study (see Chapter 5 below). Besides the present study, only a few researchers in British Columbia have attempted to follow obvious stratification in shell middens. These include the 1968-1969 excavations by Calvert at the St. Mungo site (DgRr 2) (Boehm 1973a:19); the 1970 excavations at the Namu and Kisameet sites (ElSx 1 and ElSx 3) conducted by Hester (Luebbers 1978:20); the 1971-1977 excavation by the British Columbia Provincial Museum in Hesquiat Harbour (Calvert 1980:120, 124, 129); the 1975 excavations at Deep Bay (DiSe 7) (Monks 1977:40); the 1976 excavations by the author at Crescent Beach (Trace 1977a:3); and some of the excavations conducted at the Duke Point site (DgRx 5) by the University of Victoria and the B.C.P.M. in 1978 (Mitchell n.d.).

Until now I have focused on formation processes in the systemic context (c-transforms) while equally important to an understanding of the structure of a shell midden are n-transforms, transformation processes which occur in the archaeological context (Schiffer 1976:15-17). As residual elements abandoned in a shell midden undergo various stages of decay, the site will enter into a longterm energy exchange with the surrounding environment. Figure 3-4 presents a general model of some energy flows through a shell midden in the archaeological context. A discussion of this model follows below.

Once a shell midden site was abandoned scavengers may have consumed any easily available and edible faunal material (E1), while in actual fact many scavengers may have made night time or early morning forays onto the site while it was still occupied. Scavengers have been observed destroying



Energy Flows

E1 Energy removed by scavengers.

E2 Energy made available by decomposition of refuse by bacteria and other decomposers and detritus feeders.

E3 Energy imported by vegetation dying on site (falling leaves, seeds, etc.).

E4 Energy made available by vegetation through photosynthesis.

E5 Energy imported by animals living and dying on site.

E6 Energy removed by animals grazing on plants and then leaving.

E7 Energy imported by ground water.

E8 Energy removed by rainwater leaching.

E9 Energy lost by erosion.

Figure 3-4. Energy Flow Through a Shell Midden (Archaeological Context).

practically all skeletal material at both human kill sites and natural death sites (Crader 1974:166, Galdikas 1978:70), while we should note that the scavengers most likely to use a shell midden site in this area are much smaller than their counterparts in Africa and Borneo. Most common locally would be small mammals such as raccoons, skunks and martens as well as some birds, and although the degree to which they would be attracted to a shell midden is not known, it might relate to the quantity of waste fish available as food.

An accidental experiment in bird scavenging was conducted in August 1980 when I had cleaned a large number of fish on a northern Vancouver Island beach. The fish were filleted and the remains (head, backbone and entrails) were thrown into the water at waiting seagulls. The waves washed it all up on the beach, too close to people and dogs for the seagulls, and by dark I was feeling guilty about the entire mess. Rising at 5 a.m. however I was rewarded with a quick glimpse of an osprey (*Pandion haliaetus*), three bald eagles (*H. leucocephalus*), a very vocal protest from a minimum of two dozen gulls and crows, and a beach totally cleaned of *all* fish remains. If my observations have any applicability, much of the scavenging of shell midden sites probably took place within hours, which would have two obvious implications. One is that large fish elements may be greatly underrepresented in shell middens, while secondly, scavenger modification of clusters of refuse elements (hearths, steaming mounds, refuse heaps) may have been minimal.

Depending upon what time of year a shell midden was occupied and abandoned, volatile animal proteins in the refuse would attract bacteria and other decomposers (E2) (see Limbrey 1975:34-38), within hours or days if the site is abandoned in the summer, and possibly not until the spring or early summer if abandoned in the winter or autumn. This transformation process would be very rapid and unlikely to release any large quantity of energy from the residual pool, much of the generated detritus remaining in clam valves while some would be leached by the percolation of rain water through the deposit (E8). Some shifting or settling of elements in refuse heaps might take place, while overall deposit modification would be slight.

Figure 3-5a presents a hypothetical cross section drawing of a shellfish harvesting site in the autumn after its use, and includes the major elements from Table III-I. In this example, bacteria have already destroyed most animal proteins in the refuse while plant materials have yet to begin their decay process. Figure 3-5b presents the same site some 30 years later. Most organic refuse has decayed and the deposit is capped by a thin layer of humus which is vegetated with grasses, some clover and salmon berry. The

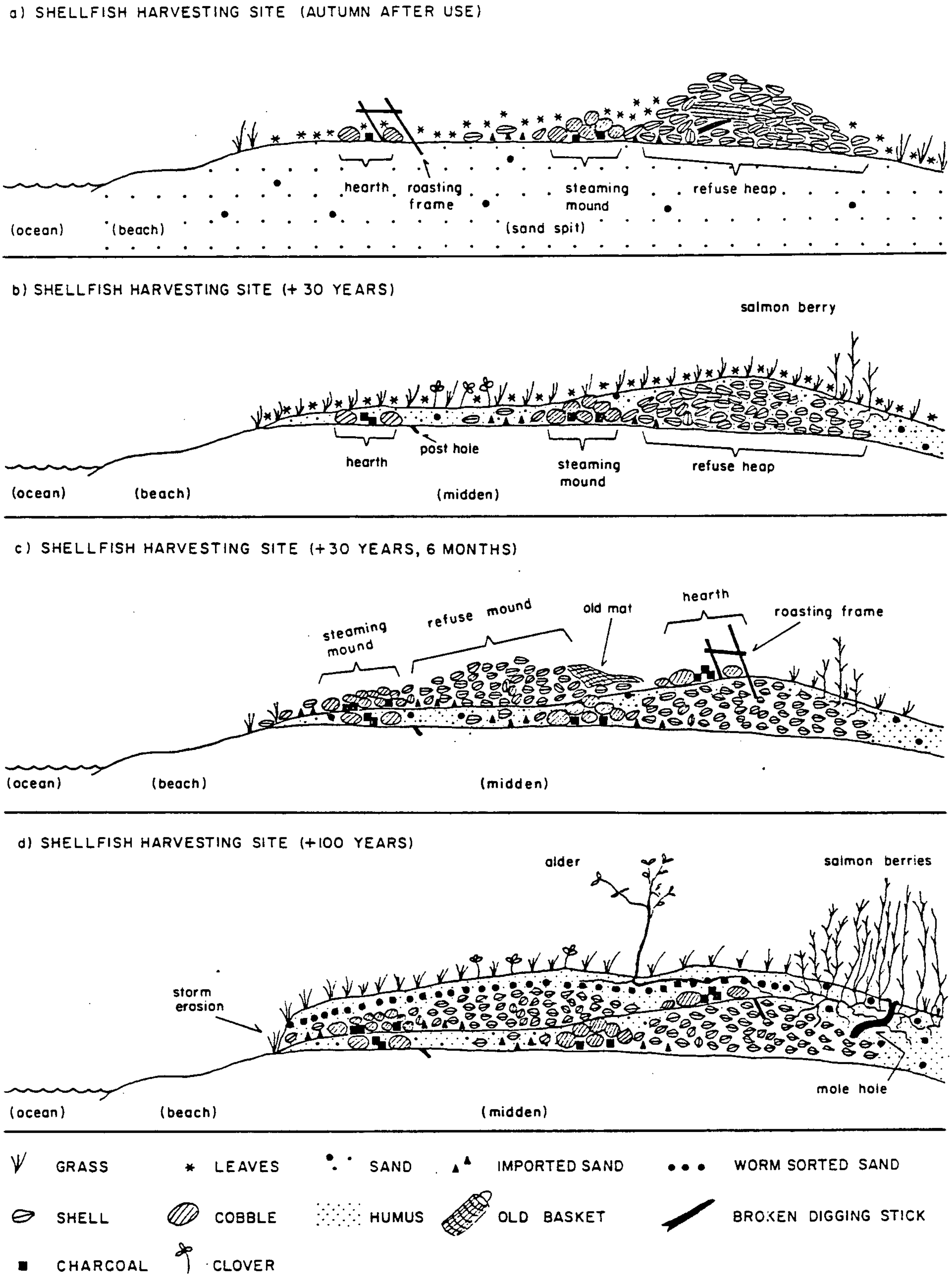


Figure 3-5. Model of Shell Midden Development.

following year the site is again used as a shellfish harvesting camp (Figure 3-5c), although activities do not occur in exactly the same location as in Figure 3-5a. In Figure 3-5d over a 100 years have elapsed since the occupation of Figure 3-5c. A well developed humus layer under a grass cover is present. Worms and grass roots have created a zone of sorted materials across much of the site, while the landward part of the midden is already facing disturbance from roots and animal burrows. On the beach front storm waves which would actually wash over the sand spit are eroding the deposits.

The initial plant colonization of a shell midden (such as is modeled in Figure 3-5) would be by dune rye grass (Elymus mollis) and possibly beachgrass (Ammophila arenaria) (Mike Broderick, 1981, pers. comm.) which would spread their rhizomes over the deposit, taking root in sandy patches and eventually covering the entire deposit. E. mollis is presently found along the beach near the 1977 excavations, and in 1976 was observed colonizing the last few remaining m^2 of exposed shellfish valves from the cannery which closed in the early 1960's. Although the exact extent and actual date of deposition of this historic shell is not known, minimally 15-20 years were involved in its colonization by grass. In 1976 there were no deciduous trees or shrubs within some 200 m of this deposit so that development of a leaf mat would be slight, not unlike the conditions we might expect if shell refuse was abandoned on a newly formed beach or sand spit similar to that portrayed in Figure 3-5a.

Colonization of a shell refuse heap surrounded by dense vegetation (i.e., Figure 3-5d) would be completed in at least half the amount of time as dense litter mats (E3) would form rather quickly, especially at sites with a lot of deciduous vegetation (see photographs in Sendey 1977:11, 49). During this same time period organic plant wastes would also decay, some of this released energy being used by the colonizing plants, some remaining unavailable collecting in shell valves, and some would be leached from the deposit (E8). Substantial settling of a refuse mound would result from the decomposition of any large quantities of plant materials (see Figure 3-5b).

Very little energy would be released from cultural refuse after the decomposition of plant remains, the largest energy transformations (besides leaf fall) would be solar energy fixed by site vegetation through photosynthesis (e4). Now that a substrate has been prepared, grasses would face increasing competition from plants capable of nitrogen fixation (see Figure 3-5b), which could dominate the next several hundred years of plant succession at the site. Initially these plants would include clovers (Trifolium sp.) followed by salmon berries (Rubus spectabilis), thimbleberry (R. parviflorus), and eventually alders (Alnus rubra). Some patches of wild rose (Rosa sp.), elderberry (Sambucus racemosa), and ocean spray (Holodiscus discolor) would be other obvious plants. All are presently common in the Boundary Bay area and along the coast of the Lower Mainland, especially in disturbed beach areas off Ocean Park and Point Grey.

At the development stage represented by the illustration in Figure 3-5b several energy exchanges could be taking place between the site and animals. Moles, shrews and small rodents could be using the site by now, those dying on site contributing their carcasses to the archaeological record (E5). Modification of cultural refuse may be slight if loosely compacted shells provide ready access to roots, worms, insects, snails and other sources of food without any need of extensive burrows. Besides the remains of burrows, small mammalian residents of archaeological sites may also be inferred from the reocvery of fairly complete to complete and partially or fully articulated skeletal remains (Thomas 1971:370).

Figure 3-5c illustrates the reuse of the same location as a shellfish harvesting site, abandoning the same set of refuse elements, only in different locations. Re-vegetation would take much less time than in Figure 3-5a as peripheral and remnant patches of grasses and salmonberry would quickly spread their rhizomes over the deposit while their leaves would contribute to a much thicker litter mat. In the Figure 3-5d illustration the site has been left alone by humans sufficiently long that processes of pedoturbation or soil mixing are taking place (see Wood and Johnson 1978).

First, on the left side of the illustration, is a worm-sorted zone of fine materials overlying a zone of coarser materials, a phenomenon likely to develop quickly in a soil under a grassy cover. In ingesting fine soil particles and depositing their castings on the surface, objects too large for the worms to swallow will become buried at the base of the worm-worked zone (Cornwall 1969:128; Evans 1972:208-9; Wood and Johnson 1978:325-8). The invasion of salmonberry and alder would begin to remix the worm-sorted zones, a process known as floralturbation, while additional mixing could result from rodent burrows (faunalturbation) (Wood and Johnson 1978:318-320, 328-333). In time, sufficient mixing could result in a distinct zone across the site of shellfish valves, humus, sand, rocks and artifacts, perhaps obscuring most of the element clusters deposited in Figure 3-5c.

Eventually on a shell midden such as that illustrated above, alder would dominate with some maples until such time as the soil has matured sufficiently to support conifers like Douglas fir and hemlock. The black humus soil which would develop under grasses and deciduous trees and shrubs is a basic mull form with plentiful fauna (Bridges 1970:12). One effect of this characteristic (plus the alkaline nature of the shell layers) is poor pollen preservation, microbiological activity quickly destroying much of the pollen rain on soils with a pH greater than 5.5 (Dimbleby 1969:172, 1976:348). Calvert (1980:209) reports pH values ranging from 6.3 to 8.0 for DiSo 1, an open air shell midden in Hesquiat Harbour, while Monks (1977:

330) reported 6.0 to 8.5 at DiSe 7, the Deep Bay midden. Sawbridge and Bell (1972:846) report a range of 6.9 to 7.2, while Holland et al. (1957) report that middens generally have a pH of 7.0 or more. Mathewes (1976:103) discusses the poor pollen preservation of the Glenrose Cannery shell midden. Another effect will be the rapid loss of soil nitrogen, through loss to the atmosphere of gaseous ammonia produced by micro-organisms, and from nitrification by bacteria which results in soluble nitrate ions susceptible to leaching (Limbrey 1975:63-4).

Once the site has been invaded by conifers an acidic mor type soil will develop, as litter from this type of forest is low in base content (Bridges 1970:12). Acidification of the soil will eventually eliminate the soil fauna responsible for soil mixing, which (including earthworms) are intolerant of acidity (Bridges 1970:12; Dimbleby 1969:173). While some nitrification is still taking place Douglas fir would grow well on a shell midden rich in calcium and magnesium, two elements important to the tree's growth (Krajina 1969:111). Podzolization which is common in the Coastal Western Hemlock Zone and the subsequent mor humus formation, in addition to stopping nitrification would also make the rainwater percolating through the site extremely acid (Bridges 1970:21; Krajina 1969:40, 111). This will encourage the decay of shell and bone elements while the mor humus will attract western hemlock which is tolerant of a low nutrient supply (Krajina 1969:122). Sawbridge and Bell (1972:847) have noted that middens had lower total nitrogen values when hemlock was present.

Initially root mixing by these large trees will destroy stratification, while over time the increased acidity will destroy organic elements. EdSs 3 at Port McNeill (Ham 1980) on northern Vancouver Island is an example of a shell midden in the early or middle stages of this process. The site is densely forested with second growth conifers having been logged once already, while shell deposits are mixed with black humus and are actively decaying. Natural plant succession must be included as an n-transform which may not only mix deposits, but in the end destroy most of a shell midden site. I suspect that Northwest Coast shell middens older than 5 or 6,000 years would be preserved only in exceptional circumstances.

Another energy transformation which may remove or introduce energy in a shell midden is ground-water seepage (E7). This process would be unlikely to occur at a site such as illustrated in Figure 3-5, or at the portion of the Crescent Beach site of concern here as both are mounds built above any existing water table. However, at sites on slopes or at the base of slopes ground-water seepage is more common. The older portions of the Crescent Beach site excavated by Percy (1974:19) are subject to ground-water seepage, while an extreme example may be portions of the Fort Rupert shell midden (EeSu 1) excavated by Capes (1964:72-7). An extensive portion of the site near Thomas Point is located along the beach front at the base of a slope where ground-water seepage appears sufficient to leach the soil of nutrients, the whole midden densely covered with nitrogen-fixing alders as well as salmonberries and thimbleberries. Although more detailed investigation is warranted, this leaching may be retarding natural plant succession and in this situation prolonging the integrity of the shell midden deposits. Rain-water percolation at all shell midden sites will continuously leach nutrients from the site and its developing soils (E8) throughout the lifespan of the site (i.e., leaching of phosphates, Schmid 1969:160).

Discussion of this model lends support to the earlier contention that a shell midden is not a static entity, some form of interaction with the local environment taking place continuously, while on occasion there are major energy transformations. Wood and Johnson (1978:317, 396) point out that soils are not static, and as part of a developing soil, shell middens have their own unique energy exhanges with the environment, some significantly altering deposits of cultural materials while others will not. Subject to the natural environment, shell deposits will eventually face total decay.

One major n-transform which may remove vast quantities of energy from the residual energy pool (and thus destroy vast portions of a shell midden) is erosion (E9). Wave erosion of shell middens is not uncommon on the Northwest Coast (Apland 1977; Carlson and Hobler 1976:126; Hanson et al., 1975:2; Hobler 1978), although not anywhere near as common as on the Atlantic Coast (Simonsen 1979). Erosional loss from the actual mining of shell middens was very common historically all along the Pacific Coast, shell midden material being used for everything from land and road fill, to chicken scratch and garden fertilizer, and for making tennis courts with the result that many shell middens have been totally destroyed (see Abbott 1962:17; Ham 1981; Howard 1931:388; Matthews 1959:16A; Nelson 1909:326; Smith 1924:447-8). The destructive activities of relic collectors must also be included in this group of transformation processes.

Providing a shell midden survives historic disturbances, it may have a long lifespan in the archaeological context with many Northwest Coast sites undergoing distinct stages of development following initial deposition including, decay of organics, initial plant colonization, establishment of nitrogen fixers, and finally invasion by climax coniferous forests. The transformation processes occurring at each stage may be interrupted at any point by the renewed deposition of cultural materials; the degree of element transformations which have taken place being directly related to how long plant succession and soil development has continued. Exposed to 5 or 6,000 years of these transformation, a shell midden could be reduced to broken cooking stones, stone artifacts, and sand.

In summary, various elements observed and recorded as archaeological data will have different lifespans in the overall site context (see Figure 3-6). Lithic and bone elements may have lifespans extending throughout the archaeological context and in some cases lengthy lifespans in the systemic context as well. These long life elements will often permit inferences to be made about the environmental setting of the site. Perishable elements such as plant remains may have very short lifespans in the archaeological context so that often we may only be able to guess at their former presence. Soil and shell refuse layers have been included as elements of the archaeological record and may also allow some inferences to be made about the nature of their lifespan in the archaeological context (i.e., local plant succession); and in the case of shell refuse layers, about their systemic context and environmental setting. Element clusters and layers will be examined in more detail in Shell Midden Layers below.

Before proceeding further however, one additional set of factors which need illuminating are those which bear upon selection of the actual location for a shellfish harvesting camp as they may be important determinants as to the nature of the observed archaeological record. The environment as well as the systemic and archaeological contexts may all play important roles in dictating where a site will be located. Evaluation of a site location will always be important taking into account such things as site setting, exposure, shelter, number of people versus available space, possibly ownership, or perhaps simply a preference for traditional family locations.

Initial settlement of a newly formed beach spit may have been fairly unrestricted by vegetation growth, and if the spit developed in increments, refuse deposits could overlap down the spit becoming progressively younger (see for example Schwartz and Grabert 1973:308). If a large expanse of beach or spit became available for use at one time, or more quickly than the human demand on space, refuse deposits may initially be deposited fairly

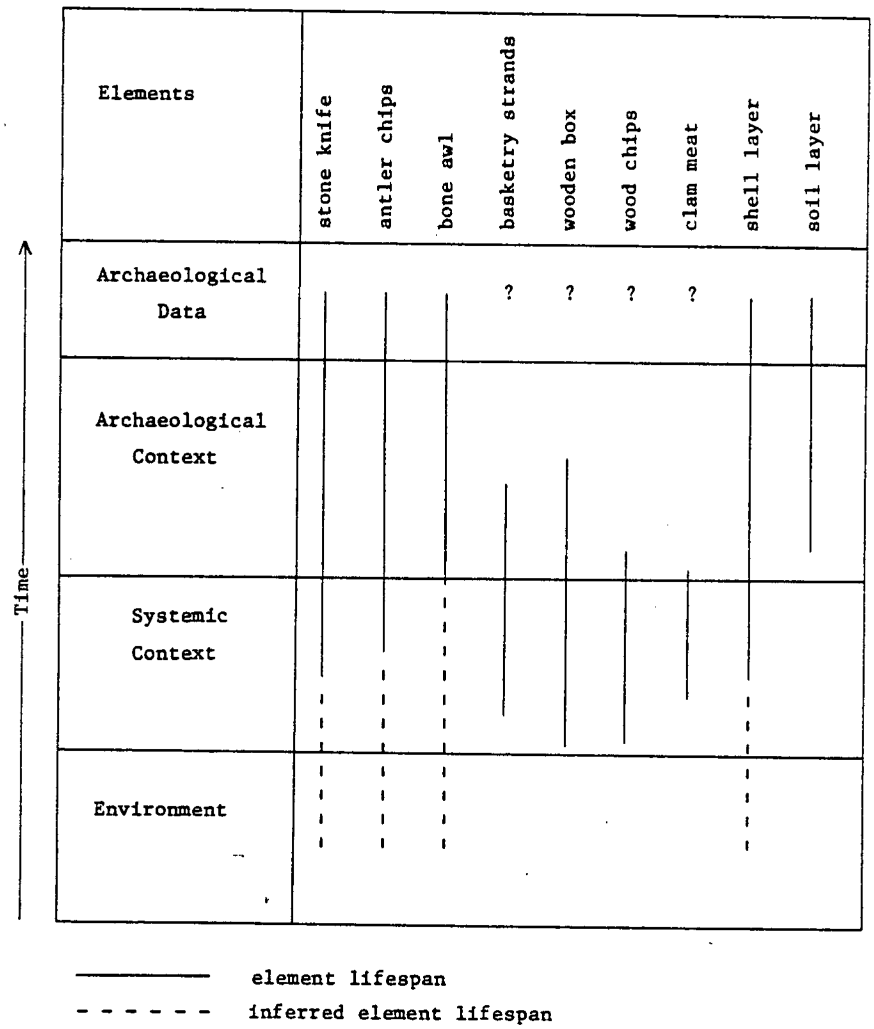


Figure 3-6. Variation in Element Lifespan.

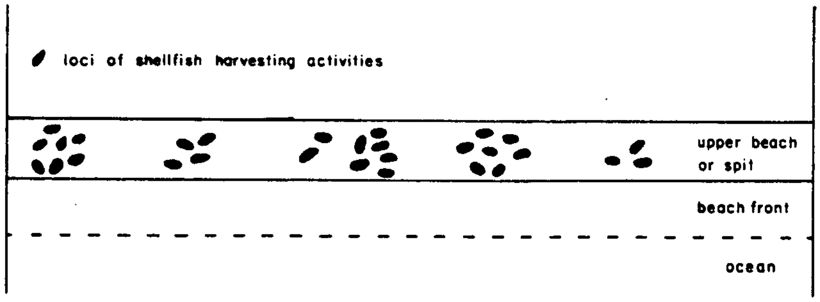
randomly about the substrate. Once the succession of vegetation discussed above became established, competition between plants and people for space could result in a distinct clustering of settlement locations (see Figure 3-7a). As salmonberries, rose bushes, alders and shell heaps begin to restrict available space, the partially cleared area about last years camp would be rather attractive. A clustering of seasonal camps around one basic location could continue for several seasons until one was basically shell heaped into the brambles. At this point that clump of pole sized alders down the beach would be a more suitable settlement location and a whole new series of refuse clusters could be deposited. Given sufficient time and use of an entire area, archaeological deposits should appear as a narrow undulating mound composed of numerous overlapping clusters of seasonal refuse deposits. This is not unlike the nature of the Crescent Beach site discussed in Chapter 2.8, although over 100 years of modern use may have obscured surface features.

One of Suttles' informants (1974:258, 1977:1) reported that a house outline was present at Crescent Beach in the late 1800s so the nature of deposit which might be expected from a main village should also be considered. Incidentally, the location indicated for this house coincides with the former location of the Crescent Hotel, while no other surface indications have been reported or observed which would suggest the presence of a main village, at least in the late period. In addition, it should be noted that I have never found any evidence of house posts in the many hundred meters of water and sewer line ditches I have observed at Crescent Beach.

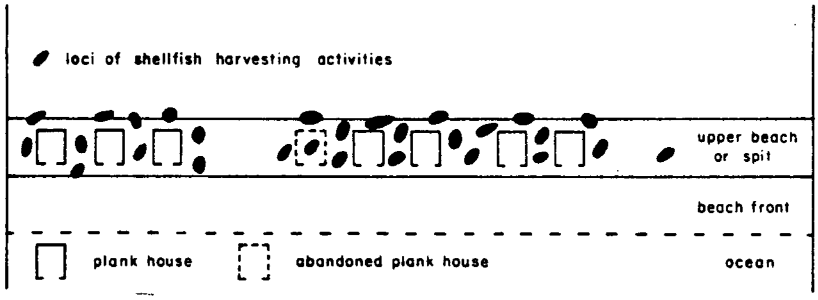
The harvesting and processing of shellfish at a main village (or even around temporary plank houses at a seasonal site) would result in a very different pattern of refuse deposition than that discussed above. While steaming and drying activities may have taken place in front of the houses, refuse could accumulate between and behind houses, while abandoned house locations would be choice activity areas (see Figure 3-7b). A pattern of refuse mounds very similar to this description may be observed at the Beach Grove site (DgRs 1), and the rough sektch map provided in Figure 3-7c will serve to illustrate the major difference in midden structure.

Hester and Conover (1970:138) have described another type of shell midden model in which a line of houses face the beach and refuse is deposited along the front of the beach resulting in layers sloping towards the water. While this type of shell discard may be common at some Northwest Coast middens, it

a) cluster effect at seasonal camps



b) horseshoe effect at a plank house village



c) steep walled house outlines at Beach Grove Site (DgRs 1)
(from Ham 1981)

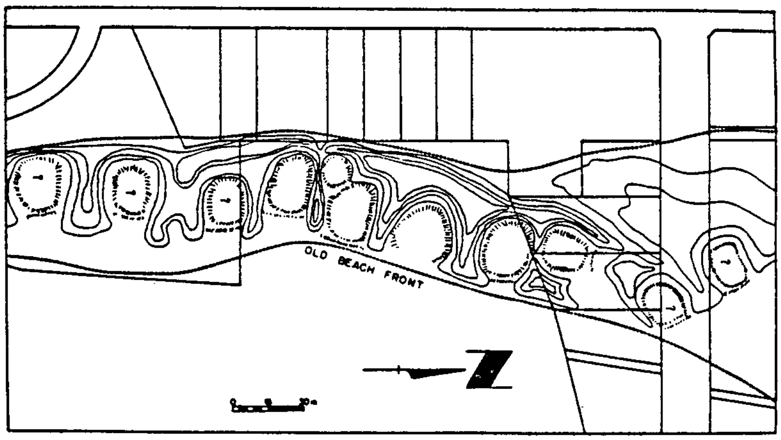


Figure 3-7. Patterns of Shellfish Discard.

is not an obvious model for the type of deposits observed at Crescent Beach.

Ethnographic information on refuse deposition is somewhat scarce, one source being the observation by Schumaker (1875:338-9) that around permanent houses shell refuse was always dumped in fixed places while at seasonal camps it was usually simply distributed over the ground surface; but especially interesting is his statement that he observed Oregon families always depositing their refuse on the same heap. Stern (1934:52) has reported that refuse was discarded behind the houses.

As stated at the beginning of this particular discussion, many factors may have been responsible for the formation and eventual character of a shell mound necessitating evaluation of each site to determine what factors were operating in each case.

Shell Midden Layers and Stratigraphy

This chapter commenced with a discussion of how a society dependent upon transformed sunlight for food energy structures itself to obtain this energy from the environment, with particular attention to the adaptive dynamics of the Coast Salish. Close examination of two types of Coast Salish adaptive strategies (one concerned with obtaining energy rich elements from the environment, and the other with the manufacture of an element used in processing energy for human consumption), demonstrated how the events or specific acts which make up these strategies transform many elements between the time they are procured from the environment, and abandoned when no longer of value. The formation of a shell midden is not complete with the discard of unwanted elements; natural activities such as plant succession may deposit a whole different set of elements, and as we saw above the two sets may eventually become mixed.

In Figure 3-5a, a model was presented in which three main clusters of refuse elements are obvious; a shell refuse heap, a cobble steaming mound and a hearth. Each cluster may be defined as a stratigrapic unit, and the archaeologist may proceed to identify the elements he recovers from each and infer the events responsible for their deposition and context. But, only rarely will a shell midden deposit of this simplicity be encountered. A somewhat more complex model was presented in Figure 3-5d, while examination of the behavioural chain models presented in Tables III-I and III-II (remembering these represent only two of many strategies which could take place) provides a better indication of the true complexity generally encountered. The archaeologist excavating the deposit illustrated in Figure 3-5a would most likely define it as one stratigraphic layer containing three features, while in reality the placement of excavation units (whether judgmental, systematic or random) would not necessarily guarantee recovery of all three features. Archaeologists working in this area, and perhaps in shell middens elsewhere, are only too familiar with the common law that burials (and other features) must extend into an adjacent and unexcavated unit. While the effect of this troublesome phenomenon may be minimized by excavating large areas in shell middens (single excavation units should be used only in exploratory investigation), there is not any guarantee that large features would be contained within the boundaries of even a wide area excavation.

Clearly a definition of a shell midden layer must be of value both in excavation and in subsequent analysis and interpretation. It must allow the archaeologist to isolate clusters of cultural elements, clusters of natural elements, varying combinations of both, and subsequently identify the events responsible for the deposition and context of these elements, replicate the behavioural chains (or natural processes) and hence the strategies (or natural activities) which took place at the site.

In this study a shell midden layer is viewed as any homogeneous body of refuse elements perceived during excavation and contained between two or more consecutive and recognizable discontinuities. Like other clusters of refuse elements (i.e., features), the recognition and definition of layers in the ground is of prime importance due to their destruction by excavation. Binford (1964:431) has pointed out that archaeologists must make many "...formal observations..." in the field. In many cases this requires a change in attitude on the part of archaeologists, all too many regarding the archaeological site as a place to collect samples for subsequent analysis, while we really should be regarding the site and its excavation as our laboratory and subsequent analysis as a postmortem examination.

Harris (1979a:9, 1979b:111-112) argues that much archaeological stratification is man made and thus not necessarily explained by laws of geological stratigraphy. Geological strata result from the deposition of mineral and organic sediments transported by air, water and ice (Gladfelter 1977:519), while the strata observed in a shell midden result from the deposition of refuse (mineral and organic) by humans and plants. Geological agents of transport may sometimes be important in the formation of a shell midden; for example, a part of the Crescent Beach shell midden consists of layers of wave eroded and deposited sediments (see Chapter 2.8), while portions of the Musqueam N.E. shell midden (DhRt 4) contain layers of stream deposited sands and gravels (Ham 1973:32-33, see also Kew 1955:30-31 for DhRt 2). It is necessary however to determine which strata are of natural origin, and which result from humans and plants.

Harris (1979b:112-113) has presented four basic laws of archaeological stratigraphy:

> <u>The Law of Superposition</u>: in a series of layers and interfacial features, as originally created, the upper units of stratification are younger and the lower are older, for each must have been deposited on, or created by the removal of, a pre-existing mass of archaeological stratification.
>
> <u>The Law of Original Horizontality</u>: any archaeological layer deposited in an unconsolidated form will tend towards an horizontal disposition. Strata which are found with tilted surfaces were so

originally deposited, or lie in conformity with the contours of a pre-existing basin of deposition.

The Law of Original Continuity: any archaeological deposit, as originally laid down, will be bounded by a basin of deposition, or will thin down to a feather-edge. Therefore, if any edge of the deposit is exposed in a vertical plane view, a part of its original extent must have been removed by excavation or erosion: its continuity must be sought, or its absence explained.

The Law of Stratigraphical Succession: any given unit of archaeological stratification takes its place in the stratigraphic sequence of a site from its position between the undermost of all units which lie above it and the uppermost of all those units which lie below it and with which it has a physical contact, all other superpositional relationships being regarded as redundant.

The first three laws refer to the "...physical aspects of strata in their accumulated state..." and are adapted from geology, for although agencies of deposition may be very different, both geological sediments and archaeological - plant refuse are deposited on a pre-existing deposit or substrate, and are governed by the laws of gravity and the form of any depositional basin, and may be subject to erosion or disturbance (Harris 1979b:113-114). The law of stratigraphic succession is important in complex sites such as shell middens for multilinear stratigraphic sequences will occur, with refuse accumulating in two or more basins of deposition at the same time (Harris 1979b:115).

Attention has so far focused strictly on refuse layers or strata, while two other types of deposits which also occur are vertical deposits, either negative (ditches, pits, graves, postholes), or positive (walls, embankments) (Harris 1979a:36, 45-6). All archaeological layers or units of stratification (except for negative deposits) share four basic characteristics including; 1) boundary contours which define the spacial extent of a layer or unit both horizontally and vertically, 2) surface and basal contours which define the topographic nature of a layer or unit, and by combining the two above dimensions, 3) volume, and 4) mass (Harris 1979a:40-41). (Negative features may have boundaries and a topographic form, but will not have a volume and mass like refuse layers or embankments for example).

One additional concept is what Harris (1979a:43) has termed an interface, the zone of mixing which may result from the deposition of a fine textured refuse on a layer in which roots or faunal activity may incorporate refuse elements from an underlying layer upwards into the soil layer. As Harris points out, it may be argued that a layer and its interface or surface are a single phenomenon, although archaeologists may wish to discriminate between the two to avoid mixing of refuse from adjacent layers. Unlike other types of layers, interfaces are arbitrarily defined by the archaeologist.

Although a shell midden may appear to be a garbled mixture of shell, bones, rocks, ash and soil, I have yet to observe one from the Northwest Coast which lacked complex internal layering. Shell midden layers are also elements of the archaeological record and may yield information about the cultural activities which took place at the site. However, in order to obtain this information the appropriate research questions must be addressed and the pertinent methods employed in excavation and analysis.

3.3 SEASONALITY INTERPRETATIONS

The correct identification of subsistence strategies conducted at Crescent Beach require accurate seasonality dates, particularly in light of the fluctuation of resources in this area and the seasonal movements of the Coast Salish to harvest them. While we would thus expect faunal remains to vary, it is also argued that seasonality may affect a wide range of material culture, as well as the structure of subsistence strategies (Abbott 1972: 274; Binford and Binford 1966:239; Clark 1975:16; Mitchell 1971b:50; Newell 1973; Taylor 1948:189; Thomson 1939). Basically:

> Once accept that artifacts reflect activities and that activities are subject to seasonal variation, then correct interpretations can

> only be made when it is known at what times of the year the sites from which they came were occupied. (Clark 1975:16)

In 1839 Darwin (1952:234) inferred from the structure and distribution of shell middens in Tierra del Fuego, that they were seasonally occupied sites. The Danes established that their shell middens had been occupied in the winter based on the presence of a migrating wild swan, the growth stage analysis of Cervus elaphus and deer antler, and from the presence of foetal deer and wild hog remains (Morlot 1861:297, 301). These two methods, the availability of a species and the growth stage analysis of faunal remains, are not only the earliest techniques, but are still the most common although their applications should be conducted in a rigorous manner (see Table III-III and Monks).

Monks (1981) has defined seasonality as "...the time of year at (or during) which a particular event is most likely to have occurred." Seasonality dates, like most other dates the archaeologist uses, place events within a restricted time range, and generally, the poorer the quality of the dating technique the greater the range. As with most sciences the range of acceptable precision depends on the research problem; even wet-dry or winter-summer interpretations may be wholly adequate for many research problems. The use of identified fauna for seasonality dating requires adequate environmental reconstruction to allow the determination of the seasonal availability of local species. If a sufficiently accurate environmental reconstruction can be obtained, and with large fauna samples from a site, variation in species may provide seasonality dates. However, whenever possible the accuracy of these dates should be tested with the more direct dating methods.

The growth stage analysis of faunal elements consists of two groups of techniques, those which correlate season of death with demonstrated seasonal

element	technique	species	season	site	source
bone	migration	wild swan	winter	Danish shell middens	Morlot 1861
antler	growth stage	Cervus elaphus, deer (and wild hog)	winter		
bone	growth stage	C. elaphus, deer (and wild hog)	winter		
site stratigraphy	winter storms	clams	summer	California shell middens	Schumaker 1875
shellfish	presence	clams	summer		
bones	migration	ducks	winter	Emeryville, California	Nelson 1909
bone	growth stage	birds	demonstrates year around	Emeryville, California	Howard 1931
bone	presence	birds	demonstrates year around		
antler	growth stage	Cervus elaphus	October-April	Star Carr, England	Fraser and King 1954, Clarke 1970
charred seeds	presence	Prunus demissa	August-September	Milliken, DjRi 3	Borden 1957
scales	growth bands	Gila bicalor	late summer-early autumn	Lovelock Cave Nevada	Follet 1967
bones	presence	lizard and sandhill crane	June-Sept., Nov.-April	Tehuacan Valley, Mexico	Flannery 1967
antler	growth stage	deer	year around		
bones	growth stage	deer	year around		
1st molar	growth bands	sheep	autumn	Barley, England	Saxon and Higham 1969
species	migration, species availability	Ranger tarandus	possible variability in settlement pattern	Upper Palaeolithic, Europe	Burch 1972
vertebrae	growth bands	freshwater fish	July-Oct., Nov.-Feb.	French Camp, California	Casteel 1972
site location	ethnographic analogy	turtles and turtle eggs	dry season	AGU 2, Peru	Myers 1972
shell plates	growth bands	sea urchin	(see source)	5 sites, New Zealand	Coutts and Jones 1974
bone	medullary bone	geese	April-May	Nottingham House, Alta	Rick 1975
bone	growth stage	deer, wapiti, seal	summer	Glenrose Cannery, DgRr 6	Imamoto 1976
bone	presence	salmon	summer/fall		
nut shells	presence	hazel nut	autumn	Cnoc Coig, 5 sites, Scotland	Mellars 1978
otoliths	growth stage	Pollachius virens	(see source)		

The reader interested in ageing and growth band studies should also consult the following: Aitken 1975, Bishop 1967, Brothers et al. 1976, Casteel 1976, Chaplin and White 1969, Craighead et al. 1970, Frisen and Reher 1970, Gasaway et al. 1978, Grau et al. 1970, Low and Cowan 1963, Monks 1981, Neville 1967, Pannella 1971, Sergeant 1967, Struhsaker and Uchiyama 1976, Thomas 1977, Turner 1977.

Table III-III. Some Seasonality Interpretations from Archaeological Sites.

or measurable ageing criteria, and those which correlate season of death with incremental growth patterns. The first group which uses tooth eruption, epiphysial closure, and mandible attrition may be unreliable for many species, especially older individuals (Aitkens 1975:27; Saxon and Higham 1969:303). Deer are especially troublesome: Cowan (1956:531) reports that local black-tail deer (Odocoileus hemionus) may give birth between March and November, with the norm ranging from mid-April to mid-July. Local food fluctuations can affect growth rates as can individual variation in development. All these factors combine to place serious limitations on this seasonality dating technique. Foetal or newborn and very young individuals are still very useful for many species, including deer in extreme environments, although caution is required if epiphysial closure is used. Antler could also result in unreliable dates as it may have a long life span in the systemic context, subject to extensive transportation, curation, use and probably trade (see Monks 1981). The presence of antler at a kill site is a valid seasonality technique, although similar conclusions may be reached from species identification of other faunal elements.

Many faunal elements such as mammal teeth, fish scales, otoliths and vertebrae grow in incremental stages reflecting seasonal variation in optimal growth periods, and provide valuable techniques for avoiding the above problems (Casteel 1976; Monks 1981; Neville 1967; Sergeant 1976). Unfortunately these techniques should be conducted by a specialist, or the archaeologist must allot time to become competent with the necessary procedures; but as they provide more accurate seasonality dates, these techniques should be applied whenever possible.

The value of marine shellfish for this type of seasonality dating is well established by several studies which all indicate temperature extremes as the key factor influencing shell growth (see Table III-IV and Clark II

1974b, 1979). Many archaeologists have taken advantage of these techniques for obtaining seasonality dates (see Table III-V), and it will form the main body of seasonality investigations in this study.

It will be noted from Table III-V that growth ring analysis is not the only technique by which archaeologists may obtain seasonality dates from marine shellfish (see also 0-18/0-16 analysis, Shackleton 1971, 1973; Koike 1979). Discussion here will be restricted to growth ring analysis of which there are two types of analysis which may yield dates suitable for archaeology. The first requires the detailed analysis of daily growth increments and probably provides the most accurate shellfish seasonality dates although it is the most expensive (requiring fairly rigorous and technically complex methods and equipment). The second approach consists of the analysis of annual growth and may be easily taken on by any archaeologist without expensive procedures or equipment (see Ham and Irvine 1975 and Chapter 5.2). Accuracy with this approach is ± 2 months comparing well with other swasonal dates and probably about as accurate as one should expect from archaeological data. The analysis of annual growth will form the basis of shell swasonality studies conducted on the Crescent Beach materials (see Figure 3-8).

Just as environmental control is necessary to other aspects of archaeological studies, shellfish growth patterns should be observed from a community which (as best can be established) resembles the prehistoric community. Besides anchoring the dating technique (by determining extreme temperature patterns), this will also help the archaeologist recognize any local growth characteristics which may be observed in archaeological specimens.

Common problems which are encountered include sample size and the occurrence of senile growth in old individuals (Calvert 1980; Ferguson 1975; Keen 1979; Matson et al., n.d.; May 1979; Monks 1977). In general, the bigger the sample sizes the better, although preservation and economics may

Source	Species	Season of Growth Check	Key Factor	Fastest Growth	Location
Stevenson and Dickie 1954	Placopecten magellanicus	winter	cool water temperature	summer	New Brunswick
Pannella and MacClintock 1968	Mercenaria mercenaria	winter	freezing spell	summer	Massachusetts
House and Farrow 1968	Cardium edule	winter	low temperature	spring	South Wales
Coutts 1970, Coutts and Higham 1971	Chione stutchburyi	winter	cold temperature	summer	New Zealand
Clark II 1979	Mercenaria mercenaria	summer	warm water	winter-spring	Georgia
Koike 1980	Meretrix lusoria	February	low seawater temperature	summer	Japan
Jones 1981	Spisula solidissima	late summer-fall	high water temperature	winter-spring	New Jersey

The reader interested in the nature of the biochemistry and calcification of marine mollusc rings should also consult: Barker 1964, Bevelander and Nakahara 1979, Chave 1954, Clark II 1968, 1974a, 1976, Gainey and Morris 1974, Goldsmith 1959, Kobayashi 1969, Seed 1969, Taylor and Kennedy 1969, Weiner and Hood 1975.

Table III-IV. Marine Mollusc Growth Ring Studies.

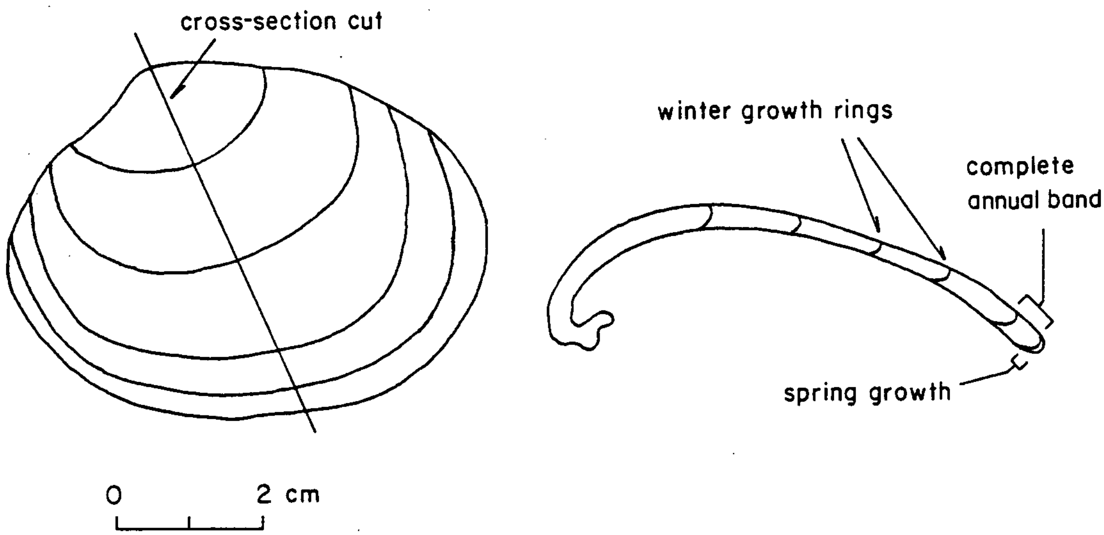


Figure 3-8. Analysis of Shell Growth Bands

element	technique	species	season	site	source
shell valve	winter check	Tivela stulforum	late winter	ORA-82 California	Weide 1969
peristome	growth stage	land snails	monsoon	Spirit Cave, Thailand	Gorman 1971
shell valve	presence	Margaritanopsis laosiensis	dry season		
shell valve	daily growth	Chione stutchburyi	March-September	5 sites, New Zealand	Coutts and Higham 1971
shell valve	daily growth	Protothaca crassicosta			
shell valve	daily growth	Meretrix lusoria	(see source)	12 sites, Japan	Koike 1973, 1980
shell valve	winter check	Mytilus edulis	spring-early summer	Glenrose Cannery, DgRr 6	Ham and Irvine 1975, Ham 1976
shell valve	annual growth	Saxidomus giganteus	winter		
shell valve	annual growth	Protothaca staminea	winter		
shell valve	annual growth	Venerupis tenerrima	winter		
shell valve	annual growth	Tresus capax	winter		
shell valve	annual growth	P. staminea	year around	Boardwalk, GbTo 31	Ferguson 1975
shell valve	annual growth	S. giganteus	year around		
shell valve	annual growth	Clinocardium nuttalli	year around		
shell valve	annual growth	S. giganteus	mid winter-spring	Deep Bay, DiSe 7	Monks 1977
shell valves	ethnographic analogy	clams and oysters	spring-summer	Kaeser, New York	Rothschild & Lavin 1977
shell valve	population structure	bivalves and univalves	Nov.-July	3047-I-3	Moreau 1978
shell valve	annual growth	S. giganteus	year around	Tsable River DjSf 14	Keen 1979
shell valve	annual growth	P. staminea			
shell valve	annual growth	C. nuttalli		Buckley Bay DjSf 13	
shell valve	annual growth	S. giganteus	year around	Ridley Island GbTn 19	May 1979
shell valve	annual growth	T. capax			
shell valve	annual growth	P. staminea	spring-summer	3 sites Hesquiat Harbour	Calvert 1980
shell valve	annual growth	S. giganteus			
shell valve	O-18 profile	Mytilus californianus	March-September	Punta Minitas Baja, Mexico	Killingley 1981
shell valve	O-18 profile	Lottia gigantea			
shell valve	O-18 profile	Thais emarginata			
shell valve	O-18 profile	Haliotus cracherodii			
shell valve	annual growth	S. giganteus	spring-early summer	Beach Grove DgRs 1	Matson et al. n.d.
shell valve	annual growth	P. staminea			
shell valve	annual growth	T. capax			

Table III-V. Some Seasonality Interpretations from Marine Molluscs.

cause problems which will have to be resolved through careful recovery or by implementing a suitable sampling strategy. Senile growth specimens (see Figure 5-4, S1103), especially those badly checked by storms, should as a rule be discarded although accurate readings may sometimes be possible. Obtaining seasonality dates from shellfish valves with badly disturbed growth patterns may benefit from the more expensive daily ring analysis. However, Gordon and Carriker (1978) have presented evidence that calcium layers may be reabsorbed by the shellfish during periods of poor growth. The implications this may have for some areas of the Northwest Coast should be investigated if these shellfish are used in seasonality studies. In general research into storm ring patterns is lacking for this area, although they could provide micro-climatic data.

As this project recovered large quantities of shellfish valves they are the obvious choice for seasonality dating. The analysis of annual growth patterns is the technique used because it allows large numbers of valves to be examined and provides a dating range adequate for the needs of this study. Procedures, controls and seasonality dates are provided in Chapter 5.2.

4.0 EXPECTED STRATEGIES AND MIDDEN DEPOSITS

4.1 NATURE OF REGIONAL ENERGY FLOWS

Halkomelem and Straits territories were characterized by two major types of energy flows, those which pass through the area, and locally generated or occurring energy buildups, both of which exhibit a transitory nature. Rivers are the world's natural energy transporters and the Fraser River system is no exception. All year around, some quantity of sea-run trout or one of five kinds of salmon may be found migrating up the river, while in early April and through most of May several million young salmon and trout move down the river each day (Northcote 1976:87). The river itself annually discharges an estimated 450,000 metric tons of total organic carbon and although its role in estuarine and Strait of Georgia food webs is not clear, the river load of carbon may exceed estuarine production by at least one order of magnitude (Kistritz 1978:25). When we add to the flow the many herring, eulachon, smelts, sturgeon, seals and other species using the system, and extend the pathway through Juan de Fuca Strait (Figure 4-1), we have a large extended river/strait system, or energy pipeline.

Comparing Figures 4-1 and 2-18, it may be noted that each group of Straits and Halkomelem held access to a portion of the main energy flow, as well as that of secondary and tertiary stream systems in each group's territory. Nanaimo and Cowichan groups without the reef net traditionally came across the Strait of Georgia to trawl for salmon in the lower reaches of the Fraser River (see Figure 2-19). While many fish species move through the area (sockeye, pinks, eulachon) others use bays and beaches as well as secondary and tertiary streams tributary to the main energy pipeline (herring, smelts, chum, coho, trout).

The other type of energy flow is locally generated or occurring energy buildups. Strictly speaking this should only include seasonal growth blooms

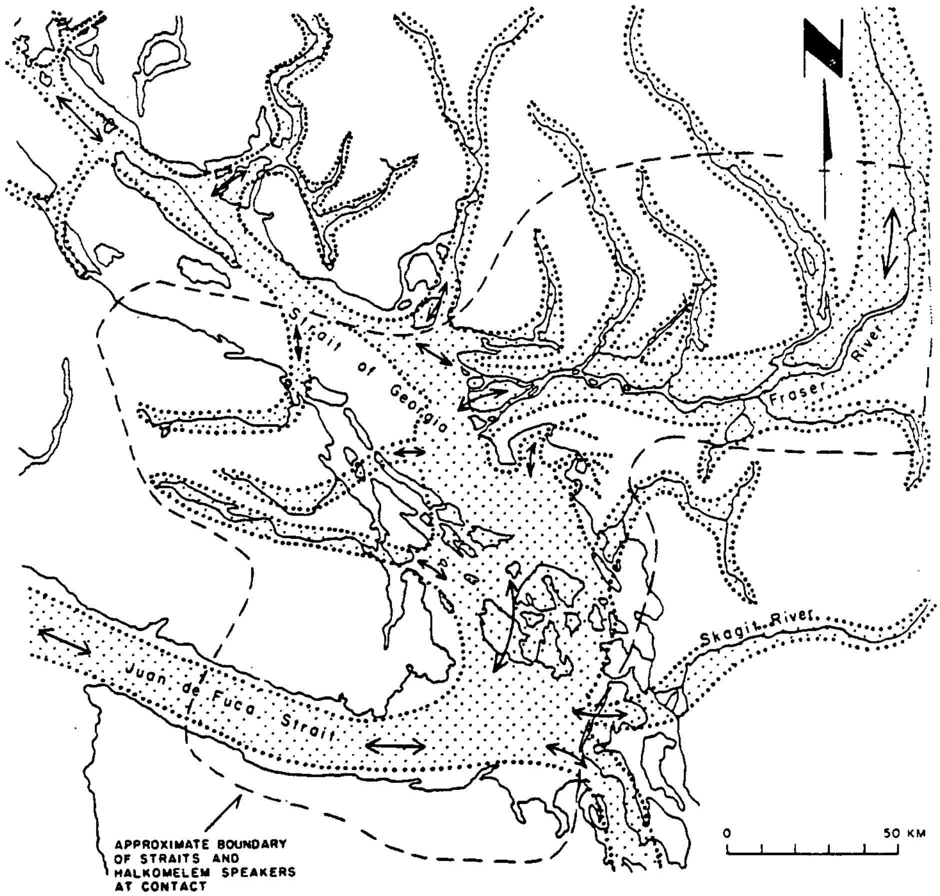


Figure 4-1. Main Energy Pathways in Halkomelem and Straits Territories.

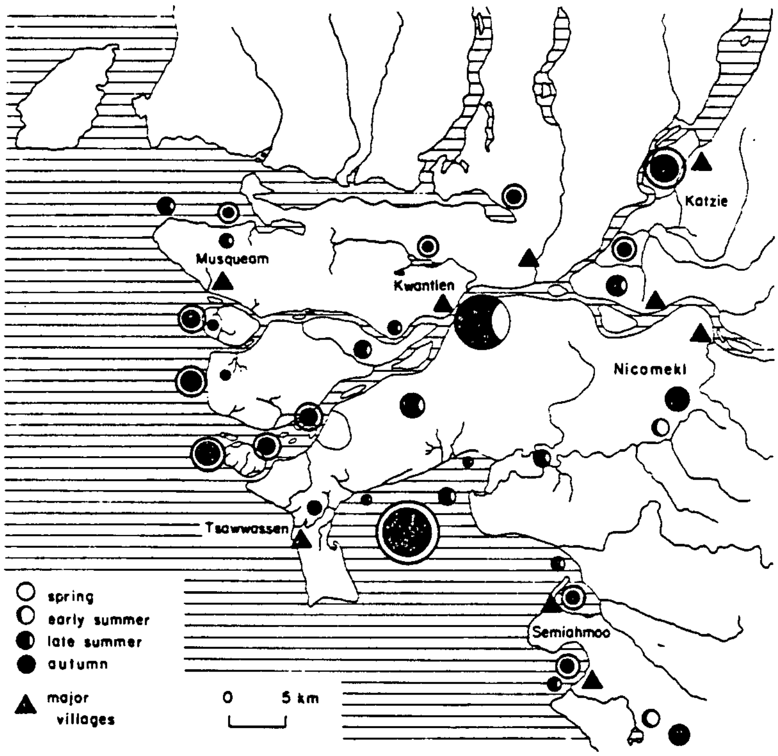


Figure 4-2. Nature of Seasonal Energy Blooms.

of local species in various communities (sprouts, berries), however, I would also include migrating birds even though they may be demonstrated as having pathways (the Pacific Flyway for example) similar to that discussed above. Many of these species are dependent upon local energy supplies which may have built up many months prior to the arrival of migrations. Dabbling ducks, for example, migrating through the area in the autumn or spring depend on seeds and plant detritus which resulted from early summer and summer plant growth in tidal marshes (Kistritz 1978:19). This model is not intended as an accurate picture of seasonal energy buildups, but rather to provide an impression of the geographic and temporal variation in resource availability and abundance.

Both types of energy flows are transient and of restricted duration. Odum (1971:261-2) provides a discussion and example of transient energy flows in which the initial input pulse moves through time (or across an area) like a wave, the height of its crest diminishing as energy is dispersed along its path. Figure 4-3 presents a model of this type of transient energy flow, in this case a sockeye run entering Juan de Fuca Strait and proceeding up the Fraser River into the Interior Plateau. Major dispersions of energy result from predation by humans and other animals, and from the fact that the salmon use up most of their stored energy during migration. Several researchers have made correlations between salmon resources and human populations (Baumhauff 1963; Donald and Mitchell 1976: Kew 1976; Sneed 1971) while Tyhurst (1976) has discussed available data on the decreasing food value of salmon as they near the end of their migration routes.

Resources belonging to the second type of energy flow (migrating birds, berry crops), although transitory in nature exhibit a different availability profile (see Figure 4-4). Berry crops will gradually build up to a short term peak, while a bird migration will build in stages or by increments as

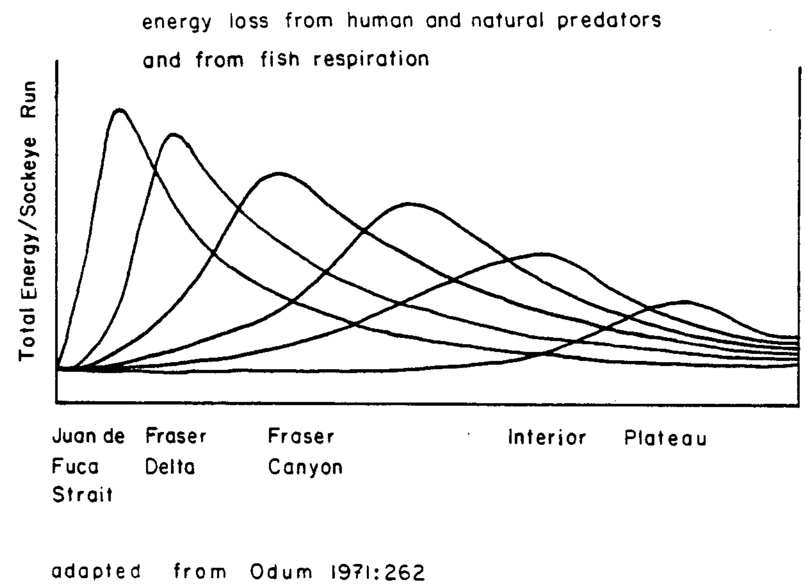


Figure 4-3. Nature of a Sockeye Run as a Transient Energy Flow.

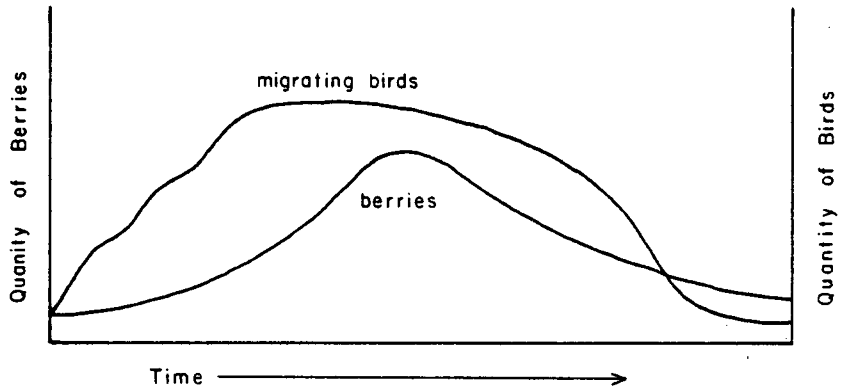


Figure 4-4. Nature of a Berry Crop and Bird Migration as a Transient Energy Flow.

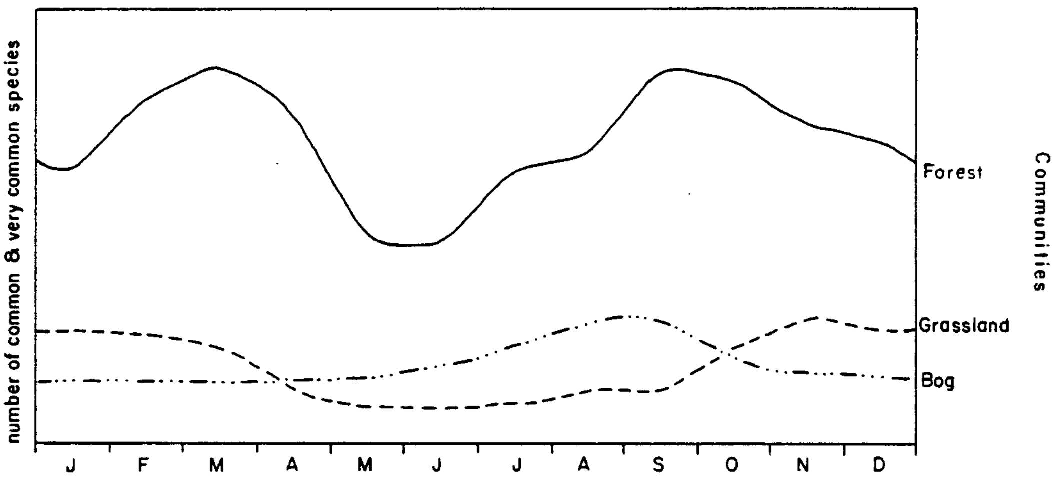
flocks arrive, stay at a peak for some time (all winter for some species) and drop off rather quickly as the migration moves on. Regardless of the differences between these two types of energy flows, if we are to observe a particular community over the span of a year, we will note substantial temporary increases in available energy. The nature of this phenomena may be observed in Figure 4-5 (based on Figure 2-17), each community exhibiting one or more periods of peak abundance of species commonly used by the Coast Salish as food.

4.2 POSSIBLE SEASONS OF SITE OCCUPATION

The likelihood that Coast Salish subsistence strategies in Boundary Bay are structured in response to one or more of these peaks should by now have some credibility. On this assumption Figure 4-5 will be employed to determine possible seasons when the site may have been occupied. Examination of the species availability and abundance curves for each community (Figure 4-5) presents a total of 15 community-seasons although this may be substantially reduced. The Saltmarsh Community was ruled out as it does not exhibit any clear peaks besides autumn-winter-spring, and because the most common species, waterfowl, can be obtained by the use of nets while feeding or flying, in numerous places around Boundary Bay. The Rocky Intertidal Community might have been exploited whenever a low enough tide occurred.

Crescent Beach is not a prime location for the exploitation of terrestrial communities; sites associated with gathering berries from bogs; salmon and trout weirs; and deer, wapiti and beaver hunting may be expected to be located in the Serpentine-Nicomekl River Valleys. It is however, a better location for the exploitation of marine communities in Boundary Bay. Although terrestrial communities are being eliminated as important seasonal settlement determinants, the presence of species from these communities should be expected at the site depending upon the season of occupation. Both Grassland and Forest Communities border the site (Figure 2-39) while sphagnum bogs may be reached within a half-hour paddle up the Nicomekl River (see Figure 2-8).

SPECIES AVAILABILITY - TERRESTRIAL COMMUNITIES



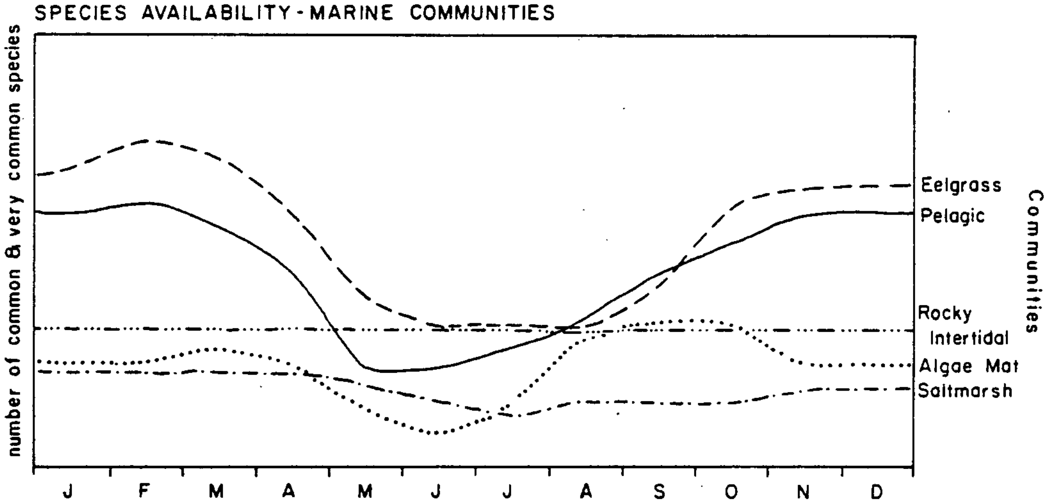
Possible seasons of expoitation:

Forest – spring, late summer, autumn

Grassland – autumn, winter

Bog – late summer

SPECIES AVAILABILITY - MARINE COMMUNITIES



Possible - seasons of exploitation:

Eelgrass – late winter, spring, autumn

Pelagic – late winter, autumn

Algae Mat – late summer

Salt Marsh – unknown

Rocky Intertidal – late winter, spring, late summer, when tides are most favourable

Source: see Figure 2-17.

