The Ancient Past of Keatley Creek

Volume II: Socioeconomy

Edited by Brian Hayden

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Cover: The cover was designed by the Simon Fraser University Instructional Media Centre. It features the broken top of a zoomorphic maul recovered from HP 93 by a private collector about 20 years ago. The head of the maul is still in a private collection. Bone buttons, archaeologically excavated from HP 105, are also shown.

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Preface

Brian Hayden

This is the final report of the Fraser River Investigations into Corporate Group Archaeology Project, a project that has lasted for 13 years. This has certainly been one of the great intellectual and collaborative undertakings of my lifetime. I trust that readers will recognize in the many contributions that make up this report, the remarkable interweaving of many divergent disciplines, lives, and perspectives into a united interpretation of the social and economic organization of a prehistoric community on the Northwest Plateau. This report is special for a number of reasons. Firstly, the nature of the archaeological remains at Keatley Creek are in my estimation, one of our most important national and world heritage treasures. The site is extraordinary in terms of its size for people following a hunter-gatherer way of life (with an estimated peak population of 1,200–1,500). The large houses are extraordinary for pithouses and the preservation of organic remains and stratigraphy is excellent.

Secondly, this report is special because it seeks one of the most elusive entities archaeologists have sought from the beginnings of their systematic exploration of the past: notably, the basic social and economic and political organization in specific prehistoric societies. How did this organization mold the lives of people on a day to day basis? This is the focus of the present volume. There have been many professional archaeologists who have said that such questions cannot be answered. There have been many others who adamantly maintain that such questions can be answered. However, while both sides have reveled in pronouncements, few archaeologists have successfully demonstrated how even basic aspects of social or economic organization can be reconstructed from the remote past.

This volume demonstrates that with determination, collaboration, and a little luck, a fairly detailed reconstruction of past social and economic organization is certainly possible. This was the goal of the project from the beginning: to understand the social and organization of unusually large houses (residential corporate groups). The results have sometimes been surprising and intellectually exhilarating, as the following chapters document.

Third, as alluded to above, this report is remarkable for the unusual breadth of data and disciplines that have all contributed to making this report a landmark study in prehistoric archaeology. While I originally defined the basic problem orientation of the project, I have had the good fortune to have been aided from the outset by a remarkable team of collaborators, excavators, and analysts in specialized fields. I consider the substantial success of this project to be a tribute to all of them. Many of the authors of the following chapters helped plan the excavation and analytical strategies to be pursued from the outset of the project, and many were on the first field crew that tested the first housepits in a hesitant and hopeful manner, unsure as to whether we would find any intact or recognizable living floor deposits upon which much of the fate of the project depended. Diana Alexander, Karla Kusmer, Dale Donovan, Dana Lepofsky, and Mike Rousseau were all members of that first field crew and planning committee. They helped modify our strategy as new realities confronted our initial idealistic models, and they continued their involvement in the project over the years in analyzing the overwhelming amounts of material recovered. I consider this final report on the work at Keatley Creek as one of the best examples of what collaborative, interdisciplinary archaeology can produce.

Fourth, this report is special because it substantially increases our depth of understanding in the study of complex hunter-gatherers. Complex hunter-gatherers have become very prominent in the theoretical domain of archaeology in the past two decades because they now appear to be the key to understanding most of the important cultural developments of the last 30,000 years of prehistory, including the emergence of prestige technologies, economic-based competition, private ownership, socioeconomic hierarchies, slavery, domestication of plants and animals, sedentism, and many tangentially related phenomena. This report also provides a major contribution to the systematic and detailed study of site formation processes which have rarely been documented in any thorough or systematic fashion.

Finally, this report is special because substantial parts of it have been built upon an in-depth understanding of the living descendants of the prehistoric Plateau peoples. We were priviledged not only to read early ethnographic accounts of traditional Plateau lifeways as recorded by James Teit and others, but also to be able to work with a number of elders from the surrounding First Nations communities. From them we learned a great deal about traditional practices and especially how resources were used. This valuable information constituted a study of traditional resource use that was exceptional in its coverage and documentation of traditional lifeways. This study was published by the University of British Columbia Press under the title of: *A Complex Culture of the British Columbia Plateau* (Edited by B. Hayden). I certainly would like to extend my very deep gratitude to everyone in the native communities that aided us in this work, and especially to former Chief, Desmond Peters, Senior, of Pavilion.

The quest to recover past social and economic organizations on the Plateau has been long and arduous, and it has led to many unexpected ventures, both geographical and intellectual. I have been constantly surprised by new facts, new relationships, new perceptions, new conclusions, and new questions. However, the quest has never become dull or boring. If anything, it has been too interesting and too captivating. At times, it has been difficult to hold all the threads together in order to make a coherent fabric of the past at Keatley Creek and to create coherent theoretical images of the past. However, the main themes have remained clear and resilient. The venture has been a wonderful growing experience, even if I have at times been exhausted by the endeavor.

I am confident that as a result of the excavations at Keatley Creek, the new conceptual, methodological, and theoretical approaches that I and the other analysts have developed will stimulate further advances in the exciting area of documenting and understanding past social and economic organization. However, many of the advances that we associate with this project have been fortuitous and serendipitous. I certainly did not foresee or plan for all of them. Many of the advances were developed by interested students and analysts who became intrigued by the project and developed their own innovative ways of looking at the data. Once again, I must acknowledge my very good fortune in having such interested, dedicated, and talented individuals involved in this project. It is above all, they who have made it successful.

Organization of the Volumes

The report is organized into three volumes. Each volume has a separate thematic focus, these are: taphonomy, socioeconomic organization, and excavation documentation. This organization is somewhat different from traditional archaeological site report formats where all the information pertaining to a given type of material such as lithics or fauna is presented together in a single chapter or section. Given the complexity of the database at Keatley Creek and the complexity of the issues being addressed, it was thought that a traditional type of material-focused organization would make it difficult for readers to follow all of the related arguments, models, and issues related to the central themes of the research at Keatley Creek. We therefore chose to structure the organization of these volumes around the major research questions at the site, especially site formation processes and prehistoric socioeconomic organization. For those accustomed to the more traditional material-focused organization of site reports, this may at first seem somewhat awkward since some of the information on lithics, for example, is presented in all three volumes. However, after reading a few chapters, and especially with some judicious use of the table of contents and indexes of the volumes, readers should be able to orient themselves sufficiently to find any type of information that they are interested in. We also have included frequent chapter cross-references to direct readers to other relevant data or interpretations in the report.

Volume I

Because questions of taphonomic biases, disturbance, mixing, and basic issues of accurate identification of the origins of sediments had to be dealt with prior to any consideration of artifactual patterning, the first volume dealt with general formation processes at the Keatley Creek site. Chapters included sediment analyses, microfabric analyses, faunal taphonomy, botanical taphonomy, lithic strategies and source identifications, and specific comparisons of rim to roof to floor formation processes. Background chapters on basic geological, environmental, climatic, typological, and dating issues were also included in this first volume.

Volume II

This, the second volume, deals with evidence for social and economic organization at the Keatley Creek site. Overall differences between housepit assemblages are dealt with as well as differences in the internal organization of space and domestic groups. Prestige artifacts are analyzed, including the large assemblage of domesticated dogs from HP 7. In addition to botanical, faunal, chemical, and lithic patterning, this volume contains an ethnographic summary of accounts of pithouse life, an analysis of architecture and heating strategies, an overall synthesis of what the socioeconomic organization of the Keatley Creek community was probably like, and an evaluation of the results of the Fraser River Investigations into Corporate Group Archaeology project.

Volume III

In order to present as full a picture of the data upon which the previous and the following interpretations are based, relatively detailed reports of all the test trenches and extended excavations are presented in the third volume. The third volume also contains a description of the lithic typology used by the project, an illustrated catalog of all the modified bone tools from the site, and a special analysis of unusual scapula tools at the site. The intention is for this volume to be used as a kind of reference book, similar to a dictionary. It should be consulted whenever any questions about excavation or stratigraphic details of a housepit arise from reading analyses or interpretations in the other volumes.

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I apologize for anyone who helped in the project and whom I have forgotten to acknowledge.

Of utmost importance for the success of this project has been the good will and cooperation of the people that have generously permitted us to excavate on their legal and traditional lands: Mr. J.E. Termuende of the Diamond S Ranch, and the Pavilion (Ts'qw'aylaxw) Indian Band. The Fountain (Xaxli'p) Indian Band has also provided substantial support. More than anyone else, Desmond Peters, Senior, of the Pavilion Band, has been a mentor of our research in the area and has been invaluable in providing information on traditional culture. In the creation of this project, Dr. Arnoud Stryd was both an inspiration and a generous advisor. Morley Eldridge has provided many seminal ideas and data. Trevor Chandler, in particular, has been a constant supporter. We have always been warmly welcomed by the people in the Lillooet region whether in meetings, at gatherings, on ranches, on reserves, in museums, or in stores; and we are grateful for their interest, their hospitality, and their friendship.

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In addition to the many authors that have helped produce this final report, I would also like to thank the many crew members and volunteers that contributed their time and expertise to help gather, process, and organize the basic data upon which everything else rests. There have been many scores of individuals involved in this aspect of the project, and I am grateful to them all.

Due to the vicissitudes of funding, there have been many agencies involved in the financing of this project. By far, the bulk of the funding has come from the Social Sciences and Humanities Research Council of Canada (and its predecessor, The Canada Council). Additional financing has been provided by the SSHRC Small Grants Committee at Simon Fraser University, the President's Research Committee at Simon Fraser University, the Simon Fraser University Special Research Projects Fund, the Simon Fraser University Publications Committee, The McLean Foundation, and the British Columbia Heritage Trust. I gratefully acknowledge the support of all these agencies.

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Introduction and Housepit Activities

Chapter 1

Socioeconomic Factors Influencing Housepit Assemblages

Brian Hayden

Introduction

This chapter synthesizes results from the lithic, faunal, and botanical analyses of housepit floors in order to develop conclusions about the social and economic organization that existed within the pithouses at Keatley Creek. There are considerable differences between housepits in terms of artifact contents and features. This chapter also describes these differences and proposes explanations for them. Due to the large amount of time and effort required for the excavation and analysis of these housepits, the sample size involved in this analysis is necessarily small and conclusions must be provisional. However, the patterns and differences that have been observed are striking enough to warrant some confidence that the broad outlines sketched below will stand the test of time.

At the outset of this research, I had a number of expectations. I expected there to be patterned variation. On the basis of previous work (Hayden and Cannon 1982, 1984; Lightfoot and Feinman 1982; Wilk 1983; Netting 1982; Maugher 1991:133) I expected house size to be generally related to relative wealth and political power, with small houses being significantly poorer than large houses. I also expected that there would be more constraints on the variability of large houses than on small houses due to the increased logistical, economic, and social requirements of maintaining large numbers of people in coherent groups, whereas individual families could behave in much more idiosyncratic fashions. Furthermore, on the basis of ethnographic accounts (Teit 1909:576) I expected differences in wealth and privilege between domestic groups within large houses, with as much as one half to two-thirds of the domestic groups displaying high levels of wealth or status. I hoped that wealth items would clearly indicate which houses and which hearths were occupied by rich families. This expectation proved largely unrealistic due to the deposition of wealth objects primarily in burials and their rare and fragmentary occurrence in housepits. Moreover, the deposition location of rare prestige objects could be affected by many fortuitous factors. A similar rarity of prestige items at residential sites has been noted for even more complex cultures such as Celtic chiefdoms (Cunliffe 1986:151). Thus, the identification of socioeconomic distinctions at Keatley Creek was largely based on differences in storage capacity, size and intensity of hearth use, differential faunal use, evidence for specialization, and overall economic intensity. Because of their rarity in floor deposits, prestige items only proved to be useful when comparing entire housepit assemblages. I also expected specialized activity areas to exhibit major differences in assemblage composition as well as potential differences in associated features. Domestic areas, on the other hand were expected to display largely repetitive assemblage compositions and features.

In order to examine the preceding expectations, I and other project analysts relied on ethnographic analogies, cross-cultural and general principles of behavior, taphonomic or site formation principles, and common sense. Before examining the variability apparent within given living floor assemblages, I will briefly review some of the differences between overall housepit assemblages.

Overall Differences Between Housepits

Housepits at Keatley Creek vary dramatically in all basic aspects: size, storage facilities, hearth development, architecture, stone tools, stone raw materials, faunal remains, botanical remains, and prestige items. Trying to explain this variability is one of the major goals of our work at the site. The most obvious socioeconomic factors capable of explaining this variability include: 1) occupation of pithouses during different prehistoric time periods (e.g., one housepit being used in Shuswap times with another being used in Kamloops times) or variable periods of reoccupation; 2) different lengths of occupation of specific pithouses; 3) differential involvement of residents in activities such as trading, hunting, fishing, mat making, basket making, and shamanism; 4) the size and composition of residential groups, e.g., the formation of large residential corporate groups vs. small nuclear or extended families; 5) differential wealth and access to resources. Causes of differences in housepit assemblages due to variable abandonment behavior are discussed in Volume I, Chapter 17. I assume that all pithouses were occupied during the winter season. There is no evidence that housepits were used in any season other than winter, although it is conceivable that the elderly, the very young, and/or the infirm may have used them intermittently in any season. As indicated later in the discussion, other more minor factors may also play important roles, such as the presence of dogs, varying standards or techniques of house cleaning, and the mode of abandonment. The discussion of house differences can be carried out in terms of the three basic size categories of structures that have been investigated: small, medium, and large housepits.

Variability Among Small Housepits

Three small housepits were extensively excavated and analyzed: HP's 9, 12, and 90. All three are on the perimeter of the site (Vol. I, Chap. 1: Figs. 9 and 11) since we were unable to locate easily interpretable Kamloops horizon small housepits in the center of the site. As it turned out, there was a greater apparent temporal difference between the three excavated housepits than was hoped for. Housepit 90 appears to have been a short Plateau horizon occupation. The bottom occupation of HP 9 was clearly Plateau in age while the upper occupation was clearly early Kamloops. The HP 12 occupation appears to be transitional between the Plateau and early Kamloops horizon. What is striking about these three small housepits (representing four occupation floors), is their extreme variability, even within the same period (e.g., the Plateau occupations), a variability which seems too extreme to be due to temporal changes. On the one hand, HP 9 exhibits numerous signs of relative wealth and specialized status although the frequency of any given prestige artifact type is often low. The indicators of wealth or status in this housepit include: the greatest number of dentalium shells from any structure at the site, a large ground piece of marine mussel shell, the second largest number of freshwater shell fragments and beaver teeth from any housepit at the site, the only occurrence of loon and bald eagle bones at the site, the largest number of worked elk and deer antler pieces of any housepit (including the only digging stick handle from the site and an unusual bark peeler of split antler 40 cm long), the largest number of bighorn sheep remains from any housepit, very high densities of fish bones on the floors especially compared to the other small housepits, large fragments of a nephrite adze, several soapstone pipe fragments, a very large storage pit unique among small housepits so far investigated, and well developed hearths (for faunal details see Vol. I, Chap. 10; Vol. II, Chap. 7).

Previous ethnographic work among households had demonstrated that the diversity rather than the total frequency of wealth objects in a household is a much better indicator of actual wealth levels (Hayden and Cannon 1984:109, 194; Cannon 1983). All of the above factors occurring together in a small housepit are highly unlikely to be due to the vagaries of loss and deposition or unusual house cleaning behavior, even given the fact that some of these objects were spread over two distinct occupations. Nor does their presence appear to be due to unusual or hurried abandonment since all stored food had been removed from the cache pit and almost all the tools left behind were in a broken or heavily used state. The occurrence of so many trade and status items together indicates an unusual degree of wealth compared to most other housepits, and probably a specialized status for one or more of the residents, such as a hunter or a shaman. Lillooet shamans were known to have had private dwellings where they kept their symbols of power (Nastich 1954:52). Shamans among the Thompson and Shuswap had loons as guardian spirits and wore necklaces of loon bones (Boas 1900:381; Teit 1909:606–607). In light of these observations, the fact that HP 9 is the only structure to yield loon bones at Keatley Creek seems particularly significant. Moreover, elsewhere in the Northwest, shamans were wealthy and belonged to the elite (Kamenskii 1985:86; Goldman 1940:365–366, 370) and thus, it does not seem unusual to find indicators of shamanistic activity associated with wealth at Keatley Creek.

While the rest of the HP 9 lithic assemblage is sparse and unremarkable (except for the accumulations of dense clusters of unmodified rocks in some parts of the floor), the remainder of the faunal assemblage is one of the most remarkable at the entire site in that it consists of extremely high densities of thousands of fish bones in all occupations, especially very thin spines and ribs which tend to be much rarer elsewhere especially in the other small housepits of this period.

At the other extreme is the penecontemporaneous occupation of HP 90. There are only six faunal remains associated with the floor (two of which were fish and three of which were simple modified artifacts) and an additional 33 bones from the roof deposits and pits. There are few unusual faunal or lithic items other than two pieces of antler and one broken maul, adze, and palette; there is no clear indication of hideworking (Vol. II, Chap. 12), there are no storage pits, and there is no fire reddening to indicate a hearth. In general, the occupations of small housepits appears to have lasted only one or a few generations, probably much less than 50 years, although some depressions were occupied several times. While occupation of HP 90 may not have lasted as long as HP 9, discoloration and mixing of roof deposits indicate that residents stayed there for at least a number of seasons and may have even stayed long enough to reroof the structure. Even if the remains that were recovered from HP 90 represent few seasons of occupation, they still indicate a much more impoverished and more generalized existence for HP 90 residents compared to HP 9 residents.

Housepit 12, occupied in the transition period between the Plateau and Kamloops horizon, is much closer in overall character to the poor profile represented by HP 90, although it is not as extreme. There is a small storage pit with exclusively low quality (pink) salmon vertebral columns in its bottom; there is evidence for a small ephemeral hearth associated with some fire cracked rock; there are 31 fish bones from the floor (all from pink salmon) and 90 mammal bones including 3 beaver teeth; and there are some indications of hideworking, the presence of a dog, and the use of a pipe. In recent times pink salmon was considered famine food by Interior groups, but was the easiest type of salmon to catch (Kennedy and Bouchard 1978:39, 1992:275). No unusual fishing sites are required to catch these fish and it is highly unlikely that procurement sites for obtaining pink salmon would have been owned or access restricted to them. Based on the degree of discoloration and mixing of roof sediments, occupation does not seem to have been much longer than the occupation of HP 90, perhaps a few decades at most.

The overall impression is not one of wealth or specialized status, but not one of abject poverty either. In both HP's 12 and 90, mammal bone dominates fish bone in the floor assemblage; however, it is important to recognize that the mammal bones in HP 90 could have resulted from the fragmentation of the bones from a single joint of a single deer procured just once during the entire occupation. The bones from HP 12 represent some increase, but not a great deal.

At this point, it is not clear why salmon bone is so rare in these two houses, especially in comparison to HP 9. Certainly residents must have been eating something during winter months. Perhaps all available edible material was consumed in these poorer houses, including fish bone cooked in occasional soups, whereas such bone material would more likely be discarded or wasted in richer households. Cooking or boiling salmon bone adversely affects preservation (Wheeler and Jones 1989; Lubinski 1996).

Testing of other small housepits in various areas of the site supports the notion of highly variable wealth and specialization characteristics between small housepits occupied during Plateau and early Kamloops times. Both faunal and lithic analyses display this variability (see Vol. I, Chap. 10; Vol. II, Chaps. 5, 12, 14). For instance, test excavations of the early Kamloops occupation of HP 101 revealed an unusually diverse faunal assemblage including several bone and shell artifacts, and an emphasis (like HP 9) on bighorn sheep. It also has a remarkable lithic industry consisting of thousands of high quality chert flakes buried in a pit and derived from a massive reduction event. Housepit 110 has a similarly rich and diverse faunal assemblage in each of its two Plateau horizon floors and in its Kamloops horizon floor (including squirrel, bird, beaver, bighorn sheep, and a partially burned dog). Like HP 101, the lithics are also unusually rich and diverse, emphasizing high quality cherts.

In contrast, HP 108 on the southern extreme periphery of the site is impoverished in all respects and probably does not represent an occupation of very long duration, perhaps an occupation during early Kamloops times. Housepit 107 exhibits only slightly greater faunal richness, but has a very distinctive assemblage of lithic sources and appears to have been occupied for a short period during the Plateau horizon.

There are also four, more enigmatic, small structures which I initially thought might have served specialized feasting or ritual functions or at least been the residences of specialized individuals. Housepit 104 high above the rest of the site on the highest eastern terrace, contained unusual, thick deposits of ash with calcined bone covering the center of the floor. These deposits contained few lithics or bone, 96% of which was burned. Excavations of other parts of the floor of this structure yielded relatively abundant ungulate and salmon remains, a bone gaming piece, a long bone spatula, but few lithics (except for abrading stones). HP 104 was also unique among the small housepits in having four very substantial main posts all of which were burned in place. This structure turned out to be protohistoric in date. Housepit 106 was only a few meters to the south and was also protohistoric in date. It was even more extreme than HP 104 in its lack of associated lithic materials. Faunal materials were also almost completely lacking.

Housepit 105 was also on the highest eastern terrace and intersected HP 106. Only the last protohistoric occupation deposits were in tact, but a large storage pit dated to the Plateau horizon contained an unusual bone point with a central hole and 72 bone "buttons" at the bottom, the largest collection from the Plateau. The last occupation floor was littered with small, delicate salmon remains as well as larger mammal remains, resembling the floor assemblage from HP 9 in terms of the density and dominant proportion of the finer fish elements. Thus, all three structures on this high terrace appear to have constituted an isolated protohistoric occupation occurring long after the majority of the site was abandoned although the use of one structure (HP 105) extends back to the Plateau Horizon.

Finally, HP 109, the only housepit on the next lower eastern terrace, is highly unusual in the depth of its deposits and in terms of contents, including the lower vertebrae of a dog wrapped in birch bark, a lithic assemblage composed almost entirely of chert and chalcedony debitage, and the largest single concentration of red ochre found at the site. The upper floor may be protohistoric, whereas the lower floor appears to be a late Shuswap occupation. Determining whether any of the structures on these high terraces had non-residential, specialized uses will require more extensive excavation. Since our main goal was to examine variability between households during the main site occupation period, we did not extend investigation of these structures beyond testing or pursue the excavation of protohistoric structures.

In sum, it appears that small housepits during both the Plateau and Kamloops horizons were occupied either by groups that were relatively wealthy having access to trade items, high quality cherts, and abundant fish and mammal resources, or that they were occupied by economically marginal groups with little access to any of these materials. The full implications of this pattern will be explored after discussing medium and large housepit variability, but here it can be emphasized that there is clearly a great deal of variability in small housepit assemblages and it seems possible that some of this variability is due to non-residential functions of some of the structures.

Architecturally, except for HP 104 and 106, small housepits differ from larger ones in having few or no structural postholes in the floors (Vol. II, Chap. 15). Some oral accounts also describe pithouses as lacking interior posts (Kennedy and Bouchard 1977:Tape 1). Shallow basins or depressions filled with unmodified rocks (e.g., in HP's 9 and 90) or rock concentrations laying directly on the floor (HP 9) also appear to be much more prominent floor features in smaller housepits (presumably for drainage of poorly sealed water vessels or for drying wet materials), although one such pit does occur in HP 7. Hearths appear to have been much more ephemeral and smaller in poorer small housepits with only small amounts of fire cracked rock associated with these houses.

Medium and Large Housepits

Unfortunately, due to the great amount of time and effort involved in excavating these larger housepits, there is only a single extensively excavated example of each from the Keatley Creek site. However, four other large housepits were tested (HP's 1, 2, 5, and 8), and these initial test excavations are quite consistent with results from the more extensive excavations in HP 7 in terms of the general nature of the lithic and faunal assemblages, the occurrence of large storage pits and the presence of perimeter hearths. These results encourage me to propose that there is much less variability in the larger housepits than in the smaller ones. This is probably due to the substantially increased constraints involved in maintaining a large group of people together in a cooperative social and economic corporate group such as those represented by the larger housepits (see also the general discussion by Hayden and Cannon 1984:192). Large corporate groups must be able to provide suitable inducements and rewards for families or individuals to remain affiliated with the group, to settle disputes within the group and defend group members' interests from outside threats, as well as to advertise wealth and power in order to recruit productive new members (as spouses or client members). All these requirements necessitate substantial economic control, the production of surpluses, consumption of prestige goods, and the establishment of hierarchies, without which large groups would disintegrate. Thus, from a theoretical point of view the larger the residential corporate group, the less variability can be expected.

