READING THE EARTH: MULTIVARIATE ANALYSIS OF FEATURE FUNCTIONS AT X̲Á:YTEM (THE HATZIC ROCK SITE, DgRn 23), BRITISH COLUMBIA

by

PATRICIA LAURA ORMEROD

B.A., The University of British Columbia, 1998

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

Department of Anthropology and Sociology

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

September 2002

© Patricia Laura Ormerod, 2002

In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Patricia Laura Ormerod

Department of Anthropology

The University of British Columbia
Vancouver, Canada

October 4, 2002

ABSTRACT

This paper summarizes the results of a multivariate analysis to determine the functions of features, dating between ca. 7000 BP and 4500 BP, at X̲á:ytem (the Hatzic Rock site, DgRn 23) in the lower Fraser River valley, British Columbia. From postulated feature functions, site use and subsistence activities are compared with the culture history for the region. As at other Old Cordilleran sites, X̲á:ytem ca. 7000 BP likely served as a field camp where foragers gathered and consumed local resources in late summer and autumn. Around 5000 years ago, Charles culture people visited the site to gather, process, and possibly store local resources during summer and autumn. There is limited data suggesting that around 4500 BP, use of the site changed from processing local resources only to processing resources gathered in other ecological niches as well. Structures, storage, and lithic evidence all suggest that X̲á:ytem ca. 4500 BP is different from St. Mungo phase sites of the Fraser River delta and exhibits a river valley adaptation of Charles culture. However, as at other Charles culture sites, X̲á:ytem was not occupied year round, but may have been visited in spring, summer and autumn.

TABLE OF CONTENTS

Abstract ii
Table of Contents iii
List of Tables v
List of Figures vi
Acknowledgements vii
CHAPTER I Introduction 1
1.1 Previous Archaeology at X̲á:ytem 1
1.2 The Environment and Subsistence Resources 4
1.3 Culture History of the Fraser River Valley Region 4
1.3.1 Old Cordilleran / Pebble Tool Tradition (9000 – 4500 BP) . . 4
1.3.2 Charles Culture 5
1.3.2i St. Mungo Phase of Charles Culture (4500 – 3300 BP) 5
1.3.2ii Eayem Phase of Charles Culture (5450 – 3300 BP) . . 6
1.3.2iii River Valley Sites: Charles Culture (5050 – 4200 BP) 6
CHAPTER II Feature Function Analysis 7
2.1 Ethnographic Features, Functions, Archaeological Expectations . . . 7
2.1.1 Structures with Permanent Post Frames 7
2.1.2 Structures and Racks Supported by Temporary Post and Stake Frames 8
2.1.3 Pit Features 9
2.1.3i Earth Ovens 9
2.1.3ii Hide-smoking Pits 10
2.1.3iii Non-Thermal Pit Features 11
2.1.4 Surface and Shallow Thermal Features: Hearths, Mound Ovens, and Smoking Fires 11
2.1.4i Hearths 11
2.1.4ii Mound Ovens 12
2.1.4iii Smoking Fires 12
2.2 Previous Archaeological Feature Function Analyses 13
CHAPTER III Research Objectives, Relevant Data, and Research Methods 15
3.1 Research Questions 15
3.2 Relevant Data and Research Methods 15
CHAPTER IV Results 18
4.1 Feature Kinds from Clustering and Scaling 18
4.2 Linking Archaeological and Ethnographic Characteristics 19
4.3 Postulated Functional Feature Kinds 20
4.3.1 Postmold Features (Kind 1) 20
4.3.1i Round Postmolds (Kind 1-a) 22
4.3.1ii Squared Postmolds (Kind 1-b) 22
4.3.1iii Probable Postmolds (Kind 1-c) 22
4.3.2 Non-Thermal Pit Features (Kind 2) 22
4.3.3 Squared, Non-Thermal Pit Features (Kind 4) 22
4.3.3i Squared, Non-Thermal Pit Features (Kind 4-a) . . 24
4.3.3ii Squared Non-Thermal Pit Features (Kind 4-b) . . 24
4.3.4 Large Thermal Features (Kind 5) 24
4.3.4i Large Historic Hearth and Earth Oven (Kind 5-a) . . 24
4.3.4ii Large Mound Ovens and Earth Ovens (Kind 5-b) . . 27
4.3.5 Medium-sized Earth Oven / Hearth with stakes (Kind 3) . . . 27

4.3.6 Medium-sized Thermal Features (Kind 6) 29
4.3.6i Medium-sized Ovens or Thermal Refuse (Kind 6-a) . 29
4.3.6ii Medium-sized Earth Ovens (Kind 6-b) 29
4.3.7 Small Mound Ovens and Earth Ovens (Kind 7) 29
4.3.7i Small Ovens with Rock Elements (Kind 7-a) . . . 31
4.3.7ii Small Ovens without Rock Elements (Kind 7-b). . . 31
4.3.8 Thermal Refuse: Fire-Modified Rock (Kind 8) 31
4.3.9 Conclusions 31
4.4 Radiocarbon Age Estimates of Features and Components 33
4.5 Seasonality and Subsistence Resources, by Component 33
4.6 Site Use, by Component 34
4.6.1 Component I Site Use (7000 – 6700 BP): X̲á:ytem in the Old Cordilleran 36
4.6.2 X̲á:ytem during the Charles Culture 38
4.6.2i Component II Site Use (5000 - 4800 BP) 38
4.6.2ii Site Use in Component III (ca. 4500 BP- unknown terminal date) 41
4.6.3 Site Use: Conclusions. 42
CHAPTER V Discussion and Recommendations 44
5.1 Discussion of Results 44
5.2 Comparisons with Culture History of the Area 45
5.2.1 X̲á:ytem and Old Cordilleran Culture History 45
5.2.2 X̲á:ytem and Charles Culture History 45
5.2.2i Why X̲á:ytem is not St. Mungo Phase 45
5.3 Recommendations for Future Research 46
5.3.1 Improving the Functional Feature Typology 46
5.4 Conclusion. 48
Bibliography 49
Appendix I Ethnographic Data: Features and Subsistence Activities 55
Appendix II Definitions of Characteristics Used in Clustering and Scaling 59
Appendix III 32 Characteristics Dominating Furthest Neighbour / Jaccard's Clusters . . . 60
Appendix IV-a Dimensions 1 and 2 of Jaccard's / Furthest Neighbour Scaling 62
Appendix IV-b Dimensions 3 and 4 of Jaccard's / Furthest Neighbour Scaling 63
Appendix V Postulated Functions of Features, Dimensions and Illustration Reference 64
Appendix VI Feature Kind 5-a (Feature 9-B, 9-A) 66
Appendix VII Feature Kind 5-a (Feature 9-C), Feature Kind 10 67
Appendix VIII Identification Key to Functional Feature Kinds at X̲á:ytem 68
Appendix IX Radiometric Age Estimates for X̲á:ytem 69
Appendix X Component Characteristics: Matrix Colours, Depths Below Unit Datum 70
Appendix XI 132 Features at X̲á:ytem, by Component and Kind 71
Appendix XII-a Features in Component I 73
Appendix XII-b Features in Component II. 73
Appendix XII-c Features in Component III 74
Appendix XIII Seeds and Wood in Feature Kinds, by Component 75
Appendix XIV Features with Fauna Present, by Component 76
Appendix XV Lithic Artifact Comparison: X̲á:ytem and Glenrose St. Mungo Component . . 77
Appendix XVI Soil Chemical Proportions in Feature Kinds, by Component 78
Appendix XVII Results of Correlation Analyses of Bruno's Data 79

LIST OF TABLES

Table 1 Postulated Functions of Feature Kinds 21
Table 2 Frequency of Feature Kinds by Component. 35

LIST OF FIGURES

Figure 1	Archaeological Sites of the Lower Fraser River and Neighbouring Regions	2
Figure 2	X̲á:ytem Site and the Study Area	3
Figure 3	Dendrogram of Jaccard's / Furthest Neighbour Clusters	18
Figure 4a	Round Postmolds (Kind 1-a) (Feature 94-20)	23
Figure 4b.	Square Postmolds (Kind 1-b) (Feature 20a)	23
Figure 4c.	Probable Postmolds (Kind 1-c) (Feature 34)	23
Figure 4d.	Non-Thermal Pits (Kind 2) (Feature 5, Probable Postmold)	23
Figure 5a-1.	Squared Non-Thermal Pits, Possible Storage Pits (Kind 4-a) (Feature 15)	25
Figure 5a-2.	Squared Non-Thermal Pits, Possible Storage Pits (Kind 4-a) (Feature 6)	25
Figure 5b.	Squared, Non-Thermal Pit (Kind 4-b) Probable Postmold (Feature 7)	25
Figure 6.	Large Earth Oven (Kind 5-a) (Features 9A, 9B, 9C, 9D)	26
Figure 7a.	Large Earth Oven (Kind 5-b) (Feature 12).	28
Figure 7b-1.	Medium-Sized Earth Oven/Hearth (Kind 3) (Feature 94-33)	28
Figure 7b-2.	Medium-Sized Earth Oven/Hearth (Kind 3) (Feature 57)	28
Figure 8a.	Medium-Sized Ovens or Thermal Refuse (Kind 6-a) (Feature 31)	30
Figure 8b.	Medium-Sized Earth Oven (Kind 6-b) (Feature 94-3)	30
Figure 9a.	Small Mound Oven (Kind 7-a) (Feature 94-1)	32
Figure 9b.	Small Earth Oven (Kind 7-b) (Feature 94-L2)	32
Figure 9c.	Thermal Refuse: Fire-Modified Rock (Kind 8) (Feature 4; Feature 10)	32
Figure 10	Component I Plan	37
Figure 11	Component II Plan	39
Figure 12	Component III Plan	42

ACKNOWLEDGEMENTS

Thank you to the members of my graduate advising committee for all their assistance in seeing this project reach its conclusion. I especially thank David Pokotylo, who chaired my committee and provided funds from his Hampton Grant for radiocarbon age estimates and who employed me as a research assistant. I also sincerely thank R.G. Matson who has been my constant mentor and who also employed me as a research assistant. And thank you to Mike Blake for chairing my committee during one of David's African safaris and for always offering encouragement, even after being relieved of "official" status on my graduate committee. And thanks also to Joyce Johnson who could always be counted on for good suggestions and cheerful encouragement.

I also thank the staff and friends of the X̲á:ytem Longhouse and the archaeologists and staff of the *Stó:lō* First Nation for their hospitality and for sharing traditional stories, crafts, and laughs during the two seasons I was at the site, and since. In completing this work, I have not forgotten the loss of history symbolized by the transformer, the Hatzic Rock. I hope my analysis of what can be read in the earth will help the *Stó:lō* write their history, in spite of the absence of written records handed down from the times of the three *sí:yá:m.*

This work could not have been accomplished without the help of students in the Anthropology Department at UBC, both past and present collegues. Without the fine work done by archaeology students who toiled in the field, there would have been nothing to say. Thank you class of '94: Brian Thom, Bonnie Campbell, Tracy Kurz, Amelia Barker, Roseanne Carrero, Angela Ma, Andy Everson, Rob Vincent, Ryan Dyer, Ani Hosepyan, Kirsten Davidson, Jennifer Mareyniuk, Jennifer Jones, and Oki Nakamura; class of '97: Matthew Begg, Lu-Anne DaCosta, Christine Dahlo, Martha Graham, Megan Hill, Shannon King, Li Min, Kate Procopio, Rod Sandoval, Bita Vorell and Jean Young; and class of '99: Michael Pearson, Dominique Bruno, Jeff Wyndham, David Milgrom, Christine Berney, Lilian Chau, Randi Drevland, Craig Sellars, and volunteers Susan Matson, Gordon Matson, and L. Mowatt. A very special thank you to the undergraduate student researchers: Elizabeth Radomski, Jeff Wyndham, Bita Vorell, and Dominique Bruno who analyzed the matrix samples and provided botanical, faunal and soil data that added so much to the interpretation of feature functions.

And thanks to my family, who were always encouraging. Deepest thanks to Alban Goulden for intellectual (and financial) support, and to Ian Chisholm for doing such a terrific job on my pencil drawings.

And thanks to everyone, old friends and new, who said "enough already, finish it."

Of the countless *Stó:lō sxwoxwiyám* [stories set at the arrival of the Transformers, *Xexáls*] which have been passed down from generation to generation, probably the best known among mainstream society is the story surrounding the large *Xá:ytem* boulder near Mission. The following story is the *sxwoxwiyám* relating to the site as shared by *Stó:lō* Elder Bertha Peters:

A person from Chilliwack Landing told me this story: The Great Spirit [*Xá:ls*] travelled the land, sort of like Jesus, and he taught these three *sí:yá:m*, (these three chiefs) how to write their language. And they were supposed to teach everyone how to write their language, but they didn't. So they were heaped into a pile and turned to stone. Because they were supposed to teach the language to everyone, and because they didn't, people from all different lands will come and take all the knowledge from the people. Because they wouldn't learn to write they lost that knowledge.

Keith Thor Carlson, editor

You Are Asked to Witness: The Stó:lō in Canada's Pacific Coast History

CHAPTER I: INTRODUCTION

This analysis of feature morphology, contents, and systemic context (Schiffer 1972) is designed to infer the functions of features dating between ca. 7000 BP and 4500 BP at the X̲á:ytem site (formerly named Hatzic Rock, DgRn 23) in the lower Fraser River valley, British Columbia (Figure 1). The primary research objective is the identification of feature classes and postulated functions using 132 features recorded on the lower terrace at X̲á:ytem during excavations by the University of British Columbia field schools of 1994, 1997, and 1999 (Pokotylo 1997a; Ormerod and Matson 2000) (Figure 2).

A secondary objective is to compare site use at X̲á:ytem with Old Cordilleran and Charles/St. Mungo phase sites in the region. Radiocarbon age estimates indicate the site was occupied during both the Old Cordilleran/Pebble Tool Tradition (9000 – 4500 BP; Matson and Coupland 1995) and Charles/St. Mungo phase (5500 – 3300 BP; Pokotylo 1998). Age estimates available for the study area date a hearth ca. 7000 BP (Beta 77759), a small structure ca. 5000 BP (Beta 143727), and a deep thermal pit ca. 4500 BP (Beta 111764) (Ormerod and Matson 2000). Features on a higher terrace provided dates between 9000 BP (Beta 46707) and 4420 BP (Nuta 1452) (Mason 1994; Pokotylo 1998). This study identifies the number of components in the study area and temporal associations with features on the higher terrace (Mason 1994), and infers site use and subsistence strategies for each component.

1.1 PREVIOUS ARCHAEOLOGY AT X̲Á:YTEM

X̲á:ytem is a National Heritage Site co-managed by the *Stó:lō* First Nation and the British Columbia Heritage Trust. It is located in the Fraser River valley about 80 km east of Vancouver in south-western British Columbia. The site is bounded by the Fraser River on the south, and Hatzic Lake (an oxbow remnant of the river) and Hatzic Slough (a wetland) on the east (Figure 2). X̲á:ytem is significant as both an archaeological site and a Coast Salish spiritual site. In *Stó:lō* oral tradition, the Great Spirit, *X̲á:ls,* transformed three leaders *(sí:yá:m)* into a boulder (Hatzic Rock) here for failing to teach the people how to write their language (Carlson 1997:187).

Archaeological investigations have explored two areas on low terraces adjacent to the Fraser River flood plain (Figure 2). Two structures, including one approximately 40 sq. metres in size, and hearth, fire-cracked rock, and post and stake features were recorded on the higher terrace (Mason 1994). The present study focuses on features on the lower terrace, identified in the site report as stakemolds, postmolds, pits, hearths, basins, fire-cracked rock concentrations, charcoal concentrations, an anvilstone, and a right-angled stain (Pokotylo 1997a; Ormerod and Matson 2000).

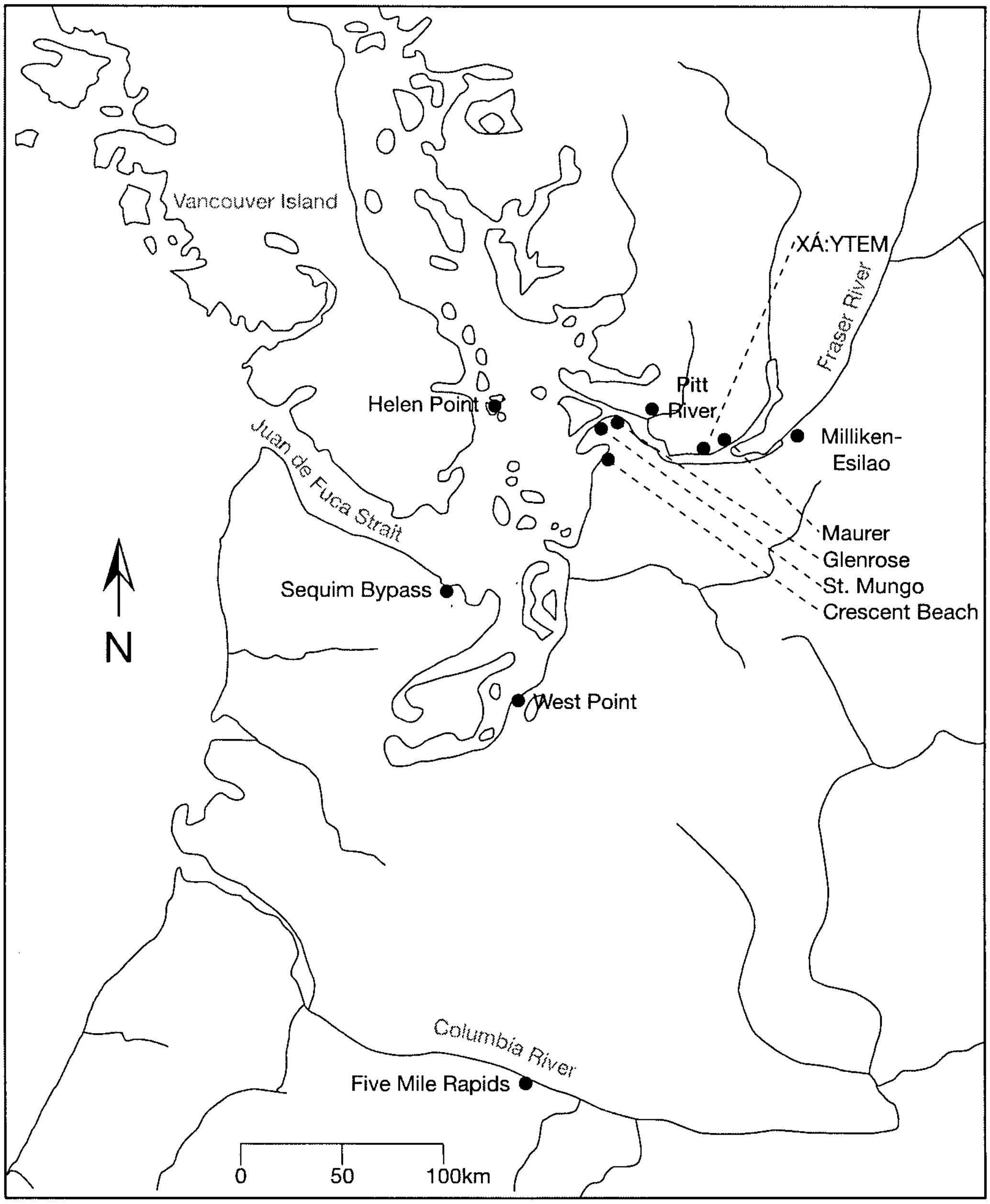


Figure 1. Archaeological Sites of the Lower Fraser River and Neighbouring Regions (Old Cordilleran/Pebble Tool Tradition and Charles Culture)

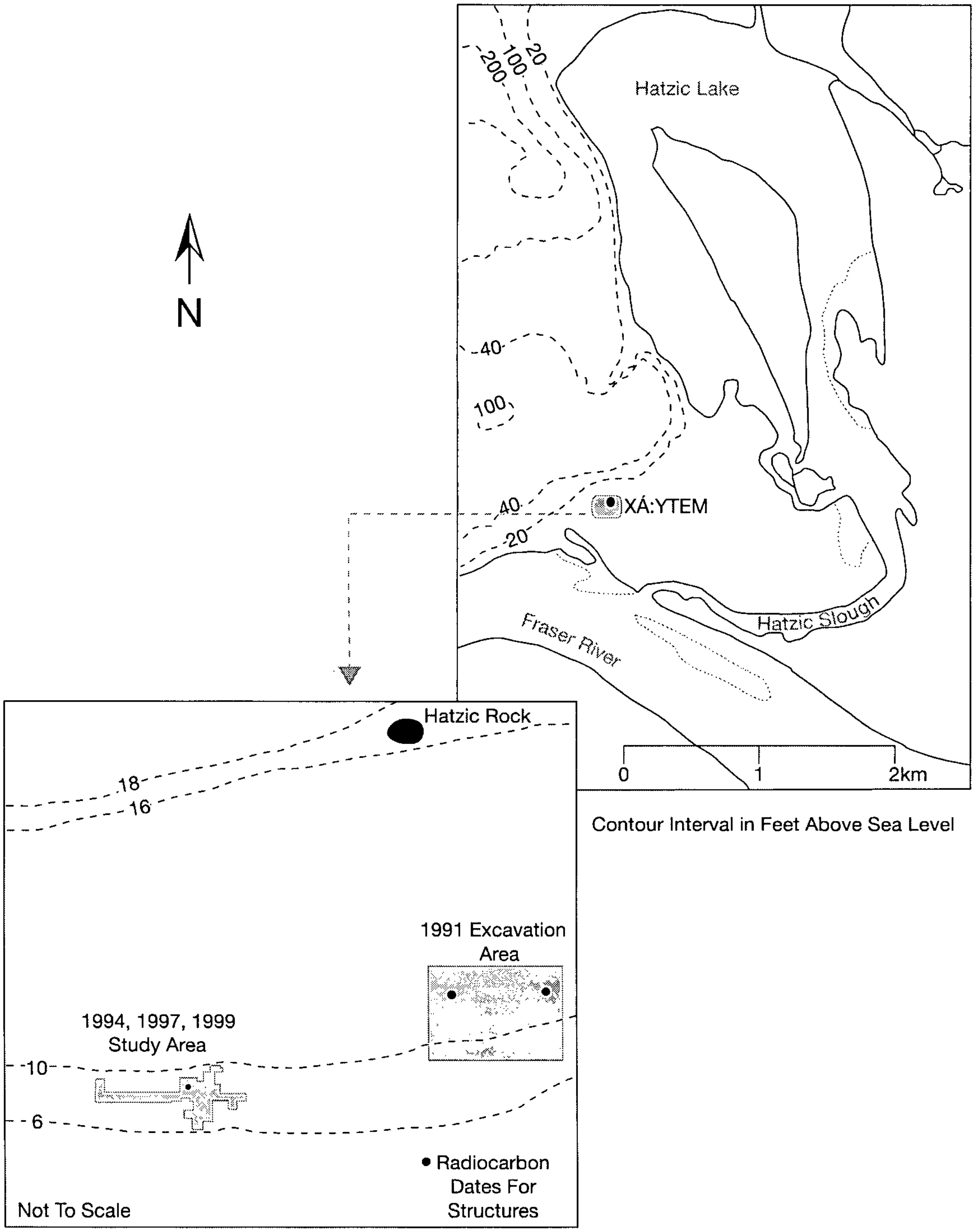


Figure 2. X̲á:ytem Site and the Study Area

1.2 THE ENVIRONMENT AND SUBSISTENCE RESOURCES

Radiocarbon dates for X̲á:ytem features indicate the site was used between ca. 7000 BP and ca. 4500 BP. From 11,500 years ago to 6000 years ago, herbaceous plants, alder *(Alnus)*, and lodgepole pine (*Pinus*) dominated the landscape of the area (Mathewes 1973). Around 6000 years ago, the present Coastal Western Hemlock biogeoclimatic zone, with high rainfall, mild winters, and cool summers with frequent hot, dry spells, was becoming established (Hebda 1995; Wainman and Mathewes 1987; Meidinger and Pojar 1991:96). Spruce (*Picea*), lodgepole pine (*Pinus*) and alder *(Alnus)* trees increased in numbers; western hemlock (*Tsuga heterophylla*) was becoming the dominant tree species; and red cedar (*Thuja plicata)* was the second most dominant species (Hebda 1995:64). Cedar trees were mature enough for massive woodworking around 5000 BP in the Lower Fraser valley area (Wainman and Mathewes 1987). At X̲á:ytem today, western hemlock (*Tsuga heterophylla*) grows amidst shrub vegetation of red alder (*Alnus rubra*), cottonwood (*Populus trichocarpa*), bracken fern (*Pteridium aquilinum pubescens*), common horsetail (*Equisetum arvense*), and salmonberry (*Rubus spectabilis*). On the former flood plain, thimbleberry (*Rubus parviflorus*) and common reed grass (*Phragmites australis*) flourish; cattails (*Typha latifolia)* grow nearby in sloughs. Wapato (*Saggitaria latifolia*), commonly called Arrowhead, grows around sloughs in the area and X̲á:ytem likely supported wapato in the past. Before dykes were built in the 1900s, ponds formed in low-lying meadows during annual floods in late spring (Kelley 1939).

Species of fish and birds available as subsistence resources include salmon (*Oncorhynchus* sp.), white sturgeon (*Acipenser transmontanus*), grouse (*Dendragapus* sp.), sandhill crane (*Grus canadensis*), and ducks (*Anas* sp.) (Meidinger and Pojar 1991:105). Mammal species include deer (*Odocoileus* sp.), bear (*Ursus americanus*), otter (*Lutra canadensis*), elk (*Cervus elaphus*), beaver (*Castor canadensis*), and chipmunk (*Tamias* sp.) (Meidinger and Pojar 1991:107).

1.3 CULTURE HISTORY OF THE FRASER RIVER VALLEY REGION

The culture history of the Fraser River valley (ca. 9000 BP to 4000 BP) is primarily derived from archaeological investigations of sites in the canyon, 100 km inland where the river leaves the Coast Mountains and enters its broad valley, and sites in the delta at the river's mouth. Sites along the river between these locations have not been studied to the same extent. As a result, site use and subsistence activities have been assumed to be similar throughout the region, although river valley site subsistence activities are not well understood.

1.3.1 Old Cordilleran / Pebble Tool Tradition (9000 – 4500 BP)

The first known occupation of the Strait of Georgia and Lower Fraser River region, the Old Cordilleran (Matson 1976, 1992; Matson and Coupland 1995) or coastal Pebble Tool tradition (Carlson 1983, 1990), dates from ca. 9000 BP to 4500 BP. Sites with Old Cordilleran components include the

Glenrose Cannery site (Matson 1976) in the delta and the Milliken site (Borden 1951, 1975; Mitchell and Pokotylo 1995) in the Fraser River canyon.

At the Glenrose site, hunting land mammals, mainly elk and deer, predominated although subsistence evidence includes small quantities of salmon, shellfish, eulachon, and birds by 6000 BP (Matson 1992; Matson and Coupland 1995). Inland, Old Cordilleran subsistence included salmon ca. 9000 BP at the Five Mile Rapids site on the Columbia River (Cressman 1960) and probably at the Milliken site (Borden 1975). Lithic assemblages at coastal and inland sites are similar, consisting primarily of leaf-shaped points and cobble tools (Matson and Coupland 1995; Borden 1975). Bone and antler tools (at the Glenrose site) and abrading stones (at Esilao-Milliken) suggest both areas also shared a tool technology based on perishable materials (Matson and Coupland 1995; Borden 1975). Inter-site diversity of faunal remains implies that groups visited numerous sites year after year, to gather local resources in season. Sparsely distributed features include hearths and small charcoal lenses, some with associated stakemolds, but no evidence for structures (Cressman 1960; Borden 1975; Matson 1976; Mitchell and Pokotylo 1995).

1.3.2 Charles Culture

Borden (1975) first noted that the St. Mungo phase of the Fraser delta (Matson 1976), the Mayne phase of the coast and Gulf Islands (Carlson 1970), and the Eayem phase of the Fraser canyon share temporal and cultural traits. He suggested they represent variants of one culture, which he named the Charles culture (Borden 1975). Accumulating evidence now dates the Charles culture as lasting from ca. 5500 BP to ca. 3300 BP (Pokotylo 1998) and all Charles culture phases are thought to share subsistence and seasonal site use characteristics with the well-documented St. Mungo phase (Matson and Coupland 1995; Matson 1992).

1.3.2.i St. Mungo Phase of Charles Culture (4500 – 3300 BP)

In the Fraser delta region, subsistence strategies of the St. Mungo phase (4500 – 3300 BP) replaced those of the Old Cordilleran/Pebble Tool tradition ca. 4500 BP (Matson 1992; Matson and Coupland 1995; Pokotylo 1998). Evidence from three shell midden sites (St. Mungo, Crescent Beach, and Glenrose Cannery) demonstrate that land mammals were replaced as dominant subsistence resources by bay mussel, salmon, and flatfish (Calvert 1970; Boehm 1973; Matson 1992). Lithic assemblages remained similar to the Old Cordilleran, however, the quantity of cobble tools and leaf-shaped points decreased, the array of bone and antler types broadened, and personal (art) objects appeared (Matson and Coupland 1995).

Sites continued to be frequently occupied for short periods and there is no evidence of year-round occupations (Matson 1992). Even the Glenrose site, with evidence of occupation in late winter (herring), spring (eulachon and flatfish), and late summer and early fall (salmon), has insufficient data to suggest continuous, year-round occupation (Matson and Coupland 1995). Compact, blackened "living floors" (Gose in Matson 1976) with scattered fire-modified rocks and hearth-type features occur at the Glenrose site, however, the lack of clearly associated postmolds resulted in debate about the presence of structures (Gose in Matson 1976; Ham 1986; Pratt 1992; Matson 1992; Matson and Coupland 1995). At the St. Mungo site, one possible small structure was recovered (Calvert 1970). Evidence includes a small rectangular floor, approximately 1.75 metres by 2 metres, covered with a thin layer of red ochre and with a hearth in one corner. Matson concludes that, although the number of sites in the area increased dramatically and there was a shift to marine resources, a forager subsistence adaptation continued: each resource was consumed at its source, permanent houses were not constructed, and storage technologies were not employed in the delta area (Matson 1992; Frederick in Matson and Coupland 1995).

One other St. Mungo phase site, Pitt River, with a small number of posts and pits dating between 4390 and 4000 BP, was interpreted as a seasonal camp, with mat shelters and fish drying racks, for processing fish and wapato (Patenaude 1985). However, wapato remains were not recovered and stakemold functions were postulated by ethnographic analogy, not from archaeological evidence of structures (Patenaude 1985:1.259-1.282).