Figure 4-5. Species Availability and Abundance.

If the Crescent Beach site was primarily a coastal resource procurement site, then two clear possibilities are evident; late-winter-spring occupation, and, late-summer-autumn (see Figure 4-5). These seasons are in fair agreement with the reported ethnographic use (Suttles 1977:4), of;

1) seasonal, summer-time occupation between 1780 (a possible date for the earliest smallpox) and whenever Indians were driven from the site by White settlement,

2) year around occupation before 1780, and

3) the passage of various people on their way to and from the Fraser River or the seashore. (via Nicomekl-Salmon Rivers)

Suttles' suggestion for a summer occupation after 1780 is based on information from Semiahmoo and Musqueam informants (1974:27, 1977:3), both groups using Boundary Bay for shellfish harvesting after the Nicomekl were decimated by smallpox. In light of the sharing of access to resource locations among affinal kin, it is possible members of these and other groups, as well as the Nicomekl used Boundary Bay before 1780.

Prior to 1780, according to Suttles' information (1974:258, 1977:1-2), Crescent Beach was the site of a Nicomekl village. This was discussed above (Chapter 3-2) and the nature of deposits one might expect to find at a main village used as a shellfish processing site were outlined. As was noted above, this house location may have been destroyed by modern development as may any others which might have been at the site. However, if house outlines were common at Crescent Beach, some mention of them should be found in historic sources or in Harlan Smith's fieldnotes from his 1915 visit to the site. Any sizeable permanent settlement should have left very characteristic and obvious deposits similar to those at Beach Grove (see Figure 3-7c).

The use of the site as an overnight camp by travellers could conceivably have taken place at any time of the year, and at any time in the site's 5,000 year history. I would expect Blackie's Spit at the north end of the site to have been most frequently used in the late period, although earlier in the site's history the area excavated by this study may have periodically been used in this manner as well.

In summary, four possible seasons of occupation, or types of occupation may be suggested based on ecological data and ethnographic information on site use. These include;

1) year around occupation,

2) late-winter-early spring occupation,

3) late-summer-autumn occupation, and

4) sporadic overnight camping at any season.

4.3 SEASONS OF OCCUPATION AND EXPECTED ARCHAEOLOGICAL ELEMENTS

The wide range of c-transforms and n-transforms which may structure shell midden deposits was discussed in Chapter 3, while two major types of c-transforms, curation and refuse disposal may have important implications here. Binford (1976:338-341) has questioned the value of artifacts in interpreting activity locations as due to curation and recycling they may have had long lifespans in the systemic context. While a long term or main village site may contain a large artifact assemblage, they may not present a clear indication of specific activities. Short term or seasonally occupied sites on the other hand may contain fewer artifacts, yet they may reflect site activities better (Schiffer 1972:162, 1976:15). However, elements other than artifacts may also be used in inferring activities at a shell midden. Interpretation of activities will also be affected by the nature of refuse disposal operative at a site. Schiffer (1972:162) suggests that refuse may be discarded some distance from the actual location of any activities. Once again, major differences may be expected between a main village and a seasonal site. This is supported in part by Schumaker's (1875:338-9) observations that at a permanent village refuse was deposited in fixed places, while at seasonal camps it was usually simply distributed over the ground. It is obvious from only two of the many c-transforms which may have been operative, that major structural differences probably exist between a main village site and a seasonal one.

1) <u>year around occupation</u>

Some idea of the nature of the deposits at a main village site may be obtained from reference to excavations at a known village site. Stselax village (DhRt 2) at Musqueam dates to the same time period as the deposits at Crescent Beach which are of concern here, and historically contained as many as seven plank houses in a row with three additional houses behind the main row (Kew 1955:28). Overall, shell midden layers at Stselax are compact and fairly level or gently sloping (Kew 1955:29-30), not unlike the model proposed by Hester and Conover (1970:138). Another obvious characteristic of the deposits at Stselax are many large post holes and compacted layers of crushed mussel shell, sand and ash which Kew interprets as the remains of house posts and house floors (1955:30-31, see also profiles 1-3). Suttles (1974:257-8) has reported that crushed mussel was a desirable material for house floors.

Although gently sloping or level floor layers and post holes could be expected from a main village at Crescent Beach, refuse layers would most likely be similar to those at Beach Grove due to the quantities of shell-fish which would have been processed (see Figure 3-7c). Artifact and faunal recovery from house floors may be expected to be low, as Suttles (1974:258) reports that house floors were swept daily. Most common would be small fish bones and crushed shell as well as small artifacts and detritus from artifact manufacture which might be trodden into the floor. Refuse layers may be expected to be thick and complex and contain a wide variety of elements including; discarded and broken artifacts and detritus from their manufacture; ash, charcoal and broken boiling stones; and a range of faunal remains.

Seasonality studies should result in a range of dates documenting a year around occupation.

2) late-winter-early spring occupation

An obvious characteristic of this type of occupation would be the absence of house post holes and house floors. Overall, artifact yield could be expected to be much lower than at a main village while evidence of artifact manufacturing will also be restricted. Layers at a seasonal site such as this may contain features associated with resource processing (heaps of cobbles and charcoal or steaming mounds, charcoal, ash spreads and hearths) as well as refuse heaps. Faunal remains should include herring (and possibly other fish), waterfowl and shellfish, while seal may also be present and some deer and wapiti if adjacent terrestrial communities were also exploited. Seasonality dates should be restricted to late winter and spring. Monks (1977:302) recovered materials very similar to the above from the Deep Bay (DiSe 7) shell midden in which shellfish, herring, waterfowl, deer and sea mammal comprise the faunal remains while seasonality dates indicated a late winter and early spring occupation.

3) late-summer-autumn occupation

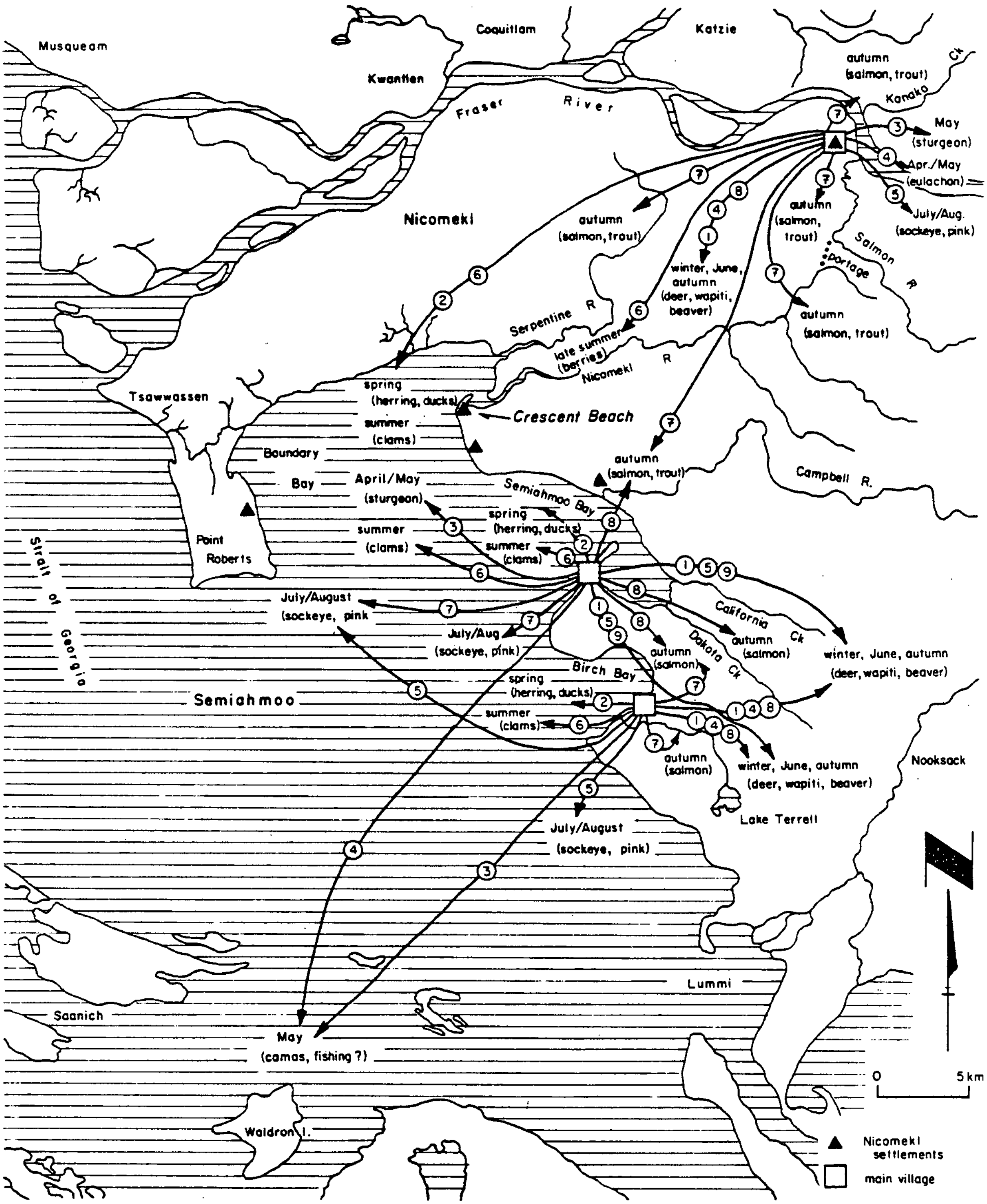
A late summer and autumn occupation would be similar to the late winter and early spring occupation in that the remains of plank houses would be absent and artifact yield low. Layers should again contain steaming mounds and hearths from processing resources while a somewhat different assemblage of faunal remains will be recovered. Substantial quantities of shellfish remains should be present as well as smelts, salmon and trout, shorebirds and in the autumn migrating waterfowl. This type of a faunal assemblage (and a late-summer-autumn seasonality) has not been reported from this area. Howard (1931:352-359) has reported shorebirds from the Emeryville shell midden in California and their presence in a late summer site in Boundary Bay would be expected. Large numbers of shorebirds migrate through Boundary Bay in the late summer while by mid-September migrating and wintering waterfowl begin arriving. Suttles (1974:80) reports that sandpipers were killed simply by throwing a stick into a flock, and thus their remains might be found at Crescent Beach as well.

4) sporadic overnight camping at any season

In general, this type of occupation may be the most difficult to recognize for unless a large group was involved, n-transforms and/or subsequent cultural activities could quickly erase any traces. Minimally an overnight camp should leave a hearth, and possibly a small steaming mound and a shell refuse heap. Seasonality dates could vary from the site norm and in the absence of any other indicators, this could be the only indication of a camp, while if stored food was used it may be impossible to observe archaeologically.

4.4 ETHNOGRAPHIC MODEL OF SETTLEMENT PATTERNS

In summary, ecological data on Boundary Bay have suggested two seasons of site occupation in addition to the possible use of the site as a main village or occasional campsite. Calvert (1980) has recently demonstrated continuity between ethnographic and archaeological land use patterns among the Nootka in Hesquiat Harbour. To assess the nature of cultural determinants in the use of Boundary Bay the annual rounds of the Semiahmoo and Nicomekl (as presented in Chapter 2) are mapped out in Figure 4-6. The hypothetical movements of a Coast Salish family from one of the main villages may be traced by following the numbers (1 to n) on each of the pathways which join the villages to their resource areas. The season of use and the most important resources which were being sought are indicated at the end of each pathway.



The seasonal round for a village family may be followed winter to autumn by the numbers on each pathway from the village in question. Sources: see Chapter 2, and Suttles 1949, 1974, 1977.

Figure 4-6. Possible Semiahmoo and Nicomekl Seasonal Strategies.

These models represent only one of several possible patterns, especially for the Nicomekl whose reconstructed annual round is highly speculative considering the paucity of ethnographic information. Its applicability to the archaeological record is also strained considering a minimal gap of 400 years between ethnographic and archaeological data. However, it will be noted that the two seasons of use reported for both the Nicomekl and Semiahmoo, spring and summer, are not significantly out of line with the occupations which have been generated in this chapter. Clarification will rest with the analysis of recovered archaeological materials from Crescent Beach which follows.

5.0 ANALYSIS OF SHELL MIDDEN LAYERS AT CRESCENT BEACH

The excavations at Crescent Beach were conducted between May 2 and August 31, 1977. The decision to excavate on Lot 47 resulted from the evaluation of cultural materials recovered from Test Unit A in 1976 (see Chapter 2.8). This portion of the site appeared to date to the Gulf of Georgia Culture Type, was well stratified, contained plenty of shellfish and other faunal remains, and thus it was a good location to obtain information on prehistoric Coast Salish subsistence activities.

To recover this information it was clear that several goals were important. These included accurately isolating stratigraphic shell midden layers and ensuring the recovery of adequate samples for artifact, faunal and seasonality studies. The following section of this chapter will discuss excavation and analysis procedures, while the remainder of the chapter will present the cultural remains from Crescent Beach.

5.1 EXCAVATION PROCEDURES

The efficiency and accuracy of the excavation of complex stratigraphy is greatly improved when it is possible to anticipate the nature of the layer about to be excavated (Hole et al., 1969:26). The 1976 excavations at Crescent Beach (Trace 1977a) consisted of the initial stratigraphic excavation of alternating units, followed by the removal of the intervening units to form a trench. The intervening units with their exposed stratigraphy were far easier to excavate. In this study the excavation grid was oriented to take advantage of the eroded beach front which was subsequently cut back to expose the midden layers (see Figure 5-1, 5-2). In addition a slit trench was placed around the entire excavation.

The stratigraphic excavation of shell middens in British Columbia has included the use of trenches and the wide area excavations (Calvert 1980:119,

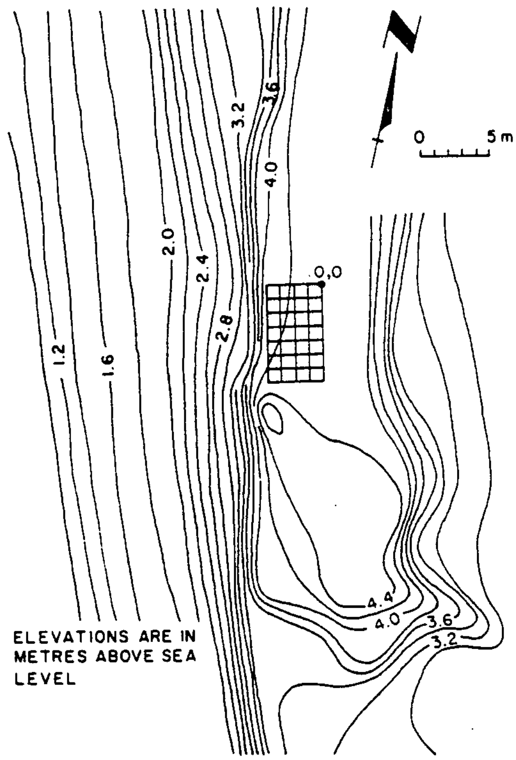


Figure 5-1. Contour Map of 1977 Excavation.

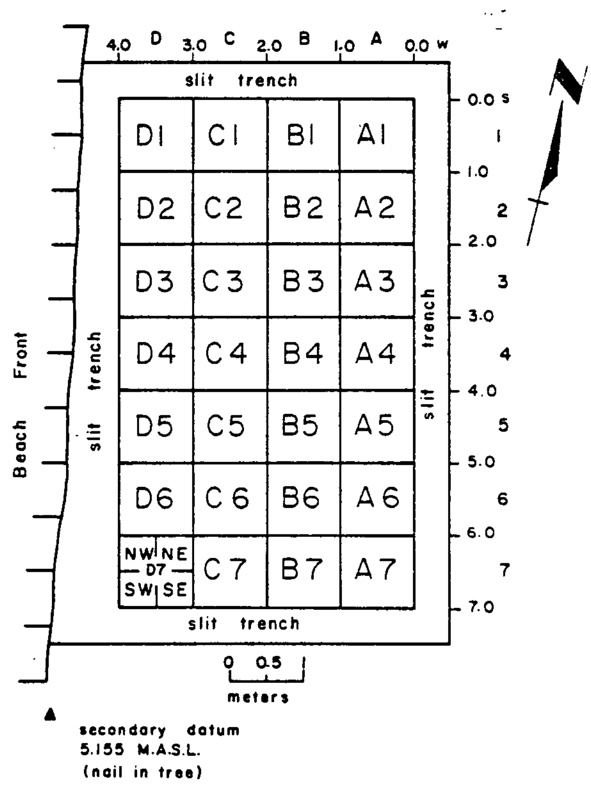


Figure 5-2. 1977 Excavation Grid.

125; Monks 1977:40; Trace 1977a). Interest in this study was focused on examining layers from an open air midden site, so that a 4 x 7 m block of 1 m excavation units was laid out along a north-south baseline with the outer row of units along the edge of the beach front (Figure 5-2). The best fit resulted in a baseline on a bearing of N 13° W on which a 0 W./ 0 S. horizontal datum point was established.

All horizontal and vertical measurements are tied into Geological Survey of Canada Monument 8629 located between the intersection of Sullivan and Beecher Streets and the Burlington Northern Railway tracks (see Chapter 2-32). The site horizontal datum was 563 m southwest of Monument 8629 on a bearing of S 37° 30' W. This monument was also used as permanent site datum, while a secondary datum was established at the site by placing a nail in a nearby tree at 5.155 m.a.s.l., 5.67 m below the monument (at 10.825 m.a.s.l.). During excavation all vertical measurements were made using a level and stadia rod with frequent backsighting to verify the instrument height.

Once the site had been contour mapped, a thin (2-3 cm) layer of turf was carefully removed and placed aside for restoration purposes. Beach front and slit trenches were then shovel excavated to a depth of 50-60 cm, and the matrix passed through 6.35 mm (¼") mesh screens to recover artifacts. The trenches were gradually deepened as layers were removed and it was necessary to expose additional stratigraphy. This gradual excavation of slit trenches helped to minimize slumpage of loose shell. A heavy wooden frame of 4 x 4's was placed around the outer perimeter of the slit trenches and 5 m long poles provided by the District of Surrey placed across the entire excavation. The resulting frame allowed the excavation area to be padlocked shut with heavy plywood covers when the site was unattended (see Plate 5-1).

A platform was erected at the front of the frame along the beach from which the excavated matrix was waterscreened. Several large logs on the beach were maneuvered to form "the settling pond" which was used to retain silts washed from the matrix and occasionally for communal reprisals against irksome crew members. With the aid of high evaporation on sunny days the settling pond was large enough to contain a day's supply of water, while on overcast and rainy days a small overflow resulted which was quickly flushed by the tides. Clearance to conduct waterscreening was obtained from the B.C. Fish and Wildlife Branch, the B.C. Water Rights Branch and the Habitat Protection Directorate (Canada).

Excavation began with the removal of the top humus layers, Layer A (the zone of fine textured worm sorted materials) and Layer B, which both extended across the entire excavation area. The lower boundary of Layer A was readily observable as the start of the zone of coarser materials, Layer B. Boundaries between layers were marked on the exposed stratigraphy with 2¼" nails and orange flagging. Initially profile drawings were made, but were soon abandoned when drying, cleaning and redrying, and finally excavation produced wandering layer boundaries. Instead it was decided to depend upon contour maps of upper and lower layer boundaries which were found more accurate and also eliminated the need for constantly revising profile drawings. Throughout the excavation a supervisor was responsible for compiling (and verifying the accuracy of) all layer contour maps.

Prior to the excavation of each unit a contour map was made of the layer surface using 4 cm contours and a 2-3 kg matrix sample was removed and placed in a labelled plastic bag. Sample bags were labelled before excavation with; unit/layer/arbitrary level (where appropriate)/quadrant, and placed with each bucket of excavated matrix before it was taken for waterscreening. These bags were used to collect all material retained in the screen which was then returned to the lab for analysis. All other materials retained from excavation were also provided with sample numbers (matrix, faunal, artifact, etc.)

in addition to the above provenience data.

One crew member was assigned daily to take instrument readings, and was also charged with issuing matrix sample, artifact and faunal numbers and with keeping the appropriate catalogues in order. Once a layer had been completely removed from a unit an additional contour map was made and the readings transferred onto the master layer contour map.

All layer excavation was conducted with trowels and restricted to a single layer at a time using 10 cm arbitrary levels when desirable. Excavation notes and other data were recorded on level forms provided by the Archaeology Division of the B.C.P.M.. Unit excavation proceeded by quadrant (0.25 m²) of each 1 m unit with matrix placed in buckets which were weighed before waterscreening, and a bucket corrected weight recorded on the level form. The matrix was waterscreened through 1.45 mm mesh screens while any samples which became mixed or were potentially contaminated were immediately discarded.

Waterscreening was carried out on all layers except for Layer A and the low shell portions of Layer B. Both contained numerous fine grass roots and were dry screened through 6.34 mm screens. However, as soon as the root zone was passed all matrix was put through the smaller 1.45 mm mesh. The impact of screen size on recovery has been discussed by Casteel (1972) who points out that even with the use of 1.59 mm (1/16") mesh, many small fish remains are lost, although with 6.35 mm mesh loss approaches 100%. The use of water and 1.45 mm mesh in this study is close to the practical limits for field recovery and required a good flow of water to wash the matrix. Some recovered items such as pearls (ca 1 to 2 mm in diameter), were several times smaller than many of the fish bones retained in the screen. Possibly the combination of a small screen mesh and the foaming action of the water prevented some of the smaller items from being washed away. In spite of this, there was no doubt a loss of small fish bones and teeth, although economics and low identification rates would not justify recovery of smaller items.

After washing, the screens were emptied onto plastic covered plywood sheets and allowed to drain while they were searched for artifacts, lithic detritus, mammal and bird remains which were placed in their respective sample bags. This method was found to be quick and very effective, approaching close to 100% recovery of rare items. Layers A, B, C, D, E, and E1 were checked in the lab resulting in the additional recovery of a bone bipoint, a piece of Mytilus californianus and a few large mammal bones, not sufficient to encourage re-searching all remaining samples. After the shell samples had drained and dried somewhat they were placed in their sample bags and returned to the lab for sample selection and analysis.

When excavations were terminated at the end of the field season, 24 m^3 of midden containing 31 layers had been removed to a maximum depth of 2.96 m.a.s.l. (see Table V-I and Figure 5-7 for stratigraphic order of layers). The beach sands encountered in Test Unit A in 1976 were not reached by these excavations (see Figure 2-34), while in addition the 4 x 7 m excavation grid was reduced to 4 x 4 m after the excavation of Layer F2. Several reasons encouraged this reduction including mixing of the southern 3 m by roots and possibly by a midden fire (Layer G1) and concern over the future of the large Douglas fir at the south end of the excavations. Once excavations were completed, the frame around the site and the screening platform were dismantled. A rock retaining wall was constructed along the beach front and the excavation filled with backdirt and beach sand. The original turf was placed on top and some grass seed added while the beach was also put in order.

5.2 LABORATORY ANALYSIS

With a crew of 31 it was possible to operate a lab during July and August and under the direction of a supervisor the students were rotated between the field and lab. In addition to cataloguing and shelving layer samples, the lab crew also dried any samples which were still wet, searched any unchecked samples for rare items, catalogued and numbered artifacts, drafted layer contour maps, drew artifacts and carried out other necessary duties. Shell samples were also selected and prepared for analysis while matrix analysis conducted by Vycinas (1978) included pH and phosphorus measurements as well as some grain size analysis. During the following winter (1977-78) two part time salaried assistants and several volunteers helped with the analysis of the faunal remains.

Shellfish were the most common faunal remains and were analysed from random samples (with replacement) drawn from each layer. Each sample consisted of one or more plastic bags of shell material retained from the waterscreening of a layer quadrant. Sampling rate varied from 100 to 5% (see Table V-I) while a minimum of 3 samples was examined from each layer ($\bar{x}$=4, md=4). However, the rates provided in Table V-I do not represent the actual quantity of shell which was analysed. In order to reduce the samples to a manageable level for analysis, each sample was passed through a nested screen series consisting of 12.30, 5.45, 2.35 and 1.45 mm meshes and each fraction bagged separately. These fractions were then split using a large riffle splitter which reduced each to what could (hopefully) be analysed in 2-4 hours. Each fraction was examined at a different rate, but in general from 100 to 25% of the 12.30 mm screen was analysed, 50 to 6.25% of the 5.45 mm screen, and 25 to 3.12% of the 2.35 mm screen. The contents of the 1.45 mm screen and residue were not analysed for shellfish although a portion of the 1.45 mm screen was searched for fish remains with an eye for any unique items.

To obtain an indication of the time required to sort the material retained by the 1.45 mm screen, a 1.56% sample (split 6x) of a quadrant from Layer D1 required 37 hours to sort approximately half of the sample at which point

	Layer	Quadrants	Sample	Sampling Rate
1	A	108	6 (1)	5.55
2	B	100	5	5.00
3	B1	3	3	100.00
4	C	29	4	13.79
5	D	70	5	7.14
6	E	31	5 (1)	16.13
7	E1	12	4	33.33
8	D1	62	4	6.45
9	D2	12	12	100.00
10	D3	57	4	7.02
11	D4	14	4	28.57
12	D5	4	4	100.00
13	G1 ash	7	3	42.86
14	G2	8	3	37.50
15	G1	27	4	14.81
16	G	23	4	17.39
17	G4	18	3	16.67
18	F	16	4 (1)	25.00
19	F2	5	3	60.00
20	F3	18	3	16.67
21	F4	6	3	50.00
22	G3	21	3	14.28
23	J	61	4	6.56
24	L1	59	4	6.78
25	L2	18	3	16.67
26	L356	24	4 (1)	16.67
27	L1 black	27	3	11.11
28	L4	55	4	7.27
29	L4 shell	28	3	10.71
30	L4 carbon	17	3	17.65
31	L4 fcr	8	3	37.50
Σ		948	124 (4)	13.08

( ) = indicates sample drawn twice

Table V-I. Sampling of Crescent Beach Layers.

the exercise was abandoned. Koloseike (1970:477) also noted that sorting time for shell material increases exponentially with decreasing shell particle size.

The accuracy of the riffle splitter which was constructed from wooden 1 x 1's and plywood varied according to the size of the materials being split.

As might be expected the larger materials retained by the 12.30 mm screen showed the largest variation, averaging 11.2% from the expected 50/50 split. Variation with material from the 5.45 and 2.35 mm screens which contained the bulk of the analysed shell was much smaller, 2.8 and 1.9% respectively.

Identification of shell remains was accomplished through reference to comparative material when necessary, while Ricketts and Calvin (1968) was followed for species nomenclature. The weight of each species or class of shellfish remains were recorded on faunal sheets and each fraction extrapolated to 100% providing an estimate of the total weight of shellfish in each layer. Overall shellfish analysis was the most time consuming in spite of sampling and splitting procedures, requiring in excess of 2,500 analyst hours. To have drawn larger samples would have required a substantial increase in analysis time without necessarily improving the data base of this study.

Although the smallest group of remains by weight, the next most frequent group of faunal elements were fish remains. Elements for identification were obtained from the shell samples, and during the shell analysis fish remains were collected from each screen fraction and placed in labelled film cannisters. To ensure recovery of smaller elements a fraction of the 1.45 mm mesh screen (usually 50%) was also searched for fish elements. Identification was carried out during December 1978 and January 1979 at the Archaeology Division of the British Columbia Provincial Museum, expedited by the assistance of Susan Crockford and Dawn Stoffer with reference to the museum comparative collection. As with the shellfish remains, fish were also extrapolated to provide estimates of species totals in the site.

Bird and mammal remains were obtained from the field search of layer samples and thus approaches 100% recovery. An exception were antler chips and fragments which were recovered from the 1.45 mm screen material searched for fish elements. Identification of the bird and mammal remains was made by reference to the comparative collection at the U.B.C. Laboratory of Archaeology and all data recorded on faunal sheets.

Once identification was completed, all faunal data were coded, keypunched and placed in computer files for manipulation. These data are currently available from the University of British Columbia Data Library under the title "Crescent Beach Site Fauna". Cultural materials recovered from Crescent Beach are in storage at the U.B.C. Laboratory of Archaeology while human remains were re-interred at Semiahmoo, B.C.

5.3 SEASONALITY DATING OF BIVALVE REMAINS

Accurate seasonality dates are necessary if the prehistoric subsistence activities at Crescent Beach are to be correctly identified. As this study recovered numerous marine bivalves, the analysis of annual shell growth patterns was selected as the best seasonality dating method to use. The following section will present the analysis of growth patterns on both prehistoric shell from Crescent Beach, and modern specimens collected in Boundary Bay.

Several studies have shown that stress from temperature extremes (both high and low) are responsible for variation in marine bivalve growth (see Table III-IV), and I expected that temperature extremes would also be important in Boundary Bay, most likely low winter temperatures. However, the time period in which shellfish would deposit winter growth was not known. Thus modern bivalves were collected from Boundary Bay in April 1980 and March 1981 for use in control studies. As the Crescent Beach midden being studied here dates within the last 1,500 years (see Figure 5-8), both modern and prehistoric shells should be subject to similar environmental variation as no major climatic change occurred during this time. Clark II (1979b:101) has suggested the use of oxygen isotope analysis as a check on paleotemperatures when archaeological specimens are more than a few thousand years old.

Current studies hold that shell growth results from mineralization of calcium carbonate on a protein binding substrate secreted by the shell mantle, and as bivalves are cold blooded, this process may be sensitive to temperature fluctuations resulting in daily growth increments (Barker 1964:70, 80; Clark II 1979b:99; Kobayashi 1969:664; Pannella and MacClintock 1968:69; Weiner and Hood 1975:988). During optimal growing periods daily increments consist of a thick opaque layer and a thin, translucent (protein poor) one reflecting lower night time temperatures (Barker 1964:80; see Clark II 1974a:Fig. 5; or Ham and Irvine 1975:Fig. 1). Deposition of opaque layers is severely retarded during poor growing seasons so that growth increments in the winter and other periods of stress consist of thin layers of protein poor translucent ones (see Figure 3-8). Retardation of growth may also result from stress induced by storms, tides, attacks by predators and spawning which may cause problems in locating winter growth if only the shell surface is examined (Clark II 1979b:100; Pannella and MacClintock 1968:71).

Additional problems may result from characteristics of bivalve growth, as the rapid growth of juvenile shellfish is reduced during the mature stage while old specimens may enter a senile phase of slow and sometimes sporadic growth (Clark II 1979b:100). Some of the control specimens collected from Boundary Bay not only exhibited rapid juvenile growth, but had complacent growth increments making it very difficult to locate reduced winter growth, presumably indicative of the mild climate and protected environment of the bay. Senile individuals may present difficulties and incorrect seasonality dates may be obtained if external valve examination alone is used (Clark II 1979b:100). Although young and senile specimens may provide accurate dates, mature and healthy shellfish are preferred.

To obtain an indication of the temperature regime which might influence bivalve growth in Boundary Bay, minimum and maximum daily air temperatures for White Rock STP were obtained from the Atmospheric Environment Service in Vancouver. These values were averaged over five day periods from January 1979 to March 1981 (encompassing the collection dates of control samples) and plotted in Figure 5-3. Periods of freezing and near freezing temperatures during this time were noted between mid-November and mid-February, suggesting that the winter growth (translucent bands) could be deposited between these dates.

Most of the modern bivalves collected from Boundary Bay had complacent growth increments which made preparation of a photographic record from polished sections difficult. Consequently thin sections were prepared by Coots Petrographic Service (Vancouver) Ltd. All of the specimens collected in March and April had substantial amounts of growth following the most recent winter growth (Figure 5-3). The 10 shellfish obtained in 1980 had an average of 16% of the previous year's growth while the 8 specimens collected in 1981 averaged 14%. Correlation with the temperature graph indicate the 1980 shellfish had commenced their deposition of opaque increments by early January, while the 1981 shells have a translucent band deposited well after winter growth, probably reflecting a period of low temperature in early February of that year (Figure 5-3, see dash-dot line). Three shells (S811, S813, S804) have translucent growth increments which may have resulted from record high temperatures during mid-July of 1979 (Figure 5-3, see dotted line).

In much more detailed and comprehensive studies of daily growth increments, Koike (1980:85-89, 1981, 1982) has cross-dated individual shells to demonstrate a progression from early spring to early summer seasonality from the bottom to the top of a layer. Conchochronology (Koike 1981, 1982) offers an opportunity to make estimates of deposition rate of midden layers and

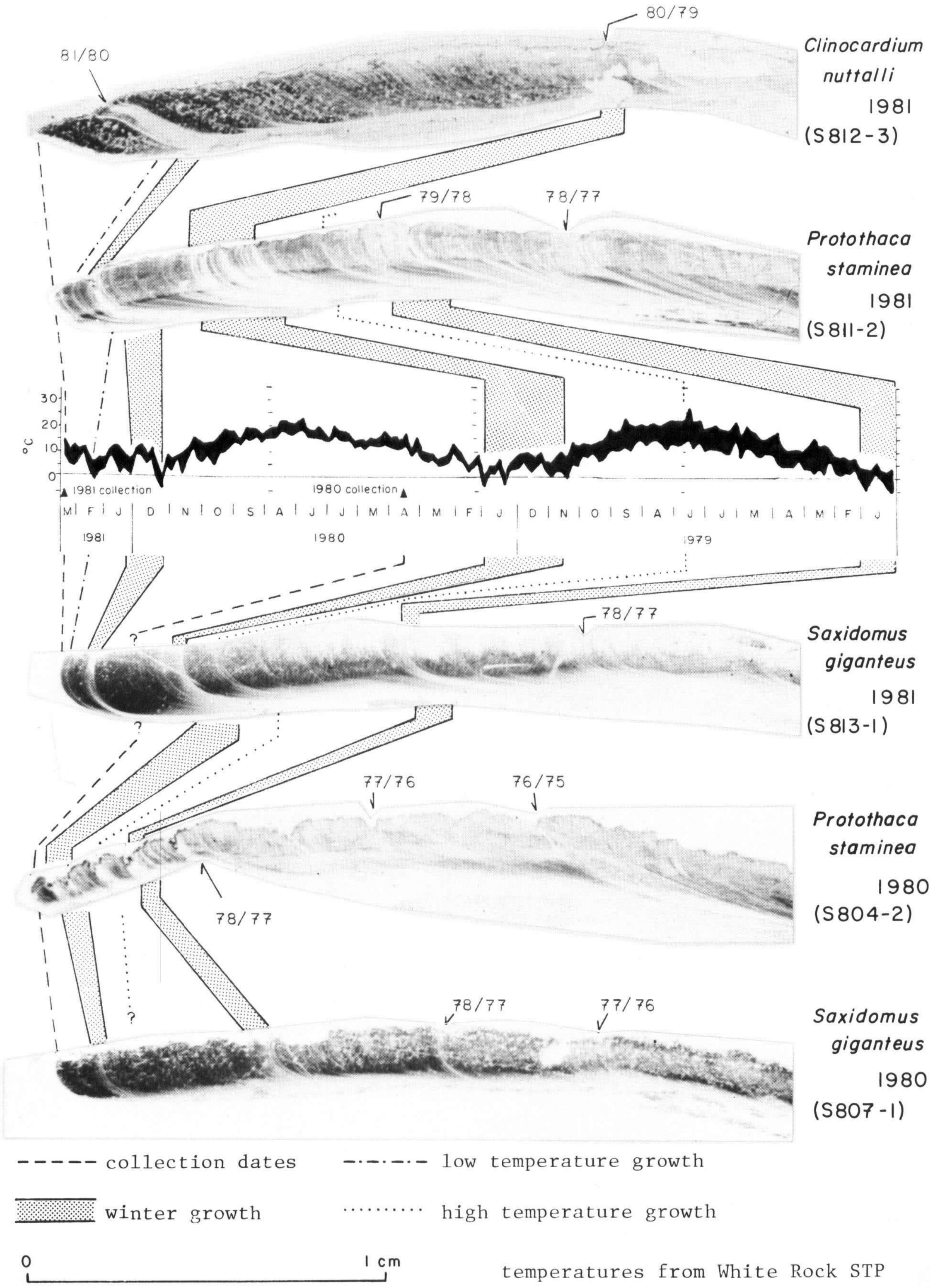


Figure 5-3. Temperature and Variation in Bivalve Growth in Boundary Bay.

length of occupation of seasonal sites, a control unfortunately lacking in this study. To summarize, bivalves from Boundary Bay may be expected to deposit translucent winter growth increments between approximately November 15 and February 15, while increasing sunshine and the warming waters of the southward facing bay encourages commencement of opaque summer growth early in the year.

Shell valves for seasonality dating were collected from the shell sample bags of all layers except for Layers A and D2 which did not have any suitable specimens. The shells were cut into 1.5 - 2.0 cm wide pieces, and using modeling clay placed upright in plastic 35 mm film cannisters. The cannisters were then filled with QuickMount™ and allowed to set. The mounted shells were sawn in half and ground smooth on a polishing wheel using 220, 600, and 900 grit. Some hand polishing was required to remove fine striations and was accomplished using tin oxide on a glass sheet.

In all, 161 shell valves were examined for seasonality dates of which growth histographs are presented for 103 specimens in Figures 5-4 to 5-6. The remaining 58 shells were in senile growth stages making interpretation difficult. Each sample number is followed by a hyphen and a number indicating species (i.e., S0103-3 = Saxidomus, etc.). Each histogram presents the amount of shell growth measured on the most recent and a number of preceeding growth bands on each shell valve. The percentage of recent growth over the previous average annual growth is provided. Photographs are also provided of selected shell sections in which each winter growth band is indicated. In both the histograms and photographs the most recent growth is to the left. The shell seasonality data is presented in three groups of layers to facilitate reference from the layer analysis later in this chapter.

A total of 135 shell valves exhibited a winter band followed by less growth than was observed on the comparative specimens collected in March and April which strongly suggests an earlier collection date, probably in February.

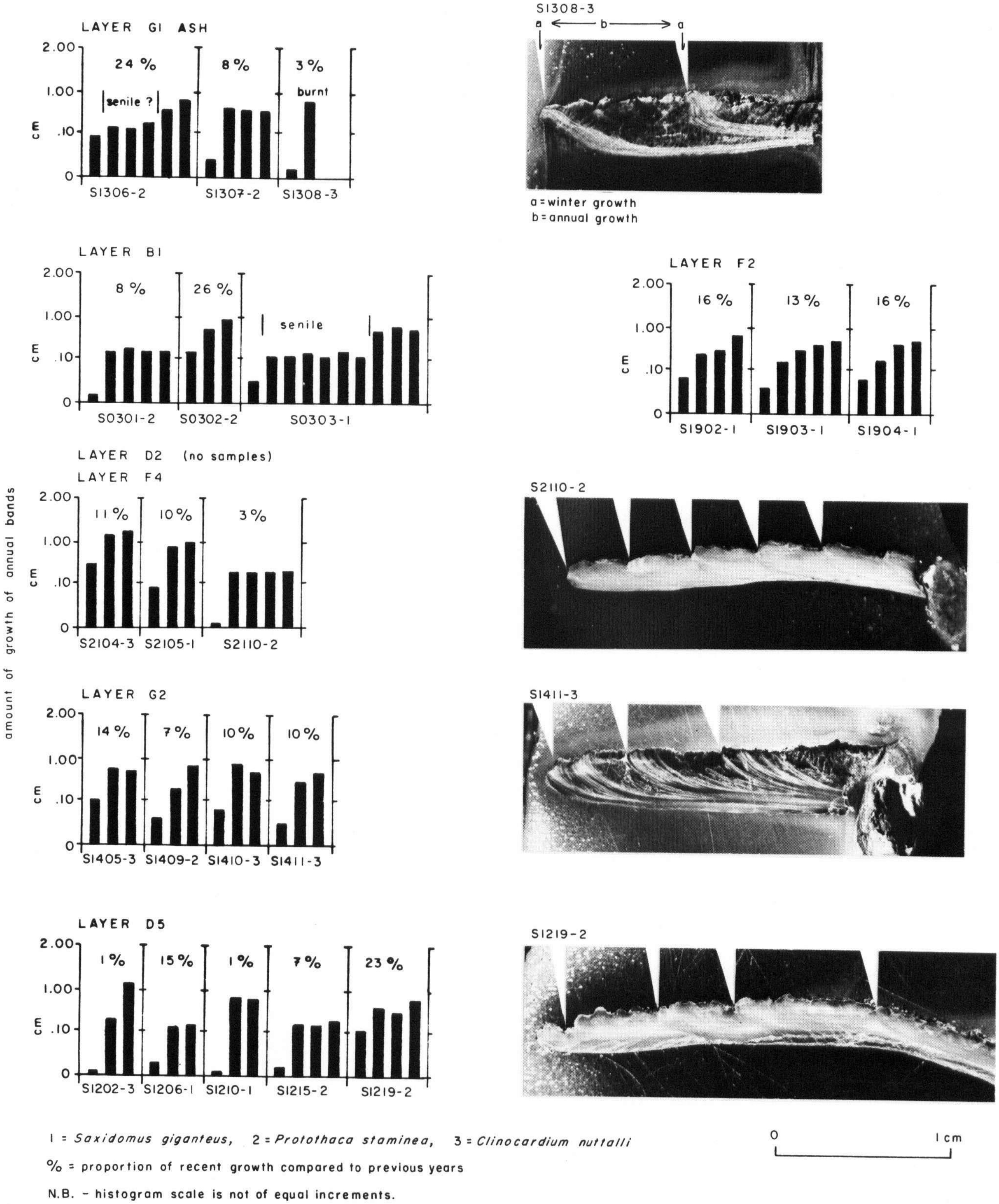


Figure 5-4. Seasonality Dating: Cluster I Bivalves.

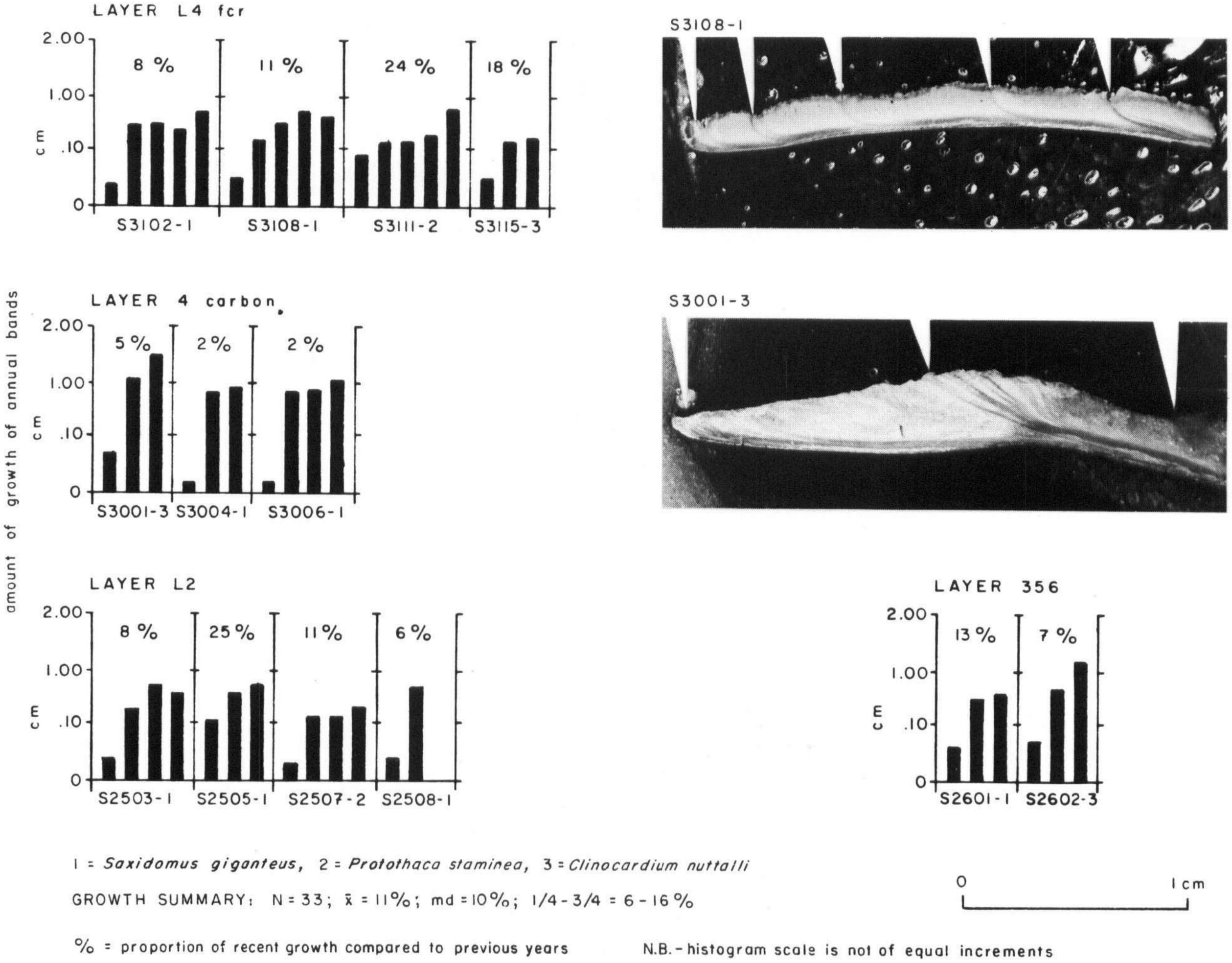


Figure 5-4 cont'd. Seasonality Dating: Cluster I Bivalves.

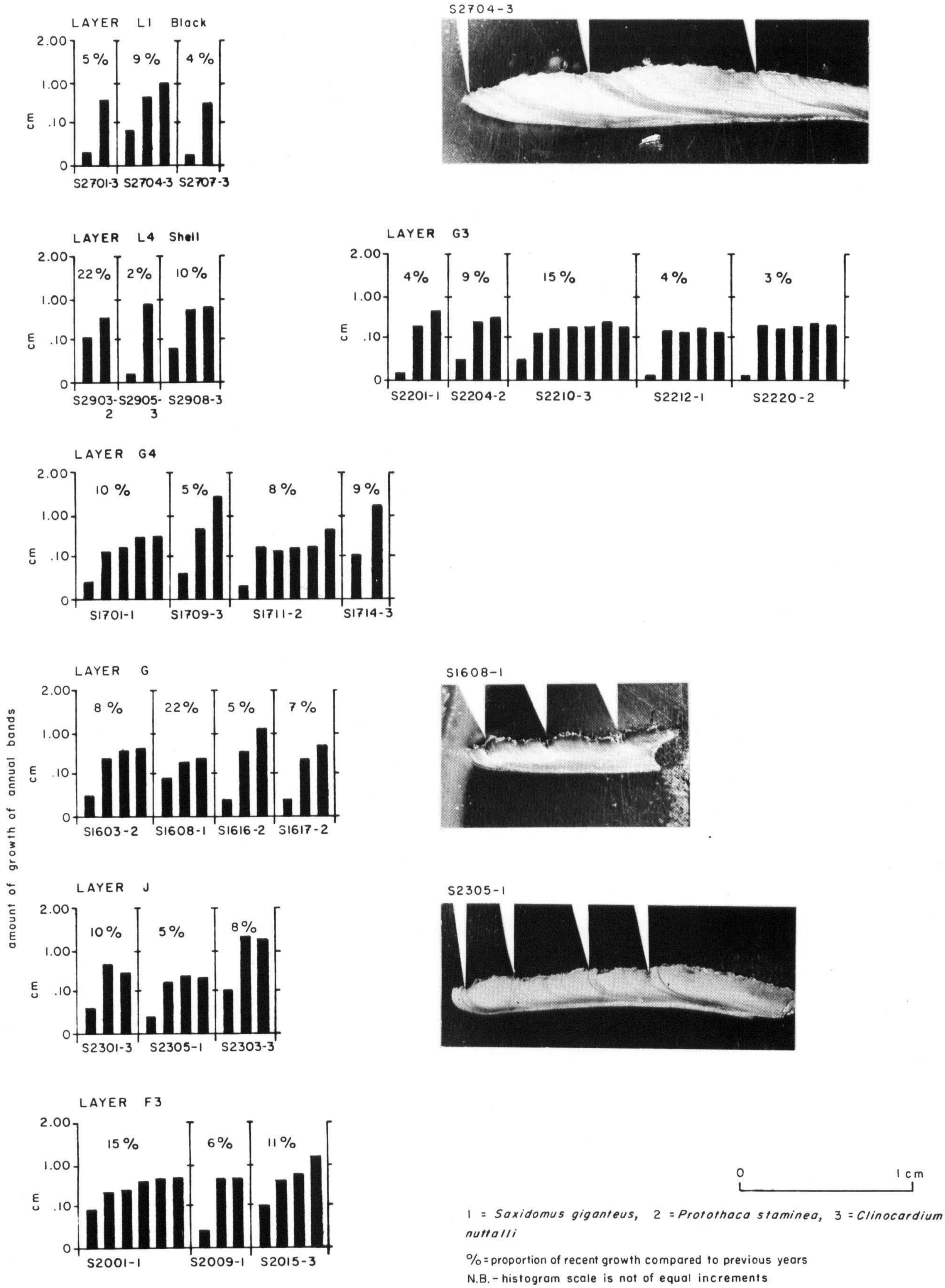


Figure 5-5. Seasonality Dating: Cluster II Bivalves.

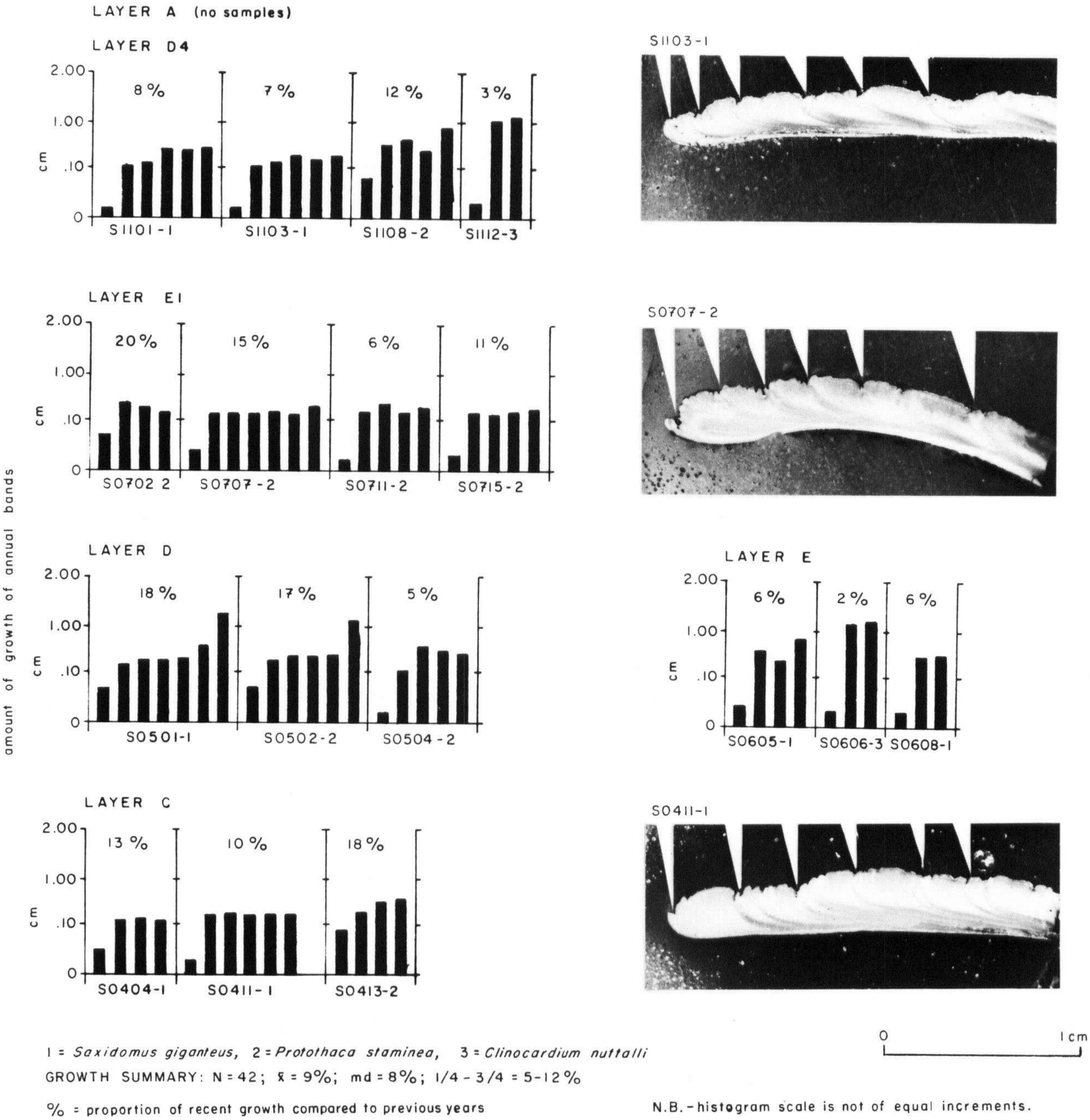
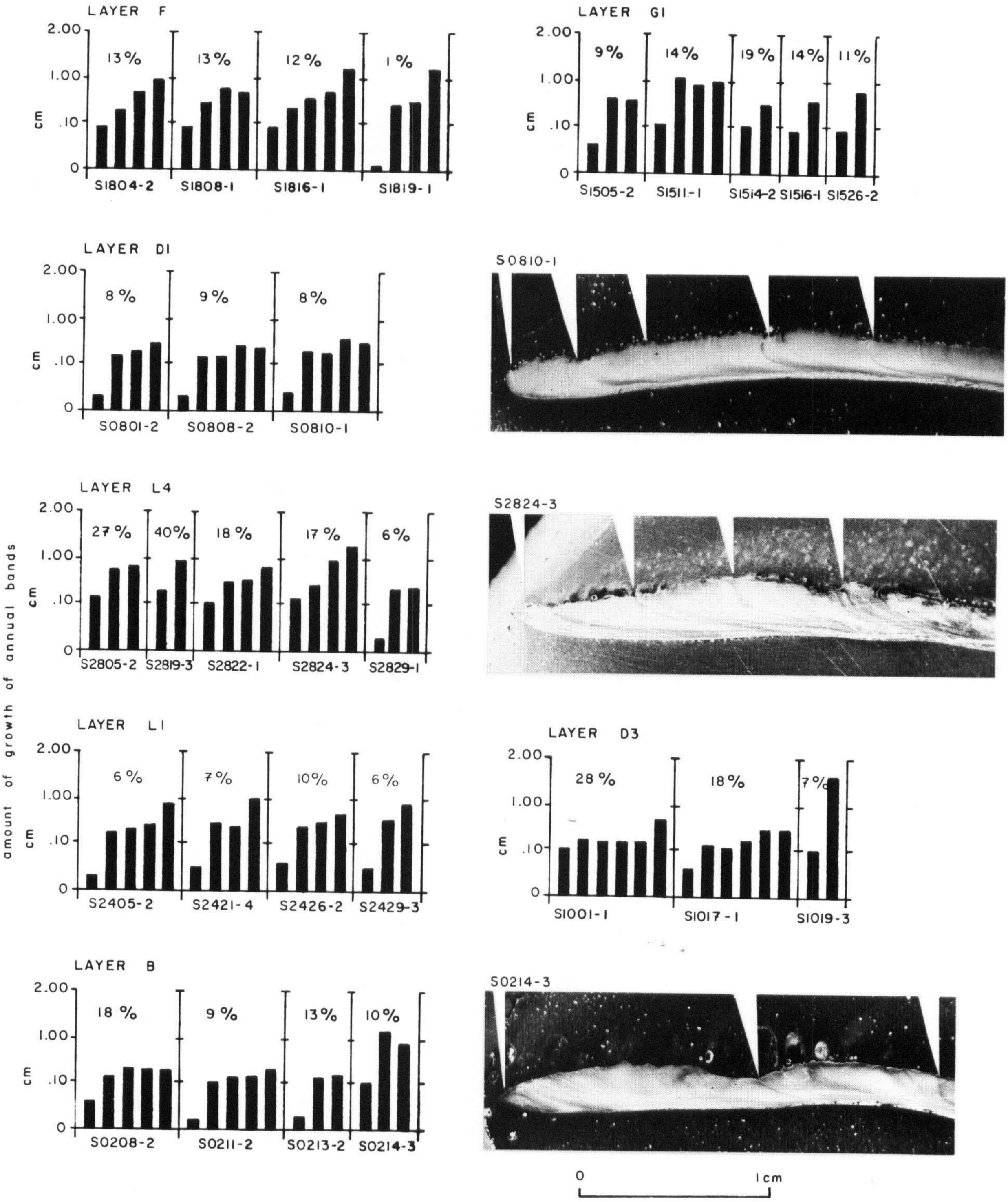


Figure 5-5 cont'd. Seasonality Dating: Cluster II Bivalves.



1 = *Saxidomus giganteus*, 2 = *Protothaca staminea*, 3 = *Clinocardium nuttalli*

GROWTH SUMMARY: N = 28; $\bar{x}$ = 13%; md = 11%; 1/4 - 3/4 = 8 - 18%

% = proportion of recent growth compared to previous years N.B. – histogram scale is not of equal increments

Figure 5-6. Seasonality Dating: Cluster III Bivalves.

of the remaining shells, 8 have a similar amount of growth while 18 have more. At least part of this difference must be assigned to measurement and interpretation errors on my part while a few were juveniles which could be expected to exhibit rapid growth. Allowance must also be made for mild winters which could allow deposition of opaque increments in December and January, and may be responsible for the growth observed on samples from Layer L4 which had several shells with very faint winter growth bands. I am confident that the few deviant specimens result from variation in individual growth and do not indicate differences in harvesting time.

Based on the growth ring analysis of the Crescent Beach bivalves, it appears that all the shellfish from the excavation were harvested in late February and March. Tentatively, it is assumed that Crescent Beach was occupied seasonally during the time under consideration here. Further evidence will be examined below.

Although detailed study of the effect of human predation of shellfish populations was not carried out, the numerous senile individuals which were observed suggests shellfish beds were not being over exploited. A total of 45% of the valves examined for seasonality dating were in the senile growth phase (e.g. Figure 5-5, S1103 and S0707). At present shellfish beds along the eastern side of Boundary Bay are heavily exploited even though the bay is officially closed for shellfish harvesting. In light of extent pressures on these beds it was felt that collection of sufficient numbers to construct population curves for some of the beds could not be justified. In general however, what modern shellfish I did observe are younger and smaller in size from those recovered from prehistoric deposits.

5.4 CONSTITUENTS OF THE CRESCENT BEACH MIDDEN

<u>Layers (n=31, 28.8 t)</u>

A total of 31 layers were identified during the excavation at Crescent (see Table V-I). A description of each layer may be found below, while a Harris diagram (1979a) is presented in Figure 5-7 outlining the stratigraphic sequence. Two additional interface layers (F1 and L) were defined in the field to avoid the mixing of adjacent layers (Figure 5-7). A summary of midden constituents is provided in Table V-II and each group is described below including the matrix analysis conducted by Vycinas (1978) along with the results of radiocarbon assays. Analysis of the layer types is conducted following this description of the layer constituents.

Radiocarbon Dates

Six wood charcoal samples were submitted to Gakushin University (Tokyo) for radiocarbon assay which provided dates between 480 and 1350 years B.P. (A.D. 1470 - 600) (Figure 5-8). Overall these site dates are in line with earlier estimates based upon artifacts recovered from Test Unit A which were given a tentative date of less than 1,500 years B.P. (Ham and Broderick 1976:5; Ham 1978:7).

Two samples, Gak 7259 (Layer D) and Gak 7260 (Layer D1) yielded dates younger than 270 years B.P. (Kigoshi, March 31, 1978). Both samples were obtained from hearths within 40 cm of the site surface, and may have been contaminated by rainwater percolation. Evidence of leaching in the upper 60 cm of the Crescent Beach midden is discussed in the following section on chemical analysis. In addition, Stuiver (1978) has discussed the nature of the severe fluctuations in the radiocarbon calendar over the last 450 years B.P. Included in this period is nearly half of the age estimate of Gak 7258 (480 ± 90) from Layer B. Thus, with the available dates, the best estimate which may be offered for Layers B to D1 is that these layers from the upper part of the site date between 200 and 650 B.P.

Three radiocarbon dates were obtained from the lower portion of the

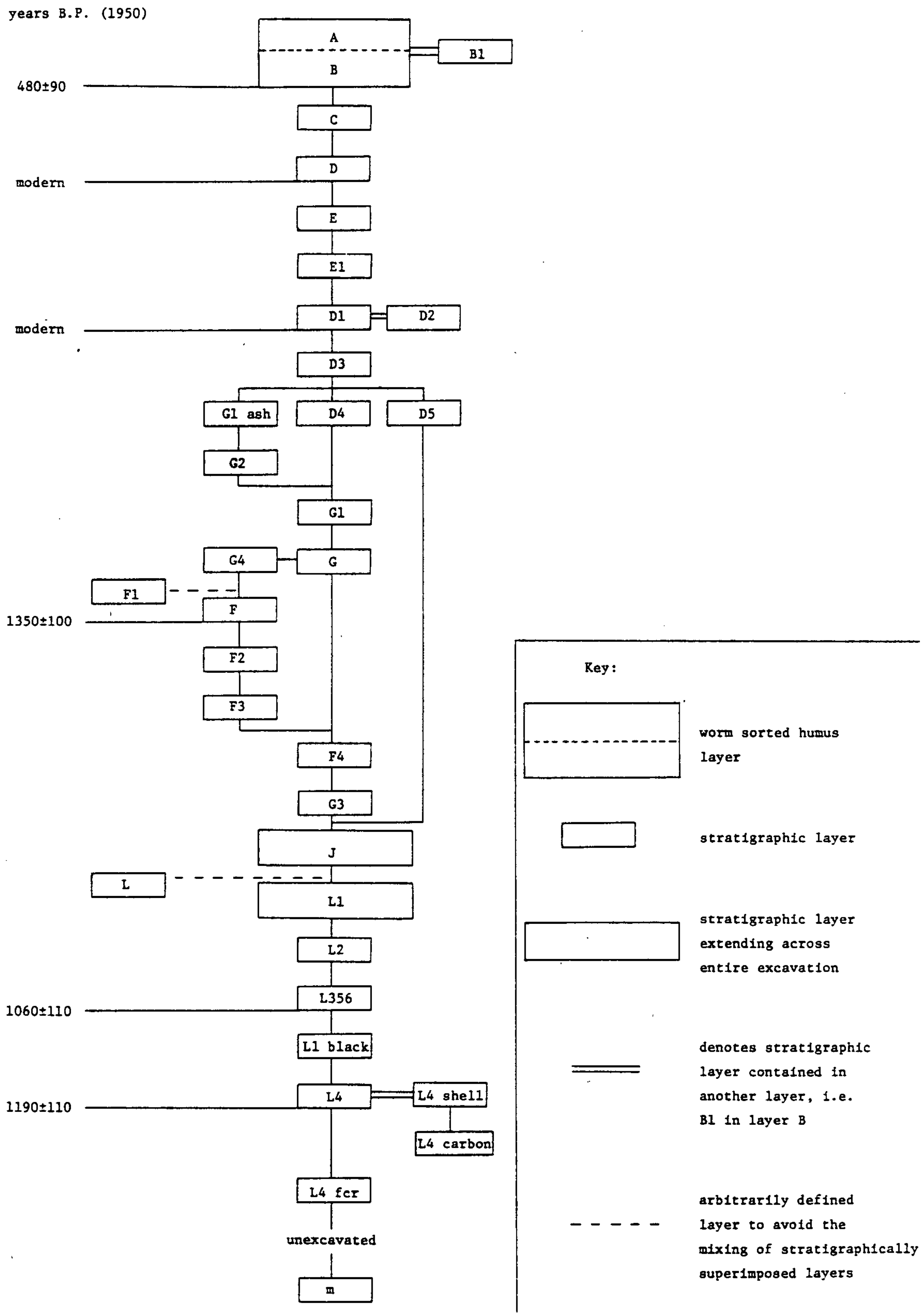


Figure 5-7. Harris Diagram of Crescent Beach Stratigraphic Layers.