As part of a moderate sized residential corporate group, the residents of HP 3 (occupied from Shuswap to early Kamloops times when the last floor was in use) could be expected to exhibit considerably more evidence of wealth and food surplus than poor residents of small housepits. This is clearly so in terms of the overall density and quantity of fish and mammal bone remains (7.2 per square meter for floor deposits in HP 3 versus 3.1 per square meter in HP 12—see Tables 3 and 4 in Vol. II, Chap. 7), storage pit capacity (Table 1), the occurrence of specialized fauna (short- and long-tailed hawks, freshwater shells, and dog), and prestige lithic items (e.g., a nephrite adze fragment, a copper sheet fragment, pipe fragments, a graphite "crayon," obsidian, and substantial indications of hideworking (both endscrapers and spall tools). In contrast to poor small households where fish remains are rare, fish bones in HP 3 constitute over half of the faunal assemblage on the living floor. In contrast to poor small housepits where almost 100% of the salmon remains are from low-status pink salmon, there is much more variability in the HP 3 floor assemblage (47% of the salmon bones from the floor were pink salmon with 53% from 3 to 4 year old salmon, although inclusion of the dense concentrations of pink salmon vertebrae at the bottom of one large cache pit (see Vol. I, Chap. 10, Appendix III) would decrease the overall proportion of 3 to 4 year old salmon species to only 5% for the entire household). This indicates that there was significant access to the better fish procurement locations and perhaps ownership of moderately productive fishing spots by HP 3 residents. Considerable stability of this moderate sized corporate group is indicated by the long accumulation of rim midden beginning in Shuswap horizon times.

Table 1. Storage Capacity of Large Storage Pits by Housepit

	Feature No.	Depth	Diameter	Estimated Volume	
HP 12	P–2	70	94		485.78
	P–3	35	65		116.14
	P–5	35	40		43.98
	P–9	35			126.00
				Total storage volume	771.91
				Estimated floor area	38.50
				Liters storage per square m of floor	20.05
HP 3	HP 3-89:2	76	114		775.73
	P–1	44	58		116.25
	P–2	145	114		495.90
	P–3	44	102		359.54
				Total storage volume	1,747.42
				Estimated floor area	78.50
				Liters storage per square m of floor	22.26
HP 7	P–4	65	156		1,242.37
	P–2	120	113		1,203.45
	P–25	100	130		1,327.32
	P–31	115	135		1,646.10
	89-5	130	101		1,041.54
	P–36A	75	81		386.47
	P–34	55	80		276.46
	P–4	60	87		356.68
	P–36	60	72		244.29
	P–35B	32	90		203.58
				Storage volume: large pits	6,460.78
				Estimated floor area	113.10
				Liters storage per square m of floor	57.12
				Storage volume: large & medium pits	7,928.26
				Estimated floor area	113.10
				Liters storage per square m of floor	70.10
HP 9		82	126		1,022.46
				Estimated floor area	20.50
				Liters storage per square m of floor	49.88

These characteristics are even more pronounced in the floor deposits of HP 7, the largest housepit to be extensively excavated. The occupation span of this housepit is similar to HP 3 with the last occupation also occurring in the early Kamloops horizon. Faunal remains are even more abundant and denser in all classes of deposits (21.2 per square meter for floor deposits), and much more diverse (including grizzly bear, lynx, hawk, grouse, hare, beaver, muskrat, fox, fisher, moose, dogs, dentalium shells, and coastal rock scallop and whelk). In fact, the faunal diversity in HP 7 exceeds all other excavations at the site combined. Storage capacity is much greater (Table 1) as is the development and the number of hearths compared to HP 3. Lithic materials indicate a greater reliance on high quality cherts (HP 3 = 3%, HP 7 = 9%) and substantial processing of hides. There is only one jade fragment, but this appears to be from an ornament or from a fine woodworking tool or knife, rather than a heavy duty adze. In addition, the only copper tubular bead, zoomorphic sculpted stone, complete maul, cache of spall scrapers, eccentric chipped stone, and other stone pendants found at the site are from HP 7. Overall lithic assemblage characteristics are quite similar between the HP's 3 and 7 floors, including basic types and densities (Vol. II, Chap. 11). However, there is a significantly greater diversity of wood species, of seed remains, and a greater density of seeds in HP 7 than HP 3 paralleling the trends in faunal densities and diversity in these housepits (Vol. II, Chaps. 4 and 7). Housepit 12 has even lower taxa diversity and densities as do the other small housepits (Vol. II, Chap. 5). With the exception of small wealthy/specialized housepits such as HP 9, these results indicate that the relative intensity and range of plant and animal use increases (in a statistically significant fashion, independent of sample sizes) as housepit size increases. The fact that HP 7 faunal remains are three times as dense as HP 3, but that the lithic density is less than twice as great indicates that something more is involved than simple length of occupation (assuming little variation between these houses in stone tool consumption per person). Minimally, it would seem that at least part of the increased density of floral, faunal, and lithic artifacts in HP 7 may be due to greater economic ability to bring technological, prestige, and food resources into the pithouse and process them more intensively. Part of the differences in density may conceivably be due to a longer use of the last floors of the larger houses (from the last reroofing and floor cleaning event to the abandonment of the pithouse). However, it would be an unusual coincidence for the length of use of the three housepits to vary exactly in tandem with their size. Moreover, statistical analysis of botanical remains clearly indicates that some factor other than sample size or length of occupation played an important role (Vol. II, Chap. 4).

Remarkable stability is demonstrated in the use of different chert sources by the residents of large housepits (HP's 1, 5, and 7) from the initial occupation of these structures to their last occupation (Hayden et al. 1996; Vol. I, Chap. 16). This indicates stability in corporate access to specific chert resources over more than a thousand years, together with continued ownership (and use) of the same house site by the same corporate group over the same period of time. Similar stability is displayed by the unchanging position of hearths, large storage pits and large postholes over the lifetime of the larger structures.

Analysis of the salmon remains from the floor of HP 7 indicate a significantly greater access to a greater variety of salmon species and a higher proportion of more valuable fish than either in HP's 3 or 12. Over a third of the salmon vertebrae on the floor of HP 7 were from 3- to 4-year-old fish, i.e., most likely sockeye or spring salmon. In other culture areas such as Micronesia, specific species of fish also were preferentially used by elites as prestige foods (Ayres et al. 1992). The HP 7 salmon remains appear to represent substantial control and probably ownership over some of the more productive fishing locations in the area. Analysis of salmon vertebrae from test trench excavations in other large housepits such as HP 1 supports the indications from HP 7 that larger housepits had greater access to more valuable salmon. Analysis of rim profiles, together with posthole and storage pit patterns indicates that there has been very little change in the dimensions of HP 7 during the length of its use. The same appears to be true of other large housepits (HP's 1, 5, and 8) as far as can be determined from test excavations. Thus, these large residential corporate group structures were also contemporaneous with smaller Plateau horizon houses, such as HP's 12, 90, 101, 110 (at the transition between horizons) and the lower occupation levels of HP 9.

Sources of Variability Between Housepits

From the above observations, it is clear that major differences between smaller and larger housepits are not due to temporal changes (e.g., as suggested by Richards and Rousseau 1987:32) nor to different abandonment conditions (Vol. I, Chap. 17). On the basis of organic discoloration of floor and roof deposits, it also seems unlikely that any of the housepit floors being considered were in use for less than 5–10 years while roofs may not have lasted much more than 10–20 years, especially if pine posts were used (Vol. I, Chap. 17). This observation combined with earlier observations on artifact density, make it seem unlikely that the length of occupation of the floors (between the first and last season of use under the last roof) can account for the dramatic differences observed between various housepit floor assemblages. I would estimate that all floors that we extensively excavated were used for over 10 years on the basis of discoloration of the matrix.

The major factors that do seem associated with variability between households are: the size of the residential corporate group (affecting the size of the structure, amount of storage, diversity and density of faunal, floral, lithic, and prestige remains, intensity of hearth development, and relative wealth), and specialization. Ethnographically, it is clear that specialized hunters were unusually prestigious and wealthy (Teit 1900:295; Romanoff 1992b:478–480). There were other specialists in the Lillooet communities as well, including shamans, chiefs, warriors, runners, police, and spokesmen for chiefs (ibid.; Ray 1942:229; Vol. II, Chap. 17). Some of these specialists may also have been accorded unusual status and wealth for their services. All such specializations probably required considerable wealth for proper training (Teit 1900:317–318) and validation, thus largely limiting these occupations to wealthy families. While many specialists such as spokesmen and runners may have been closely tied to the heads of powerful corporate groups, others like shamans and hunters may have sought a greater degree of independence either out of personal preference or to enhance their specialist image. These individuals in particular may have sought out more isolated residences on the periphery of the settlement and supported themselves in comfort on the basis of the additional economic advantages their specialized services provided or on the basis of economic support of their original patron corporate group. Among both northern Coastal and Interior groups a shamanistic vocation was an important means of acquiring wealth (Goldman 1940:365–366, 370; Kamenskii 1985:86).

Certainly, on the basis of the faunal analysis of salmon (Vol. II, Chap. 8), mammals (Vol. II, Chap. 7), and the lithic resources (Vol. I, Chap. 16), it appears that the large residential corporate groups were the major economic powers at Keatley Creek, controlling prime fishing locations, prime hunting and root collecting areas, and access to lithic sources. It was the surplus and wealth produced by the control over these resources that probably made it possible for specialists to exist who could become relatively wealthy and also live in their own independent small houses whether affiliated with a larger corporate group or not. While many poor families became common support personnel within the powerful corporate groups (see the following analysis in this chapter of variability within larger houses), other disenfranchised families apparently preferred to follow independent, relatively impoverished lives in small marginalized pithouses. On the Coast, such poor families had to wait until owners of resources or land had finished procuring resources for themselves, after which the poor could procure what was left for a fee (Swanton 1909:71). Similar ownership and use arrangements may well have characterized the Classic Lillooet communities. This model not only explains the substantial differences between households within the small range, but also accounts for changes in assemblage characteristics as the size of residential corporate groups increased. As will be seen subsequently, it also explains variations between households in the degree of hierarchical organization. In all cases, small independent households seem to have been very unstable and occupations of small housepits typically are ephemeral (Vol. II, Chap. 14; Vol. III, Chap. 11), lasting only a generation or less before they either ceased to exist or were reabsorbed back into larger corporate groups and their larger residences.

One trend which merits further attention is the relative abundance of fish versus mammals as well as the intriguing variability of the fish elements that dominate floor assemblages. The scarcer occurrence of fish bones in the poorer small housepits may well be due to the more complete consumption of fish, including bones used in soups which would not be preserved due to cooking. Fish bones occurring in larger houses may thus best be viewed as wastage of low value elements. Explaining why a few rare houses like HP's 9 and 105 have extremely high densities of fish bones dominated by spines and ribs is more difficult. One possibility may be related to the presence or absence of dogs. Desmond Peters indicated to me that fins were often given to dogs. Similar customs were common among other fishing groups with dogs (e.g., Albright 1984:63; Shnirelman 1994:174, 181). Fins contain the largest number of spines, and it may well be that other elements with little food value were also given to dogs. In other culture areas of the world, dogs are strongly associated with high status households, and at Keatley Creek, dogs were certainly part of the major households such as HP's 3 and 7 but appear to be absent in many small housepits (Vol. II, Chap. 10). Dogs presumably would have been fed the less desirable fish elements or stored fish that had spoiled (O'Leary 1985:79). In fact, fish bones were recovered from dog coprolites in HP 7. In contrast to this, there is no indication of the presence of any dogs associated with HP 9 where fish remains and especially spines are more abundant than anywhere else in the site. A comparable density of fish remains and spines occurred in HP 105, where some canid remains were recovered; however, the canid remains are from pit and roof deposits and may not have been contemporaneous with the last occupation in which the dense salmon bones occur. The only other obvious explanation for this unusual pattern of fish remains is that the occupants of HP's 9 and 105 for unknown reasons preserved fish fins while other households did not, or that they used different butchering techniques.

Variability Within Housepits

In addition to examining overall differences between housepits for indications of social and economic organization, one of the main goals of the investigations at Keatley Creek was to examine possible indications of socioeconomic organization within housepits. In order to investigate the full range of this socioeconomic organization, small, medium and large examples of housepits with clearly identifiable living floor deposits were chosen for excavation (see Vol. I, Chap. 1). The following discussion synthesizes the various lithic, faunal, and botanical indications of social and economic organization within small, medium, and large housepits. In general, it is apparent that as housepit size increases, indications of increasingly distinct and hierarchically arranged households appear, as well as evidence for internal specialization of domestic units.

Small Housepits

Housepits 9, 12, and 90 represent the most completely analyzed of the smaller housepits and represent the poorer and richer end of the spectrum respectively. With a floor area of 38 square meters, HP 12 probably accommodated 15–25 people divided into about 4–5 nuclear families (Vol. II, Chap. 11; Spafford 1991:24). Yet, in the spatial distributions of all materials recovered from the floor there is not the slightest hint of the

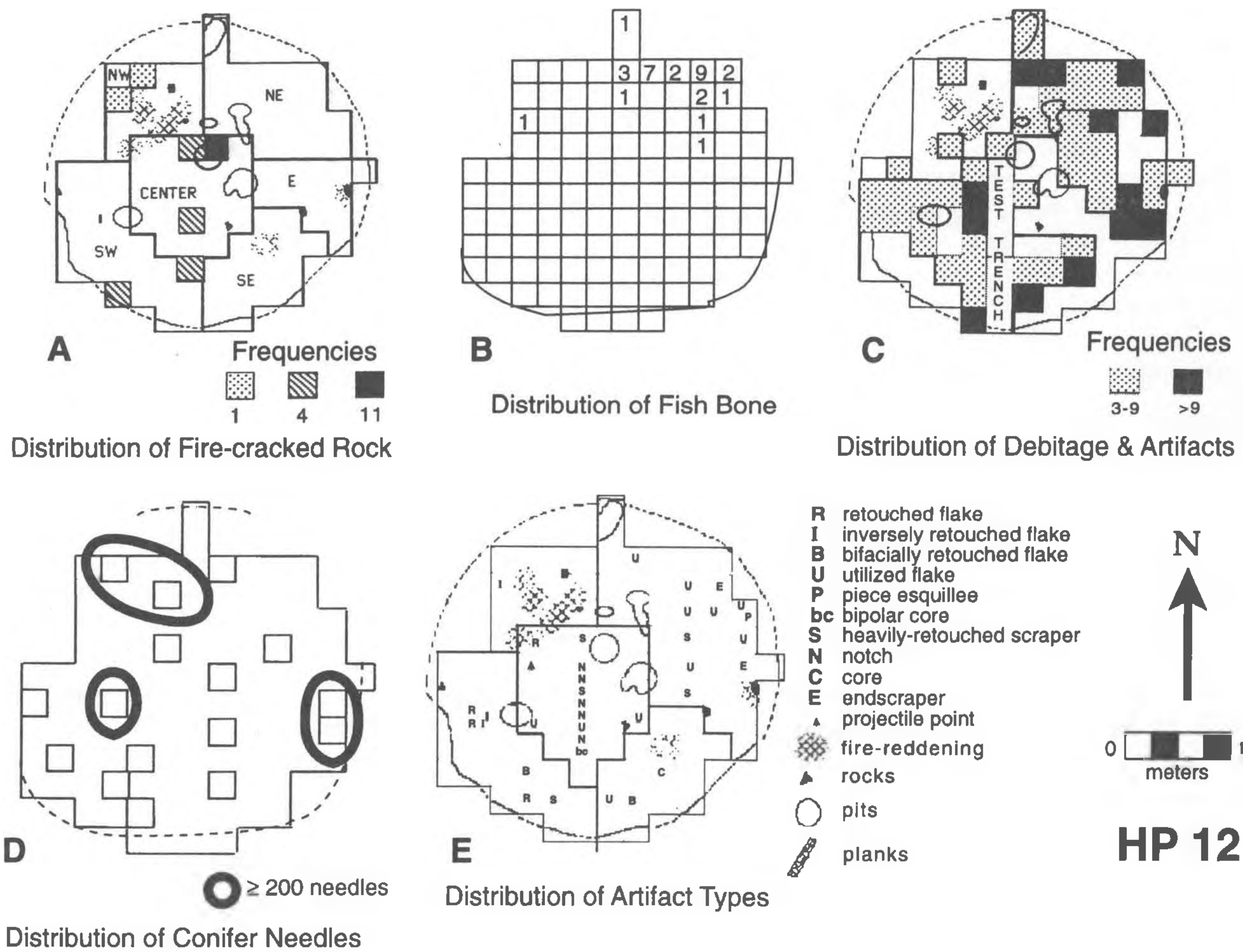

Figure 1: (A) Housepit 12 floor plan and distribution of fire-cracked rock; (B) distribution of fish bones; (C) distribution of debitage and artifacts; (D) distribution of conifer needles; (E) distribution of artifact types.

division of space according to independent domestic units. Instead, all activities seem to have been performed communally in designated activity areas. There is only one area of developed fire-reddening and the only real concentration of fire cracked rock is associated with it in the northwest (Fig. 1A). Similarly, there is only one concentration of fish and mammal bone on the floor (Fig. 1B), and it too is adjacent to the hearth whereas almost no chipped stone remains occur in the immediate vicinity of the hearth (Fig. 1C). Most botanical remains appear to be randomly scattered over the floor except for conifer needles (Fig. 1D) which tend to be most concentrated within 1–2 m of the house walls, as in other housepits. These conifer needle concentrations probably represent domestic unit bedding and sleeping areas. Lithic using activities seem to have been confined to two clearly separated areas (Figs. 1C and E) the northeast sector where the vast majority of utilized flakes and debitage occur, and to the southwest where pressure retouched cutting tools (expedient knives) together with debitage are concentrated. Notches form a third discrete activity area in the center of the floor.

Thus, while people may have slept in separate groups around the perimeter of the floor or together in one sector of the housepit which Alexander (Vol. III, Chap. 7) argues was the general case in small housepits, it appears that they conducted other activities in specialized, communal activity areas. They cooked and ate in the north, made sharp tools to cut up things in the southwest, worked on wooden shafts in the center, and made flakes for other activities in the northeast part of the floor. There are ethnographic accounts describing the "kitchen" being in one quadrant of the house with storage of meat, water, roots/berries, and firewood along the wall ledges of separate sides of pithouses (see the following chapter in this volume; also Condrashoff 1972; Teit 1909:492; 1912a:222). These accounts seem to correspond most closely to the interior communal organization of activities in small housepits although other oral accounts indicate that at lease wood was stored outside houses (Teit 1917:26; Kennedy and Bouchard 1977:Tape 4) and that there were no "rooms" with special functions (see following discussion). In our archaeological examples, there is no evidence of independent, competing, or hierarchically arranged domestic units. The economic activities and social organization appear to be consistent with what one might expect of a generalized hunter/gatherer group of affiliated nuclear families with no special access to, or control over, resources; and who cooperatively built a small earth-roofed shelter to maximize body warmth during the winter occupation. It is always possible that the local and comparative ethnographically documented densities for pithouses are misleading and that only a single nuclear family occupied HP 12, however, such an argument would have to be extended to the entire class of small housepits, and this scenario seems highly unlikely.

Material patterning on the floor of HP 90 seems fully consistent with the observations derived from HP 12. Although residents of HP 9 may have had a special status or may have been wealthier than residents of HP 12 and 90, the spatial artifact patterning is very similar to HP 12, with almost one half of the floor area used for sleeping, a condition that appears typical of small housepits (Vol. III, Chap. 7).

Medium Size Housepits

Housepit 3 is the only extensively excavated medium sized housepit at Keatley Creek. The floor area is twice that of HP 12 (78.5 square meters), and the number of occupants was most likely between 25 and 40, divided into about 6–8 nuclear families. In general, like HP 12, there is a strong indication that particular areas within the house were used for specialized activities and that space and activities were often viewed from a communal perspective. However, there are also some important indications that domestic units (comprised of nuclear or extended families) were much more independent and used the space around their sleeping areas in at least partially exclusive fashions.

Domestic Units

In detail, the four major support posts in the floor of HP 3 probably served to divide the interior space naturally into four peripheral zones (sectors) plus an open central area that probably served as a common zone for various activities (Fig. 2A). One of the strongest indicators that each of the peripheral sectors was occupied by an independent domestic group is the concentration of debitage and artifacts that occurs within each peripheral sector and appears to be separate from adjoining sectors (Fig. 2B). The fact that artifacts usually associated with male activities (billet flakes and projectile points—Spafford 1991:68,80) occur in all peripheral sectors in significant quantities, also indicates that these sectors were used by groups with similar compositions. About 50% of all the tools found in each sector occur in the same proportions (Vol. II, Chap. 11) indicating a fairly high level of activity redundancy in each peripheral sector which is also consistent with separate independently functioning domestic units. Each of the peripheral sectors also has an anvil and an abrading stone (Vol. II, Chap. 11, Fig. 2; Spafford 1991:122) each of which might be expected to be used by an independent domestic group. The high concentration of conifer needles around much of the periphery of the floor (Fig. 2C) is a further indication that people slept along the walls in each sector, presumably together with other members of their domestic group.

These interpretations are consistent with stories, myths, and oral histories that refer to houses having sleeping benches extending out 4–6 feet from the wall around the entire inside with individual sections for each family created by mats hung dividing the periphery into "rooms" (Teit 1898:59; Kennedy and Bouchard 1977:Tapes 1 and 2; Condrashoff 1980; Laforet and York 1981:120). Some of these accounts clearly state that there were no special function or named rooms in pithouses, only family sleeping areas (Kennedy and Bouchard 1977). From our archaeological results, such descriptions seem most applicable to medium and large housepits.

Communal Activity Areas

Despite the basic spatial independence of domestic units in HP 3, there are a number of indicators that the residents used portions of the floor in a communal fashion and cooperated in some basic activities. Coastal ethnographers observed that much food was prepared by slaves (Jewitt 1974:65; Oberg 1973:87; Garfield 1966:29) and shared communally (Oberg 1973:30), which may account for the communal patterning of food remains. Slaves also performed the most onerous and mundane tasks. On the basis of observations made during the excavation of HP 3, there appears to have been only one main hearth (in the south) regularly used during the terminal occupation, although the distribution of both charred seeds, charcoal, fire-reddened earth, faunal remains, and phosphorous on the floor

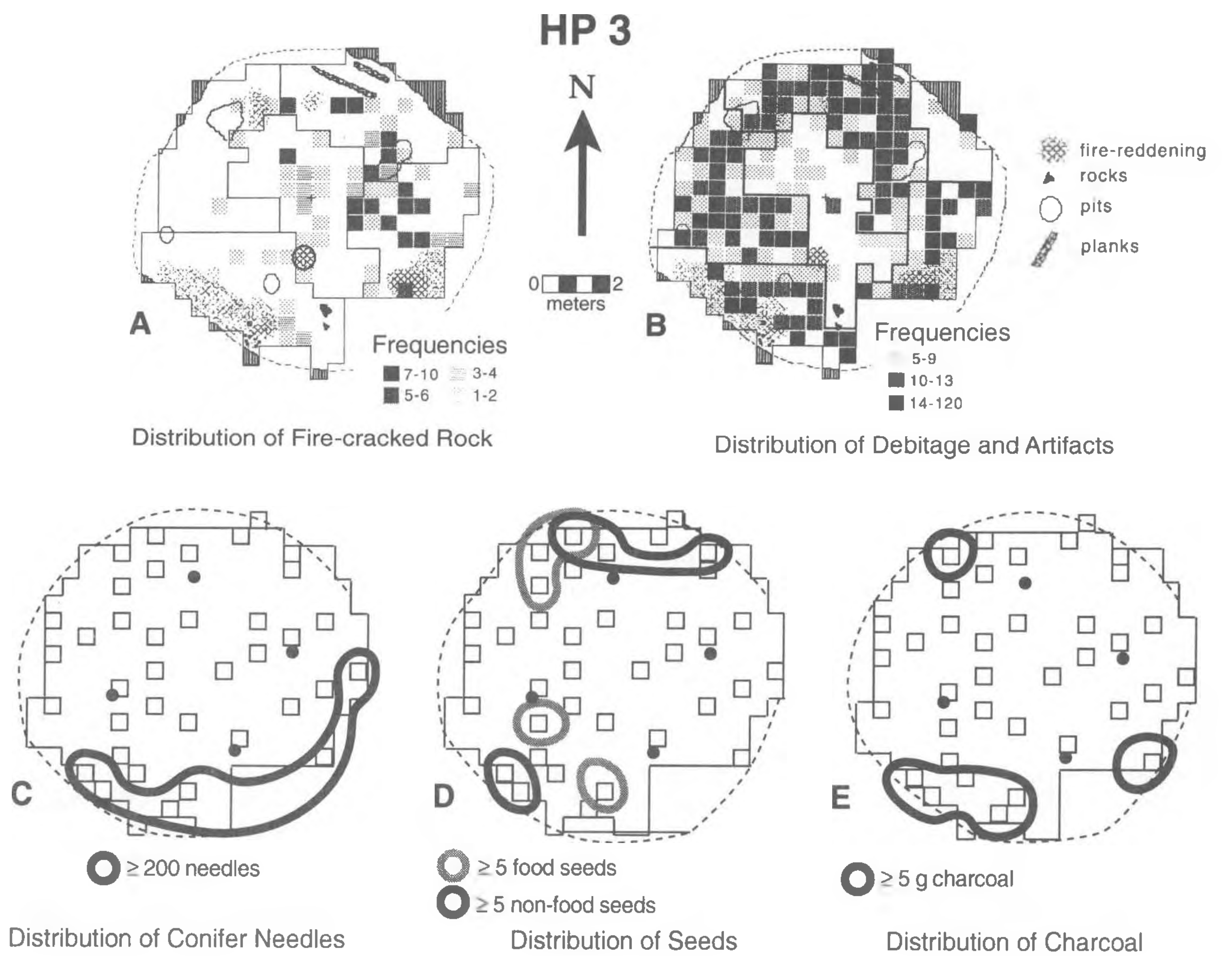

Figure 2: (A) Housepit 3 floor plan and floor distribution of fire-cracked rock; (B) floor distribution of debitage and artifacts; (C) floor distribution of conifer needles; (D) floor distribution of charred seeds; (E) floor distribution of charcoal (in g).