***1.3.2ii Eayem Phase of Charles Culture* (5400 – 3300 BP)**

The Eayem phase type-site, Esilao, in the Fraser canyon overlaps in time and shares similar lithic technology with St. Mungo components (Matson and Coupland 1995; Pokotylo 1998). Borden referred to Esilao as an "intensive occupation" (Borden 1975:72) that dated between 5490 and 3790 BP (Borden 1975). Subsistence data, however, were not reported. Drawings in the field notes illustrate hearths, fire-modified rock, areas of oxidized soil, and extensive charcoal lenses.

1.3.2iii River Valley Sites of Charles Culture (5000 – 4200 BP)

Charles culture sites located between the delta and the canyon include two sites with well defined structures: X̲á:ytem and Maurer. The silt and sand matrices of these sites (Pokotylo 1997a; Mason 1994; Ormerod and Matson 2000; LeClair 1976; Schaepe 1998) preserved structural evidence (but not subsistence remains), whereas in the delta, shell middens have preserved faunal remains (but make the identification of structural elements difficult). Maurer is significant for its rectangular house depression (LeClair 1973, 1976; Borden 1975; Schaepe 1998:157-58) with radiocarbon age estimates of 4220 BP and 4240 BP (Schaepe 1998:149). Structures on the higher terrace at X̲á:ytem have been dated ca. 4800 BP – 4420 BP (Mason 1994:37-38) and a small structure on the lower terrace, dated ca. 5050 BP (Ormerod and Matson 2000), is the earliest structure reported for the Charles culture. At X̲á:ytem, numerous features identified as hearths, pits, and post and stake molds have been reported (Mason 1994; Pokotylo 1997; Ormerod and Matson 2000). Poor preservation of floral and faunal remains, however, has restricted descriptions of subsistence activities and site use. In the present study, the identification of functional kinds of features, subsistence, and site use will provide details of river valley site use for comparison with regional culture histories for the period between 9000 BP and 4500 BP.

CHAPTER II: FEATURE FUNCTION ANALYSIS

Inferences of function applied to archaeological features generally rely on analogy to ethnographic descriptions and/or comparisons with previous archaeological interpretations. The present study avoids using previous archaeological typologies and cannot use direct historic analogy as features in this study date between ca. 7000 BP and ca. 4500 BP. Ethnographic references were used, however, to develop expected archaeological characteristics indicative of feature functions, and archaeological feature function analyses informed the methodology.

2.1 ETHNOGRAPHIC FEATURES, FUNCTIONS, AND ARCHAEOLOGICAL EXPECTATIONS

Although ethnographies specific to the X̱á:ytem locality do not exist, archaeological expectations for features used for subsistence activities were developed from ethnographic reports from other Coast Salish areas (Hill-Tout 1978a, Hill-Tout 1978b; Curtis 1913; Gunther 1927; Haeberlin and Gunther 1930; Stern 1934; Duff 1952; Barnett 1955; Bouchard and Kennedy 1974; Bouchard and Kennedy 1976a; Bouchard and Kennedy 1976b; Bouchard and Turner 1976). Details of some feature constructions come from adjacent linguistic areas: the Chinook of the Columbia River area (Teit 1928; Sapir and Spier 1930; Ray 1938) and the Interior Salish of the Fraser River watershed (Teit 1900; Teit 1906; Bouchard and Kennedy 1975a; Bouchard and Kennedy 1975b; Bouchard and Kennedy 1975c). A publication by the Gitksan (K'San 1980), describing the use of cooking features, was helpful in developing archaeological expectations for features used for processing food for immediate use, processing for preservation, and food storage. From all ethnographic sources, feature classes identified include structures supported by permanent post frames, features supported by non-permanent frames, non-thermal pits, thermal pits (including earth ovens and hide-smoking pits), and other thermal features (hearths, mound ovens, and smoking fires) (Appendix Ia-Ic).

2.1.1 Structures with Permanent Post Frames

Rectangular, shed-roof longhouses, used for shelter; incidental drying of fish or meat; storage; and (rarely) only for smoking food; were supported by permanent, upright posts (Hill-Tout 1978a; Hill-Tout 1978b; Hill-Tout 1978c; Curtis 1913; Haeberlin and Gunther 1930; Barnett 1955) (Appendix I-a). The frame consisted of four corner posts (with additional posts to enclose larger areas). Posts were occasionally squared for easy attachment of horizontal wallboards (Curtis 1913) that were lashed to small, paired poles set between the posts (Curtis 1913). Storage racks were set upon the rafters or attached to the house frame (Hill-Tout 1978a, Hill-Tout 1978b; Gunther 1927; Barnett 1955) and the ground, although levelled for the floor, was not excavated (Barnett 1955).

Interior partitions were not constructed, however, reed mat dividers were hung from rafters (Barnett 1955; Haeberlin and Gunther 1930). Posts and stakes inside structures supported racks over hearths to dry fish and deer meat (Ray 1938; Barnett 1955), freestanding storage racks, and benches

(45 cm deep, along all four walls) with wood and root storage underneath (Hill-Tout 1978a, Hill-Tout 1978b; Gunther 1927; Barnett 1955). Archaeological evidence of a house with permanent posts would include a minimum of four posts set around a levelled, but not excavated, floor; paired stakemolds along the perimeter of the structure; and possibly, stakemolds and small postmolds set 45 cm from the walls. Other stakemolds and postmolds located on the floor might imply drying racks (with or without hearths) or storage racks (without hearths) were present. Rotted hardwoods in the hearth would imply the structure was a smokehouse (Bouchard and Kennedy 1974; Bouchard and Kennedy 1975b; Bouchard and Kennedy 1975c; Bouchard and Kennedy 1976a; Bouchard and Kennedy 1975b), however, mixed softwoods and hardwoods in the hearth would imply that the structure was likely a habitation in which food drying was incidental. In small houses, a single cooking and heating hearth was located at the centre. In longhouses, multiple hearths might occupy a central trench, 30 cm deep (Ray 1938) running the length of the structure, or hearths might be separate fires located near the walls (Curtis 1913). Upright stakemolds around hearths imply food was dried for preservation on racks over the fire (Barnett 1955; Curtis 1913), whereas slanted stakes imply fish and meats were toasted or barbecued for immediate consumption (Curtis 1913). The earliest longhouses on the Fraser River occur at the Scowlitz site, and have been dated between 2200 and 2900 BP (Matson 1994; Lepofsky *et al.* 2002).

2.1.2 Structures and Racks Supported by Temporary Post and Stake Frames

Non-permanent structures constructed from small diameter posts, poles, and stakes include temporary dwellings, smokehouses (with a smoking fire at the centre), and sweathouses (Appendix I-a). Rack constructions utilizing stakes include outdoor racks for sun-drying fish (Sapir and Spier 1930; Curtis 1913; Bouchard and Kennedy 1974), berries (Bouchard and Kennedy 1974; Bouchard and Kennedy 1975a; Bouchard and Kennedy 1976b), deer meat (Bouchard and Kennedy 1976b), and cattails (Ray 1938). Outdoor racks over smoking fires were used for drying fish (Bouchard and Kennedy 1976a), and, occasionally, berries (Bouchard and Kennedy 1976b), using both smoke and sun (Appendix I-a). Other frames constructed outside include elevated storage platforms: on upright poles, in A-framed shelters, and in elevated box-like storage caches (Bouchard and Kennedy 1975c).

Temporary dwellings were constructed of slender poles set up to form a lean-to or a 4-posted shed (with front poles higher than back poles to create a slope) covered with sewn rush mats (Curtis 1913; Barnett 1955). One report indicates that if large mat-covered structures were dual purpose, providing shelter and protecting drying foods from sunlight, they would include a smoking fire (Sapir and Spier 1930). More commonly, 4-posted sheds used as smokehouses were covered with cedar planks that did not reach the ground (so the structure was not airtight) and contained a small, smoking fire, usually of alder wood (Bouchard and Kennedy 1974; Bouchard and Kennedy 1975b). The archaeological footprint for temporary houses or smokehouses is similar: 4 small postmolds set into the ground straight (for the shed-roof construction) or angled (for the lean-to), possibly with single stakemolds (not paired inside/outside as in permanent wall construction) along the perimeter to secure wall material (Curtis 1913). A hearth is not expected in temporary summer habitations (Barnett 1955; Curtis 1913), however, if present, fuel in the hearth might indicate structure function. In smokehouses, the fire would be small and contain rotted hardwoods (for low heat and smoke) and no rocks. Cooking hearths would likely contain mixed softwoods and hardwoods, possibly rock for heat retention, and might have one or more stakemolds at the rim, angled over the fire for barbecuing. Neither structure is likely to be confused in the archaeological context with domed sweat lodges covered with branches, bark, and earth (Barnett 1955; Haeberlin and Gunther 1930; Duff 1952). Although built over a bent sapling frame (Duff 1952) that might leave angled stakemolds in the archaeological record, sweat lodges were small (for one person) and contained fire-modified rock but no fire. The fire to heat rocks was located outside the structure doorway (Barnett 1955).

Barnett (1955) noted that some houses had racks outside for drying fish and a few had a narrow, raised platform on the exterior for the distribution of gifts during potlatches. Both structures might appear in the archaeological record as stakemolds and small postmolds adjacent to the house exterior, however, potlatch platforms and drying racks would likely leave different archaeological signatures. Potlatch platforms should appear as a line of postmolds running parallel to the house wall along the entire length of the structure; drying rack supports are expected to be smaller in diameter, enclose a small area, and appear unconnected to the house frame (Bouchard and Kennedy 1974; Bouchard and Kennedy 1975b; Hill-Tout 1978; Sapir and Spier 1930).

Functions of outdoor rack constructions might be identified in the archaeological record from the arrangement of stakemolds, the presence or absence of a thermal source, and the characteristics of the fire. Stakemolds not associated with a thermal source might be racks for sun drying food or supports for storage platforms; stakemolds over a smoking fire are likely racks for drying food.

2.1.3 Pit Features

Pit features recorded in ethnographies include two kinds of ovens: 1) large earth ovens to slowly roast one food (camas bulbs, red elderberries, or wild onions) for storage and 2) small earth ovens for steam-cooking fish, meat, birds, and roots, generally for immediate use (Appendix I-b). Other pits include a thermal pit for smoking hides and non-thermal storage pits.

2.1.3i Earth Ovens

Ovens are outdoor thermal pits, enclosed by a covering of earth or mats. Accounts in regional ethnographies indicate earth ovens were used for cooking daily family meals and for seasonal processing of large volumes of food. Oven dimensions and thickness of the earth covering are determined by the volume of food to be processed; the amount of earth covering an oven ranges from a "sprinkle" to a large amount of earth insulation for large volumes of food (K'San 1980:17).

Deep earth ovens used to process large quantities of one food for storage required large fires built in large pits with rocks lining the bottom to retain heat for up to two days (Barnett 1955; Curtis 1913; Haeberlin and Gunther 1930; Bouchard and Turner 1976b) (Appendix I-b). Coast Salish earth ovens ranged from 120 cm to 150 cm deep (Haeberlin and Gunther 1930). In use, hot rocks were covered with sand and damp vegetation before the food was added. More vegetation was added and, finally, sand was piled into a mound. Archaeological characteristics of a dismantled oven may include sand in or around the pit, and rocks from the lining at the bottom of the oven or piled nearby for reuse (Haeberlin and Gunther 1930). Because foods were wrapped (in skunk cabbage leaves, fern fronds or birch bark), evidence of the resource processed is rarely recovered. Salal, processed in this manner, was then sundried on mats for storage (Ray 1938).

Shallow earth ovens, often referred to as steaming ovens (Curtis 1913; Haeberlin and Gunther 1930; Ray 1938; Bouchard and Kennedy 1974; Barnett 1955), were used for foods to be eaten immediately (Appendix I-b). They are approximately 60 cm wide and at least 30 cm deep (Bouchard and Kennedy 1974; Bouchard and Kennedy 1975b; Bouchard and Kennedy 1975c). In the archaeological record, earth ovens for daily use should be shallower and smaller than earth ovens used for processing food for storage. Although common, rock was not always used as a heating element. Some shallow earth ovens, especially if used for fish or shellfish, relied on the hot earth of the oven walls to cook food (Bouchard and Kennedy 1974; Bouchard and Kennedy 1975b). Similar ovens were used to steam wapato (Sapir and Spier 1930). In shallow earth ovens with rock elements, variations, such as the presence or absence of an *in situ* fire, do not indicate the kinds of foods cooked but, rather, the recipe preferred by the baker (K'San 1980:17). One common variation, used for cooking whole fish, ducks, and deer meat, used a pit lined with hot rocks from a nearby fire followed by a covering of vegetation, the food, more vegetation, and finally, a bark or bulrush mat (Barnett 1955; Curtis 1913; Gunther 1927; Haeberlin and Gunther 1930; Bouchard and Turner 1976; Bouchard and Kennedy 1975b). Fish, meat, and plant shoots or bulbs were steamed with only a mat covering for an hour (Gunther 1927), but ovens for cooking birds and deer meat were often smothered with earth (Haeberlin and Gunther 1930; Bouchard and Turner 1976; Barnett 1955) and in some cases, a fire was set on top of the mound to speed the cooking process (Barnett 1955). In another oven variation, the pit was lined with unheated rocks, a fire was built above them to heat the rocks, and excess ash and unburned wood were removed before the vegetation and food were added in the usual manner (Curtis 1913; Barnett 1955; K'San 1980). This method was used to process elderberries (Ray 1938). In a third variation, firewood was placed in the pit, rocks were placed over the wood and, as the fire burned, the heated rocks fell into the pit onto hot coals. Construction variations in earth ovens with rock elements might be identifiable in the archaeological record: the presence of charcoal fragments or a charcoal lens might indicate an *in situ* fire, whereas their absence might indicate an oven with no *in situ* fire, heated by hot rocks or by proximity to another fire.

2.1.3ii Hide-smoking Pits

Hide-smoking pits are 30 cm wide pits containing a mixture of rotted softwood and hardwood fuel (Barnett 1955, Sapir and Spier 1930) (Appendix I-b). Although the fuel is similar to food smoking fires, the features are distinguishable in the archaeological context: hide-smoking pits are "as deep as the arm" (Sapir and Spier 1930: 200) whereas food smoking fires are on the surface. Hide-smoking fires are filled with any well-rotted wood to create a dense smoke, not the small amount of rotted hardwood used in a smoking fire (Ray 1938; K'san 1980). Although hides were pinned over the pit with small sticks (tied together at the top forming an umbrella shape), after two hours the hide and sticks were removed (Sapir and Spier 1930), leaving no archaeological evidence.

2.1.3iii Non-Thermal Pit Features

On Cortes Island, dogfish used in times of shortage (Bouchard and Kennedy 1974) and, in the Puget Sound area, hazelnuts in shells (Haeberlin and Gunther 1930), were stored in outdoor pit caches (Appendix I-b). Along the Columbia River, Lewis and Clark noted dried fish were stored in holes "of any size" lined with "straw" and "skins" and topped with 5 to 6 cm of earth (Sapir and Spier 1930:179). In the Interior Salish area, cache pits were commonly used to store food for late spring or in case of famine (Bouchard and Kennedy 1975a). These caches, often 1 to 1.5 metres deep, were dug into a hillside to ensure good drainage. The sides and bottom were lined with birch or cottonwood bark slabs; food (generally fish in wrapping or baskets) was laid into the cache in layers with more bark; and the entire cache was covered with brown, dried pine needles, thick slabs of cedar bark, and in areas of freezing, with 60 to 90 cm of earth. In the archaeological context, outdoor caches would appear as pits of any size, perhaps with flat bottom and sides created by a bark slab lining (Bouchard and Kennedy 1975b). Pit fill could be non-cultural, from the natural filling-in of the emptied pit, or cultural deposits created by decayed food or secondary refuse. Small, shallow pit "cellars" located under the benches inside habitations (Hill-Tout 1978a:108; Gunther 1927:207; Barnett 1955) would be identifiable in the archaeological record (Appendix I-a).

2.1.4 Surface and Shallow Thermal Features: Hearths, Mound Ovens, and Smoking Fires

Thermal features built on the surface or in shallow depressions include hearths, mound ovens, and food smoking fires. From ethnographic descriptions, each kind of fire is expected to have distinctive archaeological characteristics.

2.1.4i Hearths

In this study, hearths are defined as open fires, built on the surface or in shallow depressions, indoors or outdoors, that functioned for cooking and heating. The maximum depth of hearths is unknown, although 30 cm deep trench cooking hearths have been reported inside longhouses (Curtis 1913) (Appendix I-a, I-c). Cooking fires are hot and fuel may be a mixture of hardwoods and softwoods or softwoods only (softwoods burn hotter than hardwoods) (K'San 1980). Hardwood was preferred for barbecue fires (Coqualeetza 1979). Rocks were not usually placed in the fire but might rim it for safety or to provide cooking surfaces. Ethnographic reports describe three methods of cooking at hearths, both inside structures and outside: stoneboiling, roasting, and barbecuing (Curtis 1913; Duff 1952; Barnett 1955; K'San 1980). Roasting food wrapped in leaves or clay (Barnett 1955; Bouchard and Kennedy 1974) or roots (without wrappings) by covering with hot coals in the hearth was faster than cooking in an earth or mound oven (Barnett 1955; Ray 1938; Bouchard and Kennedy 1975a; K'San 1980). Slanted stakes set around the hearth were ideal to barbecue small animals, birds, and fish (Duff 1952; Bouchard and Kennedy 1976b; Coqualeetza 1979; K'San 1980). In the archaeological record, evidence of stone boiling (the presence of boiling stones) and barbecuing (slanted stakemolds around the hearth perimeter) would be distinctive. Cooking hearths used to barbecue large quantities of food to feed large groups would be longer, occur only outside, and have many slanted or upright stakes around the rim to support rectangular frames on which poles with food rested (Barnett 1955). Hill-Tout (1978a) reported a feast at which a shallow outdoor trench hearth was dug 50 cm wide and long enough to cook all the fish at once. After the fire was built, stakes a metre long were driven into the ground along both sides of the trench at regular intervals to support poles running parallel to the trench. More poles were laid across this framework to hold the salmon. Evidence of this construction in the archaeological record might be interpreted as either a smoking rack (for preserving fish) or a barbecue rack (for immediate consumption).

2.1.4ii Mound Ovens

Generally used for roasting a large quantity of one food, mound ovens are analogous in function to earth ovens but may resemble hearths in the archaeological context (Appendix I-c). Referred to as low effort ovens sufficient for some foods (Ray 1938), mound ovens were built on the surface with coverings (including leaves and mats; Ray 1938) mounded over the contents. Along the lower Columbia River, mound ovens were used to process camas and salal berries (Ray 1938). A pile of dried wood was laid on the ground, covered by stones, and burned until only hot stones and ashes remained. The hot stones were covered with fern leaves and rush mats, camas roots or salal berries were spread evenly on the mats, doused with water, and immediately covered with more mats. The entire oven was then covered with a mound of sand to keep in the steam. The oven was opened once it was cold, in 12 to 24 hours. For small quantities of food, the same effect is achieved by roasting roots or packages of food in the coals of an open hearth (K'San 1980).

In the archaeological record, mound ovens may resemble long hearths used to barbecue meat or fish in size, but, unlike hearths, mound ovens are not expected to have adjacent stakemolds. The margins of mound ovens are expected to be irregular, created by the shape of firewood piled on the surface and by raking-out contents to prepare and empty the cold oven. Expected characteristics include fire-modified rock, ash, and charcoal on the surface and possibly some evidence of earth coverings appearing as sand or clay. In the absence of evidence of a covering, the feature would likely be interpreted as a large hearth. Because foods were placed onto mats without being wrapped, tissues or seeds might be recovered from mound ovens in the archaeological record.

2.1.4iii Smoking Fires

Smoking fires used for drying food are similar to hearths in appearance, but smaller, and usually contain rotted hardwood fuel only (Coqualeetza 1979). Although hide smoking fires use similar fuel, the features are distinct, as already described. Smoking fires for food generate low, steady heat and much smoke, fuelled by "punky," slow-burning cottonwood, rotted poplar, or well-rotted alder (K'San 1980:21). Fires may be started with a few cedar sticks but are "banked" with alder or other medium dry hardwoods (Coqualeetza 1979:42). Smoking fires may appear as small, ash-filled hearths that contain mostly hardwood fuel. Rock should not be present. Smoking fires may occur inside or outside structures and are expected to be associated with either the slanted stakemolds of a lean-to structure or upright stakes of a 4-posted structure or drying rack frame.

2.2 PREVIOUS ARCHAEOLOGICAL FEATURE FUNCTION ANALYSES

The research method developed to determine functional kinds of features at X̲á:ytem draws on analyses of Charles culture phase, and later, feature functions. An early study of the Pitt River site (Patenaude 1985) attributes function based on analogy. More recent analyses of feature functions at the West Point (Seattle, Washington) site (Larsen *et al.* 1995) and the Sequim Bypass (Washington) site (Morgan *et al.* 1999) employed more systematic analyses.

Postmolds and pits with "no signs of firing" from the St. Mungo component at the Pitt River site (Patenaude 1985:2.11) were assigned "type names" and described (Patenaude 1985:1.135-1.155). Patenaude noted that specific feature functions depend on the recovery of botanical or faunal remains; lacking such evidence, functions were postulated by analogy to "environmental, ethnographic, and archaeological data" (Patenaude 1985:2.22). Four functions were postulated, primarily by analogy to previous archaeological reports: steaming pit/earth ovens, water collection or storage units, large post holes, and hearth pits to heat rocks for stone boiling (Patenaude 1985:2.12-2.14). Although structural outlines were not distinct, posts were identified as supports for temporary mat-covered shelters, a sweat lodge, and drying rack frames (Patenaude 1985: 2.16-2.23).

At the West Point (Seattle) site, features dating to the St. Mungo period were analyzed systematically (Lewarch *et al.* 1995:12.1, 12.14-12.28). Expected feature signatures were developed from *archaeological* feature data for the region (Lewarch *et al.* 1995:12.14-12.28) but the method, built on an earlier analysis of feature dimensions (Campbell 1981), added a separate feature contents analysis (Lewarch *et al.* 1995: 12.4). Four feature attributes analyzed to determine feature functions include surface of origin (on the surface or excavated), structure of feature boundary (structured but diffuse, unstructured, or tightly structured), evidence of *in situ* burning, and context of feature contents. Some attribute definitions (not provided in the report) appear subjective. Maximum measurements for feature length, width, and depth, and age estimates in years BP were included in the analysis (Lewarch *et al.* 1995: 12.6-12.9). Eight "common English names" were assigned to the resulting feature classes: fire hearth, rock oven, pit, pit with refuse, refuse, burned wood, rock pavement, and burned areas (Lewarch *et al.* 1995:12.10). The separate analysis of feature matrices identified ten contents: mammal bone, charcoal, fish bone, fire-modified rock, gravel, lithics, ochre, rock, shell, and wood, and discussed how these contents related to each of the functional feature classes (Lewarch *et al.* 1995:12.16-12.23). Researchers concluded that individual feature functions could be inferred from identified contents (as noted by Patenaude), however, contents were not distinctly different among morphologically similar pit feature classes (Lewarch *et al.* 1995:12.82-12.83) and could not be used to identify feature function. They concluded, however, that *diversity* in faunal and plant species is a good indicator of earth ovens used for immediately consumed foods (Lewarch *et al.* 1995:12.43).

An analysis of 40 features from Marpole and Gulf of Georgia components (2400 – 200 BP) at the Sequim Bypass Site on the Olympic Peninsula (Morgan 1999:5.11) was guided by the West Point analysis and used the same four variables. Feature attributes were grouped, compared, characterized by "proposed feature function," and assigned to one of four morphological classes: structures, pits, surface features, and historic era post-holes (Morgan 1999:12.1). Feature functions were inferred from size, shape, oxidation, fill type, and artifact content (Morgan 1999:12.5-12.44), however, the process used is not reported. Small structures were identified as temporary mat shelters by analogy to ethnographic descriptions and postulated functions for pits include rock ovens, hearths, firepits, postholes, and pits for stone boiling or trash. Researchers noted considerable overlap in size attributes among the pit classes identified (Morgan 1999:12.1-12.12; 12.32-12.44) with the width/depth ratio coming closest to aligning with the feature classes they had identified (Morgan 1999:12.46).

Building on the successes and shortcomings of these analyses, two principles guide the present study of X̲á:ytem features. First, the method should be replicable, and second, the method should result in a feature classification in which postulated functions are not constrained by analogy to either archaeological or ethnographic descriptions. Previous research analysed characteristics of feature morphology and context separately from contents. However, once characteristics of contents were compared with feature classes identified from morphology and context, functional classes (the "pit" class in particular) did not separate as expected. Furthermore, as both Patenaude (1985) and Lewarch (1995) noted, identification of botanical or faunal species is crucial to determine *specific* feature functions. At X̲á:ytem (and other river valley sites) faunal and floral remains do not preserve well in acidic matrices, making identification of specific feature functions difficult. Lewarch (1995) also noted, however, that diversity in feature contents is a useful measure: the more diverse the faunal and botanical remains, the more likely the feature was in daily use. Seeking evidence of diversity, this study, unlike previous analyses, includes *the presence or absence* of seeds, bone, and shell in the systematic determination of feature classes.

Given the difficulties in identifying archaeologically-defined "pit" functions by separate analyses of contents and morphology (Lewarch *et al.* 1995; Morgan 1999), this study of X̲á:ytem feature functions combines *all* characteristics (contents as well as morphology and context) and employs clustering and multidimensional scaling to identify classes of features inherent in the data. The characteristics of these classes are then compared with, but not limited by, expected archaeological characteristics of feature classifications derived from ethnographic reports.

CHAPTER III: RESEARCH QUESTIONS, RELEVANT DATA, AND RESEARCH METHODS

3.1 RESEARCH QUESTIONS

Five questions were investigated to achieve the primary research objective (to identify kinds of features and infer their functions) and secondary objectives (to infer temporal associations among features at X̲á:ytem, site use, and seasonality). The first question, "what kinds of features do the data represent?" employed clustering and multidimensional scaling to create a feature typology from characteristics of morphology, context, and contents. The next question, "are these feature kinds similar to ethnographic features?" looked at archaeological expectations for functional feature classes derived from ethnographies for the region. Determining the number of components present, the third question, "how old are the features?" was answered by seeking stratigraphic associations among features and linking stratigraphy to available radiocarbon age estimates. To answer question four, "are there structures or other associations of features?" patterns created by associated postmolds, stakemolds, and other features, were identified in each component. Finally, botanical data from the features were used to answer question five, "what evidence is there for seasonality?" for each component. The results (postulated functional kinds of features, seasonality, site use and subsistence activities at X̲á:ytem) are discussed in Chapter IV and compared with Old Cordilleran and Charles culture histories of the region in Chapter V.

3.2 RELEVANT DATA AND RESEARCH METHODS

Variables related to feature morphology, contents, and context for the 132 features (including those reported to be associated with structures) on the lower terrace were compiled from field notes (feature forms, layer and level notes, slides and photographs, plan and profile drawings, excavators' field journals), site reports (Ormerod and Matson 2000; Pokotylo 1997a), and analyses of floral and faunal remains (Vorell 1998; Radomski 2000; Wyndham 2000) and soil pH (Bruno 2000), on file at the Laboratory of Archaeology, University of British Columbia. Features identified in these sources included at least one structure, hearths, postmolds, stakemolds, and thermal pits (Ormerod and Matson 2000) although excavators had difficulty determining if some pit features were non-thermal postmolds or thermal features. Individual features, not structures, were used in the analysis, and cultural deposits appearing as charcoal lenses were excluded.

Initially, fifty-three variables were compiled from the data sources to characterize morphology (8 variables), contents (33 variables), and the context (12 variables) of each feature. Variables for feature morphology included maximum measurements in centimetres for feature length, width, and depth, and shape of feature boundary, termination, and sides. Feature contents data included weight and quantity of rock, and presence/absence of fire-modified rock, unmodified rock, oxidation, and raked-out contents. Other content data included fill matrix characteristics (including textures and colours); presence/absence of artifacts and debitage, charred seeds (by species), bone (mammal, bird, fish, or unidentified), shell, and ochre; and presence/absence of charcoal lenses, and black, organic flecks. The context of features included cardinal orientation, systemic surface of origin, soil pH, and radiocarbon age estimates. Most variables were nominal (presence/absence) data, and necessitated the use of binary coded data in the clustering and multidimensional scaling analyses (see Ormerod 2001 for further details).

Exploratory data analysis indicated numerous variables (such as soil pH, weight and quantity of fire-modified rock, and the presence of ash) for which data were not available for most features; these variables were excluded from further analysis. Measurement (interval scale) data were converted to binary scale based on the precedents of Matson (1974:112; Matson and True 1974:72-73) and Pokotylo (1982), and each binary characteristic was coded for every feature as either "present," "absent," or "missing." The resulting 69 binary characteristics, defined in Appendix II, were used for a pilot test of clustering and multidimensional scaling (Ormerod 2001).

Seventy-three features with the longest side measuring less than 16 centimetres were excluded from the pilot test as characteristics of these small-diameter features (absence of oxidation, red/yellow coloured fill, or charcoal lenses) supported the inference that these were postmolds and stakemolds (see Ormerod and Matson 2000). The pilot test of clustering and multidimensional scaling was conducted on the remaining 59 features (Ormerod 2001).

The pilot study (Ormerod 2001), using Jaccard's coefficient and Furthest Neighbour complete linkage to cluster feature characteristics, resulted in feature clusters that separated non-thermal from thermal features. Features without characteristics of heat or burning (oxidation, red/yellow coloured fill, or charcoal lenses) clustered separately from those with these characteristics. Patterns were discernable in characteristics dominating clusters (Ormerod 2001), however, seven features, lacking measurements and contents data, did not join clusters. These features were removed from the data set used for the final clustering and scaling. The remaining 52 features in the data set were run through two variations of clustering and multidimensional scaling using the same 69 binary characteristics of feature morphology, contents, and context used in the pilot test.

The clustering and multidimensional scaling analyses of the 52 features employed two matrices of taxonomic-distances between similarity scores, one using the metric coefficient of Jaccard (Sneath and Sokal 1973:131; Matson and True 1974) and one using metric binary distance (Matson and True 1974:63-64). Characteristics were not weighted so that individual attributes creating feature groupings could be noted. Three cluster analyses were performed, two (Jaccard's Distance and Binary Distance) used furthest neighbour (complete linkage) clustering (Sneath and Sokal 1973:222-228) and one used Ward's (error sum of squares) coefficient (Matson and True 1974:58-61) with Jaccard's coefficient. (Binary distance results differ from Jaccard's coefficient results in that joint absences among features are treated as points of similarity.) In this study, although characteristics dominating the clustering methods varied slightly, all analyses resulted in similar clusters of features (Ormerod 2001). Agreement between the Jaccard's / Furthest Neighbour, Binary Distance / Furthest Neighbour, and multidimensional scaling using Jaccard's coefficient, indicated that groupings of features formed repeatedly in a similar manner (Ormerod 2001). Clusters produced by one variant, Jaccard's and Furthest Neighbour, were selected to answer the remaining four research questions because characteristics affecting clusters represented the three targeted variable classes: context, morphology, and contents (Appendix III). The results, and comparisons to archaeological expectations derived from the ethnographic literature (Question 2), are presented in Chapter IV.