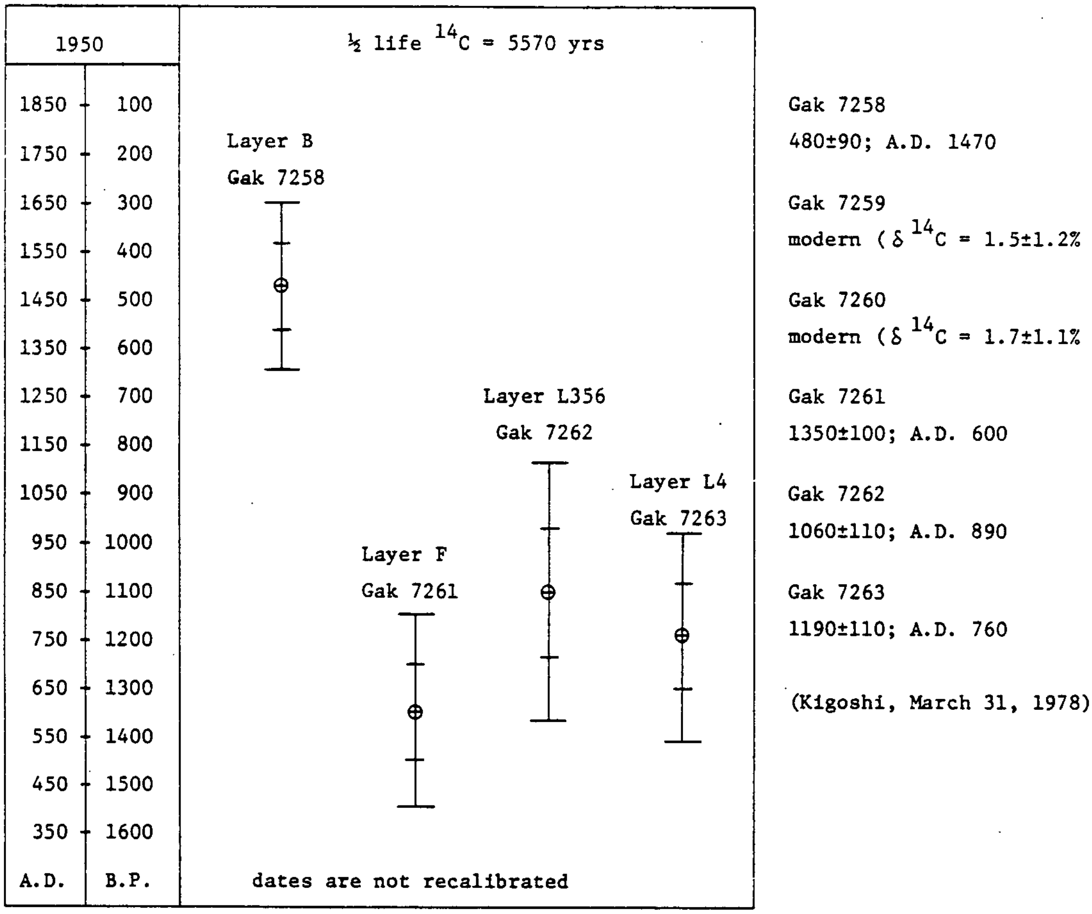


Figure 5-8. Crescent Beach Radiocarbon Dates.

midden, Layers F to L4 (see Figure 5-7, 5-8). Unfortunately, Gak 7261 (1350 ± 100) from Layer F is older than the two dates from the underlying layers. As may be seen in Figure 5-7, Layer F was stratigraphically superior to Layers L356 and L4 which yielded dates of 1060 ± 110 (Gak 7262) and 1190 ± 110 (Gak 7263) respectively. This inversion is not serious as all three estimations overlap considerably (Figure 5-8). Thus the age of the lower portion of the Crescent Beach midden may be estimated as between 840 and 1550 B.P..

No radiocarbon dates were obtained from the central part of the midden, layers D3 to G (see Figure 5-7). Presumably dates from these layers would fall within the 650 to 840 B.P. period. Historic use of Layer A may be minimally dated to 1929 and 1919 based on the age of coins recovered from the layer (see Table II-III and Figure 5-26). In summary, the upper part of the Crescent Beach midden, Layers B to D1 date between 200 and 650 B.P., and the lower part of the midden, Layers F to L4 date between 840 and 1550 B.P..

Chemical Analysis

As part of a chemical and physical analysis of Crescent Beach matrix samples Vycinas (1978) made pH and elemental phosphorus readings on 373 and 404 samples respectively. The results of that study are presented in Figures 5-9 and 5-10.

An average pH value of 8.25 was determined for Crescent Beach, similar to values of 6.0 to 8.5 reported for other shell middens in British Columbia (Calvert 1980:209; Monks 1977:330; Sawbridge and Bell 1972:846). The high shell content of middens are responsible for pH values many times more basic than the natural soils of the Western Hemlock Zone (Crozier 1981:43; Orloci 1965; Sawbridge and Bell 1972:845). Figure 5-9 presents a plot of average pH values for the 27 layers which were analysed, while y represents the best lineal fit of these means determined by the method of least squares (Arya and Larder 1979:473-6). It will be noted that surface Layer A and B with their high humus content are the most acidic, while in addition 5 of the 7 other layers whose pH values fall below y were described as humus layers (see Chapter 5.4 below). The two exceptions are Layers L356, reported as a black carbon stained matrix (but may contain humus), and L4 shell which consisted of greyish brown sand and shell. Unfortunately other humus layers, E, D3 and J have pH values above line y limiting the usefulness of pH alone in identifying old surfaces.

Overall Vycinas (1978:16) found that the range of variation of pH values

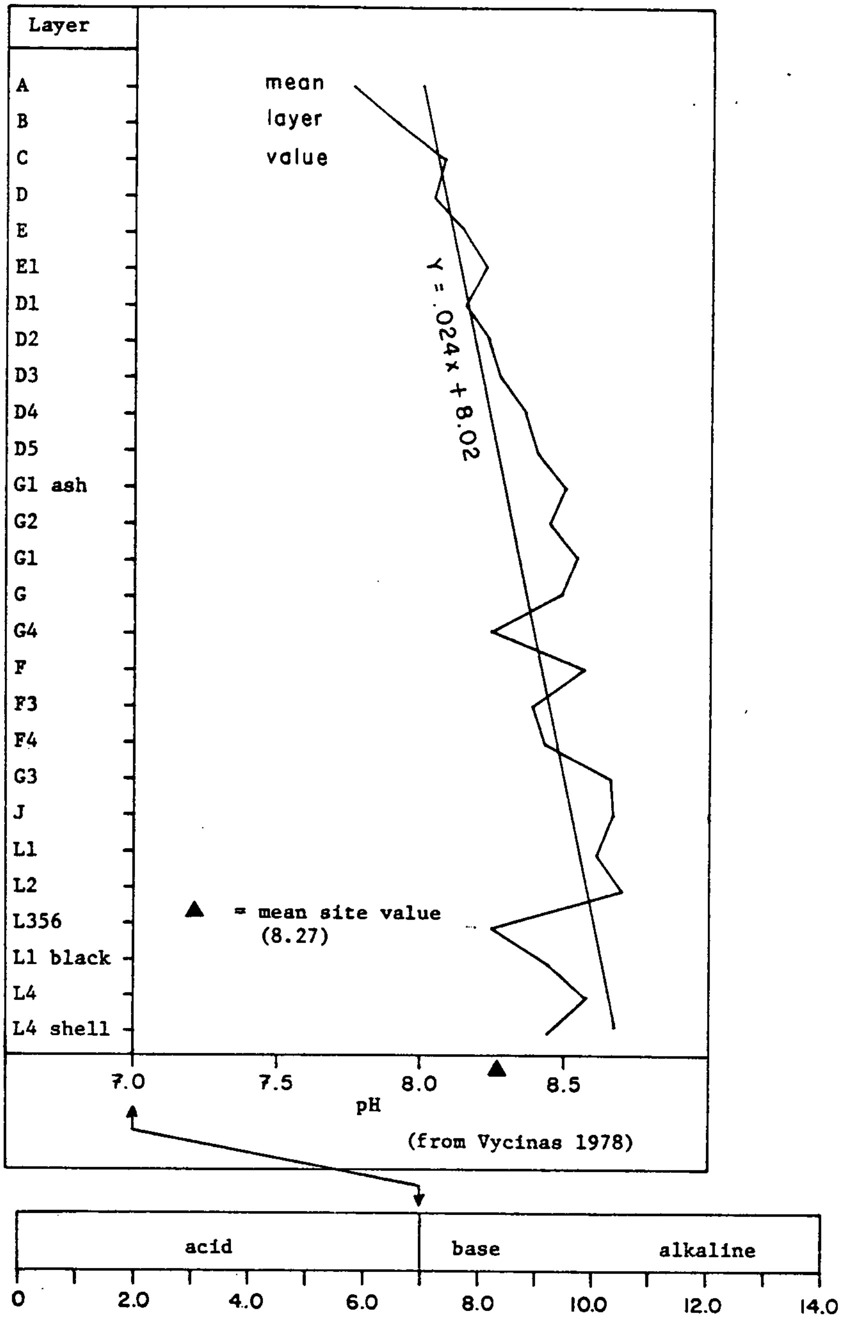


Figure 5-9. Mean Layer pH Values.

within layers was small (0.1-0.2) while the slope of y suggests that possibly the first 60 cm of the pH profile may have been affected by leaching of hydrogen ions from Layers A and B. The overall steepness of y indicates leaching has not been extensive however.

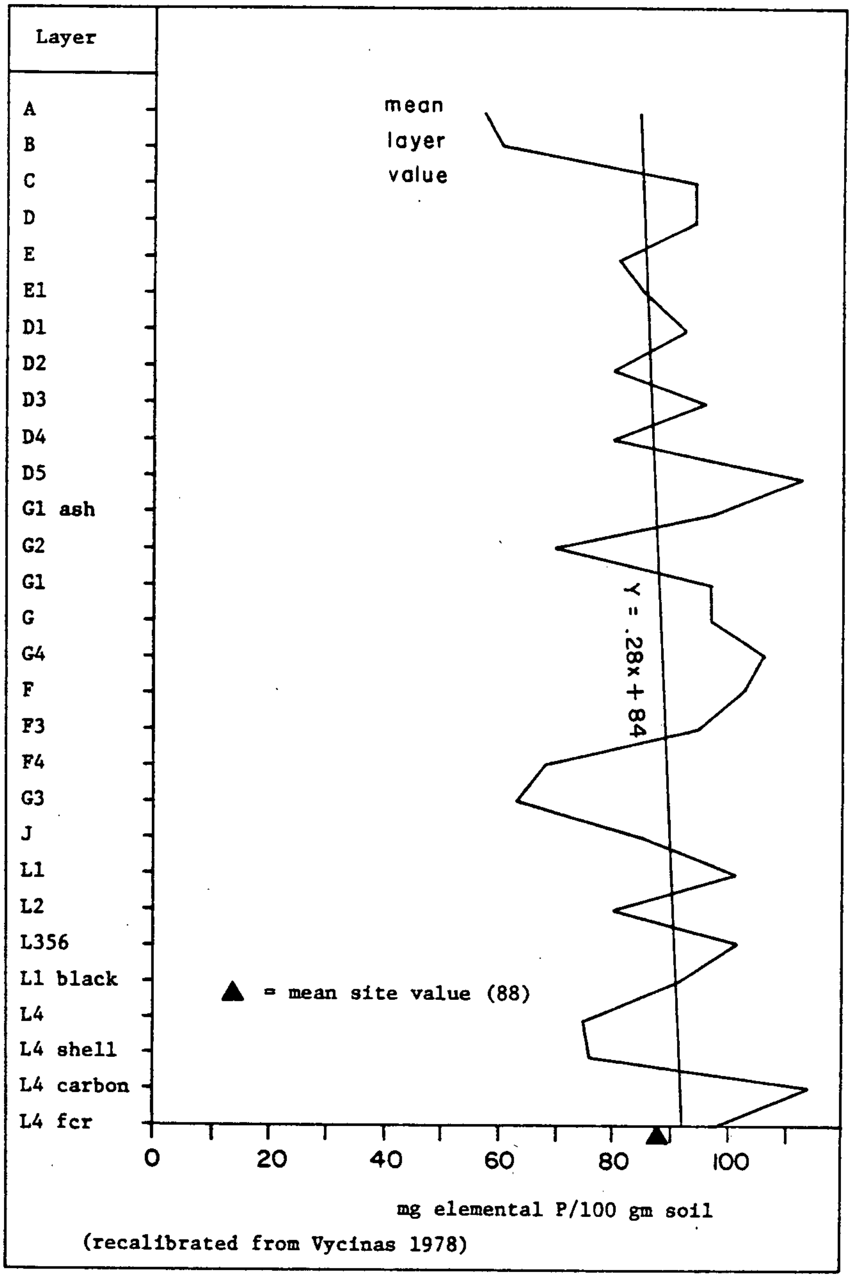


Figure 5-10. Mean Layer P Values.

Phosphorus is one of the basic ingredients of DNA molecules and accumulating through the food chain it is universally associated with human activities (Eidt 1977:1327). Once phosphorus enters the soil it may be highly resistant to leaching, especially in a high pH - high calcium environment, although if pH decreases and some calcium phosphate is dissolved it will be taken up by plants (Eidt 1977:1327). This may very well be what has happened in Layers A and B where phosphorus values fall well below the site mean (Figure 5-10).

Unfortunately the values presented in Figure 5-10 suffer from a faulty machine correlation curve and thus should not be used in any comparative analysis (M. Church, August 1981, pers. comm.) (in addition to the normal array of problems associated with this type of analysis - see Eidt 1977:1329). I would however like to point out some features of the phosphorus profile from Crescent Beach. The steepness of y is probably a good indication of the lack of phosphorus leaching in the site. In addition there is an apparent association between low pH and high phosphorus values as well as a large range of variation of phosphorus values (Vycinas 1978:19-20, Figure 8). Vycinas' results suggest chemical analysis may indeed be very useful in understanding the internal structure of shell middens. A lot of basic work is yet required however.

Physical Analysis

The remainder of this section will describe the various midden constitutents as determined by analysis. Only a very small fraction of these remains is natural in origin, the majority of the midden constituents listed in Table V-II were brought to the site and deposited as a result of human activities. Debris (mostly roots), humus, landsnails, small rodents, probably some songbirds, and perhaps a small portion of the sand in the site are all that may be attributed to non-human processes.

Sand (est. 15.2 t)

It is estimated that approximately half of the midden by weight consists of sand, based on the average of 52.7% calculated from 12 samples submitted to grain size analysis by Vycinas (1978). Although this is not a very

	kilograms	percent
Sand (estimate)	15,198.8	52.70
Debris	2.2	0.01
Ash, humus, error (estimate)	4,651.4	16.13
Artifacts	5.9	0.02
Broken cooking stones	2,566.0	8.90
Charcoal (estimate)	4.6	0.02
Landsnail (estimate)	2.8	0.01
Barnacle (estimate)	73.6	0.25
Crab (estimate)	1.3	0.00
Chiton (estimate)	0.4	0.00
Univalves (estimate)	172.9	0.60
Bivalves (estimate)	6,142.0	21.30
Fish (estimate)	9.4	0.03
Bird	0.3	0.00
Mammals	5.9	0.02
Human remains	2.7	0.01
SITE WEIGHT	28,840.2	(.00<.01)

Table V-II. Crescent Beach Midden Constituents.

reliable value, it does serve to point out the importance of this midden constituent. Monks (1977:353) noted a high sand content at Deep Bay (DiSe 7) which along with the Crescent Beach evidence may support ethnographic information on clam steaming (Elmendorf 1960:133; Haeberlin and Gunther 1930: 23; Regan 1917:27). In addition to imported baskets of beach sand to cover steaming mounds, a certain amount would adhere to clams brought back to the site (clappers for example).

Samples from several layers (D, G2, L1) have sand particle curves similar to those of local beach sands while Layer B has a coarser fraction reflecting its worm sorted pebble zone (Figure 5-11). The fine mineral portion of the ash sample from Layer D1 suggests Layers G3 and G may also have large amounts of ash. Some sand may have occasionally blown into the site although this would be rare as the site is sheltered behind the Surrey Uplands from the dominant southeasterly winds (Figure 2-2). A sample of what may be Quadra Sand obtained from the bluff behind the site (Figure 2-32) has a finer sand fraction than either the beach or layer sands (Figure 5-11). Layer B1, thought to be sand transported by humans to the site has a curve similar to those of the beach sands and also contains waterworn shell.

Debris (2.2 kg)

Debris consists of grass, tree and shrub roots, dead and decaying roots, and pebbles. This material was weighed in the field for each sample and then discarded.

Ash, Humus and Error (est. 4,654 kg)

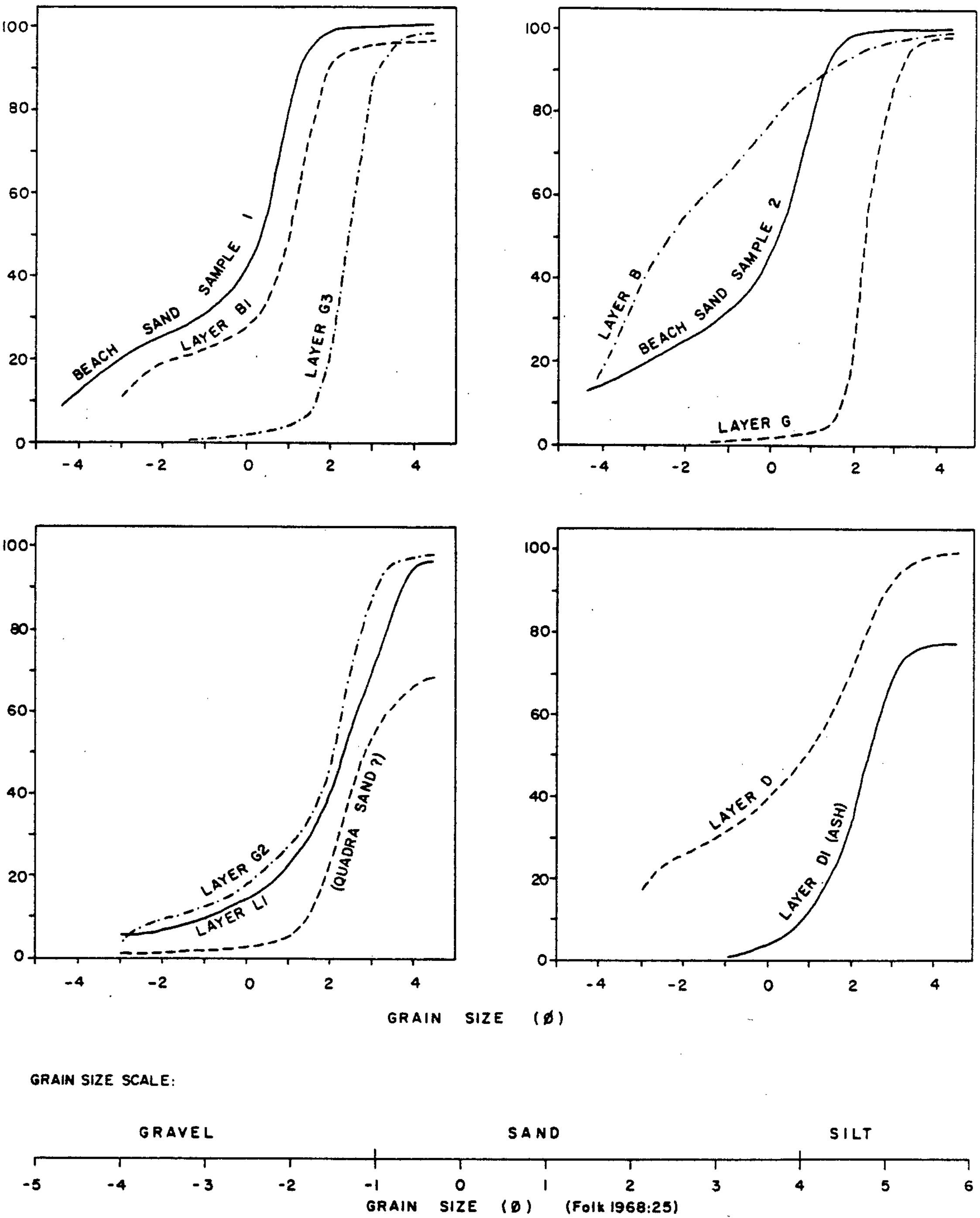
This value represents the residual weight of the site which I have not been able to account for and thus a large part of it may be simply sampling error, and the rest humus and ash washed through the screens. Fortunately, weight estimates for the site constituents do not exceed the known weight of the site.

Artifacts (n=218, 5.9 kg)

Artifacts are presented here in the major groups outlined in Table II-II, while the distribution of Crescent Beach artifact types at 11 other late period sites is presented in Figure 5-12. Metric data for the Crescent Beach artifacts are provided in Appendix I.

Overall, the Crescent Beach assemblage is similar to the summary of Gulf of Georgia Cultures presented in Figure 2-23, with the exception of antler artifacts which are much more common at Crescent Beach. Chipped stone is slightly higher than average and bone artifacts slightly lower as are pecked and ground stone artifacts. Ground stone artifacts are rare at Crescent Beach (c.f., Figures 2-23 and 5-13).

Some artifacts from Crescent Beach, including whale bone blanks,



Beach sand samples were obtained from Boundary Bay adjacent to the excavation area. Possible Quadra Sand sample was obtained from Anthropology Creek ravine approximately 20 m above sea level. Granularmetric analysis from Vycinas (1978:57-85).

Figure 5-11. Sediment Analysis.

Artifact Types	Sites	Whalen Farm II DgRs 14	Shoal Bay DcRt 1	Georgian Bay II DfRu 24	St. Mungo III DgRr 2	Montague Harbour III DfRu 13	Deep Bay III DiSe 7	Sandwick DkSg 2	Dionisio Point II DgRu 3	Pitt River DhRq 21	Stselax DhRt 2	Belcarra II DhRr 6	Crescent Beach DgRr 1	TOTAL (12)
Manufacturing	chipped stone detritus	+	0	+	+	0	+	0	+	+	+	+	+	9
	cobble cores/pebble tools	0	0	0	+	+	+	0	0	+	0	+	+	6
	bipolar cores/stone wedges	0	0	+	+	0	+	0	0	+	0	0	+	5
	quartz crystal detritus	0	0	+	0	0	+	0	0	+	0	0	+	4
	hammerstones	0	0	+	+	+	0	0	0	+	+	+	+	6
	anvil stones	0	+	0	0	0	0	0	0	0	0	0	+	2
	sandstone-slate saws	0	0	+	0	+	+	+	0	+	0	+	+	7
	small irregular abrasives	+	+	+	+	+	+	+	+	+	+	+	+	12
	ground slate detritus	0	+	+	+	+	+	+	+	+	+	+	+	11
	bone detritus	+	+	+	+	+	+	+	+	n.p.	+	+	+	11
	antler detritus	+	+	+	+	+	+	+	+	n.p.	+	+	+	11
	whale bone blanks	0	0	0	0	0	0	0	0	n.p.	0	0	+	1
	<u>Mytilus californianus</u> detritus	0	+	+	+	+	+	0	0	0	+	0	+	7
Woodworking	nephrite celts or adzes	+	0	+	+	+	+	+	0	+	+	+	+	10
	handmauls	+	0	0	0	+	0	+	0	0	+	+	i	6
	bone chisels or wedges	0	+	+	+	+	0	0	+	n.p.	+	+	+	8
	bone drills	0	0	0	0	+	0	0	0	n.p.	0	+	+	3
	antler adze hafts	0	+	+	0	+	0	0	0	n.p.	+	+	+	6
	antler wedges	+	+	+	+	+	+	0	+	n.p.	+	+	+	10
	<u>Mytilus californianus</u> celts	0	d	d	+	d	+	0	0	0	+	0	+	4
Textiles	retouched flakes, scrapers	0	+	+	+	+	+	0	0	+	0	+	+	8
	split/sectioned bone awls	0	+	+	+	+	+	+	+	n.p.	+	+	+	10
	deer ulna awls	0	+	+	0	+	+	+	+	n.p.	+	+	+	9
	incised eye bone needles	0	u	0	+	0	0	0	+	n.p.	+	+	+	6
	antler awls	0	0	+	0	0	0	0	0	n.p.	0	0	+	2
Ceremonial-Decorative Items	disc beads (stone/shell)	+	0	0	+	0	+	0	0	+	0	0	+	5
	labrets	0	0	0	0	0	0	0	0	+	0	0	+	2
	ochre	0	0	0	0	+	+	+	0	+	0	0	+	5
	bone blanket pins	0	0	0	+	0	0	0	0	n.p.	+	+	+	4
	bone pendant	0	0	0	+	0	0	+	0	n.p.	0	+	+	4
	earspool	0	0	0	0	0	0	0	0	n.p.	0	0	+	1
	birdbone beads	0	0	0	0	0	0	+	0	n.p.	0	0	+	2
	antler pendants	0	0	0	0	+	0	0	+	n.p.	0	0	+	3
	<u>Dentalium</u> beads	+	0	0	0	+	+	0	0	0	+	0	+	5
	<u>Pecten</u> shell	0	0	+	0	0	+	0	+	0	+	0	+	5
Hunting	stemmed chipped stone point	0	0	0	0	+	0	0	0	+	0	0	+	3
	barbed bone leisters	+	0	+	0	+	+	+	+	n.p.	+	+	+	9
Fishing	bone bipoints	0	+	+	0	+	+	+	+	n.p.	+	+	+	9
	incised bone points	0	0	0	0	0	0	0	0	n.p.	0	0	+	1
	basally thinned bone points	0	+	+	+	+	+	+	+	n.p.	+	+	+	10
	antler harpoon with lineguard	0	0	0	0	0	0	0	0	n.p.	0	0	+	1
	toggling harpoon valves	+	+	+	+	+	+	+	+	n.p.	+	+	+	11
Food Preparation	stemmed bifaces	+	0	0	0	+	+	0	0	+	0	+	+	6
	chipped slate knives	0	0	+	0	+	+	+	0	+	+	+	+	8
	perforated stones	0	0	0	0	0	0	0	0	0	0	+	+	2
	leaf shaped ground slate knives	+	0	0	+	0	0	0	0	+	+	0	+	5
	ground slate knives	0	+	+	+	+	+	+	+	+	+	+	+	11
	broken boiling stones	i	i	+	+	+	+	+	+	+	+	+	+	12

Key: + = reported, 0 = not reported, d = debitage of that type, u = unclassifiable fragment, n.p. = no preservation, i = inferred presence.

Sources: Boehm 1973a, Borden 1950, Calvert 1970, Capes 1974, Charlton 1977, Haggarty and Sendey 1976, Kew 1955, Mitchell 1971a, 1971b, 1980, Monks 1977.

Figure 5-12. Occurrences of Crescent Beach Artifacts at Other Late Components.

earspools, incised bone points, and antler harpoons with lineguards, are not reported from the other sites summarized in Figure 5-12. Well represented at Crescent Beach are woodworking, textile and decorative assemblages (c.f., Table II-II and Figure 5-12). Hunting artifacts are rare at Crescent Beach while fishing artifacts also appear restricted. Missing are slotted and channelled toggling harpoon valves and their arming heads, bone unipoints, thin round bone and antler points, and notched sinker stones. Among the hand tools used in food preparation, small stemmed bifaces and ground slate knives are not present. Also lacking in the Crescent Beach assemblage are artifacts which may have been related to ground slate manufacturing. These include shaped abrasives, large abrasive slabs, slate rods, and cobbles with flattened faces.

The layer distribution of Crescent Beach artifacts is presented in Figure 5-42, and descriptions follow. Artifacts recovered from the slit trench screening and historic items follow the discussion of the prehistoric artifacts. Where catalogue numbers are provided they are followed by their layer provenience (4111 B = DgRr 1:4111 recovered from Layer B).

<u>Manufacturing Artifacts</u>

<u>1) chipped stone detritus (n=69, 241.3 g)</u>

A total of 18 layers contained lithic detritus, mostly fine grained basalt (65%). The largest group were flakes lacking cortex (61%) (Table V-III). This suggests the latter stages of core reduction as well as artifact use and maintenance. Attempts to match this material with chipped stone artifacts was unsuccessful, perhaps because preliminary core reduction and most other stone flaking took place elsewhere at the site, possibly on the beach itself (or at other sites). The beach to the south of the site is covered with cobbles, many of which are the same types of basalt as recovered

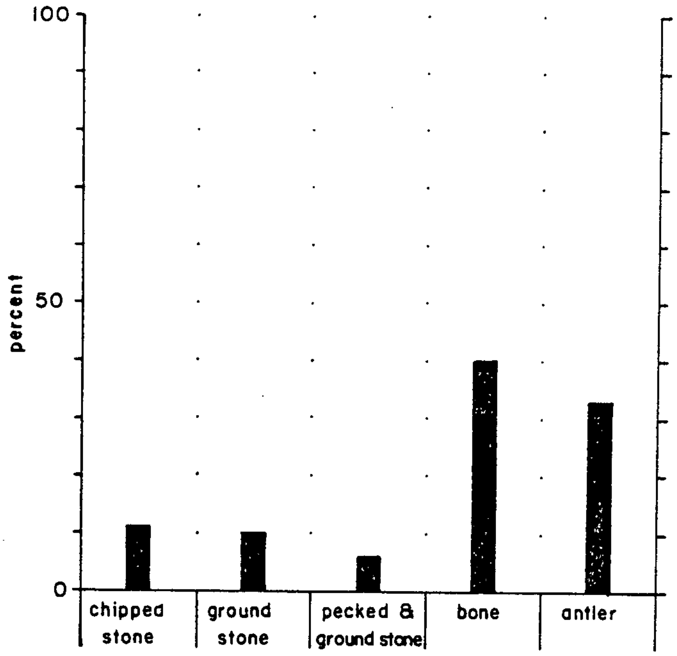


Figure 5-13. Crescent Beach Artifact Industries.

from the site. A few core remnants were observed on the beach below Ocean Park in the vicinity of DgRr 11 (Figure 2-31). Although flake detritus is reported from several late assemblages (Figure 5-12), it is not common reflecting the reduced use of chipped stone.

One flake recovered from Layer C (B7SE), a piece of greenish metamorphosed sandstone weighing 1.9 g, looks very much like a flake removed from a stone hand maul. Not enough of this flake was found to allow a positive identification however and the presence of a maul is only inferred.

2) cobble core and pebble tools (n=3, 1,004.6 g)

This class consists of three large unformed tools, 4228 D3, of metamorphosed slate, 4125 B, a thick basalt pebble spall, and 4111 B, a flat (1.4 cm) piece of chipped schist (Figure 5-14). The spall (4125 B) has small flake scars and polish along much of its steep edge (56°) although this damage may have occurred in the archaeological context. The piece of slate

Layer	block shatter		platform-bearing flake		flake shatter		resharpening flake		Total
	cortex +	cortex -	cortex +	cortex -	cortex +	cortex -	cortex +	cortex -	
A	-	-	-	1	2	2	-	-	5
B	-	-	2	2	-	2	1	-	7
C	-	-	1	-	1	-	-	-	2
D	-	-	1	2	1	1	-	1	6
E1	-	-	-	-	-	1	-	-	1
D1	-	-	1	-	1	-	1	-	3
D3	-	-	-	-	1	2	-	-	3
D5	-	-	-	-	-	1	-	-	1
G1	-	-	-	1	-	-	-	-	1
G	-	-	-	-	-	1	-	-	1
F	-	-	-	-	1	1	1	-	3
L1	-	-	-	-	1	4	-	-	5
L356	1	-	-	-	1	2	-	-	4
L1 black	-	-	-	-	-	1	-	1	2
L4	2	1	-	3	3	5	-	2	16
L4 shell	-	-	-	-	2	-	-	-	2
L4 carbon	-	-	-	1	1	3	-	1	6
L4 fcr	-	-	-	-	1	-	-	-	1
	3	1	5	10	16	26	3	5	69
	6%		22%		61%		11%		

lithic material	f	%
very fine grained basalt	6	9
fine grained basalt	45	65
very fine grained olivine basalt	1	1.4
fine grained olivine basalt	1	1.4
metamorphosed fine grained basalt	1	1.4
porphyritic fine grained basalt	1	1.4
medium grained basalt	1	1.4
porphyritic dacite	2	3
porphyritic andesite	5	7
fine grained andesite	1	1.4
medium grained andesite	1	1.4
chert	2	3
metamorphosed soapstone	1	1.4
quartzite	1	1.4
	69	

Table V-III. Crescent Beach Lithic Detritus.

(4228 D3) has bifacial step flakes removed on its acute edge (24°) and the schist (4111 B) has bifacial flaking and abrasive wear on its broad end. The wear on these last two artifacts suggests heavy chopping or similar activities.

3) bipolar cores/stone wedges (n=17, 610.6 g)

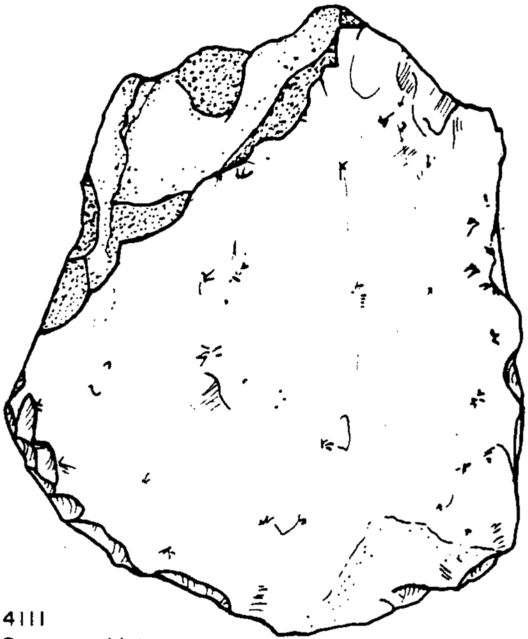
These artifacts include a variety of items which have bipolar flaking or other bipolar damage such as crushing and step flakes (Figure 5-15, 5-61). Flenniken (1981) determined that the bipolar industry at Hoko River produced flakes which were hafted and used in butchering fish. These artifacts may have had a similar use at Crescent Beach although attempts to match up lithic detritus and artifacts was not successful, perhaps because manufacturing activities took place away from the excavated area. A large portion of the bipolar cores are flat rounded beach pebbles, some of which may have lost their first flakes on the beach.

Some of the artifacts such as 4185 D (nephrite), or 4179 C (crushed rather than flaked edge) do not appear to have yielded flakes, yet display bipolar crushing and step flakes and thus may have had other uses possibly as wedges. The beach rolled artifact (4326) from Layer L4 may indicate scavenging of archaeological deposits (see Ascher 1968:50-51). These artifacts are reported from 5 of the assemblages presented in Figure 5-12 although identification and reporting of this class may be poor (see Chapter 2).

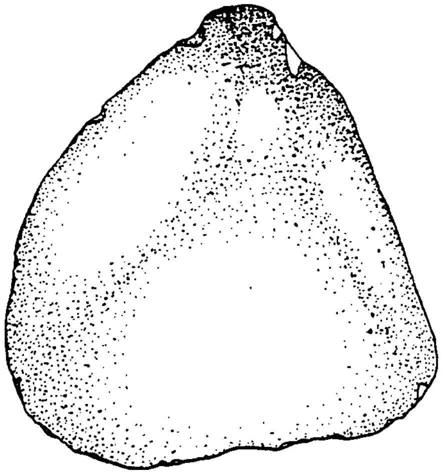
4) quartz crystal detritus (n=6, 18.6 g)

Five pieces of quartz crystal were recovered, two from Layer A, three from Layer B and one from L4. Quartz materials are more common in earlier deposits at Crescent Beach (Trace 1977a:7) while at the Pitt River Site (DhRq 21) a quartz crystal microlith industry is present in late period deposits (Patenaude n.d.).

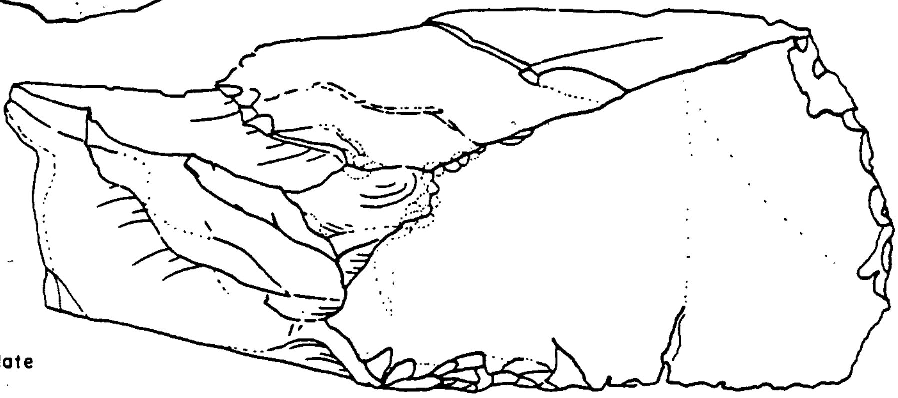
COBBLE AND PEBBLE TOOLS



4111
B schist

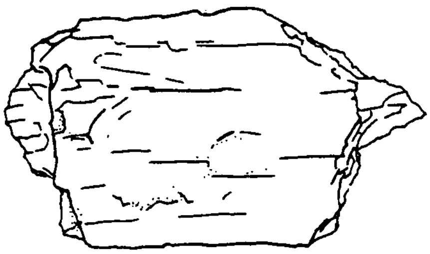


4125 basalt pebble spall
B

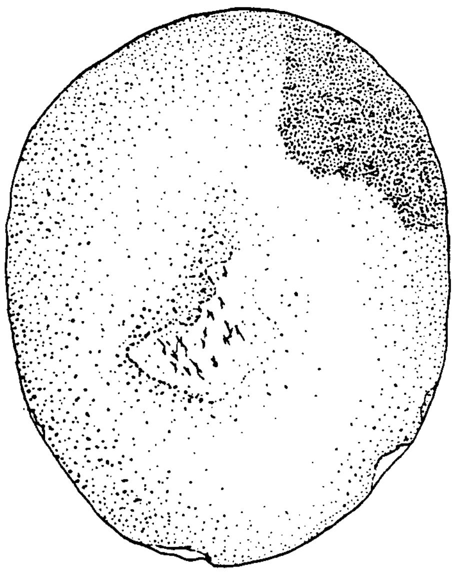


4228
D3
metamorphosed slate
block

SAW AND ANVIL STONE



4330
C
slate saw fragment



4126
B
anvil stone

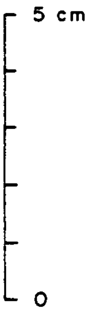


Figure 5-14. Manufacturing Artifacts.

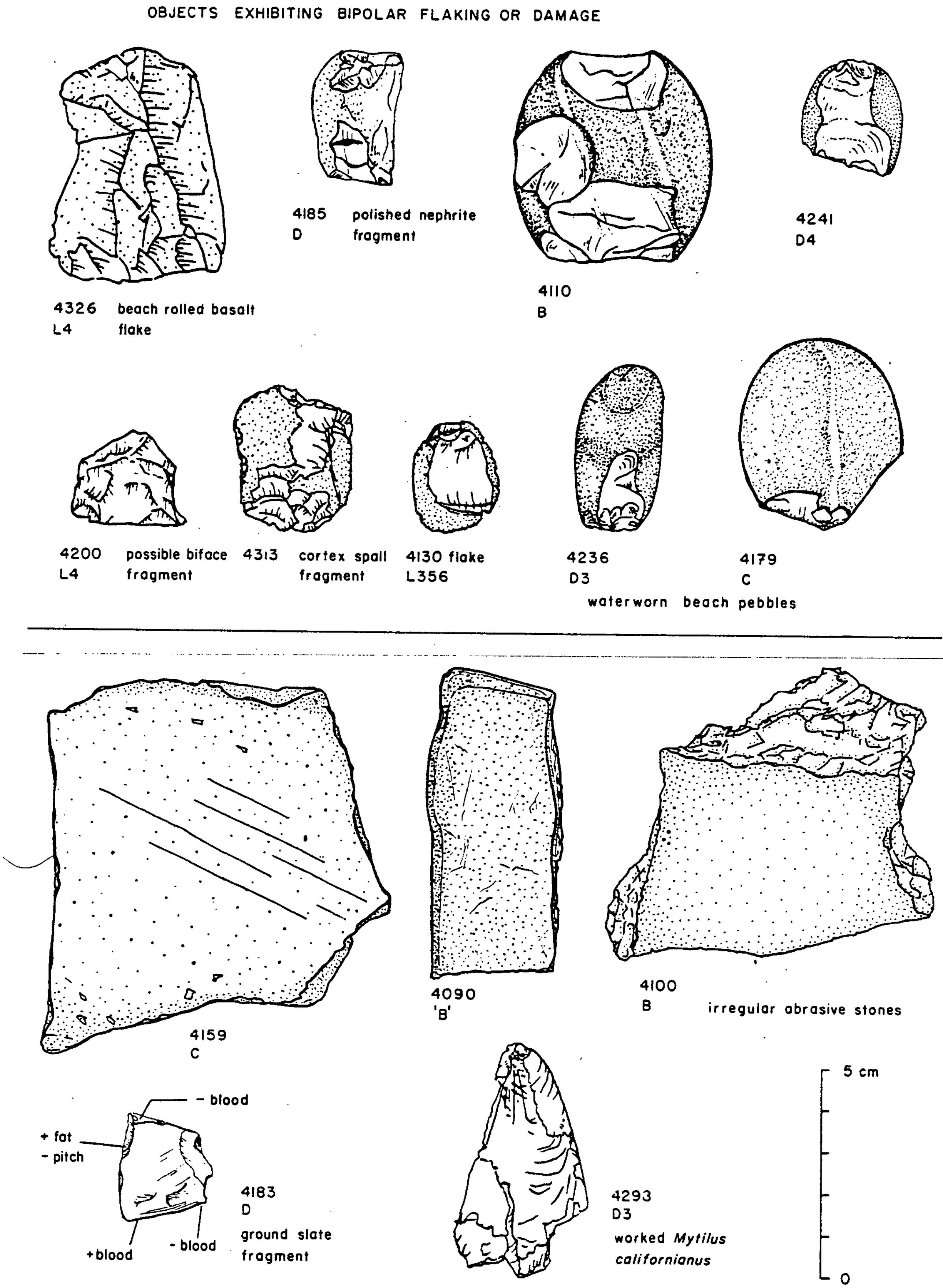


Figure 5-15. Manufacturing Artifacts II.

5) anvil stone (n=1, 475.4 g)

This artifact (4126 B) is a flat granite pebble with pecked areas on opposing flat surfaces. One corner of the stone is fire blackened (Figure 5-14). Anvil stones are not common in reported late assemblages (Figure 5-12).

6) slate saw (n=1, 15.4 g)

This piece of unworked slate (4330 C) exhibits edge wear consisting of polish and striations which are parallel to the edge suggesting a sawing action (Figure 5-14). Sandstone and slate saws are reported from 7 of the 12 late assemblages in Figure 5-12.

7) irregular abrasive stones (n=9, 1,204.2 g, $\bar{x}$=133.8 g)

A total of 6 small abrasive stones were recovered from Layer B, two from Layer C and one from L4 (Figures 5-15, 5-61). These pieces of sandstone could have been used as abrasive slabs and abraders for working materials of slate, nephrite, bone, antler and shell. Small irregular abrasive stones are reported from all 12 late assemblages presented in Figure 5-12.

8) ground slate detritus (n=8, 25.4 g, $\bar{x}$=3.2 g)

No complete ground slate knives were recovered although several fragments were found, one of which included a piece of a cutting edge. This artifact (4183 D) was subjected to residue analysis (Broderick 1980) which noted the presence of blood and fat, but no pitch (Figure 5-15). Ground slate fragments were recovered from Layers B(2), C(1), D(4), and E1(1) and have an average thickness of 0.2 cm.

9) bone detritus (n=18, 128.1 g, $\bar{x}$=6.7 g)

Sectioned and ground fragments of large mammal bone were recovered from

6 layers (Figure 5-12) and represent detritus from the manufacture of bone tools. This is probably only a small portion of the bone waste resulting from manufacture as much of it may be classed as faunal remains.

10) antler detritus (n=25, 707.5 g, $\bar{x}$=27.2 g)

These remains include adzed, split and sectioned pieces of deer and wapiti antler and were recovered from 9 layers (Figure 5-42). Included are 9 antler tine tips which may have been chopped off to facilitate the manufacture of beam wedges and as none exhibit any wear they are included as waste. Antler working was apparently more intensive than these remains indicate if we take into account the 273.7 gm of tiny antler chips found in 26 layers (Figure 5-37). Boehm (1973a:116) also recovered curled antler shavings and unused antler tines from the St. Mungo Cannery site (DgRr 2).

11) *Mytilus californianus* detritus (n=3, 11.7 g)

Three small fragments of ground and sectioned *M. californianus* were recovered (4186 C, 4276 C, 4298 D3) suggesting that *Mytilus* shell artifacts were manufactured at the site (Figure 5-15). *M. californianus* is not native to the eastern shore of the Strait of Georgia, but may be found in the western San Juan Islands, Juan de Fuca Strait and along the outer coast (Dayton 1971: 254; Kozloff 1973:136). Menzies who visited the area with Vancouver's Expedition in 1792 remarked on the lack of sea mussel shell weapons in the Strait of Georgia compared to the outer coast (Newcombe 1923:83). Artifacts and detritus of *M. californianus* occur in a number of local late period assemblages although they are by no means common and were most likely obtained through trading.

Woodworking Artifacts

1) serpentine celts or adzes (n=2, 76.3 g)

Two small adze blades were recovered from the site, 4094 from Layer B and 4213 from D1 (Figure 5-16, 5-66). Blade 4213 was associated with a broken antler haft (Figure 5-66) which probably formed an elbow adze. Adzes were widely used in woodworking tasks (Barnett 1975:108; Jenness n.d., p. 38; Stern 1934:95), and are reported from 10 of the 12 late assemblages presented in Figure 5-12.

2) hand maul (one fragment, 1.9 g)

Mentioned above under lithic detritus, the presence of a hand maul is inferred from this polished piece of metamorphosed sandstone from Layer C. Hand mauls are reported in several of the local ethnographies (Barnett 1975: 108; Haeberlin and Gunther 1930:33; Jenness n.d., p. 38; Suttles 1974:224), and are found in 6 of the 12 late assemblages in Figure 5-12.

3) antler adze haft (n=1, 62.5 g)

This broken antler sleeve (4212 D1) fits over the nephrite adze (4213) from the same layer. These two artifacts are part of a composite elbow adze (Figure 5-66). A piece of worked antler (4078) recovered several m away in the slit trench is the missing part of the antler sleeve. Elbow adzes and other composite adze tools with antler hafts are reported in the ethnographies (Barnett 1975:108; Jenness n.d., p. 38; Suttles 1974:226). Mitchell (1971b: 209, 211) illustrates an antler adze haft from Montague Harbour III (see also Smith 1903:164, 1907:314, 342).

4) antler wedges (n=25, 575.4 g)

Antler wedges were a common Coast Salish wood working tool (Barnett 1975:108; Haeberlin and Gunther 1930:15, 33; Suttles 1974:225-6), and are

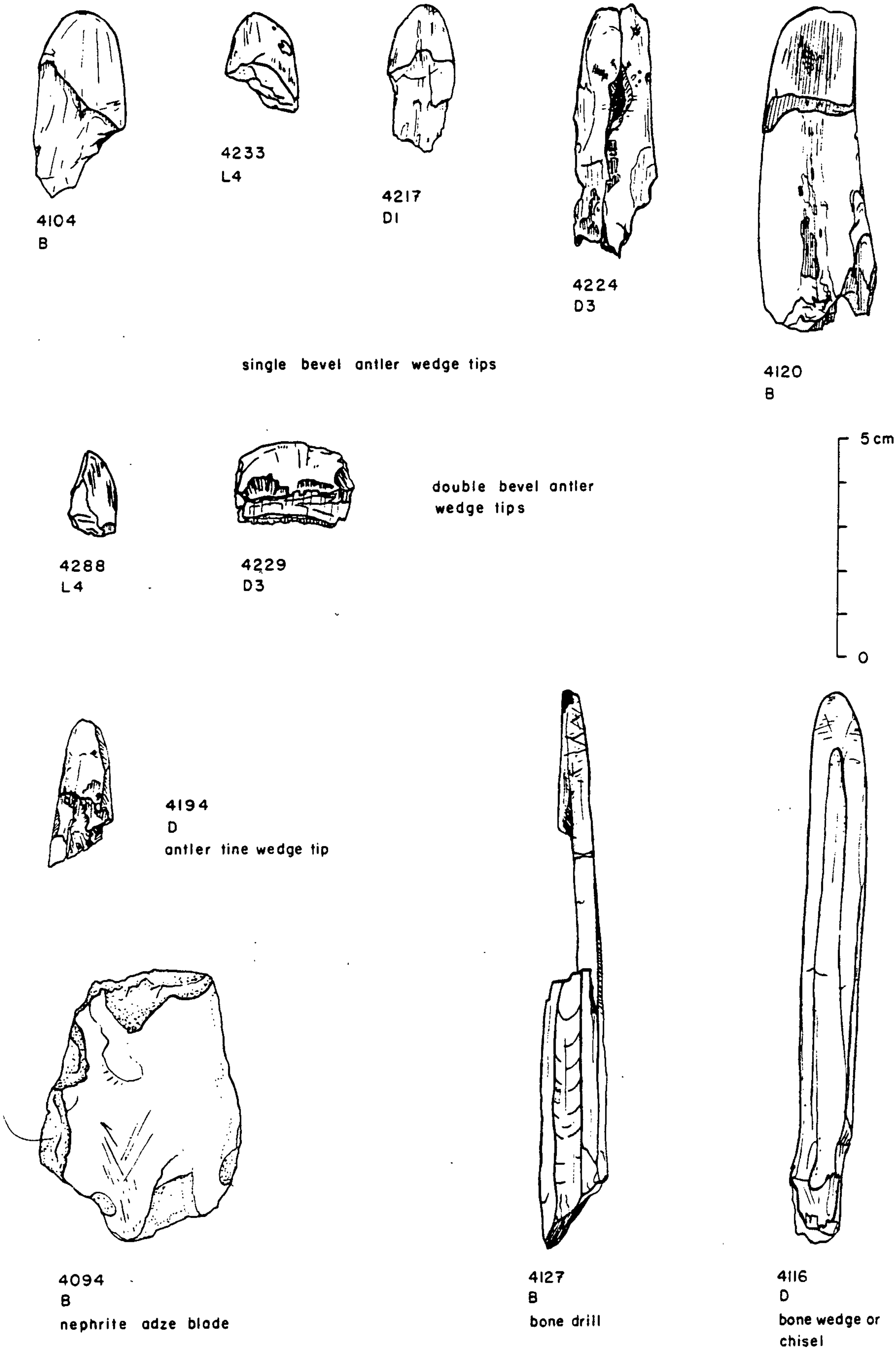


Figure 5-16. Woodworking Artifacts I.

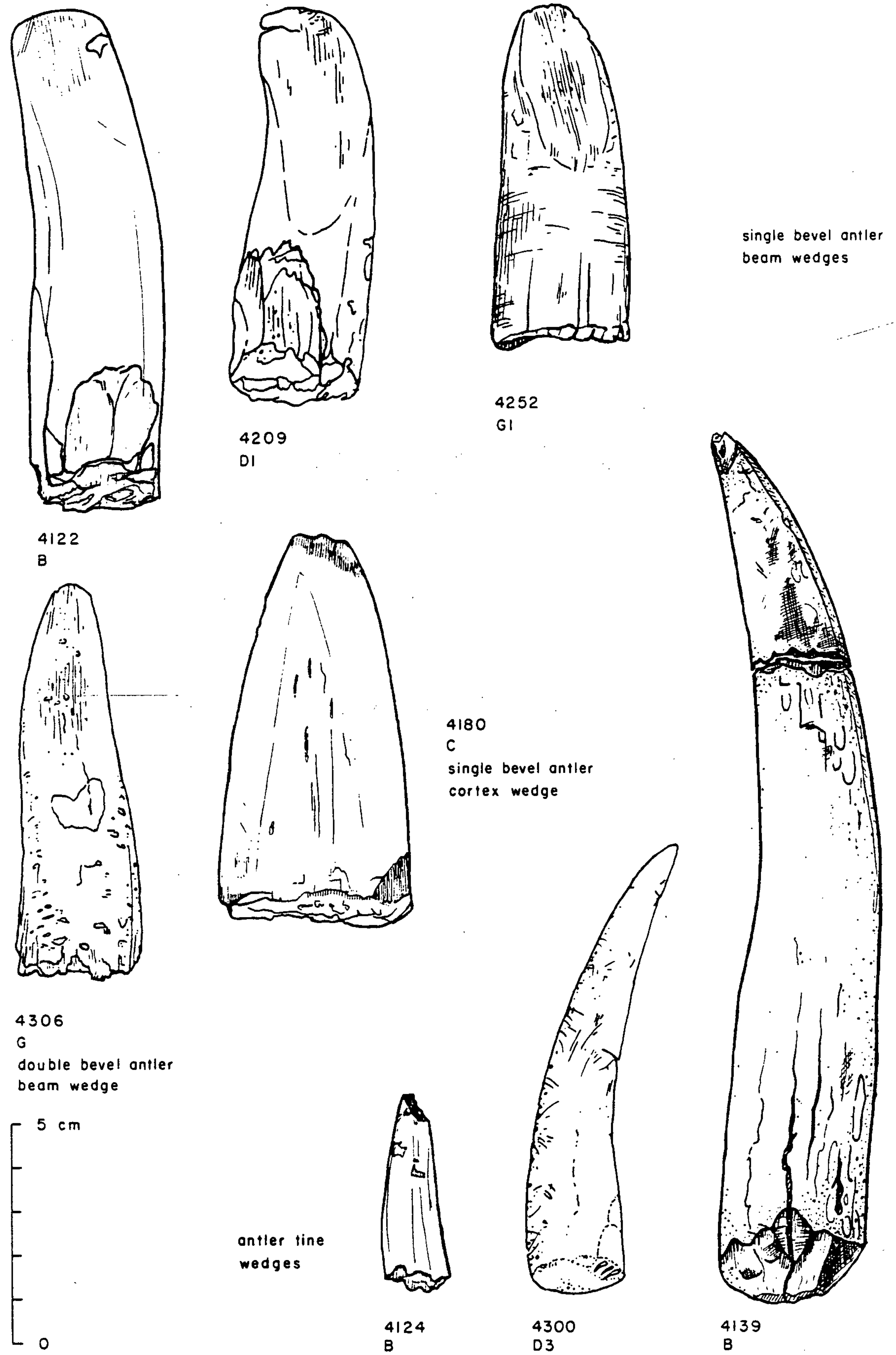


Figure 5-17. Woodworking Artifacts II.

reported from most late period sites (see Figure 5-12). Only 9 complete antler wedges were recovered from Crescent Beach. These include 5 antler beam wedges, 3 antler cortex wedges, and 1 antler tine wedge (Figures 5-17, 5-57, 5-61). Wedge tips range from straight to rounded, and all have polish and wear striations (see Figure 5-17, especially 4252, 4122, 4180).

The remaining 16 wedges were broken including; 8 broken wedge tips, 2 wedges with missing tips, 2 longitudinally split beam wedges, 1 burnt wedge, and 3 unclassified fragments. The broken artifacts are a good indication that antler wedges were used for splitting wood at the site. Antler detritus indicates these tools were also made at Crescent Beach (see p. 225).

5) bone wedges or chisels (n=5, 18.1 g)

Only two of these artifacts are complete, while the remainder consist of broken tips (see Figures 2-36; 4013, 5-16; 4116, 5-57; 4287, 5-61; 4260, 4296). The complete artifacts are made of deer cannon bone and exhibit manufacturing striations which run across the artifacts, while polish and use wear striations are perpendicular to the tip edge. Artifact 4116 though found in the slit trench was assignable to Layer D (see Table V-IV). Several ethnographic sources report the use of bone wedges or chisels in woodworking (Barnett 1975:109; Jenness n.d., p. 38; Stern 1934:95).

6) bone drills (n=2, 8.7 g)

These artifacts (4127, 4267) from Layer B are made from split deer cannon bone and have been ground to form a nearly round point (Figure 5-16). Several different kinds of damage were observed including; short (wear polished) manufacturing striations which angle across the artifacts; a zig-zag decorative line (4127 only); and two types of wear striations, fine scratches often completing more than a 90° arc around the point, and slightly larger compression scars which are also greater than 90°. This wear is consistent with the damage expected from drilling wood. Ethnographically bone points used as drills were hafted in a wooden handle for use in woodworking (Barnett 1975:111; Drucker 1963:59; Elmendorf 1960:178; Haeberlin and Gunther 1930:36; Stern 1934:95; Suttles 1974:226). Similar artifacts have been recovered from Montague Harbour and the Belcarra site (see Figure 5-12).

7) Mytilus californianus adze (n=2, 2.9 g)

Two fragments of ground Mytilus shell adzes were recovered (4193 D, 4328 E), both with single faceted cutting edges. These artifacts are too small to permit accurate classification and one or both may have been knives rather than adzes.

Textile Manufacturing Artifacts

1) retouched flake or scraper (n=1, 12.5 g)

This artifact (4173 B) is similar to two recovered from Test Unit A in 1976 (Figures 2-38, 5-18). All three artifacts are large bifacical reduction flakes and exhibit heavy to light polish on the edges of all flake scars while one (4014 tp) had a few light striations on the tool surface. Use and curation as well as abrasion in the archaeological context could account for the observed wear. Residue analysis favours the former as pitch was identified on all three artifacts, blood on two, and fat on one (Figures 2-38, 5-18). Edge angles are steep, 75°, 80° and 85° while even the more acute edges seem too steep for cutting, 59°, 54° and 61°. These tools may have been hafted, perhaps in wood and used as hide scrapers. Haeberlin and Gunther (1930:33; and Jenness n.d., p. 49) report the use of a rough stone to scrape hides during tanning. Suttles (1974:230-10) reports the use of a hafted metal scraper while pointing out that the effects of the

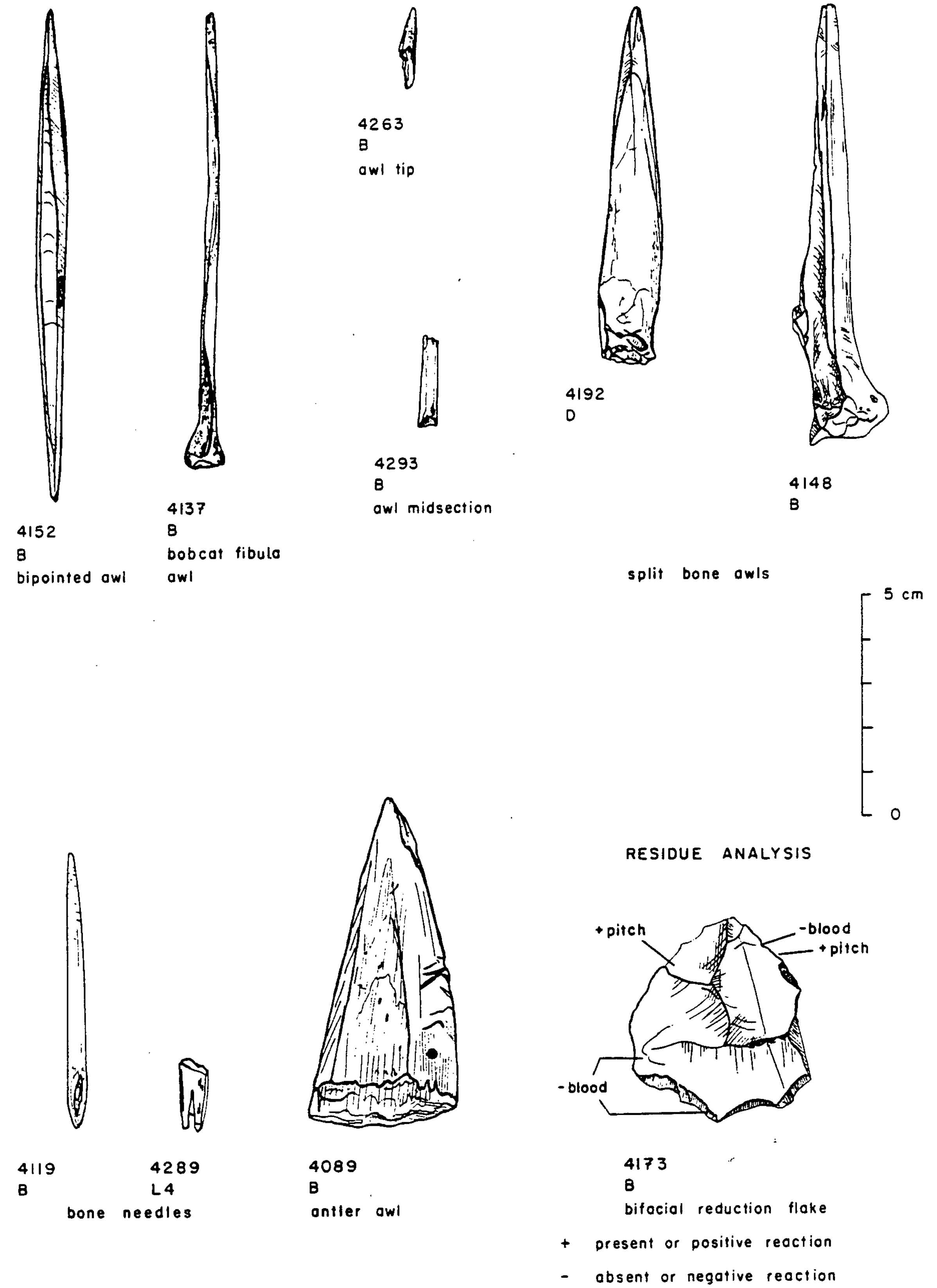


Figure 5-18. Basketry, Matting and Skin Working Artifacts.

Hudson Bay Company on this industry are not known. Retouched flakes and scrapers are reported from most late assemblages (Figure 5-12).

2) split bone awls (n=12, 82.2 g)

All of these artifacts are made from deer and wapiti cannon bone except for 4137 which is a left fibula of a bobcat (*Lynx rufus*) (Figures 5-18, 5-62). Some have been shaped by grinding while others have merely been worked enough to form a pointed tip. Points range from flat and triangular to round in shape and no two awls are the same. Wear patterns observed under the microscope are remarkably consistent however. Manufacturing striations if present near the awl tips are faint and highly polished, but become sharper and less polished up the shaft until there is no longer any polish, only manufacturing striations. Split bone awls would likely have been used in a number of skin, basketry, matting and blanket manufacturing and maintenance activities (Gunther 1927:219, 223-5; Haeberlin and Gunther 1930:33; Stern 1934:91). Split bone awls are found in all late assemblages (Figure 5-12).

3) ulna awls (n=2, 29.5 g)

Two awls manufactured from deer ulnas were recovered (Figures 5-57; 4184 D, 5-62; 4225 D3), both of which have highly polished points while some manufacturing striations were observed on the upper parts of the awls. One of these awls (4225) was found in Layer D3 in direct association with a split bone awl (4226) (Figure 5-62). Ulna awls probably had similar uses as split bone awls. An additional ulna awl (4316) recovered from the F/K interface layer is unique in that its shaft is notched (Figure 5-24). Deer ulna awls are also common in late assemblages (Figure 5-12).