(Figs. 2D and E) strongly indicate that a second hearth in the northwest was also being used at least occasionally, thus implying some degree of differentiation within the pithouse. Even more ephemeral hearths seem to have been used at two other locations, near the southwest wall and the southeast wall. All three of the minor hearths near the house walls are characterized by concentrations of charcoal, some food seeds, utilized flakes, expedient knives, and debitage. The lack of association with fire cracked rocks and the relatively superficial degree of fire-reddening may indicate that these were hearths primarily used for warmth in exceptionally cold weather as described by Hill-Tout (1978a:58). There is only a single substantial concentration of fire cracked rock (Fig. 2A) which may be related to the communal use of the central hearth for most cooking, although two minor concentrations of fire cracked rock occur near the hearth in the northwest. A similar pattern of small clusters is much more apparent when the distribution of mammal bones is examined (Fig. 3A). Fish bones (Fig. 3B) can also be divided into 2–4 clusters corresponding in part to separate sectors although they tend to cluster around the central common zone.

The concentrations of charred seeds is very discrete and occurs primarily adjacent to the south and north hearths. Whether these concentrations simply reflect the fact that seeds close to hearths are likely to be charred while seeds not adjacent to hearths will not be charred, or whether these concentrations reflect use of these hearths areas by one or more domestic units for processing seed plants is difficult to determine in this housepit, although the concentrations of some chemical elements such as phosphorous may indicate real activity differences involving plants. The complementary distribution of seeds and animal/fish bones is interesting—indeed, it is not clear why the concentration of fire cracked rock, debitage, fish bone, and mammal bone in the eastern sector is not closer to any hearth unless it served as a dumping or

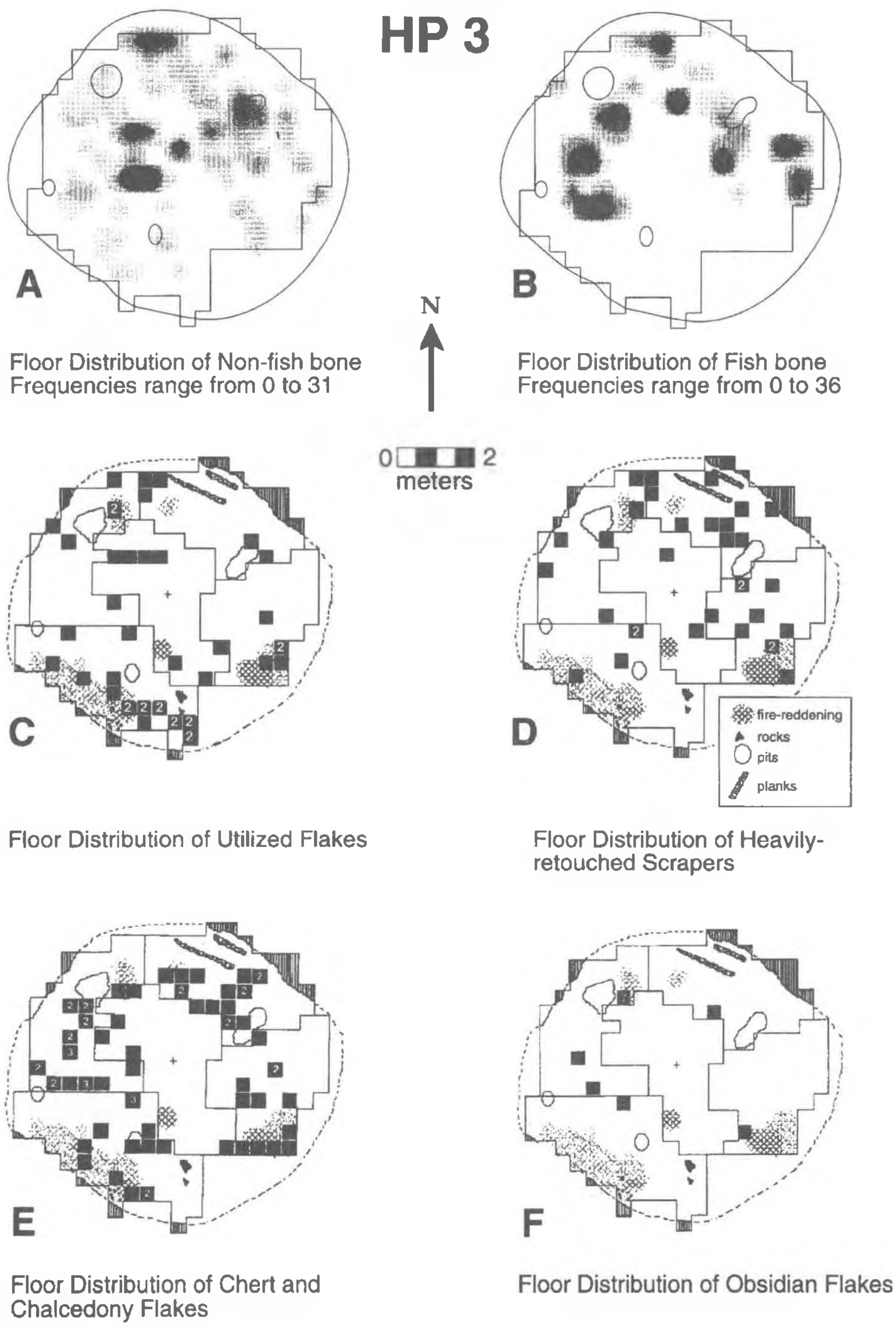

Figure 3: (A) Housepit 3 floor distribution of unidentifiable mammal bones; (B) floor distribution of fish bones; (C) floor distribution of utilized flakes; (D) floor distribution of heavily retouched scrapers; (E–F) floor distribution of chert, chalcedony, and obsidian flakes.

storage area for FCR and other provisionally discarded items such as occurs near doorways.

The distribution of large storage pits displays a north-south dichotomy (Fig. 3), while the storage pit in the east may have been used during an earlier, Plateau horizon, occupation based on the presence of a Plateau style projectile point in its fill. Chemical analyses of floor samples indicate prominent food preparation or consumption activity in all of the peripheral sectors except a small part of the east periphery (based on concentrations of P and Ca), with especially strong values near the north and south hearths.

A closer examination of the distribution of stone tool types and material across the floor also reveals some communal use of space. As with HP 12, the central area is generally devoid of artifacts and bones, but within and immediately adjacent to this area there is an unusually high concentration of notches indicating that the working of wooden shafts probably took place here—possibly due to the need for space or due to the amount of debris that might be produced. Another strong pattern involves the complementary distribution of utilized flakes versus scrapers in opposing (northeast versus southwest) sectors of the floor (Figs. 3C and D). These impressions are reinforced by the distribution of some of the rarer types of tools such as piercers, small billet flakes, and bifacial knives which occur exclusively or predominantly in the southwest; whereas hammerstones occur exclusively in the northeast and are associated there with unusually high debitage densities (Vol. II, Chap. 11). Chemical concentrations of potassium in the floor sediments mirror these stone tool distributions almost exactly (Vol. II, Chap. 6). Spafford has suggested that the northeast may have been used preferentially for making stone tools since the light would be best in that sector, perhaps constituting an occasional congregation area for males. Kusmer's observations that the fish bone in this sector is highly pulverized and indicates an unusual amount of foot traffic is supportive of the idea of periodic congregations of people here also. Similar arguments can be made for the debitage concentrations in northeast sectors on the floors of HP's 7 and 12. In contrast, the southwest may have been an occasional congregation area for women working on hide clothing, basketry, or other crafts, thereby accounting for the presence of piercers, utilized flakes, and other types of chipped stone with sharp cutting edges.

If some areas were used as occasional congregation and work areas for men and women during the day, the underlying distribution of general debitage, artifacts, and food remains seems to indicate that they were also used as residential areas for domestic units at other times. The presence of food remains and the carbonized remains of conifer needles and wood planks along the wall in the northeast are strong indications that this sector was not simply a workshop area, but the residence area of a domestic group.

Specialization and Status Indicators

There is also some indication of specialized behavior and possible status differences in the floor assemblage of HP 3. The occurrence of only two regularly used hearths at opposite ends of the house each of which is associated with a storage pit, indicates possible centers of somewhat higher status. The heavy concentration of chert, chalcedony, and obsidian flakes as well as Kamloops points in the northwestern sector (Figs. 3E and F—see also Vol. II, Chap. 11) strongly suggests an emphasis on hunting and traveling not present in any other sector. The statistically significant concentration of cherty raw materials in the northwest cannot easily be accounted for in terms of a special activity area since the tool types there are much the same as in the other domestic sectors. The unusual concentration of cherts is much more readily explained as the result of specialized economic roles of some house residents. As Teit (1900:295) and Romanoff (1992b:478–480) stress, hunters were much richer and more prestigious than most other people and presumably would have had greater access to high quality raw materials both in their hunting trips and in their exchanges.

The only other apparent location for a domestic group of unusual status or specialization is in the south where there are no fish or bone remains, but where the main hearth, a storage pit, and a high concentration of conifer needles occurs. Other than this, there is not a great deal to indicate substantially different status of residents in the south sector, although an analogous situation occurs in the much larger floor of HP 7, where it is clear that something different is taking place. The position of a tentative specialized hunter in the northwest sector of HP 3 in opposition to a possible domestic group of high status in the south is also interesting because the same opposition also seems to occur in HP 7, the largest housepit to be analyzed. It is also interesting that the concentrations of phosphorous in the floor deposits of HP 3 displays a similar bilocal distribution centering on these two opposite sectors.

Medium-Sized Housepit Summary

While not every sector of HP 3 or every domestic group may have used their own hearth, cooking rocks, or food preparation/consumption area on a regular basis (contra the ethnographic pattern reported by Nastich 1954:23), there do appear to be three areas near the walls where these activities intermittently took place and which can be related in a general fashion to the peripheral sectors. Thus there are some indications of independent domestic groups within HP 3, but also indications of more regular cooperation between domestic groups and a moderate communal ethic as might be commensurate with a corporate group controlling resources of only moderate value. Only the most modest indications of status differences or domestic specialization are discernible from the floor remains, although it is clear from the overall assemblage that residents were investing in some prestige items (copper sheets, graphite crayons, nephrite adzes, soapstone pipes, dogs, obsidian). Whether these objects were owned by the most important members of the household, or were more communally owned and used for group displays cannot be determined. In all of these characteristics, the social and economic organization displayed in HP 3 is clearly intermediate between the communal organization of small poor housepits and the highly individualized, hierarchical organization displayed in the larger housepits, to which we now turn.

Large Housepits

Housepit 7 is the only large housepit that was extensively excavated. It has a floor area of 113 square meters which is about one and a half times larger than HP 3 (and three times larger than HP 12). An estimated 40–55 people resided in the house constituting about 9 nuclear families. The patterning of material remains on the floor of this structure is quite complex and apparently affected by a number of different factors. Nevertheless, there are several very strong patterns which will be discussed first, followed by a discussion of minor patterning.

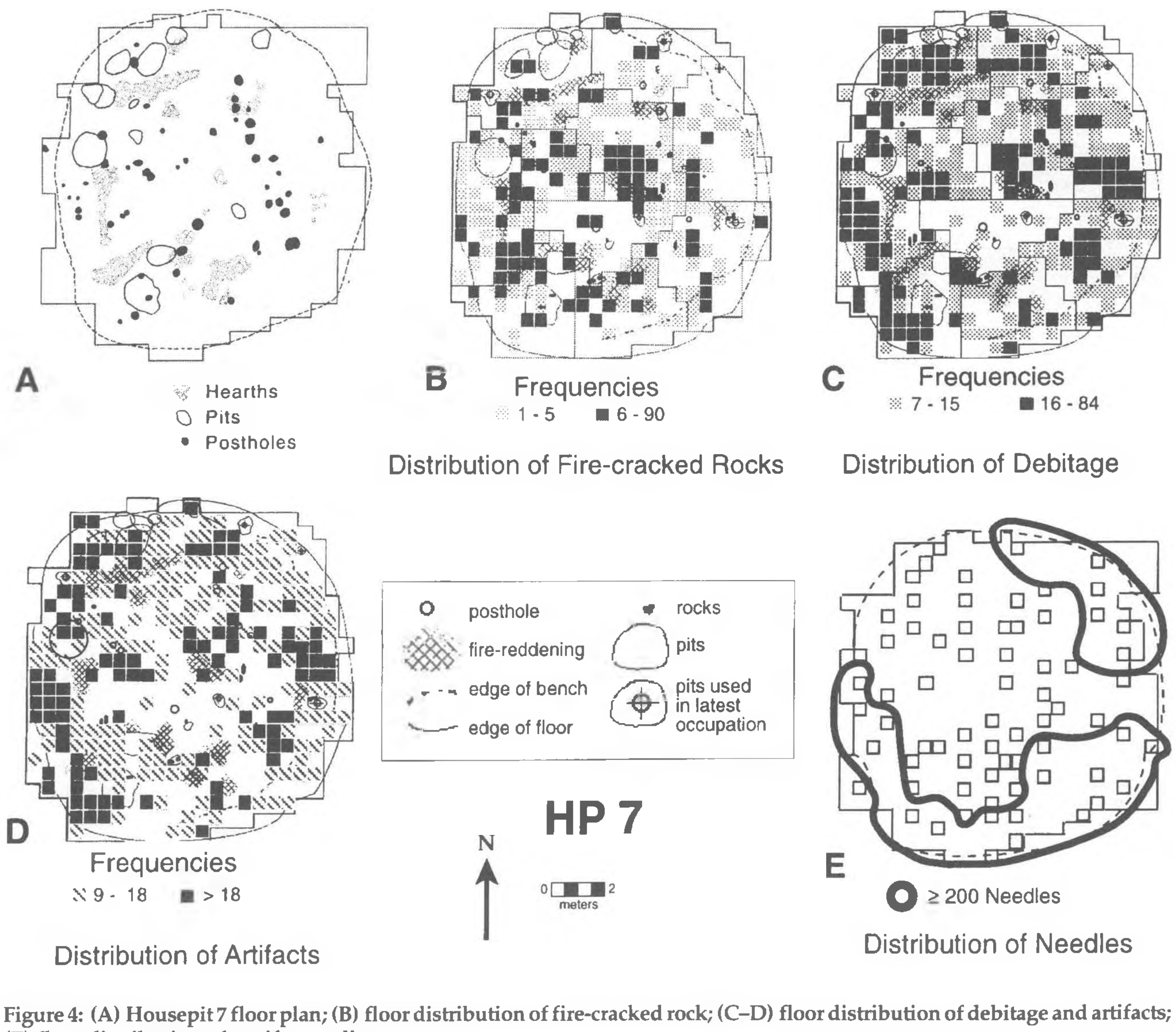

Figure 4: (A) Housepit 7 floor plan; (B) floor distribution of fire-cracked rock; (C–D) floor distribution of debitage and artifacts; (E) floor distribution of conifer needles.

Domestic Units

To begin with, the most striking aspect of the HP 7 floor is the concentric ring of hearths that occur 1–3 meters from the wall. It is interesting that on the Coast, domestic hearths occur about a similar distance from the house walls (2–4 m) and also form a concentric pattern, oblong in shape since the houses are rectangular (Samuels 1991:204). In HP 7, there are six to eight of these hearths in addition to one or two minor hearths in the central area (Fig. 4A). Most of these hearths, with the possible exception of that in the northeast sector, are associated with their own discrete cluster of fire cracked rock (Fig. 4B). As previously noted, Nastich (1954:23) observed that ethnographically, each family had their own cooking rocks and presumably their own hearth. Each hearth is also associated with its own discrete cluster of debitage and modified tools occurring between the hearth and the adjacent wall (Figs. 4C and D). As an initial assumption, it can be postulated that each of these hearths was used by a separate domestic group. This idea is supported by the occurrence of one or two abrading stones in almost every sector containing a hearth as well as anvil stones spaced between hearths. There is also a basic background similarity of artifact type frequencies in all peripheral sectors accounting for about 50% of the lithic tool variability similar to the pattern observed in HP 3 (Vol. II, Chap. 11; Spafford 1991:119). Among other hunter/gatherers, simple grinding stones or mortars similar to the Keatley Creek abraders are owned or used by separate families (Peterson 1968).

Further support for viewing each peripheral hearth as the locus for an independent domestic group is provided by the distribution of conifer needles which concentrate heavily in the zone between the hearths and the wall (Fig. 4E). Interestingly, high densities of both food remains (salmon and mammal bone) and chemical elements that reflect food processing or consumption (especially phosphorous) only occur around a few of the hearths, probably indicating the cooperative use of hearths by 2–3 domestic groups for most meals although each domestic group also had the facilities to prepare their own meals for special or other occasions. I will return to this topic below. Most of the artifact associations of the peripheral domestic areas also characterize one of the hearths in the center northeast sector of the floor, indicating another possible domestic unit located in the central area of the floor, possibly the residence of a low class or slave domestic group.

Class Differences

In addition to the basic pattern of independent domestic groups arranged around the periphery of the floor, there is a dramatic division in the character of the floor between the western half of the floor and the eastern half. This division is apparent in terms of features, stone artifacts, and faunal remains. The hearths in the west are all unusually large and well developed, with fire-reddening typically extending at least 8 cm into the sterile till (Fig. 4A). In contrast, hearths in the east are nearly all small and poorly developed extending 2–3 cm into the till at most. The major hearths in the west are all associated with one or more large storage pits, whereas no large storage pits occur in the east. Instead, an unusually high density of small pits and postholes occurs in the east part of the floor (Vol. III, Chap. 4). There is also a distinctive ledge or "bench" cut into the till along the eastern wall, whereas no such feature is apparent in the west.

Except for a small concentration of fish bone in the northwest, fish bone is overwhelmingly concentrated in the eastern half of the house (Fig. 5A). Although fragmented mammal bones (Fig. 5B) are more uniformly distributed around hearths on both sides of the house (except in the southwest sector), burned bone concentrates almost exclusively in the west half of the house. This may indicate little more than the fact that hearths in the west were more frequently used and scrap bone was therefore burned more frequently by accident; or it may indicate more roasting of meat with bones in the west half of the house.

In terms of lithics, most tasks seem to have been undertaken by residents on both sides of the house; however, there are some strong indicators of differential use and access roughly following the east-west division of hearths. Nearly all the cores are concentrated in the western sectors, together with a statistically significant preponderance of cherts, chalcedonies, primary flakes, and most large billet flakes in the west (Figs. 5C and D; Vol. II, Chap. 11; Spafford 1991:99–100, 109–110, 142–143). Teit (1909:645) recorded that "arrowstone" was a rare material, and therefore would presumably have been kept by those in control of house resources. Prentiss (Vol. I, Chap. 13) also observes a distinctive debitage pattern occurring only along the walls of the western part of the house involving a combination of bifacial and prepared core debitage. Finally, although only lithic tools from the Western sector of the floor were analyzed for use-wear, a surprising proportion of these tools displayed wear related to ochre preparation and the carving of soft stone materials (Vol. II, Chap. 3). While we have not been able to extend this analysis to other domestic areas, it seems highly unlikely that these activities would dominate the entire floor assemblage or even many sector assemblages. Both ochre preparation and soft stone carving (for pipes and sculptures) are likely elite activities and it even seems unlikely that they would occur to any significant extent in small, poor households.

How are these observations of differences between the east and west sides of the house to be interpreted? One suggestion is that special areas in the east constituted special activity areas for eating fish (although they were stored in the west) and that people preferentially kept cores and primary flakes in the west (although they were used everywhere). While there is at least one relatively good case to be made for a specialized activity area in one of the eastern sectors (to be discussed shortly), the explanation for the overall differences between the east and the west on the basis of specialized activities is unsatisfactory for several reasons. First, the basic similarity between all hearth areas on both sides of the house in terms of their associations with cooking rocks, anvils, abraders, conifer needles, debitage and artifact concentrations, simply is too strong to represent special activity areas. These similarities make much more sense in terms of domestic groups each with their own economic and food processing materials. Second, among all hunter/ gatherers and tribal groups that I am familiar with, food is principally consumed around hearths (e.g., Bartram et al. 1991; Hayden 1979:147, 160). In HP 7, it seems clear that the largest and most frequently used hearths occur in the west, together with the storage pits where large amounts of salmon were kept. To explain the fish bone distribution pattern on the basis of activity areas would mean that everyone in the house stored and cooked their fish in the west and then that they *all* moved over to the east side of the house (where fires seem to have been seldom lit) in order to eat their fish. Moreover, this would contrast with their pattern of processing mammal bone which took place around most hearths.

Such a scenario seems highly improbable. A far more plausible explanation would involve several domestic groups congregating for most meal preparation and consumption in a few locations within the house and/or the preparation of meals by slaves or very low status members of the household as documented ethnographically in the discussion of HP 3. From this

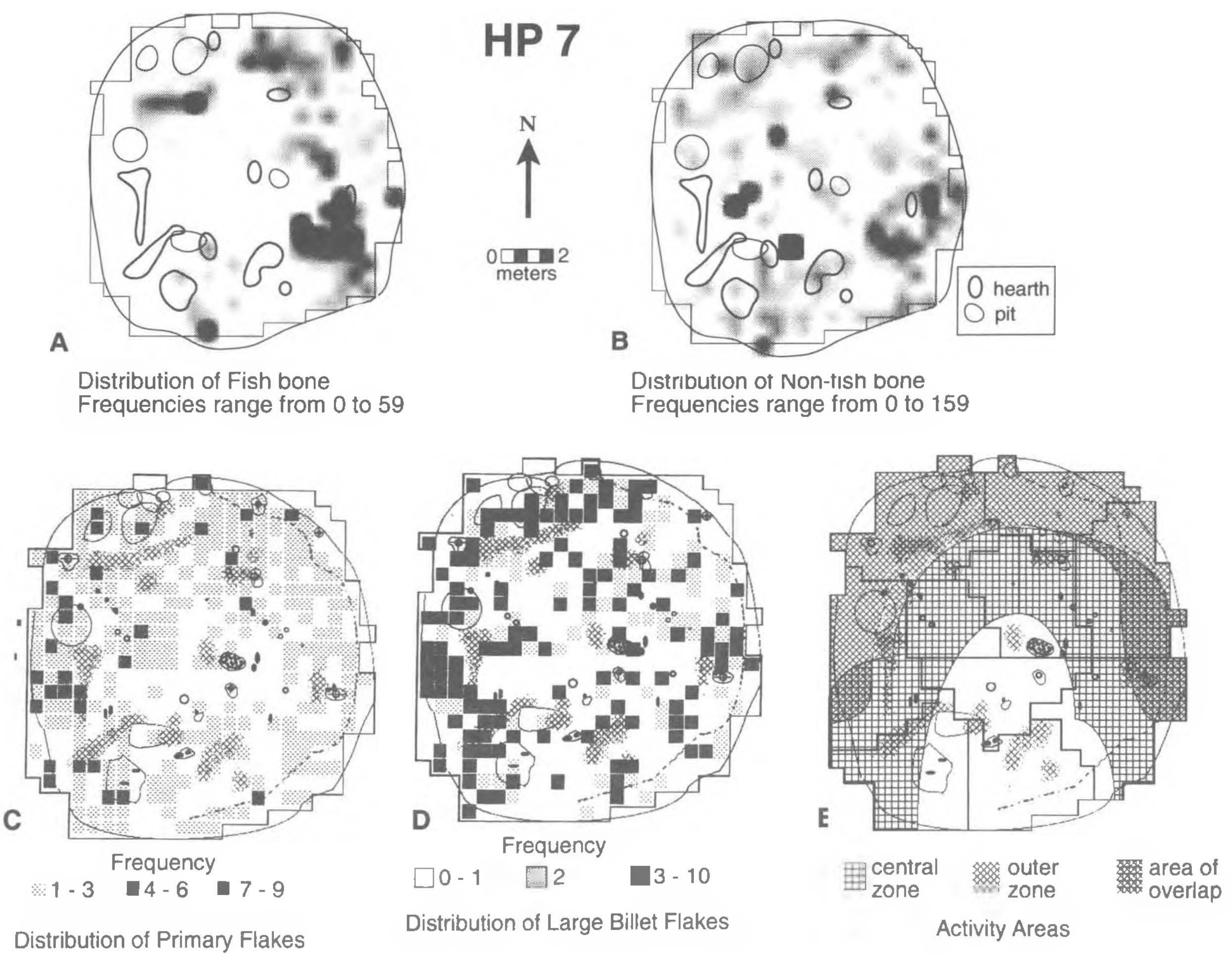

Figure 5: (A) Housepit 7 floor distribution of fish bone; (B) floor distribution of mammal bone; (C) floor distribution of primary flakes; (D) floor distribution of large billet flakes; (E) the division of the floor of HP 7 into basic lithic zones.

viewpoint it is not only interesting that archaeological houses in the Coast display a remarkably similar pattern of 2–3 loci with heavy food fauna concentrations in houses with six or more domestic hearth locations, but also that low ranking domestic groups on the Coast had more bone remains than the higher ranking ones (Samuels 1991:262–266; Huelsbeck 1994:53–58, 81). This last observation seems to parallel observations within HP 7 where the highest densities of fish bone and much mammal bone is associated with domestic groups that appear to be low ranking on the basis of other indications. While there is no simple explanation capable of accounting for all the patterning involved, the notion that most hearths on both sides of the floor were sleeping and activity areas for separate domestic groups and that there was a fundamental socio-economic division in the status of the domestic units on each side of the house seems to account for far more of the patterning observed than any alternative scenario.