In order to identify components at the site (Question 3), 73 features excluded earlier from the multidimensional analysis were added back into the data set after the clustering and scaling, including two unique features: an anvil stone (Ormerod and Matson 2000) and an L-shaped stain with stakemold. Working with field notes and drawings of all profiles exposed in the excavations, stratigraphic relationships across the entire research area, linking all 132 features, were identified. Radiocarbon age estimates, including newly obtained data for six features, assisted in refining the results and confirmed the presence of three prehistoric components in the excavation area. For each component, site use and subsistence activities are presented in Chapter IV.

Seasons of site use by component (Question 5) were inferred from identified seeds recovered from feature matrices. Inferences relied on comparisons with ethnographic accounts of seasonality of resource collection and processing and on the seasons in which plants produce seeds. The comparative material and the results are presented in Chapter IV.

Feature associations (Question 4) were identified on plans drawn for each component, using feature proximity and patterns as a guide. Patterns similar to archaeological expectations developed from ethnographic data are discussed in Chapter IV.

CHAPTER IV: RESULTS

Feature kinds identified from the clustering and multidimensional scaling analysis were examined for characteristics that might imply function. However, because ethnographic data rarely provide dimensions or post-depositional characteristics, linkages have been developed that bridge between observed, archaeological characteristics and those expected for ethnographic feature classes. Using these linkages and descriptions of characteristics unique to each feature kind, functions have been postulated and the kinds have been named and described.

4.1 FEATURE KINDS FROM CLUSTERING AND MULTIDIMENSIONAL SCALING

The multivariate analysis resulted in 14 feature clusters or kinds (Kind) (Figure 3) that may represent functional variants. The term "kind" has been used to identify a functional cluster of features and is analogous to a "type" or "class." Variables that differentiated clusters are primarily morphological characteristics (surface area, length, shape in plan, shape of sides), contents (charcoal lens, artifacts, debitage, fire-modified rock without a charcoal lens, shell, bone, and ochre), and one indicator of context (feature was on the surface) (Appendix II; Appendix III). Contents that had less effect on clustering include oxidation and red/yellow coloured fill. Characteristics that did not affect clusters include feature depth, slant of feature sides, and fill texture characteristics (pebbly, coarse, compact, hard, humic). The presence of black, organic flecks in fill had a minor effect on clustering.

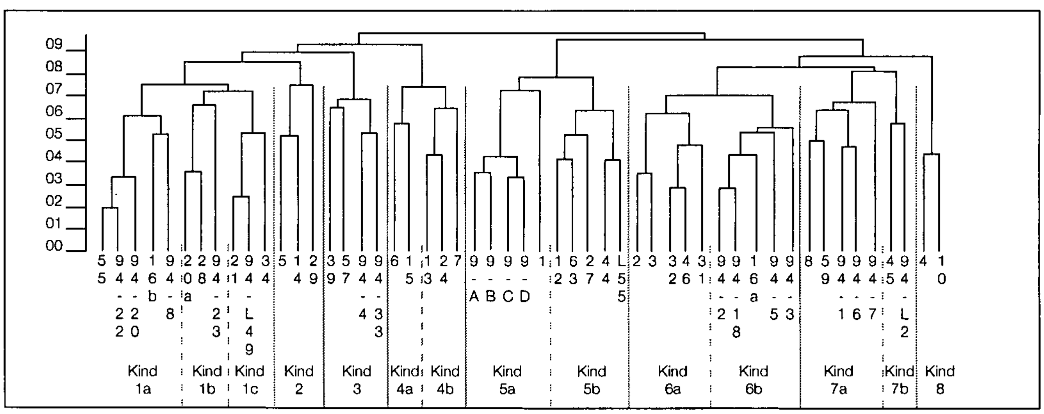


Figure 3. Dendrogram of Jaccard's / Furthest Neighbour Clusters

The Jaccard's coefficient multidimensional scaling generated a 10-dimension solution configuration accounting for 100% of variability in the sample. The first four dimensions, accounting for 46.3% of variability, were interpreted to investigate the clusters (Appendix IV; Ormerod 2001). Although 46% of variance explained does not sound like a large amount, this is typical when using Jaccard's distance and conversion of quantitative data to binary variables, and provides a satisfactory solution (Matson, personal communication, March 2002). Dimension 1 (18.78% of variability) separates features by size, presence/absence of fire-modified rock, presence of bone and by presence/absence of evidence of *in situ* burning (Appendix IV-a). Dimension 2 (9.97% of variability) is related to shape of the sides of the feature, presence/absence of unmodified rock and presence/absence of oxidation and red-yellow coloured fill (Appendix IV-a). Dimension 3 (9.21% of variability) separates features on size (surface area), margin and bottom shape, and presence/absence of greasy and humic contents (Appendix IV-b). Dimension 4 (8.37% of variability) is correlated to characteristics of fill texture and colour: presence/absence of fine silt, sand, grit, and black colour (Appendix IV-b).

4.2 LINKING ARCHAEOLOGICAL FEATURE CHARACTERISTICS AND ETHNOGRAPHIC FEATURE CHARACTERISTICS

In order to postulate functions and name feature kinds, linkages (Binford 1966; 1983) were sought between characteristics observed in the archaeological context and expected characteristics derived from the ethnographic record. Ethnographic data rarely specify feature morphology and do not describe contents of thermal features after use. However, it was variability in these characteristics that separated the feature kinds. Although feature matrix constituents in thermal features have been quantified and described by archaeologists, experimental and actualistic studies of formation processes (Schiffer 1972) of thermal and non-thermal features are rare (but see Mack 1992). As a result, unambiguous characteristics indicating feature functions do not presently exist. In this study, linkages have been postulated between archaeological characteristics and expected characteristics from scrutiny of the differential patterning of archaeological characteristics among feature kinds derived by multivariate analysis (Appendix III).

Although matrix colours and textures patterned differently in feature kinds (Appendix III), precedents do not exist to indicate how these characteristics should be interpreted. For example, matrix colours in thermal features may indicate functional differences among kinds: most features that appeared to be earth ovens (from other characteristics) also contained red-yellow and light coloured fill. In this study, red/yellow matrix (considered characteristic of heated features), charcoal lenses, and the rare occurrence of charcoal fragments above rocks lining a pit, have been interpreted as indicators of *in situ* burning. Matrix texture characteristics were also examined carefully for evidence of earth oven covering materials that might differentiate hearths (open fires) from ovens (enclosed). However, both shallow and pit thermal features contained sand and fine silts (and clay in Component I). Given the absence of unambiguous characteristics indicating oven coverings, an oven function was postulated for all features wherever thermal pits clustered with thermal surface features in one kind. Ovens in pits were named earth ovens and those on the surface or in shallow depressions were named mound ovens.

Excavators reported the presence of (but not the proportion of) visible, but not recoverable, flecks and flakes of black, organic matter in many features. This characteristic, referred to in the study as "black, organic flecks" appeared in all thermal feature kinds (except Kind 8), was less frequent in non-thermal feature kinds, and was absent from non-thermal feature Kind 4-a. Although the presence of black, organic flecks had a minor effect on clustering overall, interpreting its significance was important to infer the functions of feature Kind 8 and feature Kind 4-a. In this study, the presence of black, organic flecks was interpreted as the decomposition of organic matter, including wood. The absence of black, organic flecks in fill was interpreted as the absence of decomposed organic matter. Consequently, Kind 8 thermal features are interpreted as deposits of fire-modified rock (thermal refuse) and squared, non-thermal features (Kind 4-a) are inferred to be empty pits that had possibly been used for storage.

Paleo-botanical and faunal remains were expected to provide indications of specific feature function, however, it was first necessary to determine if feature contents were in primary context or secondary (refuse) context. In this study, the presence of refuse was inferred if a feature contained artifacts or debitage. In a rigorous application of Schiffer's (1972) definition (the location of final discard of secondary refuse is not the same as the location of use), refuse was also inferred from the presence of fire-modified rock without evidence of *in situ* burning (a charcoal lens or charcoal fragments) in a feature. Ethnographic reports indicate that rock was often heated outside a feature, placed in it, and used as a heat source. However, it was reasoned that a feature containing fractured, spalled, or reddened rock would not have been hot enough to modify rock *in situ* unless evidence of fire was also present. This restrictive definition was useful in differentiating among thermal feature kinds. *De facto* refuse, material that reaches the archaeological context but that was not purposely discarded (Schiffer 1972), was also inferred in some features. If only one feature within a kind contained refuse, especially in what other characteristics indicated was a postmold, that refuse was considered *de facto*. If, however, a large quantity or variety of refuse elements were present, that deposit was identified as secondary refuse and all other contents, including the paleo-botanical and faunal remains, were considered to be secondary refuse as well.

4.3 POSTULATED FUNCTIONAL FEATURE KINDS

Six non-thermal feature kinds and eight thermal feature kinds are postulated from the analysis. Non-thermal kinds are: postmold features (Kinds 1-a and 1-b), probable postmold features (Kind 1-c), and non-thermal pit features (Kind 2, Kinds 4-a and 4-b). Thermal feature kinds are hearths, mound ovens and earth ovens in large (Kinds 5a and 5-b), medium (Kinds 6-a and 6-b), and small (Kinds 7-a and 7-b) sizes, deposits of fire-modified rock (Kind 8), and an earth oven/hearth (Kind 3) unique to Component I (Table 1). Illustrations represent actual features (numbered on the figures) and all are drawn at the same scale. For locations of features in the study area, see Appendix XIII.

4.3.1 Postmold Features (Kind 1) *n = 11*

Kind 1 features are interpreted as postmolds (Table 1). They do not contain oxidation, fire-modified rock, or charcoal lenses; all contain fine silt matrix and half have black, organic flecks in the fill. Kind 1 divides into three groups: rounded postmolds, squared postmolds, and probable post-molds. The five round (Kind 1-a) and three squared (Kind 1-b) features have vertical, symmetrical sides, range in depth from 26 to 46 cm, and do not contain bone, shell, ochre, or black matrix. The three probable postmolds (Kind 1-c) are shallow (14 to 17 cm deep), have round and oval shapes, and, unlike other Kind 1 features, contain black matrix, bone, and ochre that may be *de facto* refuse related to site-formation processes. Kind 1-a and 1-b features are probably the remains of upright posts and stakes. Kind 1-c features may also be postmolds.

Table 1. Postulated Functions of Feature Kinds

Text Ref.	Kind	n	Evidence of Heat	*In Situ* Burning	Refuse	Postulated Functional Name and Description	Discriminating Dimensions
4.3.1i	1a	5	-	-	rare, *de facto*	***Postmolds, rounded***	Diameter 24 to 40 cm
4.3.1ii	1b	3	-	-	rare, *de facto*	***Postmolds, squared*** margins	Diameter 17 to 29 cm
4.3.1iii	1c	3	-	-	rare, *de facto*	***Probable postmolds***, shallow, rounded and ovoid	Diameter 15 to 20 cm
4.3.2	2	3	-	-	*de facto in 2*	***Non-thermal pits***, 2 probable postmolds 1 mold, function unknown	Length 20 cm Length 68 cm
4.3.5	3	4	present	present in 3 (75%)	secondary in 2	***Medium Hearth/Earth Oven with stakes***, *in situ* burning and secondary refuse; fauna absent, flora present	Length and width nearly equal (61 to 75 cm); Depth 21 to 25 cm
4.4.3i	4a	2	-	-	present, *de facto*, secondary	***Squared, non-thermal pits,*** possible storage pits; flat bottom, squared outline	Length 70 to 86 cm
4.3.3ii	4b	3	-	-	present, *de facto*, secondary	***Squared, non-thermal pits***, 1 probable postmold; 2 possible storage pits; deep with flat bottoms	Depth 40 to 60 cm
4.3.4i	5a	5	present	present	present, secondary	***Large Hearth and Earth Oven***; seeds, mammal bone, bird bone, and shell	Length 120 to 145 cm; Depth 10 to 68 cm
4.3.4ii	5b	5	present	present in 2 (40%)	rare, *de facto*	***Large Mound Ovens and Earth Ovens***	Length 89 to 150 cm; Depth 9 to 24 cm
4.3.6i	6a	5	present	-	present, secondary	***Medium-sized Ovens or Thermal Refuse***; fauna and seeds, artifacts, debitage, ochre, and rock	Length 55 to 120 cm; Depth 8 to 18 cm
4.3.6ii	6b	5	present	present	present, secondary	***Medium-sized Earth Ovens***; equal sides; *in situ* burning; secondary refuse; diffuse margins, some seeds	Length 43 to 63 cm; Depth 20 to 52 cm
4.3.7i	7a	5	occasional, but inferred for all	present	rare, *de facto*	***Small Ovens with rock elements***; probable *in situ* fire; diffuse margins	Length 33 to 51 cm; Depth 10 to 43 cm
4.3.7ii	7b	2	present	present	-	***Small Ovens without rock elements***; *in situ* burning; structured, ovoid margins	Length 36 to 48 cm; Depth 20 and 32 cm
4.3.8	8	2	present	-	present, secondary	***Thermal Refuse: fire-modified rock***; on surface; no *in situ* burning.	Length 18 to 26 cm

4.3.1i Round Postmolds (Kind 1-a) *n = 5*

Kind 1-a features are interpreted as round postmolds with large diameters (ranging from 24 to 40 cm) (Figure 4a, Feature 94-20). They do not contain refuse. The black, organic flecks throughout may be the result of *in situ* decomposition of wood.

4.3.1ii Squared Postmolds (Kind 1-b) *n = 3*

Kind 1-b features are interpreted as postmolds similar to Kind 1-a, differing only in having squared outlines and slightly smaller diameters (range 17 to 29 cm) (Figure 4b, Feature 20a). One feature contains bone and ochre, interpreted as *de facto* refuse.

4.3.1iii Probable Postmolds (Kind 1-c) *n = 3*

Kind 1-c features are interpreted as the remains of wood features, probably posts (Figure 4c, Feature 34). They have the smallest diameters (15 to 20 cm) and are the shallowest (14 to 17 cm deep) Kind 1 features. Although two features contain black coloured fill and one also contains bone, the absence of evidence of heat or burning suggests these may be *de facto* refuse.

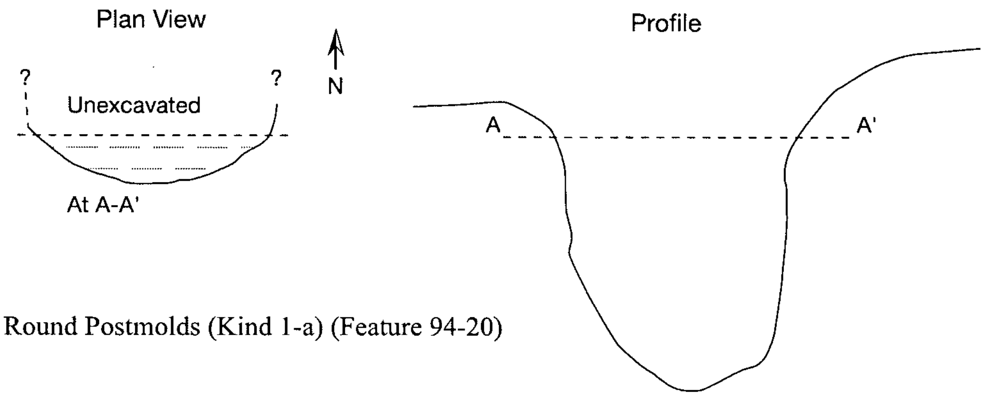
4.3.2 Non-Thermal Pit Features (Kind 2) *n = 3*

Kind 2 features are shallow, non-thermal pit features for which functions are not clear (Figure 4d, Feature 5). All have excurvate sides, rounded bottoms, but lack oxidation or charcoal lenses. They also lack artifacts, debitage, paleo-botanical and faunal remains, and unmodified rock. Two features, probably postmolds, share many characteristics although one is 12 cm deep (Figure 4-D, Feature 5) and the other is 40 cm deep: rounded margins, 20 cm by 20 cm surface area, moderate amounts of fire-modified rock, and black and brown gritty fill (not fine silt as in Kind 1 postmold features). The absence of oxidation and charcoal lenses implies the features are non-thermal pits, possibly postmolds, containing *de facto* or secondary refuse.

The other Kind 2 feature (Feature 29) is unique. It is longer (68 cm), contains compact brown and grey fill with black, organic flecks throughout, and unlike the other Kind 2 features, does not contain rock or charcoal. Although its full width is not known, it is ovoid in plan and pit-like in profile (43 cm deep) with steep sides. Contents may indicate wood decomposed *in situ* (like Kind 1-c features) or may be *de facto* refuse. The function of this Kind 2 feature is unclear. If contents represent decomposed wood, the feature may have been used as a bench. If the contents represent *de facto* refuse or natural fill in a pit, the feature may be analogous to Kind 4-a features and, therefore, may possibly have functioned as a storage pit.

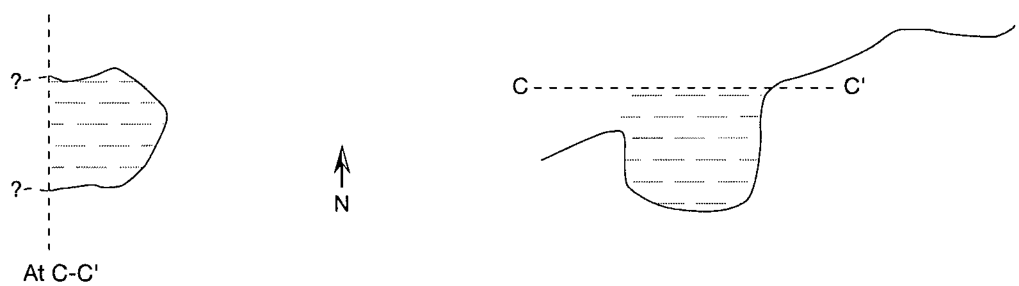
4.3.3 Squared, Non-Thermal Pit Features (Kind 4)

Kind 4 features are interpreted as four possible storage pits and one postmold (Table 1). All features exhibit flat bottoms and have layered contents and symmetrical sides. None have charcoal lenses. Fill contains unmodified rock, but is not greasy, and lacks bone. Kind 4 separates into two categories, depending on the extent of the feature exposed during field excavations.

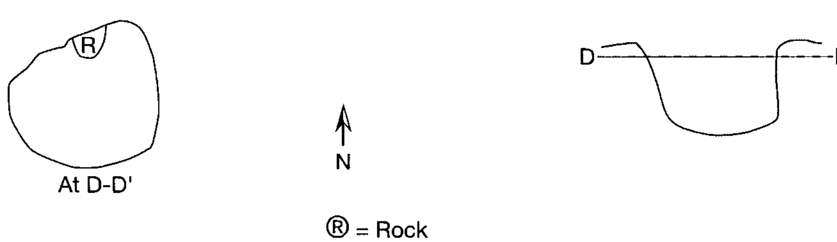


4a. Round Postmolds (Kind 1-a) (Feature 94-20)

4b. Squared Postmolds (Kind 1-b) (Feature 94-20a)

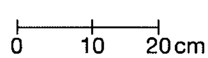


4c. Shallow Molds, probably Postmolds (Kind 1-c) (Feature 34)



4d. Non-Thermal Pits (Kind 2), probable Postmolds, (Feature 5)

Figure 4. Postmold Features and Non-Thermal Pit Features



4.3.3i Squared, Non-Thermal Pit Features (Kind 4-a) *n = 2*

Kind 4-a features, interpreted as possible storage pits, have flat bottoms, parallel vertical sides, squared margins, and large extrapolated dimensions (one is 70 x 70 x 33 cm deep, the other, (Figure 5a-1, Feature 15), is 86 cm long x 28 cm deep). None display characteristics of heat or burning. The fill, brown sandy silt with layering indicated by minor hue variations, suggests gradual, possibly natural, filling-in of the features and unmodified rock throughout the fill is interpreted as *de facto* refuse resulting from natural processes. Feature 15 has a lining of "sterile silt," and a large lithic flake, recovered at the bottom, is interpreted as *de facto* refuse (Figure 5a-1).

4.3.3ii Squared Non-Thermal Pit Features (Kind 4-b) *n = 3*

Kind 4-b features are interpreted as one large, squared postmold and two probable storage pits, similar to Kind 4-a but deeper. All three Kind 4-b features have smaller surface areas than Kind 4-a features, however, only the probable postmold (Feature 7) was fully excavated. The dendrogram (Figure 3) indicates the probable postmold (Feature 7) is an outlier. Although all features are flat-bottomed and contain layered, red/yellow coloured matrix, Feature 7 is deeper and has a smaller surface area. It measures 27 cm on one side and is 60 cm deep; the other features measure 32 x 32 cm x 47 cm deep and 34 x 34 cm x 42 cm deep. Unmodified and fire-modified rock, artifacts, and debitage in the layered fill are interpreted as cultural deposits of secondary refuse or *de facto* refuse from post-depositional fill.

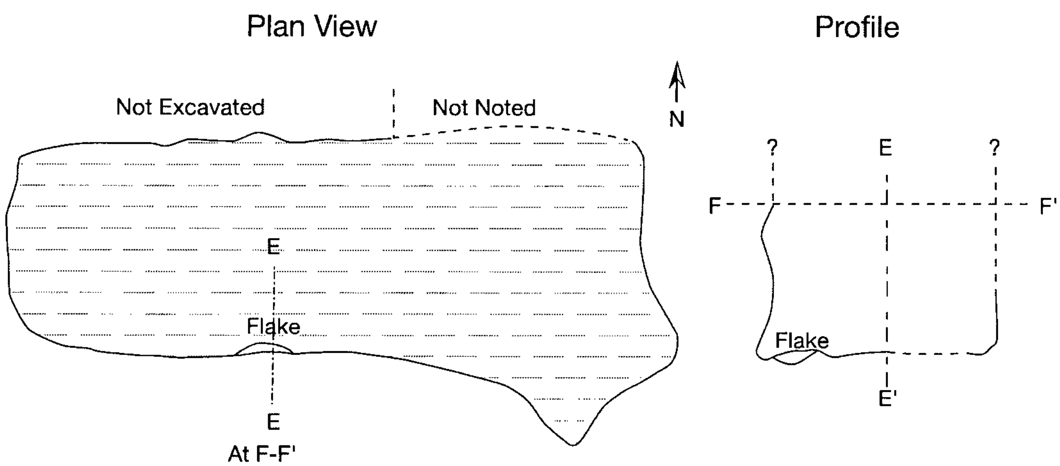
4.3.4 Large Thermal Features (Kind 5) *n = 10*

Interpreted as large mound and earth ovens and one historic hearth, the ten Kind 5 features have evidence of heat and most have evidence of *in situ* burning (Table 1). All are extra-long, have rounded shapes plan view, excurvate sides, and contain black, organic flecks throughout the matrix. Only one has stakemolds in association.

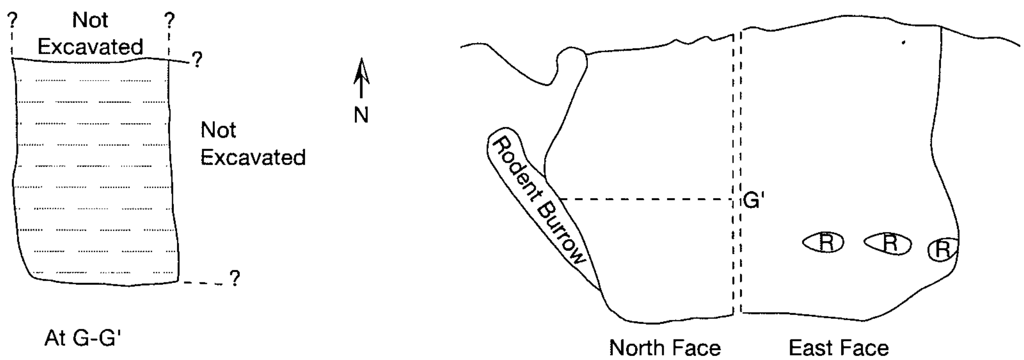
4.3.4i Large Historic Hearth and Earth Oven (Kind 5-a) *n = 5*

Kind 5-a features, all with evidence of heat and *in situ* burning and greasy fill, include one long historic (ca. 1997) hearth (130 x 51 x 10 cm deep) and four separate uses of a pit. The first use (135 x 115 x 68 cm deep) (Figure 6, Feature 9D) probably represents an earth oven, however, matrix texture and the presence of artifacts and debitage suggest subsequent uses (29, 19, and 14 cm deep respectively) included the disposal of refuse by burning (Appendix VI-a, Feature 9A; Appendix VI-b, Feature 9B; Appendix VII-a, Feature 9C; respectively). Kind 5-a features contain mammal and bird bone, shell, ochre, and large quantities of charred seeds. Similar contents are known to be in primary context in the historic hearth (Feature 1). This feature was created in 1997 when plates of food, including fish, berries, roots, and tubers, were burned as a feast for the *Stó:lō* ancestors before archaeological excavation recommenced (Mohs, personal communication, June 1997). A large, hot, fire was built on the surface using randomly placed tree limbs. After the burning, a long, shallow depression had been created in the surface. When excavated later that year, Feature 1 was rimmed in orange, oxidized soil and contained white ash, charcoal chunks, bone, and seeds.

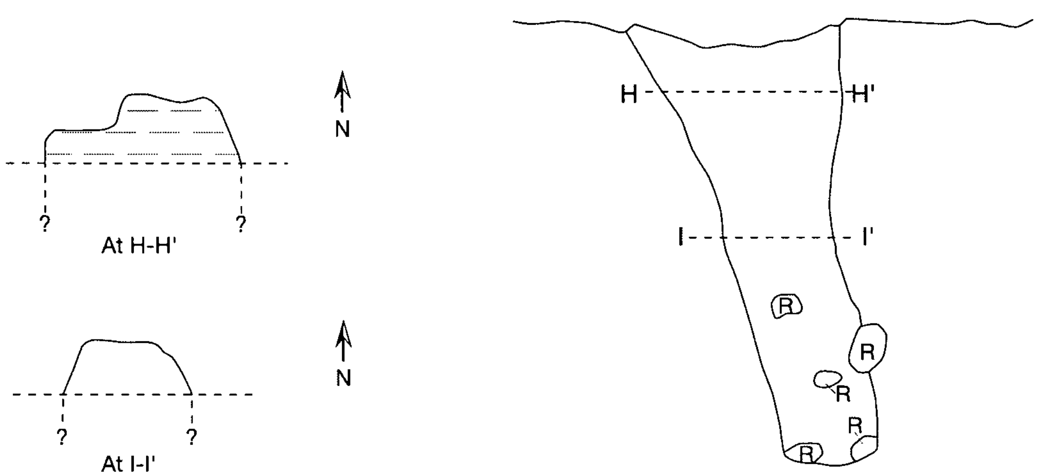
The presence of artifacts and debitage in the prehistoric features caution that seeds and faunal material may be secondary refuse. However, the presence of the ca. 1997 hearth in Kind 5-a and the



5a-1. Squared Possible Storage Pit (Kind 4-a) (Feature 15)

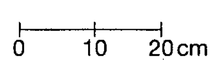


5a-2. Squared Possible Storage Pit (Kind 4-a) (Feature 6)



5b. Squared Non-Thermal Pit (Kind 4-b) (Feature 7) Possible Storage

Figure 5. Squared, Non-Thermal Pit Features



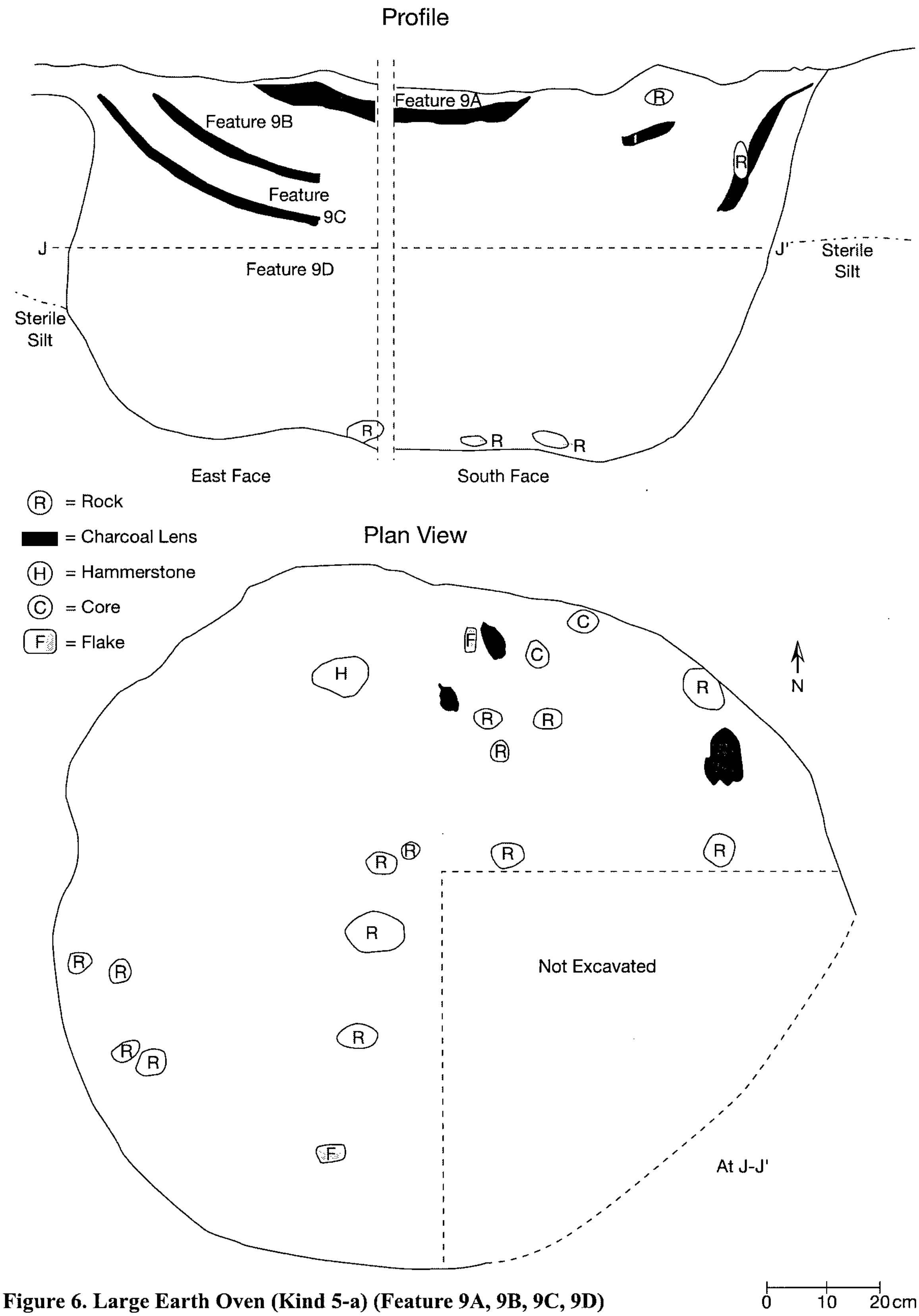


Figure 6. Large Earth Oven (Kind 5-a) (Feature 9A, 9B, 9C, 9D)

botanical and faunal remains common to all Kind 5-a features suggest an analogous function. It is possible that all Kind 5-a features were used to process large quantities and a large variety of food, possibly for feasting.