4) bone needles (n=2, 1.3 g)

One complete round bone needle (4119 B), and a distal fragment of a flat bone needle (4289 L4) were recovered (Figure 5-18). Both have bilaterally incised eyes while 4119 has a highly polished tip, possibly from sewing skins or designs on basketry. The complete needle (4119) is similar to a bone needle recovered from Stselax, DhRt 2 (Borden 1970:108).

5) antler awl (n=1, 17.1 g)

This artifact (4089 B) is a flat triangular shaped piece of antler cortex which has been ground to a point (Figure 5-18). The tip is polished but does not have any evident striations or crushing. Haggarty and Sendy (1976:58) report an antler awl from the Georgeson Bay site although it is different from 4089.

Ceremonial/Decorative Items

1) ground stone disc beads (n=5, 1.0 g)

All of these artifacts were recovered from Layers A and B which are dated at 480 B.P. (Figure 5-19). Borden (1970:103, 107) regarded ground disc beads as diagnostic of the Marpole and Whalen II Phases while they have since been recovered from late deposits at Crescent Beach, the Pitt River site (DhRq 21) (Patenaude n.d.), and the Cowichan Bay site (DeRv 107) (Yip 1982). The Crescent Beach beads average 0.6 x 0.1 cm and weigh from 0.1 to 0.3 g. Jenness (n.d., p. 50) reports that women sometimes wore necklaces of "...small stone beads".

2) labret (n=1, 1.5 g)

Also rare in late period deposits, labrets are again reported from Crescent Beach, the Pitt River site (Patenaude n.d.), and the Cowichan Bay site (Yip 1982). The artifact from Crescent Beach is a stem of a nephrite labret and was found in Layer A (Figure 5-19). Labrets were not in use locally at contact (Barnett 1975:76; Haeberlin and Gunther 1930:40; Keddie 1981), apparently losing their popularity during the last 1,000 years of Coast Salish prehistory.

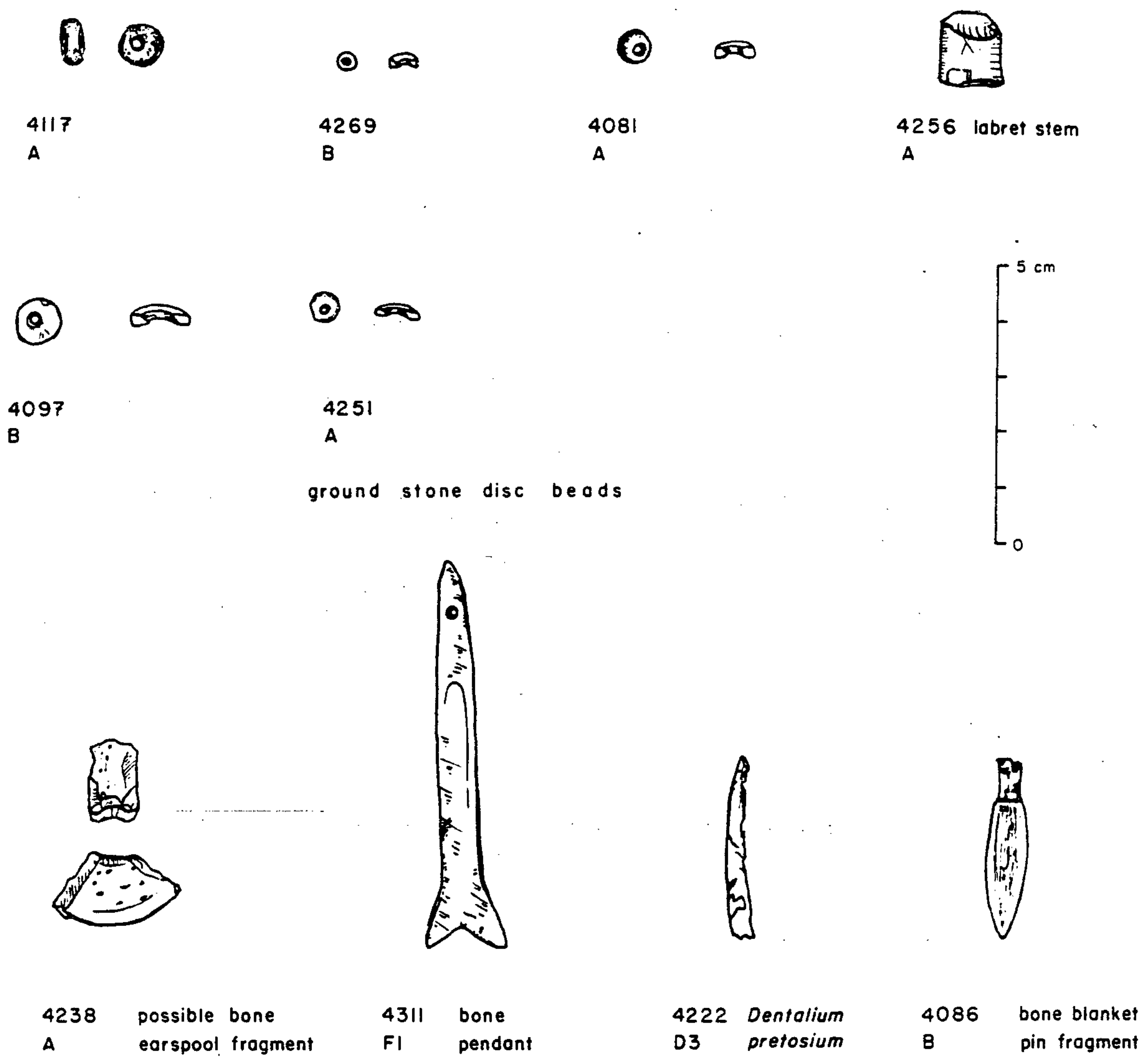


Figure 5-19. Decorative Items.

3) ochre (n=28, 30.1 g)

Pieces of ochre were recovered from 9 layers and except for two pieces which are light grey (4254 B, 4280 C) all are reddish in colour. A small fragment (0.7 g) of a clam shell smeared with red ochre was recovered from Layer A. Ochre was used as a cosmetic, both for facial protection and decoration, and in rituals (Barnett 1975:74, 89, 91, 105, 169; Jenness 1955: 7, n.d., p. 50; Suttles 1974:269). Wilson reports the use of ochre paint as a remedy for mosquito bites (South 1970:63). Ochre is commonly reported from sites of all time periods in the Strait of Georgia area.

4) bone blanket pin (n=1, 1.7 g)

The head of a round blanket pin (4086) was recovered from Layer B and is smaller than the thick flat blanket pins found in Test Unit A in 1976 (Figures 2-36, 5-19). Bone pins were used to fasten blankets made of goat wool and dog hair (Barnett 1975:71; Haeberlin and Gunther 1930:37; Jenness n.d., p. 48). Blanket pins have been reported in late assemblages from the St. Mungo Cannery, Stselax, and the Belcarra sites (Figure 5-12).

5) bone pendant (n=1, 2.1 g)

This artifact is a well polished flat fish-tailed bone ornament (4311 F1) with a biconically drilled hole at one end (Figure 5-19). Some fine manufacturing striations may be observed on both faces of this artifact. Barnett (1975:76) reports the ethnographic use of bone pendants which have also been recovered from the St. Mungo, Sandwick, and Belcarra sites (Figure 5-12).

6) bone earspool (n=1, 1.4 g)

Earspools have been reported for Locarno and inferred for Marpole assemblages but not for late period deposits (Mitchell 1971b:52, 57). The earspool fragment (Figure 5-19; 4238 A) from Crescent Beach is a piece of partly charred bone and may have been identical to one illustrated by Duff (1956:D49), although its estimated diameter is only 3.1 cm compared to 5.1 cm for Duff's artifact. Earspools are not reported in the ethnographic literature for the Strait of Georgia.

7) bird bone bead (n=1, 0.4 g)

This artifact (4291 L1) is a sawn and ground fragment of a carpometacarpus from a duck (Anas sp.) (Figure 5-62). It is most likely an unfinished artifact.

8) Dentalium shell (n=1, 0.3 g)

A single eroded Dentalium pretosium shell (4222 D3) was recovered from Layer D3 (Figure 5-19). Dentalium was a highly valued item of personal adornment although it was not available locally (Jenness n.d., p. 50; Suttles 1974:225, 268). Dentalium beads have been recovered from several late assemblages (see Figure 5-12).

9) Pecten shell (n=1, 1.5 g)

A single fragment of a large Pecten sp. shell (4160) was found in Layer E. Suttles (1974:409, also p. 225) reports the use of Pecten shell rattles as part of a sx^{w}aix^{w}e dancer's costume, and in other rituals (see illustrations in Levi-Strauss 1975:39, 41; Matthews 1955:152E; Woodcock 1977:133). Although not a common artifact Pecten shell has been found in a number of late assemblages (Figure 5-12).

Hunting Artifacts

1) stemmed projectile point (n=1, 3.3 g)

This artifact (4255 A) is a chipped chert point with nearly straight blades, triangular shoulders, a straight base and contracting stem (Figure 5-20). The small size of this point and the width of the stem midpoint (1.06 cm) is within the range of arrow points (Ham 1975:125; Stryd 1974:50). Residue analysis identified pitch around the stem and base of this artifact (Figure 5-20) possibly from hafting. Ethnographically, stone arrow points were used for hunting and warfare (Barnett 1975:101; Haeberlin and Gunther 1930:26; Suttles 1955:24, 1974:224). Stemmed projectile points have also been reported from late assemblages at Montague Harbour and the Pitt River site (Mitchell 1971b:187, Patenaude n.d.).

Fishing Artifacts

1) bone bipoints (n=5, 5.3 g)

Manufactured from pieces of mammal and bird bone, small bone points are common from late sites and were used as arming points and barbs on a range of composite fishing gear (Barnett 1975:85-6; Gunther 1927:201-2; Haeberlin and Gunther 1930:28; Jenness n.d., p. 23; Stern 1934:50-1; Suttles 1974:115, 126; Wilson 1866:283-4). Five bone bipoints were recovered from this site, four are made from mammal bone (probably deer) and one of bird bone, while they all show manufacturing striations and polished tips (Figure 5-21, 5-57, 5-62). Two of these points are fairly well formed (4202 E1, 4231 D3) while two others are not (4206 E1, 4232 D) and although both ends have been ground to a point, these two artifacts may not be finished. The remaining artifact (4140 B) is made from bird bone and has had both tips broken off. These artifacts may have been barbs on trolling hooks or three pronged leisters (see Barnett 1975:84-5). Bone bipoints are reported for 9 of the 12 late assemblages presented in Figure 5-12.

2) incised bone points (n=3, 1.4 g)

The fragments of three bone points were recovered which have had grooves incised about their midsections presumably to facilitate attaching a line. Although none of these specimens is complete, their points tend to be rounded rather than pointed (Figures 5-21, 5-24). If these artifacts were attached to a set line, baited with a herring or clam siphon and used as a gorge hook, pointed ends may not have been necessary (see Barnett 1975:86). These artifacts have not been reported previously.

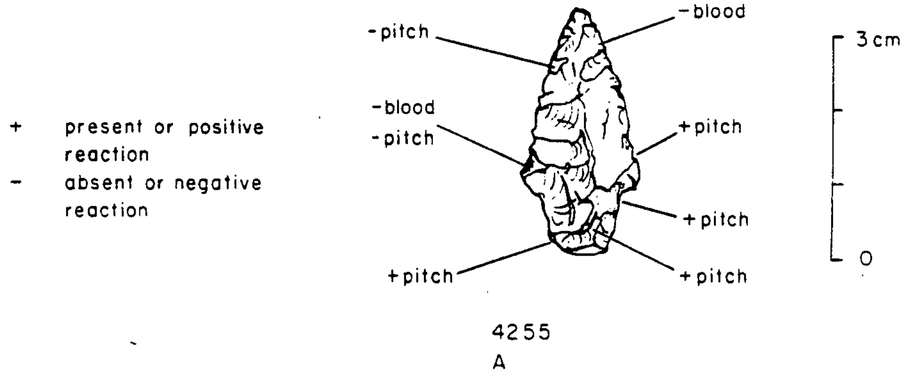


Figure 5-20. Projectile Point Residue Analysis.

3) basally thinned bone points (n=4, 1.5 g)

Three complete (and one fragmentary) bone points were recovered which have had their bases ground. Manufactured from splinters of bird and mammal bone these artifacts range from casually ground to well shaped oval blades (Figures 2-36, 5-21, 5-62). Carlson (1954:27, Pl. 7:41) reports similar artifacts used to arm toggling harpoons (see p. 240). These artifacts are quite common in late assemblages (Figure 5-12). They appear to be similar to Mitchell's (1971b:200, 205) bird-bone point class.

4) bone point fragments (n=5, 0.6 g)

Five fragments which originally formed the points of artifacts belonging to the above classes were recovered. All bone points and fragments (except incised points) exhibit both manufacturing striations as well as polish. Some of these points may have armed herring rakes.

5) antler harpoon with lineguard (n=1, 2.5 g)

Two pieces of this artifact were recovered from Layer G1, their colouration and antler structure leaving little doubt but that they are part of the same artifact (Figure 5-21). Unilaterally barbed, this artifact may have been similar to ones reported from Marpole assemblages (see Burley

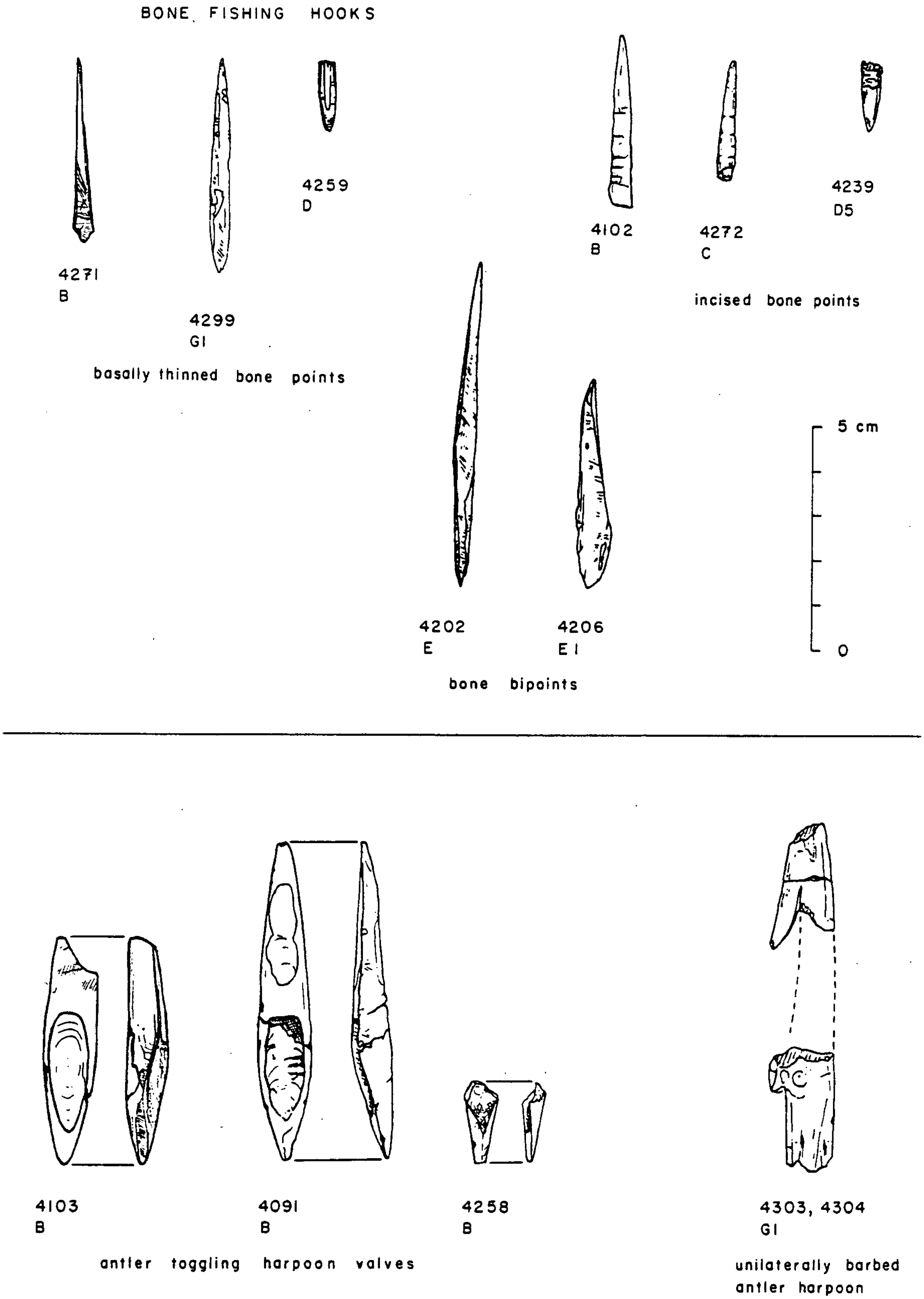


Figure 5-21. Fishing Artifacts.

1979:77, or Carlson 1970:Figure 35g).

6) toggling harpoon valves (n=3, 4.5 g)

All three of these artifacts were recovered from Layer B and are similar in that the two most complete valves have very shallow arming slots, while only 4091 has any indication at all of a lashing groove (Figure 5-21). Composite toggling harpoons armed with various types of heads were used for many purposes from salmon and sturgeon fishing to seal and beaver hunting (Barnett 1975:83; Jenness n.d., p. 17; Suttles 1955:25, 1974:96, 119). These harpoons may have been armed with the basally thinned small bone points discussed above. Composite toggling harpoon valves are reported from all of the late assemblages presented in Figure 5-12.

Food Preparation Artifacts

1) stemmed biface knife (n=1, 25.4 g)

Although only one biface (4197 L4) was recovered from the layer excavation, two others were found in the slit trench screenings (Figures 5-25, 5-62). All are stemmed and were probably hafted into wooden handles with pitch and lashing similar to those described by Haeberlin and Gunther (1930: 136) (see residue analysis of Slit Trench bifaces, p. 245). These artifacts were likely used as a general purpose hand knife for cutting and carving.

2) chipped slate knives (n=7, 236.8 g)

These pieces of chipped, and in a few cases minimally ground, fragments of slate were originally thought to be blanks for ground slate knives. Residue analysis suggests they may have been hafted with pitch into handles and used as they are (Figures 5-22, 5-62). Traces of blood and fats were also observed on these artifacts. Chipped slate knives occur at 8 of the 12 late assemblages presented in Figure 5-12.

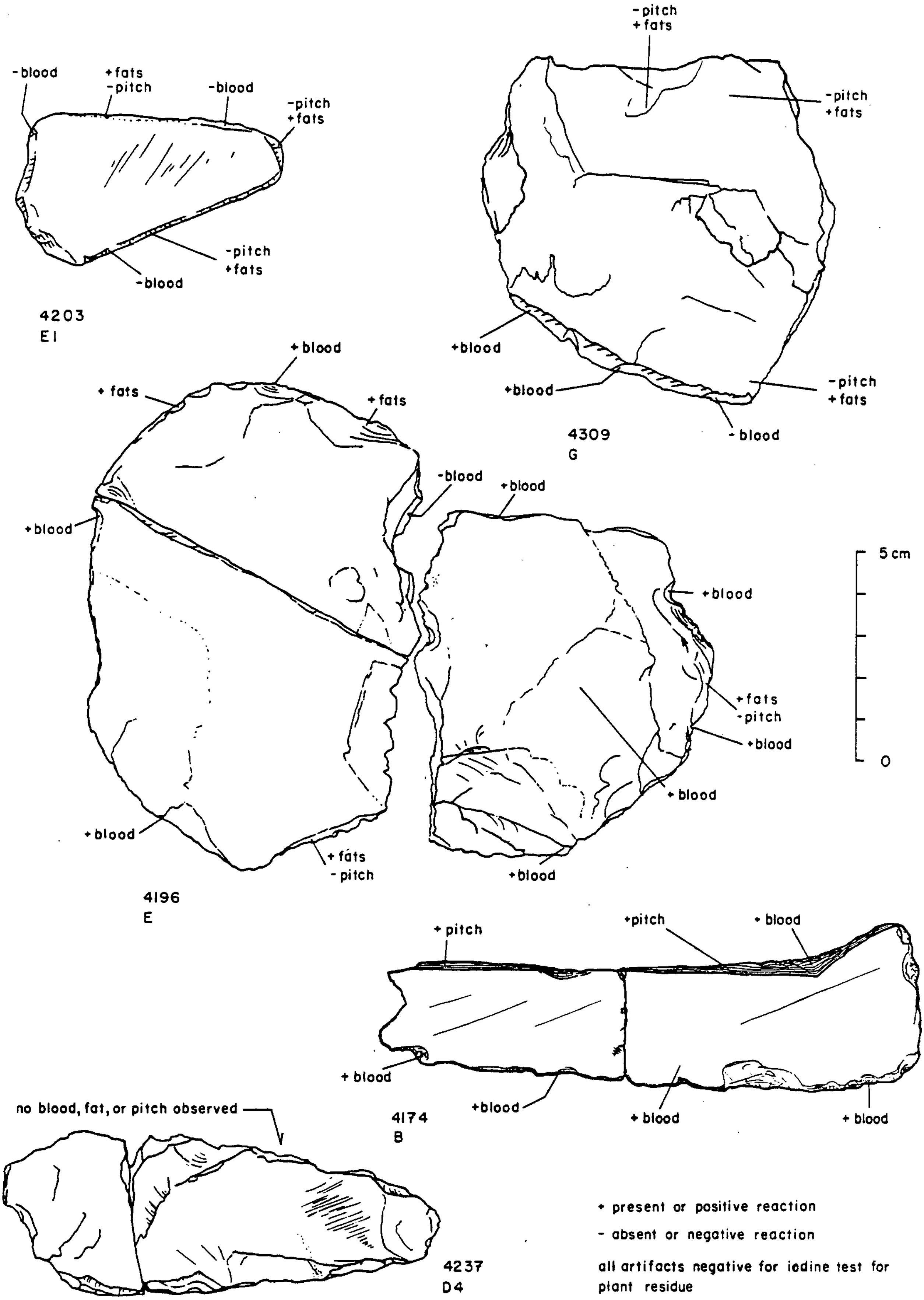


Figure 5-22. Chipped Knives, Residue Analysis.

3) ground slate knives (inferred)

No complete ground slate knives were recovered from Crescent Beach although the presence of several pieces of thinly ($\bar{x}$ =0.2 cm) ground slate detritus suggest they may have been used at the site (see above). Ground slate knives are common in late assemblages (see Figure 5-12).

4) broken cooking stones (2,566 kg)

Broken cooking stones were recovered from all layers except for Layer B1 (Figure 5-23). Three other layers, D2, G1 ash and F4 contained only 3.5, 0.7 and 3.7 kg of broken cooking sones which may be intrusive from adjacent layers. As all broken cooking stones were weighed from each quadrant, the 2.6 t total represents 100% coverage. These cobbles would have been easily obtained along the beach in front of the site. Traditionally reported as firecracked these cobbles were used by the Coast Salish for boiling water, in steaming mounds and perhaps for lining hearths and are common from sites of all time periods.

Charcoal (est. 4.6 kg)

This total represents charcoal fragments recovered from the shell samples and is probably a conservative estimate. Charcoal resulting from steaming mound fires and hearths was recovered from all 31 layers of the site (Figure 5-23).

Slit Trench Artifacts (n=28)

A total of 28 artifacts were recovered from outside of the excavation grid, 26 from the 6.35 mm (¼") mesh screening of the slit trench fill (Table V-IV). Two additional artifacts were found elsewhere, 4076, a chipped stone biface from the beach, and 4316 (Figure 5-24), a notched ulna awl was recovered from the unexcavated Layer F/K interface. Most common are bifaces, antler

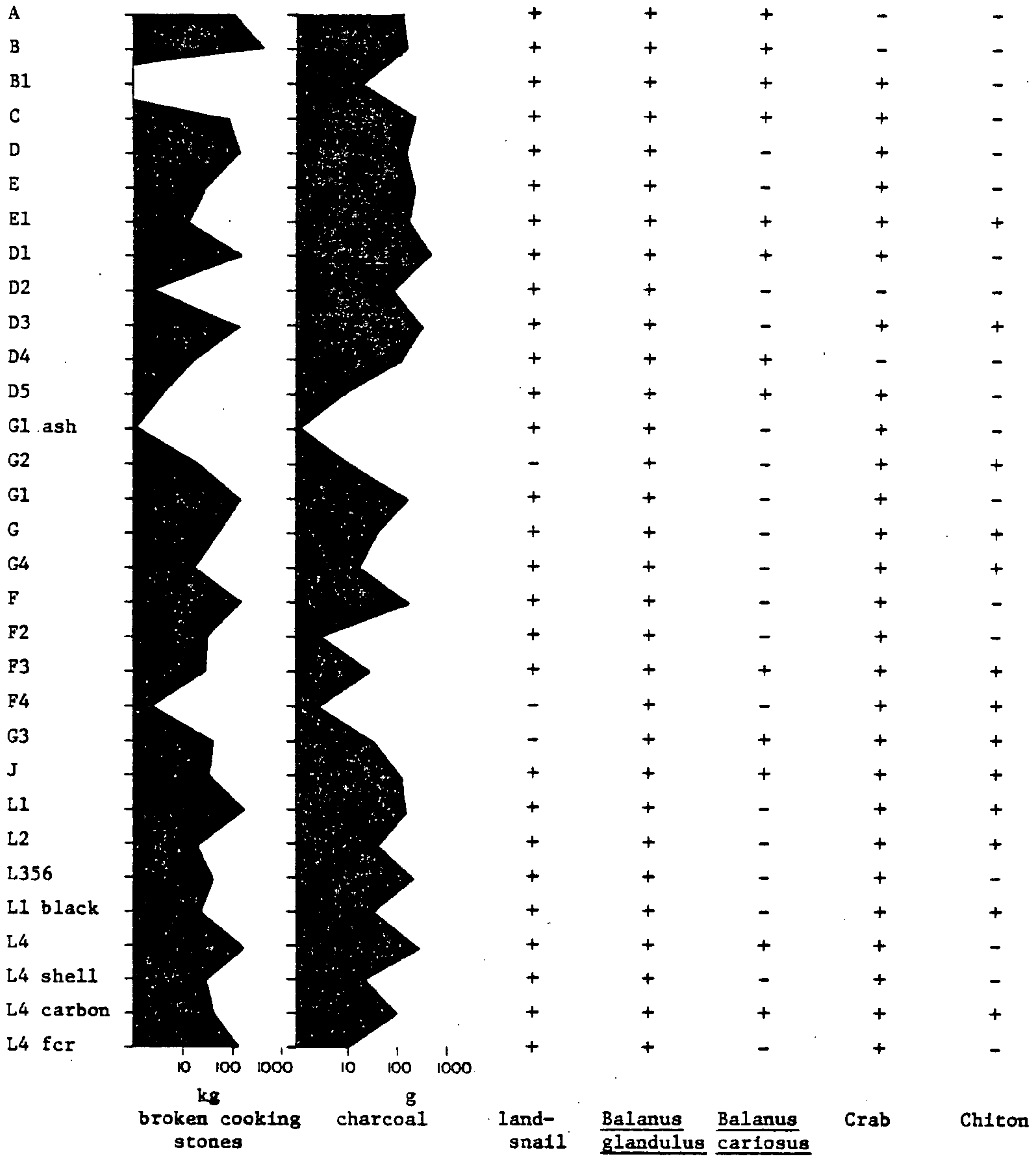


Figure 5-23. Miscellaneous Midden Remains.

wedges and abrasive stones, while other artifacts include a large bone point (4218), an incised bone point (4109), and a large barbed bone point (4176). This unilaterally barbed bone point has a thickness of 0.65 cm, close to the 0.70 cm thickness of the whale bone blanks found in Test Unit A (see Figures 2-36, 5-24), while the bone structure is similar. Suttles (1974: 225) has reported the use of whale bone for making spear points.

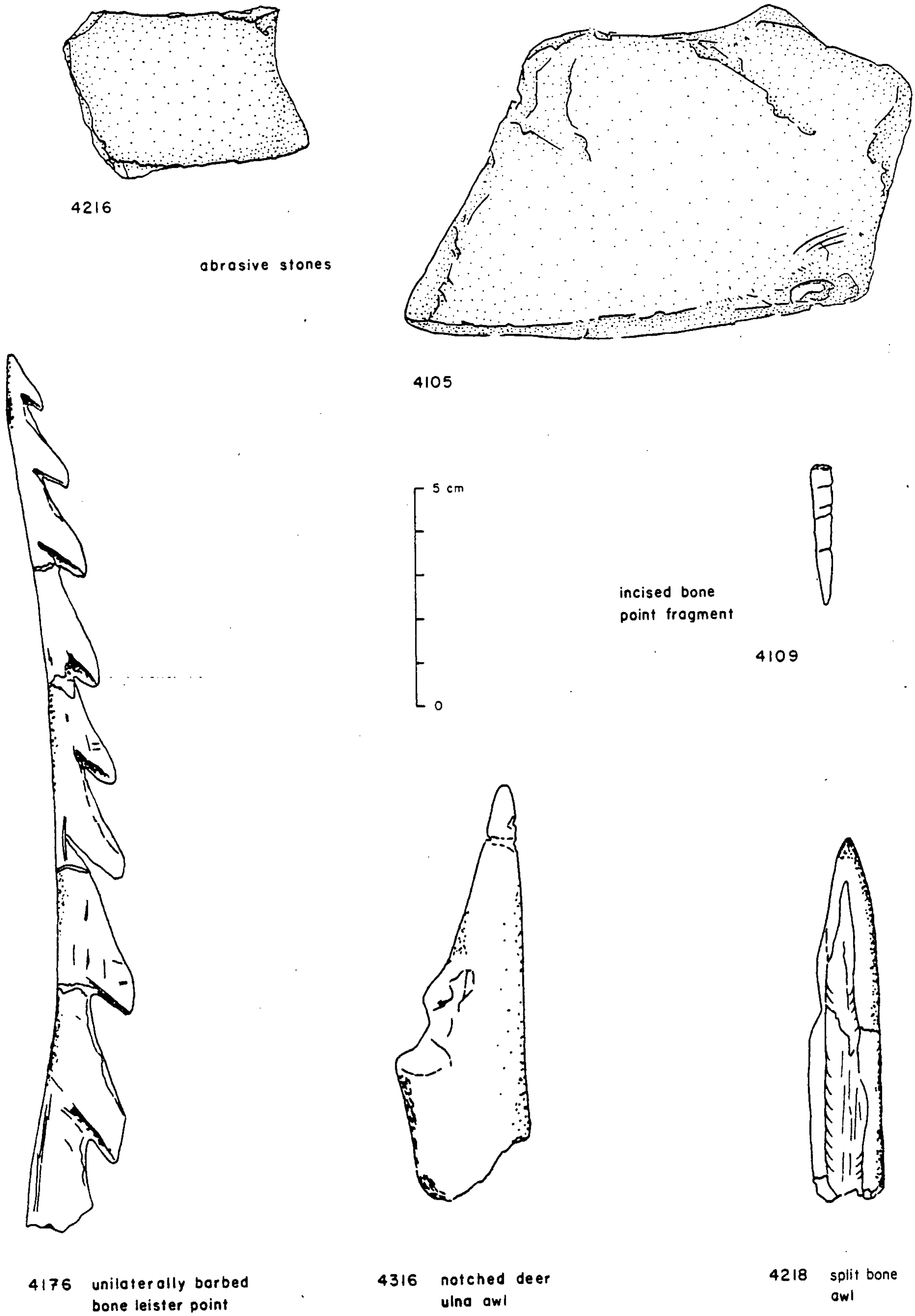


Figure 5-24. Slit Trench Artifacts.

Four of the chipped stone artifacts from the slit trench were examined for residues (Figure 5-25) (Broderick 1980). The stemmed bifaces and biface fragment contained blood, pitch and fat residues suggesting they were probably hafted hand knives. Additional support came from edge wear analysis, these artifacts exhibiting microscopic polish and tiny striations along the blades while their bases and stems have sharp, fresh and unpolished flake scars. There is also a tendency for blood and pitch residues to accumulate about the base and stem. A pebble tool (4108) had traces of pitch and a microscopic piece of wood wedged in a crack.

Historic Artifacts (n=64, 233.1 g)

All historic artifacts were recovered from the uppermost layers A and B and appear to be items lost or dropped on the site over the last 100 years. Nails and glass make up more than half of these remains while there is a tendency for heavier items to be from Layer B, reflecting sorting by worms and grass roots (Figure 5-26).

Faunal Remains

Landsnail Remains (est. 2.8 kg)

Landsnail shell fragments (*Helix* sp.) were found in 28 of the site layers demonstrating their continuous occupation of the site up to the present time (Figure 5-23). Landsnails might still be in hibernation in February and March.

Barnacle Remains (est. 73.6 kg)

Balanus remains were recovered from the shell samples of all 31 layers and is mostly (96%) *Balanus glandulus*, probably accidentally introduced into into the site on *Mytilus* and *Ostrea* shells (Figure 5-23). A small portion (3.7%) of these remains were identified as *B. cariosus* which may have been

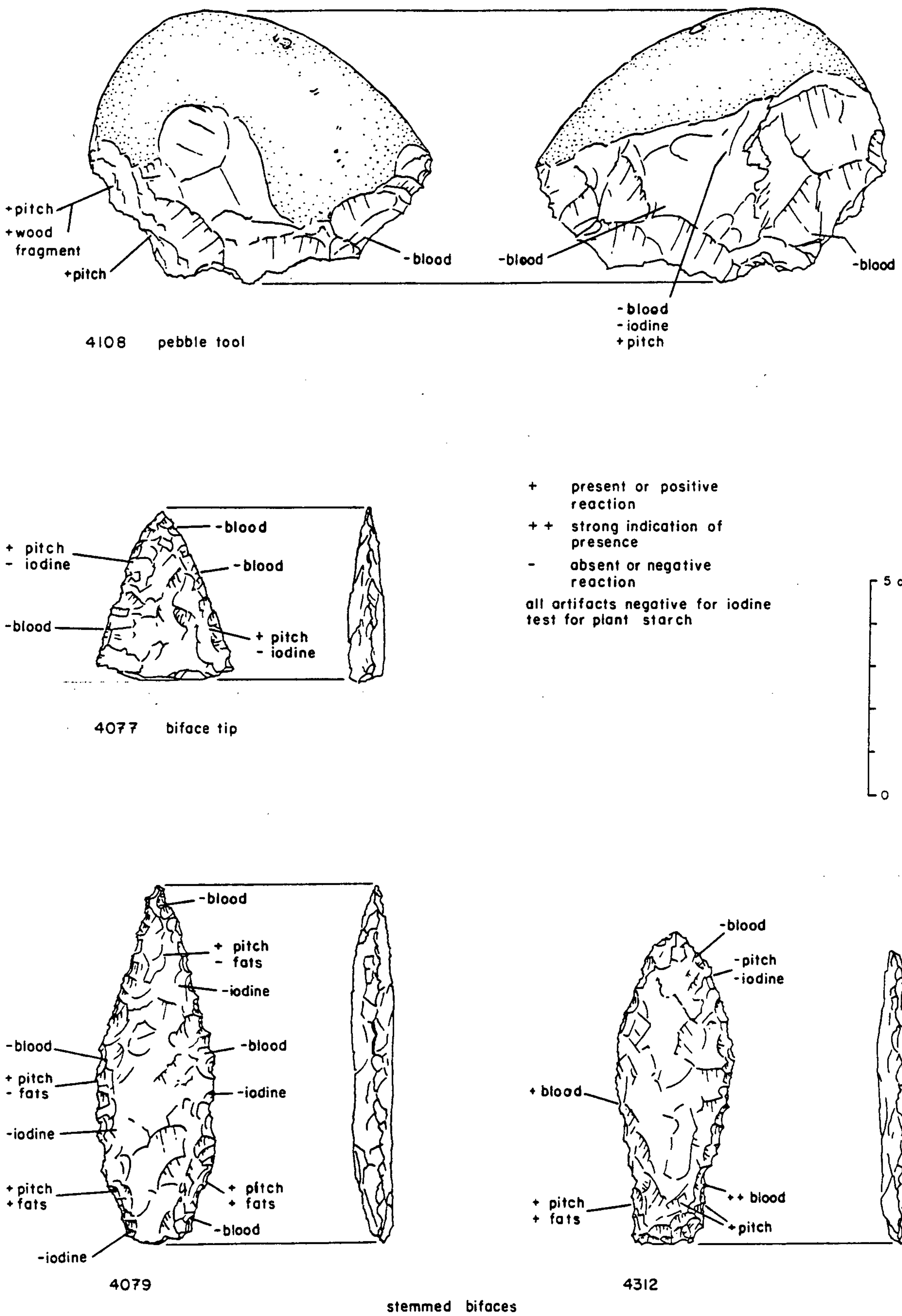


Figure 5-25. Slit Trench Artifacts, Residue Analysis.

Artifact \ Layer	B	A
rusty screw (1")	*	
square nail fragment	*	
wire nail	******	
4" common nail	***********	**
rusty wire (4 cm.)	*	
tin can fragment	*	
tin foil		*
hair pin	*	*
safety pin	*	*
bottle cap	*	***
.22 shell	******	*****
brown glass fragment		*
clear glass fragments	*****	*****
ceramic fragments	**	
button	**	
plastic comb fragment		**
asphalt tile fragment		*
bead green glass	*	
10¢ 1919	*	
TOTAL	41 (203.4 g)	22 (29.7 g)

Figure 5-26. Crescent Beach Historic Artifacts.

artifact class	artifact numbers	f
chipped stone biface	4076, 4077, 4079, 4312	4
pebble tool	4108, 4162	2
hammerstone	4114	1
basalt core, core remnants	4142, 4205	2
quartz flake	4323	1
chipped slate	4165	1
abrasive stones	4105, 4107, 4216	3
antler haft fragment	4078	1
antler wedge	4080, 4106, 4170	3
worked antler	4166	1
fixed harpoon base	4234	1
unilaterally barbed bone leister	4176	1
incised bone point fragment	4109	1
bone wedge/chisel	4172, 4116	2
split bone awl	4218, 4235	2
notched deer ulna awl	4316	1
worked bird bone	4215	1
		n = 28

Table V-IV. Non-Provenience and Slit Trench Artifacts.

eaten although their 2.7 kg only translates into 188 g of fresh meat (see Table V-VII for shell/meat ratios).

Crab Remains (est. 1.3 g)

Cancer sp. remains consist entirely of claw tips and mouth fragments and were recovered from 27 layers (Figure 5-23). Some of these remains were burnt so that observed crab remains are only a fraction of what may have been returned to the site. With the added possibility of poor preservation an estimate cannot be made of the amount of fresh meat represented.

Chiton Remains (est. 0.4 kg)

The chiton Mophalia was also collected at least casually for food as it was found in 13 layers (Figure 5-23). The low quantity of remains which were recovered makes any meat estimates unreliable. The use of chiton by the Coast Salish is reported by Bouchard and Kennedy (1974) and Suttles (1974:65).

Sea Urchin Remains (no estimate)

A 0.01 g fragment of sea urchin (Strongylocentrotus sp.) was recovered from Layer D5 (C1NW), most likely introduced into the site with sand or shellfish. Sea urchin has been recovered from other late period sites (Haggarty and Sendey 1976:63; Mitchell 1971b:219) and their use by the Coast Salish is reported in ethnographic sources (Bouchard and Kennedy 1974; Jenness p. 30; Suttles 1974:65).

Univalve Remains (est. 171.4 kg)

With an estimated 171.4 kg, univalve remains make up only 0.6% of the excavated site weight. A total of 15 univalve species was observed in the 124 sample quadrants, although the whelk Thais lamellosa makes up 99% of these remains and was the only species probably used as food (Table V-V,

species	# of layers	estimated site weight (g)	species	# of layers	estimated site weight (g)
Acmea sp.	16	464.5	Bittium sp.	2	4.9
A. digitalis	2	22.8	Crepidula lingulata	1	1.8
A. instabilis	1	0.5	Polinices lewisi	1	10.8
A. pelta	2	8.8	Odostomia quadrae	27	350.6
Megatebennus bimaculatus	1	22.8	Searlisa dira	1	158.7
Tegula sp.	1	0.4	Thais lamellosa	29	169,944.0
Littorina sitkana	18	138.9	TOTAL	31	171,410.1
L. scutulata	9	271.0			
Lacuna variegata	1	9.6			

Table V-V. Univalve Species and Estimated Site Weights.

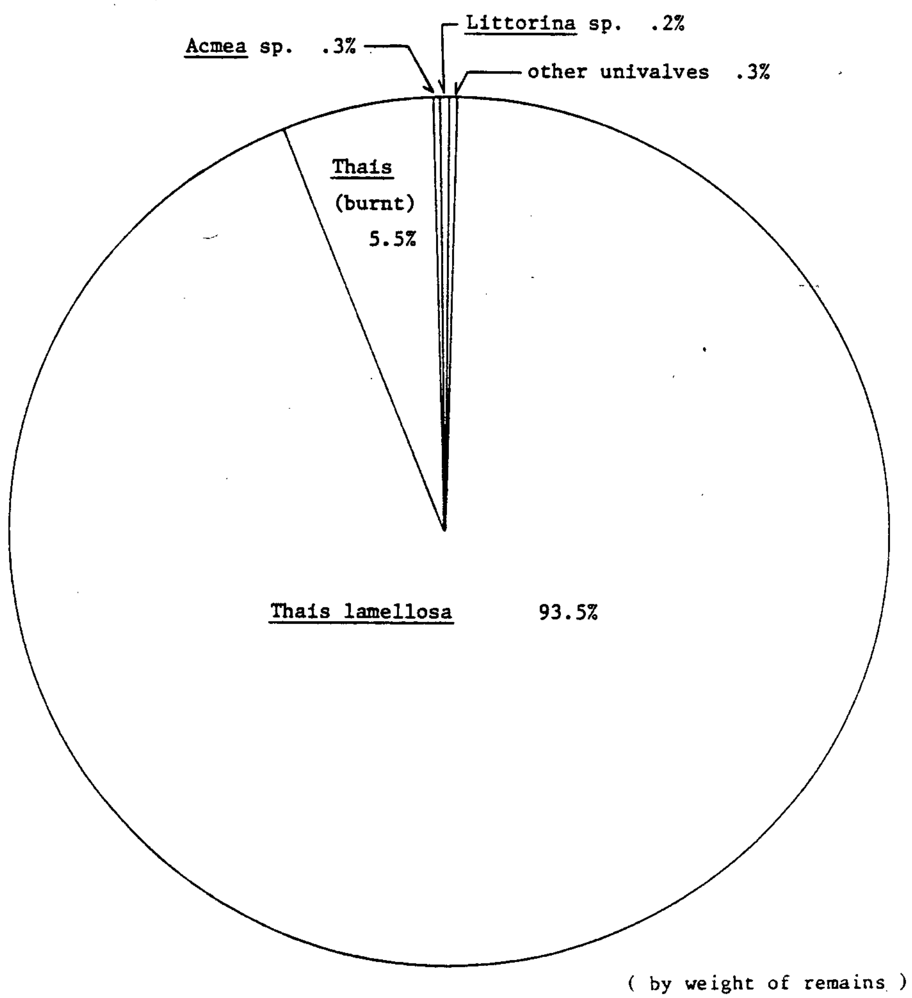


Figure 5-27. Univalve Remains from Crescent Beach.

Figures 5-27, 5-29). To obtain an estimate of the quantity of meat represented, a shell-meat ratio was calculated from 24 specimens of Thais collected from Boundary Bay in the spring of 1980 and 1981 (see Table V-VIII). Approximately 26 kg of fresh meat, or a total live weight of 196.7 kg was obtained, sufficient to fill 17½ clam baskets (based on Thompson's 1913 estimate of 25 lb. - 11.25 kg per basket). A total of 5.5% of the Thais in the site was burnt.

Ten of the remaining univalve species occur only once or twice and all could have been returned to the site accidentally with other shellfish, or on eelgrass or seaweed. Most of the limpets from the site are less than one year old, similar to those observed on Thais, Mytilus and Ostrea in Boundary Bay. The above species also had littorines grazing on them so that in effect all univalves except Thais may have been accidentally introduced. The moon snail (Polinices lewisi) was an immature individual and unlikely to represent food remains.

The remaining univalve, Odostomia quadrae is a parasite although it is not known what host species brought these shells into the site. Odostomia have been reported on mussel and oyster on the Atlantic coast, on chitons in South Africa, and on hairy triton in Puget Sound (Bullock and Boss 1971; Clark 1972; Hopkins 1956; Loosanoff 1956; Robertson and Orr 1961). None of the present residents of Boundary Bay below Ocean Park appeared to be infested in 1980 and 1981 however.

Bivalve Remains (est. 6.2 t)

Bivalves are the largest group of cultural remains and weighing an estimated 6.2 t they make up 21% of the total site weight. In all, nine species were identified (see Table V-VI), while the six most frequent are those species common in Boundary Bay historically as well as at present

species	wt in g
Mytilus edulis (bay mussel)	97,767.09
M. edulis (burnt)	5,027.04
Ostrea lurida (native oyster)	297,583.92
O. lurida (burnt)	27,332.40
Macoma secta (sand clam)	2,126.35
Macoma nasuta (bent-nose)	327.36
Tresus capax (horse clam)	950,277.60
T. capax (burnt)	32,156.45
Clinocardium nuttalli (basket cockle)	2,646,237.90
C. nuttalli (burnt)	241,197.69
Protothaca staminea (native little-neck)	196,018.13
P. staminea (burnt)	2,645.65
Venerupis tenerrima (thin shelled little-neck)	2,558.13
Saxidomus giganteus (butter clam)	433,672.38
S. giganteus	4,782.80
Pelecypoda (unidentified shell fragments)	1,073,836.80
Pelecypoda (burnt)	133,893.56
Pelecypoda (waterworn)	15,419.17
Pelecypoda (barnacle scarred)	927.16
TOTAL	6,163,783.00

Table V-VI. Bivalve Species and Estimated Weights.

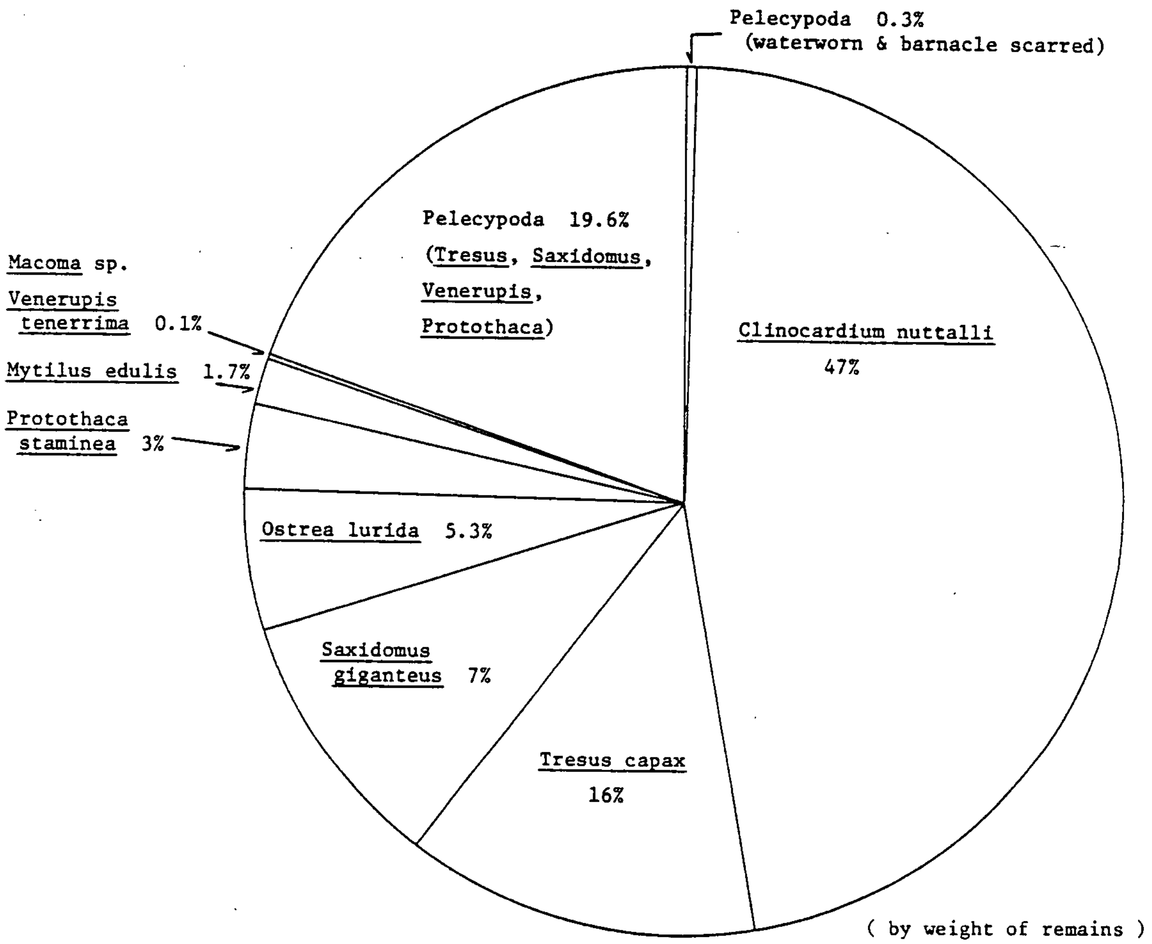


Figure 5-28. Bivalve Remains from Crescent Beach.

(see Chapter 2).

A full 80% of the bivalves were identified to species while nearly 100% of Mytilus, Ostrea and Clinocardium were identified. Unidentified shell (Pelecypoda), consisted mostly of indistinguishable fragments of Tresus and Saxidomus with lesser amounts of the remaining species. Approximately 7% of the bivalve remains had been burnt or charred, probably reflecting Coast Salish cooking methods while the burnt shell in Layer G1 suggests fires may have sometimes started in the midden itself (see p. 323). Two groups of bivalve remains do not represent food remains, both waterworn and barnacle scarred shell were most likely introduced into the site adhering to shellfish, or in baskets of sand used in steaming.

Clinocardium, Tresus and Saxidomus account for 70% of the identified bivalves (Figure 5-28). These same species are reported as the main ones smoked and dried for the winter, or for trade (Stern 1934:47; Suttles 1974: 66). To obtain an indication of the quantity of meat represented, shell-meat ratios were calculated to allow the conversion of the shell weights (Table V-VII). Except for Mytilus, all specimens were collected from eastern Boundary Bay in April 1980 and March 1981 at which time all species were observed in spawning condition. As March-April is close to the estimated season of site occupation, the Table V-VII ratios are adequate for this study although the conservative end of the ratio range was used as shellfish collected in February and March would not necessarily be as ripe. Tresus, Clinocardium and Saxidomus provide 76% of the meat, some 2.2 t (Figure 5-29), which with a 50-60% drying weight loss may represent 1 t of smoked and dried clams removed from the site. It is estimated that the bivalve remains from Crescent Beach represented a total shellfish live weight of 9 t, or based upon Thompson's (1913) estimate, 802 baskets of shellfish.

No.	Species	Source/Sample Size	Ratio	Range
1	Thais lamellosa	24	0.170 ±0.017	0.153 - 0.187
2	Mytilus edulis	Ham 1976:51 (11)	0.588 ±0.139	0.449 - 0.727
3	Ostrea lurida	16	0.324 ±0.081	0.243 - 0.405
4	Tresus capax	5	0.881 ±0.226	0.654 - 1.107
5	Clinocardium nuttalli	7	0.523 ±0.370	0.486 - 0.560
6	Protothaca staminea	8	0.329 ±0.090	0.239 - 0.419
7	Saxidomus giganteus	15	0.455 ±0.126	0.329 - 0.581
8	Pelecypoda	av. of No. 4, 6, 7		0.407
9	Balanus cariosus	4	0.088 ±0.180	0.698 - 0.106

Table V-VII. Shell Meat Ratios.

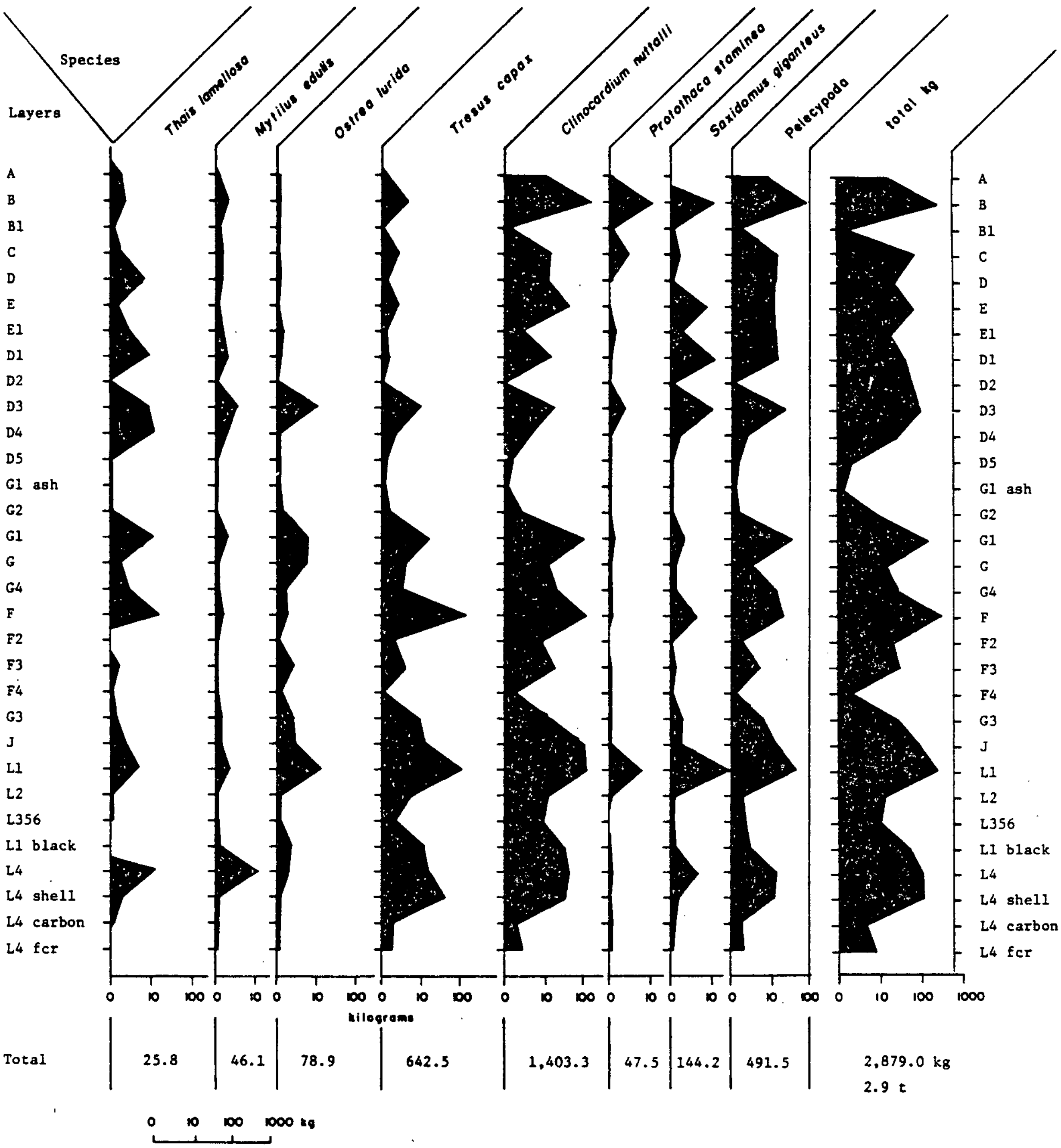


Figure 5-29. Major Shellfish Species Meat Weights.

Fish Remains

As the fish elements classified in this study were recovered from the shell samples, only a small portion of the total fish remains in the site were examined. In all approximately 6,000 fish bones weighing 123.58 g were examined of which 49% (by weight) were identified to one of 17 classes or species (Table V-VIII). Through extrapolation it is estimated that the excavated portion of the site contained approximately 9.4 kg of fish remains, more than 500,000 elements.

Most common were Pacific herring and flatfish followed by midshipmen, salmon and dogfish (Figure 5-30). Two of these species, Pacific herring and midshipmen, are important seasonal indicators. The herring spawn on the eelgrass in the late winter and early spring while at the same time midshipmen spawn beneath rocks in the intertidal where the males remain under the rock guarding the eggs until they hatch, at which time they return to deeper water (see Chapter 2, Rocky Intertidal Community). Salmon remains only account for 13% of the identified fish from Crescent Beach while it is noted that at the Glenrose Cannery site situated on the Fraser River, salmon accounted for 94% of the identified fish from the site (Casteel 1976:84).

There is no doubt that all the fish remains identified here were used as food and with the exception of salmon, all could be found in the Eelgrass and Rocky Intertidal Communities in the spring, some to spawn and others to feed on herring and herring roe. Even the rarer species, skate, sturgeon, pile perch and rockfish could be expected in the Eelgrass Community feeding on herring and herring roe. Plotting the presence/absence of species by layer, the dominance of dogfish, herring, midshipmen, sculpin and flatfish is obvious (Figure 5-31).

During analysis it was noted that salmon remains were almost entirely restricted to abdominal and the occasional caudal vertebrae, the only

Pisces (unidentified fish elements)
<u>Squalus acanthias</u> (dogfish)
<u>Raja</u> sp. (skate)
<u>Acipenser</u> sp. (sturgeon)
<u>Clupea harengus pallasi</u> (Pacific herring)
<u>Oncorhynchus</u> sp. (salmon)
<u>Porichthys notatus</u> (plain fin midshipmen)
<u>Rhacochilus vacca</u> (pile perch)
<u>Sebastes</u> sp. (unspecied rockfish elements)
<u>Sebastes ruberrimus</u> (yellow eye rockfish)
Cottidae (unspecied sculpin elements)
<u>Enophrys bison</u> (buffalo sculpin)
<u>Hemilepidotus hemilepidotus</u> (red irish lord)
<u>Leptocottus armatus</u> (staghorn sculpin)
Pleuronectidae (unspecied flatfish elements)
<u>Lepidopsetta bilineata</u> (rock sole)
<u>Platichthys stellatus</u> (starry flounder)

Table V-VIII. Crescent Beach Fish Species.

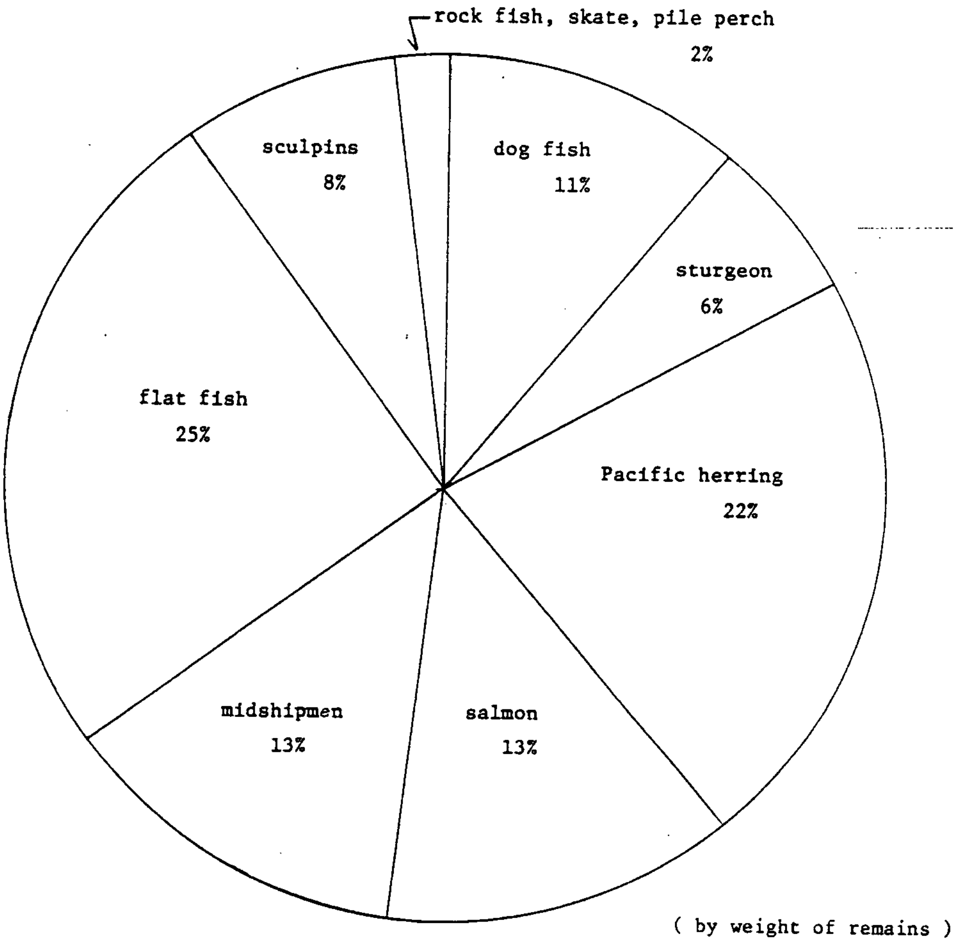


Figure 5-30. Identified Fish Remains from Crescent Beach.

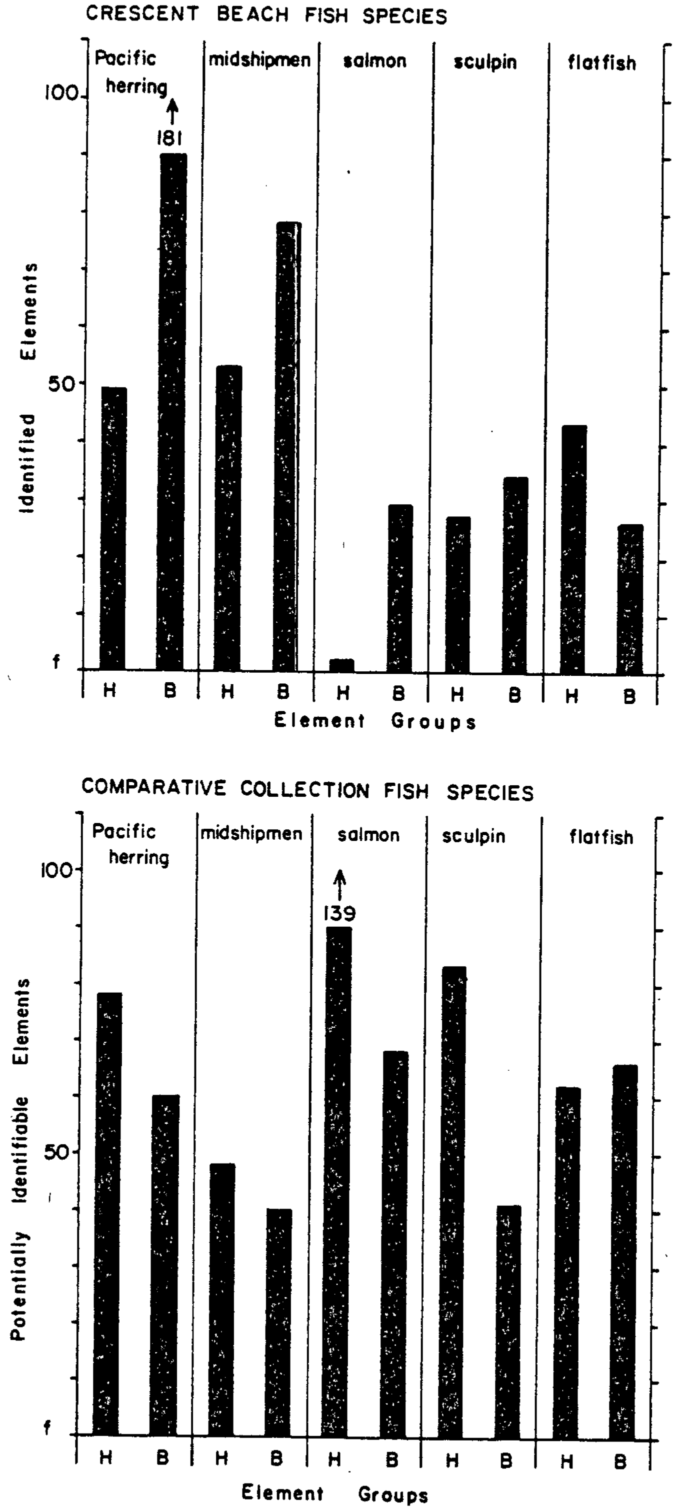
observed head elements consisting of single teeth, one each from Layers L2 and L4 fcr. Overall there is a bias towards vertebrae among the identified fish elements which is at least partly due to the ease of identification of vertebrae compared to head elements. To obtain an indication of the extent of this bias the head and body elements of the major species from the site were compared to element distributions ascertained from comparative skeletons (Figure 5-32). It may well be that the scavenging of butchered fish remains discussed in Chapter 3 played a significant part in determining what elements actually entered the archaeological record.