In the first place, ethnographically, both on the coast and specifically in the Lillooet region of the Interior, there were separate social classes consisting of hereditary elites, commoners, and slaves. Secondly, ethnographies, stories, and myths of the Lillooet clearly refer to slaves and servants as living in the same house as their masters and undertaking menial house chores such as cooking, bringing firewood or water, and hideworking (Teit 1900:268; 1912a:242; 1912b:318, 320; Nastich 1954:23). Slaves also lived with their masters on the Coast where they could constitute half of a house's residents (Jewitt 1974:65). In the same vein, Drucker (1951:279–280) reports that at least some low ranked tenants or retainers occupied the same houses as elite families, while Bolscher (1989:50) reports that nobles always outnumbered commoners. These observations are remarkably similar to Teit's (1909:576) observation that one half to two thirds of some Interior groups were elite families. Ray (1942:228–229) also reports that slaves lived in the same house as their masters for *all* Plateau groups, although commoners sometimes lived apart from nobles. While it may not be entirely justifiable to infer prehistoric socioeconomic organization only on the basis of early historic behavior, the existence of such patterns in early historic times certainly makes it seem likely that the same type of basic organization could have occurred prehistorically especially when supported by archaeological patterning.

A third reason for accepting the interpretation that half of HP 7 was occupied by elites and half by low ranking families is that the same pattern has been documented in longhouses excavated at the Tualdad Altu and Meier sites on the Coast (James Chatters 1989:176–177; Ken Ames, personal communication). Given the strong contacts of the Lillooet region with the Coast and the overall similarities in economy and other aspects of social organization, these well documented Coastal occurrences lend support to the notion that similar basic residential and socioeconomic arrangements could have existed in the larger, more powerful, Interior corporate group houses.

Thus, the existence of privileged and disadvantaged domestic groups in the same house seems amply documented by the archaeological remains in HP 7, with the hearths in the west constituting the domestic areas of the families with inherited rights to the control of corporate affairs in the group, and in particular with inherited ownership rights to the best fishing locations (as ethnographically documented at The Dalles—Spier and Sapir 1930:175). If families residing in the west part of HP 7 had greater economic and social control within the pithouse, this would explain why their hearths were larger and more developed (assuming firewood was generally difficult to procure due to deforestation in the immediate vicinity of the site for winter fuel and house construction), why their domestic areas contained the only large storage pits in the house, why cherts and chalcedonies concentrate in the west, and why cores and primary flakes also concentrate in the west (assuming that lithic materials of all types were limited in supply and therefore valued).

The poorer status of the east may also explain why dart points occur predominantly in the eastern half of the house, assuming that bows and arrows were relatively recent introductions used initially by elites while the older, simpler, atlatl technology would have persisted longer among poorer residents (Vol. I, Chap. 3). Similar technological differences between the privileged half and the poorer half of large houses on the Coast have been documented by Chatters (1989:176–177) and Ken Ames (personal communication). In both cases, the newer technologies (harpoons in one case, metal blades in the other case) are restricted to the privileged half of the houses while earlier hunting technologies characterize the poorer halves of the houses.

In addition, elite families would have had by far the greatest access to deer meat (Romanoff 1992b). In this respect the curiously elongated hearths in the southwest, west, and northwest sectors may well have been occasionally used for the drying of deer meat which was critical for the holding of potlatches (ibid.). Even today, as Desmond Peters demonstrated to me, elongated hearths are built under long meat drying racks for the jerking of deer meat (Fig. 6). Teit (1900:234) probably refers to these types of racks when he states that meat was dried on poles above fires inside lodges. Similarly elongated meat drying racks and hearths are also reported among other hunter/gatherers (Fisher

1993:257). As the least valuable part of any game brought into the house during the winter, many bones might be shared among all the domestic units in the house, elites, commoners, and favored slaves alike. Because of the rarity of winter kills, elites might also be expected to use some of the bones for soups. The sharing or recycling of bones from even the choicest cuts of meat with slaves was certainly practiced in colonial America (Crader 1990) and on the basis of the indications in HP 7, may have been a common strategy of elites to maintain the interest and loyalty of supporters without giving away the most desirable benefits of elite status. This may explain why all the identifiable artiodactyl remains occur in the east and central sectors. Given a similar low density of mammal bone in high ranking Coastal households, Samuels (1991:202) and Huelsbeck (1994:53) suggested that low ranking domestic habits may have left much more food refuse on housefloors whereas high ranking domestic areas may have been more meticulously cleaned. Samuels cites ethnographic support for this interpretation. Thus, status related cleanup behavior may also account, at least in part, for the differences in bone densities between the two sides of the HP 7 floor. On the other hand, these authors also suggest that bony portions of fish and meat may have been largely given to the poor.

Similarly, I have observed that there is a significant amount of meat which remains attached to the backbones of salmon after filleting. These backbones, or "neckties" are bundled up separately from the boneless fillets (Kennedy and Bouchard 1992:292, 294; Romanoff 1992a:235). Most people today do not even bother keeping the backbones since they are no longer essential for survival. Backbones were probably considered less desirable as food than the fillets undoubtedly because of the small amount of food on them and the effort necessary to extract the dried flesh. Thus, given the abundance of dried salmon in most years, it does not seem surprising that elite families would prefer to eat only the dried boneless fillets and would pass on most of the less desirable backbones to lower status members of the household. Nastich (1954:46) records that Lillooet slaves were given only "leftovers" to eat. Even in contemporary industrial society elites tend to eat prime boneless cuts while lower classes eat cuts with large amounts of bone and even buy soup bones (William Rathje, personal

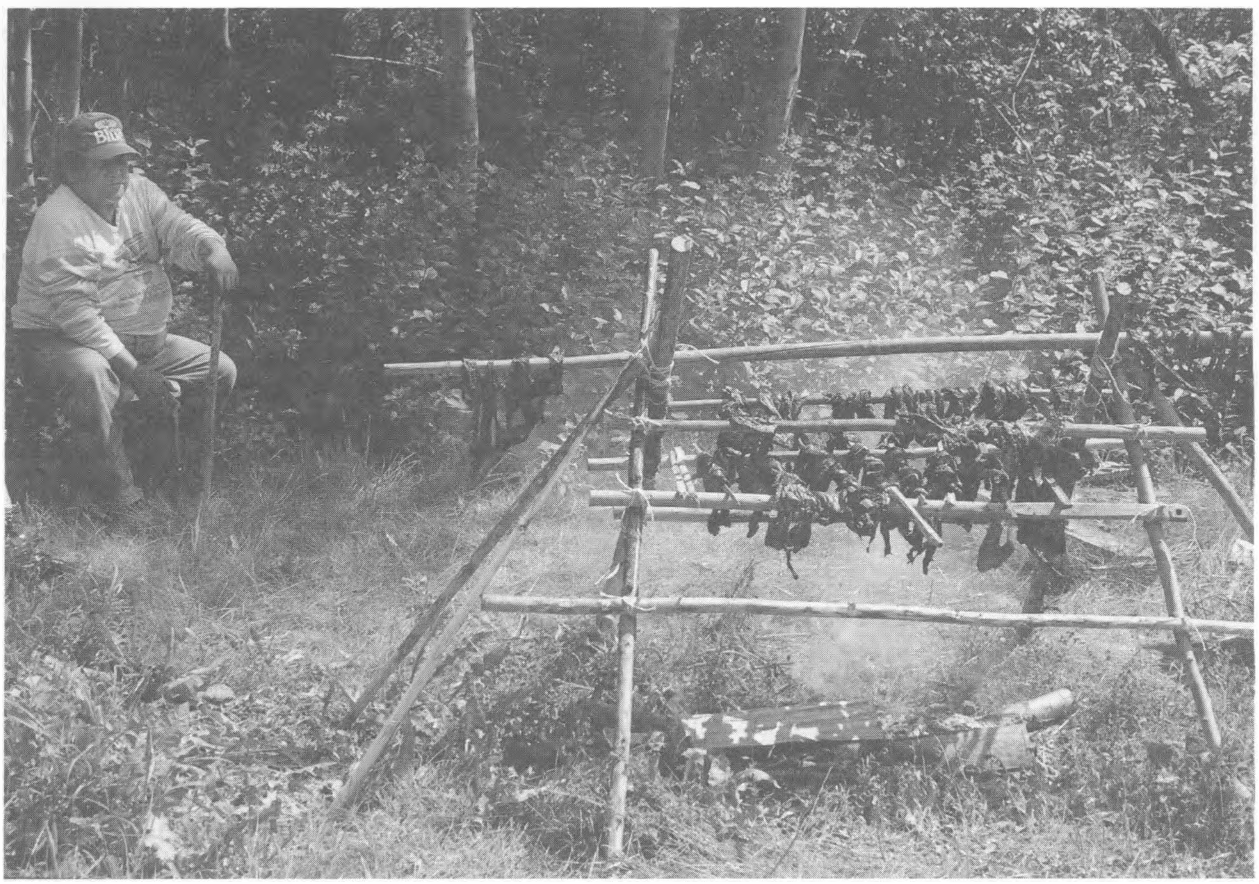

Figure 6: A traditional wood frame made by Desmond Peters, Senior (in photo) for drying and smoking deer meat. Note the elongated form of both the frame and the hearth. Similar elongated hearths occur on the floor of HP 7 (see Fig. 4A).

communication). Ironically, this would mean that for salmon the absence of bone might indicate either extreme wealth (because only boneless fillets were consumed) or extreme poverty (because everything, even the bones, was consumed). On the basis of the floor distribution of salmon bones in HP 7, it appears to have been largely commoners and slaves in well-off households which ate the meat adhering to the salmon backbones, but felt satisfied enough (and were careless enough) to discard some of the remaining bones without boiling them up in soups. Most such bones were undoubtedly gathered up periodically and thrown on the roof for dogs to eat, however enough random pieces escaped housecleaning to provide striking distributional patterns across the floor of HP 7.

One of the duties of slaves was to cook for the families in the house of their owners (Teit 1912a:242), and the dense concentrations of salmon bones in the eastern sectors of the HP 7 floor may also represent general cooking or food preparation activities on the part of slave or low ranking families for general household consumption although the small and weakly developed hearths in the east half of the house argue against this interpretation. An alternate possibility might be that the vertebrae on the floors which are dominated by pink salmon, represent fish caught and eaten during the late fall pink runs by the commoner residents of the houses while the higher status families traveled into the Montane Parklands for the most productive and valuable hunt of the year.

Finally, because the eastern half of HP 7 is actually dug out of the side of a terrace slope, it was most susceptible to water seepage and even some roof collapse as revealed in the strata (Vol. III, Chap. 4). This provides a good practical reason why the eastern half of the HP 7 floor might be a less desirable location for domestic residences, and why elite families would have avoided the area. It also may explain why an earthen bench was created (i.e., to reduce seepage problems).

Specialized Activity Areas

These considerations are also potentially relevant in considering possible specialized activity areas. There are three of these: the northeast sector, the western floor center, and the southern floor center. In addition, different kinds of activities characterize the areas between the hearths and the walls versus the areas between the hearths and the center of the house.

Perhaps partly due to seepage and roof problems, but perhaps largely due to lighting considerations, the northeast sector of HP 7 (like the northeast sector of HP's 3 and 12) appears to have been a periodic place where people would congregate for craft activities. This may also have been the sector in which a side entrance could have been located. Whether or not it was also the residence of a lower status domestic group is difficult to determine, but the low incidence of fire cracked rock (Fig. 4B) associated with this hearth and the unusually low incidence of unidentifiable mammal remains (indicating, as does the analysis of heavy fractions of flotation samples, that little bone reduction occurred here—see Vol. II, Chap. 9) together with the high fish bone concentrations (possibly from snacking), the unusually high concentration of beaver incisors (associated with woodworking), and the emphasis on primary flakes to the almost complete detriment of billet flakes (Vol. I, Chap. 13; Spafford 1991:110), all make this sector appear unusual enough to warrant the suspicion that it was used as a special activity area. Prentiss (Vol. I, Chap. 13) also thinks that the neighboring, eastern sector may have been used as a corridor zone, but there are few other supporting indicators for this interpretation. Although the possibility of a family engaged in specialized craft activities associated with their domestic area in the northeast sector cannot be definitively ruled out, the suspected similar specialized activity areas in the northeast sectors of HP's 3 and 12 make this seem less likely.

Sometime before the abandonment of the house, a large amount of roof soil evidently collapsed down onto the floor of this sector and was never removed, but seems to have simply been left as a sloping intrusion onto the floor from the wall. While the roof was undoubtedly repaired, this made the northeast sector unfit for much besides refuse accumulation or storage, which may also explain some of the artifactual and faunal characteristics of the sector. The intrusion of the roof into the northeast sector may also explain the presence of what otherwise appears to be a relatively normal domestic hearth and associated artifactual suite in the northeast center of the floor. That is, a small domestic group being unable to occupy the northeast sector due to the accumulation of roof collapse may have simply set up residence somewhat further toward the center of the floor, away from the collapsed roof material.

The west central sector of the floor seems like an unlikely location for a domestic residence, and may have been simply an extension of the use of the floor by residents of the west and northwest sectors since it falls entirely within Spafford's "central zone" (Fig. 5E) as does the east central sector. In fact, the entire central area of the floor exhibits a distinctive debitage profile which Prentiss interprets as debitage from a combination of prepared core and bipolar reduction (Vol. I, Chap. 13).

The south central sector is perhaps the clearest example of a special activity area, but this is due to the extreme paucity of all classes of archaeological remains. The only obvious explanations for such a stark contrast with the rest of the floor involve high degrees of foot traffic as might occur at the bottom of a ladder, or a special ritual space such as the heads of Mandan pithouses systematically established (Wilson 1934). Although the loam that occurs primarily in this sector is probably a naturally occurring deposit within the till gravels, it may well have helped determine the house location. Grant Keddie (personal communication) informed me that at Canoe Creek, Jack Koster and his wife reported that "clay" was traditionally put on floors for dancing and that only larger houses were used for dancing. Given the absolute rarity of clay in the Interior, Koster may have been referring to fine loam or silt. Teit (1909:610, 669) also states that large houses were used for dancing and feasting, which would also make sense if they were the richest houses. The Pomo also put clay on dance areas in pithouses (Barrett 1975:49). In this respect, it is probably more than coincidental that HP 1, one of the largest houses at Keatley Creek, also has a loam floor in its south central sector, and in this case the loam may have been introduced or at least been displaced laterally.

While the identification of specific sectors as specialized activity areas is difficult and ambiguous at best in HP 7, it is more clearcut in HP 3, and still more apparent in HP 12. On the other hand, in HP 7, for each domestic area there is quite clear evidence for the use of the wall area (between the hearths and the wall), versus the central areas (on the opposite side of the major hearths (i.e., toward the house center) for different activities. Conifer needles, grass and chenopod seeds, debitage, cores, expedient knives, large billet flakes, primary flakes, projectile points, and heavily retouched scrapers all concentrate largely in the outer zone between the hearths and the house walls. Some of these occurrences appear to represent sleeping and storage activities. Ethnographic accounts from many groups report the use of raised wooden platforms for sleeping or the placing of a log parallel to the wall with the space between the log filled with boughs (Teit 1906:213; 1909:676; 1909:678; Laforet and York 1981:120; Bouchard and Kennedy 1973; 1977:64; 1985:35; Kennedy and Bouchard 1977:Tape 1; 1978:36). Platforms might be made of poles or planks (such as those recovered in HP 3). It seems highly likely that poorer small houses might only use mats placed directly on the ground for sleeping as described by Isaac Willard for the Adams Lake region (Kennedy and Bouchard 1987:262). It is difficult to tell how widespread each of these practices may have been prehistorically since raised sleeping platforms generally do not seem to leave clear archaeological indicators.

There is considerable evidence that the areas under the sleeping platforms and / or behind them, along the walls, were used for storage as a general practice throughout western North America (Hill-Tout 1978b: 109; Barrett 1975:39; Binford 1983:164, 180). These areas contained both food and personal effects. Other storage areas for more bulky items and food soon to be consumed, existed in the form of pole shelves or series of hooks that ran around the house or were at least part of every domestic area (Teit 1906:213; 1909:688; Laforet and York 1981:120; Kennedy and Bouchard 1987:262). In the largest houses, it is possible that some shelf-like constructions became substantial platforms or lofts which were also used as landings for entrance ladders. Such a feature could account for the line of large posts near the center of the floor in HP 7.

Binford reports that Eskimos used their sleeping areas as work and eating areas where significant amounts of refuse were left. On the Coast, Maugher (1991:72) ethnographically and archaeologically identified wall benches as used for sleeping and work. This is precisely the pattern that occurs at Keatley Creek where, as is clear from the concentration of debitage near the wall areas, active manufacturing and use of objects also took place, perhaps while seated on bedding materials (Vol. I, Chap. 13; Vol. II, Chaps. 2, 7, 9, 11).

A very different suite of objects clusters on the other side of the hearths facing the center of the floor. In this zone, the greatest concentration of non-food seeds, fire cracked rocks, utilized flakes, biface fragments, notches, drills, perforators, small piercers, and spall tools occurs. Many of these tools appear to be associated with activities that generate messy wastes (boiling, butchering, defleshing or stretching wet skins [Teit 1900:185], shaving wooden shafts) or which probably involved the working of cumbersome objects requiring more free space. Many of the activities carried out in the "central zone" may have been carried out by women (especially food preparation, boiling, and hide working) and thus the central zone could constitute a sexual division of work space similar to that described for the Eskimo by Binford (1983:180). However, other central zone activities, represented by unusual numbers of notches and bifaces, were more likely carried out by men (Vol. I, Chap. 12). It seems reasonable to assume that men did most woodworking, and manufacturing of items used in hunting and fishing and warfare, while women processed most food, hides, and made mats and baskets (Vol. II, Chap. 2; Teit 1900:182, 185, 297; Turner 1992:425, 433). Hides were dressed inside houses during cold weather. There also appears to be a mixture of male and female activities represented in the outer zone, or wall area, assuming that most debitage was generated by men and that expedient knives were used by women for cutting or tailoring buckskin. The possibility that many of the items in this outer zone were stored rather than used here makes activity inferences involving many tools and primary flakes less certain. Nevertheless, given all of the above observations, it might be suggested that there is a basic sexual division of space represented in the artifact distributions. I would suggest that cooking rocks and anvil stones are likely to be strongly related to a major female activity locus, while the sleeping and lounging activity area near the wall were occupied by males during meals and used by them for the performance of many activities due to the relatively higher status of males in the households (Vol. II, Chap. 16). Traditional stories indicate that women generally occupied areas *opposite* from men across the hearths and that the men reclined on mats (Teit 1909:674; 1912a:237; 1917:23). These accounts seem to be reflected in the concentration of fire cracked rocks on the sides of the HP 7 hearths opposite the sleeping areas. Thus, the archaeological interpretations of the sexual division of space seem reasonably well grounded.

Domestic Status and Specialization Differences

In addition to the most striking material patterns that seem to be associated with domestic groups, class differences, and activity areas, there are also other differences between floor sectors where separate domestic groups seem to have resided. These differences seem to be most easily explained in terms of varying economic aptitudes, preferences, and relative socioeconomic positions within the household hierarchy.

One of the aspects of Australian Aboriginal life that I found most interesting during my ethnoarchaeological work there was the striking variability in individual craft preferences and abilities (Hayden 1979). Within the egalitarian Aboriginal communities, not everyone performed the same tasks or did them with the same frequencies. Some individuals were better hunters, some were better at stone knapping, some were better at woodworking. Generally those who were best at a specific task did most of this kind of work for their close kin and friends, and everyone shared what they could produce. This did not mean that individuals who were less gifted at stone tool production never engaged in stone knapping or could not produce tools that would work, but they did significantly less of this work than those who were good at such tasks. I observed similar idiosyncratic variability in abilities and material patterning between households in my ethnoarchaeological work among Highland Maya Indians (Hayden and Cannon 1982, 1984). I believe that the vast majority of the residual variability in debitage and artifact types between floor sectors within HP's 7 and 3 (i.e., variability beyond the underlying 50% similarity in tool types between floor sectors) is due to just such idiosyncratic factors as well as the vagaries of chance in determining what tools are lost, discarded, not removed with refuse, displaced, mixed with other strata during excavation, recognized as artifacts during excavation, and consistently (as well as accurately) classified.

However, beyond the idiosyncratic and randomizing noise that can be expected to occur between domestic groups, there are indications of more pronounced differences that cannot be as easily explained by such factors. Clearly, personal preferences and idiosyncrasies grade imperceptibly into economic specializations, and it is not always possible to recognize the dividing line, but examination of the issue is worthwhile.

As in HP 3, the strongest case that can be made for specialized economic or socioeconomic roles involve the southern sector and the northwestern sector. As in HP 3, the southern sector of HP 7 stands out primarily due to the lack of materials. In HP 3, this involved a lack of fish bone; in HP 7, there is a general lack of everything except hearths and fragmented mammal bone, and a fragment of nephrite ornament or tool in the sector's storage pit. This lack of objects extends to the center of the floor. The presence of dense conifer needles and some tools in the southern sector make it appear that some domestic activities were occurring here, but much less of the banal work that typifies the rest of the house seems to have taken place there. In fact, the entire pattern of complementary activities on the wall vs. central sides of the main hearths breaks down and disappears in the southern sector (Fig. 5E). Similarly, in our chemical analyses, the high calcium soil values that characterize the other hearth areas are absent around the southern sector hearth, leaving a conspicuous "hole."

To explain this material patterning, it is worth noting that one general cross-cultural trend which emerges with increasing concentration of political power is that political leaders and their families spend increasing amounts of their time in organizing and administrative activities and much less of their time in mundane subsistence activities. In fact, they generally try to distance themselves from commoners by avoiding such work (Krause 1956:109; Arima 1983:69–70; Oberg 1973:25, 30, 87; Swanton 1909:50; Garfield 1966:16; Romanoff 1992b:490, 497). The chiefs of most ethnographic Plateau groups, including the Lillooet, even had a special spokesmen that served them as heralds and orators, presumably so that they would not have to address commoners directly (Ray 1942:229). I suspect that this special status of the house chief and his exemption from common work may be the reason that there is so little material in the south sector.

Some people have suggested that because pithouses are round there should be no preferred orientation by which internal hierarchies could be arranged. However, in the case of HP 7, seepage along the east wall may have provided one such structuring principle. Moreover, before any excavations had begun at the site, we had postulated that the southern sectors might be the preferred domestic areas within pithouses because the roof and soil of the south would be warmed by the winter sun rendering the southern spaces inside the pithouses slightly more comfortable in winter. Notable differences in ambient temperatures occur in adobe rooms according to their orientation to the sun (Thomas 1988:576), and it seemed probable that similar variation could occur inside pithouses.

In addition, as analysis proceeded, it became apparent that lighting might also play an important role in structuring relative residential positions within pithouses. Winter light would certainly best illuminate the north and especially the northeast sectors inside the pithouses, leaving the southern sectors in relative obscurity. This factor might make the south most desirable for two reasons. First, the most desirable area for people to congregate to carry out craft activities would be in or around the northeast. Chiefs or elites who wanted to distance themselves from commoners might not want to reside near such activity areas. Second, it appears to be a cross-cultural pattern that individuals of highest status in a household reside farthest from the entrance to the house (e.g., Arima 1983:62; Sproat 1987:93–94; Kan 1989:90; Emmons 1982:78, 80; Frayser 1985:166; Wilson 1934:363; Deal 1987:77–78; Loude and Lievre 1984:58). The same locational pattern also seems to characterize sacred areas in houses, which are frequently also the places where the most important families reside. This is probably for defensive and security reasons, but is also undoubtedly related to the innate feeling that those of most importance should not be readily accessible to any friend or foe. I assume that the best place to enter a pithouse would have been with the ladder descending in the north or east where, again, the lighting would have been the best. This would allow those entering to see better, and it also allowed residents in the southern shadows to determine more easily who was entering the pithouse and what their intentions were without having to reveal themselves. From these perspectives, the south would have been the best place to reside. Thus, if side entrances were present in HP's 3 or 7, they could be expected to occur in the north or northeast sector. Such an entrance might be related to the roof slump in the floor of HP 7 in the northeast sector.