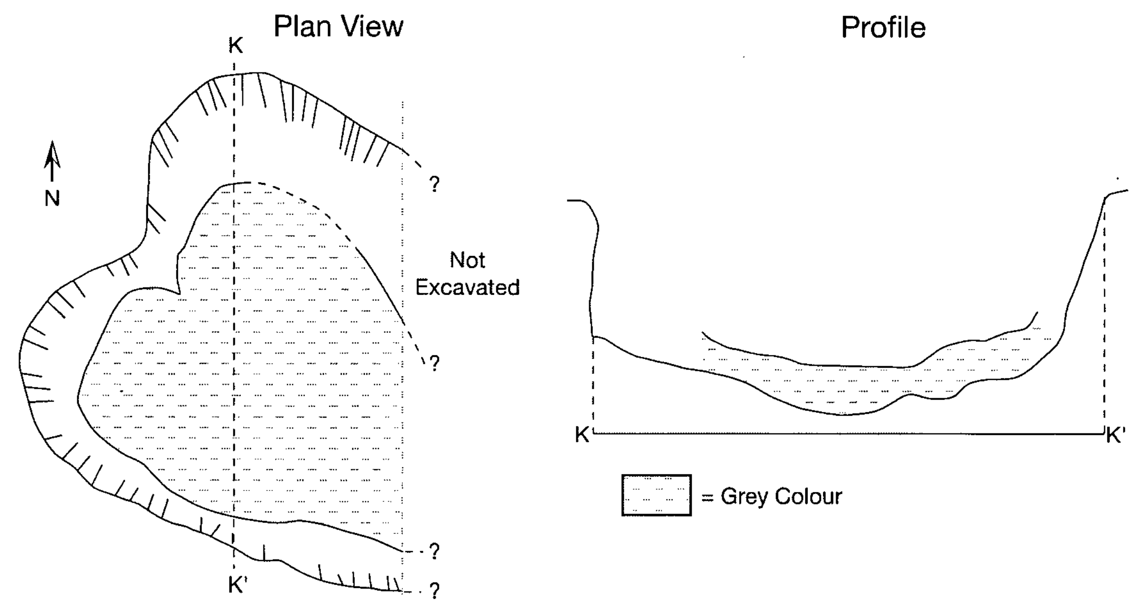
4.3.4ii Large Mound Ovens and Earth Ovens (Kind 5-b) *n = 5*

Kind 5-b features are interpreted as ovens: two mound ovens (9 and 13 cm deep) and three shallow earth ovens (20, 21, and 24 cm deep) that are long (89 to 150 cm, mean = 110 cm) but shallower than Kind 5-a pits (Figure 7a, Feature 12). Unlike Kind 5-a features, the fill is silt rather than coarse and grainy; is red/yellow coloured, not black; and is fine textured, not greasy. Features contain bone (but not shell) and charred seeds that may represent subsistence foods or layers of vegetation placed between foods during cooking. *In situ* fires heated two Kind 5-b features (a 13 cm deep mound oven and a 24 cm deep earth oven) and pre-heated rocks heated two other features (a 9 cm deep mound oven and a 20 cm deep earth oven). The fifth Kind 5-b feature (a 21 cm deep earth oven) has no evidence of burning although heating is inferred from the red/yellow coloured fill; it may have been heated by proximity to a nearby fire or by a rock element that was removed. The presence of artifacts and debitage is rare, therefore, *de facto,* not secondary, refuse is inferred and the charred seeds and bone recovered from Kind 5-b features may be in primary context. The absence of secondary refuse implies the ovens were not used to dispose of household debris but were kept clean for the primary function, cooking. The variety of floral and faunal remains suggest these large mound and shallow ovens functioned for general purpose cooking, not for seasonal processing of large quantities of one food for storage.

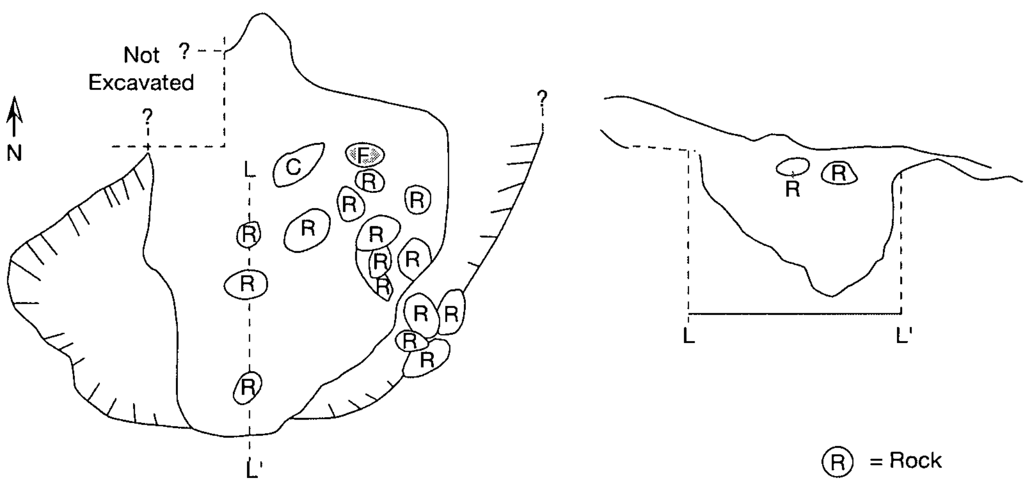
4.3.5 Medium-sized Earth Oven / Hearth with Stakes (Kind 3) *n = 4*

Kind 3 features are interpreted as shallow earth ovens (mean depth = 20.5 cm) that may also have functioned as open fires (hearths) to barbecue meat or fish as all have slanted stakes, possibly for barbecuing, in association (Figure 7b-1, Feature 94-33; Figure 7b-2, Feature 57). If, however, stakemolds are associated with closed ovens, their purpose is not known. Features range in length from 61 to 75 cm and all contain red/yellow coloured fill. One feature, with evidence of heat but not *in situ* burning, contains clay and grey coloured, ashy silt, and much fire-modified rock. It is interpreted as an earth oven with clay lining into which hot rocks (with ash) were placed to provide heat for cooking (Figure 7-Bi). One other feature contains clay fragments in the fill that may be the remains of a lining or covering. The large amount of fire-modified rock in two features may indicate they were heated by rock heating elements (Figure 7b-2), however, the presence of artifacts and debitage (refuse), suggests the rock may be secondary refuse. Although no bone was recovered, the presence of carbonized seeds in two features implies plants may have been used in the ovens, either as vegetative layers or as food.

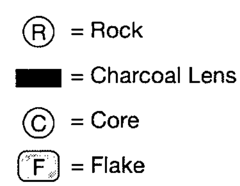
The association of stakes with Kind 3 features implies they may have functioned as hearths and as ovens. As evidence suggests the features functioned as earth ovens initially, it is likely that the shallow depressions of used earth ovens (partly filled with refuse) became the locations of hearths used with stakes for barbecuing. Alternatively, the features may be hearths (open fires) placed in excavated depressions averaging 20 cm deep.

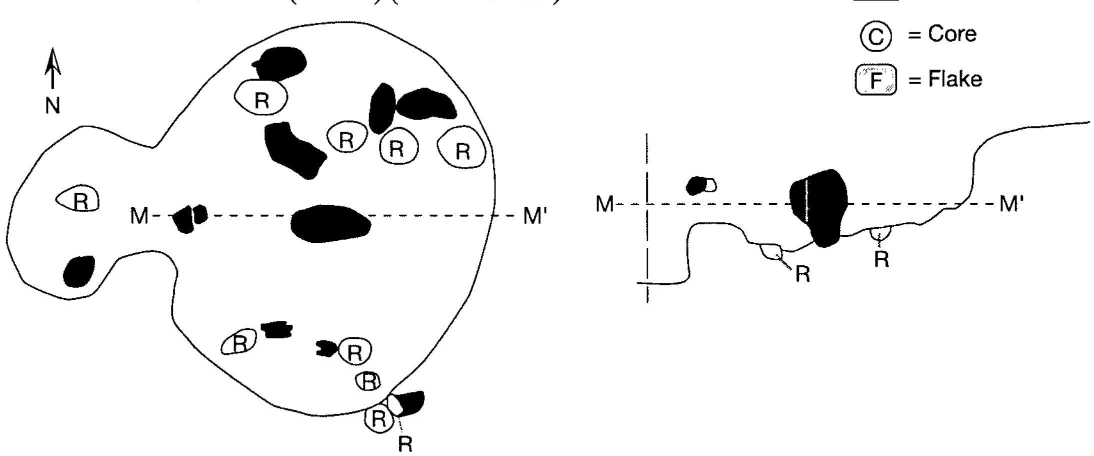


7a. Large Earth Oven (Kind 5-b) (Feature 12)



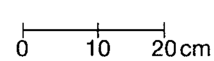
7b-i. Earth Oven/Hearth (Kind 3) (Feature 94-33)





7b-ii. Earth Oven/Hearth (Kind 3) (Feature 57)

Figure 7. Earth Oven and Earth Oven / Hearth Features



4.3.6 Medium-sized Thermal Features (Kind 6) *n = 10*

Interpreted as medium-sized mound ovens, earth ovens, or possibly deposits of thermal refuse, Kind 6 features range in length from 43 to 120 cm (mode = 55 cm) (Table 1). All have a diffuse shape in plan view and none is associated with stakemolds. Fill contains black, organic flecks, charred seeds, debitage and most features also contain artifacts, possibly from secondary use as collection areas for refuse.

4.3.6i Medium-sized Ovens or Thermal Refuse (Kind 6-a) n = 5

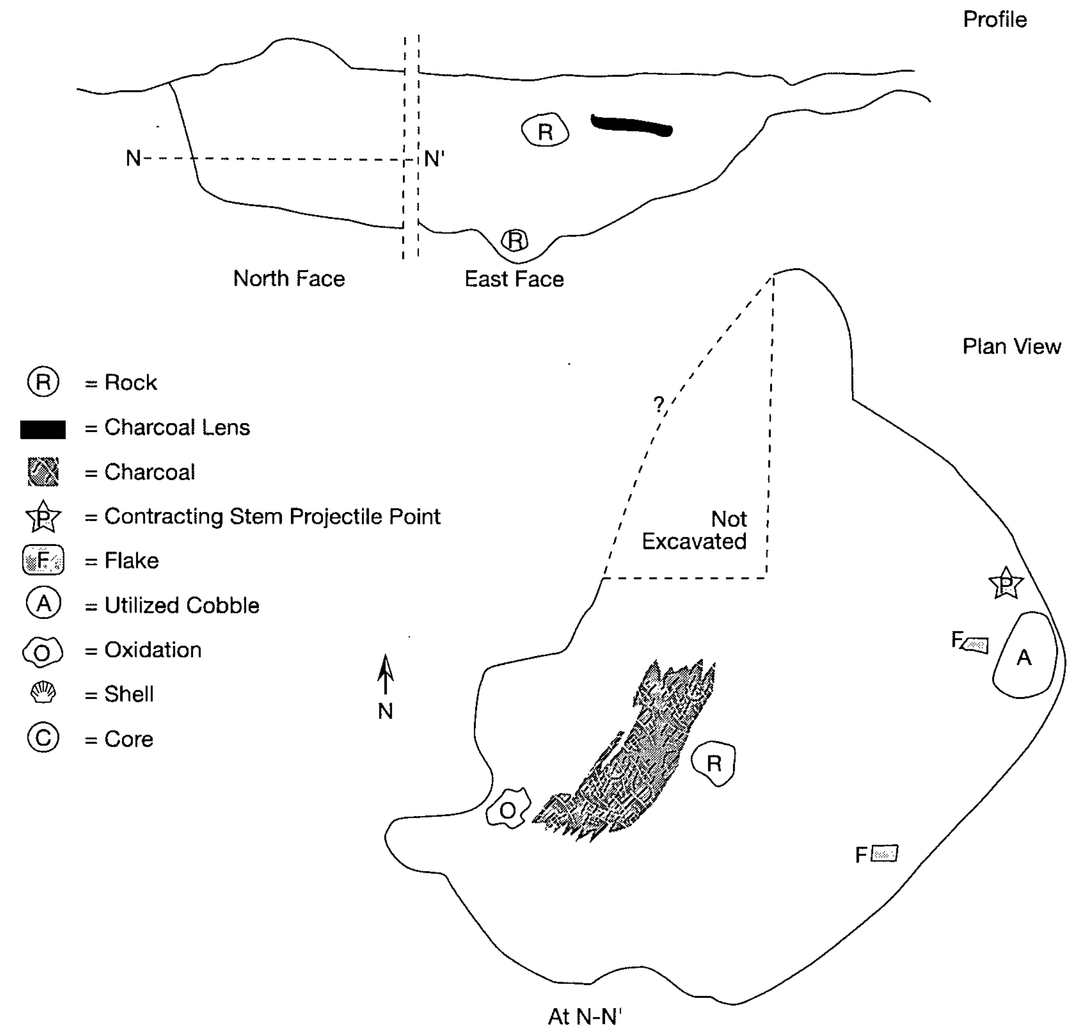
Kind 6-a features are two surface (8 and 10 cm deep) and three shallow (14 to 18 cm deep) features that contain secondary refuse (Figure 8a, Feature 31). They may be mound ovens, shallow earth ovens, or deposits of thermal refuse. The red/yellow colour fill is similar to oven features (Kind 3 and Kind 5). Kind 6-a features exhibit oxidation and contain moderate amounts of fire-modified rock and fragments of charcoal (primarily hardwood) but do not have charcoal lenses. As shown in the dendrogram (Figure 3), features in Kind 6-a cluster as one pair (Feature 2 and Feature 3) and a second pair (Feature 32 and Feature 46) with an outlier (Feature 31). Feature 2 (8 cm deep) and Feature 3 (16 cm deep) are long (65 and 55 cm) and contain gritty, black coloured matrix. Feature 32 (18 cm deep), Feature 46 (14 cm deep), and Feature 31 (10 cm deep) contain compact, grey fill, and although the features have rounded bottoms with excurvate sides, the sides are not symmetrical as in other oven kinds (Kind 3, Kind 5-a). Within this cluster, two characteristics distinguish Feature 31: it is longer (120 cm compared to 60 and 68 cm) and a large quantity of *Rubus* sp. (blackberry) and *Chenopodium* (Lamb's Quarters) seeds was recovered from the fill. All Kind 6-a features may be shallow earth ovens or mound ovens in which the fire was built over a rock lining, explaining the absence of charcoal lenses. The presence of bone (most unidentified but including flatfish) suggests fish, and probably meat, were cooked in the features. The features might also be secondary deposits of thermal refuse, deposited while hot. All features also contain secondary refuse, including ochre, artifacts, and debitage. In spite of shallow depth and charcoal from hard woods, Kind 6-a features are not likely hearths or smoking fires because rock is present in the features and because charcoal lenses are absent.

4.3.6ii Medium-sized Earth Ovens (Kind 6-b) n = 5

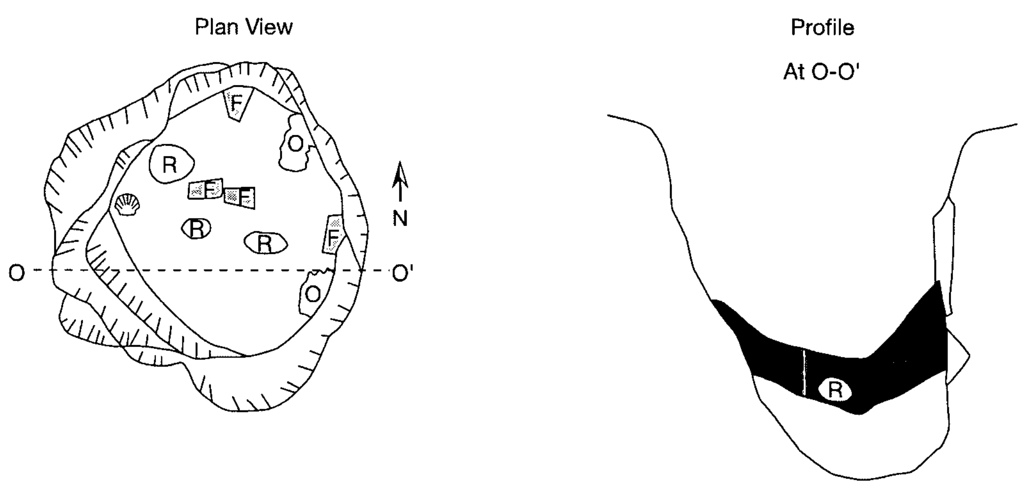
Interpreted as medium-sized earth ovens with *in situ* burning, Kind 6-b features are similar to Kind 6-a in length (43 to 63 cm, mode = 55 cm) but are deeper (20 to 52 cm) (Figure 8a, Feature 94-3). Unlike Kind 6-a, all have evidence of *in situ* burning and contain light coloured, brown matrix. Secondary refuse is inferred in all features from the presence of artifacts and debitage. Other contents, possibly also in secondary context, vary: two ovens contain bone, one contains shell, and another contains a few charred seeds and hardwood charcoal fragments.

4.3.7 Small Mound Ovens and Earth Ovens (Kind 7) *n = 7*

Kind 7 features have evidence of *in situ* burning and are interpreted as small size mound ovens and earth ovens with diffuse margins and asymmetrical sides (Table 1). All contain fire-modified rock, probably used as heating elements to retain heat for long periods. All ovens contain bone, however, some



8a. Medium Sized Ovens or Thermal Refuse (Kind 6a) (Feature 31)



8b. Medium Sized Earth Oven (Kind 6b) (Feature 94-3)

Figure 8. Medium Sized Earth Ovens or Thermal Refuse

also contain artifacts, debitage, and ochre, suggesting contents may be secondary refuse. No layering was noted in the fill.

4.3.7i Small Ovens with Rock Elements (Kind 7-a) *n = 5*

Kind 7-a features are interpreted as two small mound ovens (45 and 51 cm long and 10 and 13 cm deep) with no associated stakemolds, and three earth ovens (33 to 50 cm long and 27 and 43 cm deep), each with associated stakemolds (Figure 9a, Feature 94-1). The 43 cm deep pit is associated with two stakemolds, however, how thermal pits and stakemolds functioned together is not known. Unidentified bone in all ovens, and bird bone in one, implies these ovens were used to process hunted foods. However, as three features contain secondary refuse (artifacts and debitage), the bone may also be in secondary context. Features have diffuse margins, moderate amounts of fire-modified rock, and four contain fragments of charcoal, suggesting wood fires were probably lighted over the rock element. However, only the shallow ovens have evidence of heat (oxidation and red-yellow matrix).

4.3.7ii Small Ovens without Rock Elements (Kind 7-b) *n = 2*

Interpreted as small size earth ovens without rock heating elements, the Kind 7-b features, with lengths ranging from 36 to 48 cm, were heated by *in situ* fires (Figure 9b, Feature -B). None is associated with stakemolds and one, in Component I, contained clay. Unlike Kind 7-a ovens, they have clear evidence of heat and *in situ* burning and do not contain secondary refuse. Margins of Kind 7-b features are structured ovals, not diffuse as in Kind 7-a features, indicating, perhaps, different construction or dismantling techniques. One feature contains unidentified bone (inferred to be in primary context), the other contains charcoal and two charred seeds. These small ovens were probably used for daily cooking.

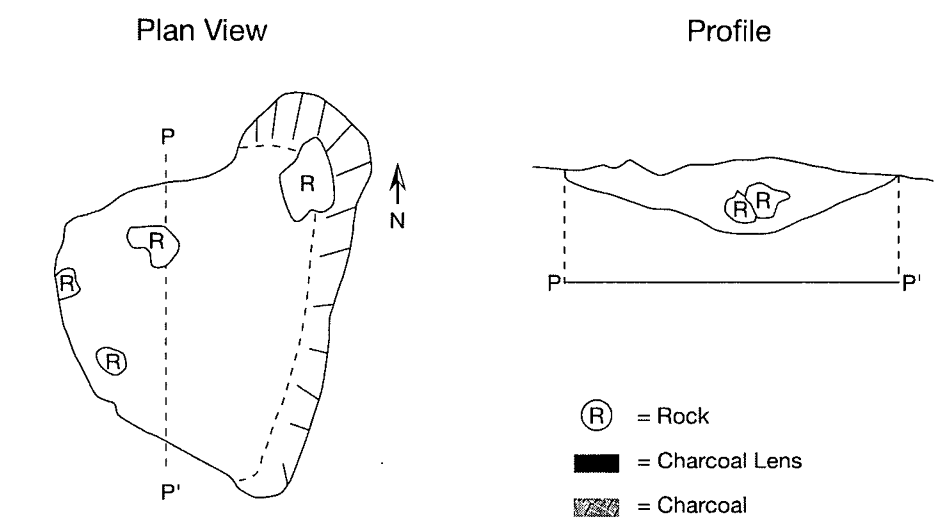
4.3.8 Thermal Refuse: Fire-modified Rock (Kind 8) *n = 2*

Kind 8 features are small (20 and 26 cm long) concentrations of fire-modified rock that are interpreted as secondary refuse from other thermal features (Figure 9c, Feature 4 and Feature 10). Kind 8 features have evidence of heat (oxidation) but not of *in situ* burning, and do not contain secondary refuse (artifacts or debitage), bone, or shell. Oxidation implies rock was deposited on the surface while hot.

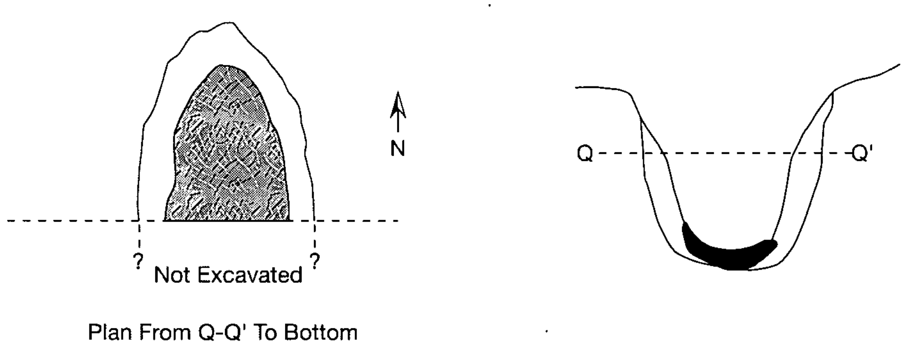
4.3.9 Conclusions

The fourteen feature kinds represent six functional feature classes described in the ethnographic literature: postmolds and stakemolds (Kind 1, Kind 2; n = 14), storage pits (Kind 2, Kind 4; n = 5), earth ovens and mound ovens (with variations in size and heating method) (Kind 3, Kind 5-a, Kind 5-b, Kind 6-b, Kind 7-a, Kind 7-b; n = 25), hearths (Kind 5-a; n = 1, historic), and a feature class identified only in the archaeological data: thermal refuse deposits of fire-modified rock (Kind 8; n = 2). One medium-sized thermal feature kind (Kind 6-a) was difficult to interpret: features may have functioned as shallow earth or mound ovens or they may be deposits of thermal refuse (n = 5). Appendix VIII provides a key, showing how these functional feature kinds can be easily differentiated using morphological and contents characteristics.

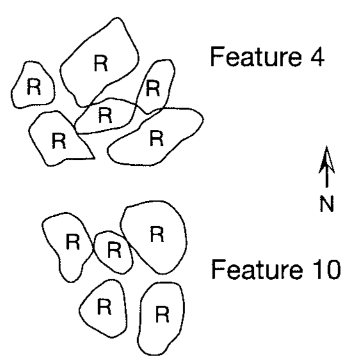
The next step in the analysis determines stratigraphic and temporal associations among all 132



9a. Small Mound Ovens and Earth Ovens (Kind 7a) (Feature 94-1)



9b. Small Earth Oven, no Rock Element (Kind 7b) (Feature 94-L2)



9c. Thermal Refuse: Fire-Modified Rock (Kind 8) (Feature 4-top, Feature 10-bottom)

Figure 9. Small Ovens and Thermal Refuse

0 10 20cm

features recorded in the site reports. Features with lengths less than 16 cm, removed from the data set before the multivariate analysis, have been assigned to Kind 1 as small postmolds and stakemolds.

Two other features, dropped from the clustering analysis because of missing data, were assigned to kinds by comparison of known characteristics: one as a squared, non-thermal pit (Kind 4) and one as a large earth oven (Kind 5). Finally, two unique features were added back into the data set: an anvilstone (Kind 9) and a box-like, right-angled stain (Kind 10) (Appendix VII-b). In the stratigraphic and temporal analyses that follow, functional feature kinds appear in boldface italic print.

4.4 RADIOCARBON AGE ESTIMATES OF FEATURES AND COMPONENTS

Twelve radiometric age estimates (Appendix IX) helped refine stratigraphic feature associations. Matrix colours and origin and termination depths below unit datum for the three components are reported in Appendix X. For features assigned to each component, refer to Appendices XII and XIII. All radiocarbon dates are reported as uncalibrated age estimates in years before present (BP). Component I features, with age estimates between ca. 7000 and 6700 BP, represent the first use of the study area (Appendix XII-a). There is a temporal gap lasting 1700 years before features of Component II, with age estimates ranging between 5000 and 4800 BP, appear (Appendix XII-b). Component II begins with the construction of a small structure dated ca. 5000 BP (Ormerod and Matson 2000). Features with age estimates ca. 4500 BP, designated as Component III, were constructed in strata above this structure, removed sections of it, and changed how the area was used (Appendix XII-c). After 4500 BP, the record is incomplete in the study area, owing to the removal of later deposits by earth-moving activities for a housing development in 1990, and therefore, the stratigraphic and temporal terminations of Component III are not known.

4.5 SEASONALITY AND SUBSISTENCE RESOURCES, BY COMPONENT

Seasons of site use at X̱á:ytem can be inferred from seeds identified from some features (Appendix XIII; Radomski 2000; Wyndham 2000, Ormerod 1998). Although preservation bias is possible, there is no significant difference in plants identified in the three components, suggesting that seasons of site occupation remained similar between ca. 7000 BP and ca. 4500 BP. Resources recovered imply this river valley site was visited seasonally, in summer and autumn, for collecting fruits and, possibly, tule and sedges for mat and basket making, and for hunting and possibly fishing.

All features, identified by kind, are presented on component plans: Component I in Figure 10, Component II in Figure 11, and Component III in Figure 12; features assigned to each component are shown in Appendix XII. Three features do not appear on plans: all were recorded in the upper, disturbed layer and may have originated late in Component III or in the historic or contemporary period. One is the Kind 5-a hearth created in 1997.

In Component I, identified seeds include *Rubus* sp. (blackberries) that ripen in late spring and summer (Gunther 1927; Turner 1995) and *Cyperaceae* sp. (tule and sedges) (Appendix XIII) that are generally harvested from late summer to early autumn, but may be collected as late as November (Turner 1998). Although the number of seeds recovered (n = 38) is small and may not indicate subsistence resources processed in thermal features, they do indicate seasons during which features were open and fires burned in them. As no storage and no processing of berries for winter consumption has been inferred from the feature function analysis, it is probable that during Component I the site was in use from late summer to late autumn while local resources were gathered for immediate consumption.

In Component II, one ***medium-sized thermal feature*** (Kind 6-a), probably a mound oven, contained 35 *Rubus* sp. (blackberry) seeds and 22 *Chenopodium* (Lamb's Quarters) seeds (Appendix XIII), indicating a late summer to autumn occupation (Gunther 1927; Turner 1995, 1998). The *Chenopodium* seeds may indicate that Lamb's Quarter greens were used as a vegetable layer in mound ovens or that it was a subsistence resource. The same feature also yielded two *Gaultheria shallon* (salal) seeds and 92 other (or unidentifiable) seeds. The presence of a variety of seeds in one feature implies that many plant species were used and suggests that berries were processed in large quantities, possibly for storage. Twenty-three other seeds were recovered in this component including 11 additional *Rubus* sp. seeds. Faunal evidence indicates other uses of the site at this time of year may have included bird hunting, mammal hunting, and possibly fishing (Appendix XIV; Vorell 1998). Because the shallow waters that supported the *Cyperaceae* sp. (sedges) are also ideal habitat for *Sagittaria latifolia* (wapato), it is possible that collecting these aquatic bulbs in October and November (Turner 1995) was another late autumn activity.

In Component III, seeds recovered include 29 *Rubus* sp. (blackberry) seeds and 49 chenopod seeds (Appendix XIII), indicating a late summer to autumn season (Gunther 1927; Turner 1995) and also that chenopod continued to be an important resource. Five seeds of *Cyperaceae* sp. (tules and sedges) also suggest late summer to autumn occupation (Turner 1998). The presence of blackberry, *Gaultheria shallon* (salal) and *Sambucus* (elderberry) seeds in one earth oven implies that many berry species may have been processed, possibly for winter storage. Bone species identified from Component III include bird, land mammal, and possibly marine mammal (Appendix XIV; Vorell 1998); all are plentiful in the autumn.

4.6 SITE USE BY COMPONENT

Site use during each component has been inferred from several lines of evidence: the functional feature kinds, seasonality, evidence of specific subsistence resources, and patterns created by adjacent features that appear similar to functional feature expectations derived from ethnographic data. Some feature kinds have temporal associations (Table 2) indicating that, although available resources appear to have remained similar, subsistence activities changed from the Old Cordilleran to the Charles culture and again ca. 4500 BP, during the Charles culture.