Examination of Figure 5-32 shows that the observed distribution of head and body elements is significantly different from expected for 4 of the 5 groups of fish. Although it is tempting to propose cultural factors to explain these differences, care must be exercised as herring, midshipmen and sculpin are small fish with tiny bones so that recovery cannot be ruled out as a possible cause. Another factor may be the low success rate in the identification of head elements while vertebrae, although small, may be readily recognized. The fact that there is not a significant difference between observed and expected flatfish elements suggests recovery and identification of elements from smaller species may not be as good as one would like. Flatfish head bones are much larger and also fairly distinct perhaps allowing for better recovery and identification. However, if these fish were butchered on the beach scavengers would probably remove most discarded elements.

It is unlikely that the low occurrence of salmon head elements results from either recovery or identification. At least equal to and often exceeding the size of flatfish bones, salmon head elements should have been recovered if they were in the site. It should be noted that salmon vertebrae were more frequent than is represented by the histogram in Figure 5-32. Most salmon

Layer	*Squalus acanthias*	*Raja* sp.	*Acipenser* sp.	*Clupea harengus pallasi*	*Oncorhynchus* sp.	*Porichthys notatus*	*Rhacochilus vacca*	*Sebastes* sp.	*Sebastes ruberrimus*	Cottidae	*Enophrys bison*	*H. hemilepidotus*	*Leptocottus armatus*	Pleuronictidae	*Lepidopsetta bilineata*	*Platichthys stellatus*	Pisces
A	+			+	+	+				+			+	+			+
B	+			+	+	+				+	+		+	+			+
B1				+		+											+
C	+			+	+	+								+	+	+	+
D	+			+	+	+								+	+	+	+
E	+		+	+		+			+	+				+		+	+
E1	+			+		+				+			+	+			+
D1	+			+	+	+		+								+	+
D2				+						+	+						+
D3	+			+	+	+				+			+	+		+	+
D4	+			+	+	+	+							+			+
D5	+			+		+				+				+			+
G1 ash	+			+						+	+						+
G2	+			+		+								+			+
G1	+			+		+				+				+		+	+
G	+			+		+				+			+	+	+		+
G4	+			+		+								+			+
F	+			+	+	+								+			+
F2	+			+		+								+			+
F3	+			+	+	+							+	+		+	+
F4	+			+		+				+			+	+		+	+
G3	+			+		+								+			+
J	+			+		+				+				+	+	+	+
L1	+			+		+				+			+				+
L2	+		+	+	+	+				+				+			+
L356	+			+	+	+				+			+			+	+
L1 black	+			+		+											+
L4	+	+	+	+	+	+				+						+	+
L4 shell		+		+	+	+								+			+
L4 carbon	+	+		+	+	+							+				+
L4 fcr	+	+		+	+	+				+	+	+		+			+
≤ 31	29	3	3	31	15	29	1	1	1	17	4	1	10	22	4	11	31

Figure 5-31. Layer Distribution of Fish Species.



Key: H = head elements

B = body elements

Comparative collection counts are approximate.

Chi Square (Siegal 1956)

H_0 no difference in element distributions

reject at .05, df = 1,
$x^2 \geq 3.84$

Pacific herring
$x^2 = 47.4$, significant, $p < .001$

midshipmen
$x^2 = 4.2$, significant, $p = .05 - .02$

salmon
$x^2 = 41.3$, significant, $p < .001$

sculpin
$x^2 = 8.8$, significant, $p = .01 - .001$

flatfish
$x^2 = 3.4$, not significant,
$p = .10 - .05$

Figure 5-32. Comparison of Fish Element Distributions.

vertebrae were badly fragmented so that actual counts could not be obtained, and thus many fragments were counted together. In light of the seasonality of the deposits being discussed here, the near absence of head elements, and the generally low frequency and fragmented nature of recovered salmon vertebrae, it is probable that dried salmon backs were being transported into the site.

Identified salmon elements recovered from the Glenrose Cannery site on the Fraser River (see Figure 2-24) may also reflect variations in seasonal patterns of salmon use. Salmon elements from the Marpole Component consisted only of vertebrae, while both the St. Mungo and Old Cordilleran Components contained cranial and post-cranial elements (Casteel 1976:84-5). Season of occupation of these components has been established as, summer and autumn for the Old Cordilleran, year around for the St. Mungo, and winter only for the Marpole (Ham and Irvine 1975:371; Matson 1976:95-6, 1981:80-2). Identified salmon elements (cranial and post-cranial) from the Old Cordilleran and St. Mungo Components are consistent with what would be expected at summer salmon fishing villages, while the use of dried salmon at a winter village (Marpole Component) could be expected to result only in salmon vertebrae.

Bird Remains

The bird remains recovered from Crescent Beach were not sampled but collected by searching all 948 sample quadrants and thus approach a 100% sample. In all 2,144 pieces of bird bone weighing 340.9 g were recovered of which 43% (by weight) were identified to one of 21 classes (Table V-IX). The 146.7 g of bird bones which were identified are dominated by dabbling and diving ducks while a few larger bones appear to be geese although they did not permit positive identification (Figure 5-33).

Plotting the presence/absence distribution of bird species by layer clearly illustrates the importance of waterfowl which were probably the only

Aves (unidentified bird)	*Bucephalia islandica* (Barrow's goldeneye)
Gavia sp. (loon)	*Clangula hyemalis* (oldsquaw)
Ardea herodias (great blue heron)	*Melanitta* sp. (scoters)
Anatidae (geese and ducks)	Accipitridae (hawks and eagles)
Anserinae (geese)	*Accipiter gentilis* (goshawk)
Anser albifrons (white fronted goose)	*Haliaeetus leucocephalus* (bald eagle)
Anas sp. (mallards, pintails, etc.)	*Larus philadelphia* (Bonaparte's gull)
Anas platyrhychos (mallard)	*Bubo virginianus* (great horned owl
A. acuta (pintail)	Passeriformes (song birds)
A. carolinensis (green-winged teal)	*Turdus migratorius* (American robin)
Aythya marila (greater scaup)	

Table V-IX. Crescent Beach Bird Classes.

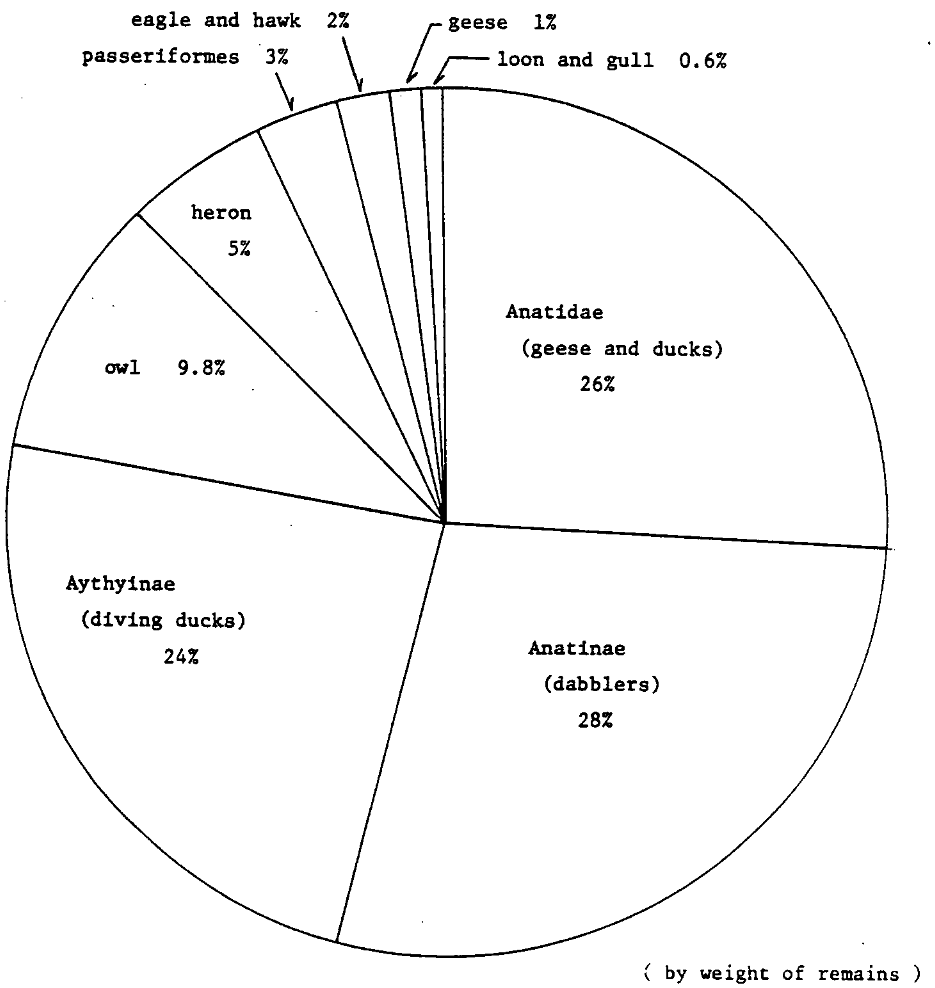


Figure 5-33. Identified Bird Remains from Crescent Beach.

birds consistently used as food (Figure 5-34). Peculiarities in the distribution of duck elements was noted during analysis while the comparison of recovered and expected elements leave little doubt but that cultural selection was taking place. Practically all duck remains from the site are wing and breast elements (Figure 5-35), while apparently the remainder of the carcass was not returned to the site. This type of selection could reflect the use of duck nets, probably a pole net as dabblers and divers are present in equal numbers. I would expect a submerged net to result in a predominance of diving ducks, as well as mergansers and grebes. Seymour (1976:87) reported a predominance of duck wing and breast bones from the Whalen Farm site on the western shore of Boundary Bay.

The few song bird and American robin remains from the site likely represent individuals which died naturally at the site. American robin remains consist of three widely scattered right wing elements from Layer B, a known surface layer, and a single claw bone from Layer D1. Passeriforme remains are represented by 20 claw and unidentified fragments from Layer D3, and single fragments from Layers B, D1, L4 and L4 carbon (Figure 5-34). Although the evidence is not conclusive, remains from at least two of the five layers suggest the remains of individuals which dies naturally.

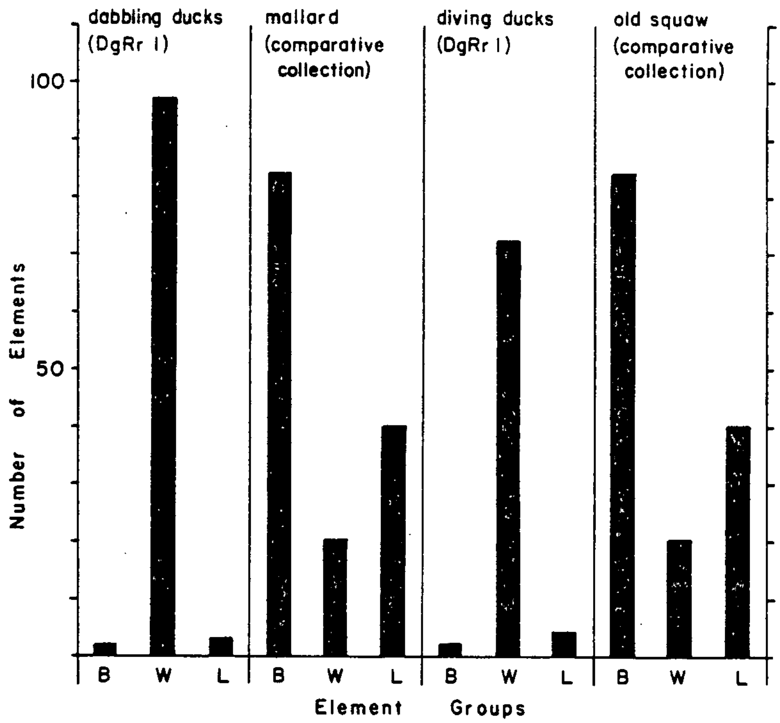
The remaining bird elements from the site may have represented talisman or had other ritual uses. All of the hawk, goshawk, and eagle elements recovered are claw and foot bones while a cluster of 58 bones from Layer L4 suggests some form of ritual activity (Table V-X). Recovered from seven adjacent quadrants which roughly approximate an east-west line are; the left wing from a Bonaparte gull, right wing of a great blue heron, minimally two right and three left feet identified as great horned owl, a bone from the right wing of a white fronted goose, and a left wing bone from a Barrow's goldeneye. All of these remains are from adult birds while the gull, owl,

Layer \ Species	*Gavia* sp.	*Ardea herodius*	Anatidae	Anserinae	*Anser albifrons*	*Anas* sp.	*Anas platyrhynchos*	*A. acuta*	*A. carolinensis*	*Mareca americana*	*Aythya marila*	*Bucephala islandica*	*Clangula hyemalis*	*Melanitta* sp.	Accipitridae	*Accipiter gentilis*	*Haliaeetus leucocephalus*	*Larus philadelphia*	*Bubo virginianus*	Passeriforme	*Turdus migratorius*	Aves
A			+												+							+
B			+	+										+	+					+	+	+
B1																						+
C			+				+							+								+
D	+		+	+			+	+			+			+								+
E			+																			+
E1			+											+								+
D1			+			+	+				+		+				+			+	+	+
D2			+																			+
D3			+	+			+	+		+				+			+			+		+
D4							+				+			+								+
D5																						+
G1 ash																						+
G2						+																
G1			+			+			+	+				+								+
G			+					+					+	+								+
G4			+			+		+						+								+
F			+										+	+								+
F2			+																			+
F3			+				+						+	+								+
F4			+																			+
G3		+	+			+	+	+			+		+	+								+
J							+															+
L1			+				+	+	+	+	+		+			+						+
L2							+															+
L356											+											+
L1 black																						+
L4		+	+		+	+	+	+	+		+	+	+	+				+	+	+		+
L4 shell						+																
L4 carbon						+			+											+		+
L4 fcr																						+
Σ 31	1	2	19	3	1	8	11	7	4	3	7	1	7	11	2	1	2	1	1	5	2	29

17 — Anatinae or dabbling ducks

14 — Aythyinae or diving ducks

Figure 5-34. Layer Distribution of Bird Species.



Key: B = body elements
W = wing and breast elements
L = leg elements

Comparative collection counts are approximate.

Chi Square (Siegal 1956)

H_0 no difference in element distributions
reject at .05, df = 2, x^2 = 5.99

dabbling ducks
x^2 = 158.1, significant,
p = .001

diving ducks
x^2 = 128.8, significant,
p = .001

Figure 5-35. Dabbling and Diving Duck Elements.

goose and goldeneye elements represent the sole observed occurrences of these species in the site. While the uniqueness of this association is obvious, its meaning remains a mystery. Jenness (1955:54) has reported that the great horned owl was an important guardian spirit making a man a good hunter on sea or land. Other exotic elements from the site include a right wing bone from a loon and two great blue heron mandible fragments.

Layer	Quadrant	Species	Elements	f
A	B1SW	hawk or eagle	phalange	1
B	B2NW	hawk or eagle	claw bone	1
D	B4NW	loon	right radialcarpal	1
D1	C7NE	bald eagle	claw bone	1
D3	D2NE	bald eagle	claw bone	1
G3	B2SW	great blue heron	2 adult mandible frags.	2
L1	C4SW	goshawk	left phalange & claw bone	2
L4	B3NE	Bonaparte's gull	left carpometacarpus and phalange	2
L4	C3NE	great blue heron	right wing bones	7
L4	C3NW	great horned owl	2 right tarsus metatarsus and phalanges	17
L4	C4NE	Barrow's goldeneye	left humerus	1
L4	D3NE	great horned owl	left and right tarsus metatarsus and phalanges	27
L4	D3SE	great horned owl	left metatarsus and phalanges	3
L4	D2SW	white fronted goose	right radialcarpal	1

Table V-X. Exotic Bird Remains from Crescent Beach.

Mammal Remains

As with the bird remains, mammal bones were recovered from searching all 948 sample quadrants and thus approaches 100% recovery. In total 3,905 bones, teeth and pieces of antler weighing 5.9 kg were recovered of which 54% (by weight) was identifiable (see Table V-XI). An additional 38% were classed as large mammal ($\bar{x}$ 0.8 g) and are probably mostly wapiti and deer which dominate the identified remains followed by sea mammal, dog and beaver (Figure 5-36). Over 50% of the deer and wapiti remains were recovered from Layer L4 (see pp. 325-7).

Deer elements were obtained from 17 of the 31 layers and included head, body and leg elements (Figures 5-37, 5-38). Deer could be expected to be using the site year around, particularly if any dense thickets were available. Early morning ambushing would be an effective method of obtaining these deer while some of the elements may have originated from natural deaths rather

species	f	wt (g)
Sorex sp.	2	0.2
Tamiasciurus hudsonicus (red squirrel)	2	0.2
Glaucomys sabrinus (flying squirrel)	1	0.1
Castor canadensis (beaver)	8	33.2
Muridae (mice and voles)	27	2.1
Ondatra zibethicus (muskrat)	4	0.8
Microtus sp. (vole)	32	2.4
Canis sp. (dogs)	6	8.0
Canis familiaris (domestic dog)	57	84.9
Procyon lotor (raccoon)	2	2.1
Mustela frenata (long-tailed weasel)	17	0.5
Lynx rufus (bobcat)	3	5.3
Pinnipodia (seal and sea lion)	12	239.1
Eumetopias jubata (sea lion	1	0.9
Phoca vitulina (seal)	2	1.7
Sus sp. (domestic pig)	1	2.4
Odocoileus hemionus (black tail deer)	161	383.4
Cervus elaphus (wapiti)	255	2,434.0
Bos sp. (domestic cow)	6	23.0
Mammalia (small)	384	142.2
Mammalia (large)	2,633	2,269.4
Cervidae (antler chips)	288	273.7
TOTAL	3,905	5,909.6

Table V-XI. Crescent Beach Mammal Classes.

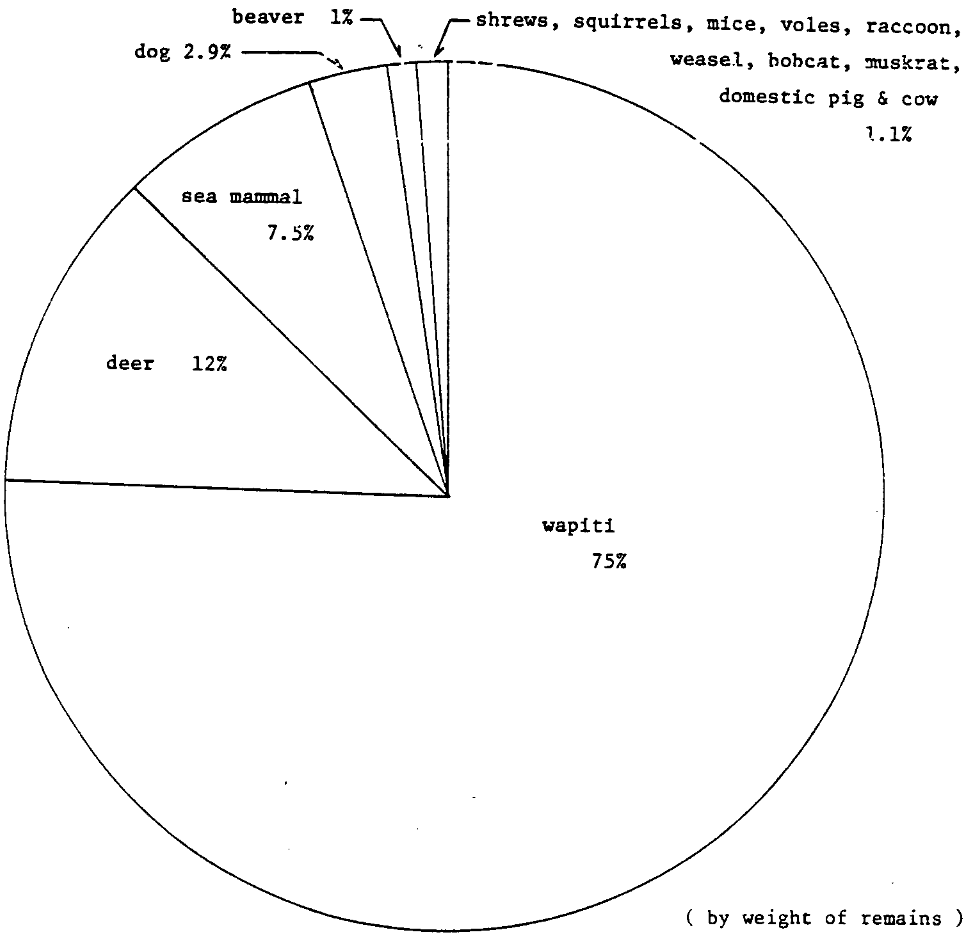


Figure 5-36. Identified Mammal Remains from Crescent Beach.

Layer \ Species	*Sorex* sp.	*Tamiasciurus hudsonicus*	*Glaucomys sabrinus*	*Castor canadensis*	Muridae	*Ondatra zibethicus*	*Microtus* sp.	*Canis* sp.	*Canis familiaris*	*Procyon lotor*	*Mustela frenata*	*Lynx rufus*	Pinnipedia	*Eumetopias jubata*	*Phoca vitulina*	*Sus* sp.	*Odocoileus hemionus*	*Cervus elaphus*	*Bos* sp.	Mammalia (small)	Mammalia (large)	Antler chips
A					+			+	+					+	+	+	+		+	+	+	
B				+	+	+		+	+	+		+	+				+	+		+	+	+
B1																				+	+	
C							+		+									+		+	+	+
D						+			+								+			+	+	+
E									+				+							+	+	+
E1							+										+	+		+	+	+
D1									+				+		+		+	+		+	+	+
D2																				+	+	
D3				+	+		+		+								+			+	+	+
D4																	+	+		+	+	+
D5	+																+			+		+
G1 ash																					+	+
G2																					+	+
G1							+		+								+			+	+	+
G							+											+		+	+	+
G4																				+	+	+
F					+		+										+			+	+	+
F2	+		+																			+
F3		+		+	+				+								+			+	+	+
F4					+			+									+	+		+	+	+
G3																				+	+	+
J							+											+			+	+
L1							+										+	+		+	+	+
L2													+				+	+		+	+	+
L356					+													+		+	+	+
L1 black																						+
L4		+									+		+				+	+		+	+	+
L4 shell																						+
L4 carbon																	+				+	
L4 fcr																	+					
≤ 31	2	2	1	3	7	2	8	3	9	1	1	1	5	1	2	1	17	12	1	23	26	26

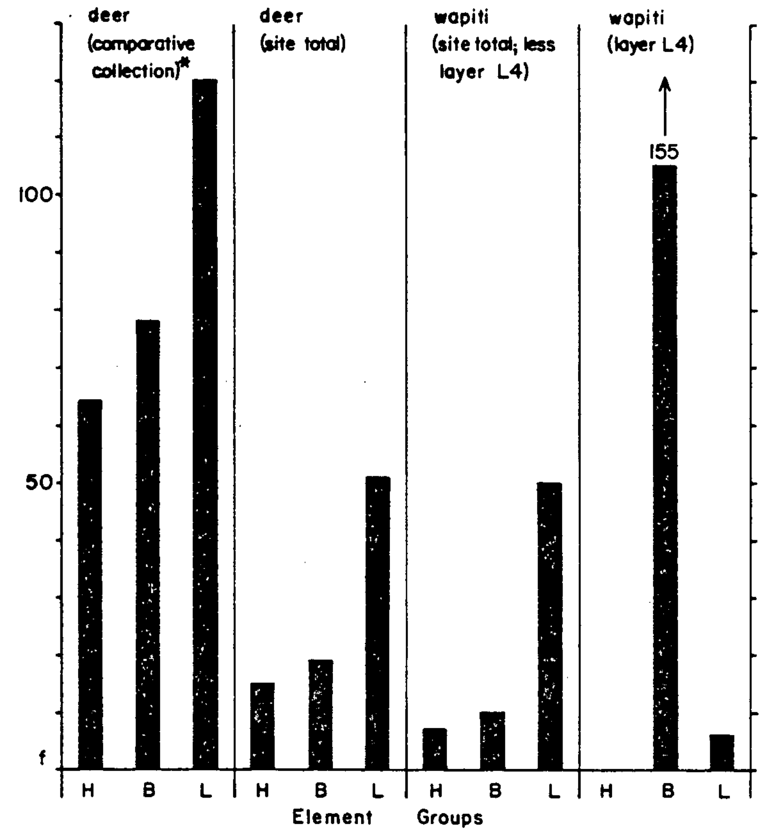
Figure 5-37. Layer Distribution of Mammal Remains.

than human activities. I have not attempted to segregate these remains as from the distribution of wapiti in Layer L4 it is unlikely any of the excavated layers were extensive enough to encompass the entire scatter area of either a natural death or kill assemblage.

Although the largest class of identified mammal, wapiti remains are found in only 12 layers. If Layer L4 is deleted, it will be noted the remains are significantly skewed towards leg elements (Figure 5-38). Suttles (1974:91) reports the curation of wapiti and deer cannon bone for artifact manufacture and this may be occurring at Crescent Beach. Caution is required however as it may be seen from Figure 5-38 that wapiti remains in Layer L4 are practically all body elements, while the excavation of L4 beyond this excavation might recover leg elements. It would seem however that the butchering of a wapiti at the site was not a common event, and given the low amount of wapiti, the presence of bone artifacts and detritus suggests the transport of bone was likely common.

Sea mammal remains are few (Table V-XI, Figures 5-36, 5-37) and except for some large chunks (vertebrae fragments) from Layers E and D1 all consist of carpals, and phalanges. Seals and sea lions might be encountered off the eelgrass beds during herring spawning. However, the restricted range of recovered elements suggests they were butchered elsewhere. Beaver remains are also restricted. Other than a left ulna from Layer B and an incisor fragment from D3, the most common elements are caudal vertebrae; 4 from Layer B (at least two individuals) and one from Layer F3. Beaver would be most plentiful in the Nicomekl-Serpentine Valley and may reflect trips to or passage through that area.

Dog remains were recovered from 10 layers although 5 of these layers contain only teeth. The rest contain elements from all body groups suggesting dogs occasionally died on site. All age classes, including old adults,



Key: H = head elements
B = body elements
L = leg elements

* data provided by Gay Calvert, B.C.P.M.

Chi Square (Siegal 1956)

H_0 no difference in element distributions
reject at .05, df = 2, chi square of 5.99 or greater

deer
$x^2 = 5.2$
not significant
p = .10 - .05

wapiti (except layer L4)
$x^2 = 13.7$
significant
p = .01

Figure 5-38. Deer and Wapiti Elements.

adults, young adults and juveniles (as well as milk teeth), are represented. A number of dog remains were recovered from Layers A and B, some of which may represent modern bones. The domestic pig and cow elements were all recovered from Layers A and B and were probably introduced into the site by modern dogs.

Sixty elements from 15 layers were identified as small rodents and insectivores (Muridae, Microtus, and Sorex) and include mostly head and leg elements. Many of these elements were found together, which supports the contention that these species lived on the site. The remaining mammal species include red squirrel, flying squirrel, raccoon, long-tailed weasel, and muskrat, most only represented by one or two identified elements. All of these small mammals could reside on or near enough to the site that their elements could be introduced without human assistance. It should be remembered that this site was possibly only occupied by humans for one or two months, but used year round by a variety of other animals. Lacking control over how many small mammal elements might be naturally introduced into a site, combined with a low (29%) identification rate makes it difficult to evaluate the role of small mammals in relation to the human occupants of the site. An exception would appear to be the 17 long-tailed weasel elements (which represent a right front foot) whose provenience in Layer L4 (C1SW) suggests a possible association with the exotic bird remains discussed above.

One additional group of mammal remains are tiny slightly curved chips of antler; 288 pieces with an average weight of 0.9 g were recovered from the shell samples and are distributed over 26 layers (see Table V-XI, Figure 5-37). In an experimental study of antler wedges, Yee (1977:4) obtained very similar appearing antler chips from working on water softened antler with a metal adze which suggests these flakes resulted from the manufacture of wedges and other antler tools at the site.

Human Remains (2.7 kg)

Human skeletal remains were recovered from 6 layers (see Figure 5-42) and except for a burial from Layer F1, all are incomplete, disarticulated and scattered elements. In addition to B2-1 (Layer F1), three other clusters of human remains were designated as burials during excavation, B2-2 and B2-3 from Layer J, and B2-5 from Layer L4 (B2-4 turned out to be deer). All are incomplete, in poor states of preservation and appear to be adults although they could not be accurately sexed (Beattie n.d.), An additional 18 disarticulated human bones were found in Layers D1, D3, J, L1 and L4 and consist of ilium fragments, carpal and tarsal bones, phalanges and teeth, all elements which could be expected to be more resistant to decay than other bones. The scattered nature of these remains suggests above ground burials were common, probably tree burials. As burial boxes disintegrated human bones fell to the ground and thus entered the archaeological record (B2-1 is the sole exception, see Figure 5-63).

5.5 STRATEGIES AND ACTIVITIES: AN INITIAL SUMMARY AND POSSIBLE LAYER TYPES

At this point it is possible to be more specific in making statements about the use of this late portion of the Crescent Beach site. The following section will determine what types of shell midden layers are expected in light of the cultural materials recovered from Crescent Beach and the seasonality of the site. Season of occupation is confidently inferred as late winter - early spring based on:

1) the February to March harvesting of shellfish (29 layers),
2) the presence of Pacific herring which spawn on the eelgrass beds between February and May (31 layers),
3) the presence of midshipmen which spawn under rocks in the rocky intertidal in March and April (29 layers), and

4) the presence of crabs which move into the lower intertidal in the early spring to moult and mate (27 layers).

Additional support could be obtained from the presence of migratory waterfowl which are most common between autumn and spring, and from the presence of dogfish, sculpins and flatfish which would be common in the lower intertidal in the spring, both to feed on herring and roe, and for some species to spawn as well. Barnett (1935 - 1936) has reported that the Nanaimo obtained shellfish between January and March, while Rozen (1978:179, 1982, pers. comm.) has compiled data on shellfish harvesting from late January to March in conjunction with procurement of herring and herring roe by Vancouver Island Halkomelem and Straits Coast Salish.

The lack of rectangular surface mounding and large post holes, low artifact frequency and restricted seasonality dates indicate this was not the location of a main village. Nor is there any evidence to support a late summer - autumn occupation, while if this area was used for overnight or short term camping, then it would have been in February or March. The elements identified from the Crescent Beach midden indicate several subsistence strategies were undertaken at the site, including shellfish and herring harvesting and a number of more casual activities.

Herring are not a very dependable resource, timing and quality of runs vary from eelgrass bed to eelgrass bed and from year to year. Jenness (n.d., p.24) reports the Saanich were sufficiently frustrated as to attempt transplanting roe, but without success. Given the capricious nature of herring runs, people probably arrived at the site several weeks prior to the run to carry out surveillance of the eelgrass beds. As drying and smoking the catch could take ten days to two weeks (Jenness n.d., p. 24; Gunther 1927:208) the site was probably occupied for at least a month. Curtis (1970:56) states that the Cowichan stayed about a month when they went herring fishing in February.

Herring could have been obtained on a high tide from canoes using herring rakes, or else raked or netted from tidal pools and channels at low tide (Barnett 1975:86, 88; Gunther 1927:202; Stern 1934:50; Suttles 1974: 126). Some of the small bone points recovered from the site may have armed herring rakes while many of the wood working tools may have been used to split and drill wood to make the rakes. Herring were dried by piercing a dozen or more through the gills with a stick which was then laid across a six foot high frame and either sun dried or smoked with a fire beneath the frame (Stern 1934:50). Roe was collected by submerging cedar or hemlock branches on which the herring would deposit their roe, and which were then dried and the roe shaken into baskets for storage (Barnett 1975: 86; Gunther 1927:202; Jenness n.d., p. 23; Stern 1934:50). Layers reflecting herring processing would probably consist of <u>ash and charcoal spreads</u>, surrounded by small post holes from a smoking frame (see Table V-XII, Layer Type 5).

Shellfish harvesting is the second harvesting strategy conducted at Crescent Beach and may represent the largest source of preserved food removed from the site (Figure 5-29). Shellfish harvesting was discussed in detail in Chapter 3 and can be expected to result in three types of layers. The first type are <u>steaming mounds</u> consisting of cobbles, charcoal, ash and scattered shell valves resulting from steaming shellfish (Table V-XII, Type 1). The second type are <u>refuse layers</u>, concentrations of shellfish valves and sand resulting from the opening of steaming mounds and the sorting of shellfish prior to preservation (Table V-XII, Type 2). The third type are <u>ash and charcoal spreads</u> (or perhaps small hearths) with small post molds from drying shellfish meat on frames over a fire (Table V-XII, Type 5).

Other subsistence strategies include more casual fishing, waterfowling,

1 <u>Steaming mounds</u>, consisting of cobbles, charcoal, ash and scattered shell (plus fish, duck and mammal remains if these foods were also steamed in the mound).
2 <u>Refuse layers</u>, or heaps of shell valves and occasional lensing of sand discarded from steaming activities (plus other faunal remains if these foods are also being processed).
3 <u>Pathways</u>, areas of compacted matrix resulting from foot traffic about the site.
4 <u>Concentrations of cooking stones</u>, and faunal remains from cooking food in wooden boxes.
5 <u>Ash and charcoal spreads</u>, (or perhaps hearths), surrounded by small post molds from frames for smoking and drying herring or shellfish (also deer and wapiti meat and possibly hides).
6 <u>Cobble mounds</u>, small steaming mounds, alignments or trenches of cobbles without any appreciable quantity of faunal material reflecting the use of steaming in woodworking activities.
7 <u>Habitation layers</u>, hearths, rectangular configurations of small post molds and greasy black pathways indicating the location of mat shelters.
8 <u>Extensive humus layers</u>, reflecting periods when that portion of the site was not used for shellfish processing, and was covered with vegetation.
9 <u>Localized humus layers</u>, reflecting the locations of traps where leaves and other plant debris may have accumulated.

Table V-XII. Summary of Expected Layer Types.

and land and sea mammal hunting. Activities associated with these strategies are reflected in the identified faunal remains and artifacts recovered from the site. Many of the fish species from the site could have been netted or speared in tidal pools at the same time as herring were obtained. The incised bone bipoints from the site may have been used on set lines for flounder while toggling harpoons armed with basally thinned bone points may have been used for sturgeon (see Barnett 1975:83, 85). Most fish were probably steamed in a <u>steaming mound</u> resulting in remains similar to those discussed above (Type 1 layers).

Waterfowl are common from the site and consist of about equal numbers of diving and dabbling ducks which suggest they were obtained with pole nets. Blackie's Spit which separates open water from the protected salt marsh of Mud Bay and the Nicomekl and Serpentine Rivers would have been an excellent location for a pole net (see Figure 2-39). Not only would fewer dabbling ducks be expected if a submerged net was used to obtain ducks feeding on herring and roe, but grebes and some other open water species would be expected, as well as a dominance of diving ducks. Waterfowl remains at both the Deep Bay and Shoal Bay sites, which may also be herring and shellfish harvesting sites (see Chapter 6), are dominated by sea birds and diving ducks (Mitchell 1980, Monks 1977) which I would argue reflects the use of submerged nets. As with the fish and shellfish, ducks were probably also steamed in the <u>steaming mounds</u> (Table V-XII, Type 1 layers).

Hunting is poorly documented by artifacts although both deer and wapiti were obviously used. Ethnographically both were preserved by steaming and sun drying while Suttles (1974:90-1) reports that Semiahmoo and Lummi who hunted inland for deer, butchered and steamed the meat before bringing it back for further drying, along with the hides and leg bones which were used to obtain marrow and for artifact manufacturing. Similar activities may have taken place at Crescent Beach where leg bones dominate the assemblage (see Figure 5-38) while many are broken or worked reflecting marrow extraction and artifact manufacture. Bone needles, stone scrapers and possibly some of the bone awls from the site may indicate hide processing. Stern (1934:48) reports the Lummi smoked hides on a tripod over a smoldering fire which could result in ash spreads and small post holes and may be similar in appearance to meat drying frames (Type 5 layers). Mammal meat, including seal and beaver could be steamed, roasted over a fire, or sun and smoke dried on a frame (Type 5 layers).

Artifact manufacturing activities were also important, especially of bone and antler artifacts used for fishing, basketry repair and skin working, and wood-working. Woodworking tools are one of the larger groups of artifacts from Crescent Beach although it is not clear what woodworking activities were carried out. The manufacture of wooden boxes or canoes may have been conducted at the site (see Table III-II). Trenches or alignments of cobbles might be noted if the Coast Salish used the same box steaming methods as the Kwakiutl (Type 6 layers, cobble mounds) (see p. 133, 142). If boxes were used for cooking food at the site it is possible box contents may have been emptied in dumps. This could result in concentrations of cooking stones and fauna such as fish elements (Type 4 layers).

At a temporary site such as Crescent Beach some evidence might be found indicating habitation structures. Suttles (1974:127) mentions a Saanich man who had a house at Ganges Harbour which was shared with Saanich and Lummi relatives during the herring season. Suttles (1974:258, 1977:1-2) also reports the remains of a house at Crescent Beach, although it was not located by this study nor mentioned in any historic sources, which probably indicates it was destroyed early in the historic period. The usual shelter at a temporary camp consisted of lean-tos or four posted frames which were covered with cattail mats and sometimes bark and roof planks (Barnett 1975:40; Gunther 1927:190; Haeberlin and Gunther 1930:18; Jenness n.d., pp. 7,9; Stern 1934:41,52; Suttles 1974:261). Haeberlin and Gunther (1930:18) state that the hearth was located outside the mat shelter and that sometimes several shelters would be erected facing a common fire. Gunther (1927:190) reports a fire could be made inside the shelter where cooking was carried out during bad weather. Habitation layers (Table V-XII, Type 7) consisting of hearths in close proximity to rectangular configurations of small post holes, and greasy black pathways could be expected from a temporary camp such as Crescent Beach.

Given that this portion of the Crescent Beach site was only occupied for a month or two each year, natural soils may have been important in the development of the shell midden deposits. If settlement use follows the cluster pattern outlined in Figure 3-7a followed by periods of abandonment, fairly extensive humus layers could be expected (Type 8 layers). These layers would extend across the entire excavation area. Another type of humus development may be found reflecting the location of traps which accumulated leaves and other plant debris. This type of layer could develop in the lee of mounds or in the hollows between mounds. This type of layer is classed as localized humus layers (Table V-XII, Type 9 layers).

As the shell midden layers being studied here result from a seasonally occupied herring and shellfish harvesting camp it has been possible to suggest what types of layers should be encountered. The models presented in Figures 3-5 and 3-7a are regarded as the most appropriate examples of systemic and archaeological context at this site. Past refuse mounds, on site vegetation, and perhaps even family tradition would probably encourage a clustering of activity loci from successive seasons of occupation until space limitations necessitated a shift to another part of the site. A summary of the nine expected layer types if presented in Table V-XII.

5.6 TYPES OF CRESCENT BEACH SHELL MIDDEN LAYERS

Before comparisons may be made between suggested and recovered shell midden layers, the 31 excavated layers must be identified. On the premise that similar types of layers would contain similar kinds and quantities of cultural remains, the multidimensional clustering and scaling analysis of shellfish and other common faunal constituents was felt to be the next logical step. Shellfish are the largest group of cultural remains comprising approximately 22% of the site weight (see Table V-II) and were a major factor enabling segregation of layers during excavation. These remains may also be useful in isolating various types of shell midden layers although the representativeness of analysed shell samples must be addressed.

Although bearing no relation to prehistoric shellfish deposition, the absolute number of samples which could be analysed in this study was dictated by economics. Refuse discard does not ensure any degree of homogenization of elements and thus the relative amounts of various species vary from one part of a layer to another. With a minimum of three samples from each layer there is not any guarantee that the estimates determined in this study reflect the full range of variation in any layer. While there may be some question whether a larger number of samples would alleviate this problem, they might allow the generation of reliable confidence intervals.

Judgemental selection could potentially provide improved spacial coverage of a layer although a larger number of samples would still be required. The use of random sampling is defended as it permitted orderly and open ended sample selection, two or three times as many samples were retained as were analysed. Thus additional samples may be analysed which would perhaps provide more reliable data. The obvious solution would have been to increase substantially the number of lab workers analysing shell samples, a prerequisite for future shell midden analysis if larger sample sizes are desired.

At issue here is just how much confidence may be placed in the results of this shell analysis. To assist in this evaluation species/sample weight ratios have been plotted in Figure 5-39 for the eight most common classes of shellfish. It is immediately obvious that many layers exhibit a large variation in shell percentage, from 2 to 55% for <u>Clinocardium</u> in Layer L2 for example.

Some of this variation may result from the nature of species distribution in Boundary Bay as well as harvesting and processing activities. <u>Saxidomus</u>, <u>Protothaca</u> and <u>Tresus</u> may be obtained from the patches of

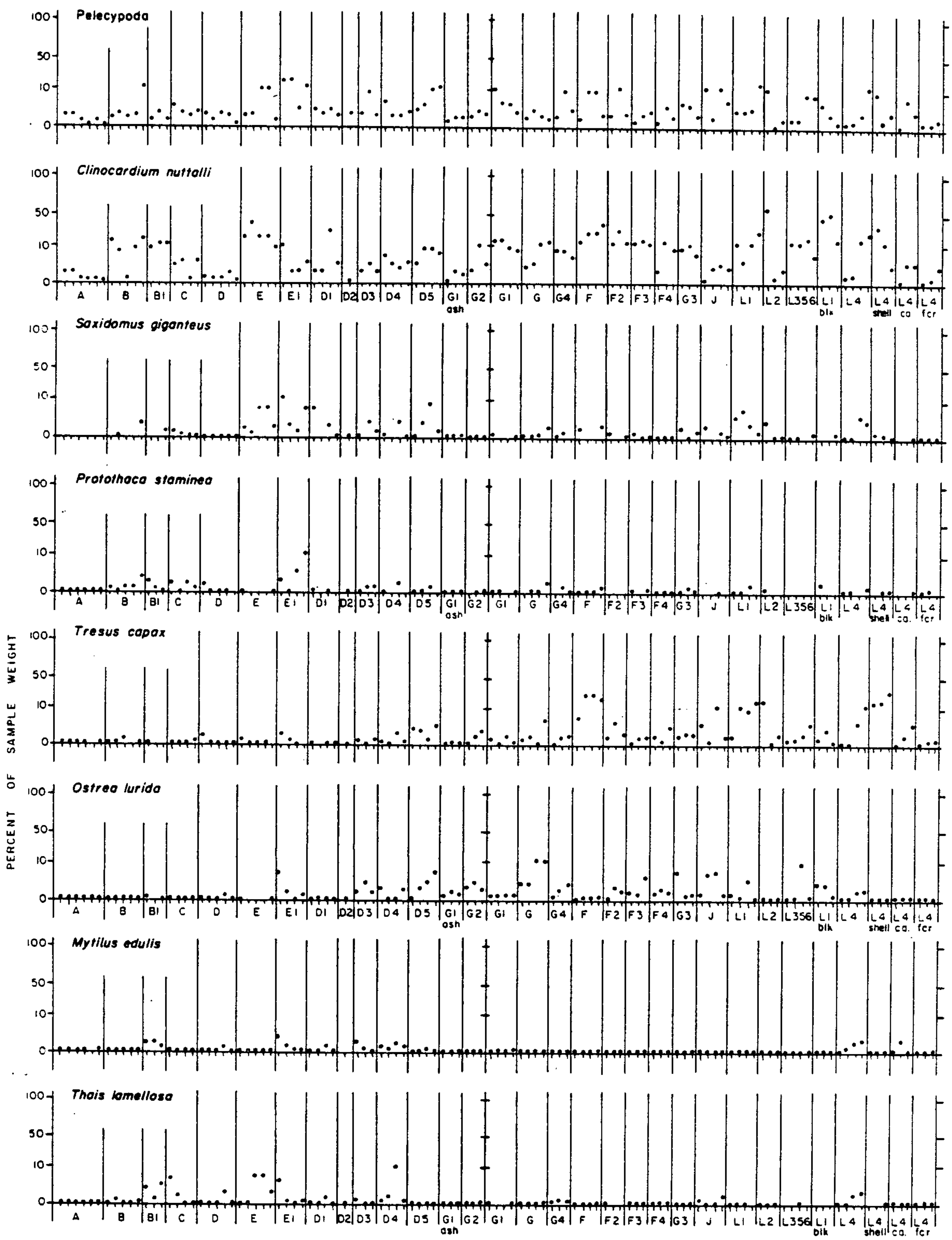


Figure 5-39. Shell Species/Sample Weight Ratios.

sand and gravel beach which lie between the rocky intertidal and the eelgrass beds indicating that collections from here should contain a mix of species. Clinocardium may be obtained in large numbers from sand bars and the eelgrass beds which could result in baskets containing little else. Similarly concentrations of Tresus may be obtained from the lower intertidal zone. Dumped on a steaming mound these individuals could be expected to cluster and as other species might be eaten immediately, Clinocardium (and perhaps Tresus as well) could be tossed to one side to await preservation, thus encouraging even more pronounced clustering of these species. In any event, large concentrations of Clinocardium (and other species) should be expected to result from natural distribution and human activities.

Shell breakage and the effect this may have on successful identification may also be responsible for some of this variation. This problem may be restricted primarily to Saxidomus and Tresus but could also include occasional fragments of Protothaca. While species such as Clinocardium, Mytilus, Ostrea and Thais may with practice be correctly identified even down to tiny fragments, small pieces of Saxidomus or Tresus are much more difficult. This bias may be evident from Layer B which has no identified Saxidomus and very little Tresus, yet contains up to 3% Pelecypoda. Layer B was the second layer analysed.

Mixing of shell between adjacent layers may also be a problem here in spite of precautions in the field to avoid contamination during excavation. Layer B1 for example shows up to 10% Clinocardium which is surprising considering there is little doubt but that this layer represents one or more dumps of beach sand. No doubt the high Clinocardium values reflect those of Layer B (within which B1 was contained) while this type of mixing may also be a problem with other small or thin layers (see Cluster I Layers below, p. 283).

To try to avoid complications due to small sample size, this analysis will be restricted to the total quantity of shell from a layer. The basic premise is that quantity of shell remains should provide a key to the type of activities which may be responsible for the deposition of a layer. It is expected that shell dump or discard layers will contain large quantities of shell, one formed by the development of humus will contain much less, while hearths, steaming mounds, pathways, and shelter floors may contain very little. Thus inspite of a lack of control over variation from sample to sample, these larger patterns are not expected to be masked by sampling error. In the end result, low sample sizes may well be adequate to obtain a reasonable estimate of site elements, and an indication of cultural and natural activities.

To reduce the layer data to a format which would permit Q type analysis using multidimensional clustering and scaling, all major elements were ranked. Shellfish were standardized by calculating live weights for each species based on the estimated layer totals and the shell meat ratios derived in Table V-VII. Based on Thompson's (1913:50-1) reported average weight of 14.13 kg (25 lb) for a basket of shellfish, each species was ranked 1 - 9 depending upon the number of baskets of live weight shellfish represented in each layer (see Figure 5-43). Fish, bird, mammal, charcoal and broken cooking stones were ranked 1 - 3 based on weight of remains in each layer. These values were intentionally biased towards the shellfish as they represent a substantially greater portion of the site than do any of the other remains. Given that shellfish harvesting took place in February and March, the shell meat ratios derived from species collected in March and April are appropriate.

Multidimensional clustering and scaling were used to reduce the 31 layers from Crescent Beach into groups or clusters of similar layers.

Cluster analysis is a class of numerical techniques for defining related groups of OTU's based on high similarity coefficients (Sokal and Sneath 1963:178). It is hierarchical in that layers are grouped in incremental decreasing levels of similarity until they constitute a single group (Sneath and Sokal 1973:214). A Manhattan or city-block metric matrix (Sneath and Sokal 1973:125) was clustered by Ward's Error Sum of Squares Method (Anderberg 1973; Ward 1963) using HCLUS, Hierarchical Cluster Analysis program (Wood 1974).

Metric multidimensional scaling (Matson n.d.) employed Torgerson's double centered B* matrix (Torgerson 1958:254-267) to calculate euclidian coordinates from the City Block matrix. Coordinates were extracted via extracting eigenvalues in their order of importance and a goodness of fit measure (% of trace) calculated for each (Matson n.d.). The resulting factor matrix was then plotted, two dimensions or vectors at a time. The usefulness of these numerical techniques are established in archaeology (Cowgill 1972; Matson and True 1974) and have been applied to problems by several researchers in this area (Burley 1979; Matson 1974; Monks 1977).

Ward's method of clustering resulted in a dendrogram containing 3 main clusters of layers (Figure 5-40), while a plot of Dimensions 1 and 2 from the scaling analysis resulted in identical clustering of the layers (Figure 5-41), so that it now remains to demonstrate that these clusters may be interpreted in a meaningful manner as reflections of cultural and natural processes. In total Dimensions 1 and 2 account for 73% of trace while plotting Dimensions 1 and 3 yield similar configurations. Plotting of the remaining Dimensions resulted in single clusters of layers about the centroid.

To assist in interpreting the various activities responsible for the Crescent Beach layers, artifact frequency per layer has been plotted in

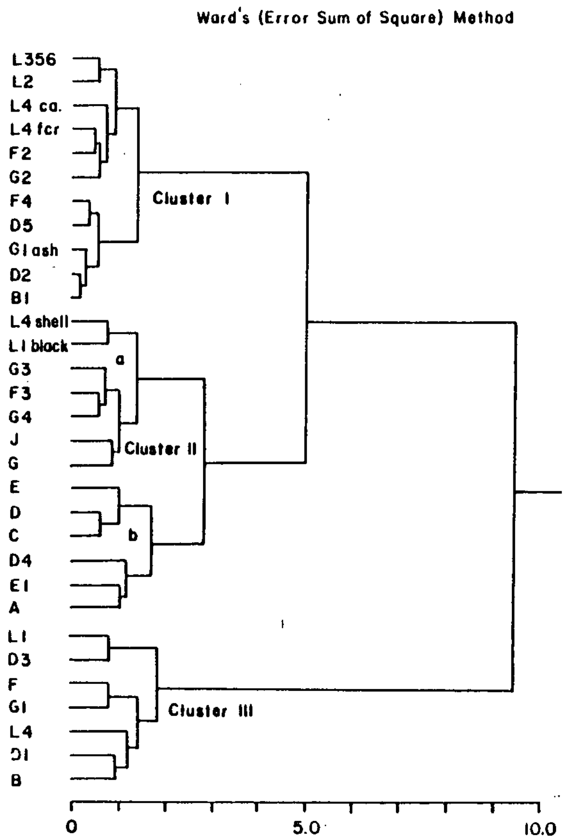


Figure 5-40. Q Mode Cluster Analysis of Crescent Beach Layers.

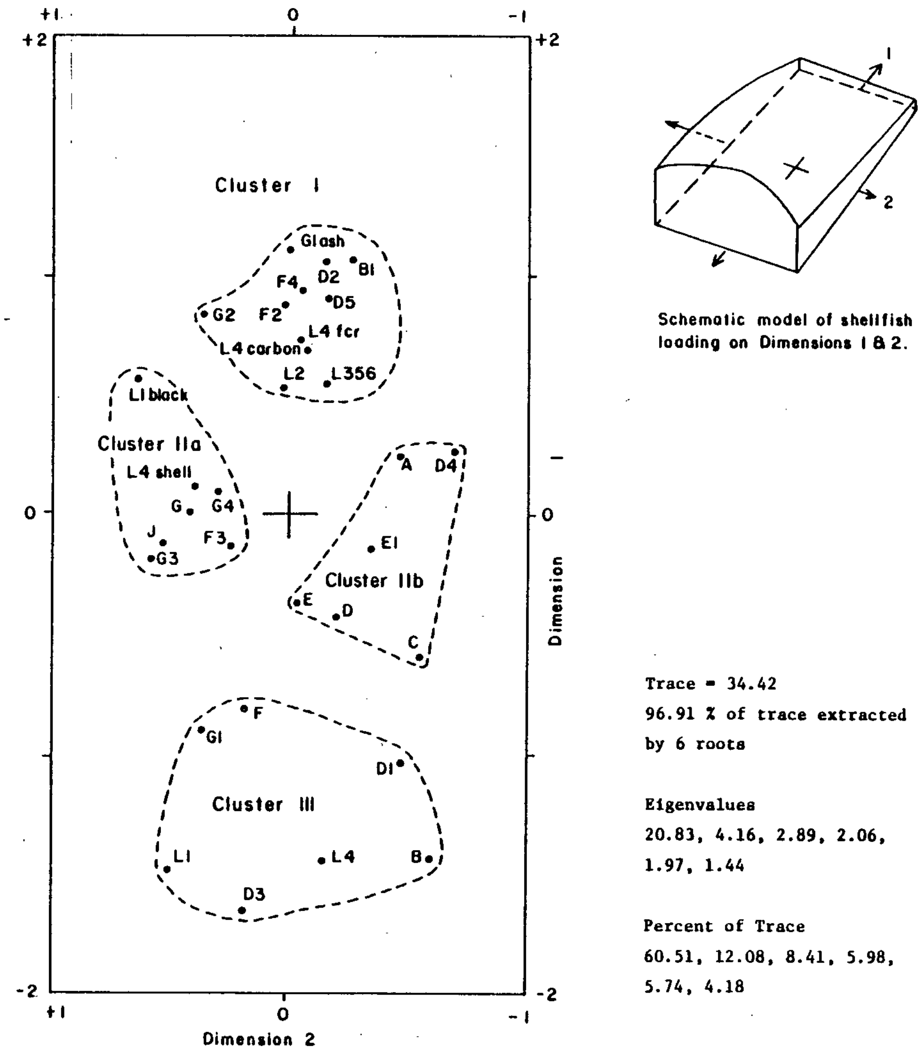


Figure 5-41. Torgerson's B* Metric Multidimensional Scaling of Crescent Beach Layers.

Figure 5-42. It should be noted that only 17 layers contained artifacts, while 3 were recovered from the interface Layers L and F1 which were not included in the cluster analysis. In addition, 95% of the artifacts from Crescent Beach were recovered from the layers which make up Clusters IIb and III. As these are heavy shell and humus layers Schiffer's (1976:32) warning about artifact traps warrants consideration (see below). Figure 5-43 presents the faunal ranks which were clustered (see Figure 5-40) and may also be of value in interpreting layer activities.

Cluster I Layers

It is not surprising these layers group as they are the smallest and thus contain the lowest quantities of shell. Several exhibit high shell percentages however and as adjacent layers have a high shell content, mixing is probably responsible (see Figure 5-39). Included are Layers L4 carbon, L356, F4 and B1 which were 4-6 cm thick (except for F4, 9 cm) making archaeological mixing a certainty, no doubt compounded by excavation. Thus not only shell content, but the provenience of faunal material and artifacts must be considered with caution. Only two artifacts were recovered from these layers, an incised bone point (Figure 5-21; 4102 D5) and a bipolar core/stone wedge fragment (Figure 5-15; 4239 L356). The most common cultural elements are broken cooking stones, charcoal, crab, herring and midshipman reflecting the close association between some of these layers and food preparation. Seasonality dates from the Cluster I layers are overlapped by the dates from the other clusters (see Figures 5-4 to 5-6).

Layer B1 (0.01 m^3, 21.5 kg)

Layer B1 was located in Layer B (Unit B2NE), a small localized patch of dark grayish brown (Munsell 2.5Y 4/2) pebbly sand and waterworn shell. It was recognized during excavation as either an intentional or accidental dump

	Cluster	1		2a			2b						3						misc.		Total	% of Total
	Artifacts \ Layers	D5	L356	J	G3	G	D4	E1	A	D	E	C	G1	D1	B	L4	L1	D3	L	F1		
Manufacture	chipped stone detritus	(1)	(1)	-	-	(1)	-	(1)	(5)	(6)	-	(2)	(1)	(3)	(7)	(16)	(5)	(3)	-	-	-	
	bipolar cores/stone wedges	-	1	-	-	1	1	-	-	2	-	3	-	1	2	4	1	1	-	-	17	
	quartz crystal materials	-	-	-	-	-	-	-	2	-	-	-	-	-	3	1	-	-	-	-	6	
	heavy duty stone tools	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-	3	
	anvil stones	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	
	sandstone-slate saws	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	
	small irregular abrasive stones	-	-	-	-	-	-	-	-	-	-	2	-	-	6	1	-	-	-	-	9	
	ground slate detritus	-	-	-	-	-	-	1	-	4	-	1	-	-	2	-	-	-	-	-	8	
	bone detritus	-	-	-	-	-	-	-	3	1	-	1	-	-	6	4	-	2	-	-	17	
	antler detritus	-	-	1	1	-	-	1	-	1	-	2	-	4	9	3	-	2	1	-	25	
	Mytilus californianus detritus	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	1	-	-	3	
	CLUSTER SUBTOTALS	1	1%	3		3%		28		31%				57	63%				1	1%	90	42%
Woodworking	serpentine celts or adzes	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	2	
	handmauls	-	-	-	-	-	-	-	-	-	-	i	-	-	-	-	-	-	-	-	i	
	antler adze hafts	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	
	antler wedges	-	-	-	-	1	-	-	-	2	-	3	1	4	7	4	-	3	-	-	25	
	bone chisels or wedges	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-	1	1	-	-	5	
	bone drills	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	
	Mytilus californianus celts	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	2	
	CLUSTER SUBTOTALS	0		1		3%		9		24%				27	73%				0		37	17%
Textiles	retouched flakes, scrapers	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	
	split and sectioned bone awls	-	-	-	-	-	-	-	-	2	-	-	1	1	6	-	1	1	-	-	12	
	deer ulna awls	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	2	
	incised bone needles	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	2	
	antler awl	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	
	CLUSTER SUBTOTALS	0		0				3		17%				15	83%				0		18	8%
Ceremonial-Decorative Items	human remains	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	-	
	disc beads	-	-	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-	-	-	5	
	labrets	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
	ochre	-	-	-	-	1	-	-	5	7	-	4	1	1	8	-	-	1	-	1	29	
	bone blanket pins	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	
	bone pendant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	
	earspool fragment		-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
	birdbone beads	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	
	Dentalium shell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	
	Pecten shell	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	
	CLUSTER SUBTOTALS	0		1		2%		22		54%				16	39%				2	5%	41	19%
Hunting	stemmed chipped stone point	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
	CLUSTER SUBTOTAL	0		0				1		100%				0					0		1	5%
Fishing	bone bipoints	-	-	-	-	-	-	1	-	1	1	-	-	-	1	-	-	1	-	-	5	
	incised bone points	1	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	3	
	basally thinned bone points	-	-	-	-	-	-	-	-	1	-	-	1	-	2	-	-	-	-	-	4	
	bone point fragments	-	-	-	-	-	-	-	-	2	-	1	-	1	1	-	-	-	-	-	5	
	antler harpoon with lineguard	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	
	toggling harpoon valves	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	
	CLUSTER SUBTOTALS	1	5%	0				8		38%				12	57%				0		21	10%
Food Preparation	stemmed bifaces	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	
	chipped slate knives	-	-	-	-	1	1	1	-	-	2	-	-	-	2	-	-	-	-	-	7	
	ground slate knives	-	-	-	-	-	-	i	-	i	-	i	-	-	i	-	-	-	-	-	i	
	broken boiling stones	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
	CLUSTER SUBTOTALS	0		1		12%		4		50%				3	37%				0		8	4%
	TOTAL	1	1	1	1	4	2	4	16	27	5	21	5	14	72	19	4	16	1	2	216	
	CLUSTER TOTALS	2	1%	6		3%		75		35%				130	60%				3	1%		

misc. layers = interface layers ( ) = not included in totals + = present i = presence inferred

Figure 5-42. Distribution of Crescent Beach Artifacts by Layer Clusters.

Clusters by Ward's Method (see Figure 5-40)

Cluster	LAYER / ELEMENT	Mytilus	Ostrea	Tresus	Clinocardium	Protothaca	Saxidomus	Polecypoda (unidentified shell)	Thais	Balanus glandula	Balanus cariosus	Patellacea	Cancer	Mophalia
I	L356	*	*	**	****	*	*	***	*	*		*	**	
	L2	*	*	***	*****	*	*	**	*	**	*		**	*
	L4 carbon	*	*	**	**	*	*	**	*	**	*		*	*
	L4 fcr	*	*	**	***	*	*	**		*		*	***	
	F2	*	*	**	****	*	*	**		*		*	*	
	G2	*	**	**	***	*	*	**	*	*		*	***	***
	F4	*	*	*	**	*	*	*	*	*			*	*
	D5	*	*	*	**	*	*	*	*	*	*		*	
	G1 ash	*	*	*	*	*	*	*	*	*		*	*	
	D2	*	*	*	*	*	*	*	*	*		**		
	B1	*	*	*	*	*	*	*	*	*	**	**	*	
IIa	L4 shell	*	*	*********	*********	*	**	*****	**	**		*	***	
	L1 black	*	***	*****	*********	*	*	***		*			*	*
	G3	*	***	****	*********	*	***	****	*	**	**		***	**
	F3	*	***	***	*********	*	**	****	*	**	*		**	**
	G4	*	**	**	*********	*	*	*****	**	**			*	***
	J	*	****	******	*********	*	**	*******	**	**	**			*
	G	*	*****	***	******	*	*	***	**	**		**	**	***
IIb	E	*	*	**	*********	*	*****	******	*	**		***	***	
	D	*	*	*	*****	*	*	******	***	***			**	
	C	*	*	**	*********	****	**	*******	*******	**	***	*	**	
	D4	**	*	**	***	*	**	***	*****	***	***	**		
	E1	*	**	*	***	**	***	*******	**	***	**	**	**	**
	A	*	*	*	****	*	*	****	*	**	*			
III	L1	**	*********	*****	*********	******	*********	*********	***	***		***	***	***
	D3	***	********	****	*********	****	*******	*********	***	***		***	***	***
	F	**	**	*********	*********	**	****	*********	*	***			**	
	G1	**	*****	*******	*********	**	***	*********	****	***			***	
	L4	*****	***	********	*********	*	****	********	*****	***	***		***	
	D1	**	*	*	*********	**	*******	********	***	***	**	***	***	
	B	**	*	*******	*********	*********	******	*********	**	***	***	***		

Cluster	LAYER / ELEMENT	Squalus	Oncorhynchus	Clupea	Porichthys	Cottidae	Pleuronectidae	Anatinae	Aythyinae	Anatidae	Odocoileus	Cervus	Large mammal frags.	small mammal frags.	charcoal	broken cooking stones	Helix	Insectivores
I	L356	*	*	*	*	**	*		*			**	*	*	***	**	**	*
	L2	*	*	*	**	*	*	**			*	**	**	*	*	*	**	
	L4 carbon	*	**	**	**	*		**			***		*		**	**	*	
	L4 fcr	**	**	**	**	*					*				*	***	*	
	F2	*		*	*		*			**					*	**	*	*
	G2	*		**	*		**	*					*		*	*		
	F4	*		*	*	*	*			*	*	*	**	*	*	*		*
	D5	**		*	**	**	*				**			*	*	*	*	
	G1 ash	*		*		**							*		*	*	*	
	D2			*		*				*			*	*	**	*	*	
	B1			*	*								*	**	*	*	*	
IIa	L4 shell	**	*	***	**		*	*							*	**	*	
	L1 black	*		*	**										**	**		
	G3	***		***	**		*	***	***	***			**	*	**	**		
	F3	***	*	**	*	**	**	*	*	**	**		**	***	**	**	**	
	G4	**		**	**		**	*	**	**			**	*	*	*	**	
	J	*		**	**	**	**					*	*		**	**	**	**
	G	**		**	*	***	**	**	***	*		*	**	**	**	**	**	**
IIb	E	**		***	***	***	***			***			**	***	***	**	***	
	D	*	**	***	***		***	**	*	***			***	***	***	***	***	
	C	**	**	***	***		***	*	*	***		**	***	***	***	***	***	
	D4	*	*	*	*		*	*	**		**	***	***	*	**	*	***	
	E1	**		**	**	**	***		***	*	**	*	*	**	***	*	***	*
	A	**	***	**	**	**	**			*	*		***	***	**	***	**	**
III	L1	***		***	***	***		***	***	*	*	***	***	**	***	***	**	*
	D3	***	***	***	***	***	***	***	*	***	**		***	***	***	***	***	***
	F	***	**	**	***		**		**	***	***		*	*	***	***	***	**
	G1	***		***		**	**	**	*	**	***		**	**	***	***	***	
	L4	***	***	***	***	***	***	***	***	**	***	***	***	**	***	***	***	
	D1	***	***	***	***		***	***	**	**	**	**	**	**	***	***	***	
	B	***	***	***	***	***	***		**	**	***	***	***	***	**	***	**	***

Figure 5-43. Distribution of Faunal Ranks by Layers and Clusters.