If the south sector was the domestic area of the house chief, with a possible ritual and dancing or performance area in front of him that utilized the large naturally occurring patch of glacial loam forming the center floor, it might be expected that the hearths immediately flanking him on either side would be occupied by fairly high ranking families to the west and special status commoners or slaves to the east. Given the strong oral and ethnographic traditions of multiple wives for the most wealthy and powerful men in Lillooet communities (Teit 1900:326; Romanoff 1992b:479; Nastich 1954:61), the southwest sector and the southeast sector may have well been occupied respectively by a high-ranking elite wife and a concubine or slave or a family of slaves. In fact, Teit (1898:59) recorded an account in which multiple wives resided on either side of their husband in a housepit. Slaves were primarily women (Teit 1930:277) and slave women were frequently taken as secondary wives (see Kennedy and Bouchard 1977:Tape 4; Kamenskii 1985:49). Slaves could be expected to occupy the least desirable locations within a pithouse, however, favored slaves or slave wives might be expected to reside immediately adjacent to chiefs to protect them or to act as a buffer. Such favored status may explain the unusual concentrations of fish bones and spall tools in the southeast. As noted in the discussion of HP 3, slaves performed all the most onerous tasks including food preparation. On the other side of the suggested chief's domestic area, the southwest sector is remarkable in terms of its general absence of fish and mammal bone (although analysis of heavy fractions of flotation samples indicates that these remains were consumed in the sector and concentrations of potassium and phosphorous indicate that it was one of four major food preparation or consumption areas in the house (Vol. II, Chaps. 6 and 9) accompanied by one of the few real concentrations of charred seeds away from the wall (Vol. II, Chap. 4). A similar concentration of seeds occurred in the southwest sector of HP 3. One of the few charcoal concentrations occurs in this sector possibly indicating that it was one of the few hearths to be used on a more regular basis. Two of the largest storage pits are also found in this sector. In Pomo multi-family houses, a single hearth was used by all women in the structure for jointly baking a large bread which was then shared (Barrett 1975:39). The communal use of the Pomo hearth was due to the need for a large fire for baking. In HP 7, the concentrations of plant food seeds around only one or two locations (including the southwest sector) may represent a similar situation although there is no indication that bread *per se* was used at Keatley Creek. Interestingly, among the Pomo, the hearth used for baking reverted to normal floor use between bakings, a pattern that also seems common at Keatley Creek, especially in HP's 3 and 7.

Kusmer interprets the lack of large bones in the southwest sector in comparison to small fragments as evidence for intensive trampling; however the concentration of meso-sized bones (1–10 mm) found in the south and southwest sectors are denser and more wide-spread than those of other sectors (Vol. II, Chap. 9). Thus, meticulous idiosyncratic care in cleaning up food refuse may equally well explain the absence of bone remains in the southwest sector of HP 7. On the Coast, Samuels (1991:202) and Huelsbeck (1994:53) cite early historic accounts to the effect that commoner households were "incomparably" more filthy than those of higher status households. They suggest that greater cleanliness and more systematic removal of food refuse among higher status families may explain the lower density of mammal bone in the coastal high status houses.

The other likely location for a domestic area in HP 7 reflecting special status or involved in a specialized economic activity is the northwest sector, situated more or less opposite to the southern sector—similar to the suggested opposition of high status domestic areas in HP 3. As in HP 3, there is an indication that some of the occupants of HP 7 were more involved in hunting than other residents. Notably, the evidence for bone processing, the unusually large and numerous anvil stones, and the unusual variety of faunal remains associated with the northwest sector of HP 7 seem to reflect very successful hunting or unusual status. Faunal remains in this sector include: grizzly bear, deer, red fox, mussel shell, and sheep. Furthermore, the multiple large storage pits in this sector contained dentalium shells, copper, and a large collection of dog remains representing at least eight individuals, while storage areas along the wall contained a cache of spall tools. In addition, as in HP 3, the distribution of charcoal indicates that the hearth in this sector was one of the most intensively used hearths during the terminal occupation, if not the most intensively used, and it is associated with the only other concentration of burned seeds away from the walls besides the concentration in the southwest sector. In sum, one or more of the residents in the northwest sector seem to have been unusually active in economic activities in general, and hunting and trading and possibly ritual activities in particular. In terms of productivity, this appears to be the strongest domestic area in HP 7, and it is perhaps not inappropriate that it is situated in opposition to the other area that appears to warrant consideration as the residence of a high status domestic group. This may be comparable to the archaeological identification of separate administrative and executive roles for domestic groups in the houses at Ozette on the Coast (Gleeson et al. 1979). It is also worth noting that ethnographically, Jewitt (1974:50) observed that the next in rank to the house chief resided "opposite" the chief, "on the other side" of the house. Drucker (1951:279–280) recorded a similar opposing location of elites in Coastal houses, and this same arrangement may well have characterized Interior pithouses. Perhaps one or more residents in the northwest sector of HP 7 were specialized hunters or warriors or both, and as such were given the responsibility of protecting the base of the entrance ladder in the north of the house. As very high ranking families, they may also have had slaves or lower class concubines residing in the sector with them, which may account for the anomalously high density of fish bones in this sector compared to other sectors in the west part of the house.

Summary of Housepit 7

In sum, there are fairly sound indicators that 7–8 domestic groups resided in HP 7 arranged in a circular fashion around the periphery of the floor with another possible group residing in the center of the floor in the north. The west half of the house appears to have been occupied by hereditary elite families that held title to corporate group resources, while poorer commoner families and/or slaves occupied the eastern half and perhaps some parts of the north central floor space. In many respects this corporate group organization can be viewed as a kind of forerunner of modern corporate organization, especially family-based corporations. The hereditary elite occupied the roles of principal shareholders and decided corporate policies amongst themselves with the house chief being the principal administrator. Commoners occupied the roles of employees with varying amounts of economic and political leverage in corporate affairs depending on the circumstances.

The northeast sector and parts of the central floor are the most likely areas to have served as communal activity areas. Domestic areas were clearly divided into two complementary activity areas on either side of the hearth: the bedding areas against the walls being used for smaller, lighter crafts and storage, and for snacking on dried salmon backbones, while the more central side of the hearths were used for cooking and more waste-producing activities. Within the elite series of domestic groups on the west side of the house, the southern and northwestern sectors appear to be the most likely candidates for economically (the northwest) and politically (the south) specialized roles, with the possibility of multiple wives or slaves associated with each area.

From the distribution of artifact types such as bone awls, endscrapers, spall tools, projectile points, bipolar cores, perforators, bifaces, notches, scrapers, and expedient knives, as well as the widespread distribution of prepared core reduction debitage, bifacial reduction debitage, resharpening debitage, with the widespread culling of acute and steep edged flakes across the floor (Vol. I, Chap. 13; Vol. II, Chap. 11) it is apparent that certain basic manufacturing tasks were distributed more or less uniformly among all domestic groups throughout the household—except for those in the southern sector.

Overview

Combining all of the material patterning at our disposal, it has been possible to propose a number of interpretations about the socioeconomic structure of different sized housepits at Keatley Creek. I feel the basic interpretations are quite sound and are well supported by the data. These basic conclusions include the notion that residents of small housepits ranged from rich (probably specialists) to poor. The socioeconomic organization of the poorer households was relatively egalitarian with many activities conducted on a communal basis, similar to the socioeconomic organization of generalized hunter/gatherers. Material patterning on the floors of these housepits therefore reflects activity locations rather than social or economic groups or hierarchies.

In contrast, large houses were groups of hierarchically organized domestic units. Material patterning on the floors of large housepits, therefore, is dominated by repeated configurations representing individual domestic groups, and is further characterized by a two or three tier hierarchical division of domestic groups into hereditary owners, low ranking tenant groups, and possibly a household administrator or chief's domestic group. Medium sized housepits exhibit intermediate characteristics of both small (communal) and large (hierarchical) housepits. Given the stability in the position of large storage pits, large postholes, and hearths over time, the basic organization of large housepits seems to have been remarkably static for over 1,000 years.

Extending this interpretive exercise into a slightly more speculative realm, it seems likely that some material patterning reflects the specialized status of several domestic groups in the large household, including hunters (and/or warriors), household administrators and their secondary wives (and/or slaves). It also seems likely that residents of rich small households were specialists (hunters, or shamans) underwritten either directly or indirectly by large wealthy households.

After documenting these socioeconomic interpretations in more detail in the following chapters, it will be possible to proceed to examine the broader implications and interpretations of the FRICGA project results in the final chapters of this volume.

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Chapter 2

Pithouses on the Interior Plateau of British Columbia: Ethnographic Evidence and Interpretation of the Keatley Creek Site

Diana Alexander

Introduction

This chapter summarizes ethnographic information on the construction and use of pithouses of the British Columbia Plateau. Using a direct historical approach, this summary can aid in the archaeological interpretation of artifacts and features found in the housepits at Keatley Creek. Although ethnographic accounts of the construction and use of pithouses on the Interior Plateau are numerous, little attempt has been made to consolidate and evaluate this information. Archaeologists often cite ethnographic evidence only where it lends support to conclusions or interpretations previously derived from the direct observation of the excavated remains. Some researchers only consider the ethnographic evidence following excavation, thereby limiting the questions they could ask of the excavated material by not collecting and excavating sites in a manner that would provide the necessary material evidence to properly evaluate the issues. This lack of ethnographic background research is often puzzling, especially at sites from the late prehistoric period where analogies based on ethnographic evidence are most likely to prove successful.

The research presented here was stimulated by the need to interpret the archaeological evidence gathered from the excavation and testing of 23 housepits at the Keatley Creek Site. Ethnographic evidence was examined prior to this research, and the techniques employed allowed for the examination of possible changes in the ethnographic pattern of pithouse use over time. Nevertheless, the ethnographic background search was fairly limited, and the archaeological patterning could not always be easily interpreted. This more detailed examination of ethnographic evidence is intended to answer some of the unsolved problems.

Six basic questions were addressed in this research:

1) Why did these people build pithouses?
2) When were the pithouses built?
3) Where did they build their pithouses?
4) How did they build a pithouse?
5) What did they do inside their pithouses?
6) Who lived in the pithouses?

The last pithouse to be built in the Lillooet area was constructed in the 1880's (Bouchard and Kennedy 1973:42 [Lillooet]). By the 1890's, when the earliest and most detailed ethnographic studies were made, almost all natives in the study area had abandoned pithouses (also referred to as underground houses or earth lodges) in favor of Euro-Canadian style cabins (Teit 1900:195 [Thompson], 1909a:495–496 [Shuswap]; Bouchard and Kennedy 1973:42 [Upper Lillooet]; Laforet and York 1981:116 [Thompson]). Where citations refer to specific groups, they will be listed in brackets after the citation.

To begin with, the investigation focused on the published and unpublished accounts of the first ethnographers, geologists, and explorers to visit the area. Their information was gathered in the nineteenth century when native informants still remembered a traditional way of life largely unaffected by white culture.

All of the early pithouse photographs (Smith 1987:183; Teit 1900:Plate XV; Nabokov and Easton 1989) located during this research, and two of the most frequently cited pithouse illustrations (Dawson 1892:Fig. 2; Teit 1900:Figs. 135 & 136; see Fig. 1) were made from three standing, but abandoned structures from the Nicola Valley. Another important early illustration was based solely on verbal descriptions (Boas 1891:Figs. 20 & 21; see Fig. 3). It also appeared that many of the early accounts of pithouses were based on interviews with only a few informants. The result was an idealized and static view of pithouses. The variability that must have existed, given the vagaries of human nature, was often missing (Vol. II, Chap. 15). Also missing from the puzzle were many pieces of information about the inhabitants' daily lives. For example, even the most comprehensive early accounts (Teit 1895, 1900, 1906, 1909a, 1930; Dawson 1892; Boas 1891) provided few details of the activities and objects inside the pithouses.

Consequently, the literary research expanded to include more recent accounts, which addressed these issues. Some of these reports related the childhood memories of informants who had actually been inside an occupied pithouse, while others recounted the experiences of their elders (Condrashoff 1972a, 1972b, 1974; Green 1972; Green, Condrashoff and Speitz 1974; Kennedy and Bouchard 1977, 1987; Smyly 1973; Surtees 1975; Bouchard and Kennedy 1977, 1979). The most comprehensive information was provided in Annie York's account of Thompson pithouses (Laforet and York 1981). Additional details were gleaned from Interior myths and stories which incidentally refer to details of pithouse life (Teit 1909a, 1912a, 1912b, 1930; Boas 1917).

The present investigation was not limited to an examination of reports on the Lillooet and Shuswap—the groups that were known to have occupied the Keatley Creek area at contact. Information on many other peoples from the Interior Plateau was also examined. The search did not extend worldwide, but some additional knowledge was gained from the cursory examination of literature on other cultures. Archaeological evidence from Keatley Creek was also used to gain further insights into the traditional use of pithouses, but only where the evidence was unambiguous.

The text and references in this paper clearly identify whether a custom was known to have been followed by groups in the study area, or whether a practice was inferred from information gathered on other Interior Salish groups, or from even more distant cultures and/ or environments. The native groups referred to in the citations are indicated in the square brackets following the citation. Inferences based on information from other Interior Plateau cultures should be very strong since, according to Teit, the pithouses of the Upper Thompson, Upper Lillooet, Chilcotin, Shuswap, and Okanagan

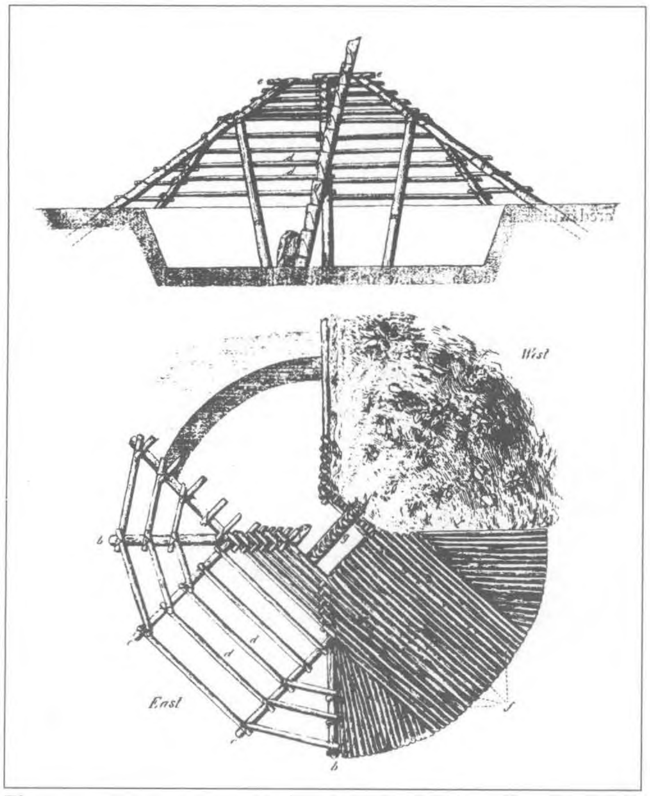

Figure 1. Illustration of a Pithouse, by James Teit (1900:193).

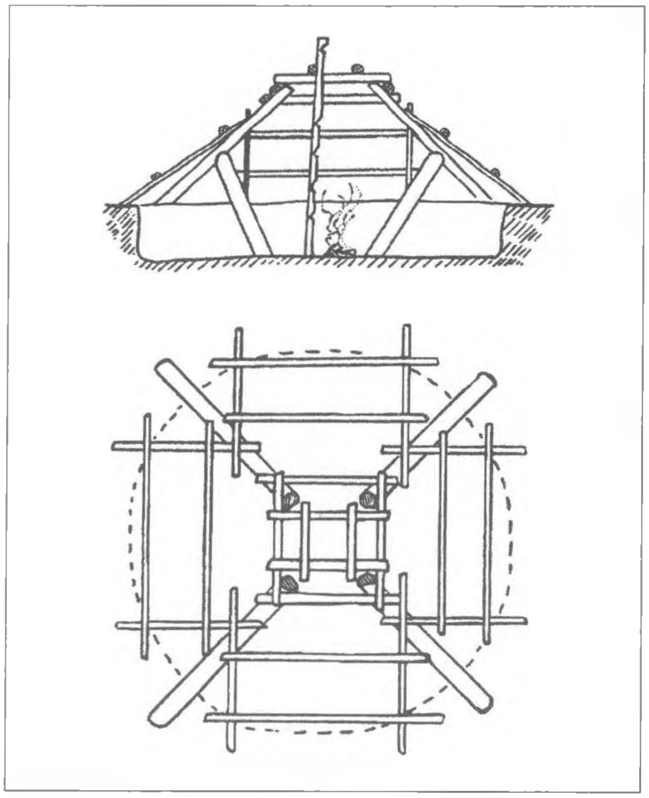

Figure 2. Illustration of a Pithouse, by George Dawson (1892:7).

were built in exactly the same way, and those of the Lower Thompson and Lower Lillooet were almost, if not exactly, the same (1895, 1900:192, 1906:212, 1909a:492, 1909b:775). Anglicized versions of native group names are used throughout the paper, primarily because these versions were used in most of the examined texts.

Why Pithouses Were Built

Why did the people of Keatley Creek build pithouses? Pithouses were not the only type of structure used in the area. Native groups in British Columbia built an astonishing array of different house types, with each group constructing at least two or three different kinds of shelters. For example, in addition to pithouses, the Lillooet and Shuswap built small brush lean-tos, and both conical and larger rectangular shelters covered with bark, poles, branches, or mats, and banked with earth in cold weather (Alexander 1992:132–136). Despite the effort involved in construction and the existence of serviceable alternatives, pithouses were the preferred winter dwelling. For example, among the Lillooet only the lazy (and by implication poor) people who did not help in pithouse construction were forced to spend the winter in a summer lodge (Bouchard and Kennedy 1977:63; see also Teit 1930:226; Boas 1917:22), while among the Southern Okanagan, where the climate was milder and more people used above-ground structures, pithouses were generally built only by the "wealthier and more industrious people" (Post and Commons 1938:40). Three factors seem to have strongly influenced the choice of structure and led to the preference for pithouses at Keatley Creek: climate, the availability of trees for construction and firewood, and group mobility.

It was obvious even to early investigators that pithouses were found almost exclusively in environments with long winters typified by cold, but dry conditions. Armed with more accurate maps, detailed climatic records, and additional ethnographic accounts, modern archaeologists have been able to plot the worldwide distribution of pithouses (Gilman 1983:84), and clearly demonstrate a correlation between pithouses and climate (Gilman 1983:94–97; Hayden et al. 1996).

The reasons for this relationship between weather and house type have been alluded to by native informants and speculated on by archaeologists. The most obvious reason for building pithouses in cold climes was that they were warmer than other structures. Natives repeatedly asserted that the semi-subterranean pithouses were always warm and comfortable in the winter (Teit 1900:194 [Thompson]; Lenihan 1877:4 [Stalo]; Mitchell 1925:5, 12 [Shuswap]; Bouchard and Kennedy 1973:41 [Lower Lillooet]), in fact, so warm that blankets were not always needed (Post and Commons 1938:41 [Southern Okanagan]). A few early observers actually report that the pithouses were "oven-like dens" (Champness 1972:92 [Thompson]), or "excessively warm from the numbers congregated together in so small and confined a space. They are frequently obliged, by the drifting billows of sand, to close the aperture, when the heat and stench become insupportable to all but those accustomed to it (Kane as cited in Rice 1985:99 [Walla Walla])." Archaeologists argued that the soil surrounding the base and covering the roof provided the pithouse with much better insulation than could be expected in any above-ground structure, while native informants discussed how the heat of the fires was retained inside (Kennedy and Bouchard 1978:36 [Lower Lillooet]; Laforet and York 1981:120 [Thompson]).

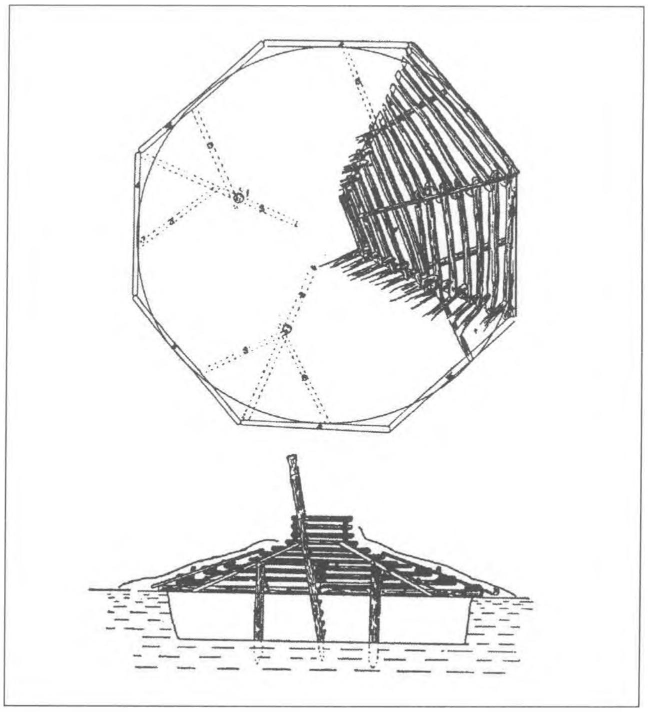

Figure 3. Illustration of a Pithouse, by Franz Boas (1891:633).

Since the pithouses were better insulated, they also required less wood for heating (Teit 1928:114 [Columbia Salish]). Shuswap informants and fur traders maintain that only a very small fire was needed to heat a pithouse (Anderson 1863:77; Green 1972:2–3; see also Rice 1985:99 [Walla Walla]), and in some Lillooet pithouses the fire was only lit for one hour every morning and one hour at night (Bouchard and Kennedy 1973:41). This contrasts with conditions in the large above-ground earth lodges of the Hidatsa (on the American Plains) where a fire was kept constantly burning, and where in extremely cold weather the family abandoned the main lodge for a smaller annex that could be more easily heated (Wilson 1934:405).

Hill-Tout (1907:58) made some of the earliest observations on the relationship between the insulating properties of pithouses and the need for firewood:

> The Dene tribes [primarily Carrier and Chilcotin] protected themselves from the rigours of the winter by keeping up huge fires night and day in their ordinary winter-lodges, which being wholly above ground, needed more heat to make them comfortable than did the Salish underground dwellings. But these large fires meant the consumption of considerable quantities of wood, and as the Carriers possessed but few facilities for felling and cutting up trees, and no ready means for its transportation when cut up save the backs of their women, and as the amount of suitable firewood available in any one center was soon exhausted, one winter at most was as long as they could stay in any one place.

Body heat may have provided much of the warmth in the pithouses (Vol. II, Chap. 16). In Shuswap pithouses occupied by three or four families the inside temperature in very cold weather was describe as "mild," while in pithouses used for very large social gatherings (100 people), body heat made the interior temperature uncomfortably hot (Goode 1861–1890, as cited in Kennedy and Bouchard 1987:261). Some archaeologists have suggested that body heat alone may have been used to provide most of the heat in the house, especially for poorer families that may have lacked the tools and warm clothes (Nastich 1954:24 [Lillooet]) that may have been needed to gather large quantities of wood in winter weather (Hayden et al. 1996). Crowding into multi-family pithouses could have been an inexpensive and efficient means of heating for both rich and poor families, and may explain why multifamily dwellings are more common in colder climates (Hayden et al. 1996). Crowded or not, pithouses seem to have required less wood to heat than other structures, a saving of time, energy, and resources, which would have been appreciated by any group. The large resident population of Keatley Creek must have put heavy demands on the local supply of wood for fires and construction, thus favoring the use of pithouses.

Pithouses are also associated with dry environments. The Stalo rarely built pithouses south of Chilliwack because "the ground was too low and it was difficult to keep water from seeping in" (Duff 1952:46). Barnett (1944) noted that at least four coastal peoples built underground dwellings, but they were uncommon, a costly luxury, and built either for protection in time of war, or as a cold weather residence, especially for the weak and infirm. Their construction also differed from that of pithouses on the Interior Plateau, with a deeper hole and a flat roof at ground level. Given the amount of precipitation in the rainforests of the Coast, it is not surprising that pithouses were rarely constructed in coastal environments. On the other hand, the semiarid conditions found at Keatley Creek would have encouraged the construction of pithouses.

The availability of suitable building materials may also have influenced the type of housing used by the inhabitants of Keatley Creek. On the coast, where cedar for planking was abundant, plank houses were the rule. In drier portions of the Interior Plateau, where cedar was uncommon, poles, branches, bark, and mats were the preferred building materials, and pithouses were the preferred winter dwelling. Native groups living at the transition zone between these two environments blended the two technologies or used both. For example, at Mount Currie, on the southern border of Lillooet territory, the people built pithouses, but dug shallow foundations and used cedar planks in construction (Bouchard and Kennedy 1973:41). Like the Stalo, they also built as many, if not more, plank winter houses (Teit 1906:213 [Lower Lillooet]; Duff 1952:46 [Stalo]; Hill-Tout 1978c:47[Chilliwack]).