Table 2. Frequency of Feature Kinds by Component

Feature Kind	Probable Function	Component: I 7000 - 6700 BP		II 5000 - 4800 BP		III 4500 BP		III or later 4500 BP (or later)		Total	
		n	%	n	%	n	%	n	%	n	%
1	Post and Stake molds	19	*61*	44	*72*	22	*60*	0	*0*	85	*64*
2	Probable Post Molds	0	*0*	1	*2*	2	*5*	0	*0*	3	*2*
3	Hearth/Earth Oven	4	*13*	0	*0*	0	*0*	0	*0*	4	*3*
4	Squared, Non-Thermal Pits	0	*0*	2	*3*	4	*11*	0	*0*	6	*5*
5	Large Ovens & Hearth	0	*0*	2	*3*	6	*16*	3	*100*	11	*8*
6	Medium Ovens & Refuse	3	*10*	5	*8*	3	*8*	0	*0*	11	*8*
7	Small Ovens	4	*13*	4	*7*	0	*0*	0	*0*	8	*6*
8	Thermal Refuse	0	*0*	2	*3*	0	*0*	0	*0*	2	*2*
9	Anvil Stone	1	*3*	0	*0*	0	*0*	0	*0*	1	*1*
10	Box-like Stain	0	*0*	1	*2*	0	*0*	0	*0*	1	*1*
	Total	31	*100*	61	*100*	37	*100*	3	*100*	132	*100*

Seeds recovered from features at Xá:ytem indicate the habitat between ca. 7000 BP and ca. 4500 BP was similar to today. Evidence for tule, bulrush (*Scirpus*) and sedges (*Cyperaceae*) (Appendix XIII) indicate that the area was affected by the Fraser River's annual flood, and probably was partly covered by standing, shallow water in the spring. The site was moist and open, supporting bluebells (*Mertensia*), mustards (*Brassicaceae*), buttercups (*Coptis*), blackberry (*Rubus* sp.) and Lamb's Quarters (*Chenopodium*) (Appendix XIII). Although biases in preservation and data collection are possible, evidence suggests that tree species available to site inhabitants changed over time: only hardwood species, including maple (*Acer*) and alder (*Alnus*) were recovered in Component I, whereas both hardwood and softwood species were found in Charles culture features.

Thermal feature kinds and sizes also vary over time, and suggest how site use and subsistence activities may have changed. One kind, ***earth oven/ hearth*** (Kind 3), is unique to Component I (Old Cordilleran). Evidence indicates oven sizes also increased: ***small mound ovens and earth ovens,*** with diffuse margins and asymmetrical sides (Kind 7), occur in equal numbers in Component I (Old Cordilleran) and Component II (Charles culture before 4500 BP) but do not appear in Component III (Charles culture after 4500 BP). Three ***medium-sized earth ovens,*** with diffuse margins and without associated stakes (Kind 6-b), appear in Component I but only one occurs in each of the later Components. ***Large earth and mound ovens*** (Kind 5) are not present in Component I, two appear in Component II, and nine are noted in Component III or later strata.

The use of stakemolds adjacent to oven features is also time sensitive. Although the four ***small mound ovens and earth ovens*** (Kind 7) in Component I are associated with ***stakemolds*** (Kind 1), only one of four similar features present in Component II has stakemolds. As most of the stakemolds slant toward the thermal features and have been interpreted as barbecue stakes, this difference between Component I (Old Cordilleran) and Component II (Charles culture) ovens and hearths may imply that barbecuing was no longer the ubiquitous form of cooking or that small game was no longer a primary source of subsistence.

The presence/absence of shallow thermal features also changes over time. ***Medium-sized*** thermal features, probably ***ovens or thermal refuse deposits*** (Kind 6-a), do not appear in Component I (Old Cordilleran) but are present in Components II and III (Charles culture). If these are shallow earth or mound ovens, they imply intensified resource preservation activity, with the use of low effort ovens to process large quantities of food with the least effort. If these are secondary deposits of oven refuse, they imply that ovens were opened hot, possibly to transfer berries (such as salal or elderberry) to mats for sun drying, or possibly for immediate consumption of processed food.

In summary, temporal evidence for thermal features suggests that shallow ***earth oven/hearths*** with associated stakes (Kind 3) were constructed only in Component I and that ***medium-sized*** (Kind 6-b) and ***small*** (Kind 7) ***earth ovens*** with diffuse margins were replaced over time with ***larger***, more symmetrical, ***ovens*** (Kind 5) and shallow, low effort, ***medium-sized ovens*** (Kind 6-a). As ovens became larger and more numerous during the Charles culture, hot refuse was deposited on the surface (***fire-modified rock***, Kind 8 and possibly some features in Kind 6-a). This evidence, coupled with the presence of secondary refuse in many thermal features, implies intensive use of the area, probably for processing seasonal food for storage.

Large, ***non-thermal pit features*** (interpreted as storage pits) occur in Charles components only: three in Component II (one Kind 2 and two Kind 4) and four in Component III (Kind 4). The unique right-angled, ***box-like stain*** (Kind 10), that may represent a storage feature, is in Component II. If all feature kinds that may have storage functions (including possible storage racks) are considered, there appears to be an increase in storage facilities during the Charles culture around ca. 4500 BP, keeping step with increases in the frequency and size of processing features.

4.6.1 Component I Site Use (7000 - 6700 BP): X̲á:ytem in the Old Cordilleran

Component I features, recovered at the eastern and western edges of the study area (Figure 10; Appendix XII-a), date from the Old Cordilleran period. One ***earth oven/hearth feature*** (Kind 3, Feature 94-4) provided a radiocarbon age estimate of 6880±80 BP (Beta 77759). An activity surface adjacent to a ***medium-sized earth oven*** (Kind 6-b, Feature 94-18) provided an estimate of 6715±125 BP (Appendix IX). Evidence indicates that X̲á:ytem was occupied during late summer and late autumn: seeds of the *Cyperaceae* sp. family (tule and other sedges) suggest July to November (Turner 1998) as do *Rubus* sp. (blackberry) and *Chenopodium* (Lamb's Quarters) seeds (Turner 1995). Found in thermal features, the *Cyperaceae* seeds do not necessarily imply tules and sedges were gathered, but do suggest months during which thermal features were lighted.

Although few subsistence remains were recovered, bone (Appendix XIV; Vorell 1998); blackberry (*Rubus* sp.); and Lamb's Quarters (*Chenopodium*) seeds suggest thermal features were used to cook a variety of foods and may have functioned as both hearths and earth ovens as needed. Only maple (*Acer*) charcoal, a hardwood, was found in Component I thermal features (Appendix XIII; Wyndham 2000; Radomski 2000) implying that hardwoods were selected for cooking fires.

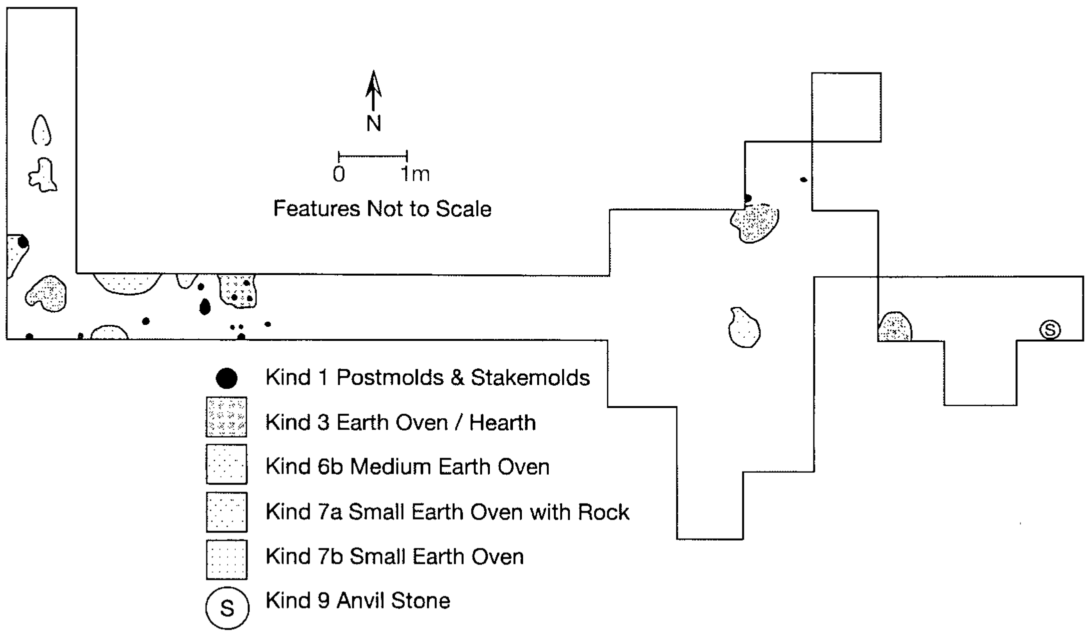


Figure 10. Component I Plan

Evidence indicates food was processed for immediate consumption, not for storage. Nine (of 11) thermal features (82%) have ***stakemolds*** (Kind 1) associated and most stakes (12 of 19) are located at the rim of, and slant toward, the fires. ***Earth oven/hearths*** (Kind 3), present only in Component I, each have one to three ***stakemolds*** (Kind 1) and ***small mound and earth ovens*** (Kind 7) also have one stake. Together these features comprise 72% of the thermal features; medium-sized earth ovens without stakes make up the remaining 28% of cooking features. The purpose of stakes adjacent to what appear to be earth ovens is not known. However, it is probable that oven pits also served as open hearths as needed, or as pits gradually filled in with oven refuse. The stakes were likely used to barbecue small birds, mammals, and fish. Food was probably also steamed in ovens for immediate consumption. Clay, noted only in Component I (in ***small*** (Kind 7) and ***medium-sized*** (Kind 6) ***earth ovens***) likely indicates clay linings and coverings. It is not possible to suggest whether subsistence relied on hunting or fishing as the bone recovered was not identifiable. The presence of ***small earth ovens*** (Kind 7) heated only by rocks lifted into the pits from other fires, not by *in situ* fires, however, implies some foods were prepared in low heat steaming ovens. This technique was used for cooking fish in the ethnographic period.

Seven other ***stakemolds*** (Kind 1), located in the same area as the thermal features, may represent temporary shelters or drying racks, however no patterns are apparent on the ground. An ***anvil stone*** (Kind 9) was also recovered in Component I, but, owing to the small area excavated, it is not associated with other features and its function is not known.

From this evidence, in Component I, X̱á:ytem probably functioned as a resource location and base camp (Binford 1980) used by Old Cordilleran foragers during brief periods in summer and autumn. The absence of storage features and the presence of features with non-specific functions (Binford 1980), such as the ***earth oven/hearth*** features (Kind 3), imply it was a temporary residential base (Binford 1980) providing access to a broad subsistence base that likely included small game, fish, and berries. In the study area, evidence for Old Cordilleran period occupation ends ca. 6700 BP (BGS 2297) and the area does not appear to have been reoccupied for around 1700 years.

4.6.2 X̲á:ytem during the Charles Culture

Both Component II and Component III fall within the Charles culture. Component II features span a period from the construction of a small structure, ***Structure 1,*** ca. 5000 BP (Beta 143729) to the use of a ***medium-sized oven or thermal refuse*** (Kind 6-a, Feature 31) ca. 4800 BP (BGS 2300). Two features, a ***medium-sized oven or thermal refuse*** (Kind 6-a, Feature 32) dated ca. 4500 BP (BGS 2296), and a ***large earth oven*** (Kind 5-a, Feature 9D) dated ca. 4500 BP (Beta 111764) provided the age estimate for Component III. Component III (ca. 4500 BP), marks a change in the scale of subsistence activity at X̲á:ytem: the size and frequency of ovens, structures, and possible storage features, increase. ***Small ovens*** (Kind 7) occur only in Component II, ***medium-sized ovens*** (Kind 6) are equally distributed in both components (eight percent of all features), however, the frequency of ***large ovens*** (Kind 5) increases from three percent of features in Component II to sixteen percent in Component III. ***Squared non-thermal features*** (Kind 4), probably storage features, increase from three percent of features in Component II to eleven percent in Component III.

Seeds recovered in Components II and III are similar species to those found in Old Cordilleran features. Plants that thrive in moist, open areas predominate (Appendix XIII) and these botanical remains indicate the site continued to be occupied in late summer and late autumn. Limited evidence (one flatfish bone) suggests the site may also have been occupied in early spring (Suttles n.d.; Matson and Coupland 1995:173) after 4500 BP.

4.6.2i Component II Site Use (5000 - 4800 BP): Charles Culture

In Component II, features were recorded in most of the study area (Figure 11, Appendix XII-b) except in the south-central portion where construction of a large earth oven (Kind 5-a) in Component III may have removed earlier evidence (Figure 12). Botanical remains indicate occupation was primarily from summer to late autumn and the frequency of oven processing activities and possible storage pits implies sufficient food was processed at the site to keep some for later use. Although bulk procurement is rare among foragers (Binford 1980:10), Component II occupations at X̲á:ytem probably represent a temporary field camp (and possibly a cache site) for Charles culture foragers. It is possible small groups were gathering, processing, and storing subsistence resources for a larger residential community located elsewhere.

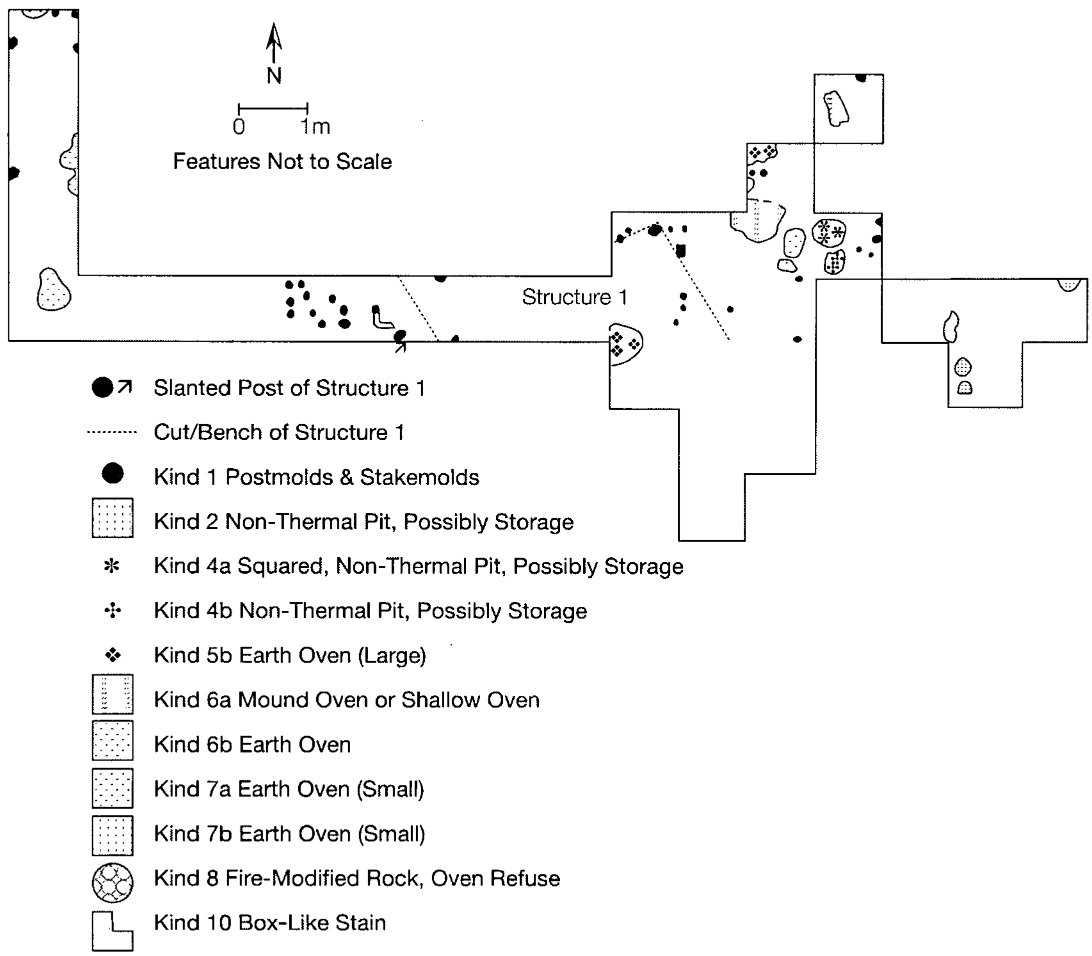


Figure 11. Component II Plan

The earliest feature recorded in Component II, a ***large earth oven*** (Kind 5-b, Feature 63), dated 5050±50 BP (Beta 143729), was soon filled with clean sand, covered with clay, and small, ***Structure 1*** (Ormerod and Matson 2000), dated 5050±130 (Beta 143727), was built over it. Associations of postmolds and stakemolds suggest up to three structures with post frames as well as temporary, stake-supported features were constructed in the study area during Component II.

Large quantities of charred blackberry (*Rubus* sp.) and Lamb's Quarters (*Chenopodium*) (Appendix XIII) seeds, recovered in a ***medium-sized oven or thermal refuse*** deposit (Kind 6-a) and on the floor of ***Structure 1***, suggest these plant resources were gathered, consumed, and processed at the site. The presence of bone (Appendix XIV) in ***small ovens*** (Kind 7-a), ***medium-sized ovens*** (Kind 6-a), and ***large ovens*** (Kind 5-b), implies birds (identified), and probably mammals and fish, were prepared in varying quantities. The ***small ovens*** (Kind 7-a, Kind 7-b) suggest immediate consumption may have been intended, however, use of shallow, ***medium ovens*** and ***large ovens*** imply larger quantities were processed, possibly for storage. Only two tule (*Scirpus*) seeds were recovered and these may not indicate this resource was gathered at the site. One seed, from a ***medium-sized oven or thermal refuse*** deposit (Kind 6-a), may indicate the use of tule mats as oven covering. The other, found on the floor of ***Structure 1***, may indicate the ubiquitous use of tule mats as dividers and floor and bench coverings, as noted in ethnographic reports.

Although less than half of ***Structure 1*** was exposed in the archaeological excavations (Figure 11), structural elements include a bench-like cut, with maximum depth of 30 cm at the north end, that formed the floor and back of the structure. The compacted, black floor area measured over 3.5 metres at the north end and was at least 4.5 metres long. Two large diameter (17 and 24 cm) ***posts*** (Kind 1) were set in the north east corner of the structure and 10 cm diameter ***posts***, located 50 cm away, followed the bench-like cut. ***Stakemolds***, ranging from 6 to 9 cm in diameter, also followed the wall line, inside and outside the cut, and are interpreted as supports for wall material. In the interior, near the eastern wall, 6 cm diameter ***stakemolds*** may have supported interior benches or storage racks. At the western extremity of the structure, a deep-set, 12 cm diameter ***postmold***, slanted at an acute angle, would have met the edge of the structure about one metre above the floor surface. The post alignments imply a structure with vertical posts and walls on the north and east sides but possibly with a slanted support post, and perhaps a slanted wall, on the west side. Although this construction implies a lean-to superstructure (often used in the ethnographic period with tule mat coverings), the paired stake system along the east perimeter of the structure (similar to the method reported ethnographically for the attachment of horizontal wallboards), and the prepared floor, are techniques reported for shed roof structures in the ethnographic literature. A hearth was not recovered, however, it is expected to lie south of the archaeologically excavated area. It is probable the structure functioned as both a shelter for a nuclear family and for incidental smoking of food as needed. Although the duration of the structure's usefulness is unknown, the area it occupied was not used for any other purpose until Component III, ca. 4500 BP.

East of Structure 1, ***postmolds and stakemolds*** (Kind 1), in an arrangement similar to those of Structure 1, suggest there might have been another structure with a permanent frame. Two ***squared***, 11 cm diameter ***postmolds*** (Kind 1-b), set one metre apart, and a north-south alignment of two 20 cm diameter ***postmolds*** (with a 10 cm diameter postmold between them) may be part of a structure. Adjacent to the postmolds are two ***squared, non-thermal pits*** (Kind 4), interpreted as possible storage pits.

In the northwest corner of the study area, another group of three ***postmolds*** (10, 11 and 25 cm diameter) is associated with a ***medium-sized earth oven*** (Kind 6-b) and a charcoal deposit with a radiocarbon age estimate of 4955±200 BP (BGS 2298). The post diameters, similar to those of Structure 1, may indicate another structure.

Two arrangements of ***stakemolds*** (Kind 1), possibly to support racks for drying food, processing hides or storage, lie west of ***Structure 1*** (Figure 11). Of ten ***stakemolds*** adjacent to the structure, half are set at angles, however, no pattern implying function is discernable. Lacking any association with hearths or smoking fires, the stakes likely supported racks for air-drying food or hides. Adjacent to them is a unique feature, a 10 cm deep stain, the colour of decomposed wood, with a distinct, ***box-like*** right angle (Kind 10) (Appendix VII) that may represent one corner of a squared feature, probably elevated on stakes, and possibly used for storage.

Oven features, located east of Structure 1, were probably used to oven process quantities of meat or fish: of four ***earth ovens*** with bone fragments, only one (Kind 7-a) had a ***stakemold*** (Kind 1) angled over it, suggesting it may also have served as an open barbecue fire. Two ***earth ovens*** with evidence of *in situ* burning contained rock elements, one did not, and one shallow ***large earth oven*** (Kind 5-b) may have been heated only by its proximity to an adjacent ***small earth oven*** (Kind 7-a). Three other ***medium-sized ovens or thermal refuse*** deposits (Kind 6-a) also contain bone. One, (Feature 31, dated 4827 ±150 BP (BGS 2300), yielded thirty-five blackberry (R*ubus* sp.), two salal (*Gaultheria shallon*) seeds, and twenty-two seeds of *Chenopodium* (Lamb's Quarters). The Lamb's Quarters may have been used as the moist layer of greens in ovens, or possibly, as food. By ethnographic analogy, the many variations of ovens in this small area, all containing bone and many with seeds, implies individual preferences for oven construction, variation in the amount of meat or fish being processed, and reuse of features for processing many kinds, rather than specific kinds, of food.

Three ***non-thermal features***, possibly storage pits (Kind 2, Kind 4-a, Kind 4-b), adjacent to the oven-cooking area, may have provided temporary storage for processed resources. Other possible storage features include the rafters of ***Structure 1,*** possible storage platforms west of Structure 1, and the ***box-like feature*** (Kind 10).

4.6.2ii Site Use in Component III (ca. 4500 BP- unknown terminal date): Charles Culture

Three large ***postmolds*** (Kind 1) stand out among Component III features (Figure 12, Appendix XII-c). Located near the centre of the study area, the posts cover a length of 7.5 metres, approximately double the size of Structure 1 in Component II. These may be permanent posts from a large structure, however, limited archaeological excavation provided insufficient evidence to confirm its existence or infer its size or function. Within the outline of the posts are two ***medium-sized ovens*** (one Kind 6-a, one Kind 6-b). One is associated with two pairs of stakemolds, suggesting it may have functioned as a hearth for barbecuing. It is possible both features were hearths for daily cooking and heating inside the possible structure. The presence of multiple hearths would indicate that, if the structure did exist, it housed an extended family group. Other evidence for a structure includes a small, ***squared, non-thermal pit***, (Kind 4) possibly a storage cellar, adjacent to the southernmost post.

In strata dated to ca. 4500 BP, thermal features, including ***large earth ovens*** (Kind 5-a and Kind 5-b), extend over the entire study area. The earliest use of one large, deep (68 cm) oven (Feature 9D) (4540±90 BP, Beta 111764) is temporally associated with two structures on the higher terrace, which have radiocarbon age estimates of 4590±70 BP (WSU 4328) and 4530±120 BP (Beta 47260) (Mason 1994). Contents of the greasy, dark oven fill of Feature 9 include shell, mammal, bird, and unidentified bone fragments (Appendix XIV), blackberries (*Rubus* sp.), Lamb's Quarters (*Chenopodium*), and salal (*Gaultheria shallon*) seeds (Appendix XIII). If the faunal and botanical remains represent subsistence resources processed in the oven, the variety of species implies that large volume features may have been used to process many different resources, possibly in different seasons, probably for preservation before storage. Alternatively, the ***large earth oven*** (Feature 9D) may have been used to feed large groups, perhaps at infrequent feasts. Between uses, the ***large earth oven*** (Feature 9) was used to dispose of refuse, including spent artifacts and debitage, probably by burning.

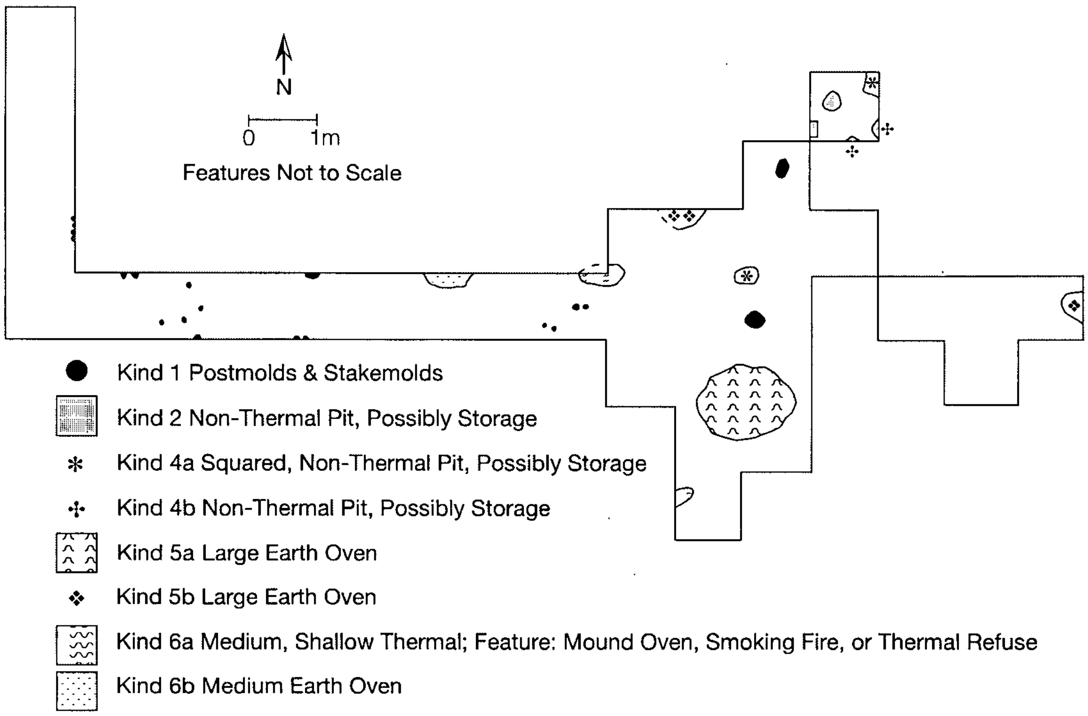


Figure 12. Component III Plan

The size and frequency of processing features suggest that, approximately 4500 years ago, X̲á:ytem continued to be used a field camp for resource procurement, processing, and storage. However, the size of structures on the higher terrace (Mason 1994) and of processing ovens (Kind 5) on the lower terrace, as well as limited faunal and botanical evidence, suggest that X̲á:ytem may also have been a residential base (Binford 1980) to which resources gathered at greater distances were transported for processing or storage. Subsistence resources not available in the fluvial zone, including flatfish and shellfish (species unidentified) (Appendix XIV), salal (*Gaultheria shallon*), and elderberry (*Sambucus*) (Appendix XIII), appear in thermal features at this time. Although resources recovered indicate most visits to X̲á:ytem occurred in summer and autumn, the presence of a flatfish bone suggests the site was also visited in spring.

4.6.3 Site Use: Conclusions

The earliest occupation of the study area at X̲á:ytem (Component I), ca. 7000 BP, provides evidence of subsistence activities of Old Cordilleran people in a river valley environment. Resources hunted and gathered in late summer and autumn were prepared for immediate consumption in clay lined earth ovens and barbecued on slanted stakes over features that served as both earth ovens and hearths. Stakemolds adjacent to some thermal features may indicate saplings or poles were used to construct drying racks or temporary shelters.

After 1700 years (for which no evidence of occupation was recovered), ca. 5000 BP, people of the Charles culture built a small, nuclear family-size structure (Structure 1) on a prepared surface, using posts up to 24 cm in diameter. There is evidence that other, similar structures were built nearby. X̲á:ytem likely served as a field camp where local resources, including blackberries (*Rubus* sp.), birds, mammals, and probably fish, were prepared in small and medium-sized earth ovens. Evidence suggests drying racks were also constructed, probably for sun and air-drying meat and fish. Food may have been stored for a time in squared, non-thermal pits, probably storage pits, and in the structures before being moved to residential base camps.

Around 4500 years ago, larger structures were constructed on the higher terrace at X̲á:ytem (Mason 1994). On the lower terrace, only subsistence related features have been recovered, and medium and large earth ovens and squared, non-thermal pits, probably storage pits, predominate. A decrease in the quantity of stakemolds between Component II and Component III implies fewer drying racks were constructed on the lower terrace. Although local resources predominate, subsistence resources from other ecological zones (flatfish, shellfish, elderberry, and salal) recovered in thermal features, suggest X̲á:ytem may have been a residential base camp for summer and autumn gathering, processing, and storage.

CHAPTER V: DISCUSSION AND RECOMMENDATIONS

Two objectives guided this study: first, to identify functional feature kinds, and second, to describe site use and seasonality at X̲á:ytem in Old Cordilleran and Charles culture components. In achieving the first objective, multivariate analysis of feature morphology, contents, and context revealed 14 feature kinds that differ from typologies commonly seen in the archaeological literature. In relation to the second objective, the analysis of X̲á:ytem features adds details to subsistence and settlement patterns of Old Cordilleran and Charles culture people in the Fraser River region. Although similar to expectations for the Old Cordilleran period, in Charles culture components dissimilarities exist between the valley adaptation at X̲á:ytem and the St. Mungo phase adaptation of the delta. Lack of evidence for features of the Eayem phase of the Fraser River canyon prevents a comparison with X̲á:ytem.

5.1 DISCUSSION OF THE RESULTS

Because of poor preservation of botanical and faunal remains, the results of this study could not attribute specific functions to features at X̲á:ytem. The objective, therefore, was to classify features using multivariate analysis of characteristics of morphology, contents, and context and to postulate feature functions. The resulting typology of 14 functional feature kinds includes: ***earth oven/hearth*** features with stakes (Kind 3), found only in the Old Cordilleran component; three size classifications of ***hearths and ovens*** (***large***, Kind 5; ***medium***, Kind 6-b; and ***small*** Kind 7); ***thermal refuse*** deposits (Kind 8); and ***squared, non-thermal pits*** (Kind 4), possibly used for storage. Variations in earth oven construction have also been identified from characteristics of feature contents: these are interpreted as indicators of preferences in oven construction, not functional differences.

Feature length and contents had the greatest influence on clusters. Therefore, kinds differ from classifications reported in other archaeological feature typologies for the region, in which feature depth separates "hearths" and "pits". X̲á:ytem kinds imply that deep features ("pits") and shallow features ("hearths") may have had similar functions, as enclosed ovens (earth ovens and mound ovens). This result is not incongruous with ethnographic reports that thermal feature size is dependent on the amount of food to be processed and available human and environmental resources.

Although further testing of two kinds, ***medium-sized ovens or thermal refuse*** deposits (Kind 6-a) and ***squared, non-thermal pits*** (Kind 4) is recommended, distinctive characteristics of the kinds have been identified in a key (Appendix VIII) intended for use at X̲á:ytem, and possibly other Fraser River valley sites. The key begins with four choices among feature contents and, ultimately, through variation in contents and size, assigns features to the kinds identified in this study. It should be noted that some feature contents, such as the presence of fire-modified rock, had little effect on the kinds: small postmolds often contained rock (probably post-depositional) and even in earth ovens, the presence of rock indicates variation in oven construction and dismantling, not function.