Mytilus to *Thais* ranked 1 - 9, all others 1 - 3.

of beach sand which is supported by both grain size analysis (Figure 5-11) and the presence of waterworn shell. Whether this sand was freshly brought from the beach, or discarded from a steaming mound is not clear.

Comprising half the site weight (Table V-II), sand was an important midden constituent frequently observed in lenses in shell refuse layers, around steaming mounds and lining hearths (see pp. 297, 299), while it was also observed spilling from clappers (dead paired valves filled with sand). There are several ethnographic reports of sand being used to cover steaming mounds (Elmendorf 1960:133; Haeberlin and Gunther 1930:23; Reagan 1917:27). Faunal material recovered from Layer B1 is no doubt intrusive from Layer B although some fish remains as well as waterworn shell may have been present in the original beach sand. Probably associated with steaming activities Layer B1 was classed as a Type 2 or refuse layer (see Table V-XII).

Layer D2 (0.04 m^3, 95.4 kg)

Layer D2 was located within Layer D1 (Figure 5-44) and consisted of yellowish red ash, fragments of burnt clam, and mussel shell. A total of 13 post molds were observed in this ash layer while No. 2 was traced an additional 5 cm into the underlying Layer D1. As far as could be determined some of the post molds may have originated at the ash surface as several were capped with ash. An ash spread, post mold and a shallow patch of charcoal and pebbles (Table V-XII, Type 5 layer) suggest a small fire kept beneath a frame for smoking or drying herring, meat or hides. The extensive ash and low charcoal indicate a fire was maintained for sufficient time to reduce practically all fire wood. Unfortunately the excavated post molds do not present an obviously meaningful pattern.

Shell and other faunal material (scarce) in Layer D2 may be intrusive from Layer D1. Burnt and charred shell would result from the fire built beneath a frame on previously deposited Layer D1. A portion of D2 was

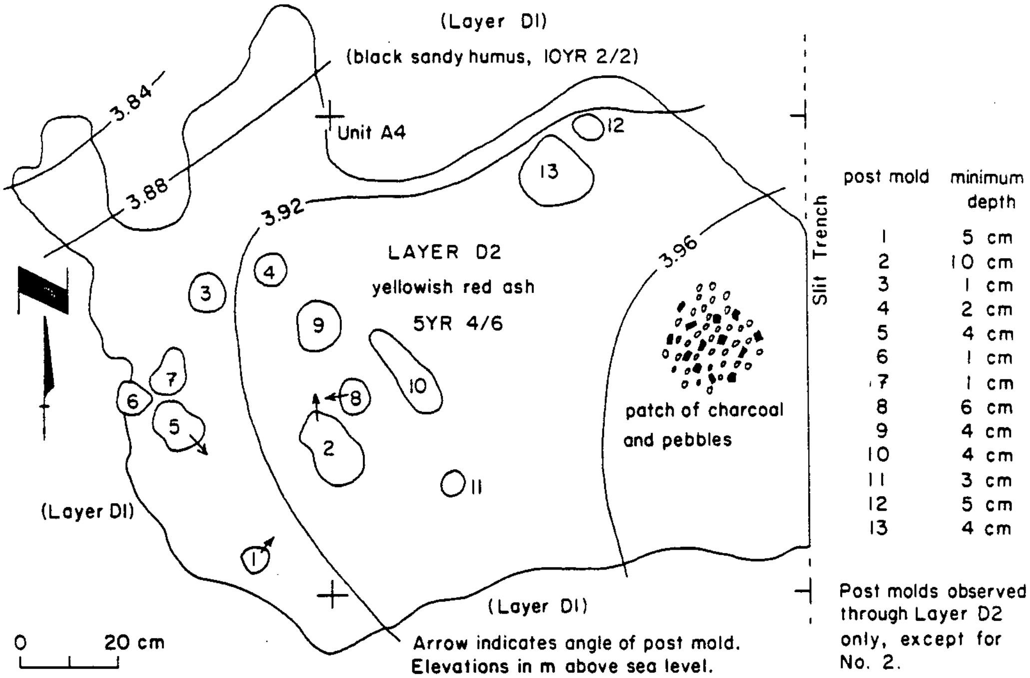


Figure 5-44. Layer D2.

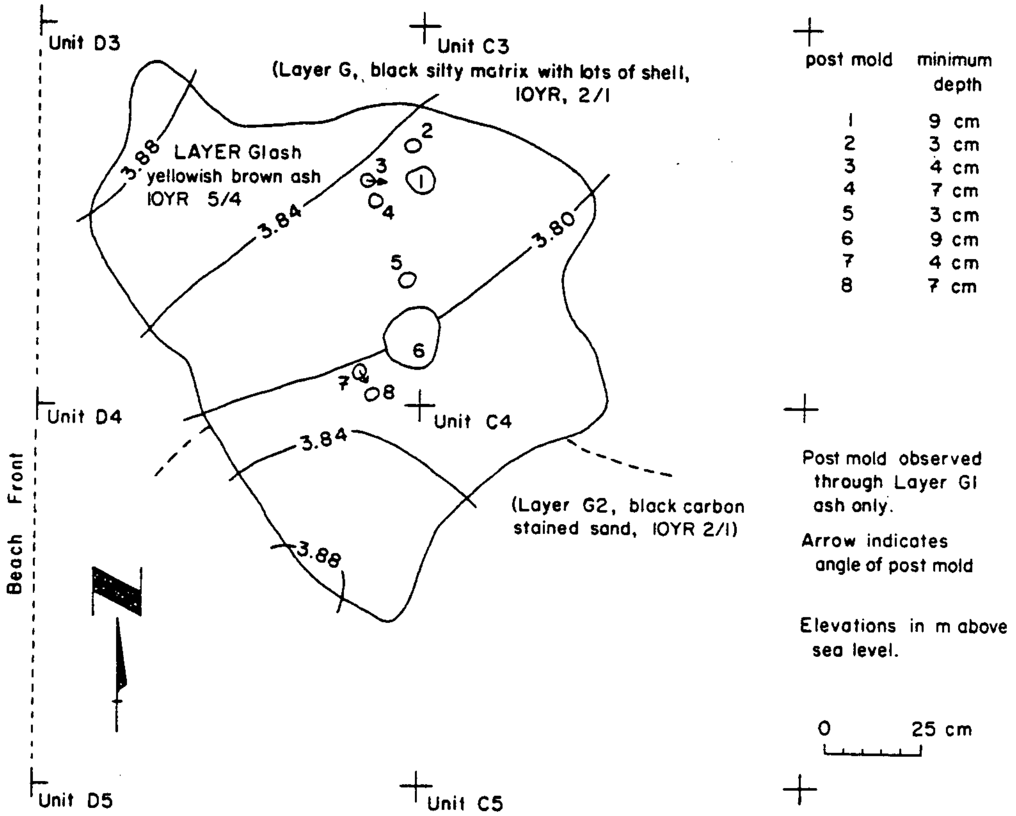


Figure 5-45. Layer G1 Ash.

truncated by the slit trench so that the full extent of the layer is not known. Layer D2, as well as all other ash spreads excavated at Crescent Beach have been modified by rain to some extent. The fingers of D2 ash extending downslope are an excellent example of this phenomenon (see Figure 5-44). This type of postdepositional modification is to be expected at an open air site such as Crescent Beach.

Layer G1 ash (0.03 m^3, 57.9 kg)

Layer G1 ash consisted of yellowish brown ash with fine fragments of burnt shell (Figure 5-45). A total of 8 post molds were observed in this layer, several of which appear to originate at or near the surface of G1 ash. As with the previous layer, G1 ash is thought to be a Type 5 layer (ash and charcoal spread), the remains of a hearth and smoking frame (Table V-XII). Faunal remains are scarce while the burnt shell probably originated from the underlying layers and was burnt by the fire.

Layer D5 (0.04 m^3, 57.6 kg)

Layer D5 consisted of a black (5Y 2.5/1) matrix of carbon stained crushed shell and silty sand and was recovered from a narrow strip along the north end of the excavation (Figure 5-46). Charcoal fragments were a dominant element in this layer suggesting a relation to hearths or steaming mounds although not enough of the layer was recovered to determine its extent and nature. One guess is that D5 was a dump of refuse from cleaning out a hearth or steaming mound, or as argued below it may be the remains of a steaming or cooking oven. This type of layer was not expected and was classed as Type 10.

Layer F4 (0.02 m^3, 112.7 kg)

Layer F4 was a small layer approximately 16 cm deep and consisted of

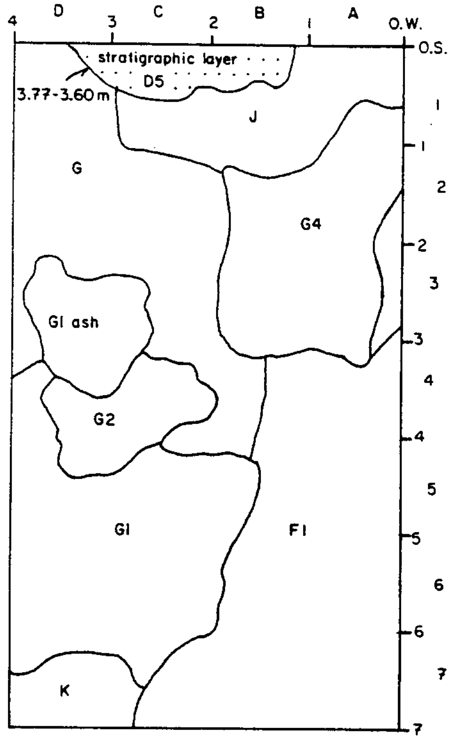


Figure 5-46. Extent of Layer D5.

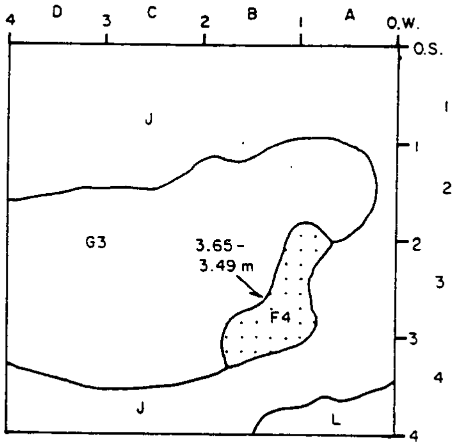
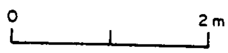


Figure 5-47. Extent of Layer F4.



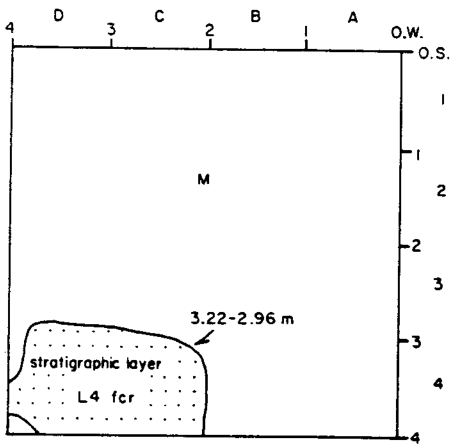


Figure 5-49. Extent of Layer L4 fcr.

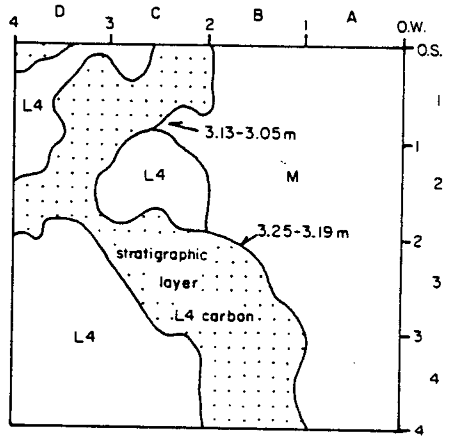


Figure 5-50. Extent of Layer L4 Carbon.

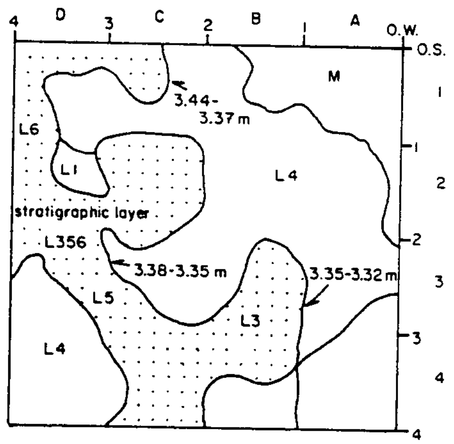


Figure 5-51. Extent of Layer L356.

black (2.5Y 2/0) organic matrix with numerous worm casts and some fragments of shell (Figure 5-47). This layer appears to be a leaf trap, a localized humus layer (Table V-XII, Type 9 layer). It occupies a low spot on the surface of Layers G3 and J in which leaves and other plant debris accumulated and was eaten by earth worms. Shell and other cultural remains are rare probably originating from Layer G3.

Layer G2 (0.07 m³, 129.3 kg)

Layer G2 was up to 8 cm thick and consisted of a black (10YR 2/1) carbon stained sand, gravel and charcoal matrix with burnt and unburnt shell. The western and southern portions of G2 contained a number of cobbles (Figure 5-48) while Layer G1 ash overlapped onto the northern portion of the layer (Figure 5-46) although the two are not necessarily related. G2 may represent the remains of a small steaming mound which was partially scattered around or cleaned away. The fact that charcoal was not reduced to ash indicates the fire was allowed to burn for only a short time compared to Layers G1 ash and D2. Although faunal remains are scarce this layer ranks highest in crab and chiton remains for Cluster I. This type of layer was not expected and as it is similar to Layer D5 it was also classed as a Type 10 layer, the remains of a steaming or cooking oven.

Layer F2 (0.07 m³, 112.7 kg)

Layer F2 was removed from Units A6 and A7 and consisted of a black (10YR 2/0) carbon stained sandy matrix with charcoal, broken cobbles and shell fragments and lay between the shelly Layer F and the F3 humus layer. Truncated by the slit trench on the east and south and an undefined western boundary, F2 was removed from only two units before the southern three rows of excavation units were abandoned. It may be the same firecracked rock layer encountered just below 3.0 m.a.s.l. in Test Unit A (see Figure 2-34).

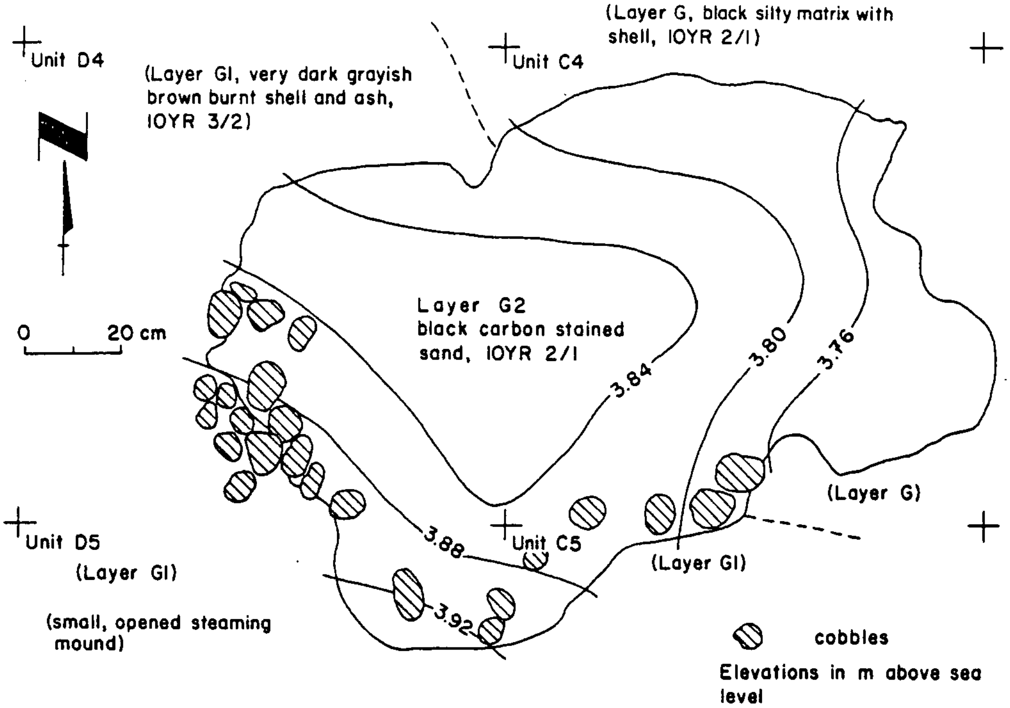


Figure 5-48. Layer G2.

The presence of charcoal suggests a short term fire while the close association of F2 with the shelly layer F leaves little doubt that F2 results in part from shell steaming activities. This layer also appears to have been redeposited as though a steaming mound had been opened to obtain meat and other foodstuffs placed in it to cook. Such an explanation could account for the apparently mixed deposits of some layers which may be related to cooking activities such as F2, G2 and perhaps even D5 and L4fcr. Feature F2-1 (Figure 5-52) uncovered in Layer B presented a very different picture of a steaming mound in which cobbles were pressed onto chunks of charcoal indicating the mound had not been opened or the cobbles disturbed after the fire had died down. Similar types of layers such as D5, G2 and L4fcr may represent the remains of some kind of cooking oven. Layer F2 was classed as a Type 1 and Type 10 layer (<u>steaming mound</u>

and possible cooking oven, Table V-XII). There was no obvious indication of post molds in association with any of the Type 10 layers.

Layer L4fcr (0.23 m^3, 334.7 kg)

Layer L4fcr consisted of a very dark gray (10YR 3/1) matrix with broken cobbles, charcoal and shell. As 36% of the layer's weight was broken cobbles it is apparent this layer was associated with cooking activities. Charcoal and cobbles were not in situ as might be expected after a fire, but appear to have been churned about. It may be that L4fcr represents the remains of an opened steaming mound similar to what was suggested above. L4fcr was bounded on two sides by a slit trench, but as it was not apparent in the midden profile 50 cm to the south it clearly was not a large layer (Figure 5-49). It is also suspected as representing a cooking oven and was classed as a Type 10 layer.

Layer L4 carbon (0.14 m^3, 170.8 kg)

L4 carbon consisted of a black (5YR 2.5/1) carbon stained matrix with scattered crushed shell and charcoal (see Figure 5-50). One of the thinnest layers (averaging 3.1 cm), it proved difficult to excavate as it was well mixed into the underlying shelly Layer L4. Most if not all of the shell and broken cooking stones in this layer and probably other faunal remains are from Layer L4 (see Figures 5-23, 5-39, 5-43). Although charcoal fragments are extensive (see Figure 5-23) there was no evidence of a closely associated hearth or steaming mound. This layer appears to be a pathway (Table V-XII, Type 3 layer), along the edge of L4 and the thick humus Layer M.

Layer L356 (0.28 m^3, 212.2 kg)

L356 was a black (10YR 2/1) carbon stained matrix with scattered shell and charcoal (see Figure 5-51). It is also a thin layer averaging 5.4 cm in which shell and broken cooking stones and possibly other elements are most likely intrusive (see Figures 5-39, 5-43). This layer also appears to be a pathway (Table V-XII, Type 3 layer) located near the boundaries of Layers L4 and M, although approximately 10 - 15 cm below Layer L4 carbon.

Charcoal is extensive (see Figure 5-23) and a radiocarbon date of 1,060 B.P. (Gak 7262, Figure 5-8) was obtained on wood charcoal from unit C3. A flake from a bipolar tool was recovered from C4NE and may be intrusive from Layer L4 (Figure 5-15; 4130).

Layer L2 (0.24 m^3, 333.8 kg)

Layer L2 consisted of a dark gray (2.5Y 4/0) sandy matrix with isolated patches of olive gray (5Y 4/2) sand, crushed *Mytilus* and scattered shell fragments. With an average thickness of 6.1 cm, L2 extends to 18 cm in depth and was recovered from the southwestern portion of the excavation. In addition to some shell, this layer also contains a few wapiti, deer and fish remains (see Figure 5-43) while bird remains are scarce and no artifacts were recovered. This layer appears to be a deposit of sand and assorted food debris tossed off a steaming mound probably located to the south or west of the excavated area. Layer L2 was thus classed as a Type 2 layer, a refuse layer (Table V-XII).

Miscellaneous Features

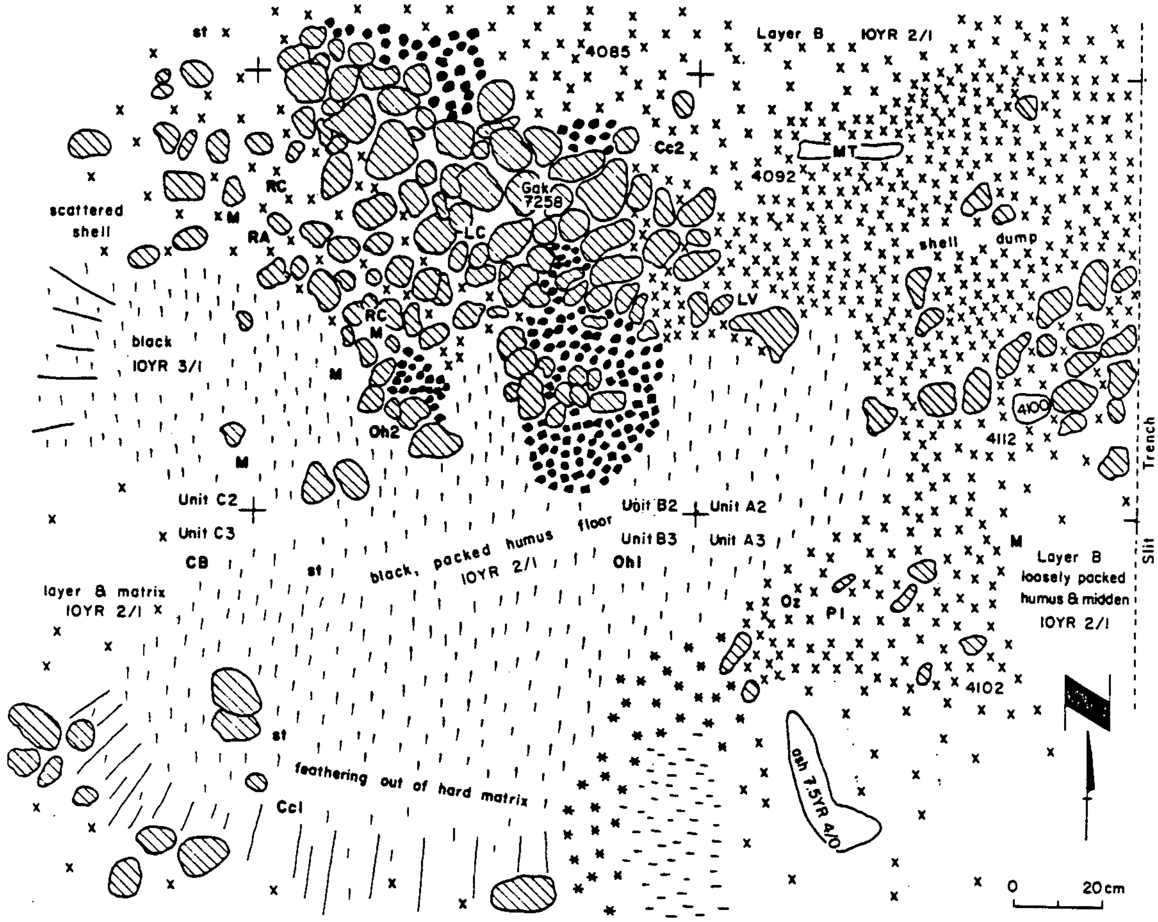
Although it would have been preferable to isolate each and every definable layer it was realized that features and floor plans were necessary if more than a handful of layers were to be examined. Data recovery from features and floor plans are not as detailed as that from layers so it was not possible to include them in the above cluster analysis. However, it is thought desirable to describe the features here as they may assist in understanding the Crescent Beach layers.

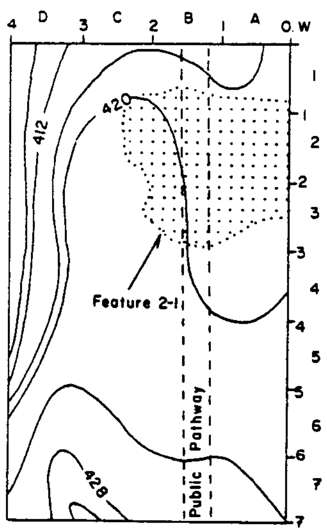
Feature 2-1 Steaming Mound

This feature was a small steaming mound (Table V-XII, Type 1 layer) (approx. 1.4 x 0.9 m) bordering on a packed humus floor to the south and a small shell dump to the north and east (Figure 5-52). Contained within Layer B, the top of the mound lay between 4.18 and 4.08 m.a.s.l., only 2 to 12 cm below the site surface indicating the lack of historic disturbances at this particular location. A radiocarbon date (Gak 7258) obtained on charcoal from beneath a cobble in the mound indicated the last deposition of shell in this area was approximately 480 years ago (see Figure 5-8, 5-52). [Charcoal from beneath a cobble was selected to attempt to avoid any possible contamination from the public path 30 cm above (Figure 5-52)].

Heavy shell was noted in the southern portion of excavation units A1 and B1 prior to encountering the steaming mound so the extent of the shell dump illustrated in Figure 5-52 represents only a portion of what was probably steamed on the mound. *Clinocardium*, *Protothaca*, *Saxidomus* and *Tresus* were the most common shellfish represented while practically all species found at the site are present. About 6 or 7 complete pairs of *Clinocardium* valves recovered from the western portion of A2 were closed, each containing a pair of smaller shell valves which had been placed inside the larger pair.

In addition to shell and crab, a range of fish remains were common including; herring, midshipmen, dogfish, flatfish, sculpins and sturgeon. Other than the sturgeon, the fish remains were recovered predominantly from the refuse deposits. Waterfowl remains were not common while deer, wapiti and some small mammals were also steamed (see Figure 5-52). Most of the wapiti remains were scattered on or near the edge of the shell





Surface of Layer A and location of public pathway 22 cm above F2-1.

wapiti remains:
- CB cloven bone
- LC left calcaneus
- RA right astragalus
- MT metatarsal
- LV lumbar vertebrae
- RC right calcaneus
- M molar

mammal remains:
- Cc beaver (1 = left ulna, 2 = caudal vertebrae)
- Oh deer (1 = phalange frag., 2 = left tarsal)
- Pl raccoon (left humerus frag.)
- Oz muskrat (left rear IV digit)

fish remains:
- st sturgeon

artifacts:
- 4085 antler wedge (Figure 5-61)
- 4092 ochre
- 4100 abrasive stone (Figure 5-15)
- 4112 antler wedge (Figure 5-61)
- 4102 incised bone point (Figure 5-21)

Gak 7258 A.D. 1470 (Figure 5-8)

charcoal

shell

crushed Mytilus

cobbles

dark grayish brown sand (2.5YR 4/2)

elevations:

mound surface	4.18 - 4.12 m.a.s.l.
shell heap	4.12 - 4.09 m.a.s.l.
floor area	4.09 - 4.07 m.a.s.l.

Figure 5-52. Feature 2-1, Steaming Mound.

refuse.

The southwestern quadrant of B3 and adjacent A3 contained patches of crushed Mytilus and sand (see Figure 5-52), an association frequently noted in the Crescent Beach midden. Some suggestions may be made although attempting to demonstrate them would require a more detailed analysis. Possibly Mytilus was placed near the top of the steaming mound and removed relatively early, the shells being discarded near sand spilt from removing mats or other coverings. The range of faunal remains found in and around the steaming mound suggests steaming was likely a multiple stage process as Mytilus, wapiti and other foods could require different cooking times. Thus, the opening and closing of steaming mounds could account for some of the many small sand lenses observed in the midden.

The hard packed humus from around the southern edge of the steaming mound was easily recognized during excavation. An important feature of the mound was the quantity of in situ cobbles, many imbedded into the underlying charcoal indicating they were not moved after the fire went out. This is in contrast to the state of the cobbles observed in several of the Cluster I layers (Type 10 layers, D5, G2, F2, L4fcr) in which cobbles and charcoal are well mixed. It is suspected that these Cluster I layers may represent small cooking mounds which have been broken open to obtain food from inside or beneath them, thus mixing the cobbles and charcoal. In total 58.4 kg of cobbles were removed from Feature 2-1, more than any Cluster I layer except for Layer L4fcr (see Figure 5-23). Seasonality dates from shell valves recovered in Unit A2NW are consistent with the rest of the site (see Figure 5-6, S 0213, S 0214).

Several artifacts were found in the shelly deposits associated with Feature 2-1 and probably represent items lost in the shell (see Figure 5-52), perhaps lending some support to Schiffer's (1976:32) argument for artifact traps. With the possible exception of an incised bone point (Figure 5-21; 4102), none of these artifacts seem particularly associated with observed faunal remains and steaming or food preparation. One antler wedge has a broken tip and may have been purposely discarded (see Figure 5-61; 4112).

Feature 2-2 Cobble, Charcoal and Ash Spread

This feature was a small (1.2 x 0.6 m) spread of cobbles and charcoal resting on patches of yellowish brown ash (see Figure 5-53). Removal of the cobbles and charcoal revealed more extensive ash suggesting that at least two burning episodes took place, the last one not reducing all the wood to ash. Several possible post molds were observed in both Units D2 and D3 after removal of the charcoal which suggests this may also represent the remains of a frame over a fire for smoking meat or fish. It was classed as a Type 5 layer, ash and charcoal spread (see Table V-XII).

Feature 2-3 Ash Spread and Post Molds

A portion of this feature was recovered during the excavation of Layer D (Figure 5-53). Although incomplete, the presence of an ash spread and post molds suggest a fire beneath a frame (Table V-XII, Type 5 layer) for smoking meat or fish similar to that suggested for Layer D2 above (see Figure 5-44).

Feature 2-4 Hearth

This feature was a 2.5 x 1 m hearth consisting of ash layers on a gravel and sand base and was partially intermingled with ash, black humus and shell deposits of Layer D (see Figure 5-58). Layering of ash and carbon stained matrix suggests the hearth was reused while the gravel base of the hearth is obvious from Plate 5-2. A radiocarbon sample of wood

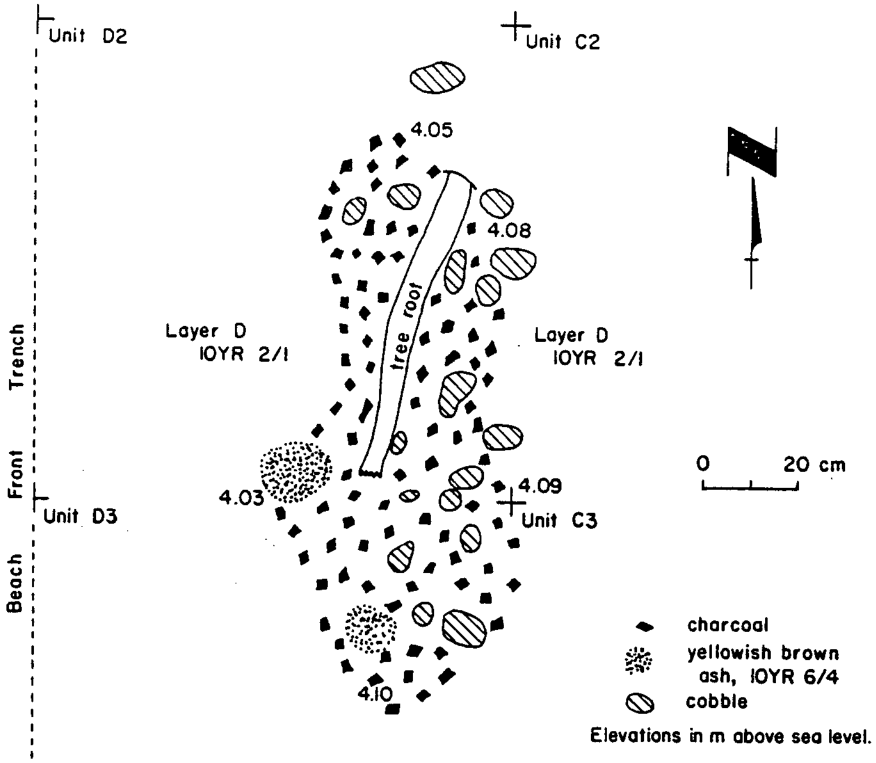


Figure 5-53. Feature 2-2, Cobble and Charcoal Spread.

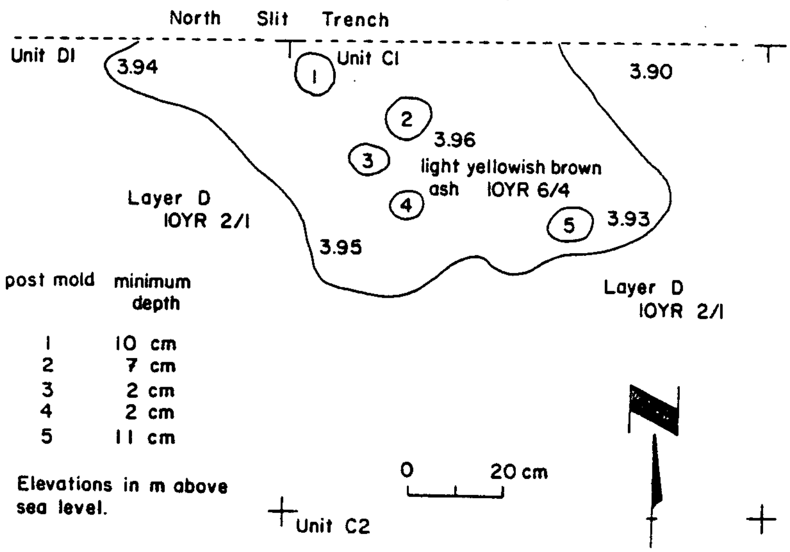


Figure 5-54. Feature 2-3, Ash Spread and Post Molds.

charcoal obtained from this feature provided a modern date (Gak 7259, Figure 5-8). Although excavation did not successfully determine the association of Feature 2-4 with Layer D ash spreads and post molds, it is possible they were used together (see Figure 5-58) and thus Feature 2-4 may be cautiously classed as a Type 5 layer (Table V-XII).

Feature 2-5 Post Mold

This feature was a post mold observed in Unit D1 where it passed through a Layer D ash spread (see Figure 5-58). Approximately 16 cm in diameter this post mold was only discernable for a depth of 5 cm as it went through the ash. Thus it was similar to other post molds observed at Crescent Beach, all were observable for 0.5 to 10 cm as they passed through ash spreads.

Two size groups were noted, small stake (?) molds from 5 to 8 cm wide, and larger post molds ranging between 10 and 16 cm in width. A few larger irregular post molds reaching 25 cm and some small unfilled holes appear to be rodent holes. A few post molds were observed to angle into the matrix while insufficient data was obtained to determine any overall patterns. The size of most observed post molds (5 to 8 cm) are compatible with what could be expected from smoking and drying racks or mat covered lean-to shelters. MacDonald and Inglis (1981:52) have also interpreted 4.5 to 9.0 cm post molds as resulting from drying frames.

Feature 2-6 Hearth

Observed in Layer D1 this hearth, although smaller, is very similar to Feature 2-4 and also consisted of ash layers on a gravel and sand base. This feature appears clearly associated with several ash spreads and post molds indicating its possible use in preserving meat or fish (Table V-XII, Type 5 layer) (see Figure 5-65). A radiocarbon sample of wood charcoal submitted from this feature provided a modern date (Gak 7260, Figure 5-8).

Summary of Cluster I Layers and Features

It was possible to assign most of the Cluster I layers as well as the recorded features to one of the 9 types of expected layers (see Table V-XII). Most common were Type 5 layers consisting of hearths and ash spreads with post molds which are inferred as the remains of fires and frames for smoking and drying fish and shellfish meat. Included in this group are Layers D2, G1 ash, and Features 2-2, 2-3, 2-4, 2-5 and 2-6. Layer B1 was discarded beach sand, either dumped in preparation for steaming activities, or discarded afterwards. Layer L2 was a sandy shell layer discarded from steaming activities, while both B1 and L2 were classed as Type 2, refuse layers. Layer F4 was classed as a Type 9, localized humus layer or leaf trap while L4 carbon and L356 were classed as Type 3 layers or pathways. Feature 2-1 was a small steaming mound or Type 1 layer.

One group of Cluster I layers including F2, G2, D5 and L4fcr did not correspond to any expected types (classed as Type 10). Common to these layers were a lack of post molds, and black carbon stained crushed shell, sand, cobbles and charcoal which unlike similar materials observed in steaming mounds, appear to have been stirred or mixed in some manner. It is hypothesized that these layers may have resulted from cooking or baking activities in which these small ovens (?) were opened to retrieve food, thus resulting in the mixing of constituents. It is possible that these layers could have resulted from the cleaning of shelter hearths, with the contents discarded on the midden. Other than a slight increase in crab, faunal remains are low in these layers as they are in the rest of Cluster I (see Figure 5-43) and offer little insight into layer function.

Plate 5-1. Crescent Beach Excavation (surface of Layer D, 1 m grids).

Plate 5-2. Feature 2-4 Hearth (Layer D).

With the sole exception of F4 which is thought to be a leaf trap and thus natural in origin, all other Cluster I layers as well as the recorded features consist of either de facto or primary refuse (see Table V-XIII). It should be noted that if the small ovens (Type 10 layers) represent materials cleaned from hearths, they would then represent secondary refuse, perhaps the only deposits of secondary refuse observed at the site.

Cluster IIa Layers

This group of layers has moderate quantities of faunal remains dominated by Clinocardium, Tresus and Ostrea (Figure 5-43). Fish and duck remains are more frequent than in Cluster I. Mammal remains are not very important while charcoal and broken cooking stones are common as they are throughout most of the site. The presence of humus and in some layers, landsnails and insectivores indicate association with old surface soils.

All layers were only partially excavated except for Layer G4, while in general all of these layers are small and thin ($<m^3$, $\bar{x}$ 7.6 cm), lay flat on a previous layer, and lens out gradually to thin edges. Only 6 artifacts were recovered from the Cluster IIa layers (see Figure 5-42), 4 from Layer G and one each from Layers G3 and J. Seasonality dates on shell from these layers are overlapped by dates from the other clusters (see Figure 5-4 to 5-6). Layer boundaries are presented in Figure 5-55.

Layer L4 shell (0.50 m^3, 626.7 kg)

L4 shell was a grayish brown (10YR 5/2) sand with Clinocardium and Tresus remains (Figure 5-43). Contained within Layer L4 (Figure 5-7), L4 shell averaged 8.6 cm in thickness but reached 13 cm in some places. Clinocardium, Tresus, and unidentified shell (probably Tresus) dominate the faunal remains and while herring elements are plentiful they could easily have percolated into the layer from L4. Overall L4 shell is best classed

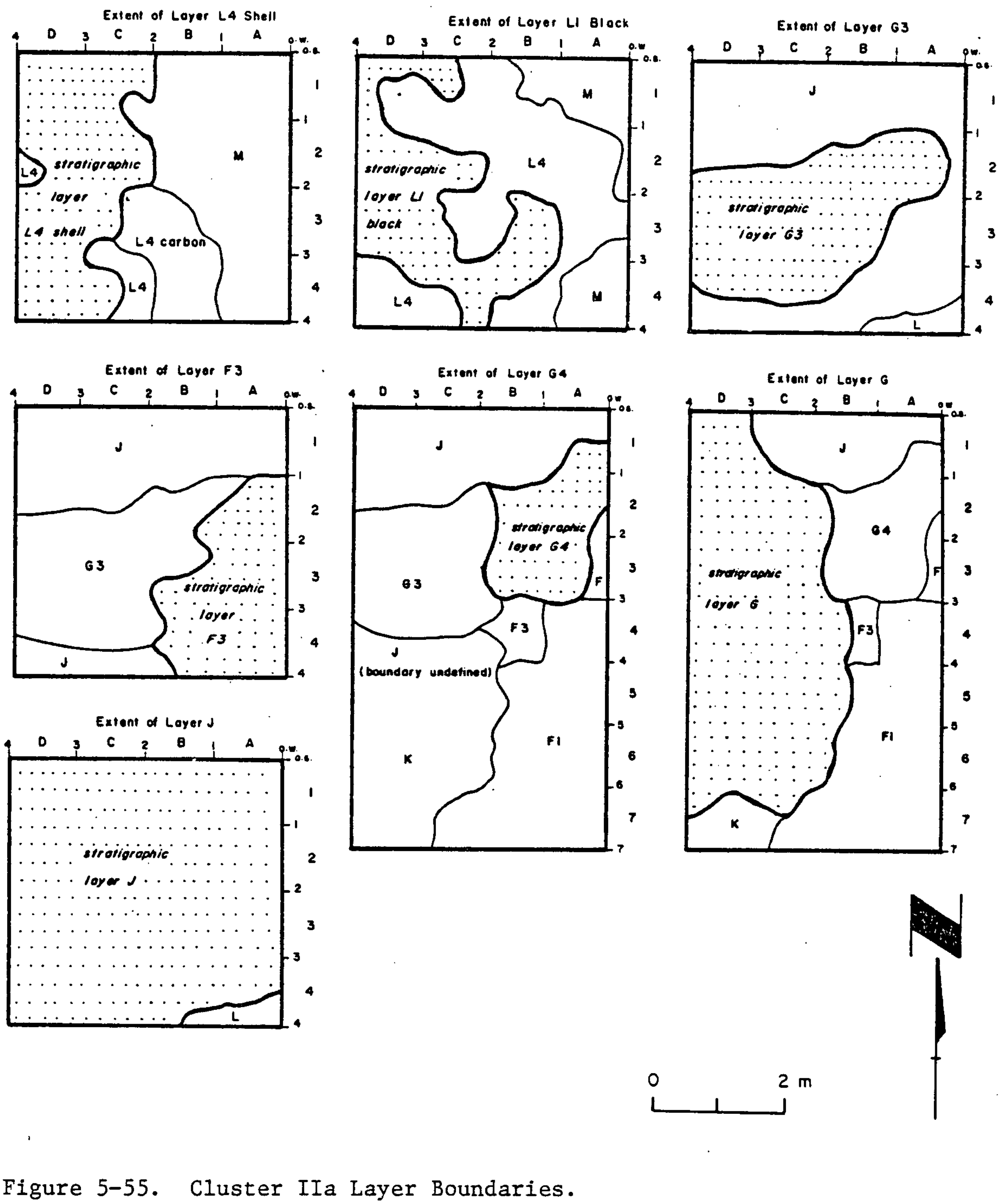


Figure 5-55. Cluster IIa Layer Boundaries.

as a Type 2 layer, a refuse layer (Table V-XII) associated with steaming activities while the restricted range of refuse suggests some of the selection factors discussed at the beginning of this section may be influencing the presence of shell species.

Layer L1 black (0.25 m³, 437.8 kg)

Layer L1 black was a black (10YR 2/1) carbon stained shelly matrix which averaged 5 cm in thickness but reached 10 cm in a couple of locations. Sandwiched between the charcoal and humus layer L356 and the sand and shell Layer L4, L1 black appears to be L356 matrix compacted into the L4 shell. With one small exception Layers 356 and L1 black share nearly identical boundaries (cf., Figures 5-51, 5-55). However, *Ostrea* and *Clinocardium* were important guides during the excavation of L1 black and given their predominance in L1 black compared to supposed parent L4 (see Figure 5-39), it is very possible that this is also a specialized refuse layer similar to L4 shell. As only 3 of 27 samples from the layer were examined it is not possible to accurately trace out the boundaries of the *Ostrea* and *Clinocardium* dump relative to the black matrix. Given that L1 black is low or lacking in many types of faunal remains common to Layer L4, the two layer concept may well be valid. Layer L1 black should be classed as a Type 2 refuse layer, and also as a possible pathway, or Type 3 layer (Table V-XII).

Layer G3 (0.26 m³, 533.7 kg)

Layer G3 was a very dark gray (10YR 3/1) sandy matrix with crushed shell lying across the top of the humus Layer J, and averaged 6 cm in thickness with a maximum of 12 cm. Layer G3 was dominated by *Ostrea*, *Clinocardium* and sand while fish and bird are also common (Figure 5-43). Possibly associated with a steaming mound on or near the upper part of the beach, Layer G3 may also be classed as a Type 2 refuse layer (Table V-XII) although with a specialized range of faunal remains. A single artifact, a piece of antler detritus (4318) was recovered from this layer.

Layer F3 (0.23 m^3, 411.0 kg)

Layer F3 consisted of a black (10YR 2/1) humus with worm casts and shell and was only recovered from the southeastern portion of the excavation area (see Figure 5-55). Layer F3 averaged 8 cm and reached 10 - 11 cm in thickness along its southeastern edge suggesting a substantial amount of the layer lay to the southeast of the excavation area. As the very shelly Layer F was deposited on Layer F3 some faunal remains may be intrusive, especially fish bones. However, *Clinocardium* and *Ostrea* again dominate the shell remains while humus and landsnails indicate association with old surface soils. Layer F3 was classed as a Type 8, extensive humus layer, (Table V-XII) all the time keeping in mind that a Type 2 (specialized?) refuse layer may be masked by the dark matrix.

Layer G4 (0.18 m^3, 248.1 kg)

Layer G4 was a small black (10YR 2/1) humus layer with worm casts, landsnails and shell fragments. Averaging only 5 cm in thickness, G4 was sandwiched between Layers D3 and D4 on the top, and Layers G3, F3, F and J underneath, all except D4 ranking high in *Clinocardium* (see Figure 5-7, 5-43). Assuming that faunal materials including *Clinocardium* are probably intrusive, Layer G4 was classed as a Type 8, extensive humus layer (Table V-XII).

Layer J (0.80 m^3, 797.5 kg)

Layer J was a dark gray (10YR 4/1) humus layer which extended across nearly the entire excavation area (see Figure 5-55). Averaging only 5 cm in thickness, it is very possible faunal remains in this layer are also intrusive, while humus, worm casts, landsnail shells and insectivore bones indicate this was probably a developed soil layer, a Type 8 or extensive humus layer (Table V-XII). One artifact, a piece of antler detritus (4243) was recovered from Layer J while two clusters of human remains were also found (B2-2, 2-3), both of incomplete and poorly preserved bones suggesting the proximity of tree burials at this time.

Layer G (0.53 m^3, 688.0 kg)

Layer G was a black (10YR 2/1) humus layer with shell and dark gray (2.5YR 4/0) sand patches. Averaging 16 cm and reaching 27-30 cm in thickness along its southern boundary, G was the thickest of the Cluster IIa layers. *Ostrea* and *Clinocardium* were reported during excavation and their importance is borne out by Figure 5-43, while fish and duck remains are also common. Four artifacts were recovered from Layer G, a bipolar core/stone wedge (4313), a chipped slate knife (4309), an antler wedge (4306) (see Figures 5-15, 5-17, 5-22), and a piece of ochre (4310). Sand and shell suggest Layer G was a Type 2 refuse layer while humus, landsnails, insectivores and worm castings indicate it was also an old soil layer, or Type 8, extensive humus layer (Table V-XII).

Summary of Cluster IIa Layers

Most of the Cluster IIa layers were not completely excavated, yet from the data that was obtained there appears to be a consistent relation between humus, sand, *Clinocardium* and sometimes *Tresus* and *Ostrea*. This is in part due to the fact that *Clinocardium* and *Tresus* are the most common shell species in the site (see Figure 5-43), although activities associated with steaming and processing shellfish may also be responsible. Possibly shellfish, and other foods to be processed, were spread across any open surface (such as a grassy area) to facilitate sorting and meat removal. Whether the sand was purposely spread out to place the shellfish on, or simply represents sand washed from the shellfish or dumped from mats covering the steaming mound is not clear. As at least half the excavated site consisted of sand (approx. 15.2 t) the first possibility is an attractive explanation which would warrant more detailed attention in future midden excavations.

In summary, Cluster IIa consists of two main types of layers; extensive humus layers (Type 8) indicating former surfaces and developed soils, and refuse layers (Type 2) related to processing shellfish removed from a steaming mound (see Table V-XII). One other layer, L1 black, may represent a pathway (Type 3), or a fossil imprint of a path on an underlying shelly layer. A summary of layer types is presented in Table V-XIII.

Cluster IIb Layers

Also moderately low in shellfish remains, this group of layers (except for D4) are all from near the surface of the excavation (see Figures 5-7, 5-56). *Clinocardium* and *Tresus* are lower than in Cluster IIa, while *Thais* and limpets (which may have entered the site together), as well as mammal remains, cooking refuse, and landsnails all exceed the Cluster IIa values (see Figure 5-43). Where the Cluster IIa layers had only a few artifacts, the Cluster IIb layers contained 1/3 of the artifacts from the site, and notably, 56% of the decorative items (see Figures 5-42, 5-57). All artifact groups are represented while no human remains were recovered. Seasonality dates are in line with those from the other clusters (see Figures 5-4 to 5-6).

Overall these layers appear to have been peripheral to most shell dumping in the area and resulted from food processing and preservation in addition to soil development. Layer A may be regarded as natural even though it contains cultural material as it formed as a result of root and worm action over the last 50 years or so.

Layer E (0.65 m^3, 887.1 kg)

Layer E was a very dark gray (5YR 3/1) humus with sand, scattered ash and crushed shell and was recovered from the eastern portion of the excavation area (see Figure 5-56). Lensing out on the west and reaching 18 cm in thickness along the eastern slit trench, Layer E was part of a much larger unexcavated layer. A sliver of a pale red ash spread was observed in Unit A3 (see Figure 5-58) and was also noted in the eastern profile of the slit trench. A post mold was also found in this unit, but could be associated with those in Layer D (see Figure 5-58).

Artifacts from Layer E are plotted in Figure 5-58 and included; chipped slate knives (4196, 4223), a bone bipoint (4202), a *Mytilus californianus* adze blade fragment (4328), and a fragment of *Pecten* shell (4160) (see Figures 5-21, 5-22). Although clearly a Type 2 (refuse layer) and a Type 8 (extensive humus layer, Table V-XII), E has indications that it may also have been a Type 5 layer (ash and charcoal spread) resulting from preservation activities. This association is clearer in Layer D (see below) in which a much larger portion of the layer was recovered.

Layer D (1.32 m^3, 2,324.6 kg)

Layer D was a black (10YR 2/1) sandy humus with moderate amounts of shell and patches of concentrated ash (Figures 5-11, 5-58). Extending across half of the excavation area and reaching a maximum thickness of 24 cm, Layer D was a Type 2 refuse layer and Type 8 extensive humus layer, but also contained ash spreads and post molds typical of Type 5 layers (Table V-XII) and included four of the features discussed above.

Direct associations between ash spreads, post molds and hearth were not obvious as excavation did not succeed in determining the presence of

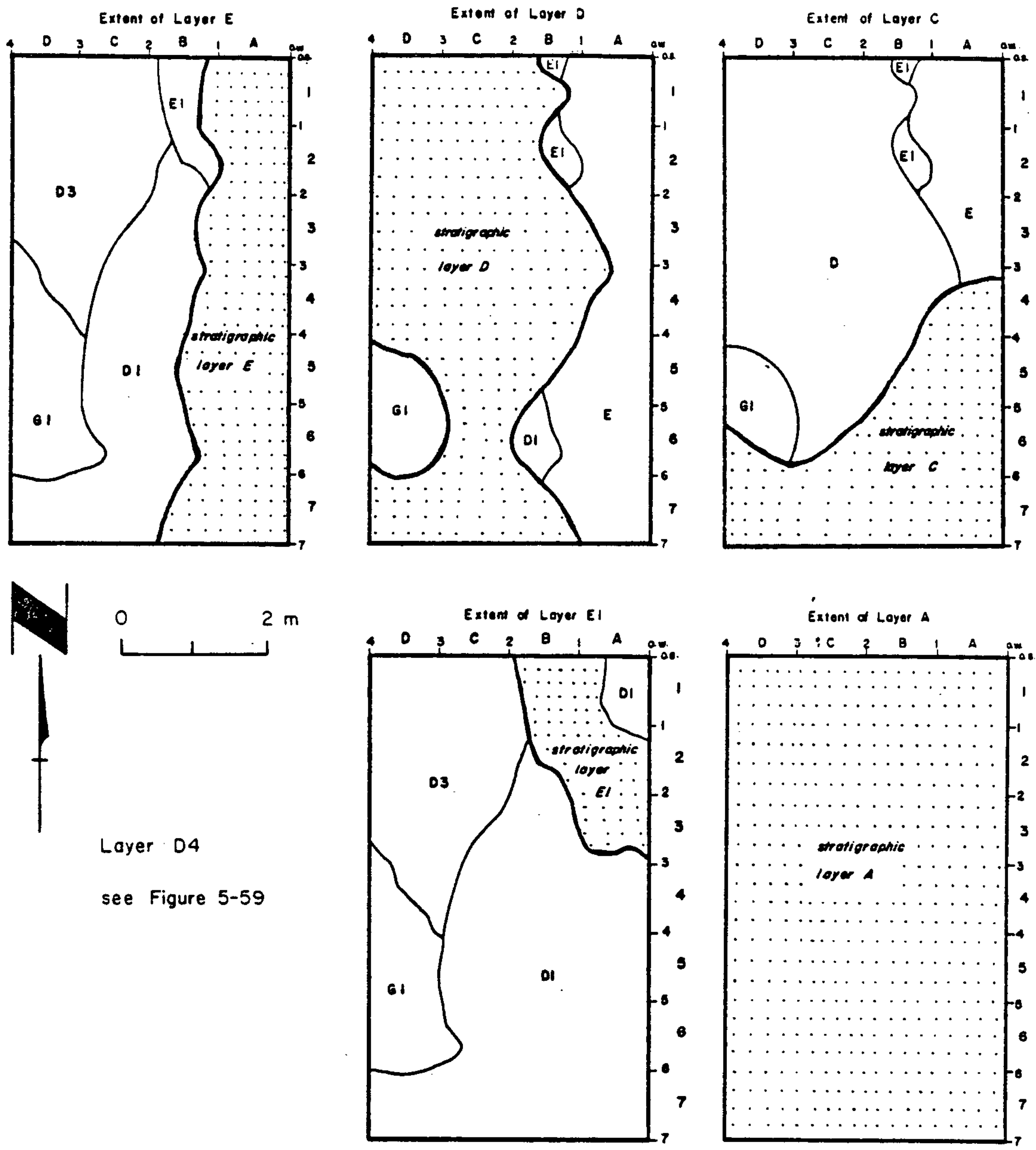


Figure 5-56. Cluster IIb Layer Boundaries.

floors. However, the distribution of ash spreads suggests the continued use of Layer D for the same types of activities. Layer D was probably a clear grassy area used for several seasons as a location for preserving herring and shellfish.

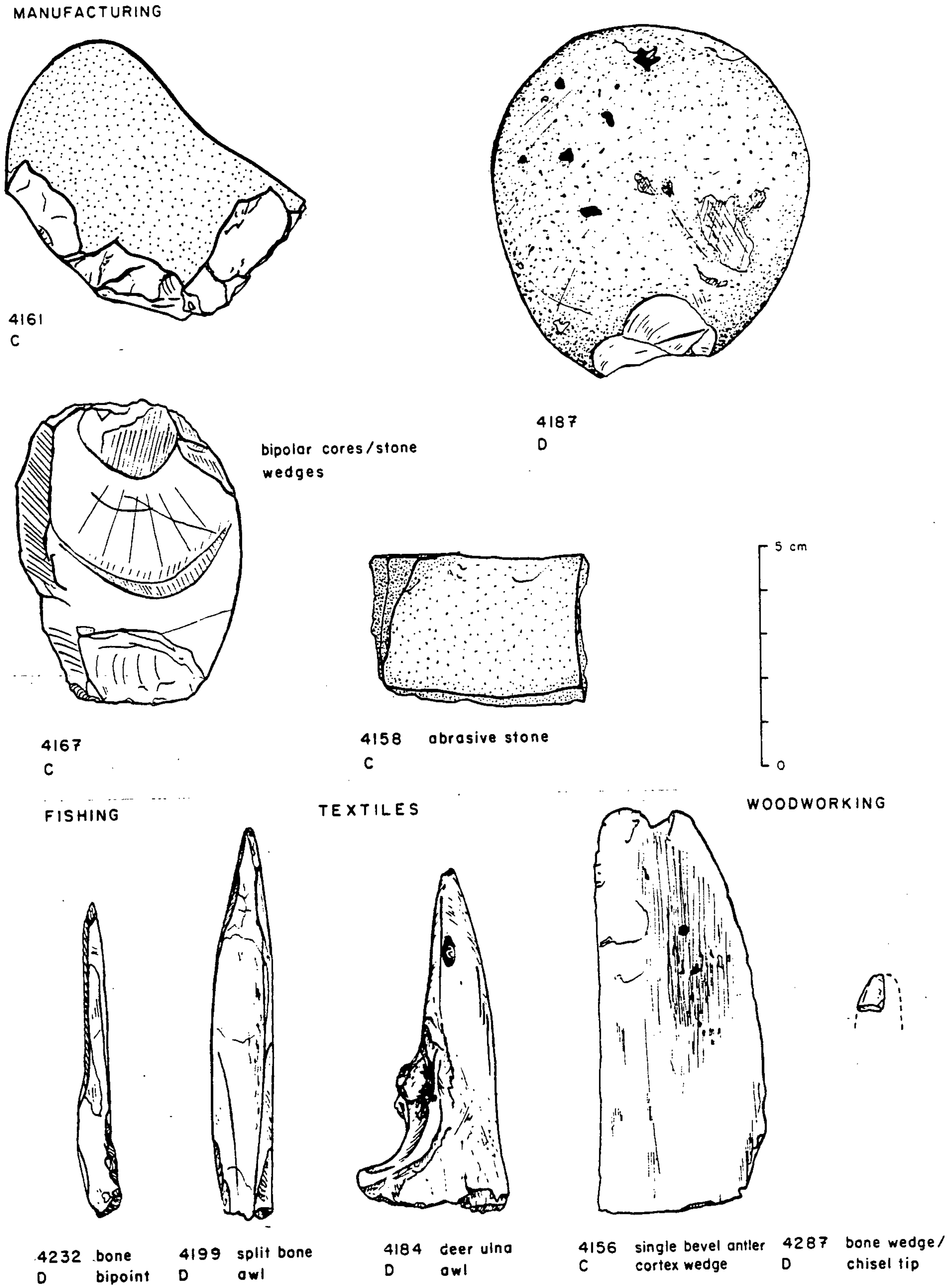
Artifacts reflect the manufacturing, textile, fishing and woodworking activities common to the site as a whole while a clustering of artifacts in B1 may represent a work area (see Figure 5-58). Similarly the group of woodworking tools in D7 and C7 may indicate a woodworking area. It is not clear whether the Layer D artifacts (n=27) reflect the presence of an artifact trap (grassy area), or simply an activity locus.

Layer C (0.74 m³, 1,025.7 kg)

Layer C was a dark brown (10YR 4/3) sandy humus matrix with ash and scattered shell fragments. It was approximately 8 cm thick and covered the southern 1/3 of the excavation area (see Figure 5-56). Layer C appears to have been a sand, *Thais* and *Clinocardium* dump from a steaming mound, or Type 2 refuse layer as well as a surface layer, or a Type 8 extensive humus layer (Table V-XII). A total of 21 artifacts were recovered (Figure 5-42) including manufacturing, woodworking and fishing tools (see Figures 5-15, 5-17, 5-21, 5-57), suggesting this surface was a work area as well as a refuse dump.

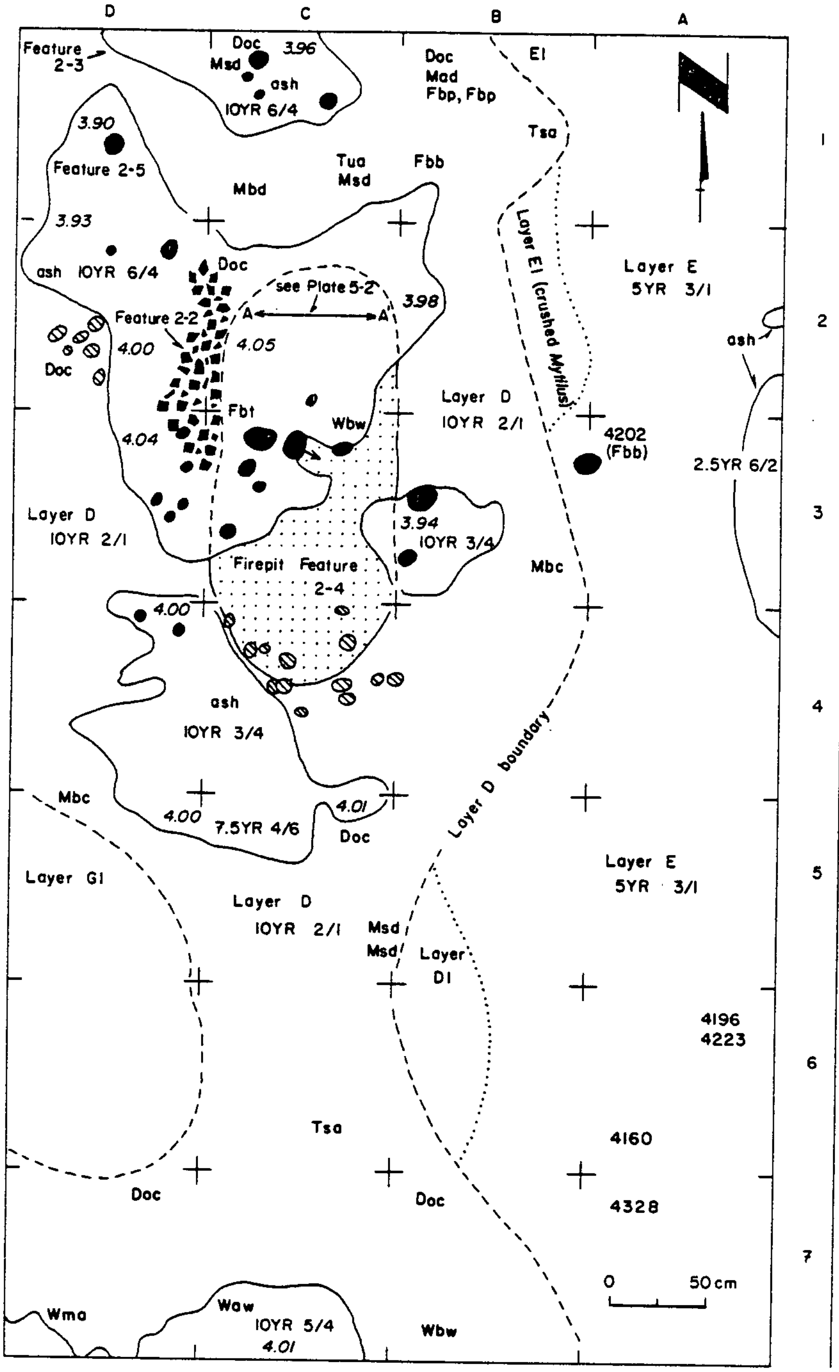
Layer D4 (0.27 m³, 399.1 kg)

Layer D4 consisted of a very dark gray (10YR 3/1) sandy matrix of broken and crushed shell with a large patch of worm castings. Basically D4 filled in a 25 cm deep hole between the F and G layers (see Figure 5-59) and bore no resemblance to the black Layer D3 which was above it. It appears to represent a small and distinct layer in which wapiti, large mammal bones and *Thais* dominate the identified fauna. Two artifacts were



See also: Woodworking (Figures 5-16, 5-17, 4194 D, 4116 D, 4180 C), Fishing (Figure 5-21, 4259 D, 4272 C, 4202 E, 4206 E1), Food Preparation (Figure 5-22, 4203 E1, 4196 E, 4237 D4).