These analyses explain why pithouses were uncommon on the wet, cedar-rich coast and in warmer southern climes, but it raises the question of why pithouses were not more common to the north of the Interior Plateau. While some northern peoples lived in environments possibly too wet for pithouses, precipitation levels in some localities were not unlike those found in moister parts of the Interior Plateau.

The answer may be found in the nature of the resource base. With substantial and reliable salmon runs in the Fraser River and with the technology needed to catch and store this food in large quantities, the Lillooet and Shuswap were able to be relatively sedentary and maintain a high population density. Most of the more northern hunters and gathers lacked this abundant and reliable food source and had to live in smaller groups and move more frequently in pursuit of their more dispersed, mobile or unpredictable food resources. These small northern groups probably could not afford the time and energy needed to build a pithouse when they could only occupy it for a short time each year, and when it may have had to be abandoned the following year if the food resources in the area fell below survival needs. This scenario may also be used to explain why some Shuswap and Chilcotin bands, who lived in a suitable climate but lacked rivers with reliable populations of spawning salmon, were not typically building pithouses at contact (Teit 1909b:775 [Chilcotin], 1909a:494 [Lake Shuswap]; Lane 1953:146, 1981:403 [Chilcotin]). This relationship between pithouses, population increases, subsistence, intensification, storage and food preparation techniques, and mobility has been discussed by Gilman (1983:258).

In conclusion, the people of Keatley Creek typically built pithouses rather than above-ground structures because: 1) in the cold winters of the Interior Plateau, pithouses were better insulated and required less wood to heat, 2) the dry conditions made subterranean foundations practical, and 3) the abundance of salmon in the Fraser River allowed for a high population density and a more sedentary lifestyle where the greater time and effort needed to construct a pithouse was made feasible and effective by large groups living in the same location for four to five months every year.

When Pithouses Were Built

Season

Pithouses were primarily used during the cold winter months. In fact, the Lillooet and Shuswap names for this structure are derived from the term for winter (Kennedy and Bouchard 1987:257). Although some informants deny that the pithouses were used at all during the summer (Green 1972:2 [Shuswap]), other native accounts suggest otherwise. Pithouses were sometimes occupied during the summer (Kennedy and Bouchard 1978:37 [Upper Lillooet]) to escape the heat (Bouchard and Kennedy 1990:277 [Shuswap]), but only "the very old stayed at the winter sites all summer" (Post 1938:11 [Southern Okanagan]; see also Kennedy and Bouchard 1978:37 [Lillooet] and Teit 1898:52 [Thompson]). Since young children spent much of their time with their grandparents (Nastich 1954:50, 66 [Lillooet]), they too may have spent much of the summer in the pithouses. The infirm and young were probably left behind because it was difficult for them to keep pace with fitter members of the family when they traveled into the mountains or to other distant localities to hunt, fish, and gather plants during the warmer months. Even if they managed the trip, they would be of little help at the distant camps.

Although most food was stored near the procurement camps until the winter (Post 1938:31 [Southern Okanagan]), archaeologists (Alexander 1992:158) have also speculated that the village was revisited periodically during the summer and fall to store the dried foods gathered on these distant trips. They may also have returned to the village to pick berries in June and July (ibid.). In summary, the pithouse village may have been occupied all year, though the resident population would have dropped dramatically outside of the winter season.

Based on ethnographic accounts, Interior Plateau pithouses were occupied from late November or early December, to February or late March, according to the severity of the winter (Teit 1900:194, 238–239 [Thompson], 1906:223–224 [Lillooet], 1909a:517–518 [Shuswap]; Lane 1953:219 [Chilcotin]; Dawson 1892:40 [Shuswap]; Hill-Tout 1907:57 [Salish]; Kennedy and Bouchard 1987:258 [Shuswap]). The first extreme cold and/or snow seems to have signaled the move into the pithouse, while warm weather, the disappearance of the snow, and the first growth of plants, heralded their seasonal abandonment.

The Southern Okanagan built their winter homes in early November (Post 1938:11). If the Lillooet and Shuswap pithouses were also built or rebuilt in November, this work would have taken place after the main fall hunt when most of the winter food supplies had been gathered, and before the winter snows. On the other hand, people in the Nicola Valley were said to have built their pithouses before the fall hunt (Post and Commons 1938:41), possibly in September or October. Even if a pithouse did not need to be rebuilt, it required repair every fall since "there was generally some subsidence of the earthen walls" (Laforet and York 1981:121 [Thompson]). To prepare their pithouses for winter, the women would burn juniper to freshen the air, sweep out the pithouse, smooth the walls, and repair or renew the bark lining (ibid.). The Chilcotin conducted such work in November (Lane 1981:405), suggesting that the inhabitants of Keatley Creek may also have repaired their houses in November.

Lifespan

A pithouse was only inhabitable for approximately 20 years, after which time it had to be rebuilt or abandoned (Green 1972:2; Kennedy and Bouchard 1987:260 [Shuswap]). Despite the preservation afforded by the dry Interior Plateau climate, a pithouse was commonly ruined by wood rot. Some people attempted to retard this decay by keeping a small fire burning at all times (ibid.). In the wetter climate of the plains, the Hidatsa had to rebuild their earth lodges every seven to twelve years (Wilson 1934:358–372). Similarly, the first sign of wear in a Hidatsa lodge was the base of the wooden support beams rotting in the ground and that caused the entire structure to settle (ibid.).

The Lillooet also noted that an infestation of insects, rodents, or snakes sometimes necessitated abandonment of the pithouse before the timbers rotted (Kennedy and Bouchard 1978:37; see also Posey 1976). In areas where rattlesnakes were common, it may, in fact, have been necessary to dismantle the roof every year (Laforet and York 1981:121 [Thompson]). Fortunately for the residents of Keatley Creek, no rattlesnakes occurred in the area, though insects and rodents were no doubt problematic.

A pithouse was also said to have been abandoned if two or more people had died inside at the same time or in quick succession (Bouchard and Kennedy 1973:42 [Lillooet]; Kennedy and Bouchard 1978:37 [Lillooet];

Teit 1906:273 [Lillooet], 1900:331 [Thompson]). During the large smallpox epidemics in the 1860's such pithouses were burned down and/or collapsed with the former occupants' bodies, beds and utensils inside, but their bones were later removed (Teit 1900:176, 331 [Thompson]). It is possible that this practice originated after contact, when the introduction of European diseases at contact resulted in widespread epidemics.

If the pithouse was to be rebuilt in the same location, the residents had the option of either burning or dismantling the old superstructure. Burning the intact structure would have been quick, and would have destroyed any infestations, but it was probably a less desirable alternative. First of all, such a large fire would have presented the possibility of the fire spreading and accidentally destroying other structures or valuable forest resources. More importantly, total burning would have destroyed many reusable parts of the superstructure. In the rebuilding of a Hidatsa earth lodge the women first removed the earth to the base of the roof for later reuse, discarded the grass underneath, kept the poles for firewood, reused the rafters and beams, and then cut off the ends of the rotted posts and reused them as well (Wilson 1934:373). They even used the same postholes in reconstruction. It seems highly likely that similar practices were employed at Keatley Creek. In a large village like Keatley Creek (much like the 70 earth lodge Hidatsa village), each year would have seen new lodges being built and old ones being torn down (Wilson 1934:353).

Origins

Native accounts indicate that Keatley Creek has not been used as a village site since at least the mid 1700's (Bouchard and Kennedy 1973:42 [Lillooet]), while archaeological evidence suggests that this village, as well as the neighboring Bell Site, had few if any residents by 1,000 BP (Stryd 1973). Hayden and Ryder (1991) have concluded that this abandonment was probably the result of a bedrock landslide that dammed the Fraser River at Texas Creek, destroyed the salmon runs, and forced the inhabitants to move away. A much smaller occupation later occurred around 270 BP.

It is clear from the archaeological record that pithouses were rare or absent from the study area prior to approximately 4,400 BP (Stryd and Rousseau 1996:195–197). The oldest radiocarbon date from a pithouse on the Canadian Plateau is 4,450 ± 100 BP (Wilson et al. 1992). Since no native accounts describe a time when pithouses did not exist in the area, we must rely heavily on archaeological speculation to answer the question of why they were not present earlier. The concept of building a pithouse may have been unknown to the residents of Keatley Creek prior to 4,400 BP. The idea may have been introduced from the American Plateau, where the earliest structures are 5,640 ± 155 BP, from Surprise Valley in Northeastern California (O'Connell 1975), and 5,550 ± 120 BP, from the Hatwai Site in Central Idaho (Ames and Marshall 1980:35). A new house design may have been adopted as soon as it was known, but some archaeologists argue that the idea would not have been accepted if other conditions were not in place first.

Some speculate that prior to 4,500 BP environmental conditions were unsuitable or too unstable to allow large dependable salmon runs to become established (Fladmark 1975; Mathewes 1985; Kuijt 1989). Alternatively, or perhaps concurrently, the residents of Keatley Creek may have lacked the technology (dip nets and set nets) to catch salmon in large numbers, or the knowledge of how to dry and store the surplus salmon (Hayden et al. 1985). Without large quantities of stored salmon, the residents of Keatley Creek would probably have been required to live in smaller, more mobile groups (Gilman 1983), though others suggest plant intensification was the critical subsistence change enabling people to use pithouses in a seasonally sedentary fashion (Ames and Marshall 1980). As with the more northern groups seen at contact, early residents in the study area may have found the building of pithouses too expensive in terms of time and effort to warrant their construction. Therefore, prior to 4,500 BP the residents of Keatley Creek probably lived in shelters similar to the modified summer lodges used at contact. The greater need for mobility at this earlier time may mean that Keatley was only one of several village sites being used by the same group (see for example Walters 1938:87 [Southern Okanagan]).

Where Pithouses Were Built

According to native informants, the decision of where to build a pithouse was determined by both environmental and social considerations. The most basic physical needs included a close source of fresh drinking water and trees for construction and firewood (Walters 1938:87 [Southern Okanagan]; Sproat 1987:31 [Nootka]; Teit 1900:192 [Thompson]). With salmon playing such a crucial role in survival, efforts were also made to locate the pithouse close to the residents' fishing station (Teit 1900:179 [Thompson]; Bouchard and Kennedy 1973:42 [Lillooet]). Archaeologists speculate that close proximity to the fishing station ensured that the salmon did not have to be carried too far (Blake 1974:15), and that dried salmon stored near the river could be safeguarded. The Lillooet also wanted to protect their privately owned stations from unauthorized use by others (Nastich 1954:35 [Lillooet]).

Probably for similar reasons, the villages were also located close to berrying and root-digging grounds (Smith 1899:129 [Thompson]).

It was also important to select a warm, southern exposure, a sheltered location that afforded protection from the cold winter winds that were funneled down the river valley, and a site that contained dry, well-drained, sandy or gravely soil that could be easily dug (Bouchard and Kennedy 1990:286 [Shuswap]; Dawson 1892:8 [Shuswap]; Teit 1900:192 [Thompson], 1909b:492, 1895 [Shuswap]). Archaeologists have noted that some pithouse depressions were partially excavated into a hillside, presumably because it required less effort. Certainly the original surface did not need to be level (Bouchard and Kennedy 1973:42 [Upper Lillooet]).

In the Mid-Fraser River area these requirements were met by building the pithouses on well-developed river terraces. North of Lillooet, little dry, level land was available close to the river bank, since the Fraser River was confined within a steep and rocky canyon. On the sagebrush and grass covered terraces above the canyon, trees were common only where the terraces met forested mountain slopes, and along the few tributary streams that cut through the terraces and provided the only sources of fresh water. Good pithouse locations were therefore limited to the lower reaches of these tributaries, with the largest villages typically found near the terrace/forest ecotone.

In other areas, such as most of the Thompson River Valley, suitable locations were easily found along the river floodplains. Consequently, pithouse sites in these areas were less likely to occur on streams, were closer (horizontally and vertically) to the river, did not cluster as tightly as those in the Mid-Fraser River area (Blake 1974:2), and had a lower density of pithouses. Thompson villages were three or four miles apart on average, though the next village could be as many as ten miles away or just across the river. For the Thompson peoples, this meant that "the smoke of Indian camp-fires was always in view" (Teit 1900:175).

Village Size and Density

At contact, some pithouses were built in isolation (Nastich 1954:25 [Lillooet]), while others clustered together in small villages containing rarely more than three or four houses (Teit 1900:169, 192 [Thompson]; Condrashoff 1974 [Shuswap]; Dawson 1892:8 [Shuswap]). One notable exception was the nine to eleven large pithouses at Fountain village, the closest nineteenth century village to Keatley Creek (Teit 1906:199 [Lillooet]). The archaeological information shows that a different settlement pattern existed in the past. An examination of prehistoric housepit sites in the study area on the east bank of the Fraser River between Kelly Creek and Cayoosh Creek (ca. 26 km) revealed 40 villages. The size of most villages conforms to the ethnographic pattern with 31 (77.5%) having four or less housepits and seven (17.5%) with five to eleven housepits. In contrast, two very large sites (5%), Keatley Creek with over 100 housepits and Bell with 31 housepits, do not have ethnographic precedents.

Archaeologists speculate that many people were attracted to village life because it afforded the residents social and economic support, as well as protection from raids by distant groups. Living in the village also allowed people to be close to their family and/or work partners outside the residential group. For example, people for men's hunting expeditions and women's plant gathering parties were often drawn from houses throughout the village (Alexander 1989:20–22). Although some natives undoubtedly lived apart by choice perhaps because they felt mistreated, others were ostracized and banished for social misconduct or forced to move away because of the birth of twins (Nastich 1954:64–65 [Lillooet]; Teit 1909a:587, 687, 709 [Shuswap], 1906:263 [Lillooet]; Boas 1891:644 [Shuswap]).

In some cases, residents may have taken advantage of the need to rebuild their house by moving to a different village or a more desirable location within the same village. Each band had a large village which served as its principal headquarters, but many of its members lived in small villages scattered nearby. As Teit (1909a:457 [Shuswap]) explains, these small villages were:

> . . . frequently changed, and even the main locality or village of a band could have more families one winter, and less another. Some families were more nomadic than others, and each band would have people from neighboring villages living with them every winter.

Some Thompson families actually constructed several pithouses (Teit 1900:175). Nevertheless, most natives in the study area were probably like the Southern Okanagan who "almost always wintered at the same site [and in the same pithouse], changing only if firewood became scarce or some catastrophe occurred" (Post 1938:11). In fact, the Fraser River Shuswap, who had access to the best salmon fishing stations were more sedentary than any other Shuswap (Teit 1909a:513).

Defense

Defense may have been another consideration in deciding where to locate a pithouse. Villages were ideally supposed to be situated in good defensive localities with clear views of the approaches (Kennedy and Bouchard 1977:Tape 2 [Lillooet]). Raiding was one means of acquiring food, especially salmon, when supplies were scarce, either by capturing the stored food itself or by claiming use of fishing stations and hunting areas (Nastich 1954:36–37 [Lillooet]; Teit 1906:237–238 [Lillooet]; Cannon 1992). Slaves (Nastich 1954:46 [Lillooet]) and luxury goods seized in these raids could also grant additional prestige and material benefits to the warrior. The raiding parties were typically comprised of one to twenty men but could contain several hundred (Nastich 1954:37 [Lillooet]; Teit 1906:267 [Lillooet]). The Lillooet attempted to minimize raids from neighbors by establishing friendships through trade and intermarriage (Nastich 1954:44–45 [Lillooet]), but they had a wealth of salmon and were commonly on the receiving end of these attacks (Cannon 1992). The greater their wealth, the more likely it seems that they would want to chose a well-protected and secluded location, or at least a site where the inhabitants could not be easily surprised (e.g., Sproat 1987:31 [Nootka]).

This need for defense had to be weighed against the desire for trade. Surplus goods had little value for the owner unless part of it could be traded for luxury and prestige items. Trading requires that the trader be easily located by potential customers, and the village be conspicuously placed. Defensive fortifications, like those noted by Simon Fraser at present-day Lillooet (Lamb 1960:82), may have provided the necessary compromise between being easily located for trade, but protected against enemy attacks (Nastich 1954:37 [Lillooet]).

How Pithouses Were Built

Once the decision to construct a pithouse had been made and the location selected, the builder's next concern was to assemble the necessary people and materials. The people who were to live in the house could build the house on their own, but construction of a small or moderately sized house with 25 to 30 people could then take from one week (Green 1972:2 [Shuswap]) to twenty days (Post and Commons 1938:41 [Nicola Valley], 1938:40 [Southern Okanagan]). For comparison, a group of about twenty Hidatsa took one day to raise the frame of their earth lodge, and six days to complete the superstructure including two days to sod the roof (Wilson 1934:359, 362, 366–367, 404). As many as twenty men may have been needed to raise the main beams of a large house (Wilson 1934:361 [Hidatsa]), but those of smaller pithouses only needed five men (Smyly 1973:51 [Shuswap]). On the other hand, by acquiring the aid of twenty to thirty adults from other houses, a moderately sized Upper Thompson pithouse could be built in as little as one day (Teit 1900:192; 1895). Any individual who did not help in construction was forbidden to live in the pithouse (Bouchard and Kennedy 1973:41 [Lillooet]).

In a manner similar to that seen in a communal barn raising, the potential home owners claimed assistance from family and friends (mostly neighbors) in exchange for food (Teit 1900:192, 1895 [Upper Thompson]). This practice was also followed by the Hidatsa (Wilson 1934:356). Extra food would have had to have been acquired in advance by the owner and his relatives, through hunting, fishing, and gathering, or loans (Teit 1895 [Upper Thompson]). The Lillooet and Shuswap may also have followed the Hidatsa practice of giving assisting women part of the discarded wood from an old structure to use as firewood (Wilson 1934:356, 372–374).

Many of the building materials were probably collected in advance. For example, in Hidatsa society the women cut the posts and beams the previous summer and the men hauled them to the village over the winter snows (Wilson 1934:359). It took several women only one day to cut four main posts, twelve short posts, and seventy or more poles (Wilson 1934:397). Posts and poles were also probably recycled from the old pithouse or pithouses abandoned nearby. The women would also have been responsible for making the baskets in which the excavated soil was gathered and dumped (Teit 1900:192 [Thompson]).

Size

Ethnographic estimates for the diameter of circular Lillooet and Shuswap pithouses range from 3.7–15 m (Table 1). The neighboring Thompson at Lytton described the upper size limit as 18.3–21.3 m (Hill-Tout 1978a:58), while the Chilcotin and Sanpoil size limit ranges as low as 3.1 m (Lane 1953:157; Ray 1932:31). It is likely that people in the study area also occasionally built these very large and very small pithouses at contact. The ethnographic accounts also seem to suggest that the most common size in the study area was between four or five metres and eight or nine metres.

A comparison of these ethnographic accounts with the distribution of housepit diameters at Keatley Creek (Vol. I, Chap. 1, Fig. 14) suggests that the range of housepit sizes is similar for both the protohistoric and prehistoric periods. No housepits smaller than 4 m are recorded, but any housepits this size may have been designated as cache pits or roasting pits during the site survey. The lower half of the bimodal distribution at Keatley Creek is also similar to the pattern seen at contact, with a peak in the distribution between five and eight metres.

On the other hand, the upper half of the bimodal distribution at the Keatley Creek Site, with a peak between 12 and 16 m, does not seem to have an ethnographic precedent. Moreover, at the neighboring Bell site, with dates ranging from about 3,000–1,000 BP,

Table 1. Ethnographic Data on Pithouse Dimensions and Number of Occupants

Diameter of Circular Pithouse (Metres)	Dimensions of Rectangular Pithouse (Metres)	Area of Pithouse (Square Metres)	Persons/ Pithouse	Area/ Person (Square Metres)	Cultural Group	Source
up to 18.3 to 21.3		262.9 to 356.2	60 to 70	4.38 to 5.09	Upper Thompson	Hill-Tout 1978a:58
7.6 to 9.1		45.3 to 65.0	20 to 30	2.17 to 2.27	Interior Salish	Hill-Tout 1907:56
6.1 to 12.2		29.2 to 116.9	15 to 30	1.95 to 3.90	Thompson, Shuswap	Teit 1900:192,1909a:492
12.2 to 15.2		116.8 to 181.4	12 to 15	9.73 to 12.09	Walla Walla	Rice 1985:99
15.2		181.4			Methow	Rice 1985:100
15.2		181.4			Southern Okanagan	Post & Commons 1938:40
9.1 to 15.2		95.0 to 181.4			Upper Thompson	Hill-Tout 1978a:57
6.1 to 12.2		29.2 to 116.9			Okanagan	Cline 1938:40
4.6 to 18.3		16.6 to 262.9			Interior Salish	Hill-Tout 1907:56
5 to 15		19.6 to 176.6			Upper Lillooet	Teit 1906:213
up to 8		50.2			Shuswap	Ray 1939:177
7.6		45.3			Carrier	Morice 1893:191–2
7.6		45.3			Shuswap	Dawson 1892:7
6.1		29.2			Carrier	Morice 1893:191–2
6.1					Thompson	Champness 1971:92
ca. 5		19.6			Shuswap	Surtees 1975
4.9					Wishram	Rice 1985:99
4.6 to 9.1		16.6 to 65.0			Lillooet	Ray 1939:177
usually 4.6 to 9.1		16.6 to 65.0			Okanagan	Cline 1938:40
4.3 to 9.1		14.5 to 65.0			Chilcotin	Ray 1939:177
4.6 to 7.6		16.6 to 45.3			Stalo	Duff 1952:47
3.7		10.8			Northern Okanagan	Post & Commons 1938:41
3.7 to 6.7		10.8 to 35.2			Thompson	Ray 1939:177
3.7 to 6.1		10.8 to 29.2			Wenatchi	Ray 1942:177
3.7 to 4.6		10.8 to 16.6			Shuswap	Boas 1891:633
3.1 to 7.6		7.5 to 45.3			Chilcotin	Lane 1953:157
3.1 to 4.9		7.5 to 18.8			Sanpoil	Ray 1932:31
	usually 4.6 × 9.1	41.9			Southern Okanagan	Post & Commons 1938:40
	6.1 × 6.1 to 9.1 × 9.1		37.2 to 82.8			Chilcotin Lane 1953:158
	3.7 × 3.7 to 4.6 × 4.6		13.7 to 21.1			Stalo Lenihan 1877;4
	? × 12.2		80		Southern Okanagan	Post & Commons 1938:40
	? × 6.1				Southern Okanagan	Post & Commons 1938:40
	15.2				Southern Okanagan	Post & Commons 1938:40
			50		Nicola Athapaskan	Smith 1900:406
			40 to 50		Nicola Valley	Post & Commons 1938:41
			up to 40		Shuswap	Bouchard & Kennedy 1979:129
			25 to 30		Shuswap	Green 1972
			20 to 30		Lower Lillooet	Bouchard & Kennedy 1973:41

all housepit diameters are greater than nine metres (see Vol. I, Chap. 1, Fig. 14). This evidence suggests the possibility that Shuswap and Plateau Horizon pithouses on the Mid-Fraser River were actually larger on average than Kamloops Horizon and protohistoric pithouses. This conclusion is supported by other archaeological information.

The size of the house was dependent on the number of people who were going to occupy it (Teit 1900:192 [Thompson]; Hill-Tout 1907:56 [Salish]). Estimates of the resident population for the Lillooet and Shuswap range from 15–80 people/house, with the most common population seemingly about 20–30 people (Table 1). This figure is close to an average figure of 25 given for the local group size in many simple hunter-gatherer societies (Lee and Devore 1968:241–249; Wobst 1974).

Teit's estimates of average pithouse diameter and resident population imply that each resident had 2.0–3.9 m^2 of floor area (Table 1). These figures bracket Hill-Tout's implied estimate of 2.2–2.3 m^2 for similarly sized pithouses. Hill-Tout's figures also suggest that in larger pithouses (18.3–21.3 m diameter) the 60–70 occupants had about 4.4–5.1 m^2 each. A description of Walla Walla pithouses by Paul Kane (as cited in Rice 1985:99) suggested the 12–15 occupants had 9.73 to 12.09 m^2 each. This last estimate differs markedly from the other estimates. This suggests the estimate is inaccurate or that more southern groups had lower densities of people in their pithouses.

If their estimates were based on the diameter at the surface, rather than the floor diameter—which can be substantially smaller depending on the slope of the walls—then the real area per person would be much less. Assuming the diameters represent the exterior measurement and using information from the excavations at Keatley Creek to calculate floor area (Fig. 4), it is possible to recalculate the area per person. A smaller house (9 m across at the rim crest) had a floor area of about 33 m^2 (at Keatley Creek) and a resident population of about 22–30 people (extrapolating from Teit and Hill-Tout) giving a density of 1.1–1.5 m^2 per person. A larger house (19 m across) had a floor area of about 113 m^2, a resident population of about 65 people, and 1.7 m^2 per person.