5.2 COMPARISONS WITH CULTURE HISTORY OF THE AREA

5.2.1 X̲á:ytem and Old Cordilleran Culture History in the Lower Fraser River Area

Beginning ca. 7000 BP, people of the Old Cordilleran culture visited X̲á:ytem in late summer and late autumn, likely year after year. Although bone recovered in features was not identifiable to genera, people probably hunted game, fished, and gathered ripening berries; activities reported for other Old Cordilleran sites. Also similar to other sites, no structures were recovered, however, stakemolds located near thermal features may have supported temporary shelters or drying racks. Although X̲á:ytem does not provide information about specific subsistence resources, the feature analysis suggests how Old Cordilleran people prepared foods. Stakes were commonly slanted over shallow, thermal pit features, particularly ***earth oven/hearths*** (Kind 3) and ***small earth ovens*** (Kind 7), probably to barbecue small game and fish over open fires. Ovens were small in size and shallow, often lined with clay, and some were heated only with pre-heated rock. By ethnographic analogy, these oven characteristics imply food was steam cooked for a few hours for immediate consumption.

5.2.2 X̲á:ytem and Charles Culture History in the Lower Fraser River Area

The Charles culture occupation in the study area at X̲á:ytem began ca. 5000 BP, slightly later than the Eayem phase in the canyon (ca. 5500 BP at Esilao; Borden 1975:72) and the Mayne phase (ca. 5400 BP; Borden 1975:93) in the Gulf of Georgia, but slightly earlier than the St. Mungo phase of the Fraser delta (ca. 4500 BP; Matson and Coupland 1995). In the site report (Ormerod and Matson 2000), Matson wrote that radiocarbon age estimates and analysis of the lithic assemblage indicate that X̲á:ytem, although a variant of Charles culture, does not fit neatly into the St. Mungo phase. X̲á:ytem feature analysis provides more evidence that the subsistence adaptation, although part of the regional Charles culture, *is* dissimilar from St. Mungo in the delta, and probably from the Eayem phase of the canyon (for which few features have been recorded). X̲á:ytem features indicate people of the Charles culture first used the area around 5000 years ago, probably as a field camp for gathering riverine resources in summer and autumn. Site use intensified over time until, around 4500 years ago, X̲á:ytem may have functioned as a base camp from spring to autumn. A broad range of subsistence resources were processed and stored at the site before transport to winter camps.

5.2.2i Why X̲á:ytem is not St. Mungo Phase

Around 5000 years ago, on the lower terrace at X̲á:ytem, Charles culture people constructed Structure 1, a small nuclear family-sized structure with a levelled floor and permanent posts . By 4500 BP, larger structures, with multiple hearths (suggesting extended families) had been built on the higher terrace (Mason 1994) and only processing facilities were located on the lower terrace. It was also ca. 4500 BP that temporary structures are first noted for the St Mungo phase in the delta (Ham *et al.* 1986). It is expected that subsistence adaptations to the delta (St. Mungo) and the river valley (X̲á:ytem) should result in some differences in lithic assemblages and site use. When examined, however, notable differences in both lithic assemblages and site use suggest X̲á:ytem may not be like St. Mungo phase sites.

Lithic assemblages from the St. Mungo component at the Glenrose site and from X̲á:ytem were compared in the site report (Ormerod and Matson 2000; Appendix XV) and, although X̲á:ytem data mix Old Cordilleran and Charles component lithics, differences exist. Notably missing at X̲á:ytem are well-made retouched flakes, thought to function as scrapers, and heavy-duty bifaces, suggesting, as expected, that different processing activities occurred in the two ecological zones. Differences in projectile point assemblages, however, were also noted. At the Glenrose site, in the St.Mungo component, small, leaf-shaped points predominate, whereas at X̲á:ytem, contracting stem points are most common, and a Lehman point and a tanged point were also recovered. Differences also exist in ground stone and decorative objects: ground stone tools and beads were recovered at Glenrose, not at X̲á:ytem. However, the X̲á:ytem assemblage included a fine, ground stone pendant and obsidian tinklers. These variations in projectile points, proportions of ground stone artifacts, and personal objects, may imply cultural variation between people of the delta in the St. Mungo phase (at least at the Glenrose site) and people in the Fraser River valley (at X̲á:ytem).

The major difference, however, between subsistence activities reported for the St. Mungo phase and X̲á:ytem is storage. As expected, food processing facilities at X̲á:ytem reflect a river valley resource base and include earth ovens, possible racks for air-drying, and structures (probably serving as shelter and incipient smokehouses). Although storage has not been noted for the St. Mungo phase (Matson and Coupland 1995), people at X̲á:ytem may have been using storage pits and stake-supported storage platforms. Feature functions postulated in this study suggest that from the first arrival of Charles culture people ca. 5000 BP, resources were not all consumed on site but were processed and stored, probably until moved to winter camps. There is limited data suggesting that around 4500 BP, use of the site intensified. Subsistence remains indicate a change from processing only local resources to processing resources gathered in other ecological niches as well.

Although the increasingly substantial structure forms and increases in the number of storage facilities indicate X̲á:ytem ca. 4500 BP is not like St. Mungo phase sites, there is no indication for increasing sedentariness (Rafferty 1984) at the site. Evidence suggests that, as of 4500 BP, although site use and subsistence at X̲á:ytem imply a distinctly valley adaptation of Charles culture, as at St. Mungo phase sites (Matson 1992), site use remained semi-sedentary.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

5.3.1 Recommendations to Improve the Functional Feature Typology

The use of multivariate analysis highlighted characteristics distinctive to non-thermal and thermal feature kinds and aided in identifying different functional kinds of features as noted in the key (Appendix VIII). The results of this study deviate from typologies reported in ethnographies and archaeological analyses in the way "hearths" and "earth ovens" bundle into classifications that do not recognize depth as a functional attribute. This difference warrants further analysis. Previous feature function analyses (Lewarch *et al.* 1995; Morgan *et al.* 1999) indicated that feature functions inferred from content analyses often do not fit into categories derived from morphological analyses. Do archaeological typologies that separate hearths from pits on the depth dimension represent modern notions about function, or prehistoric, indigenous concepts of functional kinds of features? Recommended are experimental studies of thermal feature classes postulated here, especially the ***earth oven/hearth*** (Kind 3) of the Old Cordilleran component and the ***medium-sized oven or thermal refuse*** deposits (Kind 6-a). Morphological characteristics (length, width, and depth) of these feature kinds could be replicated and various covering materials (mats, clay, earth, no covering) tested to process food types recovered in the archaeological record. After firing, content characteristics (colour, texture, and the presence of botanical and faunal remains) of each experimental class could be compared to data used in this study in creating the archaeological kinds. It would be particularly beneficial to identify evidence of oven coverings. This would clarify if the postulated mound ovens existed, or if these features are more like hearths or surface deposits of oven refuse.

Further research is also needed to test the inferences for storage pits in Charles culture components. Evidence for ***squared, non-thermal pits*** (Kind 4) with layering may represent storage pits or unknown kinds of features, possibly created by wood decomposition. Actualistic studies are recommended to compare the colour, proportions of black organic flecks, and chemical signatures of matrix samples from wood posts (decomposed in the ground) with known storage pits. The study could also develop a baseline for comparing black, organic fleck contents across a range of functional feature kinds, as these flecks were identified in most thermal and non-thermal feature kinds in the present study, although not in postulated storage pits (***squared, non-thermal pits*** Kind 2 and Kind 4) or in ***thermal refuse*** deposits (fire-modified rock Kind 8).

In future excavations, minor improvements to data collection and recording of features are recommended. Variability in feature matrix colours and textures (including black, organic flecks), reported in the data set used for the study as "mottles" or as merely "present" can be reported using Munsell charts for granular structures and for estimating proportions of mottles and coarse fragments (Munsell 1992). Also, in this study, lack of data for some features, particularly those encountered in profiles or in basal levels but not excavated, meant seven features had to be dropped from the analysis. It is recommended that matrix characteristics (including colours, texture, and mottle proportions) should be recorded for all features, including those not excavated. A small sample of matrix (50 ml) should be collected for laboratory investigation by chemical analyses (described below) and, wherever possible, larger matrix samples should also be collected for flotation under laboratory conditions for recovery and identification of paleo-botanical remains, including wood genera.

Interpreting subsistence functions of features at non-midden sites in the Fraser River area is hampered severely by the scarcity of preserved botanical and faunal remains. Chemical analysis of feature fill is one potential source of data, and this process has been the subject of a limited test using matrix samples from X̲á:ytem features (Bruno 2001). Bruno's study of samples from seven features (thought at the time to be four thermal and three non-thermal features) and four samples from Structure 1, offers hope that chemical signatures might discriminate among decomposed feature contents. Brunos's results (Appendix XVI) led him to suggest that proportions of phosphorous, magnesium, and potassium may differentiate among decomposed matter in features: phosphorous was lowest in postmolds, magnesium was lowest in thermal features, and potassium (found in high amounts in fish and berries) was highest in earth ovens. Unfortunately, two "non-thermal" features used in Bruno's study were identified as "thermal" kinds in the present study (Appendix XVI) and there are no significant differences in chemical signatures among non-thermal kinds, thermal kinds, and Structure 1 as identified in the present study (Appendix XVII). Results did agree, however, that the proportion of potassium is highest in thermal feature kinds and also indicated that the carbon : nitrogen ratio is lowest in thermal feature kinds. Bruno's limited study offers hope that soil chemistry might at best, aid in the identification of specific feature functions, and at worst, identify features as thermal or non-thermal kinds. In future excavations, the collection of small matrix samples (50 g) from features, for chemical testing, is recommended.

5.4 CONCLUSION

The results of this analysis of feature functions at X̲á:ytem ca. 7000 BP, ca. 5000 BP, and ca. 4500 BP, indicate the importance of Fraser River valley resources to Old Cordilleran and Charles culture people, and add details to regional subsistence and settlement patterns. Among the most significant results is the temporal patterning of features. In the absence of preserved faunal evidence (a result of acidic matrices at X̲á:ytem), the earth oven/hearth with stakes (Kind 3) used only by Old Cordilleran people not only provides a tangible link to subsistence activities of foraging hunter-gatherers, but also provides indications of expedient use of thermal features that sometimes served as ovens and other times as open fires for barbecuing. Within Charles culture components, changes in the size and frequency of earth ovens, probable storage pits, and structures around 4500 BP indicate increasing sedentariness at X̲á:ytem at a time when people were also "settling in" (Matson and Coupland 1995:142) to local resources in the Gulf of Georgia and Fraser River delta region (Matson and Coupland 1995).

When Borden defined the Charles culture (Borden 1975:97), he listed regional components that shared lithic artifact and temporal traits. He included: "Eayem at Esilao, the habitation component at the Maurer site, the lowest component at both St. Mungo and Crescent Beach, Component II at Glenrose, the early component at the Helen Point site on Mayne Island, probably the lowest component at the Bliss Landing site, and perhaps some . . . early components in . . . northwest Washington" (Borden 1975:97). Since then, several of these components have provided descriptions for three distinctive phases within Charles culture: Eayem (Esilao in the Fraser River canyon), St. Mungo (St. Mungo, Crescent Beach, and Glenrose in the Fraser River delta), and Mayne (Helen Point in the Gulf Islands). Until now, there has been insufficient evidence to describe site use and subsistence at Fraser River valley sites of the Charles culture period, although Maurer and X̲á:ytem, with evidence for structures, have not fit comfortably into either the Eayem or the St. Mungo phase. However, evidence of feature functions, site use, and subsistence activities presented in this study indicate that X̲á:ytem is not like delta (St. Mungo) phase or canyon (Eayem) phase sites and that a fourth phase within Charles culture may best characterize Fraser valley material.

BIBLIOGRAPHY

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

Binford, Lewis R.
1967 Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning. *American Antiquity* 32(1):1-12.

1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

1983 *Working at Archaeology.* Academic Press, New York.

Boehm, S. Gay
1973 Cultural and non-cultural variation in the artifact and faunal samples from the St. Mungo Cannery site, DgRr 2. Unpublished Master's thesis, University of Victoria.

Borden, Charles
1951 Facts and Problems of Northwest Coast Prehistory. *Anthropology of British Columbia* 2: 35-57.

1975 *Origins and Development of Early Northwest Coast Culture to about 3500 B.C.* National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper 45, Ottawa.

Bouchard, Randy and Dorothy Kennedy
1974 *Utilization of Fishes, Beach Foods, and Marine Animals by the Tl'U'hus Indian People of British Columbia.* British Columbia Indian Language Project, Victoria, B.C.

1975a *Utilization of Fish by the Colville Okanagan Indian People.* British Columbia Indian Language Project, Victoria, B.C.

1975b *Utilization of Fish by the Chase Shuswap Indian People of British Columbia.* British Columbia Indian Language Project, Victoria, B.C.

1975c *Utilization of Fish by the Mount Currie Lillooet Indian People of British Columbia.* British Columbia Indian Language Project, Victoria, B.C.

1976a *Utilization of Fish, Beach Foods, and Marine Mammals by the Squamish Indian People of British Columbia.* British Columbia Indian Language Project, Victoria, B.C.

1976b *Knowledge and Usage of Land Mammals, Birds, Insects, Reptiles, and Amphibians by the Squamish Indian People of British Columbia.* British Columbia Indian Language Project, Victoria, B.C.

Bouchard, Randy and Nancy J. Turner
1976 *Ethnobotany of the Squamish Indian People of British Columbia.* British Columbia Indian Language Project, Victoria, B.C.

Bruno, Dominique
2000 Burning Ambitions: A look at soil acidity and its effects on organic material within Hatzic Rock. Unpublished research paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

2001 An Archaeologist in Soil Scientist's Clothing: the use of Chemical Analysis in the Distinction and Diagnosis of Features at DgRn 23. Unpublished Honours Thesis, Department of Anthropology and Sociology, University of British Columbia, Vancouver.

Campbell, Sarah K., editor
1981 *The Duwamish No. 1 Site: A Lower Puget Sound Shell Midden.* Office of Public Archaeology, Institute for Environmental Studies, Research Report No. 1. University of Washington, Seattle,

Carlson, Keith Thor, editor
1997 *You are Asked to Witness: The Stó:lō in Canada's Pacific Coast History.* Stó:lo Heritage Trust, Chilliwack.

Carlson, Roy L.
1970 Excavations at Helen Point on Mayne Island. *Archaeology in British Columbia: New Discoveries*, edited by R. Carlson. *B.C. Studies,* Special Issue 6-7: 113-125.

Calvert, S. Gay
1970 The St. Mungo Cannery site: a preliminary report. *Archaeology in British Columbia: New Discoveries*, edited by R. Carlson. *B.C. Studies,* Special Issue 6-7: 54-76.

Cannings, Sydney and Richard Cannings
1999 *Geology of British Columbia: a journey through time.* Greystone, Vancouver.

Coqualeetza Education Training Centre
1979 Upper Stó:lō Fishing: Fraser Valley. Unpublished manuscript on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Curtis, E.S.
1913 *The North American Indian, Vol 19: Coast Salish.* University Press, Cambridge, Mass. Reprinted 1976, Johnson Reprint Corporation.

Duff, Wilson
1952 The Upper Stalo Indians of the Fraser Valley, British Columbia. *Anthropology in British Columbia, Memoir No. 1.* British Columbia Provincial Museum, Victoria.

Gunther, E.
1927 Klallam Ethnography. *University of Washington Publications in Anthropology* 1(5): 171-314. University of Washington Press, Seattle.

1945 Ethnobotany of Western Washington. *University of Washington Publications in Anthropology* 10(1):1-62. University of Washington Press, Seattle.

Haeberlin, Herman and Erna Gunther
1930 The Indians of Puget Sound. *University of Washington Publications in Anthropology* 4 (1):1-84. University of Washington, Seattle.

Ham, Leonard C.
1982 *Seasonality, Shell Midden Layers, and Coast Salish Subsistence Activities at the Crescent Beach Site, DgRr 1.* Unpublished PhD. Dissertation, Department of Anthropology and Sociology, University of British Columbia, Vancouver.

Ham, Leonard C., Arlene J. Yip, Leila V. Kullar, and Debbie L. Cannon
1986 *The 1982/83 Archaeological Excavations at the St. Mungo Site (DgRr 2), North Delta, British Columbia.* Unpublished report. Heritage Conservation Branch, Victoria.

Hebda, Richard J.
1995 British Columbia Vegetation and Climate History with Focus on 6 KABP in *Géographie physique et Quaternaire,* 49(1): 55-79.

Hill-Tout, Charles
1978a *The Salish People. The local contribution of Charles Hill-Tout.* Volume II: The Squamish and the Lillooet. Edited with an introduction by Ralph Maud. Talonbooks, Vancouver.

1978b *The Salish People. The local contribution of Charles Hill-Tout.* Volume III: The Mainland Halkomelem. Edited with an introduction by Ralph Maud. Talonbooks, Vancouver.

Kelley, C.C. and R.H. Spilsbury
1939 *Soil Survey of the Lower Fraser Valley.* Publication 650, Technical Bulletin No. 20, Dominion Department of Agriculture, Ottawa.

K'San, the People of
1980 *Gathering What the Great Nature Provided: Food Traditions of the Gitksan.* Douglas and McIntyre, Vancouver.

LeClair, R.
1976 Investigations at the Maurer Site near Agassiz. *Current Research Reports,* edited by R. Carlson, pp. 33-42. Simon Fraser University, Department of Archaeology, Publication No. 3, Burnaby.

Larson, Lynn L. and Dennis E. Lewarch, eds.
1995 *The Archaeology of West Point, Seattle, Washington: 4000 years of hunter-fisher-gatherer land use in Southern Puget Sound.* Larson Anthropological Archaeological Services, Seattle, Washington.

Lepofsky, Dana, Michael Blake, Douglas Brown, Sandra Morrison, Nicole Oakes, and Natasha Lyons
2002 The Archaeology of the Scowlitz Site, sw British Columbia. *Journal of Field Archaeology,* 27 (4): 391-416. Boston University, Massachusetts.

Lewarch, Dennis E., Eric Bangs, and Guy F. Moura
1995 Features. In *The Archaeology of West Point, Seattle, Washington: 4,000 years of hunter-fisher-gatherer land use in Southern Puget Sound.* Edited by Lynn L. Larson and Dennis E. Lewarch, pp. 12.12-12.85. Larson Anthropological Services, Seattle.

Mack, Cheryl A.
1992 In Pursuit of the Wild Vaccinium: Huckleberry Processing Pits in the Southern Washington Cascades. *Archaeology in Washington* 4:3-16, Association for Washington Archaeology, Seattle.

Maclachlan, Morag, ed.
1998 *The Fort Langley Journals 1827-30.* UBC Press, Vancouver.

Mason, Andrew Robert
1994 *The Hatzic Rock Site: a Charles Culture Settlement.* Unpublished M.A. Thesis, Department of Anthropology and Sociology, University of British Columbia, Vancouver.

Matson, R.G.
1981 Prehistoric subsistence patterns in the Fraser delta: the evidence from the Glenrose Cannery Site. *B.C. Studies No. 48, Fragments of the Past, British Columbia Archaeology in the 1970s,* edited by Knut Fladmark, pp. 64-85.

1992 The Evolution of Northwest Coast Subsistence. *Research in Economic Anthropology Supplement 6: Long-Term Subsistence Change in Prehistoric North America.* Edited by Dale R. Croes, R. Hawkins, and B. L. Isaac, pp. 367-428. JAI Press Inc., Greenwich, Conn.

1994 Excavations at Scowlitz, Stage II: Report on the 1993 Excavations at Scowlitz. Unpublished report for the Archaeology Branch and the Stó:lõ Nation. On file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Matson, R.G., editor
1976 *The Glenrose Cannery Site.* National Museum of Man, Mercury Series, No. 52, Ottawa.

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

Matson, R.G. and D.L. True
1974 Site Relationships at Quebrada Tarapaca, Chile: A Comparison of Clustering and Scaling Techniques in *American Antiquity* 39(1): 51-74.

Meidinger, Del and Jim Pojar
1991 *Ecosystems of British Columbia*, BC Ministry of Forests, Victoria.

Mitchell, Donald and David L. Pokotylo
1995 Early Period Components at the Milliken Site in *Early Human Occupation in British Columbia*, edited by Roy Carlson and Luke Dalla Bona, pp. 65-82. UBC Press, Vancouver.

Morgan, Vera E., editor
1999 *The SR-101 Sequim Bypass Archaeological Project: Mid- to Late-Holocene Occupations on the Northern Olympic Peninsula, Clallam County, Washington.* Reports in Archaeology and History, No. 100-108. Eastern Washington University Archaeological and Historical Services, Cheney.

Ormerod, Patricia
1997a A Statistical Analysis of Hearths, Pits, and Charcoal Concentrations at the Hatzic Rock Site (DgRn 23). Unpublished research paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

1997b Analysis of Flotation Samples from Pit Feature 9, Hatzic Rock Site (DgRn 23), 1997. Unpublished research paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

2001 Clustering and Multidimensional Scaling of Features at the X̱á:ytem Site (DgRn 23), British Columbia. Unpublished research paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Ormerod, Patricia and R.G. Matson
2000 *Excavations at DgRn 23 in 1997 and 1999.* Unpublished Permit Report for the British Columbia Archaeology Branch and the Stó:lō Nation. On file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Patenaude, Valerie C.
1985 *The Pitt River Archaeological Site, DhRq 21. A Coast Salish Seasonal Camp on the Lower Fraser River,* Volumes I and II. Unpublished report. Heritage Conservation Branch, Victoria, B.C.

Patenaude, Valerie and Michael Broderick
1981 Archaeological Investigations at the Pitt River Site, DgRq 21: a preliminary report. *Annual Research Report I, Activities of the Heritage Conservation Branch for the Year 1978.* Edited by Bjorn O. Simonsen, pp. 111-131. Province of British Columbia, Heritage Conservation Branch, Victoria.

Pojar, Jim and Andy MacKinnon
1994 *Plants of Coastal British Columbia, including Washington, Oregon, and Alaska.* Lone Pine Publishing, Vancouver.

Pokotylo, David L.
1982 A Multivariate Analysis of Inter-Assemblage Variability in the Shield Archaic Tradition. *Approaches to Algonquian Archaeology.* Edited by Margaret G. Hanna and Brian Kooyman, pp. 213-231. Proceedings of the Thirteenth Annual Conference, The Archaeology Association of the University of Calgary. University of Calgary.

1997a *Excavations at X̱á:ytem (Hatzic Rock site), 1994.* Unpublished Interim Report for British Columbia Heritage, Victoria.

1997b Archaeology Field Guide for Excavations at the Hatzic Rock Site (DgRn 23), unpublished paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

1998 Charles/St. Mungo Culture Type in *Archaeology of Prehistoric Native America: An Encyclopedia*, edited by Guy Gibbon, pp. 141-143. Garland Publishing, New York.

Pratt, Heather L.
1992 *The Charles Culture of the Gulf of Georgia: A re-evaluation of the culture and its three sub-phases.* Unpublished Masters Thesis, Department of Anthropology and Sociology, University of British Columbia, Vancouver.

Radomski, Elizabeth
2000 Preliminary analysis of flotation samples from Hatzic rock (DgRn 23). Unpublished research paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Rafferty, Jane E.
1984 The Archaeological Record on Sedentariness in *Advances in Archaeological Method and Theory,* Vol. 8, edited by Michael B. Schiffer, pp. 113-156. Academic Press, Toronto.

Ray, Verne F.
1938 Lower Chinook Ethnographic Notes. *University of Washington Publications in Anthropology* 7(2): 29-165. University of Washington, Seattle.

Sapir, Edward and Leslie Spier
1930 Wishram Ethnography. *University of Washington Publications in Anthropology* 3 (3): 151-300.

Schaepe, David M.
1998 *Recycling Archaeology: Analysis of Material from the 1973 Excavation of an Ancient House at the Maurer Site.* Unpublished Masters Thesis, Department of Archaeology, Simon Fraser University, Burnaby.

Schiffer, Michael B.
1972 Archaeological Context and Systemic Context in *American Antiquity* 37(2): 156-164.

1984 *Formation Processes of the Archaeological Record.* University of New Mexico Press, Albuquerque.

Sneath, Peter H.A. and Robert R. Sokal
1973 *Numerical Taxonomy: the Principles and Practice of Numerical Classification.* Freeman, San Francisco.

Stern, Bernhard J.
1969 *The Lummi Indians of Northwest Washington.* AMS Press, New York. (Reprint of 1934 edition.)

Suttles, Wayne
1990 Introduction in *Handbook of North Americian Indians: Vol. 7: Northwest Coast.* Edited by Wayne Suttles, pp. 1-29. Smithsonian Institute, Washington.

n.d. The Subsistence Base on the Northwest Coast. Unpublished manuscript. On file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Teit, James
1900 *The Thompson Indians of British Columbia.* Memoirs of the American Museum of Natural History 2(4): 163-392. Edited by Franz Boas. Knickerbocker Press, New York.

1906 *The Lillooet Indians.* Memoirs of the American Museum of Natural History 4(5):193-300. Edited by Franz Boas. E.J. Brill Ltd., Leiden and G.E. Stechert and Co., New York.

1928 The Middle Columbia Salish. *University of Washington Publications in Anthropology* 2 (4): 83-128. Edited by Franz Boas. University of Washington Press, Seattle.

True, D.L. and R.G. Matson
1970 Cluster Analysis and Multidimensional Scaling of Archaeological Sites in Northern Chile. *Science* 169: 1201-1203.

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

1998 *Plant Technology of First Peoples in British Columbia.* UBC Press, Vancouver.

Vorell, Bita
1998 Analysis of the Hatzic Rock site faunal remains, 1997. Unpublished research paper on file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Wainman, Newton and Rolf W. Mathewes
1987 Forest history of the last 12,000 years based on plant macrofossil analysis of sediment from Marion Lake, southwestern British Columbia. *Canadian Journal of Botany* 65: 2179-2187.

Wells, Oliver N.
1987 *The Chilliwack and Their Neighbours.* Talonbooks, Vancouver.

Wyndham, Jeff
2000 Analysis of the paleobotanical remains from Hatzic Rock (DgRn 23). Abridged in Ormerod, Patricia and R.G. Matson, *Excavations at DgRn 23 in 1997 and 1999.* On file in the Laboratory of Archaeology, University of British Columbia, Vancouver.