Figure 5-57. Cluster IIb Artifacts.



Feature 2-2 charcoal

post mold

broken cooking stones

4.01 spot elevation in m above sea level

Artifact Key:

Decorative

Doc ochre (4150, 4182, 4188, 4191, 4195, 4261, 4283)

Manufacture

Msd ground slate detritus (4183, 4189, 4190, 4292)

Mad antler detritus (4181)

Mbd bone detritus (4282)

Mbc bipolar tool (4185, 4187, Figures 5-15, 5-57)

Textile

Tsa split bone awl (4192, 4199 Figures 5-18, 5-57)

Tua deer ulna awl (4184, Figure 5-57)

Fishing

Fbb bone bipoint (4234, Figure 5-57)

Fbt basally thinned point (4259, Figure 5-21)

Fbp bone point frag (4177, 4317)

Woodworking

Wbw bone wedge frag (4116, 4287, Figures 5-16, 5-57)

Wma <u>Mytilus californianus</u> adze frag (4193)

Waw antler wedge frag (4194, Figure 5-16)

Figure 5-58. Layers D and E Ash Spreads.

recovered from this layer, a bipolar core/stone wedge, and a chipped stone knife (Figures 5-15;4241: 5-22;4237).

Sometime following the shell deposition, this layer attracted large numbers of earth worms and landsnails as evidenced by a concentration of worm casts and Helix shells. Perhaps something discarded in the layer attracted them, or, this shell dump between two humus layers may have formed some kind of a refuge for these residents of the site, possibly a worm aestivation chamber (see Limbrey 1975:30-1). D4 was classed as a Type 2 refuse layer from steaming activities (Table V-XII).

Layer E1 (0.20 m³, 242.2 kg)

Layer E1 was a very dark gray (5YR 3/1) sandy matrix with crushed Mytilus and scattered clam shell fragments. Reaching a maximum thickness of 15 cm, E1 was recovered from the northeastern portion of the excavation area (see Figure 5-56). It appears to be a Type 2 refuse layer (Table V-XII), a dump of sand and crushed Mytilus, perhaps similar to the sand and Mytilus associated with the Feature 2-1 (see Figure 5-52), and may suggest the close proximity of a steaming mound. Landsnails and voles (see Figure 5-43) are a reminder that this layer was closely associated with surface layers. Artifacts included manufacturing, fishing and food preparation tools (see Figure 5-42, 5-57), all tools which were also noted in association with Feature 2-1.

Layer A (0.87 m³, 1,193.4 kg)

Layer A consisted of a black (10YR 2/1) humus matrix of worm sorted materials which extended across the surface of the entire excavation area (Type 8, extensive humus layer, Table V-XII). The lower boundary of this very thin layer ($\bar{x}$ = 5 cm) was the coarser pebble zone designated as Layer B. Shell was not common (see Figures 5-39, 5-43) and consisted of small

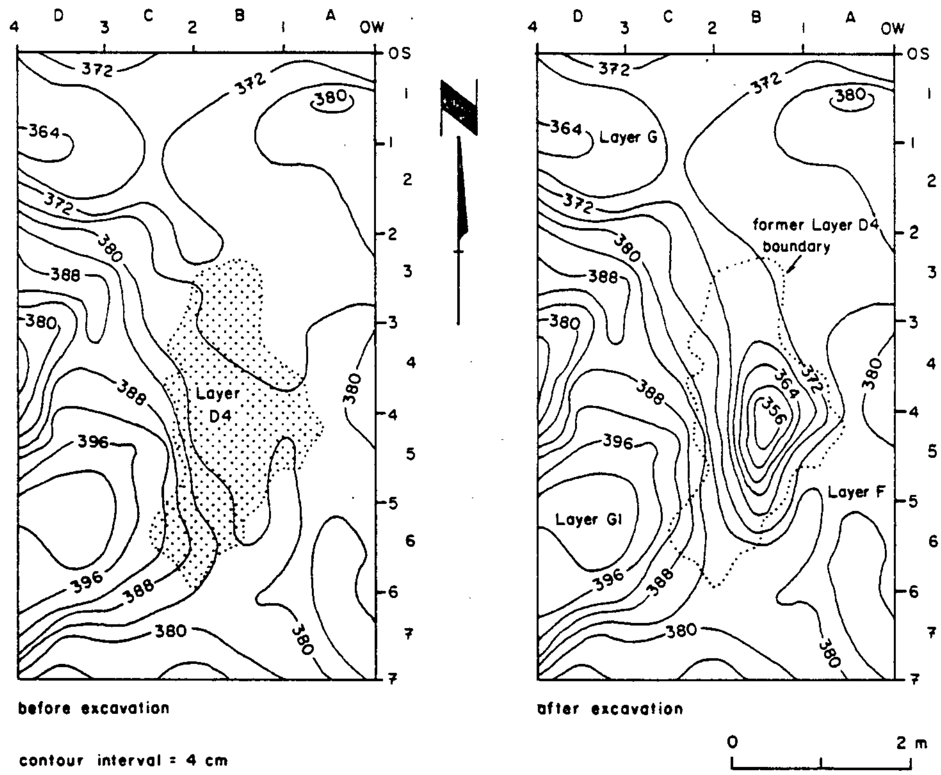


Figure 5-59. Extent of Layer D4.

fragments, while most shell and other faunal remains are probably intrusive from Layer B due to floralturbation and faunalturbation. This is evident from the ranks for Layers A and B (see Figure 5-43) where each Layer A constituent is present in equal or often greater quantities in Layer B. Domestic pig and cow are of course recent additions as are historic artifacts (see Figures 5-37, 5-26).

While some artifacts in this layer may be intrusive from Layer B, others may have been lost or dropped since the last shell processing activities took place (see Feature 2-1 above). A total of 62% of the artifacts from Layer A are decorative items (see Figures 5-42, 5-19) and may indicate the proximity of tree burials in the area between 1470 and 1850 A.D.. As burial boxes decayed, decorative burial goods as well as human remains may have fallen out, the bones probably decaying rapidly in the slightly acid Layers A and B (see Figure 5-9).

At the time of excavation the natural development of the shell midden surface had been arbitrarily fixed at a grass cover stage for at least 50 years and possibly longer. Over this time worm and root activity formed Layer A, while nitrification and subsequent leaching has increased the acidity of the surface layers of the site (see Chapter 3 and Figure 5-9).

Summary of Cluster IIb Layers

Layer D4 was the only Cluster IIb layer which was completely recovered as all others extended beyond the boundary of the excavation. There is also an apparent association of sand, certain shell species and humus as was noted in the Cluster IIa layers, possibly resulting from the deliberate spreading of sand on humus surfaces to facilitate shellfish sorting and processing, or perhaps simply from removing steaming mound coverings.

An obvious difference between the Cluster IIa and IIb layers is that the latter have much less *Ostrea*, *Tresus* and *Clinocardium* but rank higher in *Thais* (see Figures 5-39, 5-43). This difference may be observed in the shell weight ratios presented in Figure 5-39. It is not clear if this shift indicates a change in species preference, the environment, or simply a predominance of species consumed immediately while shellfish preservation activities took place outside of the excavated area.

As with the previous cluster, Cluster IIb is also dominated by *extensive humus layers* (Type 8, see Table V-XII) and sandy shell layers discarded from steaming activities (Type 2, *refuse layers*). Layers D and E also contain *ash spreads* and post molds (Type 5 layers) which could have been excavated separately if time had been available. A summary of layer types is presented in Table V-XII.

All artifact classes were represented in the Cluster IIb layers although manufacturing and decorative items were most common (see Figure 5-42). Many of these artifacts could have entered the site through loss, especially decorative items which may have fallen from decaying tree burials. The clustering of woodworking artifacts, and of textile manufacturing and fishing artifacts in Layers D and C suggests the presence of work areas (see Figure 5-56).

Cluster III Layers

These 7 layers were the largest ones recovered from Crescent Beach and contained the greatest quantities of faunal remains, dominated as in the previous layers by shellfish (see Figures 5-43, 5-60). They also contained 60% of the artifacts from the site with all major groups represented (see Figures 5-42, 5-61, 5-62). Presumably they include lost items as well as those broken or discarded during use. The seasonality dating of shell valves from these layers overlaps with the dates obtained from the other clusters indicating these layers were also deposited in February or March (Figure 5-6).

Layer L1 (2.35 m^3, 2,555.8 kg)

Layer L1 was a dark grayish brown (10YR 4/2) sandy matrix with lots of shell and other food refuse (see Figures 5-11, 5-43). Extending across the entire excavation, it averaged 16 cm in thickness, but reached 34-41 cm in Unit B1. A thin 3-4 cm interface Layer L was removed from some portions of the excavation to isolate any L1 matrix which was mixed with overlying J humus layer (see Figure 5-7). A piece of antler detritus was recovered from Layer L.

Artifacts from L1 were rare and consisted of a fragment of a ground bird bone bead (Figure 5-62; 4291), a bone wedge or chisel tip (Figure 5-61; 4260), a bipolar core/stone wedge (Figure 5-61; 4325), and the base of a

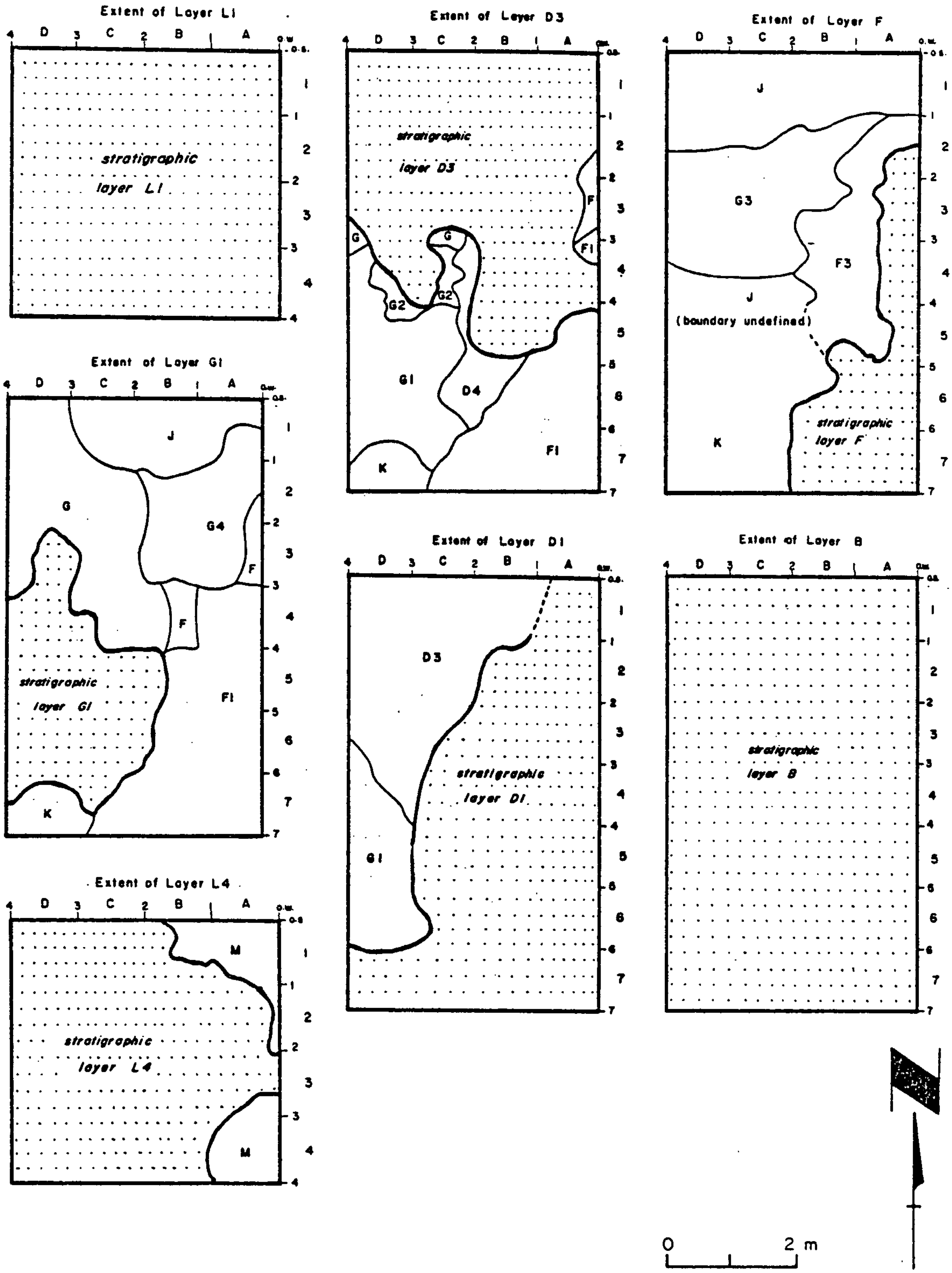


Figure 5-60. Cluster III Layer Boundaries.

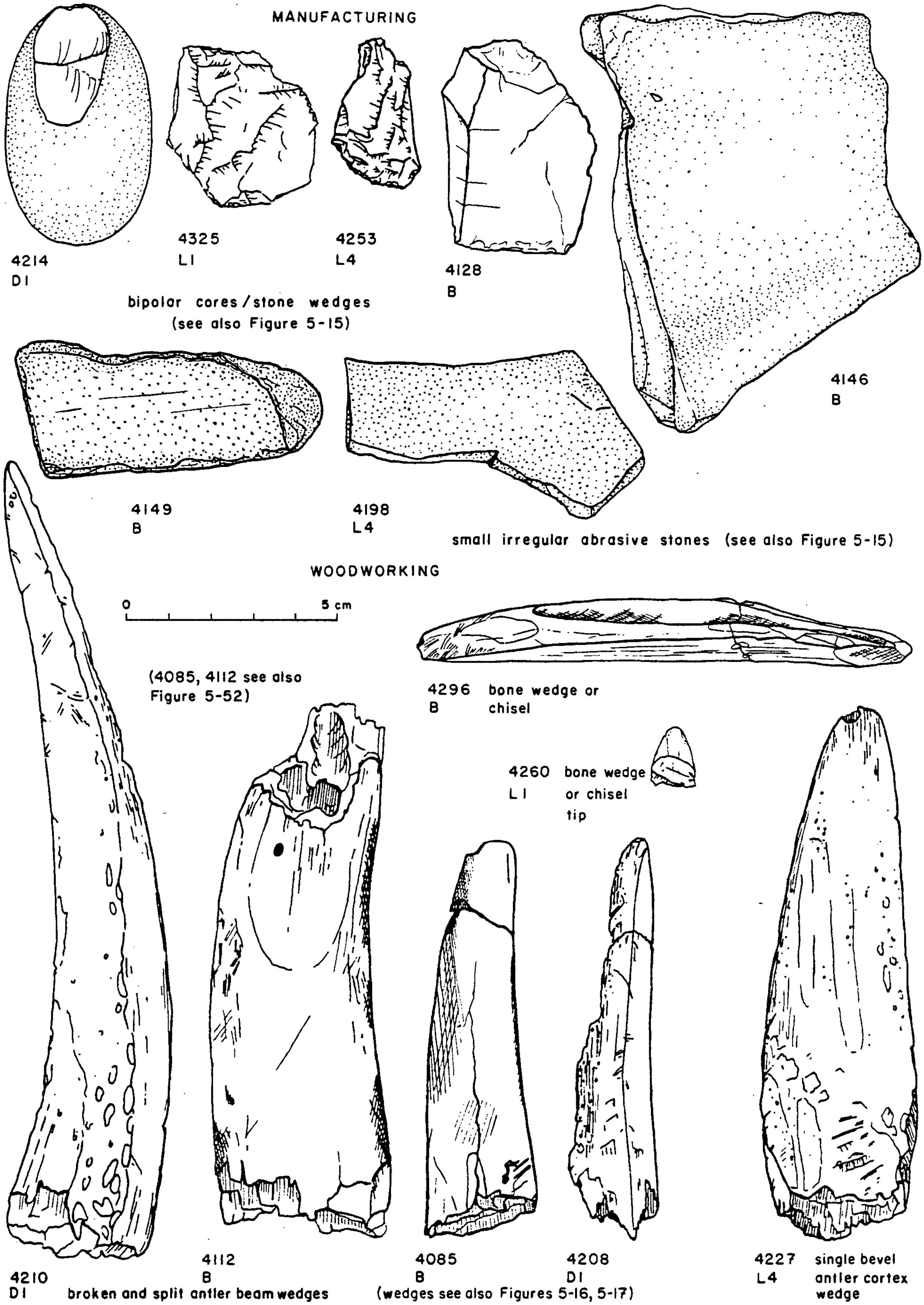


Figure 5-61. Cluster III Artifacts I.

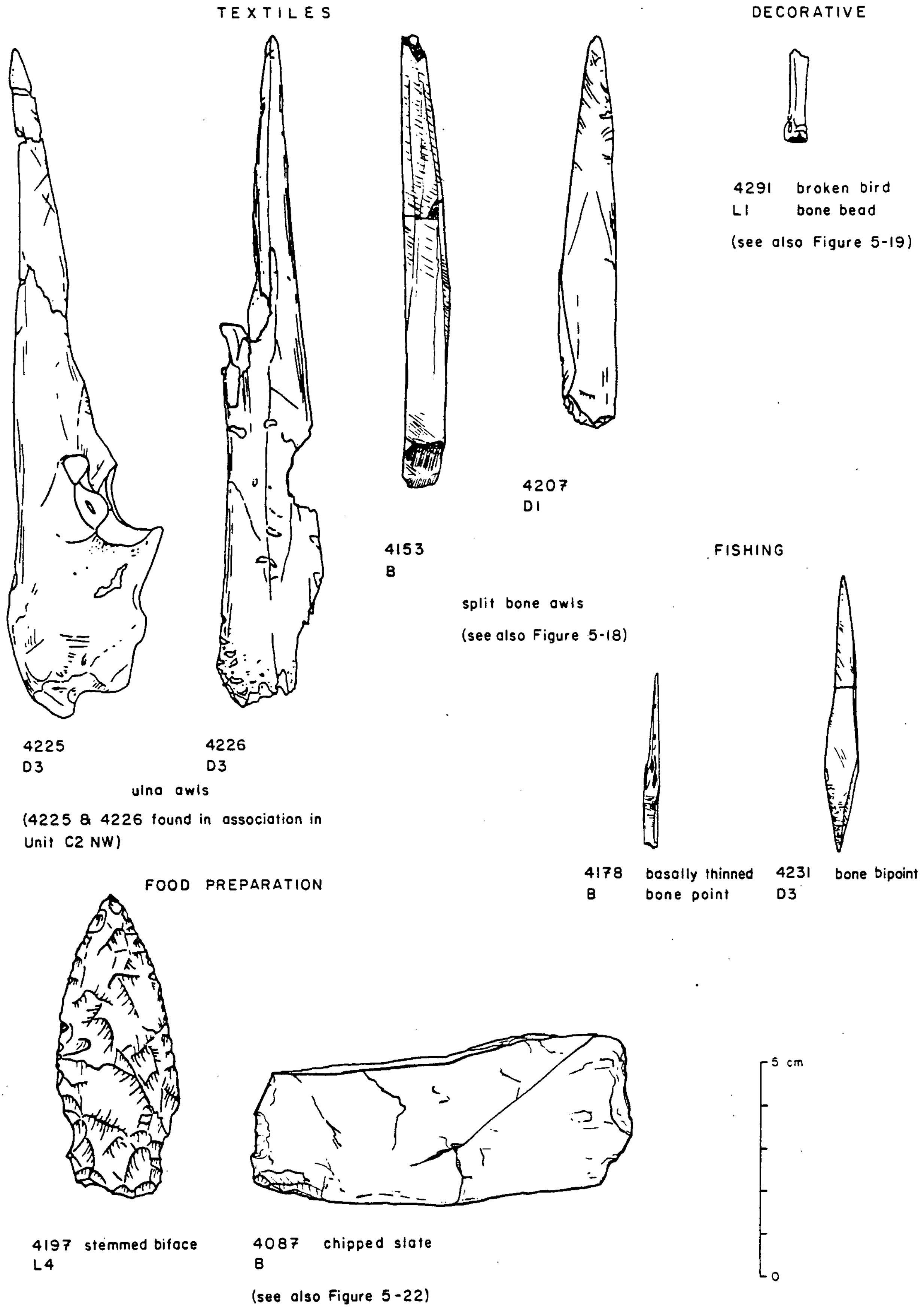


Figure 5-62. Cluster III Artifacts II.

split bone awl (4327). Charcoal and broken cooking stones were very common (Figure 5-23) and as the layer lacks ash spreads, hearths and other de facto refuse, it is best classed as a Type 2 refuse layer (see Table V-XII). Some disarticulated human remains were also found in this layer which probably fell from nearby tree burials.

Layer D3 (1.43 m^3, 1,988.5 kg)

Layer D3 was a black (10YR 2/1) sandy humus with shell which averaged 11 cm in thickness and while lensing out along its southern edge, reached 15 to 20 cm along the northern slit trench. A total of 15 artifacts were removed from D3 and included manufacturing, woodworking, textile, ceremonial and food processing artifacts (see Figures 5-42, 5-14, 5-15, 5-16, 5-17, 5-62). A well formed ulna awl (4225) was found in Unit C2NW in close association with a poorly made split bone awl (4226) (see Figure 5-62). Scattered human remains were recovered while broken cooking stones and charcoal were also common (see Figures 5-23, 5-42).

Although the presence of artifacts indicate a number of activities in addition to refuse deposition, de facto refuse consisted of only a small ash patch in Unit C2 and a 10 cm diameter post mold in Unit B1. Shell and other food remains were very common (see Figure 5-43) indicating D3 was a Type 2 refuse layer (see Table V-XII). However, the presence of humus as well as landsnail shells and insectivore bones indicate the layer was probably modified by site vegetation and must also be classed as a Type 8 extensive humus layer.

Layer F (1.26 m^3, 1,530.8 kg)

Layer F was a dark brown (5YR 3/1) matrix with a large quantity of whole shell and fragments. Visually this layer consisted of clam shells and little else and was also encountered in 1976 during the excavation of

Test Unit A (see Figure 2-34, "Whole and partial clam valves"), and obviously resulted from a large steaming operation. Only a small portion of the layer was excavated, what appears to be the northwest corner of a large shell dump. Feathering out along its northern and western edges, Layer F reached a maximum thickness of 56 cm in Unit A7SE and 75 cm in Test Unit A. Some of the underlying layers observed in Test Unit A may have been associated with this steaming operation, as may Layer F2 (see Cluster I layers).

Other food remains besides shell were common, although not as plentiful as in some of the other Cluster III layers (see Figure 5-43), and in light of the absence of artifacts and de facto refuse, and the dominance of shell (approximately 87% of the layer weight, see Figure 5-39), Layer F is clearly a Type 2 refuse layer (see Table V-XII). A wood charcoal sample from this layer provided a radiocarbon date of 1,350 ± 100 B.P. (Gak 7261), some 200 years older than two dates from the underlying Layers L356 and L4 (Gak 7262, 7263, see Figure 5-8). Layer F overlapped the L layers as indicated by the Harris Diagram (see Figure 5-7) and thus may be considered younger.

Unique to Layer F was the only complete human interment which was recovered. Burial 2-1 (Figure 5-63) was encountered in Units A4 and A5 along the western edge of the layer. There was no evidence of an intrusive burial pit to accommodate this interment, the first indications of which were pedal phalanges protruding through the Layer F shell. It appears that the shell had been raked over the burial to cover it and thus the burial post dates the shell deposition. As all other human remains from the site indicate the use of tree burials, it is possible this burial represents the impromptu interment of a body found on the beach.

This burial was an adult male (over 30) represented by a very fragmented but nearly complete skeleton (right hand missing ante mortem). Decay

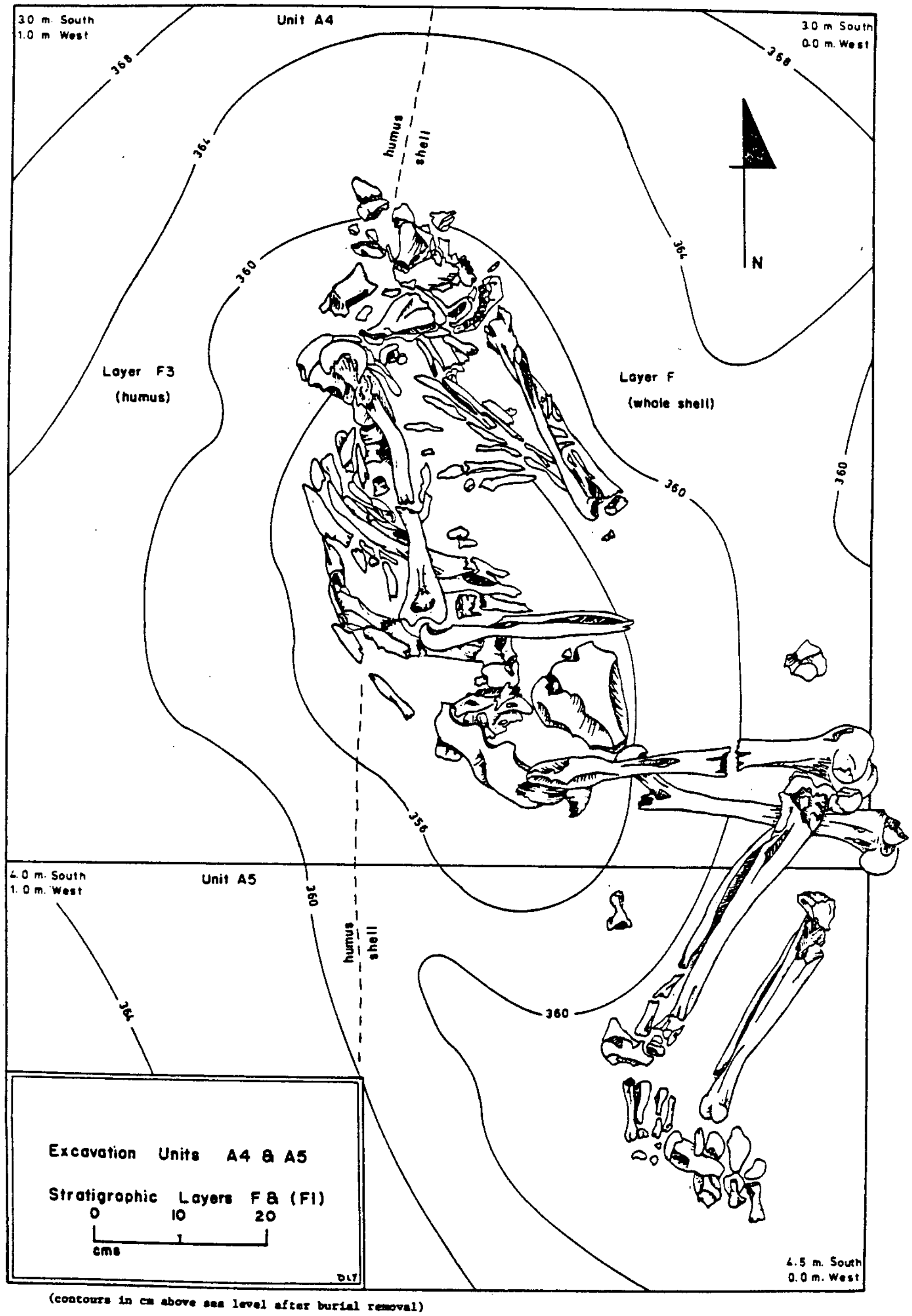


Figure 5-63. Burial 2-1 from Layer F.

was very pronounced in those portions of the skeleton lying along the boundary of the shelly Layer F and the humus F3 (see pH values Figure 5-9), while numerous worm casts, landsnail shells and insectivore remains were also found. Inspite of the poor condition of many elements including the cranium, Beattie (n.d.) was able to determine the skull was lambdoidally deformed, and noted degenerative arthritic changes in lower limb and pelvis indicative of a lifestyle associated with excessive stresses to the locomotory skeleton. No burial inclusions were observed.

A very thin interface layer was removed from the surface of Layer F and designated Layer F1. Consisting of mixed Layer F shell and humus from overlying Layers D1 and D3, this matrix was removed in an attempt to avoid layer mixing. Two artifacts were recovered from F1, a piece of ochre (4314) and a bone pendant (Figure 5-19; 4311). Both are probably intrusive from Layers D1 or D3.

Layer G1 (0.85 m^3, 1,067.3 kg)

Layer G1 was a yellowish to dark brown (10YR 5/4 to 10YR 3/3) layer of burnt shell. Control of this layer was lost during excavation at a depth of 50 cm in Unit C5 resulting ultimately in the abandonment of the southern 3 rows of excavation units. Concern over uprooting the large Douglas Fir south of the excavation and dwindling time were also factors, however, in all honesty there were no tears over the loss. It became apparent during the excavation that this layer and possibly one beneath it had caught fire resulting in obscured boundaries. To eliminate possible mixing of layers, quadrants from Units C5 and C6 were dropped from this analysis.

It is possible this fire originated from Layers G2 or G1 ash which lay on G1 (see Figures 5-45, 5-46, 5-48), although these layers also lay on the unburnt Layer G which suggests they are unlikely sources. Burning was not uniform throughout the layer in which approximately 89% of the shell was burnt while other faunal remains also showed differential burning. Inspite of this incomplete burning, Gl contained between 96 and 99% of the burnt shell from the site (depending upon species).

Only a handful of artifacts were recovered from Gl including an antler wedge (Figure 5-17; 4252), a split bone awl fragment (4302), a piece of ochre (4305) and a basally thinned bone point (Figure 5-21; 4299). None of these artifacts showed evidence of burning although two fragments of an antler harpoon (Figure 5-21; 4203, 4204) were burnt as was a piece of antler detritus.

Layer Gl reached a maximum thickness of 40 cm along the exposed beachfront, but lensed out on all other sides. Lacking de facto refuse and taking its shape into account it is most likely that Gl was a Type 2 refuse layer (see Table V-XII) although it may once have contained some humus. However, the fact that it lensed out on three sides and contained very few artifacts suggests this was not so.

Layer L4 (1.73 m^3, 2,558.4 kg)

Layer L4 was a dark gray (10YR 4/1) sandy shell layer high in *Mytilus* with lenses of other shell species. It ranged in thickness from 28 to 36 cm along the western, northwestern and southwestern edges of the excavation, but lensed out against the underlying Layer M on the east (see Figure 5-60). The depositional history of this layer is complex and may have extended over more than one season although it is clearly a Type 2 refuse layer (see Table V-XII) associated with steaming activities.

Part of the complexity of this layer results from the presence of two layers contained within L4, L4 carbon, a Type 3 layer or pathway (see Cluster I layers above), and a layer high in *Clinocardium* and *Tresus* designated as L4 shell (see Cluster IIa layers), a Type 2 refuse layer which may represent the processing of selected species for preservation.

Unique to Layer L4 and perhaps indicating some kind of ritual activity were 58 bones representing wings and feet from exotic or non-food species of birds. Identified were Bonaparte's gull, great blue heron, great horned owl, Barrow's goldeneye, and white fronted goose (see Table V-X). Possibly associated are 17 bones representing a right front foot of a long-tailed weasel (Mustela frenata). It is not obvious whether these remains indicate ritual activities, the loss or abandonment of ceremonial regalia, or grave goods which fell from a tree burial. Disarticulated human remains were also recovered from L4 while it should be noted that ochre was not reported.

Wapiti and deer were important in L4, in fact, this layer contained 56% of the wapiti and 54% of the deer identified at the site. While most of the deer and wapiti from the site consisted of leg elements, the wapiti remains from L4 were predominantly body elements (see Figure 5-38). Minimally two individual wapiti were present, a young adult and a large adult. The young adult remains included a distal epiphysis of a left tibia from Excavation Unit D2, a phalange and its epiphysis from Unit D1, and a cluster of 81 pieces of bone from Units A2 and B2 representing a disarticulated pelvis and lower back. One vertebrae body had sharp cut marks on it while a stemmed biface (Figure 5-62; 4197) was found in association with these bones in B2SW and may have been lost during butchering.

All of the young adult wapiti bones (and the biface) were resting directly on the underlying Layer M although surrounded by shell. They clearly result from an earlier event than the shell deposition which means the L4 seasonality dates may not be used to date the butchering. Just how much earlier could only be answered if it was possible to date the wapiti with the same accuracy as the shell. However, indirectly the evidence tends to suggest the time between butchering and shell deposition was probably minimal. These bones were broken and brittle from crushing and contact with humic acid from Layer M, but, most were complete elements, bore no evidence of scavenging by dogs or rodents, and had a dark reddish brown colour indicating they had not been weathered. If these bones had been left exposed on the surface for any length of time I would expect the bones to be dispersed over a much wider area, poorer preservation, and some accumulation of humus around them, or evidence of their movement into the Layer M humus.

The large adult wapiti remains were scattered across and throughout the layer and included an axis, a cervical vertebra, a nearly complete right metatarsal, two cannon bone fragments, and some 75 fragments of a left scapula (from C3SW). Cut marks were also observed on the metatarsal bone (see Figure 5-64).

Deer remains comprised 54% of the site total and represented a minimum of an adult, a young adult, and a juvenile. It is not clear how much of these remains represent food as with the exception of a juvenile axis and 12 adult molar fragments, all other bones could have been tools, curated as raw material, or attached to hides. This includes an adult left scapula, a left radius, 6 cloven bones, and 3 sesamoids.

Too little of Layer L4 was excavated to permit determining if complete animals were represented, or only portions of carcasses. Thus, while it may be stated that ungulates were occasionally butchered at the site, it is clear they were not an important food source. Only 2.8 kg of deer and wapiti bones were recovered from the site (5.0 kg if large mammal bones are assumed to represent deer and wapiti), with over half of it from L4.

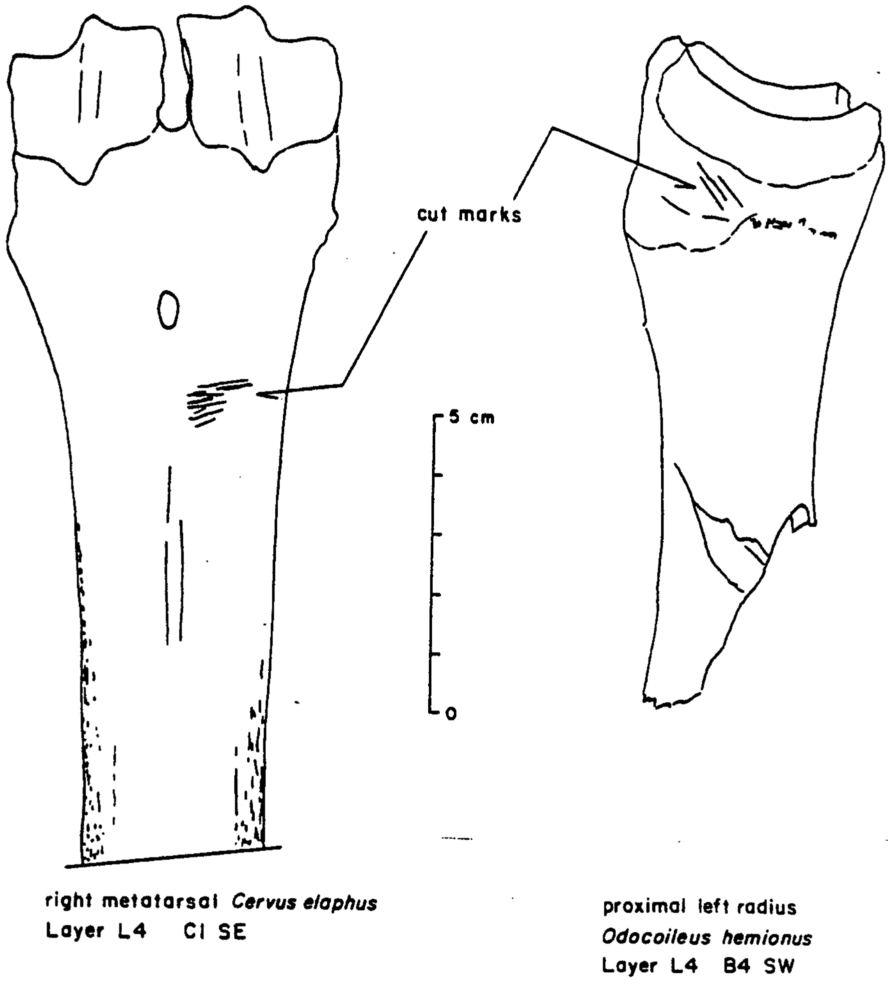


Figure 5-64. Butchering Marks on Ungulate Bones.

The remainder of the recovered ungulate remains were distributed over 17 and 12 layers respectively with some bias towards leg bones (see Figure 5-36, 5-38). Allowance should also be made for those bones curated as raw material, and for any elements resulting from natural deaths on or near the site.

Although discussion here has focused on ungulates, it should be noted that fish and waterfowl remains were very common in this layer (see Figure 5-43). Pacific herring dominated the fish bones with both head and body elements present while mallards were the most frequent waterfowl. Similar to the rest of the site wing and breast bones were most common accounting for 84% of the L4 bird elements.

In total 19 artifacts were recovered from L4, 68% of which were manufacturing related tools while other artifacts reflected woodworking, textiles and food processing (Figure 5-42). Bone and antler detritus was common perhaps a reflection of a ready supply of raw materials. Also common were bipolar cores/stone wedges and lithic detritus and although attempts to match raw material was not successful, bipolar technology may have been the source of this lithic material (see Figures 5-15, 5-61, Table V-III). Other manufacturing artifacts included an abrasive stone (Figure 5-61; 4198) while woodworking was indicated by the presence of antler wedges (Figures 5-16, 5-61). A bone needle fragment may indicate skin working while food processing, probably the butchering of a portion of a wapiti is represented by a stemmed biface knife (Figures 5-18, 4289; 5-62, 4197).

Layer D1 (1.73 m^3, 2,328.2 kg)

Layer D1 was a very dark brown (10YR 2/2) sandy humus layer with Clinocardium and ash spreads. Lensing out along its western boundary, D1 averaged 11 to 12 cm in thickness along the eastern and southern slit trenches. Clinocardium dominated the shellfish remains while fish bones were also common (see Figures 5-39, 5-43). Initially then this layer may be classed as a Type 2 refuse layer (see Table V-XII) from steaming activities, while de facto refuse and artifacts indicate other activities.

De facto refuse included ash spreads, post molds and a hearth which was recorded as Feature 2-6 (see Figure 5-65). A general similarity of these remains with those from Layer D should be noted although there is a clearer association between the Layer D1 ash spreads and hearth (compare with Figure 5-58). One ash spread was isolated as Layer D2 (see Cluster I layers) while Feature 2-6 was a sand and gravel bottom firepit or hearth similar to Feature 2-4 (see Plate 5-2). A piece of wood charcoal from this hearth submitted for radiocarbon assay provided a modern date (Figure 5-8, Gak 7260). Although there is not an obvious pattern to the Layer D1 post molds, these are probably indicators of smoking or fire drying activities as expected for Type 5 layers (see Table V-XII, ash and charcoal spreads).

Woodworking artifacts are common and include one complete antler wedge (Figure 5-17, 4209), and three pieces of broken wedges (Figure 5-16, 4217; 5-61, 4208, 4210). Also recovered from Layer D1 were three pieces of an elbow adze found 2 to 4 m apart, one fragment in the slit trench (Figure 5-66), but which fit together to form a single composite tool. The antler haft (4212, 4078) part of the tool is bi-socketed to receive the adze (4213) in one end and a wooden handle in the other. Grooves along each side of the haft presumably permitted the handle to be lashed on, while it would appear that the weakening of the haft from grooving may have caused it to break during use. A broken elbow adze and broken antler wedges are strong indicators that woodworking activities are also represented in Layer D1.

Manufacturing of antler tools may also have been important as 4 pieces of antler detritus as well as small antler shavings and chips were recovered (see Figures 5-37, 5-42). Other artifacts include a bipolar core/stone wedge (Figure 5-61, 4214), a split bone awl (Figure 5-62, 4207), a piece of ochre (4141), and a fragment of a bone point (4290).

Layer B (3.59 m³, 5,499.1 kg)

Layer B was a very dark gray (10YR 3/1) humus and shell layer with historic debris which averaged 12 cm in thickness and extended across the entire surface of the excavation area. It was separated from Layer A because of an observable increase in small pebbles and pea gravel which was also apparent in the sediment curve for the layer (Figure 5-11). Historic artifacts were common (Figure 5-26), but were larger and heavier

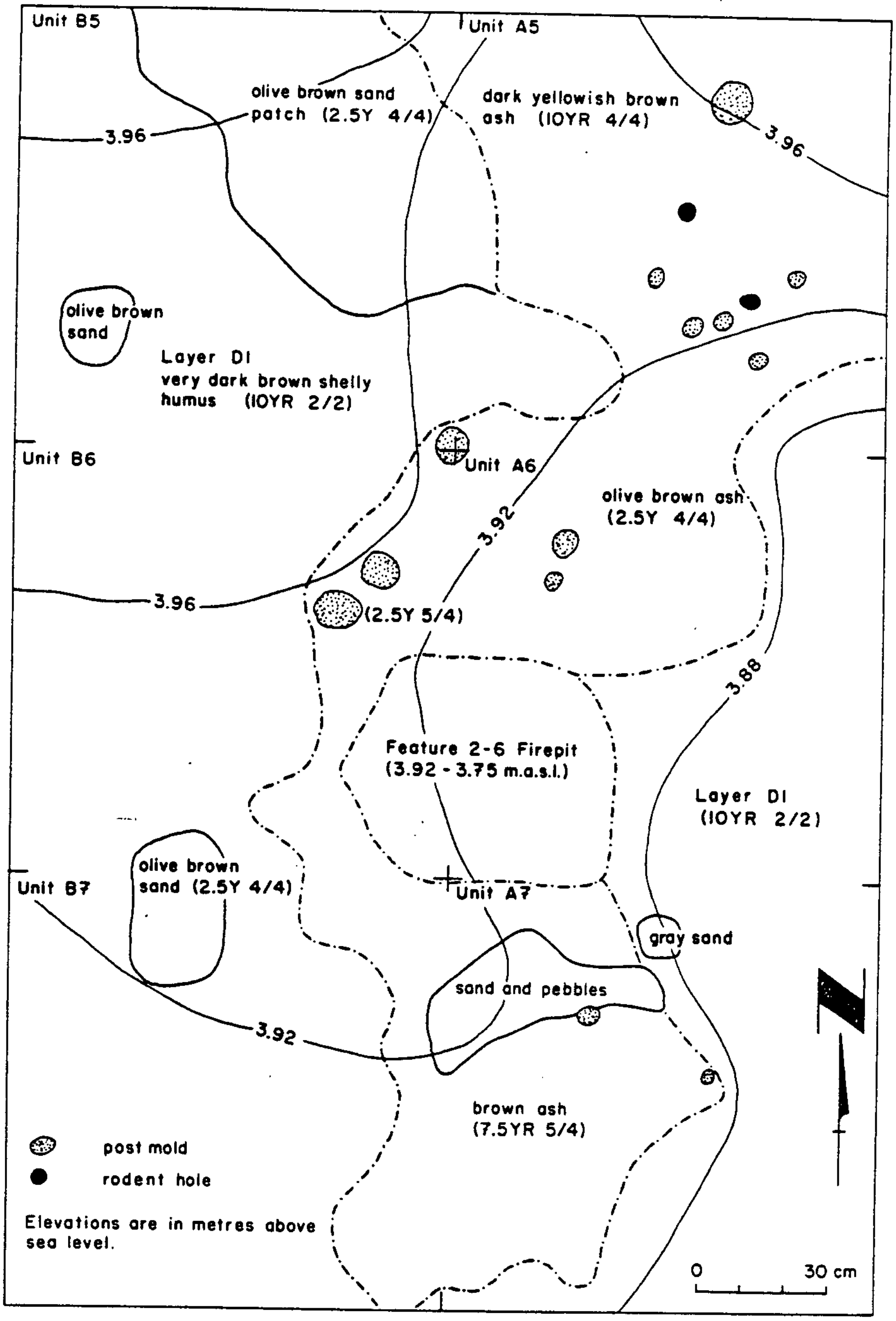


Figure 5-65. Layer D1 Firepit and Ashspreads.

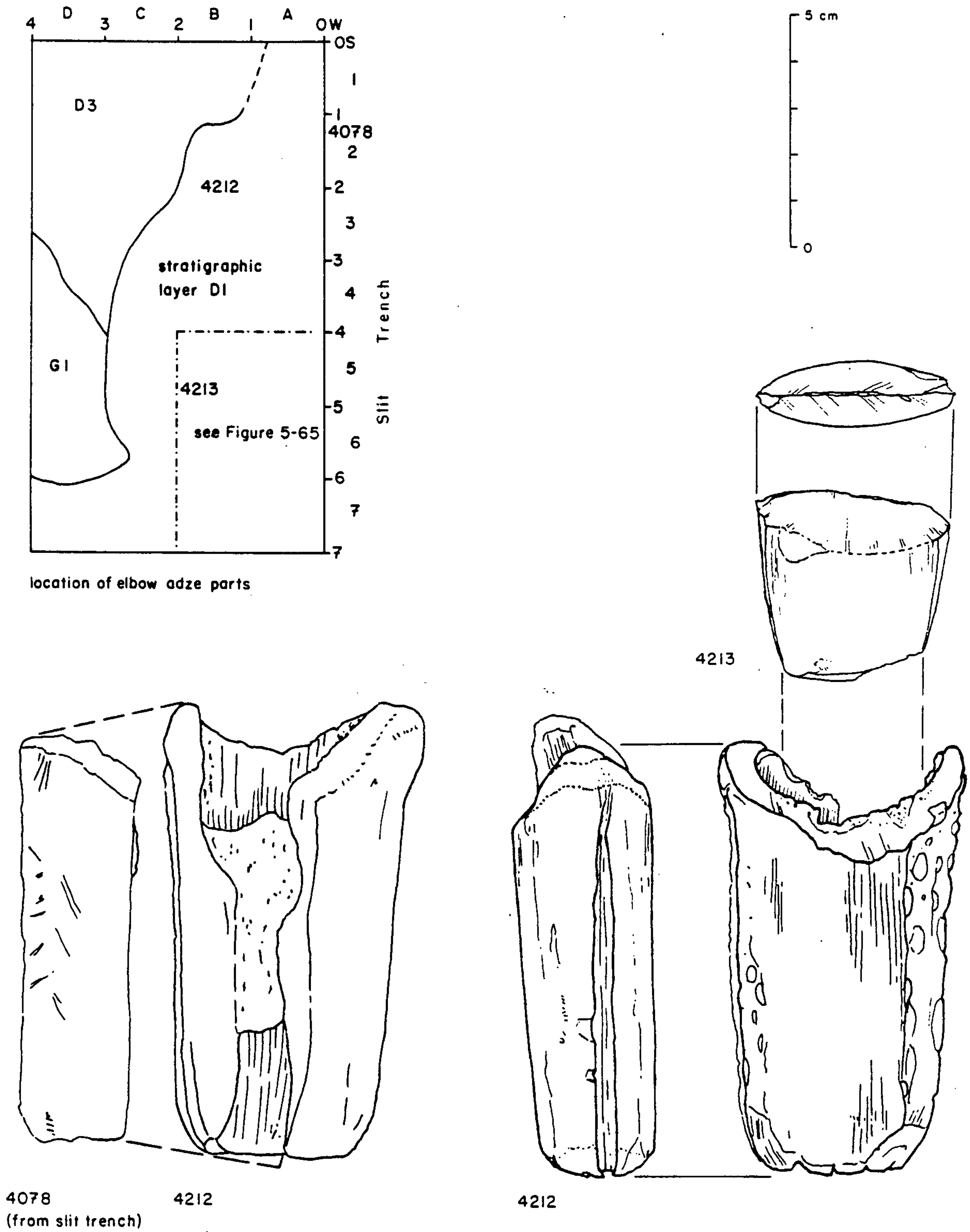


Figure 5-66. Elbow Adze from Layer D1.

than those recovered in Layer A. The average weight of Layer B historic artifacts was 5 g compared to only 1.3 g for Layer A. Sorting of materials was much less pronounced along the western edge of the excavation where the surface began to slope towards the beach and the grass cover was replaced by shrubs whose roots tend to mix rather than sort.

Contained within Layer B was Feature 2-1 (Figure 5-52), a small steaming mound (Type 1 layer, see Table V-XII) dated to 480 B.P. which represents the last shell processing at this portion of the site. The humus which forms a major part of Layer B (and Layer A) has accumulated since that date while the sorting which allowed the separation of Layers A and B probably occured over the past 50 years that a grass cover has been present. Shell was scattered throughout Layer B, but was greatly concentrated to the east and north of Feature 2-1. Clinocardium was most frequent while other common faunal remains included Protothaca and Tresus as well as fish and ungulate bones. Waterfowl remains were not as common as they were in the other Cluster III layers (see Figure 5-43).

Layer B contained 34% of the prehistoric artifacts recovered from the site with all major groups represented (Figure 5-42). While some objects such as decorative items (Figure 5-19) may have been lost at the site, others may have been used in activities which were conducted on the site surface. Included could be some of the many manufacturing, woodworking, textile and fishing artifacts from this layer (see Figures 5-14, 5-15, 5-16, 5-17, 5-18, 5-21, 5-22, 5-61, 5-62). Artifacts found in the vicinity of Feature 2-1 do not provide clues as to which artifacts may have been lost or which had been purposely discarded. Many were probably unintentionally lost as the site surface would have been heavily vegetated for most of the last 500 years. Although Layer B was a Type 2 refuse layer containing refuse from steaming activities, much of the layer has been subject to surface vegetation and thus must also be classed as a Type 8 extensive humus layer (see Table V-XII).

Summary of Cluster III Layers

None of these large layers were completely excavated as all extended beyond the boundaries of the excavation area. All layers were classed as Type 2 refuse layers resulting from shellfish steaming and processing activities while humus development was noted in Layers D3, D1 and B (Type 8 extensive humus layers, Table V-XII). In addition, Layer D1 which contained a hearth, ash spreads and post molds was classed as a Type 5 layer, while Layer B containing a small steaming mound was also classed as a Type 1 layer. A summary of layer types is presented in Table V-XIII.

The association of shell refuse and sand noted in the Cluster II layers was obvious in Cluster III and where humus development did not obscure the finer details of stratigraphy, these layers consisted of a continuous but irregular scattering of shell refuse and sand. While these scatters could not be called lenses, they did not appear as mounds which might be expected if baskets of shell were discarded. Rather, they appear to be primary deposits resulting from the sorting of shellfish preparatory to meat preservation, and seem to offer support to Schumaker's (1875:338-9) observation made in Oregon that at a seasonal site shell refuse was simply discarded over the ground.

Thus it would appear that Cluster III layers and probably some Cluster II layers consist of multiple refuse deposition events which span the occupation represented by a particular layer. Closer attention to detail during excavation could isolate these mini-layers although a substantial investment of time would be required. Obviously the careful selection of samples would be the only feasible method to employ.

The Cluster III layers contained 60% of the artifacts recovered from the site with all major classes represented (Figure 5-42). Although many of these artifacts may have been lost in shell and humus deposits, the fact that some tend to group together (see Figure 5-58) and that others are broken (Figures 5-61, 5-62) indicates that these layers may not be considered solely as artifact traps (see Schiffer 1976:32). Woodworking was clearly an important activity as may be seen from the presence of broken bone and antler wedges, as well as an elbow adze. The manufacture of herring rakes and the splitting of wood skewers for drying fish and shellfish may account for all observed woodworking tools although it seems unlikely. Bone and antler detritus and other manufacturing artifacts indicate tools were made at the site, especially wedges, awls, and bone points for fishing.

The Cluster III layers were the largest layers excavated so that it is not unexpected that they contained the greatest quantities of faunal remains (see Figure 5-43). With the exception of chiton remains, all other faunal classes exceed the quantities observed in the other layers. The fact that Cluster III includes layers from all parts of the site indicates there was no significant change in resources during the time represented by this deposit.

5.7 SUMMARY OF LAYER TYPES AND MIDDEN DEVELOPMENT

The analysis of midden constituents indicated that shellfish and herring harvesting were the most important subsistence activities at Crescent Beach, while seasonality dating placed this occupation within a short time period in February and March. Based upon this evidence 9 types of layers were expected (see Table V-XII), although only 6 were recognized among the 31 recovered layers (Table V-XIII). However, these 6 types account for 27 of the Crescent Beach layers while the remaining 4 were very similar and possibly represent refuse discarded from hearths, or perhaps small cooking ovens. These 4 layers were not expected and at present a satisfactory explanation cannot be provided to account for them. They were classed as Type 10 layers.

With the exception of the Type 10 layers which may represent secondary refuse, all other layers represent either de facto or primary refuse, or natural deposits. Besides lending support to Schumaker's (1875) observations, they also support Schiffer's (1972:162; 1976:15) hypothesis that a high correspondence should be observed between use and discard at a seasonal site such as Crescent Beach. Insofar as it could be determined with the data obtained from Crescent Beach the majority of the layers are compatible with what was expected from a seasonal shellfish and herring processing site situated on Boundary Bay.

Most common were Type 2 refuse layers consisting of sand, shell and other food refuse resulting from the processing of food from steaming mounds. Accounting for 19 of the Crescent Beach layers, many appear to be constructed from a scatter of materials rather than mounding, suggesting they result from the actual sorting of shell and removal of meat prior to preservation, rather than simply from shell discard. While 10 of these layers consisted purely of shell and other cultural refuse, 8 were also classed as extensive humus layers (Type 8). This is not surprising considering the sporadic and temporary occupation of the site as cultural activities would commonly occur on a developed humus surface, or vegetation would soon follow any human occupation.

As might be expected humus layers were the second most common layer type and in addition to the 8 Type 2 layers (refuse layers) with humus, 3 other layers were classed only as Type 8 (extensive humus layers) and 1 as a Type 9 layer (localized humus layer or leaf trap). The presence of a

	Layer	Predicted Types	Refuse Types	Cultural Activities	Natural Activities	Artifact Types (see Figure 5-42)
Cluster I	B1	2	primary	sand discarding	-	-
	D2	5	de facto	meat drying frame	-	-
	G1 ash	5	de facto	meat drying frame	-	-
	D5	n.e. (10)	de facto/secondary?	oven/hearth refuse?	-	F
	F4	9	humus	-	leaf trap (vegetation?)	-
	G2	n.e. (10)	de facto/secondary?	oven/hearth refuse?	-	-
	F2	n.e.(10)(1)	de facto/secondary?	oven/hearth refuse?	-	-
	L4 fcr	n.e. (10)	de facto/secondary?	oven/hearth refuse?	-	-
	L4 carbon	3	de facto	pathway	-	-
	L356	3	de facto	pathway	-	M
	L2	2	primary	shellfish processing	-	-
Cluster IIa	L4 shell	2	primary	shellfish processing	-	-
	L1 black	2, (3?)	primary, (de facto?)	shellfish processing (path imprint?)	-	-
	G3	2	primary	shellfish processing	-	M
	F3	2, 8	primary, humus	shellfish processing	vegetation	-
	G4	8	humus	-	vegetation	-
	J	8	humus	-	vegetation	M
	G	2, 8	primary, humus	shellfish processing	vegetation	MWDP
Cluster IIb	E	2, 8, (5?)	primary, humus, (de facto?)	shellfish processing, (meat drying frame?)	vegetation	WDFP
	D	2, 5, 8	primary, de facto, humus	shellfish processing, meat drying frame	vegetation	MWTDF
	C	2, 8	primary, humus	shellfish processing	vegetation	MWDF
	D4	2	primary	shellfish processing	(worm chamber?)	MP
	E1	2	primary	shellfish processing	-	MFP
	A	8	humus	-	vegetation	MDH
Cluster III	L1	2	primary	shell processing	-	MWTD
	D3	2, 8	primary, humus	shell processing	vegetation	MWTDF
	F	2	primary	shell processing	-	-
	G1	2	primary	shell processing (midden fire)	-	MWTDF
	L4	2	primary	shell processing	-	-
	D1	2, 5, 8	primary, de facto, humus	shell processing, meat drying frame	vegetation	MWTDF
	B	1, 2, 8	de facto, primary, humus	steaming mound, shell processing	vegetation	MWTDFP

artifact key: M - tool manufacturing, W - woodworking, T - textiles, D - decorative items, H - hunting, F - fishing, P - food preparation.

n.e. = not expected

(?) = uncertain classification

expected types (see descriptions, Table V-XII): 1 - steaming mounds, 2 - refuse layers, 3 - pathways, 4 - concentrations of cooking stones, 5 - ash and charcoal spreads, 6 - cobble mounds (not identified). 7 - habitation layers (not identified), 8 - extensive humus layers, 9 - localized humus layers, 10 - cooking ovens (not expected).

substrate for processing activities may have made humus layers attractive. Occupation during February and March corresponds to the time period when herbaceous vegetation has died back, making these surfaces available for human settlement.

The third most frequent type of layer were hearths and ash spreads with associated stake or small post molds (Type 5). The substantial development of these ash spreads indicates fires were maintained for sufficient time to reduce all fuel to ash, while the presence of post molds suggests that wooden frames were erected over them. This kind of de facto refuse corresponds to what was expected from smoking or drying fires and frames used to preserve shellfish or herring and prehaps for tanning hides. The possibility must also be considered that some of the ash spreads and post molds resulted from the presence of habitation structures. In particular, Layers D and D1 which each had a gravel lined hearth could be candidates (see Figures 5-58, 5-65). It is not improbable that meat drying frames might be erected in close proximity to shelters.

Two layers appear to be the remains of pathways (Type 3) while one other may represent humus trampled into an underlying shell layer. Trampled humus was also noted along one edge of the small steaming mound excavated in Layer B (see Figure 5-52). The only other example of a steaming mound (Type 1 layer) was Layer F2, a portion of which was encountered in Test Unit A in 1976. While obviously the remains of a steaming mound because of its close association with the heavy shell Layer F, this layer had clearly been churned and thus it was also thought to be the remains of a baking oven (see Table V-XIII, Type 10 layers). Four Type 10 layers were recovered and may simply represent redeposited cobbles, ash and charcoal from hearths and steaming mounds.

Three types of expected layers were not found or could not be recognized. Type 4 layers, concentrations of cooking stones and faunal material from cooking in wooden boxes would almost certainly require more detailed analysis of layer samples than was economically feasible. Post depositional mixing of materials as well as refuse disposal patterns could make their recognition very difficult. Type 6 layers, cobble mounds or alignments, and trenches of cobbles used in woodworking were not encountered even though woodworking artifacts were common in some layers. These layers were expected from descriptions given for the Kwakiutl and thus may not be applicable to the Coast Salish.

While Type 7 layers (Table V-XII, habitation layers) or the remains of temporary shelters were fully expected it is possible that insufficient attention was paid to stratigraphy during excavation to allow this identification. However, pathways which were expected in association with post molds (see Table V-XII) may have been destroyed by floralturbation and although some of the larger post molds may have resulted from shelter frames, the overall low visibility of these remains in the shell and humus layers made determination of any patterning impossible. One other factor which may suggest shelter outlines were missed is the higher artifact frequencies in the upper part of the site. It is anticipated that most of the activities reflected by these tools might take place in the vicinity of habitations.

It is possible that shelters at Crescent Beach were situated on the upper beach or behind the midden mound. A photograph of plank shelters taken at Departure Bay near Nanaimo, B.C. in 1874 (B.C.P.M., PN 5970) shows structures on the upper part of the beach. Two photographs from the B.C. Provincial Archives (PN 1420 and 1421) taken on the Fraser River near New Westminster, B.C. in 1867 show mat shelters along the upper mud flats of the river. Shovel testing of the area east of the excavation area was carried out in 1976 and while this area is low in shell, broken cobbles, ash and charcoal are very common (see Ham 1978:7, Area 10). Shelters erected in this area would be protected from any late winter storms which might blow into the bay.

It is apparent from the distribution of layer types in the excavated midden that there was a decrease in the intensity of shellfish processing through time (Figure 5-67). There is an obvious increase in humus on the upper part of the site and while it is doubtful this may be interpreted as a lessened intensity of occupation over time, a change in types of activities at this location seems likely. It was noted during the discussion of the Cluster IIb layers that those layers from the upper part of the site might reflect a greater emphasis on consumption rather than preservation of foods. Feature 2-1 from Layer B certainly supports such a stance as it is smaller than deposits in Layers F and F2 (and the L layers) which indicate large quantities of shellfish were processed. Some of the D and G layers suggest preservation activities were the dominant activities in these layers. This grouping of similar types of.layers would seem to suggest that an area used for any particular activity in one season might be used for the same activities in subsequent seasons.