Taken together, these two sets of calculations provide estimates ranging from 1.1–5.1 m^2 per person, with density decreasing with increasing house diameter. These resident population estimates are far below those of about 10 m^2/person seen for cultures living in southern temperate and tropical environments (Naroll 1962; Cook and Heizer 1968). Hayden et al. (1996) have noted a correlation between mean January temperature and average household population density, with higher densities at lower temperatures. Population densities from Keatley Creek, with a mean January temperature ranging from about $^-3°$–$^-8°$ C (Mathewes 1978:74), is comparable to population densities ranging from 1.4–4.23 m^2 per person that they found for northern populations with January temperatures from $^-5°$–$^-10°$ C.

The figures for the Interior Plateau seem to represent a static ideal that may not correlate with the reality or variability of life in a pithouse. As discussed previously, it was not unusual for individual families to move from one village to another. The resident population of a pithouse may have fluctuated from year to year as one or more nuclear families left to take up residence in a different village or house, or as new families were added to the pithouse.

Other factors may also have challenged the rule that size at construction was dictated by the expected

Housepit	Rim Crest Diameter	Housepit Area	Floor Diameter	Floor Area
9	8	50	5	20
12	9	64	6.5	33
3	14	154	10	79
7	19	283	12	113

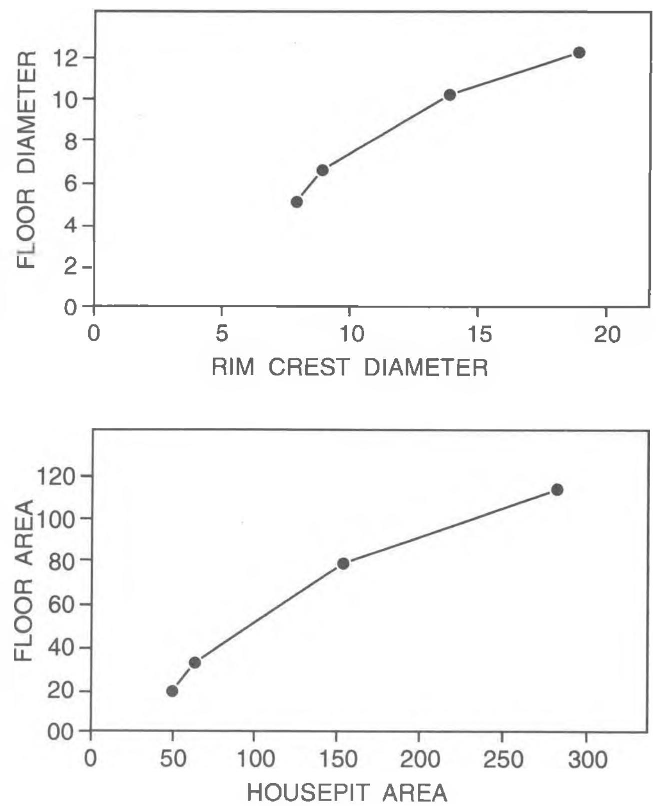

Figure 4. Relationship between Rim Crest Diameter, Floor Diameter, Floor Area, and Housepit Area at the Keatley Creek Site.

resident population. The largest houses in the village were commonly used during feasts and public gatherings (see the following section on Activity Areas). With these future needs in mind, a large house may have been made larger than the resident population dictated. On the other hand, as was discussed earlier, poor families may have opted to build unusually small pithouses in order to conserve fuel costs through crowding. For example, in the stories that Teit recorded, some small housepits contained only one or two families (1912a:247–248; 1912b:323; 1930:226; Boas 1917:22). These crowded conditions may, however, have also tended to produce an unstable situation where personal antagonisms induced by overcrowding were resolved by families or individuals changing their residences.

The Foundation Pit

Ethnographic evidence shows that once having decided on the pithouse size, four men used two measured ropes that crossed at right angles to mark the center of the projected pithouse, and to mark the four corners where the butt ends of the four beams were to be placed. An outline of the pithouse depression was then made by a man by using a stick to scratch the ground surface between the corner stakes (Teit 1900:192 [Thompson]; 1895 [Upper Thompson]). The circular hole was made as uniform as possible (Surtees 1975 [Shuswap]) by digging out a little more here and there as needed (Teit 1895 [Upper Thompson]), but the final result was probably not a perfect circle (Wilson 1934:399 [Hidatsa]).

The depression was excavated by loosening the soil with digging sticks or "wooden scrapers with sharp, flat blades," and then placing the soil in large woven baskets using the hands or small baskets (Teit 1900:192 [Thompson], 1895 [Upper Thompson]; Kennedy and Bouchard 1987:258 [Shuswap], 1978:36 [Lillooet]; Surtees 1975 [Shuswap]; Ray 1932:31 [Sanpoil]). The soil from the large baskets was then dumped around the perimeter of the hole, where it could be easily collected for later redistribution on top of the finished roof (ibid.). Stones were simply thrown out (Teit 1895 [Upper Thompson]).

Many of the housepit depressions recorded by archaeologists have been partially excavated into a hillside. Such pithouses may not have actually needed a hole dug into the surface. The soil removed from the upper slope may have been redeposited on the surface of the lower slope to form a rim on the opposite side, with the soil for the roof removed from the surrounding hillside.

Although most native accounts from the Interior Plateau describe pithouses with a circular outline (Mitchell 1925 [Shuswap]; Teit 1900:192 [Thompson]; Boas 1891 [Shuswap]; Dawson 1892:7 [Shuswap]; Laforet and York 1981:116 [Thompson]), some informants report pithouses that were square or at least squared along the back and two sides (Teit:1895 [Upper Thompson], 1906:213 [Lower Lillooet]; Post and Commons 1938:40–41 [Southern Okanagan]; Bouchard and Kennedy 1990:277 [Shuswap]; Lane 1953:158 [Chilcotin]; Ray 1939:177–178 [Wenatchi]). In fact, the Thompson River Shuswap (Condrashoff 1974) and Fraser River Stalo (Lenihan 1877:4) may have more commonly excavated square foundation pits. Many of the pithouses recorded by archaeologists, especially those in Shuswap territory, are squarish in outline (Kennedy and Bouchard 1987:258). All of the housepit depressions at Keatley Creek appear, however, to be circular.

The depth of the depression generally varied from approximately 1.2 m to 1.8 m (Boas 1891:633 [Shuswap]; Duff 1952:47 [Stalo]; Ray 1939:177 [Shuswap, Lillooet, Thompson, Chilcotin]; Lane 1953:157–158 [Chilcotin]; Kennedy and Bouchard 1987:258 [Shuswap], 1978:36 [Lillooet]; Bouchard and Kennedy 1990:277 [Shuswap]; Surtees 1975 [Shuswap]; Farrand 1898:646 [Chilcotin]; Ray 1932:31 [Sanpoil]). Two reports suggest the foundation pit may have been up to 2.1 m deep (Post and Commons 1938:40 [Southern Okanagan]; Champness 1971:92 [Thompson]). In places where the water table was high, the foundation pit was quite shallow (Bouchard and Kennedy 1973:42 [Lower Lillooet]), but the .9 m estimate given by Morice (1893:191–192 [Carrier]) seems too low given the adamant assertion by a Shuswap informant that 1 m was too shallow (Kennedy and Bouchard 1987:258). On the other hand, many of the smaller housepits at Keatley Creek were far less than a meter deep (see Vol. III, Chap. 11). In warmer climates, the depth was often less than 1.2 m (e.g., Woodward 1933:81 [Mexicans in southwest]; Wilson 1934:357 [Hidatsa]). In fact, Gilman (1983:97) has shown that depth increases with a decrease in the average winter temperature. It may be that shallow foundation pits were less than ideal depths necessitated by a lack of manpower and/or resources.

The Superstructure

The posts and poles may have been cut and hauled to the site well in advance of construction, as mentioned earlier, or during construction as is implied by Teit (1900:192 [Thompson]). The main support posts and beams were generally made from green timber (Teit 1895 [Upper Thompson]). Yellow pine was preferred by the Upper Thompson because it was easy to cut (Teit 1900: 1895), while the Shuswap used cedar or hemlock for the beams (Green 1972:2). Their length was determined by a rope measured according to the depth of the hole

(Teit 1900:192 [Thompson], 1895 [Upper Thompson]), or with small poles that were temporarily set up inside the pithouse depression (Surtees 1975 [Shuswap]).

The tree was cut, barked and occasionally squared with the use of antler or stone wedges and stone or wood hammers, and hauled to the site by men with stout bark ropes (Teit 1900:192 [Thompson]; 1895 [Upper Thompson]). Some of the peeling and squaring of posts and beams, some of the chopping of poles, and all of the notching was done with stone adzes with a short crooked handle (Teit 1895 [Upper Thompson]). The small poles used to cover the roof were also peeled, unless dry wood was used, in which case peeling to prevent rot was unnecessary (Teit 1900:192 [Thompson], 1895 [Upper Thompson]). These poles were then tied in bundles and hauled back to the building site with the use of tump lines (Teit 1900:192 [Thompson], 1895 [Upper Thompson]).

Most ethnographic accounts describe a roof structure supported on four large posts set into corners of the floor, sloping either outward (Teit 1900:192–194 [Thompson], 1909b:492 [Shuswap]; Laforet and York 1981:117 [Thompson]; Surtees 1975 [Shuswap]; Duff 1952:47 [Stalo]), or toward the center (Post and Commons 1938:41 [Nicola Valley]; Bouchard and Kennedy 1973:42 [Upper Lillooet]), and between the beds and the fire (Duff 1952:47 [Stalo]). Based on illustrations by Boas (1891), Teit (1900) and Dawson (1892), the posts in an average sized pithouse were located approximately 2/3 of the radius from the wall. Like the large pithouses of the Thompson (Laforet and York 1981:117), Chilcotin (Lane 1953:157) and Shuswap (Ray 1939:177–178) pithouses sometimes had six main support posts. Five posts were also used by the Chilcotin (Lane 1953:157) and Southern Okanagan (Post and Commons 1938:40).

This description has proven problematic for archaeologists who often find houses (especially small houses) with few, or no large postholes (Vol. II, Chap. 15). It is possible that the posts in these cases were merely resting on the floor, but they would have provided a much less stable structure. If the posts were placed against the wall, as was noted in Chilliwack pithouses (Smith 1947:257), then such posts would have been somewhat more stable.

Native accounts of structures from neighboring groups suggest other possible solutions to the posthole question. The Upper Stalo (Duff 1952:47) and Mount Currie Lillooet (Bouchard and Kennedy 1973:41; Kennedy and Bouchard 1977:Tape 1) maintain that no posts were placed inside the pithouse. Instead, the Mount Currie account describes a four-sided roof constructed of notched logs whose size diminished with height to produce a central entrance and smokehole. This structure had no support beams. Although this roof design resembles a log cabin structure and may be the result of Euro-Canadian influences, it is also similar to the hogan of the American southwest and may reflect a common ancestral form for both the hogan and the Mount Currie pithouse.

Probably the best alternative to internal posts is suggested by lodges typically built for summer use. The A-frame or tipi frame roof used for these structures may have been constructed over the pit with all the support beams placed outside the foundation pit (see Woodward 1933 for a description of how Mexicans living in the southwest built similar roofs over their pithouses). Interestingly, Bouchard and Kennedy provide a description of a Shuswap house that appears to be a cross between a pithouse and a lodge (1990:277–278). This structure had a square hole, 1.2 to 1.8 m deep, but it was covered with a tipi-like roof covered only with bark. It had a large central smokehole, but access was provided by two side entrances with steps leading up to the surface. Similarly, the Chilcotin built square pithouses with a ridge pole on two supports 1.5 m from the end walls (Lane 1953:158). The Sanpoil also constructed a pithouse with a single central post with radiating poles, as well as a flat-topped pithouse with no support posts (Ray 1932:31). With the flat roof the entrance hole and hearth were placed at the edge of the pithouse. "Although easier to build than the conical roofed lodge, this type was less efficient in the matter of drainage and consequently less used" (Ray 1932:32). Although these roof structures may have been suitable for smaller pithouses, they were probably impractical for the larger structures.

The main support posts of the pithouses were sunk about 38–50 cm into the ground and the base firmed by stamping the ground, with the feet or beating with sticks (Teit 1900:192 [Thompson]; 1895 [Upper Thompson]; Surtees 1975 [Shuswap]). Rocks were also occasionally used to help hold the posts in place (Laforet and York 1981:119 [Thompson]). The post holes were probably dug by the women with digging sticks and hands as was done by the Hidatsa (Wilson 1934:357), though men were also known to do this work (Surtees 1975 [Shuswap]). The top of the posts were sometimes notched or forked to provide a support for the four main beams that were sunk about 61 cm into the ground outside the depression and attached to the posts with willow withes, rawhide, spruce root, honeysuckle fibre, or cherry bark (Teit 1900:192 [Thompson], 1895 [Upper Thompson]; Boas 1891:634 [Shuswap]; Surtees 1975 [Shuswap]; Laforet and York 1981:117; Lane 1953:158 [Chilcotin]). The Chilcotin sometimes rested the ends of the rafters on a step inside the edge of the pit rather than on the ground surface, and if the pithouse was large and had four posts, extra beams might be added between the posts (possibly supported on a door frame) (Lane 1953:158).

The main beams were usually further supported by side braces resting on the ground, and they were attached to the beams by withes where they met the posts (Teit 1900:192 [Thompson], 1895 [Upper Thompson]; Laforet and York 1981:117 [Thompson]; Boas 1891:634 [Shuswap]; Post and Commons 1938:41 [Nicola Valley]; Lane 1953:157 [Chilcotin]). The Lillooet and some Shuswap did not use these side braces (Teit 1906:213; Ray 1939:177–178). Some side braces may have been notched and slightly sunk into the ground (Teit 1895 [Upper Thompson]). Cross beams and vertical or horizontal poles were then placed over the main beams with bark, grass, mats, moss, boughs, and/or hides laid over the poles and dirt or sod then put on top of the roof. A square hole was left in the center of the roof to let smoke escape and to serve as a "doorway" for entering and leaving the house. Additional information on construction of the superstructure are provided in Appendix I.

Access to the doorway was provided by a ladder that was typically made from a notched log (Anderson 1863:77 [Shuswap]; Bouchard and Kennedy 1973:42 [Lower Lillooet]; Post and Commons 1938:40–41 [Nicola Valley]; Laforet and York 1981:119 [Thompson]; Surtees 1975 [Shuswap]; Kennedy and Bouchard 1978:36 [Lillooet]; Boas 1891:634 [Shuswap]; Hill-Tout 1978a [Thompson]; Morice 1893:192 [Carrier]). In large pithouses (twice the norm), the central doorway was divided into two parts, with a notched ladder in each (Teit 1906:213 [Lillooet]; Post and Commons 1938:40–41 [Southern Okanagan]; Laforet and York 1981:119 [Thompson]). The bottom of the ladder was usually, but not always, sunk slightly into the ground, with one account placing the ladder 30 cm into the floor (Surtees 1975 [Shuswap]; Teit 1900:194 [Thompson]; Post and Commons 1938:41 [Nicola Valley]; Teit 1895 [Upper Thompson]). Sometimes the ladder was secured with rocks (Laforet and York 1981:119 [Thompson]). The top of the log, which protruded above the entrance hole, was sometimes painted and/or carved with a round nob, or an animal or bird head that might represent the guardian spirit of the builder or headman of the house (Teit 1909a:492–493 [Shuswap], 1900:194 [Thompson], 1906:213 [Lillooet]; Kennedy and Bouchard 1987:260 [Shuswap]). A groove was made with an adze down the back side (sometimes the side) of the ladder to provide a hand hold for climbing (Teit 1909a:492 [Shuswap], 1895 [Upper Thompson], 1900:194 [Thompson]; Kennedy and Bouchard 1987:260 [Shuswap]). Alternatively, in more southern areas the ladder was made of a cedar plank with holes burnt through it (Bouchard and Kennedy 1973:41 [Lower Lillooet]).

The ladder stood almost upright (early photographs and illustrations show ladders leaning at angles ranging from 55–80 degrees) and projected 1.2–1.8 m above the roof for convenience in grasping (Teit 1895 [Upper Thompson], 1900:194 [Thompson]; Post and Commons 1938:41 [Nicola Valley]; Lenihan 1877:4 [Stalo]). A notch was sometimes made in a doorway post or lashing was used to stabilize the ladder (Post and Commons 1938:41 [Nicola Valley]; Teit 1895 [Upper Thompson], 1900:194 [Thompson]). If the pithouse was built in a valley running north-south, the ladder was placed in the northeast or northwest corner of the doorway, leaning north, while in other valleys it leaned east (Teit 1909a: 492 [Shuswap], 1900:194 [Thompson]). The direction was apparently immaterial to the Southern Okanagan (Post and Commons 1938:40). Sometimes a log or pliable willow ladder was also used outside the pithouse to ease the climb from the outer rim to the doorway (Laforet and York 1981:121 [Thompson]; Mitchell 1925:12 [Shuswap]). A platform near the top of the ladder was used to keep lookout for approaching enemies (Condrashoff 1974 [Shuswap]; Green 1972:1 [Shuswap]). One account describes the ladder being lowered when women were cooking and at night while sleeping (Kennedy and Bouchard 1978:36 [Lillooet]). Given the size of the ladder and the small amount of open floor space inside, this was probably an uncommon practice.

According to ethnographic accounts, an additional doorway was also sometimes built into the side of the pithouse. This entrance was commonly referred to as the "women's entrance," a passage that allowed women to enter the house without passing over a man's head, which was a sign of disrespect (Laforet and York 1981: 119 [Thompson]; Surtees 1975 [Shuswap]). A side door also allowed easy access for old people (Post and Commons 1938:41 [Northern Okanagan]; James and Oliver 1991:22 [Nicola]), permitted firewood to be thrown into the pithouse (Ray 1939:177–178 [Shuswap]), and would have improved ventilation (Ray 1939:177–178 [Lillooet]) and reduced smoke inside the pithouse (Wilson 1934:370 [Hidatsa]). The Thompson side door was set into the wall at ground level and followed the angle of the wall (Laforet and York 1981:119). Steps ascended from the floor to a doorway covered with a willow and bark panel attached with rope hinges. An awning of poles and a sheet of bark were also used when it snowed. A pithouse used by the Shuswap in the early 1900's had two side entrances with steps leading down to the floor (Bouchard and Kennedy 1990:278). The side doors probably faced away from the prevailing winds to prevent them from blowing into the pithouse (Post and Commons 1938:40 [Southern Okanagan]; Wilson 1934:395 [Hidatsa]).

A side door leading to a narrow underground passage was also occasionally built to provide escape from enemy attacks—especially those during which the pithouse was set on fire (Laforet and York 1981:121 [Thompson]; Teit 1906:236 [Lillooet]; Nastich 1954:38 [Lillooet]; Kennedy and Bouchard 1978:37 [Fraser River Lillooet]; Bouchard and Kennedy 1985:185 [Thompson]). This passage (perhaps 5 m in length) had a hidden exit that emerged from a bank or hillside near a creek or tree-covered area (Kennedy and Bouchard 1978:37 [Lillooet]). The passage was described as a trench covered with camouflage in the form of poles, sticks, hides, or branches (Condrashoff 1974 as cited in Kennedy and Bouchard 1987:261 [Shuswap]). They were also lined with poles to prevent the soil of the walls and ceiling from filling in the tunnel (Laforet and York 1981:121 [Thompson]). Similar passages were also sometimes constructed between pithouses (Kennedy and Bouchard 1987:261 [Shuswap]; Bouchard and Kennedy 1985:185 [Thompson]). Possible side entrances or passages have been noted at a number of archaeological sites (Mohs 1981:45).

Stockades

Early historic and ethnographic accounts report that the Lillooet commonly built stockades or walls to protect themselves from attacks by strangers (Teit n.d., 1906:235–236, 238–242; Nastich 1954:38; Hill-Tout 1978b:50; Kennedy and Bouchard 1978:37). Stockades were constructed around a large house or a group of houses (pithouses among the Upper Lillooet) built some distance from other houses in the village (Teit 1906:235–236). The walls typically formed a circular, square, or oblong enclosure of logs piled horizontally to a height of about 2–3.5 m, and braced on the inside. The entrances were narrow zigzag passages, with front and rear gates securely locked by heavy wooden bars or large stones (Nastich 1954:38; Teit 1906:235–236). They were also equipped with two or more escape tunnels and a scaffold to facilitate shooting (Teit 1906:235–236). The Shuswap built similar log stockades with 2–3 m high earth banked walls and a deep trench at the base. A pit or underground room was dug in the center and roofed shelters were built around the walls. Although they retired to the fortresses at night, the lack of houses inside some fortresses suggests these structures may have been intended for summer use (Teit 1909a:539–540). The Thompson built a log fortified house with escape tunnels, rather than a palisade (Teit 1900:266–267). A few Lillooet stockades, presumably those of the cedar-rich Lower Lillooet were built of planks lashed to poles sunk into the ground (Teit 1906:235).

A Lillooet palisade described by Simon Fraser (Lamb 1960:82) had vertical poles 5.5 m high around an enclosure 30.5 × 7.3 m. It was a summer structure with no central house, located near the present town of Lillooet.

No evidence could be found of archaeological sites with palisades, but no concerted effort has been made to locate such structures.

Division of Labor

According to Teit's (1895) Upper Thompson informants, women did most of the digging, but men also seemed to be regularly involved in this task (Kennedy and Bouchard 1987:258 [Shuswap]). The men did most of the other work (Teit 1895 [Upper Thompson]), though women helped carry the poles back to the building site (Teit 1900:192 [Thompson], 1895 [Upper Thompson]). Similarly Hidatsa women cleared and leveled the site, and hauled the posts, while the men marked the site, cut the big timbers and hauled the posts and beams (Wilson 1934:356–397). Hidatsa women also helped cut the posts and beams, and trim and prepare the central posts (Wilson 1934:356–397) raising the possibility that women at Keatley Creek could have been involved in similar tasks.

What Took Place Inside the Pithouses

Upon completing the primary structure, the residents had to decide how to finish and arrange the interior of the pithouse. This involved planning where certain activities would take place, assigning sleeping and storage space to the resident families, and building any necessary benches, hearths, or other facilities.

The dirt walls of the pithouse were sometimes lined. The Shuswap piled horizontally-lying logs on the top of the natural ground surface and held them in place with stakes driven into the floor. Any remaining space between the logs and wall was filled with soil to form a shelf (Condrashoff 1974). The Lower Lillooet also lined the inside walls with logs that were held in place with notches burnt into the ends (Bouchard and Kennedy 1973:41). The Thompson used slabs of birch and cedar bark held against the wall with poles or woven cedar splints (Laforet and York 1981:120). The Southern Okanagan used brush or tule mats supported with small upright poles to cover the walls and keep out the damp (Post and Commons 1938:40). Any or all of these techniques may have been used in pithouses at the Keatley Creek site to provide additional insulation, to serve as a moisture barrier, and possibly to prevent the dirt walls from collapsing or slumping into the pithouse. Some of the small postholes found along the perimeter of HP 7 at Keatley Creek may be evidence of a wall lining, though similar postholes are absent from the other, smaller excavated pithouses.

Sleeping Areas

A large part of the interior of the pithouse was comprised of sleeping areas (Boas 1891:634 [Shuswap]; Post and Commons 1938:41 [Nicola Valley]; Lenihan 1877:4 [Stalo]; Mitchell 1925:12 [Shuswap]). Wooden sleeping benches (*yáywas*), 30–45 cm high and 1.5–1.8 m wide, were constructed around the perimeter of some pithouses, behind the posts (Teit 1909a:676 [Fraser River Shuswap]; Kennedy and Bouchard 1977:Tape 1; 1978:36 [Lillooet]; Bouchard and Kennedy 1977:64, 1973:41–42 [Upper and Lower Lillooet]; James and Oliver 1991:22 [Nicola]), though in other pithouses the bedding appears to have been placed directly on the floor (Laforet and York 1981:120 [Thompson]; Hill-Tout 1978b:109 [Upper Lillooet]; Smyly 1973:50 [Shuswap]). Wooden benches also lined the walls of Stalo and Lower Lillooet plank houses (Duff 1952:47; Teit 1906:213–214). The Upper Lillooet sleeping platform was constructed from a log laid near the wall with the space between the log and wall filled with branches or covered with planks (Kennedy and Bouchard 1977:Tape 1 [Upper Lillooet]). One account describes the beds as being recesses cut into the walls (Mitchell 1925:12 [Shuswap]).

The Thompson wooden platform is described as a box frame of lodgepole pine poles supported by four pole legs, 46–61 cm high, and covered with peeled poles (Laforet and York 1981:120). A bed was placed behind each post, with additional beds lining the walls if needed. They could be easily dismantled. This description sounds very similar to a Euro-Canadian bed and may not be the traditional form of platform construction. The Hidatsa adopted a similar bed construction after contact, but their traditional bed consisted of a single, continuous platform (Wilson 1934:384–385, 387, 409).