Appendix I-a Features and Subsistence Activities described in the Ethnographic Record
Part 1: Post and Stake Features

Subsistence Function	Ethnographic Description	Feature Characteristics Expected	
		Permanent Post Frame	Temporary Post / Stake Frame
Shelter	Permanent Shelters and Temporary Shelters	Rectangular outline; minimum 4 corner posts; paired stakes along perimeter to support horizontal wallboards; levelled floor; hearth(s) inside, up to 30 cm. deep, location varies (B, J)	Square or rectangular outline; 4 corner stakes or posts that may be slanted or upright; mat, brush, or board covered frame; no hearth inside, hearths/earth ovens outside; floor not levelled (J)
Processing for Immediate Use	*Inside Shelter:* 1) Stone Boiling 2) Barbecuing 3) Roasting *Outside Shelter:* 1) Stone Boiling 2) Barbecuing 3) Roasting 4) Oven Steaming	*Inside Permanent Shelter:* 1) Boiling stones, hearth (B, J,Lc) 2) Hearth and slanted stakes (J) 3) Hearth (J) *Outside:* 1) Boiling stones, hearth (J, Lc) 2) Hearth and slanted stakes (J) 3) Hearth (J) 4) Small pit, rock heat element; evidence of *in situ* fire; earth or mat covering; diverse botanical and faunal remains (J)	*Inside Temporary Mat Shelter:* 1) - 2) - 3) - *Outside:* 1) Boiling stones, hearth (J) 2) Hearth, slanted stakes (B, J, M) 3) Hearth (J) 4) Small pit, rock heat element; evidence of *in situ* fire; earth or mat covering; diverse botanical and faunal remains (J)
Processing for Preservation	*Inside Shelter:* 1) Air drying meat or fish 2) Incidental, heat-assisted drying of meat, fish, fowl 3) Smoke Drying of meat, fish, fowl *Outside:* 1) Air drying 2) Heat-assisted drying 3) Smoke drying	*Inside Permanent Shelter:* 1) Stake supported rack (or from rafters); no fire (C) 2) Stake supported rack (or from rafters) with hearth (H, J) 3) Drying meat, fish, fowl (J) *Inside Permanent Smokehouse:* 3) Stake supported racks (or from rafters), small smoking fire, rotted hardwood fuel: fish (K, Lb, Lc): deer (Ma, Mb) *Outside:* 1) Stake supported rack; no fire, meat (C) 2) Stake supported rack with hearth: meat (C) 3) Stake supported rack with smoking fire (L)	*Inside Temporary Mat Shelter:* 1) Stake supported rack (or from rafters); no fire (C) *Inside Temporary Smokehouse:* 3) Stake supported racks or from rafters with low-heat fire (hardwood); square or rectangular outline of 4 corner posts or stakes that may be slanted or upright (K, Lb, Lc, Ma, Mb) *Outside:* 1) Stake supported rack; no fire (K), berries (Mb), fish (B, C) 2) Stake supported rack with hearth; berries (I) 3) Stake supported rack with smoking fire, fish (B, K)
Storage	*Inside Shelter:* 1) Rafter storage of fish, meat, roots, berries 2) On bench storage of roots 3) Under bench storage of roots *Outside:* 1) Platforms on upright stakes	*Inside Permanent Shelter:* 1) Rafter storage (B) 2) Stake supported bench (B, J) 3) Cellars around wall perimeter for roots, under benches (B, J, E) *Outside:* 1) Stake supported rack (B, C, K)	*Inside Temporary Shelter:* *Outside:* 1) Stake supported rack; dried foods (Lb, Lc)
Other	Sweat Lodge Potlatch Platform	- *Outside:* Posts parallel to wall (J)	Sweat Lodge: pole framed lodge for one; ash spread and fire-modified rocks; hearth outside (J) -

Appendix I-b Features and Subsistence Activities described in the Ethnographic Record
Part 2: Non-Thermal and Thermal Pit Features

Subsistence Activity	Ethnographic Function	Feature Characteristics Expected	
		Non-Thermal Pit Features	Thermal Pit Features
Shelter	Shelter	Pit House: Circular, pit diameter 20 to 40 feet. Superstructure supported by 4 slanted posts from the floor area (going 30 to 40 cm into ground), and 4 obliquely angled rafters from outside the pit (going 60 cm into the ground); Posts not squared (I, J)	-
Processing for Immediate Use	1) Stone Boiling 2) Barbecuing 3) Roasting / oven steaming of fish, shellfish, deer meat, wapiti meat, roots	- - -	1) - 2) - 3) Shallow pit near the house; possible evidence of earth from covering; some with mat coverings; rock heating element; evidence of *in situ* burning; diverse botanical and faunal remains (J) including deer/meat (J, E), fish (E, K, Lb, Lc), shellfish (H), fowl (Mb), and roots or other vegetable food (C, E), berries (H)
Processing for Preservation	1) Air Drying meat or fish 2) Heat-assisted Drying meat, fish, fowl 3) Smoke-drying of meat, fish, fowl 4) Oven steaming of berries, roots	- - - -	- - - 4) Large pit, possible evidence of earth from covering; rock heating element; evidence of *in situ* fire; botanical or faunal remains not diverse; one resource common: berries (H, Mb), roots (N), elderberries (M)
Storage	Storage	1) Storage pits for roots; inside shelter, under bench along wall (E) 2) Outdoor storage pits for fish (C, K, La, Lb), nuts (F)	-
Other	Hide Processing	-	Small diameter pit; "deep as the arm"; containing damp, rotted wood (C) (J)

Sources:

A = Teit 1928; 1900; 1906
B = Hill-Tout 1978a, b
C = Sapir and Spier 1930
D = Curtis 1913
E = Gunther 1927
F = Haeberlin and Gunther 1930
G = Stern 1934
H = Ray 1938
I = Duff 1952
J = Barnett 1955
K = Bouchard and Kennedy 1974
L = Bouchard and Kennedy 1975a,b, c
M = Bouchard and Kennedy 1976a, b
N = Bouchard and Turner 1976

Appendix I-c Features and Subsistence Activities described in the Ethnographic Record
Part 3: Cooking Hearths and Smoking Fires

Subsistence Activity	Ethnographic Function	Feature Characteristics Expected	
		Cooking Hearths	Smoking Fires
Shelter	Cooking in Shelters	*In permanent shelters:* Hearths for cooking and heating are up to 30 cm. deep; number and location of hearths varies; hearth may have rock or wood rim for safety; fuel is softwood and hardwoods (B, J, Lc, D)	*In permanent or temporary smokehouses:* Small, low-heat fires of rotted hardwood; no rock heating element; no rock rim except (rarely) in large permanent, communal smokehouses (K, Lb, Lc, Ma, Mb)
Processing for Immediate Use	1) Stone Boiling 2) Roasting 3) Barbecuing	1) Boiling stones associated with a hearth inside permanent shelter or outdoors (B, J, Lc); hearth may have rock or wood rim for safety; fuel is softwood and hardwood 2) Same hearth as above, inside or outdoor; food wrapped in vegetation, occasionally clay, roasted in hot embers of fire (J, L) 3) Slanted stakes over same hearth as above (J)	- - -
Processing for Preservation	1) Heat-assisted Drying of meat, fish, fowl 2) Smoke Drying of meat, fish, fowl 3) Oven Steaming of berries, roots, clams	1) If outside; large hearth/fire (as above); surrounded by stakes to support drying rack for meat, fish, berries. If inside; hearth (as above) with food on rafters to dry incidentally (K, Lb, Lc, Ma, Mb) - 3) Mound Oven: outdoor only; rock element and evidence of *in situ* burning; evidence of earth covering; larger size than cooking hearth, for camas and salal (H)	- 2) *In smokehouses:* Small, low-heat fires of rotted hardwood; no rock heating element; no rock rim except (rarely) in large permanent, communal smokehouses (K, Lb, Lc, Ma, Mb) *Outdoors:* Stake-supported racks with small, low-heat fires of rotted hardwood; no rock heating element; no rock rim, for meat, fish, berries (K, Mb, B, C, I) -
Storage	Storage	-	-
Other	Hide Processing	-	See hide processing Appendix I-b

Sources:

A = Teit 1928; 1900; 1906 B = Hill-Tout 1978a, b C = Sapir and Spier 1930
D = Curtis 1913 E = Gunther 1927 F = Haeberlin and Gunther 1930
G = Stern 1934 H = Ray 1938 I = Duff 1952
J = Barnett 1955 K = Bouchard and Kennedy 1974 L = Bouchard and Kennedy 1975a,b, c
M = Bouchard and Kennedy 1976a, b N = Bouchard and Turner 1976

Appendix II-a Definitions of Characteristics used in Clustering and Scaling

Characteristic	*Definition*
E/W Orientation	Longest side of feature runs east-west.
N/S Orientation	Longest side of feature runs north-south.
Size Code	Area in metres (extrapolated length X extrapolated width) of feature at systemic surface of origin if known or at archaeological surface of origin coded based on percentiles of the range of sizes. Small is .0 to .05, Medium is .05 to .189, and Large is .189 to .420 square metres.
Shape Ratio	Ratio representing the shape of the feature at systemic surface of origin if known or at archaeological surface of origin (extrapolated length : extrapolated width). Low ratio is 1.0 to 2.2, High ratio is 2.3 to 4.0.
Depth/Area Ratio	Ratio of depth : area based on extrapolated measurements, except for depth. Features with unknown depth were excluded. Low ratio is .000 to .004, Medium ratio is .005 to .011, High ratio is .012 to .040, and Extra-High ratio is .041 to .247.
Length	Measurement of the longest side of the feature (extrapolated when necessary) coded so that Small is 0 to 20 cm, Medium is 21 to 52 cm, Long is 53 to 75 cm, and Extra-Long is 76 to 160 cm.
Depth	Maximum observed depth of the feature from systemic surface of origin to feature termination in cm, coded so that Surface is 0 to 11 cm, Shallow is 12 to 22 cm, Mid-Depth is 23 to 36 cm, Deep is 37 to 55 cm, and Very Deep is over 56 cm deep. Features with unknown depth were excluded.
Shape	Plan view outline of the feature from field drawings and slides with four codes: Rounded, Ovoid, Squared, and Diffuse. Codes are mutually exclusive.
Bottom Shape	Profile view outline of the feature bottom from field drawings and slides with four codes: On Surface, V-shaped, Flat, and Rounded. Codes are not mutually exclusive.
Side Shape	Profile view outline of the feature sides from field drawings and slides with seven codes: No sides (on surface), Symmetrical, Asymmetrical, Slanted, Vertical, Excurvate, and Incurvate. Codes are not mutually exclusive.
Unmodified Rock P/A	Presence/absence of unmodified rocks in the feature. May include ballast or "levelling" rocks in postmolds if noted in the field.
Diffuse Unmodified Rock P/A	Diffuse rock is present if rock was located throughout the feature fill. The absence of "diffuse" rock includes rock concentrated within the feature: at the bottom, mid-point or top.
Oxidation P/A	Presence/absence of oxidation (fire-reddened soil) noted in the field.
Rakeout P/A	Presence/absence of a raked out area at the rim of a feature noted in the field or laboratory.
Matrix	Descriptive codes for matrix (Pokotylo 1997) in features as noted in the field. Codes used: Fine Silt, Sandy, Grainy, Pebbly, Coarse, Compact, Hard, Clay-like, Gritty, and Greasy. One other code, Humic, was created in the lab to describe "punky" fill noted in the field.
Fill Colour	Colour of feature fill based on Munsell colour codes. Codes are not mutually exclusive. Black is Munsell 5YR 2.5/1 and 10YR 2.1. Grey is Munsell 7.5YR 4/0, 10YR 3/1, and 10YR 3/2, Red/Yellow is Munsell 2.5YR 3/2, 2.5YR 4/4, 5YR 2.5/2, 7.5YR 4.6, 10YR 3 /4, 10YR 4/4, and 10YR 5/8. Brown is 7.5YR 3/2, 10YR 2/2, 10YR 3/3, and 10YR 4/3.

Appendix II-b Definitions of Characteristics used in Clustering and Scaling (continued)

Characteristic	***Definition***
Artifacts P/A	Artifacts are defined as projectile points, cores, utilized or retouched flakes, boiling stones, spall tools, and historic artifacts.
Debitage P/A	Detritus from lithic manufacture not including artifacts noted above.
Fire-modified Rock P/A	Presence or absence of fire-modified rock (FMR) as noted in the field including: cracked, reddened, pot-lidded, and blackened rock.
Moderate FMR	Up to 3 kg of fire-modified rock is present in the feature.
Large Amount FMR	Over 7 kg of fire-modified rock is present in the feature. Note: No features contained rock weighing between 3 and 7 kg.
Black, organic flecks	Presence or absence of black, organic "flecks, flakes or chunks" as reported in the field notes.
Seeds P/A	Presence or absence of seeds as noted in the laboratory analyses of flotation samples.
Bone P/A	Bone includes unidentified bone, land mammal bone, marine mammal bone, bird bone, and fish bone as noted in field notes and laboratory analyses.
Shell P/A	Presence or absence of shell as noted in the field or laboratory analyses.
Ochre P/A	Presence or absence of ochre, as noted in the field.
Charcoal P/A	Presence or absence of recoverable/recovered charcoal or matrix identified in the field as a "black," Munsell 10YR 2/1 or 7.5 YR 2/0.
Charcoal Lens P/A	Presence or absence of a charcoal lens as identified in the field.
Feature is Surface	Based on Campbell and Vance (1981) this characteristic is designed to separate surface features such as hearths and refuse piles from pit-based features. Surface features have archaeological depths from 0 to 7 cm measured from the systemic surface to the bottom.
Pattern of Contents P/A	Presence or absence of pattern of any feature content, including rock, charcoal, bone, fill colour or texture, etc. as noted in the field.
In Situ Burning P/A	Presence or absence of evidence of in-situ burning. Evidence is present if oxidation is present and/or charcoal lens or patterned charcoal is present.

Appendix III-a **32 Characteristics Dominating Furthest Neighbour / Jaccard's Clusters**

Characteristic	**Feature Kind**										
	1	**2**	**3**	**4**	**5a**	**5b**	**6a**	**6b**	**7a**	**7b**	**8**
E/W Orientation	·	○	◎	○	◎	⊙	·	·	·	○	◎
N/S Orientation	⊙	·	·	◎	·	⊙	**○**	⊙	⊙	●	○
Size (Area) S	●	●	○	◎	**○**	●	◐	●	●	●	●
M	○	○	**○**	·	○	○	**○**	●	⊙	○	○
L	○	○	·	·	●	●	·	○	○	○	○
Shape Ratio Low	**○**	**○**	●	◎	**○**	●	◐	●	●	●	●
High	·	·	○	⊙	·	○	○	○	○	○	○
Depth/Area Ratio Low	○	○	·	○	●	●	⊙	○	○	○	○
Med	○	○	**○**	·	○	○	◎	⊙	◎	○	◎
High	·	**○**	○	·	○	○	○	◎	·	●	◎
X-High	**○**	·	○	◎	○	○	○	○	·	○	○
Length S	⊙	**○**	○	○	○	○	○	○	○	○	◎
M	◎	○	○	◎	○	○	○	·	●	●	◎
L	○	·	●	⊙	○	·	**○**	**○**	○	○	○
XL	○	○	○	○	●	**○**	·	○	○	○	○
Depth Surface	○	·	·	○	·	·	⊙	○	·	○	●
Shallow	⊙	○	·	○	⊙	◎	◎	·	·	◎	○
Mid-depth	⊙	○	◎	⊙	·	·	○	·	⊙	◎	○
Deep	⊙	**○**	○	⊙	○	○	○	◎	·	○	○
Very Deep	○	○	○	·	·	○	○	○	○	○	○
Shape (plan) Rounded	◎	○	**○**	·	◎	○	○	○	○	○	○
Ovoid	·	●	·	○	○	⊙	○	○	○	●	○
Squared	⊙	○	○	◎	○	○	○	○	○	○	○
Diffuse	○	○	○	·	⊙	⊙	●	●	●	○	●
Bottom Shape On Surface	○	○	○	○	·	○	⊙	○	·	○	●
V-shaped	⊙	○	·	○	○	·	○	○	·	◎	○
Flat	⊙	○	○	●	○	○	○	·	○	○	○
Rounded	⊙	●	**○**	○	**○**	●	◎	**○**	◎	◎	○
Side Shape No Sides	○	○	○	○	·	○	·	○	○	◎	●
Symmetrical	◎	**○**	●	●	**○**	·	○	◎	○	○	○
Asymmetrical	⊙	·	○	○	○	◎	◎	·	●	○	○
Slanted	○	○	○	⊙	○	○	○	○	○	○	○
Vertical	◎	**○**	○	◎	·	○	◎	●	·	○	○
Excurvate	⊙	●	●	⊙	**○**	●	◎ .	**○**	●	○	○
Incurvate	·	·	·	·	○	·	·	·	⊙	○	○
Unmodified Rock Present	·	·	◎	●	●	○	○	●	●	○	X
Unmodified Rock Diffuse	○	○	◎	●	◎	○	○	●	●	○	X
Oxidation Present	○	○	·	·	**○**	⊙	●	·	·	●	◎
Rakeout Present	○	○	◎	○	·	○	·	·	·	○	○

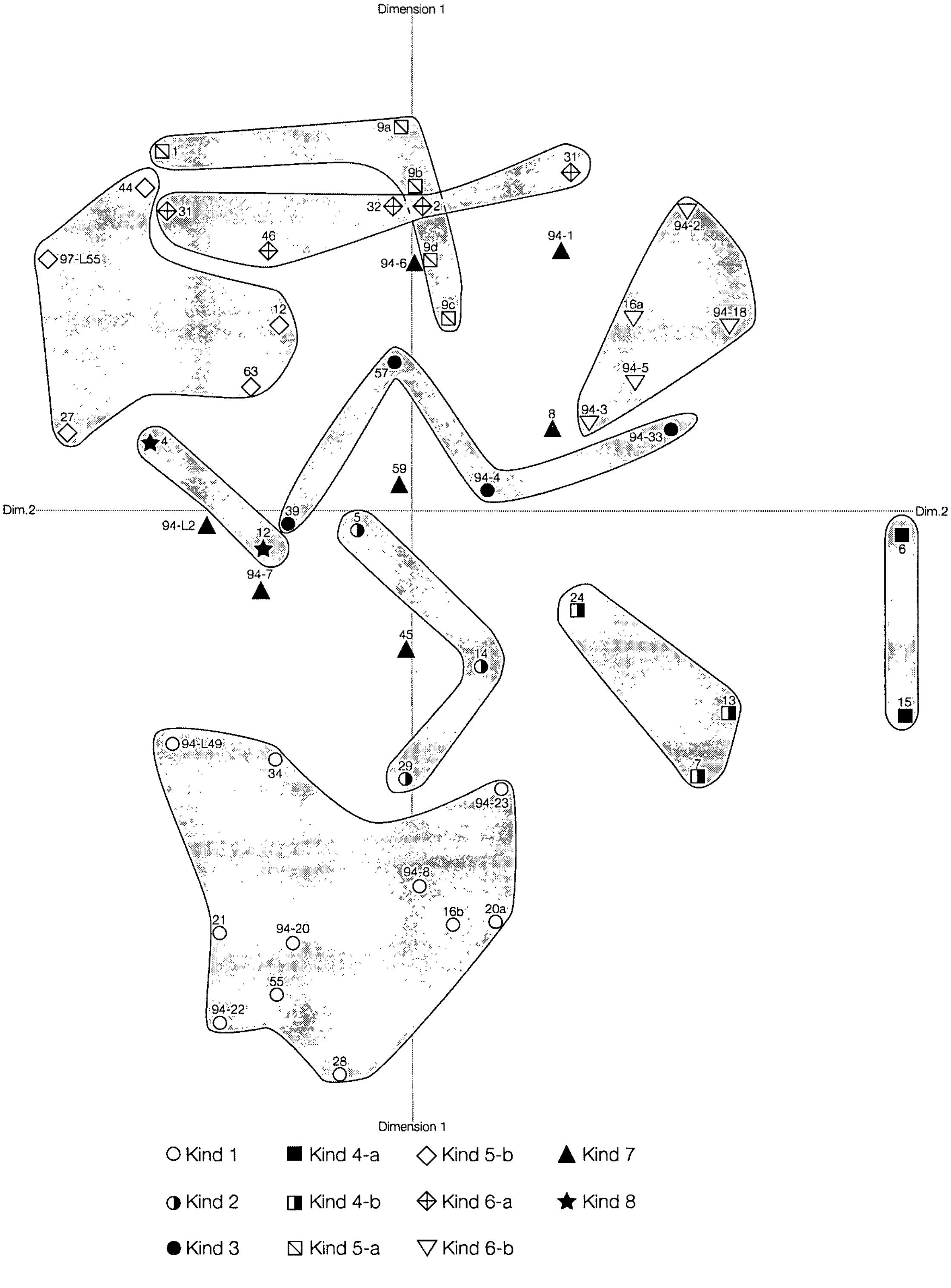
Appendix III-b 32 Characteristics Dominating Furthest Neighbour / Jaccard's Clusters

Characteristic	Feature Kind										
	1	2	3	4	5a	5b	6a	6b	7a	7b	8
Matrix Fine Silt	●	○	●	⊙	○	●	❍	●	❍	◎	●
Sandy	⊙	○	◎	·	○	·	◎	❍	·	❍	○
Grainy	○	○	○	○	·	○	○	○	○	○	○
Pebbly	○	·	○	·	·	○	⊙	⊙	·	○	○
Coarse	○	○	·	○	·	○	·	○	○	◎	○
Compact	⊙	·	○	·	◎	⊙	◎	·	·	◎	○
Hard	·	○	○	○	⊙	○	○	○	○	◎	○
Clay-like	○	○	◎	○	○	○	○	○	·	◎	○
Gritty	⊙	❍	·	⊙	◎	·	⊙	⊙	·	○	○
Greasy	○	○	○	○	⊙	○	○	·	○	○	○
Humic	○	○	○	○	❍	○	○	·	·	○	○
Fill Colour Black	⊙	❍	○	⊙	❍	○	⊙	·	◎	◎	○
Grey	·	·	·	○	❍	·	◎	⊙	⊙	◎	○
Red/Yellow	⊙	○	●	⊙	◎	❍	⊙	·	·	◎	●
Brown	◎	●	◎	●	◎	◎	❍	❍	·	◎	◎
Artifacts Present	⊙	○	·	⊙	◎	·	◎	❍	⊙	○	○
Debitage Present	⊙	○	·	○	❍	○	◎	●	·	○	○
Fire-modified Rock	○	❍	◎	⊙	●	◎	◍	❍	●	○	●
- Moderate Amount	○	●	○	●	◎	◎	◍	❍	●	○	●
- Large Amount	○	○	●	○	⊙	○	○	○	○	○	○
Black Organic Flecks Present	◎	·	●	·	●	❍	◍	●	●	●	○
Seeds Present	X	X	●	X	●	·	X	X	X	X	X
Bone Present	⊙	○	○	○	●	⊙	◍	·	●	◎	○
Shell Present	○	○	○	○	◎	○	○	·	·	○	○
Ochre Present	·	○	○	○	●	·	◎	❍	·	○	○
Charcoal Present	⊙	·	❍	·	●	◎	◍	❍	❍	●	○
Charcoal Lenses	○	○	·	○	○	⊙	○	❍	○	●	○
Feature is on Surface	○	○	○	○	○	○	○	○	○	○	●
Contents Patterned	○	○	❍	●	⊙	⊙	○	●	⊙	●	○
In-situ Burning Present	○	○	·	·	❍	❍	◍	●	·	●	◎

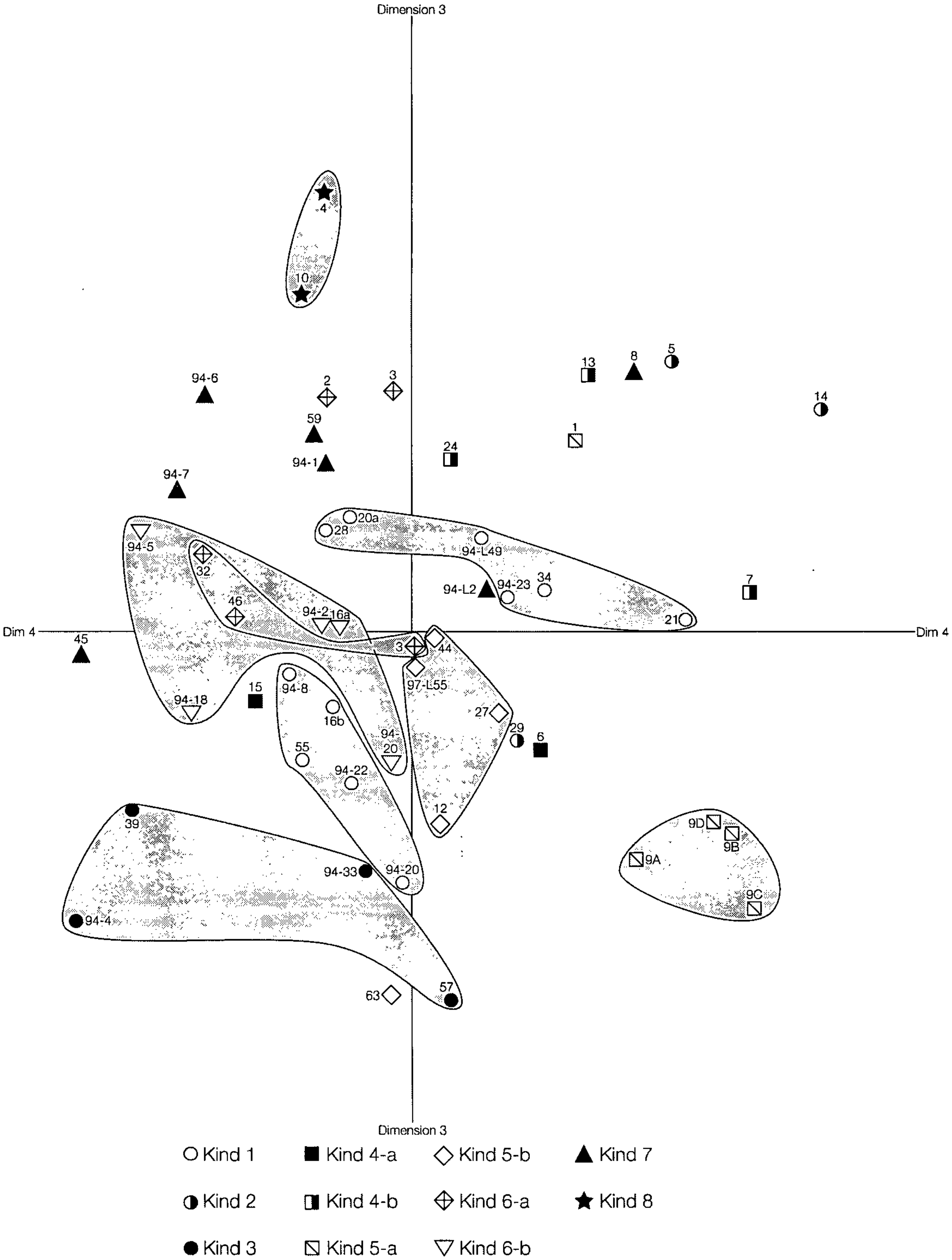
Codes:

- ● All Features
- ❍ All but one Feature
- ◎ Half of Features
- ⊙ Some Features, but less than Half
- · One Feature only
- ○ No Feature
- X No Data Available

Appendix IV-a. Dimensions 1 and 2 of Jaccard's / Furthest Neighbour Scaling



Appendix IV-b. Dimensions 3 and 4 of Jaccard's / Furthest Neighbour Scaling



Appendix V Postulated Functions of Features, Kind, Dimensions and Illustration Reference

Kind	Postulated Function	Feature Number	Length in cm	Width in cm	Depth in cm	Illustration Reference
1a	Post, rounded	55	24	24	-	
1a	Post, rounded	94-22	25	20	26	
1a	Post, rounded	94-20	40	-	47	Figure 4A
1a	Post, rounded	16b	30	25	41	
1a	Post, rounded	94-8	26	24	30	
1b	Post, squared	20a	29	10-	30	Figure 4B
1b	Post, squared	28	27	19	24	
1b	Post, squared	94-23	17	17	46	
1c	Probable Post	21	19	10-	14	
1c	Probable Post	94-L49	19	15	14	
1c	Probable Post	34	20	17	17	Figure 4C
2	Unknown, Probable Post	5	20	20	6	Figure 4D
2	Unknown, Probable Post	14	20	20	40	
2	Unknown, Possible Storage Pit	29	68	19-	43	
3	Earth Oven / Hearth	39	61	45-	24	
3	Earth Oven / Hearth	57	75	75	6	Figure 7Bi
3	Earth Oven / Hearth	94-4	70	60	25	
3	Earth Oven / Hearth	94-33	69	55	21	Figure 7Bii
4a	Possible Storage Pit	6	70	70	33	Figure 5Aii
4a	Possible Storage Pit	15	86	22-	28	Figure 5Ai
4b	Probable Storage Pit	13	34	26	42	
4b	Probable Storage Pit	24	32	32	47	
4b	Probable Postmold	7	27	9-	60	Figure 5Bii
5a	Hearth or Earth Oven, Large	9-A	120	75	14	
5a	Earth Oven, Large	9-B	145	145	19	App. VII
5a	Earth Oven, Large	9-C	135	125	29	App. VI
5a	Earth Oven, Large	9-D	135	115	68	Figure 6
5a	Hearth, Large	1	130	51	10	
5b	Earth Oven, Large	12	110	50	24	Figure 7A
5b	Mound Oven, Large	63	89-	80-	13	
5b	Earth Oven, Large	27	91	53	21	
5b	Mound Oven, Large	44	150	80	9	
5b	Earth Oven, Large	97-L55	110	70	20	

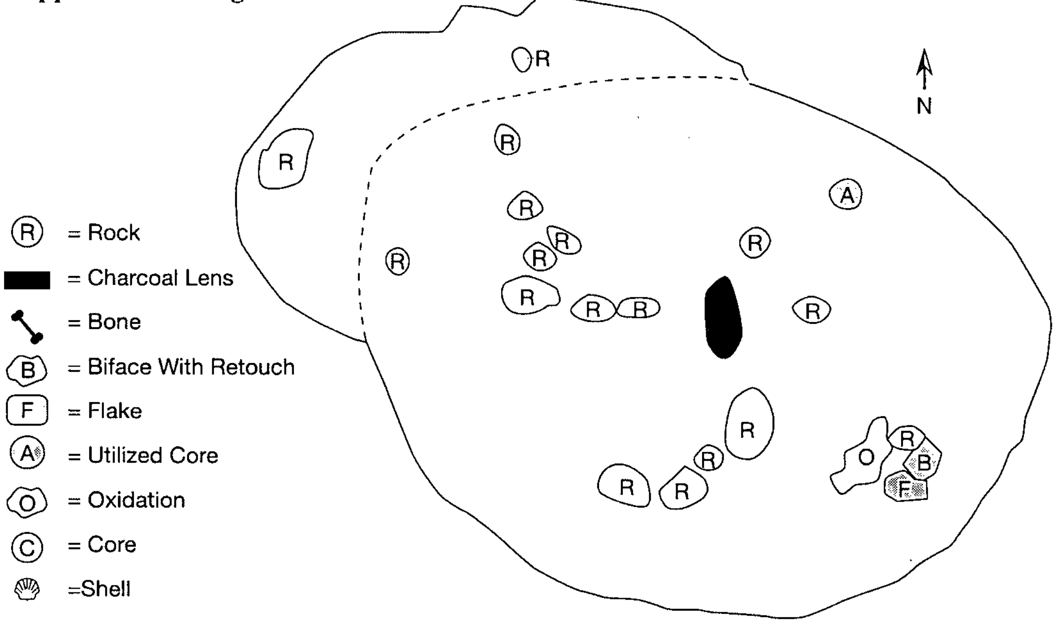
\- not fully excavated, dimension unknown

Appendix V-b Postulated Functions of Features, Kind, Dimensions and Illustration Reference

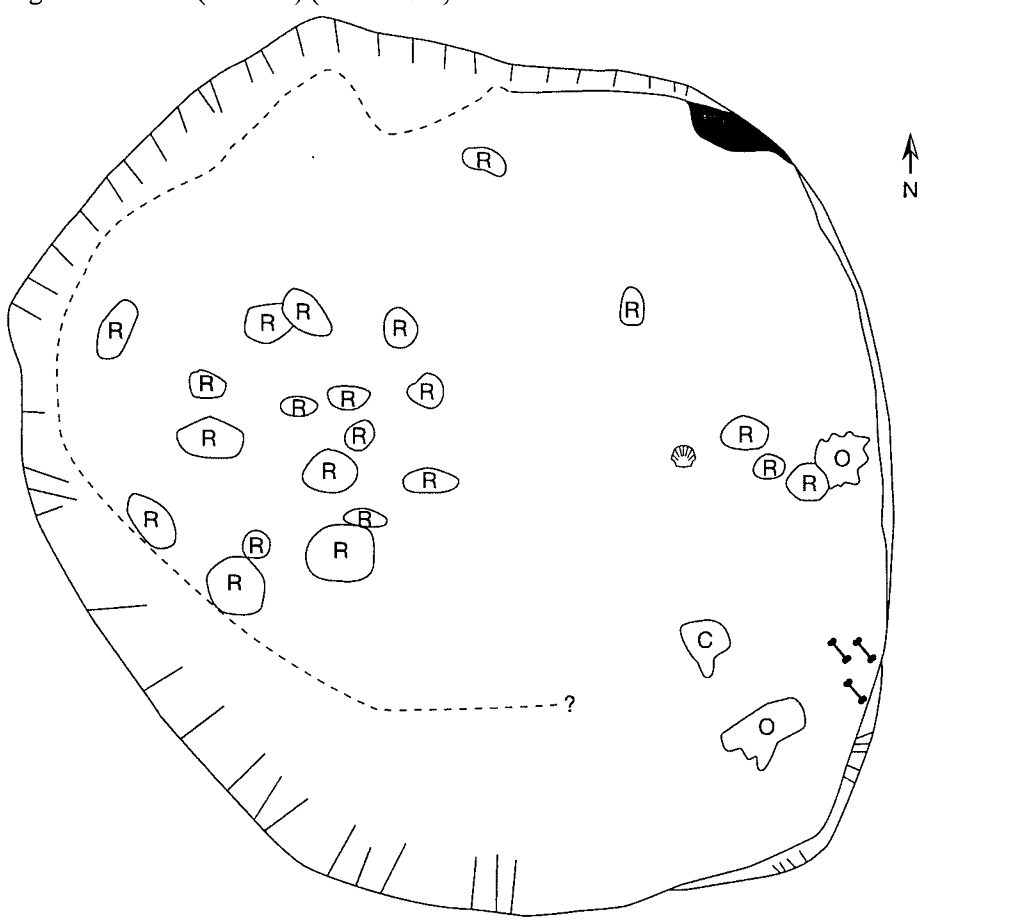
Kind	Postulated Function	Feature Number	Length in cm	Width in cm	Depth in cm	Illustration Reference
6a	Mound Oven, Smoking Fire	2	65	39	8	
6a	Mound Oven, Smoking Fire	3	55	41	16	
6a	Mound Oven, Smoking Fire	32	60	45	18	
6a	Mound Oven, Smoking Fire	46	68	40	14	
6a	Mound Oven, Smoking Fire	31	120	102	10	Figure 8A
6b	Earth Oven, Medium	94-2	63	63	20	
6b	Earth Oven, Medium	94-18	55	45	25	
6b	Earth Oven, Medium	16a	55	50	52	
6b	Earth Oven, Medium	94-5	55	40	41	
6b	Earth Oven, Medium	94-3	43	38	49	Figure 8B
7a	Earth Oven, Small	8	33	30	43	
7a	Mound Oven, Small	59	51	33	13	
7a	Mound Oven, Small	94-1	45-	45	10	Figure 9A
7a	Earth Oven, Small	94-6	50-	50	27	
7a	Earth Oven, Small	94-7	42	25	27	
7b	Earth Oven, No Rock	45	36	22	32	
7b	Earth Oven, No Rock	94-L2	48	23	20	Figure 9B
8	Fire-modified rock on surface	4	20	20	7	Figure 9C
8	Fire-modified rock on surface	10	26	18	5	Figure 9C