Additional support for a shift in types of activities may also be obtained from the distribution of recovered artifacts, 87% of which were found above Layer F. Except for those indicating tool manufacture, artifacts from Crescent Beach are predominantly from the upper part of the midden while fishing artifacts were not recovered in the lower layers (see Figure 5-67). The casual examination of fish and waterfowl remains suggest greater quantities were represented in the upper layers as well although samples are not adequate to permit statistical testing. In addition to artifact manufacturing and fishing, other activities indicated in the upper

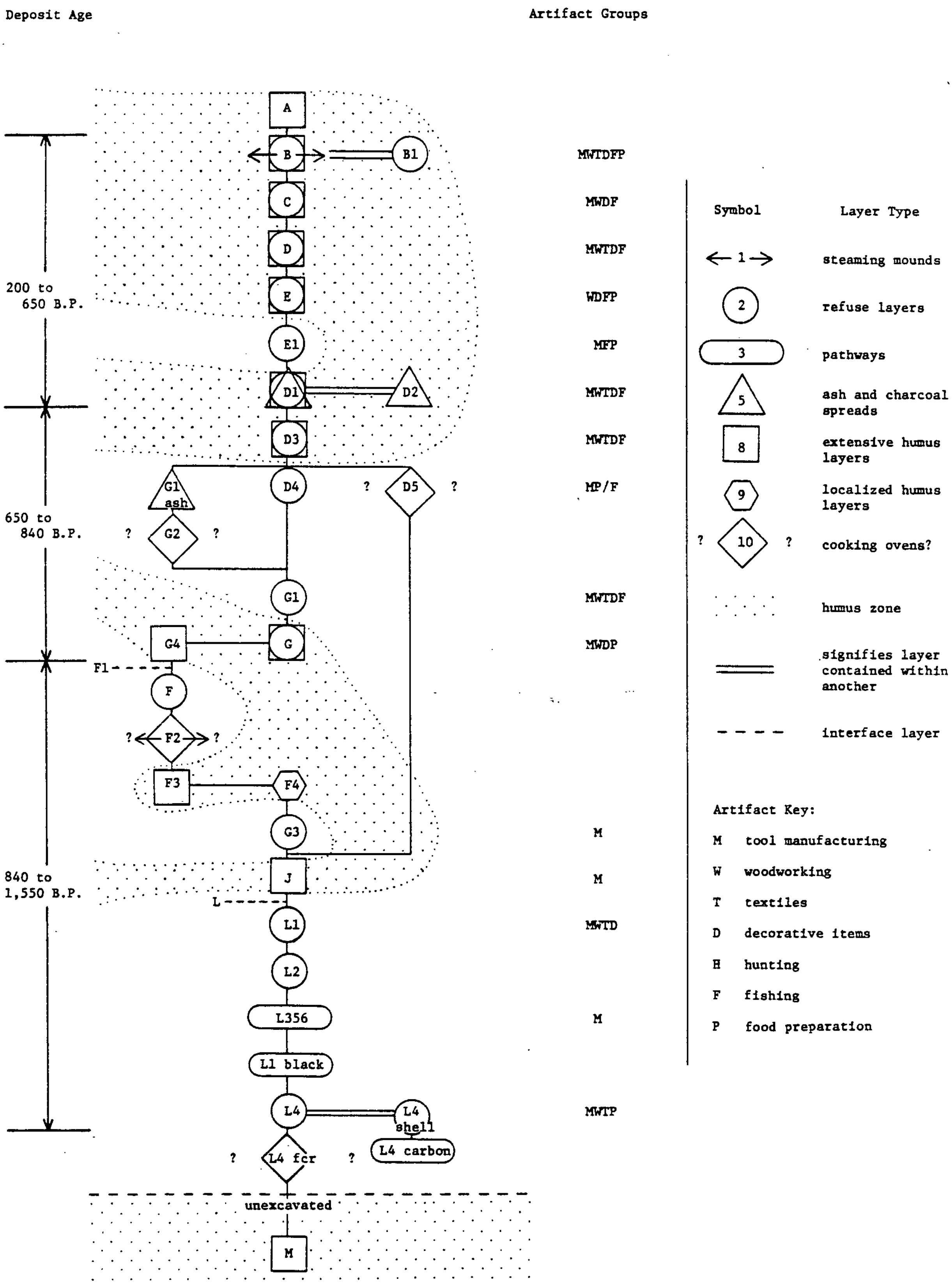


Figure 5-67. Harris Diagram of Crescent Beach Layer Types.

part of the site include woodworking, textiles (probably both skin working and basketry repair), food preparation and perhaps hunting. Decorative items of bone may have been manufactured as well as lost from tree burials and by the site occupants.

If Schiffer (1976:32) is correct concerning artifact traps, then we should expect to observe some variation in the distribution of complete and broken artifacts. Ordinarily functional tools would be curated with predominantly broken artifacts entering the archaeological record. Exactly the opposite pattern was observed in the upper part of the site (Layers A to G) where 58% of the recovered tools were complete and 42% were broken. Only those artifacts which would have been used as tools were included in these calculations. The binomial test (Siegal 1956:36) indicates this distribution could be due to chance however ($z=0.34$, $p=.37$). The lower part of the site conformed to expected with 62% broken artifacts and 38% complete ones. This distribution was significant ($z=10.4$, $p<.001$).

Although support for the presence of artifact traps is weak, it is possible to hypothesize why so many tools were lost in the humus rich upper part of the Crescent Beach site (see Figure 5-67). During February and March the site would have been relatively clear of the lush vegetation which would have covered it at other times of the year. Thus I do not expect vegetation cover to be responsible, but more likely the piles of wood chips from woodworking activities. A total of 91% of the woodworking tools from Crescent Beach were found in these upper layers including broken and complete tools. The examination of photographs of canoe building in Sendey (1977:35-6) leave little doubt as to why so many woodworking tools were lost.

Natural vegetation growth resulted in a high humus content in many layers and was as important in the overall site development as cultural activities including discarding of shellfish and other refuse. In addition to providing a substrate on which processing, preservation and other activities took place, vegetation growth also mixed cultural deposits. In the case of Layers A and B two distinct layers resulted, although modern occupation is ultimately responsible. No doubt during some periods in the site history salmonberry would have formed the dominant vegetation cover and may have added to the attractiveness of the site. Large quantities of wood chips from woodworking activities may also have encouraged the development of humus in the upper part of the site.

The distribution observed in Figure 5-67, a complex of layers reflecting cultural activities followed by humus indicating vegetation cover suggests the cluster pattern of occupation proposed in Figure 3-7a may be accurate. In fact, the stratigraphic grouping of similar types of layers suggests that not only did seasonal occupations tend to cluster, but that similar kinds of activities were usually conducted at the same location for several seasons. With reference to Figure 5-67, it is apparent that the L and F layers resulted predominantly from the processing of fish, shellfish and other foods, the D and G layers predominantly from meat preservation and manufacturing activities, and the upper layers, food consumption and manufacturing activities rather than preservation of food.

While there is an obvious indication of variation in the types of activities reflected through the site stratigraphically, this may not be taken as evidence of diachronic variation. It is hypothesized that the excavation of additional midden deposits would recover similar types of layers and cultural refuse, but that the stratigraphic order would be different from that observed here. Supporting this hypothesis is the fact that in Test Unit A excavated in 1976 approximately 60% of the recovered artifacts were from Layer F and below. This excavation was only 1 m southeast of the 1977 excavation while identical types of artifacts and refuse were recovered (see Figure 2-33 and Table II-III).

6.0 CONCLUSIONS

The basic goals of this study were to obtain information concerning Coast Salish subsistence activities at the Crescent Beach site, and to initiate a better understanding of the formation of shell midden layers. The exacting segregation, recovery and analysis of shell midden layers from a portion of the Crescent Beach site allowed both goals to be realized.

In addition, the close relationship observed between recovered archaeological remains and expected economic pursuits at Crescent Beach permits hypotheses to be made about subsistence activities at a number of other archaeological sites in the Strait of Georgia area. It is proposed that specialized seasonal sites may date to the time of the Locarno Beach Culture, and possibly even earlier. I am confident that the approach followed in this study has the potential to identify other Coast Salish and Proto-Coast Salish settlement types, and to elaborate on the subsistence activities which took place at these sites.

6.1 COAST SALISH SUBSISTENCE STRATEGIES AT CRESCENT BEACH

The analysis of faunal elements and midden layers from Crescent Beach indicate that between 1350 and 480 B.P. the site was occupied from February to March primarily for the harvesting of shellfish and herring. At present, this period is one of peak resource availability and abundance in Boundary Bay (Figure 4-5) while historic data and the range of species recovered from the site suggest this was also the case 1,500 years ago. Thus for a society dependent upon the environment for energy and surpluses this would appear as an optimal time to be in Boundary Bay.

The length of these seasonal occupations was not determined although Koike (1980, 1981, 1982) has recently demonstrated that length of occupation may be obtained from shellfish valves. Curtis (1970:56) reports that the Cowichan remained about a month at their herring camp and in view of the limited growth observed on shellfish from Crescent Beach, occupation was probably about the same length.

Habitations at Crescent Beach were either mat or plank shelters, as no evidence of permanent structures or large house frames were found. The two hearths encountered in Layers D and D1 (see Figures 5-58, 5-65) may have been communal hearths in front of temporary shelters similar to those reported by Haeberlin and Gunther (1930:18). If this was the case, the post molds from shelter frames have been obscured by humus or confused with those resulting from meat drying frames. However, shelters may have been habitually placed either along the beach or to the east behind the midden mound.

Procurement activities appear to have taken place along the 3 km stretch of beach immediately south of the site where there is a large eelgrass community and shellfish beds (see Figure 2-18). In addition to the fact that all of the shellfish species (and crab) identified from Crescent Beach may be found in these communities, other evidence also indicates the use of this area. One of the petroglyphs which have been found along this beach is of a fish (see Figures 2-31 and 2-40) and may have been used in rituals to encourage a good herring run, not unlike the use of the Jack Point petroglyph by the Nanaimo (Jenness n.d., p. 115). Another possible link to Crescent Beach is the Indian Fort site (DgRr 5) located in the area where Suttles has reported a Nicomekl camp (1977:1). Not only would this site have offered shellfish and herring harvesters a sanctuary from marauders, but it would also have provided an excellent vantage point from which a watch could have been maintained for the flocks of seagulls which would accompany approaching herring.

The majority of the food resources identified from Crescent Beach could have been obtained from the Eelgrass and Rocky Intertidal Communities south of the site. Shellfish were the most common faunal remains (22% of the site weight) and species such as Thais, Ostrea, Mytilus and chitons could have been obtained from boulders in the Rocky Intertidal. Beneath these boulders both plainfin midshipmen and crabs would have been found. While digging sticks might have been used to loosen these species, they would have been necessary to obtain bivalves (Saxidomus, Protothaca, Tresus) from the sandy patches between the boulders. Crab and Clinocardium would have been common across the surface of the Eelgrass Community, and the latter species would also be scattered across the Upper Sand Wave Community. All species could be expected to be reaching full sexual development in preparation for spawning as was observed in 1980 and 1981 (see also Quayle and Bourne 1972:27,43,57,59).

Fish bones were the second most common faunal remains. It is not clear from recovered fishing artifacts that herring rakes were used, as none of the bone points from the site seem suited for mounting in a wooden handle, although some of the bone point fragments may have served this purpose (see Figures 2-36, 5-21, 5-62). As the tidal channels which run through the Eelgrass Community retain water at low tide, forming natural fish traps, it is quite possible that dipnets were used instead. Practically all of the fish from the site could be expected to feed on herring or roe and thus would have been obtained at the same time. Herring and any predatory fish could be driven easily in these shallow pools and removed with dipnets while composite harpoons and spears may have been used to catch the larger fish. Some of the bone points from Crescent Beach have incised grooves and blunt tips suggesting they were used as baited gorge hooks on a set line, probably for flatfish. Salmon remains are almost entirely dominated by vertebrae indicating that dried salmon backs were brought into the site, not surprising considering the season of occupation.

Waterfowl and other bird remains were not as frequent as the faunal remains listed above and consisted primarily of dabbling and diving ducks. Basically equal amounts of both groups of ducks were recovered suggesting they may have been obtained with pole nets. If submerged nets had been used on the eelgrass beds, an assemblage dominated by diving ducks and including grebes and mergansers should have been recovered. Practically all of the duck remains consisted of wing and breast bones which indicates that ducks were butchered at the pole net site and only meaty portions returned for consumption. A similar distribution of duck bones was noted by Seymour (1976:87) in a brief report on excavations at the Whalen Farm site (DfRs 3) across Boundary Bay from Crescent Beach.

Most of the exotic or non-food bird remains were found in Layer L4 and probably represent ritual activity. At contact, Jenness (1955:54) reports that the great horned owl was an important guardian spirit for hunters which is interesting in view of the fact that at least two individual wapiti were butchered in Layer L4. Combined with possible use of petroglyphs this evidence suggests very similar religious practices as were reported among the Coast Salish at contact.

Mammal remains were not common at Crescent Beach even though at least two wapiti were butchered in Layer L4. A full 90% of the mammal remains may be classed as ungulates, mostly leg bones brought to the site for use in tool manufacturing and, possibly, marrow extraction. Suttles (1974:91) has indicated that leg bones were saved for tool manufacture, while many of the recovered leg bones were sesamoids and phalanges and may have been attached to hides. It is unlikely Crescent Beach was used as a base camp for hunting as only one arrow point was found. More likely, deer and wapiti were hunted in the Nicomekl-Serpentine Valleys en route to Crescent Beach, an interpretation also supported by the presence of beaver bones. Sea mammal bones were rare while most of the small mammals are from species which could have used the site in the 10 months people were not there. Two occurrences of small mammals are cultural however, a long tailed weasel foot probably associated with the exotic bird remains in L4, and a bobcat fibula made into an awl. Dog remains were common while the fact that many of these bones were scattered through the site suggests some of them may have been grave inclusions which fell from tree burials.

The detailed analysis of midden layers at Crescent Beach provides some insight into processing and preservation activities at the site. Steaming mounds were used to open shellfish and to cook other foods. Construction of these mounds was accomplished by heating beach cobbles on a fire, heaping on the shellfish and covering the mound, probably with mats and beach sand. Many of the shelly layers were formed of sand and shell and are thought to indicate that shellfish were spread out, perhaps on sand, to facilitate sorting and the removal of meat from the shells.

Shellfish meat and herring may have been placed on wooden skewers and smoked or fire dried on a frame. A number of ash spreads were observed which reflect fires maintained for long periods while associated post molds suggest frames were placed over the fire (Suttles 1974:66). Stone boiling was apparently common as broken cooking stones were found scattered through many of the layers. Duck wings and breasts, some types of fish, and dried salmon backs may have been cooked in this manner. Deer and wapiti meat as well as crabs were probably steamed or perhaps roasted on stakes around hearths such as those found in Layers D and D1.

There was no evidence found at Crescent Beach to indicate that it was used in the late summer and autumn to harvest salmon, steelhead, smelts and waterfowl resources whose availability and abundance peak at that time (see Figures 2-17, 4-5). In addition, some resources which might be expected in the Crescent Beach faunal assemblage are lacking, perhaps indicating cultural preferences or choices, or differences in the distribution of modern, historic and prehistoric fauna in Boundary Bay. Among these are sea birds (including grebes and mergansers), black brants and spring salmon, which should be plentiful in the late winter-spring. I think cultural selection is the most likely factor involved.

Artifacts recovered from Crescent Beach reflect a number of activities conducted at the site, some related to procurement strategies. Foremost is tool manufacture, mostly in bone and antler, of artifacts used in fishing, woodworking and textiles. While there is some indication of a ground slate industry, these tools were obviously not used to any great extent. Ethnographically ground slate knives were used for butchering salmon in preparation for preservation (Barnett 1955:62; Duff 1952:66) and thus they should not be expected in large numbers at a site such as Crescent Beach where salmon butchering was not an important activity. Chipped stone is more predominant and included biface knife resharpening and a bipolar core technology, perhaps to produce flakes for fish butchering similar to what Flennikan (1981) has reported at the Hoko River site in Washington.

Woodworking was obviously an important activity at Crescent Beach and although it is not clear just what was being manufactured, adzing, splitting, chiseling and drilling are indicated. Procurement of red cedar may have been every bit as important as shellfish and herring harvesting; the search for trees suitable for manufacturing house planks, canoes, boxes and other items likely took place throughout the year.

Textiles were also important and probably included skin working and basketry repair. The best evidence appears to be for skin working as all of the artifacts placed in this group including pitch hafted stone scrapers, bone and antler awls, and bone needles would be suitable. It was noted above that some of the ungulate leg bones may have been attached to hides, while it is also possible that the meat preservation frames and fires were also used in hide tanning.

Ceremonial and decorative items include objects which may have been lost by the site occupants as well as those which could have fallen from tree burials. The bone pendant found in Layer F1 (see Figure 5-19) appears freshly made as manufacturing striations are sharp and clear, and some other bone and antler decorative items may have been made at the site, including the bone blanket pins and antler pendant found in Test Unit A (see Figure 2-36). Ochre was fairly common and could have been used for a range of things from rituals to cosmetics. Although labrets and ear-spools were not used by the Coast Salish ethnographically, their presence at the Crescent Beach, Pitt River and Cowichan Bay sites indicates they were still used by some groups as recently as 500 - 1000 years ago. A few artifacts were recovered which suggest trade contacts with Vancouver Island groups to the west. These include whale bone blanks, <u>Mytilus californianus</u>, and <u>Dentalium</u> shell.

Fishing artifacts made from bone and antler indicate a number of composite harpoons and spears were used, as well as gorge hooks, composite hooks and fixed harpoons, the unfinished nature of some of these suggesting they were made at the site. Hand knives, which were probably used in various butchering and food preparation activities, included hafted bifaces and chipped slate knives while a few fragments of ground slate were also found.

Although one complete human burial was recovered from Layer F (see

Figure 5-63), it is thought to be an impromptu interment of a body. Scattered and incomplete human skeletal remains were found in some layers and probably represent bones which fell from disintegrating tree burials. This type of interment corresponds to the pattern observed at other late sites.

In summary, the careful stratigraphic excavation of a wide area combined with water-screening through a fine mesh screen permitted reliable recovery of cultural materials from throughout the deposit. Analysis indicates a high degree of consistency in activities at the site even though activity loci shifted somewhat during different occupations. Although subtle differences were observed, it is felt these do not represent cultural change, but rather are a result of the placement of excavation units. Overall there is little difference between what was observed at Crescent Beach and what could be expected based on ethnographic sources, although detailed archaeological investigation is clearly capable of adding substance to the ethnographic record of the Coast Salish.

6.2 DEVELOPMENT OF SHELL MIDDEN LAYERS

The second goal of this study was to understand the formation processes responsible for the development of the layers recovered from the Crescent Beach shell midden. Through the explicit modeling of systemic and archaeological formation processes and evaluation of midden constituents, it was possible to generate hypothetical types of expected layers. The fact that only 1 layer type (4 layers) was not expected, and that the remaining 27 recovered layers were accounted for by 6 layer types indicates the success of this approach. The constituents which comprised these layers were also remarkably consistent.

The 29 t (Table V-II) of shell midden deposit excavated at Crescent

Beach averaged 1,201.6 kg/m³. Sand and shell deposited as primary refuse during steaming and sorting of shellfish in preparation for preservation and immediate consumption accounted for 75% of the midden mass. Broken cooking stones, steaming mound cobbles, charcoal and other faunal remains comprised an additional 15-20% of the site. Although highly visible, humus probably only made up 5-10% of the shell midden weight.

Much of the sand and shell in the site appears to be primary refuse resulting from the actual sorting, removal of shellfish meat, and washing of sand from the meat prior to preservation. In addition to actual shell dumps (such as with Feature 2-1, see Figure 5-52; or Layer F), these deposits were the most evident factor responsible for the midden development. In addition, de facto refuse (including steaming mounds, ash spreads, hearths and pathways) were also important in this stratigraphic development. In fact, these deposits of cobbles and ash spreads appear to be highly resistant to various n-transforms which resulted in the mixing of shell and humus in other parts of the midden.

Bands of humus reflect old surface soils and indicate that cultural activities were not the only factors responsible for development of the Crescent Beach midden layers. Occupied seasonally and sporadically by people for at least 840 years, the site was used by plants and animals fairly continuously as is evident from the humus which formed much of the site stratigraphy. Although there is a tendency for landsnail shells, insectivore and small rodent remains to be more frequent in humus layers there are numerous exceptions. Most of the shell midden was very loosely consolidated permitting easy access for these animals.

The analysis of the structure and constituents of the Crescent Beach shell midden layers made it possible to determine the major types of activities represented in the site (see Figure 5-67). The shelly layers from the lower part of the site (F to L4fcr) which date between 1550 and 840 B.P. reflect activities associated with herring and shellfish processing. Hearths, ash spreads and post molds in the layers (D3 to G) from the central part of the site indicate that between 840 and 650 B.P. this area was used primarily for activities associated with the preservation of fish and shellfish meat. The layers (A to D1) from the top of the site lack heavy shell deposits and appear to have been peripheral to shell processing and preservation activities. These layers date from 650 to 200 B.P. and contain more varied fish and duck remains as well as a small steaming mound indicating food preparation and consumption were important activities. Artifacts indicate that woodworking, skin working and artifact manufacture were also important. These shifts in activities are regarded as a factor of the limited size of the area which was excavated.

Development of the Crescent Beach shell midden followed a cycle consisting of plant growth and soil development, human occupation, shellfish processing, and site abandonment; regularly repeated at different places along the entire beach front. Ownership, family tradition, previous activity areas, nature of vegetation growth and any of a number of unknown factors could singularly or together determine the precise settlement and activity locations (see Chapter 3).

However, a seasonal site such as Crescent Beach represents a record of human interaction with the local environment, the actual substrate on which selected strategies unfolded. With a stable resource base and specialized economic strategies like those of the Coast Salish, we may expect that refuse from similar types of settlements have faced the same range of systemic and archaeological transformation processes. Some of the more obvious structural differences between shell middens which were main villages and those of seasonal sites like Crescent Beach were discussed in Chapters 3 and 4. Not only will late winter herring and shellfish harvesting sites contain very similar types of layers, but main villages and other specialized sites will each share their own characteristic layers.

It is clear that treating shell midden layers as elements of the archaeological record increases our confidence in interpretations about transformation processes at a site. There may also be important economic implications for shell midden research, particularly in the Strait of Georgia area where the Coast Salish followed a "...fairly rigidly determined..." annual round (Suttles 1974:50,57). When research goals are primarily concerned with seasonality, economic strategies and settlement patterns, I feel it is possible to obtain these goals without the excavation and analysis of large blocks of shell middens. The power excavation of a long trench combined with the small block(s) (1 x 2 m or 2 x 2 m) excavation of shell midden layers, fine mesh (1.59 m or less) waterscreening, multiple stage recovery of elements, and the analysis of a small number of samples from each layer will be adequate in many cases.

While attention to formation processes is felt mandatory in shell midden research, it may be even more important in older non-shelly sites. The model of shell midden development discussed in Chapter 3 suggests that given sufficient exposure to natural transformation processes, stone artifacts, broken cooking stones and sand may be the only remains of a shell midden once shell and bone have decayed. This suggests archaeologists working with early coastal sites might be wise to compare the sand fraction of their sites to that of surrounding natural soils. In general I think shell midden researchers will be surprised when they explicitly examine the transformation processes which operated at their sites.

6.3 SHELLFISH AND HERRING HARVESTING SITES: A COAST SALISH SETTLEMENT TYPE

Crescent Beach is not the only site from which archaeological evidence of a late winter occupation and the harvesting of shellfish and herring have been obtained. Two other widely dispersed sites have been reported in the Strait of Georgia and evidence of at least two more are hypothesized. It is anticipated that detailed stratigraphic excavation coupled with comprehensive faunal and seasonality studies will identify more of these sites.

Most fully reported is the Deep Bay site, DiSe 7 (see Figure 2-28) where Monks has presented evidence of a late-winter-spring occupation centered on shellfish and herring harvesting which may have a time depth of 3,500 years (1977:301). Associated with the shell midden deposits were stone fish traps and a trench embankment (Monks 1977:35,166; Barnett 1975: 23; also, Smith 1907:323),although the use of these facilities may have been restricted to the late period.

Faunal remains from Deep Bay are dominated by shellfish (Clinocardium, Mytilus, Protothaca, Saxidomus, Tresus and Thais), fish (mostly herring, but also some salmon and dogfish), deer and wapiti, seals and sea lions and waterfowl (Monks 1977:182-196). Leg bones were the most common deer elements (Monks 1977:281), although salmon and waterfowl elements are not reported. An interesting difference between the faunal assemblages from Deep Bay and Crescent Beach is that bird remains consisted predominantly of sea birds and diving ducks indicating the use of a submerged net at Deep Bay rather than a pole net. Although there are some differences in artifacts recovered from the two sites, the major emphasis at Deep Bay is also on tool manufacture (bone, antler and chipped stone), woodworking, textiles (probably skin working), fishing, and butchering and other food preparation (chipped stone biface, chipped slate, and ground slate knives) (Monks 1977:222-224). A major difference between the two sites is that Deep Bay had ground slate points and sea mammal remains.

The second site of concern here is the Shoal Bay site, DcRt 1, located near Victoria, B.C. (Figure 2-28) and recently reported by Mitchell (1980). This small site was excavated in 1959 and thus Mitchell's analysis was hampered by the methodologies of that time. However, sufficient faunal remains were recovered to indicate that this site also contained shellfish (Clinocardium, Protothaca, Saxidomus, and Ostrea), herring (plus salmon and a number of herring predators), ungulates (deer and wapiti), sea mammals and waterfowl (Mitchell 1980:48-50). Waterfowl are again mostly sea birds suggesting the use of a submerged net as many of the identified species could be expected to follow a herring run. Based on the bird and herring remains reported by Mitchell (1980), it is possible that this site was occupied in March. Additional faunal samples should be obtained however.

Some of the artifacts from the Shoal Bay site are remarkably similar to the same types found at Crescent Beach. While chipped stone is rare, tool manufacturing in bone and antler was obviously important, as were woodworking, textile and fishing artifacts (Mitchell 1980:40). Additional recovery and analysis of faunal materials combined with shell seasonality studies would serve to remove any doubts about the use of this site.

While all three sites appear to have only been occupied in late winter and have so far provided no evidence of permanent plank houses, they also share an association consisting of woodworking tools, two piece toggling harpoon valves, chipped stone (except for Shoal Bay), and at Crescent Beach and Shoal Bay, an appreciable lack of ground slate. It was just this type of assemblage which led Borden (1951:263) to define the ill-fated

Whalen II Phase rejected by Mitchell (1971b:56). Seymour (1976) reporting on 1972 excavations at the Whalen Farm site (DfRs 3) describes very similar artifacts, but no ground slate knives or permanent plank house remains. Although Borden (1970:109) inferred the presence of plank houses in Whalen II, large post molds are not mentioned in his earlier publications on the site (1950a, b, 1951).

Located on the western side of Boundary Bay, the Whalen Farm site (DfRs 3; Canadian portion is DgRs 14, the Spetifore Farm site) corresponds to a location named by Suttles (1949:4) as a Nicomekl seasonal camp (see Figures 2-19, 4-6). It is hypothesized that this site was also a late winter shellfish and herring harvesting camp, perhaps since the formation of Boundary Bay. Exploitation of a river mouth environment could very well account for the differences Borden (1950b:244-5) noted between the lower and upper deposits at Whalen. Adequate testing of this hypothesis demands the excavation of faunal samples which will permit proper seasonality and subsistence studies.

The brief examination of faunal remains in level bags from the Locarno Beach shell midden (DhRt 6) revealed the presence of herring remains (prootics), and it is hypothesized that this site was also a late-winter shellfish and herring harvesting camp. The Locarno Beach site (see Figure 5-25) is only part of a poorly understood complex of site remnants (including DhRt 5, 18, and 10) along the southern shore of English Bay. It would not be surprising to find that English Bay (see Figure 2-2) and the adjacent lowland area of Kitsilano provided a very similar range of resources with abundance and availability cycles identical to those noted for Boundary Bay, although there is a difference in the size of the two bays.

While there are some obvious differences in artifact styles between Locarno Beach and the above sites, except for a more pronounced use of ground slate, the same basic set of activities are represented. Borden (1950a:15-17; 1970:97-99) reports woodworking tools, chipped stone biface knives, hide working tools (stone scrapers, bone needles and awls), numerous small bone points (gorge hooks and fishing hook barbs), and the absence of permanent plank houses. Although Borden (1970:98) underrates the chipped stone industry at this site and emphasizes ground slate, there is not really a shortage of chipped stone. Stratified midden deposits destroyed by a housing development in early 1980 contained large quantities of basalt chipping detritus as do collections from the site at U.B.C..

Borden (1970:99) infers that sea mammal hunting was important at Locarno Beach, and was perhaps similar to Deep Bay. Given the proximity of Locarno Beach to sea lion wintering grounds at the mouth of Howe Sound (Suttles 1952:13), and that they would certainly be attracted to a herring run, this is not surprising. Other faunal remains from Locarno Beach included Mytilus, Clinocardium and other shellfish, land mammals (probably deer and wapiti) and fish (Borden 1970:99). As with the Whalen Farm site, our understanding of Locarno Beach would also benefit from the recovery of midden samples for subsistence and seasonality studies.

Ethnographically the Coast Salish of the Strait of Georgia occupied large permanent villages and followed a seasonal round which included not only the use of shellfish and herring harvesting camps, but also several other specialized types of sites, including those used for camas and fishing, as well as salmon, berrying, and hunting camps to mention but a few. At present only a handful of these types of sites have been identified archaeologically, while entire settlement pattern reconstruction is necessary if we are to understand the development of Coast Salish Cultures.

Two factors indicate it is possible to reconstruct subsistence strategies and settlement patterns for much of the last 5,000 years. First, this area is characterized by a degree of environmental stability during this time. Changes which have taken place consist of habitat development such as the formation of Boundary Bay and the growth of beaches, bogs and river deltas. These changes have not resulted in (or from) climatic or biotic shifts, but rather in substantial increases in the abundance of native species such as salmon (see Fladmark 1979).

The pre-5,000 B.P. environment of the Strait of Georgia would simply have not been as productive as was observed historically. The predominance of Mytilus in some early deposits reflects fewer productive shellfish beds rather than a lack of knowledge about shellfish procurement. Just as the Fraser River Delta (and those of the Squamish, Nanaimo, Skagit and other rivers) have developed since deglaciation and sea level stabilization, so have beaches, eelgrass beds, marshes and other biotic communities important not only in shellfish productivity, but for the entire energy flow cycle of the Strait of Georgia. With the development of these biotic communities the Proto-Coast Salish Cultures would have faced increasing regularity in the availability and abundance of a range of resource surpluses. This would certainly have preceded the establishment of any specialized economic and settlement pattern such as that observed ethnographically.

The second factor (which also suggests a degree of environmental stability) is that all of the major archaeological sites in this area are either multicomponent, or consist of a complex of sites from different time periods in close proximity to each other. This includes all of the major sites of the Fraser River Delta area; Locarno Beach-Jericho-Point Grey; Musqueam; Marpole-Orchard Site; Glenrose-St. Mungo; Pitt River; Beach Grove-Spetifore-Whalen; and Crescent Beach; most of which contained at one time a minimal 3-5,000 year record of occupation. Many sites have been severely damaged by modern activities while others have disappeared totally such as the Orchard Site, apparently a late period shell midden which was situated on Fraser River alluvium 100 m south of the main Marpole midden (Smith, Field notes, Box 9, file 1, 1903:139). While some of these site complexes were main villages, others such as Crescent Beach and Pitt River were not, although at this time it is not clear how many components are the result of seasonal occupations. However, careful conservation and resource management of remaining cultural deposits is crucial if our knowledge of Coast Salish prehistory is to ever proceed beyond the artifacts.

At this point little may be said about prehistoric settlement patterns in the Fraser Delta area. It would seem that at least during the late period Crescent Beach was used by Halkomelem peoples from the Fraser River in an overall settlement pattern structured much like that presented in Figure 4-6. It must be noted that the evidence presented in this study indicates Boundary Bay was used in February and March rather than spring and summer as hypothesized in Figure 4-6.

Perhaps the best evidence of a Halkomelem rather than Straits presence is the absence of any evidence of a large scale summer salmon fishery. Halkomelem would of course be on the Fraser at this time and while Straits could be expected to be reef netting off Point Roberts, there is nothing to indicate that Crescent Beach was ever used as a reef-net camp or village. While subsistence and seasonality data are lacking for earlier deposits from Crescent Beach, it is possible this site was a seasonal camp for much of its 4,000 year history, as evidence of permanent structures has not been reported (Percy 1974, 1976; Trace 1977a, b).

The complex of sites at Musqueam and Marpole deserves consideration as main winter villages, perhaps for all of their 3-4,000 year histories. Musqueam is still a Coast Salish village and may be the oldest occupied settlement in British Columbia. Other main villages in the Fraser Delta area have not been identified except for the Marpole Culture component at the Glenrose Cannery site (Matson 1976:95-7; 1981:80-2).

Prior to the formation of Boundary Bay, Crescent Beach would have been a river mouth site not unlike the Musqueam and Marpole sites, so it is possible there may have been a village here. However, ethnographically (and prehistorically it appears) Halkomelem villages were along the main river which would have facilitated harvesting the staple food, salmon, as well as permit a physical control over access to the resources of the Fraser. I am confident that this control has considerable antiquity.

In addition to the Crescent Beach, Whalen Farm and Locarno Beach sites, at least 3 additional seasonal sites have been reported from the Fraser Delta area. These are sites in the Pitt Meadows area and include; the Pitt River site (DhRq 21), a late-summer-early-autumn salmon fishing and plant harvesting site (Patenaude,n.d.); the Telep site (DhRp 35), a late autumn salmon fishing camp (Peacock, n.d.); and the Carruthers site (DhRp 11), an undated assemblage assigned to the Gulf of Georgia Culture Type (Crowe-Swords 1974), and interpreted in Peacock (n.d.) as an autumn salmon fishing site. The Carruthers site is only one of 12 recorded sites about the confluence of the North and South Alouette Rivers which were probably used as camps during the October sockeye and pink runs (Environment Canada 1925-1970).

Burley (1979:207-9, n.d.) has argued that economic specialization was not important until the Marpole Culture. Based upon this and the other studies discussed above I feel a strong case may be made that economic specialization was well established in the Locarno Beach Culture. In addition to Crescent Beach, the Deep Bay and Locarno Beach sites may have been specialized herring and shellfish harvesting sites at 3,500 B.P.

and perhaps even earlier. The Telep site has been dated at 3,100 B.P. (Peacock n.d.), while the Pitt River site dates to 4,390 B.P. (Patenaude n.d.).

While it seems Crescent Beach was not used by the Straits Salish as a reef net village, it may be possible to trace this highly specialized type of settlement back to the Locarno Beach Culture as well. However, the reader must realize that the following scenario is highly speculative. At European contact several Straits groups maintained plank houses at a summer reef net village at Cannery Point (see Figure 2-2) (Newcombe 1923:60; Rathbun 1900:293, 314; Suttles 1949:4-9, 1974:201-215). In the late 1800s the Indians were driven from Cannery Point by White squatters and re-established their village for a time at Goodfellow Point, about 2 km to the west (Rathbun 1900:293; Suttles 1949:13, 1974:26). If permanent plank house frames occur at earlier sites as well, a good candidate for a Marpole Culture reef net village is the Beach Grove site with its 10 house outlines (see Figure 3-7c; Ham 1981). Subsistence and seasonality studies at a portion of the Beach Grove site indicate it may have been occupied from spring to summer for herring, shellfish and salmon (Matson _et al_, n.d.). Possibly dating to the Locarno Beach Culture are 5 house outlines which were once present at the western portion of the Whalen Farm site (Smith 1925:315, field notes, Box 10, file 3). Obviously much research is required to verify these hypotheses, but I feel a Straits occupation (spring-summer) may be found at both of these sites.

Another characteristic of Coast Salish Culture which appears to be established by the Locarno Beach Culture or earlier is ascribed status. Matson (1976:301) states that "... the presence of high status symbols with a sub-adult burial would be considered positive evidence" of social ranking. To this criteria I would add the use of labrets which starts with novice labrets in childhood, and cranial deformation which is applied to infants (Matson 1976:301; Mitchell 1971b:54). Both of these practices have been reported for the Locarno Beach Culture where most high status individuals appear to be male (see Figure 2-27). By the Marpole Culture some 2,500 years ago there is ample evidence of high status women, possibly indicating that bilateral descent house-kin groups were established.

While there are many unresolved issues concerning the development of Coast Salish Culture, I am reluctant to proceed further without additional data. Matson (1974:113, 1981:85) has repeatedly called for better information on subsistence and seasonality if the development of Northwest Coast Culture is to be understood. Hopefully this study will serve to further emphasize this need. Unfortunately, much of the archaeology of this area has been characterized by tsp syndrome (or type, style and phase fever) with little or no attempt to obtain data pertaining to economic strategies. While it seems that aspects of Northwest Coast Culture were present in the Strait of Georgia some 4,000 years ago, our understanding of the entire development is hampered by this substantial lack of knowledge. In general understanding the precise roles played by the environment and cultures of the area still require basic information on subsistence and seasonality. It is clear, however, that archaeological theory and method are certainly adequate for the task at hand.

6.4 SUMMARY

The first goal of this study was to obtain information about Coast Salish economic strategies at Crescent Beach. Evaluation of modern and historical sources, and the range of species reflected in the fauna identified from the Crescent Beach site, would appear to support a 1,500 year continuum of the ecological communities of Boundary Bay. At present, biological productivity in these communities reaches a peak in the late winter-early spring, and again in the late summer and autumn. Faunal analysis and seasonality studies of materials recovered from the 1,300 to 500 year old shell midden layers at Crescent Beach reflect the exploitation of the late winter-early spring resources, probably by Halkomelem people from the Fraser River. Occupation of the site was restricted to about a month during late February and early March.

The most important resources obtained during this time were shellfish and herring, with much of this harvest preserved and removed from the site. The major procurement area was the Eelgrass and Rocky Intertidal Communities along the 3 km of beach immediately south of the site. Besides the fauna from the Crescent Beach site, there are other indications of the use of this area including several petroglyphs (DgRr 7, 9, 11, 12) and a trench-embankment-lookout site (DgRr 5). Resources obtained here include all of the shellfish found in the site, crab, herring, midshipmen, and probably most of the other fish in the midden (sculpins, dogfish, flatfish, etc.). Ducks were probably obtained with pole nets near the mouth of the Nicomekl River and only meaty portions (wings and breasts) returned to the site. Salmon remains consist almost entirely of vertebrae indicating dried salmon backs were brought into the site. Except for preserved herring and shellfish removed from the site, all other food remains were probably consumed at Crescent Beach.

Wapiti and possibly deer were occasionally killed and butchered at the site, although most of the ungulate remains indicate hunting was conducted some distance from the site, probably in the Nicomekl - Serpentine Valley. Both leg bones and antler were brought into the site for use in artifact manufacture, while some ungulate remains, sesamoids and phalanges were probably attached to hides. The occasional presence of beaver remains also suggests the use of the Nicomekl-Serpentine Valley, perhaps during passage from the Fraser River to Boundary Bay.

Shellfish, and probably some other foods, returned to the site were steamed on sand and mat-covered mounds of heated cobbles and then spread out to facilitate sorting prior to preservation. Shell meat and perhaps herring were smoke or fire dried either on raised frames or stakes. Other activities at the site included the manufacture of bone and antler artifacts for fishing, woodworking, hide working and occasionally, decorative items. Woodworking appears to have been an important activity in the upper part of the site. Chipped stone working was far more common than the manufacture of slate tools. Habitations were probably pole frame mat shelters placed either along the beach, behind the midden mound, or perhaps occasionally on the midden itself. Tree burials appear to have been common in the area through all of the occupation.

While there is evidence of some shift in types of activities conducted at Crescent Beach, it is viewed as a factor of excavation. All activities inferred at Crescent Beach were either directly associated with herring and shellfish harvesting, or consisted of ancillary activities such as food consumption, artifact manufacture and maintenance.

The second goal of this study was to understand the nature of the formation of the Crescent Beach midden. The major midden formation processes included discarded sand and shell, and humus development reflecting dense vegetation growth when the site was not occupied. Of the 31 layers excavated at Crescent Beach, the majority consisted of sand and shell from shellfish processing, these two elements accounting for 75% of the midden weight. Cobble mounds and scatters as well as ash spreads were also important midden constituents and combined with highly visible humus zones were very important in allowing the segregation of midden layers during excavation. Although highly visible, and reflecting the sporadic and seasonal occupation of the site, humus actually accounted for a very small proportion of the site weight (5-10%).

The thorough evaluation of environmental and ethnographic data permitted the modeling of systemic and archaeological transformation processes. Thus upon examination of the various midden constituents recovered from Crescent Beach it was possible to suggest expected layer types. In total 27 of the 31 recovered layers were accounted for by 6 expected layer types. Most common were refuse layers from shellfish processing, and humus layers reflecting vegetation growth between occupations. Other common layers were ash spreads and hearths with post molds resulting from preservation activities. Three pathway layers were also recovered. All of these layers are considered as either de facto or primary refuse. Only one layer type was not expected nor satisfactorily accounted for, and may represent secondary refuse. In general the results are compatible with ethnographic observations about refuse disposal at a seasonal site.

The evidence from Crescent Beach, Deep Bay, and Shoal Bay suggests that shellfish and herring harvesting sites constitute an important and common type of Coast Salish resource procurement camp. A brief look at data recovered from both the Whalen Farm and Locarno Beach sites suggest that they may also have been shellfish and herring harvesting camps. Recovery of shell midden samples from these sites suitable for detailed fish analysis and seasonality studies should clarify the role these sites played in Coast Salish economic activities.

While in excess of 112 archaeological sites have been excavated in the Strait of Georgia area, adequate faunal and seasonality studies have been conducted at very few. The excellent preservation at practically all of these sites indicates these studies are possible. It is also apparent that it is possible to recognize other types of seasonal Coast Salish sites, in addition to main village sites and to develop a comprehensive picture of economic strategies for most of the 5,000 year history of the Coast Salish. It is hypothesized that specialized seasonal sites date to the Locarno Beach Culture and perhaps (for some types) even earlier. I feel the evidence suggests the Proto-Coast Salish developed a specialized economic base during the Charles Culture in response to increasing biotic productivity. While there is evidence of high ranking males in the Locarno Beach Culture, it is not until the Marpole Culture that there is evidence of both high ranking males and females. This may suggest the establishment of village communities with bilaterally reckoned house-kin membership.

While many questions about the origins and development of Coast Salish Culture remain unanswered, it is obvious that many of the answers will be found in the shell middens of the Strait of Georgia. However, substantial improvements in the regional data base are required. Not only is information on subsistence and settlement patterns mandatory, but so too are the application of modern methods of data recovery and analysis. Not only will the application of this rigorous methodology significantly improve our knowledge of Coast Salish economic strategies, it will also clarify cultural history and environmental issues, and allow a far more enlightened discussion of the factors behind the development of the complex cultures of this area.

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8.0 APPENDIX I:

ARTIFACTS FROM THE CRESCENT BEACH SITE

KEY

= artifact number

L = length in cm

W = width in cm

T = thickness in cm

() = incomplete measurement

md = median

$\bar{x}$ = mean

r = range

P = Provenience;
st = slit trench find
tp = Test Unit A (1976)

Wt = weight in g

F = see Figure for artifact illustration

1/4 - 3/4 = quartile

n = frequency

CONTENTS

1. MANUFACTURING ARTIFACTS (n = 93)

1) chipped stone detritus (see Table V-III)

2) cobble cores/pebble tools (n = 8)

#	P	L	W	T	Wt	F
4031	tp AL21	19.9	9.7	8.7	927.3	
4108	st	7.3	6.0	2.2	124.4	5-25
4111	B B2NW	10.9	9.2	1.4	195.3	5-14
4125	B D7SE	7.7	7.1	2.4	132.1	5-14
4142	st	9.1	7.1	3.9	416.2	
4162	st	8.9	8.3	4.2	491.4	
4205	st	6.3	5.8	2.8	138.2	
4228	D3 C2SW	15.4	7.0	8.3	676.2	5-14

3) bipolar cores/stone wedges (n = 18)

#	P	L	W	T	Wt	F
4008	tp AL2	3.0	2.5	0.9	10.7	2-35
4110	B B2NW	5.1	4.9	1.1	45.0	5-15
4128	B C5NE	5.0	3.6	1.2	25.6	5-61
4130	L356 C4NE	2.6	1.9	0.4	2.3	5-15
4161	C C7NE	6.5	4.5	2.2	115.4	5-57
4167	C A7SW	6.9	5.1	1.9	87.4	5-57
4179	C D6SE	4.5	3.8	1.4	36.0	5-15
4185	D B3SE	3.1	2.2	0.7	8.0	5-15
4187	D D5NW	7.4	7.2	1.2	122.2	5-57
4200	L4 D3NW	2.7	2.3	1.9	6.2	5-15
4214	D1 C5SE	5.7	3.5	1.6	52.4	5-61
4236	D3 B4SW	4.1	2.1	1.2	18.0	5-15
4241	D4 B5SW	2.6	2.4	0.9	10.8	5-15

3) cont.

#	P	L	W	T	Wt	F
4253	L4 D3SE	3.6	1.7	1.1	7.3	5-61
4285	L4 D2SW	3.6	3.0	0.6	9.4	
4313	G D1SW	3.6	2.9	0.7	8.6	5-15
4325	L1 A4NW	4.3	3.6	0.7	9.3	5-61
4326	L4 B2SW	5.3	4.1	1.8	46.2	5-15
	md	4.2	3.3	1.2	14.4	
	$\overline{x}$	4.4	3.4	1.1	34.5	
	1/4 - 3/4	3.1-5.2	2.3-4.1	0.7-1.6	8.6-46.2	
	r	2.6-7.4	1.7-7.2	0.4-2.2	2.3-122.2	

4) quartz crystal detritus (n = 6)

#	P	L	W	T	Wt	F
4093	B B3NW	2.1	1.2	0.5	0.8	
4095	B C1NE	1.9	1.5	0.7	2.0	
4113	A A6NE	1.0	0.9	0.2	0.2	
4144	B C6SE	1.8	1.6	0.8	2.9	
4154	B A4SW	2.7	2.5	1.4	9.5	
4323	st	1.0	0.9	0.2	0.2	

5) hammerstone (n = 1)

#	P	L	W	T	Wt	F
4114	st	2.6	2.8	2.8	28.4	

6) anvil stone (n = 1)

#	P	L	W	T	Wt	F
4126	B D5SW	9.6	7.9	4.2	475.5	5-14

7) slate saw (n = 1)

#	P	L	W	T	Wt	F
4330	C A5SW	(7.1)	4.2	0.7	(15.4)	5-14

8) small irregular abrasive stones (n = 14)

#	P	L	W	T	Wt	F
4012	tp AL9	7.3	5.7	1.8	105.8	2-35
4030	tp AL18	18.6	9.4	2.7	555.4	2-35
4090	B C2NE	7.5	3.3	0.9	47.8	5-15
4100	B A2SE	9.2	7.3	1.9	95.8	5-15
4105	st	12.2	6.9	2.5	346.5	5-24
4107	st	14.3	10.3	3.2	809.6	
4143	B A7SE	12.6	10.0	2.0	358.1	
4146	B C6SW	11.5	0.7	0.3	253.8	5-61
4149	B D6SE	7.3	3.3	1.0	47.7	5-61
4151	B D6SE	9.6	7.1	1.4	174.4	
4158	C B7NW	4.8	3.4	1.4	51.7	5-67
4159	C B7NE	8.7	8.0	1.2	154.3	5-15
4198	L4 C3NE	7.0	3.8	0.6	20.6	5-61
4216	st	4.8	3.6	0.8	28.3	5-24
	md	8.7	5.7	1.4	105.8	
	$\overline{x}$	9.7	5.9	1.5	217.8	
	1/4-3/4	7.0-11.5	3.3-7.3	0.8-1.9	47.7-253.8	
	r	4.8-18.6	0.7-10.3	0.3-3.2	20.6-809.6	

9) ground slate Fragments and detritus (n = 9)

#	P	L	W	T	Wt	F
4006	tp AL2	(4.8)	(2.9)	0.4	(9.1)	2-37, 2-38
4084	B D3NE	(2.5)	(1.9)	0.2	(1.5)	
4123	B A3NW	(3.0)	(2.5)	0.2	(2.8)	
4157	C B5SW	(3.7)	(2.7)	(0.2)	(3.9)	
4168	E1 A2NE	(4.8)	(2.8)	0.2	(4.0)	
4183	D C1NW	(2.1)	(2.5)	0.1	(1.4)	5-15
4189	D B5SW	(6.3)	(3.2)	0.3	(9.3)	
4190	D B5SW	(3.1)	(2.3)	0.2	(2.2)	
4292	D C1SE	(1.7)	(1.0)	0.2	(0.3)	
	md			0.2		
	$\bar{x}$			0.2		
	1/4-3/4			0.2-0.3		
	r			0.1-0.4		

10) bone detritus (n = 20)

#	P	L	W	T	Wt	F
4002	tp AL2				5.5	
4019	tp AL14				3.8	
4025	tp AL15				3.4	
4138	L4 C2SW				6.7	
4169	L4 C2SW				17.8	
4220	D3 C1NW				30.9	
4246	A B1SW				2.4	
4248	A B2SE				0.2	
4257	B A1SE				0.4	
4264	B B6NW				1.0	
4268	B C4SE				0.3	
4277	C B7NE				41.2	
4278	L4 C2SW				8.0	
4279	L4 D2SW				15.2	

10) cont.

#	P	L	W	T	Wt	F
4282	D C1SW				4.5	
4294	A A2SW				0.2	
4307	B B6SW				1.5	
4315	B A2NW				0.4	
4320	D3 A3SE				1.4	
4324	B C5SE				0.2	
	md				2.4	
	$\overline{x}$				7.2	
	1/4-3/4				0.4-6.7	
	r				0.2-41.2	

11) antler detritus (n = 28)

#	P	L	W	T	Wt	F
4001	tp AL2				10.2	
4010	tp AL5				30.1	
4099	C B1NW				17.9	
4129	B D7NW				51.1	
4131	B B7NE				85.5	
4132	B D7SW				10.1	
4133	B D7NE				5.4	
4135	B D7NE				14.5	
4136	B D7NE				13.4	
4163	B C7NE				43.8	
4164	L4 A3NW				24.5	
4166	st				69.6	
4201	E1 B1NW				3.2	
4204	D1 A5SW				19.5	
4211	D1 A2SE				7.2	
4219	D3 D1SW				7.2	
4221	D3 C1NW				81.5	

11) cont.

#	P	L	W	T	Wt	F
4230	D1 D7SW				3.1	
4243	J C1NW				11.1	
4250	B C3SW				28.8	
4274	C A5SW				10.6	
4281	L4 D2NW				83.4	
4284	L4 D1NW				4.2	
4286	D1 A3SE				15.9	
4295	B D6SW				11.1	
4318	G3 B3SW				16.1	
4321	L D1SW				0.9	
	md				14.8	
	$\overline{x}$				24.9	
	1/4-3/4				9.5-30.1	
	r				0.9-85.5	

12) whale bone blanks (n = 2)

#	P	L	W	T	Wt	F
4016	tp AL12	(155.1)	(55.5)	0.7	(49.6)	2-36
4020	tp AL14	(150.0)	(66.6)	0.7	(47.1)	2-36

13) <u>Mytilus</u> <u>californianus</u> detritus (n = 3)

#	P	L	W	T	Wt	F
4186	C D4NE				(0.9)	
4276	C B6NW				(3.4)	
4298	D3 C2SW				(6.9)	

2. WOODWORKING ARTIFACTS (n = 41)

1) nephrite celts or adzes (n = 2)

#	P	L	W	T	Wt	F
4094	B A1NE	(6.0)	(4.7)	0.7	(34.9)	5-16
4213	D1 B5SW	4.1	4.0	1.5	41.4	5-66

2) bone chisels or wedges (n = 6)

#	P	L	W	T	Wt	F
4013	tp AL10	(42.3)	(17.1)	(5.4)	(3.1)	2-36
4116	D B7SW	12.5	1.4	1.0	17.2	5-16
4172	st	(8.3)	(1.6)	(0.6)	(8.1)	
4260	L1 B2NE	(1.5)	(1.1)	(0.5)	(0.5)	5-61
4287	D C3NE	(0.7)	(0.6)	(0.3)	(0.2)	5-57
4296	B C3NE	11.8	1.7	1.4	17.4	5-61

3) bone drills (n = 2)

#	P	L	W	T	Wt	F
4127	B B7SE	(12.9)	(1.4)	(1.1)	(8.2)	5-16
4267	B B7NW	(29.1)	(6.1)	(5.2)	(0.5)	

4) antler adze haft (n = 1)

#	P	L	W	T	Wt	F
4078	st	8.2	2.8	1.0	24.1	5-66
4212	D1 B2SW	8.2	5.6	3.2	62.5	5-66

(both are part of same artifact)

5) antler wedges (n = 28)

#	P	L	W	T	Wt	F
4004	tp AL2	(49.3)	(30.6)	(14.5)	(7.7)	
4080	st	(12.0)	4.8	3.4	(102.1)	
4085	B A1SE	(94.5)	(28.5)	(20.9)	(22.8)	5-61
4104	B A1SW	(42.1)	(22.5)	(7.3)	(3.5)	5-16
4106	st	(7.5)	2.3	3.4	(22.5)	
4112	B A2SE	(126.9)	38.8	28.9	(65.0)	5-61
4115	C B7SW	70.4	43.9	14.2	21.1	
4120	B A2NE	(73.9)	(27.0)	(12.8)	(12.3)	5-16
4122	B B3SW	(114.4)	32.4	27.0	48.3	5-17
4124	B D5NE	(44.1)	(14.1)	(13.8)	(4.3)	5-17
4139	B C7NW	198.3	40.5	34.5	114.6	5-17
4155	L4 B3NE	(165.5)	34.9	(28.2)	(69.3)	
4156	C B5SW	(92.1)	(38.1)	(22.9)	(27.1)	5-57
4170	st	(6.2)	(2.9)	(1.7)	(12.9)	
4180	C D6SE	88.1	44.4	16.3	30.3	5-17
4194	D C7SW	(35.3)	(14.9)	(11.2)	(2.2)	5-16
4208	D1 B6NE	(97.5)	(25.5)	(17.7)	(14.4)	5-61
4209	D1 B5SW	(92.7)	(32.5)	(21.1)	(31.2)	5-17
4210	D1 B7SW	(192.1)	(33.1)	(21.4)	(52.1)	5-61
4217	D1 D7NW	(32.8)	(15.2)	(6.9)	(1.5)	5-16
4224	D3 C2NE	(56.4)	(19.2)	(8.6)	(4.6)	5-16
4227	L4 D1SW	(128.5)	(36.4)	(15.6)	(34.3)	5-61
4229	D3 A3NE	(19.0)	(27.4)	(8.1)	(3.1)	5-16
4233	L4 D3SW	(21.3)	(15.8)	(7.3)	(0.7)	5-16
4252	G1 C6NE	(81.3)	32.7	25.4	(26.5)	5-17
4288	L4 D3NW	(19.5)	(12.5)	(7.0)	(0.6)	5-16
4300	D3 B3SW	104.4	22.4	22.0	22.6	5-17
4306	G D3SE	(91.1)	(26.9)	(16.8)	(23.7)	5-17

6) *Mytilus californianus* adze fragments (n = 2)

#	P	L	W	T	Wt	F
4193	D D7SW	(26.2)	(24.7)	(2.4)	(2.8)	
4328	E A7NW	(13.3)	(7.3)	(1.9)	(0.2)	

3. TEXTILE AND HIDE WORKING ARTIFACTS (n = 24)

1) retouched flakes or scrapers (n = 3)

#	P	L	W	T	Wt	F
4014	tp AL13	4.5	3.9	1.5	13.5	2-35, 2-38
4032	tp AL21	3.9	3.3	1.4	10.5	2-35, 2-38
4173	B B2NE	4.0	4.7	1.3	12.5	5-18

2) split or sectioned bone awls (n = 15)

#	P	L	W	T	Wt	F
4027	tp AL15	(27.3)	(12.6)	(5.9)	(0.4)	
4137	B C5NW	10.1	1.0	0.6	1.8	5-18
4148	B C6SE	9.8	1.7	1.4	8.0	5-18
4152	B D7NE	10.9	0.7	0.5	3.5	5-18
4153	B A4SW	(10.4)	1.1	0.8	(8.1)	5-62
4192	D C6SE	8.0	1.2	0.6	7.2	5-18
4199	D B1SE	8.9	0.4	0.3	7.0	5-57
4207	D1 B5SE	9.0	1.2	0.8	8.8	5-62
4218	st	7.3	1.8	0.8	5.8	5-24
4226	D3 C2NW	15.7	2.4	0.8	14.8	5-62
4235	st	7.5	1.8	0.8	5.8	
4263	B B4NW	(1.7)	(0.3)	(0.4)	(0.2)	5-18
4293	B A5SW	(2.0)	0.3	0.3	(0.3)	5-18
4302	G1 C6SW	(5.5)	2.0	1.0	(5.0)	
4327	L1 C1NW	(14.4)	1.6	0.9	(17.5)	

3) deer ulna awls (n = 3)

#	P	L	W	T	Wt	F
4184	D C1SE	7.8	3.9	1.7	12.0	5-57
4225	D3 C2NW	14.6	3.6	1.7	17.5	5-62
4316	F-K	9.6	3.0	1.0	9.7	5-24

4) incised bone needles (n = 2)

#	P	L	W	T	Wt	F
4119	B A2NE	6.1	0.4	0.3	1.1	5-18
4289	L4 D3SW	(1.6)	(0.5)	(0.1)	(0.2)	5-18

5) antler awl (n = 1)

#	P	L	W	T	Wt	F
4089	B B1SE	74.6	33.0	13.9	16.8	5-18

4. CEREMONIAL AND DECORATIVE ITEMS (n = 47)

1) disc beads (n = 5)

#	P	L	W	T	Wt	F
4081	A A1NW		0.5	0.1	0.1	5-19
4097	B C3NE		0.8	0.1	0.2	5-19
4117	A A2NW		0.7	0.3	0.3	5-19
4251	A B4SW		0.5	0.1	0.1	5-19
4269	B C6NW		0.3	0.1	0.3	5-19
	md		0.5	0.1	0.2	
	$\overline{x}$		0.6	0.1	0.2	

2) labret (n = 1)

#	P	L	W	T	Wt	F
4256	A C5NW	(1.3)	(1.1)		(1.5)	5-19

3) ochre (n = 29)

#	P	L	W	T	Wt	F
4082	A B1NE				1.3	
4083	A B1NE				0.7	
4092	B A2NW				0.4	
4098	B C3NE				0.2	
4101	B C3SW				0.9	
4118	B C4NW				0.2	
4121	B B4SW				0.8	
4141	D1				0.2	
4150	D B1NW				2.6	
4171	C B6NW				2.5	
4182	D D2SW				0.4	
4188	D C5NE				0.4	
4191	D B7NW				1.1	
4195	D D7NE				5.4	
4244	B A2NE				0.6	
4245	A B1SE				0.4	
4247	A B1NW				1.1	
4249	A B1SW				0.3	
4254	B C6SE				1.6	
4261	D C1NW				0.1	
4265	C C6SE				0.1	
4266	B B7NW				0.2	
4273	C A4NE				0.1	
4280	C B7NW				0.5	
4283	D C2NW				1.3	
4301	D3 B3NW				3.2	
4305	G1 D5NE				2.1	
4310	G C4SW				0.2	
4314	F1 A4SW				1.2	
	md				0.6	
	$\bar{x}$				1.0	
	1/4 - 3/4				0.2 - 1.2	
	r				0.1 - 5.4	

4) bone blanket pins (n = 5)

#	P	L	W	T	Wt	F
4015	tp AL13	(97.9)	(8.0)	(5.1)	(3.1)	2-36
4023	tp AL13	154.0	13.7	4.8	6.6	2-36
4024	tp AL14	(111.0)	(7.8)	5.9	(4.7)	2-36
4026	tp AL14	(24.1)	6.6	4.6	(0.7)	2-36
4086	B A1SE	(32.6)	6.9	6.9	(1.7)	5-19

5) bone pendant (n = 1)

#	P	L	W	T	Wt	F
4311	F1 A7SE	69.9	14.8	2.3	1.9	5-19

6) earspool fragment (n = 1)

#	P	L	W	T	Wt	F
4238	A B4SE	(22.3)	(13.0)	(9.4)	(1.2)	5-19

7) birdbone bead (n = 1)

#	P	L	W	T	Wt	F
4291	L1 B2SW	(21.1)	(5.7)	(10.0)	(0.2)	5-62

8) <u>Dentalium</u> shell (n = 1)

#	P	L	W	T	Wt	F
4222	D3 A1NW	33.4	4.1	4.1	0.1	5-19

9) Pecten shell (n = 2)

#	P	L	W	T	Wt	F
4160	E A6SW				(1.5)	
4325	tp AL21				(0.7)	

10) antler pendant (n = 1)

#	P	L	W	T	Wt	F
4029	tp AL18	69.0	20.5	18.6	15.1	2-36

5. HUNTING ARTIFACTS (n = 2)

1) stemmed chipped stone arrow point (n = 1)

#	P	L	W	T	Wt	F
4255	A D7NW	3.2	1.7	0.6	3.3	5-20

2) leister point (n = 1)

#	P	L	W	T	Wt	F
4176	st	(19.9)	2.0	0.6	(14.8)	5-24

6. FISHING ARTIFACTS (n = 25)

1) bone bipoints (n = 5)

#	P	L	W	T	Wt	F
4140	B C6NE	(3.9)	0.4	0.3	(0.5)	
4202	E A3NW	6.3	3.6	0.2	0.8	5-21
4206	E1 A3NE	4.7	0.7	0.4	1.2	5-21
4231	D3 A4SE	6.6	0.8	0.3	0.4	5-62
4232	D B1SW	7.1	0.8	0.4	2.4	5-57

2) incised bone points (n = 4)

#	P	L	W	T	Wt	F
4102	B A3SE	(3.8)	0.6	3.5	(0.7)	5-21
4109	st	(3.2)	0.4	0.3	(0.3)	5-24
4239	D5 C1NE	(1.6)	0.5	0.4	(0.3)	5-21
4272	C A4NW	(2.6)	0.5	0.5	(0.4)	5-21

3) basally thinned bone points (n = 5)

#	P	L	W	T	Wt	F
4017	tp AL5	3.9	0.4	0.2	0.2	2-36
4178	B C6NE	4.1	0.4	0.3	0.8	5-62
4259	D C3NW	(1.5)	0.3	0.1	(0.2)	5-21
4271	B D6NE	4.1	0.5	0.2	0.2	5-21
4299	G1 D6NW	4.6	0.4	0.3	0.3	5-21

4) bone point fragments (n = 5)

#	P	L	W	T	Wt	F
4177	D B1NW	(1.8)	(0.4)	(0.2)	(0.1)	
4270	B D6SW	(1.6)	(0.3)	(0.2)	(0.1)	
4275	C B6NW	(1.6)	(0.3)	(0.1)	(0.1)	
4290	D1 A7SW	(1.5)	(0.3)	(0.3)	(0.2)	
4317	D B1NW	(1.2)	(0.5)	(0.2)	(0.1)	

5) antler harpoons with lineguard (n = 2)

#	P	L	W	T	Wt	F
4303/						
4304	G1 D5NE	(52.0)	(15.0)	4.5	(2.3)	5-21
4234	st	(7.6)	(2.0)	0.8	(6.4)	

6) toggling harpoon (n = 4)

#	P	L	W	T	Wt	F
4011	tp AL6	69.3	12.3	7.0	2.0	2-36
4091	B B1NE	71.3	12.9	6.1	2.1	5-21
4103	B A1SE	(53.0	12.8	6.4	(1.7)	5-21
4258	B C7SE	(18.8)	(7.6)	(3.9)	(0.2)	5-21

7. FOOD PREPARATION ARTIFACTS (n = 14)

1) stemmed biface knives (n = 5)

#	P	L	W	T	Wt	F
4076	beach front	155.1	40.2	13.5	103.7	
4077	st	(3.8)	(3.1)	(.0.8)	(8.9)	5-25
4079	st	8.2	2.8	1.0	24.1	5-25
4197	L4 B2SW	7.1	2.9	1.3	25.4	5-62
4312	st	7.2	2.6	0.8	19.7	5-25

2) chipped slate knives (n = 7)

#	P	L	W	T	Wt	F
4087	B B1SE	8.9	3.8	0.8	34.5	5-62
4165	st	8.4	4.9	0.5	34.0	
4174	B C6SE	12.8	3.8	0.3	20.0	5-22
4196	E A6NE	11.2	8.2	0.6	90.6	5-22
4203	E1 A2NE	6.3	3.6	0.2	8.0	5-22
4237	D4 B4NE	10.3	3.8	0.3	18.7	5-22
4309	G C3SW	9.5	8.0	0.7	65.0	5-22

3) ground stone knife (n = 1)

#	P	L	W	T	Wt	F
4003	tp AL2	6.7	2.1	1.1	15.5	2-37

4) perforated stone (n = 1)

#	P	L	W	T	Wt	F
4028	tp AL15	(8.0)	(4.7)	3.4	(193.3)	2-35