\- not fully excavated, dimension unknown

Appendix VI. Large Earth Oven



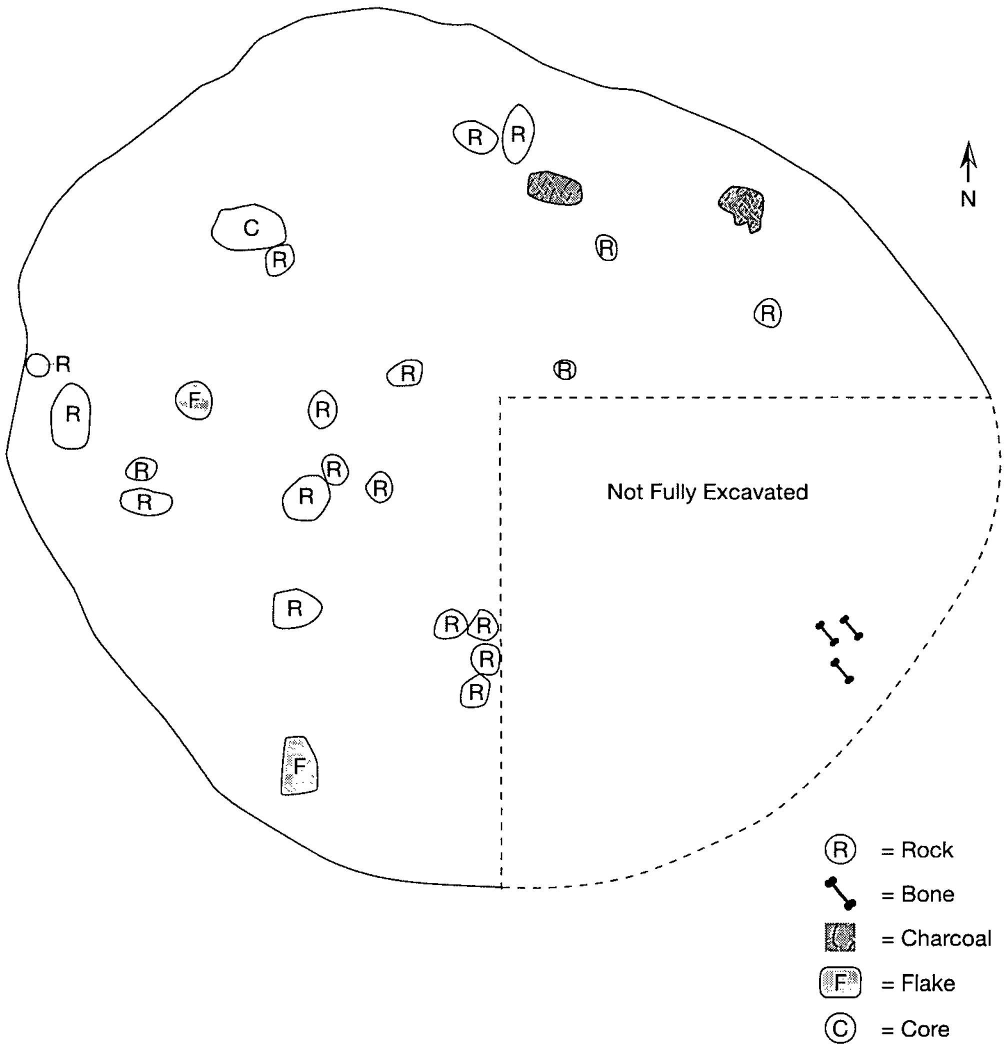
Large Earth Oven (Kind 5a) (Feature 9A)



Large Earth Oven (Kind 5a) (Feature 9B)

0 10 20cm

Appendix VII. Large Earth Oven and Box-Like Stain



Large Earth Oven (Kind 5a) (Feature 9C)

Box-Like Stain (Kind 10) (Feature 94-L57)

Appendix VIII Identification Key to Functional Feature Kinds at X̲á:ytem

Feature has:

1a. Charcoal lens.			2
1b. Charcoal chunks above fire-modified rock			2
1c. No charcoal lens, no charcoal chunks but has yellow/red matrix or oxidation			5
1d. No charcoal lens, no charcoal chunks, no yellow/red matrix or oxidation			6
2a. Longest side is 89–150 cm	**Kind 5**	**Large Thermal Feature**	
2b. Longest side is 43-75 cm			3
2c. Longest side is 33-51 cm.			4
3a. Margin is diffuse	**Kind 6b**	**Medium Earth Oven**	
3b. Margin is not diffuse	**Kind 3**	**Medium Earth Oven/Hearth**	
4a. Fire-modified rock present	**Kind 7a**	**Small Oven with Rock Element**	
4b. No Fire-modified rock	**Kind 7b**	**Small Oven, no Rock Element**	
5a. Longest side is 18-26 cm	**Kind 8**	**Thermal Refuse**	
5b. Longest side is 55-120 cm	**Kind 6a**	**Medium Oven or Thermal Refuse**	
6a. Longest side is less than 16 cm	**Kind 1**	**Postmold / Stakemold**	
6b. Longest side is greater than 16 cm			7
7a. Margin is rounded			8
7b. Margin is not rounded			9
8a. Matrix is fine silt	**Kind 1a**	**Round Postmold**	
8b. Matrix is not fine silt	**Kind 2**	**Probable Postmold**	
9a. Margin is ovoid	**Kind 2**	**Non-Thermal Pit**	
9b. Margin is squared, bottom is flat.			10
10a. Longest side is 17-29 cm	**Kind 1b**	**Squared Postmold**	
10b. Longest side is 60-86 cm	**Kind 4**	**Squared, Non-Thermal Pit**	

Appendix IX Radiometric Age Estimates for X̲á:ytem

Feature Number	Kind	UBC Sample(s) #	Laboratory, Sample Number	Location of Sample Relative to feature	Radiocarbon Years Before Present	Calibrated Age* in Years BC
94-4	3	C14-94 and C15-94	Beta 77759	In feature	6880±80	5840 – 5660
94-18	6-b	C9-94	BGS 2297	Lens adjacent to feature	6715±125	5730 – 5510
63	5-b	C32-99	Beta 143729	Bottom of pit, beneath Structure 1	5050±50	3950 – 3780
Structure 1	100	C24-99	Beta 143727	Floor of Structure 1	5050±130	3970 – 3700
9	5-a	C1-99	BGS 2295	Top of pit**	4980±400	4350 – 3300
94-1	7-a	C1-94	Beta 76984	In feature	4970±50	3890 – 3660
94-L9	Lens	C18-94 and M129-94	BGS 2298	Lens in Unit 12 near Feature 94-20	4955±200	3980 – 3520
3 and 5	6-a / 2	C20-97 and C23-97	BGS 2299	Feature 3 and Feature 5, Blended	4946±140	3950 – 3540
Structure 1	100	C11-94	Beta 77758	Fill 10 cm above floor	4840±110	3760 – 3380
31	6-a	C17-94 and C22-94	BGS 2300	Bottom of feature	4827±150	3770 – 3370
32	6-a	C30-97	BGS 2296	Bottom	4541±150	3510 – 3020
9-D	5-a	C32-97	Beta 111764	Bottom of pit	4540±90	3490 – 3090
Structure II (1994)		Nuta 1452	Postmold	4420±180	3360 – 2880	
Structure III (1994)		Beta 47260		4530±120	3500 – 3020	
Structure II (1994)		SFU 888	Hearth 2	4490±70	3350 – 3090	
Structure II (1994)		WSU 4328	West of structure	4590±70	3510 – 3100	
Structure II (1994)		Beta 46708	Hearth 1***	4800±70	3660 – 3380	
Structure II (1994)		WSU 4327	Above structure****	4930±70	3780 – 3640	
Below Structure III		Beta 46707	Hearth*****	8980±90	8280 – 7970	

* Calibrated age range of values, OxCal v3.5 Brunk Ramsey (2000); 68.2 % probability; all calendar years B.C.; all samples are charcoal.

** This sample has extremely large standard deviation and appears to be about 400 years too old. It is from disturbed systemic surface of feature that has a basal date of 4540± 90 BP (Beta 111764).

*** Hearth may not be associated with Structure II; may be earlier.

**** This sample is too old. Although recovered 1 metre above Structure II (1994) the age estimate suggests it is earlier.

***** This estimate may date a feature predating Structure III.
Sample context and integrity is questionable (Mason, personal communication, April 2002).

Appendix X Component Characteristics: Matrix Colour, Origin and Termination Depths Below Unit Datum

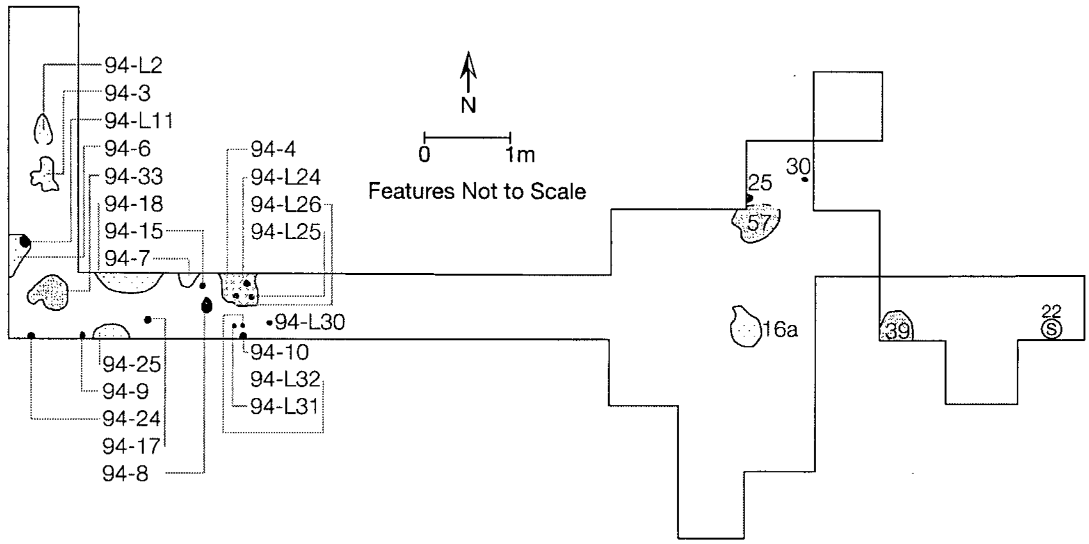
Component	**Component III**		**Component II**		**Component I**	
Colour/ Texture	**Very dark brown and grey brown sandy silt**		**Dark brown sandy silt**		**Dark yellowish brown sandy silt**	
Excavation Unit	Origin	End	Origin	End	Origin	End
1	Disturbed		Disturbed		~32 cm	Sterile
2	Removed		1	9-15	9-15	20-25
3	Disturbed	~15-~20	20	25	25	Sterile
4	Disturbed	~10	10	25	25	Sterile
5	Disturbed	~13	21		35	Sterile
6	Disturbed	~13	21		35	Sterile
7	Disturbed	~15	15-20	~30	30-32	Sterile
8	Disturbed	15-20	17	25	25	Sterile
9	Disturbed	~20	23	40	40	Sterile
10	Disturbed	~20	~20	45-50	Below 50	
11	Disturbed	~48	48	60	Below 60	
12	Disturbed	~30	~30		~39	
13	Disturbed	~20	~20	45-50	Below 50	
14	Disturbed	~15	~15		Not excavated	
15	Disturbed		Disturbed, ~19	~33	33	43
16	Disturbed	~19-25	~19-34	~40	Below 40	
17	6-23	16-30	~16-35	38-39	Below 40	
18	Disturbed	~9-~29	29	55-70	Below 55-70	
19	Disturbed	~20	~20	Below 43	Not excavated	
20	Disturbed	~20	~20	52	~63	
21	Disturbed	~25	~30	~42	~42	
22	Disturbed, ~31	~40	Not excavated		Not Excavated	
23	Disturbed	~25	~30	~60	~60	
24	Disturbed, 36	39	Not excavated		Not excavated	
25	Disturbed, 33	46	~50	63	Not excavated	
26	Disturbed, 45	52	Not excavated		Not excavated	
27	Disturbed, 37	57	Not excavated		Not excavated	
28	Disturbed	~30	~30	59-60	Not excavated	
29	Disturbed	~20	~20	43-45	~60	
30	Disturbed	~45	~45	~73	Not excavated	
31	Disturbed	~20	~30	~59	Not excavated	
32	Disturbed	35-40	35-40	55	Not excavated	
33	Disturbed, 17		Not excavated		Not excavated	

Appendix XI Features at X̲á:ytem, by Component, by Kind

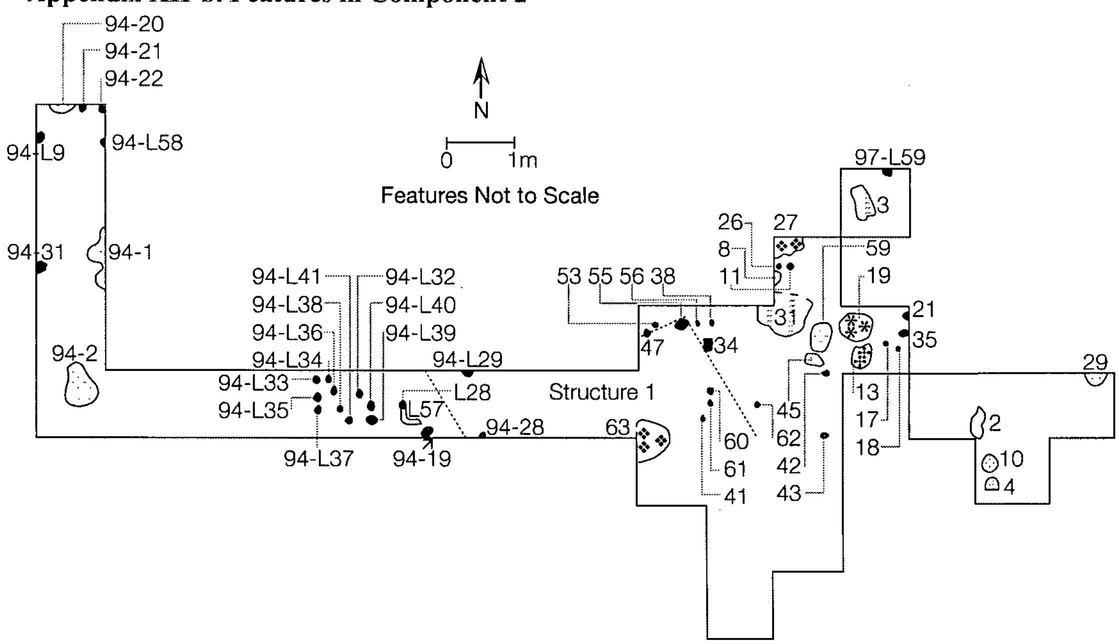
Component			Component II			Component III		
Feature #	Kind		Feature #	Kind		Feature #	Kind	
16a	6b	Earth Oven	2	6a	Earth Oven	5	2	Post
21	1	Stake/Post	3	6a	Earth Oven	6	4a	Storage Pit
22	9	Anvil stone	4	8	Refuse	7	4b	Storage Pit
25	1a	Round post	8	7a	Earth Oven	9A	5a	Earth Oven
30	1a	Round post	10	8	Refuse	9B	5a	Earth Oven
35	1	Stake/Post	11	1a	Round post	9C	5a	Earth Oven
39	3	Oven	13	4b	Storage Pit	9D	5a	Earth Oven
57	3	Oven	17	1	Stake/Post	12	5b	Earth Oven
94-3	6b	Earth Oven	18	1	Stake/Post	14	2	Post
94-4	3	Oven	19	1	Stake/Post	15	4a	Storage Pit
94-6	7a	Earth Oven	23	1	Stake/Post	16b	1a	Round post
94-7	7a	Earth Oven	26	1	Stake/Post	20	1b	Sq. post
94-8	1a	Round post	27	5b	Earth Oven	24	4b	Storage Pit
94-9	1a	Round post	29	2	Storage Pit	28	1b	Sq. post
94-10	1a	Round post	31	6a	Earth Oven	32	6a	Earth Oven
94-15	1a	Round post	33	1a	Round post	40	1a	Round post
94-17	1a	Round post	34	1	Stake/Post	46	6a	Earth Oven
94-18	6b	Earth Oven	36	1	Stake/Post	94-5	6b	Earth Oven
94-24	1	Stake/Post	38	1a	Round post	94-11	1	Stake/Post
94-25	7	Earth Oven	41	1a	Round post	94-12	1	Stake/Post
94-29	1	Stake/Post	42	1b	Sq. post	94-13	1	Stake/Post
94-30	1	Stake/Post	43	1b	Sq. post	94-14	1	Stake/Post
93-33	3	Oven	45	7b	Earth Oven	94-16	1	Stake/Post
94-L2	7b	Earth Oven	47	1	Stake/Post	94-23	1b	Sq. post
94-L11	1a	Round post	48	1	Stake/Post	94-26	1a	Round post
94-L24	1a	Round post	49	1	Stake/Post	94-27	1	Stake/Post
94-L25	1a	Round post	51	1	Stake/Post	94-34	1	Stake/Post
94-L26	1a	Round post	52	1a	Round post	94-35	1a	Round post
94-L30	1	Stake/Post	53	1	Stake/Post	94-L20	1	Stake/Post
94-L31	1	Stake/Post	54	1	Stake/Post	94-L21	1	Stake/Post
94-L32	1	Stake/Post	55	1a	Round post	94-L22	1	Stake/Post
			56	1a	Round post	94-L23	1	Stake/Post
			59	7a	Earth Oven	94-L46	1a	Round post
			60	1a	Round post	94-L49	1	Stake/Post
			61	1a	Round post	97-L55	5b	Earth Oven
			62	1a	Round post	97-L60	1a	Round post
			63	5b	Earth Oven	97-L61	1a	Round post
			94-1	7a	Earth Oven			
			94-2	6b	Earth Oven			
			94-19	1	Stake/Post			
			94-20	6	Earth Oven			
			94-21	1	Stake/Post			

Component 1			Component II			Component III		
Feature #	**Kind**		**Feature #**	**Kind**				
			94-22	1a	Round Post			
			94-28	1a	Round Post			
			94-31	1	Stake/Post			
			94-32	1	Stake/Post			
			94-L9	1	Stake/Post			
			94-L28	1a	Round post			
			94-L29	1	Stake/Post			
			94-L33	1	Stake/Post			
			94-L34	1	Stake/Post			
			94-L35	1	Stake/Post			
			94-L36	1	Stake/Post			
			94-L37	1a	Round post			
			94-L38	1	Stake/Post			
			94-L39	1	Stake/Post			
			94-L40	1	Stake/Post			
			94-L41	1b	Sq. post			
			94-L57	10	Box-like			
			94-L58	1	Stake/Post			
			97-L59	1	Stake/Post			

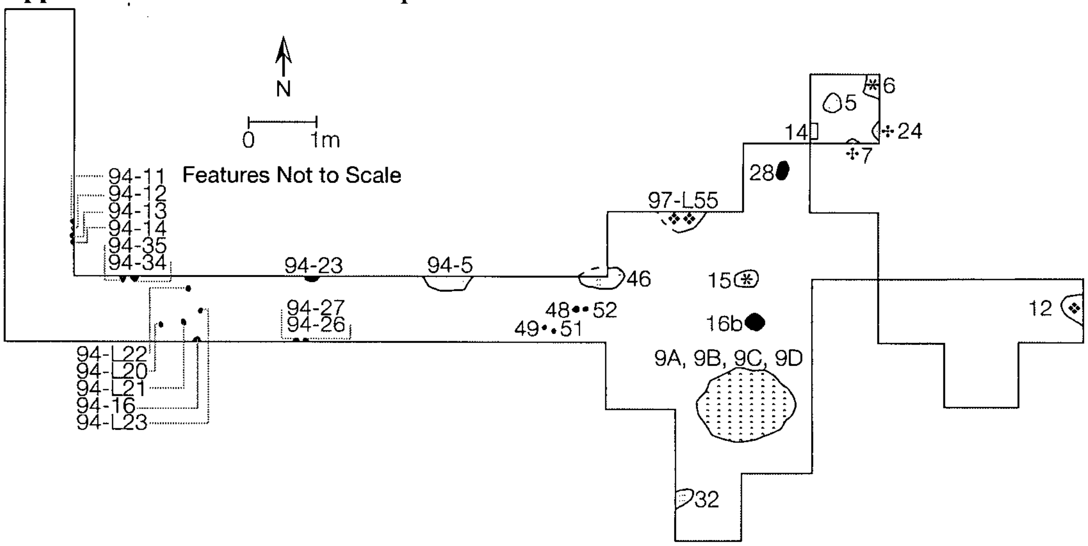
Appendix XII-a. Features in Component 1



Appendix XII-b. Features in Component 2



Appendix XII-c. Features in Component 3



Appendix XIII **Seeds and Wood in Feature Kinds, by Component**

Component	***Component I***				***Component II***			***Component III***			
Feature Number	*57*	*39*	*16a*	*	*31*	*45*	**	*9*	*46*	*40*	*16b*
Feature Kind	**3**	**3**	**6b**		**6a**	**7b**		**5a**	**6a**	**1a**	**1a**
CHARRED SEEDS											
Shallow Water Plants:											
Scirpus (Tule, Bulrush)	-	-	-	-	1	-	-	1	1	-	-
Eleocharis (spike rush)	-.	-	2	1	-	-	1	-	-	-	3
Cyperaceae (other sedges)	-	2	-	-	-	-	-	-	-	-	-
Moist, Open Area Plants:											
Mertensia (Bluebells)	-	-	-	1	3+	-	1	-	-	-	-
Brassicaceae (Mustards)	-	3	-	-	4	-	-	13	6	-	-
Portulacaceae (Purslanes)	3	-	-	-	6+	1	-	3	-	-	-
*Coptis (*Buttercups)	2	-	-	-	3	-	-	-	-	-	-
Betula (Birch)	1	-	-	-	-	-	-	-	-	-	-
Sambucus (Elderberry)	-	-	-	-	-	-	-	1	-	-	-
Coniferous Forest Plants:											
Gaultheria shallon (salal)	-	-	-	-	2	-	-	4	-	-	-
Disturbed Area Plants:											
Rubus (Raspberry clan)	2	1	1	-	35+	1	11	25+	3	+	1
Chenopodium (Lamb's Quarters)	1	-	1	1	22	-	-	47	1	1	-
Unidentified Plant Seeds:	5	1	3	7	75+	0	8	71+	5	0	8
WOOD											
Hardwood:											
Acer (Maple)		5	3			0	7	3	1		-
*Arbutus menziesii (*Madrone)		-	-			-	-	2	-		-
Populus (Cottonwood)		-	-			-	-	1	-		-
Cornus (Dogwood)		-	-			1	-	-	-		-
Alnus (Alder)		-	1			-	4	-	1		3
Rubus (Raspberry clan)		-	-			1	-	-	-		-
Pseudotsuga menziesii (Douglas Fir)		-	-			-	-	2	-		-
Unidentified Hardwood		-	1			-	1	-	2		1
Softwood:											
Picea (Spruce)		-	-			-	-	1	-		-
Pinus (Pine)		-	-			-	1	-	-		1
Taxus brevifolia (Yew)		-	-			-	-	-	-		-
Tsuja plicata (Western Redcedar)		-	-			7	-	16	-		-
Camaecyparis nootkatensis (Yellow Cedar)		-	-			-	-	1	-		-
Unidentified Softwood		-	-			-	1	2	1		-

Scientific names are for family unless species was identified, then species name is given instead.

* Seeds from systemic surface of Component I. ** Structure 1 floor and fill

\- This species or family not recovered in the sample + plus fragments

Note 1: Blank cells indicate no sample was analyzed for this feature.

Note 2: Plant families and species were assigned to habitat categories based on descriptions in Pojar and MacKinnon (1994).

Paleo-botanical identifications are from Ormerod 1998; Radomski 2000, and Wyndham 2000.

Appendix XIV Features with Fauna Present, by Component

Component I

Feature #	*F 16a*	*F 30*	*F 94-3*	*F 96-6*	*F 94-7*	*F 94-L2*
Feature Kind	**6b**	**1a**	**6b**	**7a**	**7a**	**7b**
Mammal						
Bird						
Fish						
Unidentified Bone	*	*	*	*	*	*
Shell						

Component II

Feature #	*F2*	*F3*	*F8*	*F27*	*F31*	*F34*	*F38*	*F59*	*F94-1*
Feature Kind	**6a**	**6a**	**7a**	**5b**	**6a**	**1**	**1a**	**7a**	**7a**
Mammal									
Bird			*						
Fish									
Unidentified Bone	*	*	*	*	*	*	*	*	*
Shell									

Component III

Feature #	*F9*	*F32*	*F40*	*F46*	*F94-23*
Feature Kind	**5a**	**6a**	**1a**	**6a**	**1b**
Mammal	*				
Bird	*				
Fish				*	
Unidentified Bone	*	*	*	*	*
Shell	*				

* fauna present in feature

Faunal data from Vorell 1998

Appendix XV Lithic Artifact Comparison: X̲á:ytem and Glenrose St. Mungo Component

Artifact Type	Glenrose St. Mungo		X̲á:ytem	
	Frequency	Percent	Frequency	Percent
Chipped Stone				
Large Crude Biface	19	3.8	0	0.0
Large Leaf Biface	5	1.0	0	0.0
Small Leaf Biface	9	1.8	1	1.0
Square-base Biface	3	0.6	0	0.0
Contracting Stem Biface	5	1.0	4	3.8
Square-tang Biface	3	0.6	0	0.0
Biface Fragment	13	2.6	5	4.8
Lehman Point	0	0.0	1	1.0
Stemmed Point	0	0.0	1	1.0
Large Unifacially Retouched Flake	11	2.2	8	7.6
Medium Unifacially Retouched Flake	34	6.7	0	0.0
Small Unifacially Retouched Flake	35	6.9	0	0.0
Well-made Unifacial Flake	10	2.0	0	0.0
Small, Steep Retouched Flake	33	6.5	0	0.0
Large, Steep Retouched Flake	34	6.7	0	0.0
Heavy Duty, Steep Retouched Flake	19	3.8	0	0.0
Denticulate Flake	10	2.0	0	0.0
Graver, Drill, Notched Stone	7	1.4	0	0.0
Blade Tool	5	1.0	0	0.0
Microblade-like Flake	5	1.0	0	0.0
Stone Wedge	5	1.0	0	0.0
Bifacially Retouched Flake	8	1.6	0	0.0
Unformed Core	55	10.9	13	12.4
Cortex-based Core	5	1.0	9	9.6
Small, Utilized Flake	55	10.9	28	26.7
Large, Utilized Flake	25	5.0	3	2.9
Unmodified Cortex Spall	4	0.8	2	1.9
Steep, Retouched Cortex Spall	4	0.8	0	0.0
Narrow Angle Cortex Spall	4	0.8	4	3.8
Modified Cobbles				
Hammerstone	13	2.6	6	5.7
Anvil Stone	1	0.2	2	1.9
Bifacial Chopper	8	1.6	0	0.0
Unifacial Chopper	15	3.0	8	7.6
Scraping Plane	10	2.0	0	0.0
Utilized Pebble Flake	0	0.0	4	3.8
Ground Stone				
Decorative Slate	9	1.8	0	0.0
Abrasive Stone	17	3.4	0	0.0
Ground Slate Point	3	0.6	0	0.0
Miscellaneous Ground Stone	6	1.2	0	0.0
Pendant	0	0.0	1	1.0
Other				
Paint Stone	0	0.0	3	2.9
Obsidian Tinkler	0	0.0	2	1.9

From Table IV-1 in Ormerod and Matson, 2000

Appendix XVI **Soil Chemical Proportions in Feature Kinds, by Component**

	Component I			Component II			Component III		
Feature Number	***57***	***39***	***16a***	***45***	***31***	*	**	***9***	***40***
Feature Kind	**3**	**3**	**6b**	**7b**	**6a**			**5a**	**1a**
Sample # (Bruno)	7	3	2	5	6	10	9/11	1	4
Measurements of Chemical Proportions									
pH	5.3	5.0	5.6	5.2	5.3	5.3	5.2	5.2	5.3
Cation Exchange Capacity (CEC)	13.54	14.37	12.58	16.91	15.54	21.22	12.88	13.89	15.22
Base Saturation	5.05	9.64	9.20	8.42	5.61	7.75	6.62	7.63	7.5
% Carbon	2	1.96	1.54	2.78	2.6	4.5	1.8	2.14	2.26
% Nitrogen	0.06	0.09	0.06	0.1	0.08	0.12	0.14	0.08	0.10
Ca	0.51	0.87	0.77	1.21	0.69	1.38	0.64	0.77	0.9
Mg	0.02	0.21	0.06	0.06	0.22	0.05	0.02	0.04	0.05
K	0.08	0.22	0.26	0.1	0.1	0.15	0.13	0.19	0.15
Na	0.06	0.08	0.06	0.06	0.07	0.06	0.06	0.05	0.05

* Structure 1 floor

** Structure 1 fill

From Bruno 2000 and Bruno 2001

Appendix XVII **Results of Correlation Analyses of Bruno's Data**

Chemical Tested	Pearson Chi-Square Value	df	Asymp. Sig. (2-sided)
Potassium as % of CEC	36.000	24	.055
Carbon : Nitrogen Ratio	28.000	18	.062
Phosphorous parts per million	30.286	24	.175
Calcium as % of CEC	33.143	27	.192
Magnesium as % of CEC	18.286	18	.437
pH	13.091	15	.595
Sodium as % of CEC	6.776	9	.660