The sleeping area was covered with a "mattress" of hay, grass, boughs (of cedar, spruce, or fir), needles or crushed cedar bark that was replaced frequently (every two weeks) as the vegetation dried out (Laforet and York 1981:120 [Thompson]; Teit 1900:199 [Thompson], 1909a:496 [Shuswap]; Bouchard and Kennedy 1973:41–42 [Upper and Lower Lillooet], 1990:277 [Shuswap]). Tule mats were sometimes placed under and/or over the boughs (Teit 1900:199 [Thompson], Laforet and York 1981:120 [Thompson]; Hill-Tout 1907:57 [Salish]; Green 1972:1 [Shuswap]). These "mattresses" were covered with "blankets" of hides, furs, or woven mountain goat blankets (Bouchard and Kennedy 1973:41–42 [Upper and Lower Lillooet], 1990:277 [Shuswap]; Kennedy and Bouchard 1978:36, 38 [Lillooet]; Teit 1906:210–212 [Lillooet]; Laforet and York 1981:120 [Thompson]). Pillows consisted of any of the following: folded wool blankets, folded rabbit skin, folded buckskin, rush mats filled with needles, rolled up ends of a grass mattress, or skin bags filled with the down of birds, cottonwood seed fluff, or bulrushes (Teit 1900:199 [Thompson]; Laforet and York 1981:120 [Thompson]).

Some accounts describe a bench extending around the entire wall (Bouchard and Kennedy 1973:42; Kennedy and Bouchard 1977:Tape 1 [Upper Lillooet]) but this seems to be an unlikely scenario, at least in the smaller pithouses. An average sized ethnographic pithouse with a 6.1 m inside diameter and a 1.8 m wide bench around the entire perimeter would only have approximately 3 m^2 of space in the center for all the other activities of the approximately 15 residents (see the previous discussion of pithouse size). Informants report that when it was crowded in the pithouse people slept with their heads to the wall (Teit 1898:29: 1909a:676; Ray 1932:32 [Sanpoil]; Bouchard and Kennedy 1973:41 [Lower Lillooet]) which, given the circular configuration of a pithouse and the wedge-like shape of the human body, was more spacious and comfortable than sleeping with their feet to the wall. If all the residents slept at right angles to the wall rather than parallel to the wall and if each person had about 50 cm of the circumference (estimated average shoulder width) then only half of the perimeter would have to be dedicated to sleeping space.

Buckskin hammocks slung from the posts or beams were another possible solution to overcrowding in the sleeping areas, though the Shuswap only used them for small children (Teit 1900:199 [Thompson], 1909a:496 [Shuswap]; Hill-Tout 1907:57 [Salish]). Children could also sleep in cradles hung from the roof, until they were one or two years of age (Bouchard and Kennedy 1977:25 [Lillooet]; Nastich 1954:48 [Lillooet]). Some of the burnt planks and posts found around the perimeter of HP's 3 and 7 at Keatley Creek may be remains of sleeping benches, and archaeologists at the site have also evoked the presence of sleeping areas and benches as the best means of explaining the distribution of cultural materials along the walls (Vol. II, Chaps. 4 and 7; Vol. III, Chap. 7).

In the plank houses and shelters of the Lower Lillooet, partitions of mats, hides, or cedar boards were sometimes attached to the posts to separate the sleeping areas of each family (Teit n.d.; Kennedy and Bouchard 1977:Tape 1). These sleeping areas were generally open to the center of the structure, but blankets or mats were sometimes hung in front at night. The Thompson also used rush mats to partition the pithouse into family areas or "corners" between the posts (Laforet and York 1981:120). It is possible that similar temporary partitions were constructed in the pithouses at Keatley Creek. These partitions were more likely to be absent or temporary where winter dances were common and a large common area was required (Duff 1952:48 [Stalo]; Hill-Tout 1907:5–53 [Coast Salish]).

Hearths

Each family in the house prepared their own meals, but most accounts maintain that only one central hearth was built under the doorway (Kennedy and Bouchard 1978:36 [Lillooet]; Laforet and York 1981:120 [Thompson]; Bouchard and Kennedy 1973:41–42 [Upper and Lower Lillooet]; Lenihan 1877:4 [Stalo]; Post and Commons 1938:40–41 [Southern Okanagan]; Champness 1971:92 [Thompson]; Condrashoff 1974 [Shuswap]; Ray 1932:31 [Sanpoil]; see also Wilson 1934:376 [Hidatsa]). This arrangement was probably only feasible in small pithouses. In large pithouses, of perhaps three or more families, each family had its own fire (Hill-Tout 1907:56 [Salish]). These fires were placed under the smokehole (Post and Commons 1938:41 [Nicola Valley]) or at the four main posts (Hill-Tout 1978a:58 [Thompson]). When large feasts took place in the pithouse, two large fires were built to cook the large quantities of food gathered for the guests (Nastich 1954:59–60 [Lillooet]).

When a single central hearth was constructed, it was commonly located at the foot of the ladder on bare ground (Boas 1891:634 [Shuswap]; Post and Commons 1938:41 [Nicola Valley]). If it was built under the base of the ladder, a large rock or a pile of rocks was placed behind the fire to protect the ladder from the heat (Smyly 1973: 50 [Shuswap]; Laforet and York 1981:119–120 [Thompson]; Teit 1900:194 [Thompson]; Bouchard and Kennedy 1987:260 [Shuswap]; Condrashoff 1974 [Shuswap]). For the Shuswap, the fire was typically built on the north side of the ladder (Teit 1900:194). In some cases the fire was surrounded with four logs to prevent sparks from burning the bedding (Bouchard and Kennedy 1987:260 [Shuswap]). Young boys were sent to gather firewood that was dry and so produced little smoke (Bouchard and Kennedy 1973:42 [Upper Lillooet]).

The food was typically cooked by dropping heated stones into bark or coiled root baskets filled with food (Bouchard and Kennedy 1973:41–42 [Upper and Lower Lillooet]). The cooking fire was probably used primarily to heat these boiling stones that "were smooth, about fist-size, and were heated on a crib of sticks which were fired from below" (Post and Commons 1938:60 [Southern Okanagan]). The coiled baskets used to cook the food were sometimes set into the ground and could last up to 10 years (Post 1938:32 [Southern Okanagan]). The meals were typically small (because the people seldom went outside) and everyone in the family ate from the same communal bowl or mat (Bouchard and Kennedy 1973:42 [Upper Lillooet]; Teit 1906:216 [Lillooet], 1900:199 [Thompson], 1909a:496 [Shuswap]; Kennedy and Bouchard 1978:39 [Lillooet]). This food was typically eaten on a mat while seated on the floor or on the beds (Teit 1900:199 [Thompson]; Laforet and York 1981:121 [Thompson]; Kennedy and Bouchard 1977:Tape 2; 1987:262). Each family had their own boiling stones, baskets, and eating utensils (Nastich 1954:23 [Lillooet]).

The fire was extinguished after the meal (Kennedy and Bouchard 1978:36 [Lillooet]; Bouchard and Kennedy 1973:42 [Upper Lillooet]) with one account stating that the fire was only lit for one hour in the morning and one hour at night (Bouchard and Kennedy 1973: 41 [Lower Lillooet]). Other accounts state that fires were used primarily for cooking, that dried salmon was eaten without cooking (Kennedy and Bouchard 1977:Tapes 1 and 2 [Lillooet]), and that food was often eaten cold in winter (Post 1938:32 [Southern Okanagan]; Rice 1985:99 [Walla Walla]) suggesting that a cooking fire was not always necessary. On the other hand, the children and elderly could not always chew the dried food and needed the soup produced when the food was boiled in the baskets (Post 1938:32 [Southern Okanagan]).

In very cold weather, small fires were sometimes lit to provide heat closer to the sleeping areas near the four main posts (Hill-Tout 1978a:58 [Thompson]). As discussed previously, it was generally not necessary to keep a fire burning all day to keep the pithouse warm. In fact, much of the heat generated by a fire would probably be lost through the opening for smoke ventilation, and if enough body heat could be generated fires would be unnecessary for heating (Hayden et al. 1996). The need for a constant fire or secondary fires was probably even less in smaller pithouses since they had a smaller area to heat. Given the small communal area in these pithouses, an active hearth may have also been a safety hazard and it would have been difficult to find a safe and open area for the construction of secondary fires.

Almost all of the excavated pithouses at Keatley Creek had some evidence of a main hearth, commonly indicated by a circular patch of fire-reddened soil in the underlying sterile till. Some of the large houses had evidence of more than one hearth (Vol. I, Chap. 17). However, not all floors had clear evidence of a hearth in the soil deposit representing the last occupation. The fire-altered rocks, charcoal and ash that must have been produced by these fires were rarely encountered in situ. This patterning suggests that the hearths were cleared away on a regular basis. Although the hearths may only have been removed in a general cleaning prior to summer abandonment, the evidence more strongly suggests they were cleaned each day or after every use. Given the relatively crowded conditions in the pithouses and the combustible nature of the construction materials, it may have been safer and more convenient to remove the fire debris when not in use.

Areas of superficially fire-reddened sterile till were found away from the center of three of the excavated housepits (3, 7, and 12). These areas may be evidence of secondary fires or the possible in situ burning of sleeping benches and/or collapsed roof beams resulting from the obvious post-abandonment burning of these pithouses. Housepit 9, with no evidence of burning after abandonment, had no evidence of fire-reddened soils at the floor margins, suggesting that many of the marginal fire-reddened areas in the other houses are not hearth remains. Given the need for smoke ventilation, and the fire hazard that would have been produced by building large hearths near the walls and sleeping areas, it is unlikely that anything but small secondary fires would have been constructed at the margins.

Storage

Dried salmon was the most important and abundant dried food stored for the winter (Dawson 1892:15 [Shuswap]; Bouchard and Kennedy 1990:249–51 [Shuswap]). One estimate suggests that each person ate as much as 500 pounds of fresh and dried salmon annually (Bouchard and Kennedy 1990:259 [Shuswap]; Hewes 1973:137 [Shuswap]). Dried plants (Turner 1992:429–32 [Lillooet]) and meats (Romanoff 1992:480–485 [Lillooet]) were also stored in large quantities. Most of the food was temporarily stored near the procurement camps, and then brought to the village for storage in the winter when there was more spare time (Teit 1906:215 [Lillooet], 1900:495 [Thompson]; Post 1938:31 [Southern Okanagan]). Outdoor storage facilities at the procurement camps and villages included underground cache pits, elevated wooden box caches, and wooden storage platforms (Bouchard and Kennedy 1990: 279 [Shuswap]; Teit 1900:198–199 [Thompson], 1906:215 [Lillooet], 1909a:495 [Shuswap], 1909b:776 [Chilcotin]; Hill-Tout 1978a:58 [Thompson], 1978b:110 [Lillooet], 1907:108 [Salish]; Boas 1892:635 [Shuswap]; Alexander 1992:129–132 [Interior Salish]; Laforet and York 1981:120 [Thompson]; Romanaff 1992:240–241 [Lillooet]).

Expedient elevated caches were sometimes built in trees, but most elevated caches (*p'aKw'ulh*) consisted of a large roofed wooden box constructed on a pole platform with four pole supports, usually 1.5–1.8 m high, but up to 2.7 m high (Bouchard and Kennedy 1990:280 [Shuswap]; Teit 1900:198–199 [Thompson], 1909a:495 [Shuswap], Teit 1906:215 [Lillooet]; Boas 1891:635 [Shuswap]; Duff 1952:67, 89 [Stalo]). These caches were probably used primarily to store dried fish, with a box 2.4 m^2 holding several hundred fish (Alexander 1992:128 [Shuswap]; Teit 1900:234 [Thompson]). Meat and utensils were also sometimes stored inside (Teit 1900:198 [Thompson]; Kennedy and Bouchard 1978:43 [Lillooet]). One historic account discusses salmon being removed from riverside cache boxes every week or two as needed, and taken back to the village (Romanaff 1992:240–241 [Lillooet]). Storage platforms (like an elevated cache without a box), were used near the house to store cumbersome articles such as utensils, skins, and ropes out of the reach of the dogs (Teit 1900:199 [Thompson], 1909a:495 [Shuswap]).

Underground caches (*tsrp wen and skw'ezks*) were constructed as pits (.9–1.8 m wide and 1.2–1.8 m deep) covered with poles or bark, dry pine needles or grass, and then soil (Teit 1900:198 [Thompson], 1909b:776 [Chilcotin]; Dawson 1892:9 [Shuswap]; Hill-Tout 1907:108 [Salish], 1978a:58 [Thompson]; Alexander 1992:130 [Chilcotin]; Kennedy and Bouchard 1977: Tapes 1 & 2 [Lillooet]; Bouchard and Kennedy 1990:280 [Shuswap]). Items were removed through a door made in the center or, in the case of caches made in the side of a bank, through a side door. To prevent moisture damage and mold, the pits were lined with maple sticks, grass and/or birch bark. Dried fish, and baskets of roots and berries were also wrapped or layered with birch bark (Teit 1900:199, 234 [Thompson]; Hill-Tout 1978a:58 [Thompson]; Bouchard and Kennedy 1990:280 [Shuswap]). Grass and pine needles were used to discourage mice, while juniper berries kept the insects away (Romanoff 1992:241 [Lillooet]).

Some underground caches, left undisturbed all winter, were used solely to store surplus food that the owners did not anticipate using that winter (Teit 1906:223 [Lillooet]). This food may have largely consisted of salmon left over from the previous year (Teit 1900:234 [Thompson]). Other caches, made with less care and constructed near the house, were used to store food needed for use during the winter (Teit 1906:223 [Lillooet]). Foods were removed from these caches as needed.

In discussing the external cache pits of the Southern Okanagan, Post (1938:32) notes that small pits were sometimes built by one individual (see also Boas 1917:45 [Thompson]), but larger pits were often used by two or three families with each woman using sticks to denote her section of the pit. "If many pits were dug together, only one type of food would be put into each, lest the flavors mix, for the sacks were always placed close together to keep the air from circulating" (Post 1938:32 [Southern Okanagan]). Similarly, in an early

1900's pithouse, several cache pits were constructed outside, each of which contained a different type of food (Bouchard and Kennedy 1990:278 [Shuswap]).

The cache pits, used to store dried fish, roots and berries, kept the food better and longer than the elevated caches (Teit 1909a:495 [Shuswap]; 1900:198 [Thompson]; Post 1938:32 [Southern Okanagan]). Although one informant mentions meat being stored in a cache pit (Bouchard and Kennedy 1990:278 [Shuswap]) other informants state that meat was not put in its because it would become moldy (Kennedy and Bouchard 1977:Tape 1 [Lillooet]). The residents of Keatley Creek probably preferred the use of cache pits over elevated caches (Teit 1906:215 [Lillooet], 1909a:495 [Shuswap]; Hill-Tout 1907:108 [Salish]). Wood for constructing elevâted caches may have been scarce near the village, while the dry climate and sandy soil was ideal for cache pits (Hill-Tout 1978a:58 [Thompson]; Teit 1909a:495 [Shuswap]). During raids they would also have found it easier to hide a pit than an elevated cache. On the other hand, relatively few cache pits have been found at the site, suggesting that many of them were located inside houses, or some distance from the site, and/or elevated caches were preferred.

Other items were also stored outside. Firewood was piled outside and covered with a roof supported on four poles. Dishes, spoons, and other utensils used for feasts but not needed for every day use and baskets to be used in the warmer months were stored in a summer shelter (Laforet and York 1981:120 [Thompson]; see also Boas 1917:26 [Thompson]).

The main food storage areas were in outside cache pits where the berries, nuts and dried roots were protected from the heat of the fire (Smyly 1973:50–51 [Shuswap]), however, storage pits were also constructed inside the pithouses. The size and number of internal cache pits differs with each excavated housepit at Keatley Creek. Interior cache pits were more common on the Fraser River than in the Thompson River valley, where external pits are more common (Blake 1974:2). This evidence suggests that internal pits were used, in part, as an alternative to external pits. The average number of internal pits in Southwestern U.S. pithouses was 1.2–2.0, with two to six external cache pits (Gilman 1983:192).

Women were forbidden to step over the food (Kennedy and Bouchard 1987:262 [Shuswap]), so presumably the cache pits were not in heavy traffic areas of the pithouse. Low traffic areas would have included localities along the walls and under the benches. Teit (1898:66 [Thompson]) mentions inside caches being hidden where people sit. Like the Hidatsa, the Shuswap and Lillooet probably covered the cache pits with a trap door and took enough food out with each visit to last several days (Wilson 1934:384). Teit describes caches covered with planks or poles (Teit 1898:109, 150 fn [Thompson], 1900:199 [Thompson]).

A shelf, constructed in the angle between the roof and the top of the wall was also used for storage (Kennedy and Bouchard 1978:36 [Lillooet]. The Shuswap report that each section of the shelf, as defined by the main beams, held a different item—with roots and berries in one, meat in another, and baskets of water and firewood on others (Green 1972:2; Condrashoff 1974; Smyly 1973:50–55; Surtees 1975; Teit 1909a:492). Food stored on the shelf was intended to be used relatively quickly (Bouchard and Kennedy 1987:262 [Shuswap]). Since each family was allotted a separate corner of the house (Teit 1898:59 [Thompson]), this division by materials may only have applied to pithouses occupied by a single family or perhaps a group of families organized communally.

Alternatively, or in addition to the shelf, each family had a rack hanging from the ceiling in their corner of the pithouse, on which they stored food intended for immediate consumption (Kennedy and Bouchard 1977:Tape 1 [Upper Lillooet]; 1987:262 [Shuswap]; Laforet and York 1981:120 [Thompson]). Each family may have also had a separate corner for storing "personal belongings and general impedimenta" as did the Carrier in their winter lodges (Hill-Tout 1907:60; Morice 1893:195, 199). A Fraser River Shuswap myth also recounts how a man "brought home different kinds of meats, which he rolled up in grass and placed on the shelves of poles which were all around his house" (Teit 1909a:688; see also Teit 1898:38; 1912b:367). In a similar fashion, the Nootka placed dried plants, dried fish, mats and hunting and fishing equipment on their storage shelves (Sproat 1987:33).

The area under the ladder (i.e., near the center of the floor) was used by all families in the house as a common storage area for "bundles of pitchwood and kindling needed to maintain the fire, and for cooking utensils, which when not being used, were hung up out of the way" (Laforet and York 1981:119 [Thompson]). Teit also mentions wood storage inside a lodge (1912a:222 [Thompson]). Besides the wood pile, food stores were generally kept close to the fire for immediate use (Post and Commons 1938:41 [Nicola Valley]).

Many items were stored by hanging them from the posts or beams, or from strings stretched between the beams. These items included: baskets of roots and berries, water containers, pouches, clothes, and mats and blankets (Surtees 1975 [Shuswap]; Kennedy and Bouchard 1977:Tape 4 [Lillooet]; Laforet and York 1981:120 [Thompson]; Wilson 1934:394 [Hidatsa]). Large baskets (e.g., 1.9 × .9 × .8 m) of birch, poplar, or spruce bark were used to store provisions inside the winter houses, such as water, food, and clothing (Teit 1900:200 [Thompson], 1909a:496 [Shuswap]). Large coiled baskets were used to store clothes and other valuables (Duff 1952:57 [Stalo]). Water was also fetched and stored in baskets that were placed "in between the corner sleeping areas," never under the ladder (Laforet and York 1981:120 [Thompson]). Although bathing took place outside in a stream or sweat lodge (Nastich 1954:51–2 [Lillooet]; Teit 1909a;495 [Shuswap], 1900:198 [Thompson]), residents of the pithouses probably used plenty of water for cooking and drinking (Post 1938:32 [Southern Okanagan]).

Some items were stored under bed platforms. The Lillooet stored baskets of goods under the benches or where people ate (Teit 1898:66; Kennedy and Bouchard 1977:Tape 1; 1978:36). In the plank houses of the Lower Lillooet, roots were stored in "shallow cellars under the bed-platform" (Hill-Tout 1978b:109), and small storage pits were also constructed under Upper Lillooet sleeping platforms (Kennedy & Bouchard 1977:Tapes 1 & 2).

In summary, at Keatley Creek, food that was to be stored for four months or longer was probably placed in carefully constructed outdoor cache pits. Food intended for use over the winter was probably stored in elevated caches or in less well built outdoor cache pits. The indoor cache pits (and perhaps storage baskets) held food that was to be used in a relatively short time period; while food stored on shelves and racks was intended more for immediate use. The Southern Okanagan followed a similar pattern in their tule long-houses which had indoor storage compartments near the door replenished from the outside caches as needed, and had small quantities of food also stored in each family's domestic area (Post 1938:32).

Most of the tools owned by the residents were probably stored inside the pithouse during the winter. Raw materials that could be used in the future, such as bones for tools, were either stored or hung up (Teit n.d. [Thompson?]). Teit also discusses how tools were cached in other seasons:

> If all the people of one house were going off on a trip, they buried some of valuable tools they did not want to take along. Especially things made of stone. If of bone or antler etc. then [they were] wrapped up and dry ground selected. Stones did not matter. Buried pipes and hand hammers etc. (n.d. [Thompson?])

Women were forbidden to touch men's hunting gear (Nastich 1954:63 [Lillooet]), so these tools must have been stored separately. Perhaps, like the Hidatsa, they hung these items from the rafters (Wilson 1934:394). Since men did not seem to be restricted from touching women's tools, women's tools may have been widely dispersed throughout the pithouse with tool kits duplicated in each woman's sleeping area. The corresponding men's activity areas may have been similarly isolated. Women were also supposed to avoid walking where the meat was stored (Post and Commons 1938:41 [Nicola Valley]). This prohibition may be one of the reasons that inside the pithouse the meat was dried (and perhaps stored) on a rack suspended from the ceiling (Bouchard and Kennedy 1990:277 [Shuswap]).

Activity Areas

Teit (1909a:492 [Shuswap]) describes an idealized pattern of house arrangement with the internal space, divided into four rooms, defined as the space between two support posts (or alternatively between the beams Teit 1900:194 [Thompson]). The space closest to the high land or mountain, usually the eastern most space, was referred to as the "upper," "top," or "head" room. The room closest to the water or river was sometimes called the "kitchen," "storeroom," or "lower room" but was most commonly called the "passing-place" because people passed this space on their way to the water. The space under the ladder, generally the northern most room, was called the "under" or "hand" room, both in reference to the ladder. The room opposite the foot of the ladder was called the "bottom" room. Alternatively the rooms were named according to the compass direction, e.g., east (see also Teit 1900:194 [Thompson]). Most pithouses were built so that one of the side rooms, either the east or west, was the closest room to the water. If this arrangement of rooms was followed at Keatley Creek, it is unclear whether the storage room or kitchen would have been in the west, closest to the river, or in the south nearest the creek. The ethnographies suggest that all pithouses at the site might be orientated the same way however, this is not supported by hearth positions in the north (HP 12), center (HP 9), and south (HP 3) in archaeological contexts.

In addition, more recent accounts of pithouse use either fail to mention, or deny the identification of rooms named on the basis of direction or function (Kennedy and Bouchard:Tapes 1 and 2 [Lillooet]). Many reports, including Teit's, also described the margins of the pithouse, where the sleeping platforms were located, as being divided into family areas [Nastich 1954:61 [Lillooet]; Bouchard and Kennedy 1973:42 [Upper Lillooet]; Laforet and York 1981:120 [Thompson]; Teit 1898: 59 [Thompson]). A Nicola informant explained that if a man had five children, "then he would need five corners since one was for each one of his family. There's generally a corner to a family. That corner would be your sleeping area and your private spot in there. You hang your most valuables in there and nobody touches it. Even those staying at your house, they don't ever enter your area. The center is open to everyone (James and Oliver 1991:24)." As discussed previously, in larger pithouses, each family may also have had their own hearth and storage areas. In smaller these larger pithouses, Teit's "rooms" may only apply to the centrally located communal areas. In pithouses where the sleeping platform only extended around part of the perimeter of the floor, the "kitchen / storage" room may have been located in the corner lacking platforms. Communal storage and cooking facilities may have been more feasible in the smaller pithouses. In fact, the division of floor space in HP's 9, 12, and 90 appear to approximate Teit's description of the division of pithouses into "rooms" for cooking, sleeping, other activities, and perhaps storage (Vol. II, Chaps. 6, 11, 12; Vol. III, Chap. 7).

Descriptions of the day-to-day activities inside a pithouse are rare, but some idea of the range of possible activities involving stone and bone materials can be obtained from the list of ethnographic references to these items presented in Appendix II of this chapter. Documentation of plant uses is provided by Turner (1992; Turner et al. 1990).

We know that men and women spent most evenings conversing, telling stories and playing lahal and dice (Teit 1909a:617, 621 [Shuswap], 1900:367 [Thompson]; Commons 1938:185 [Southern Okanagan]). Many activities took place around the central hearth "where women sewed, made baskets, and toasted salmon, and hunters told yarns, or played bone [game] and sang" (Mitchell 1925:12 [Shuswap]). The central space between the four supporting posts was probably a common area, with family areas around the wall (Hill-Tout 1978a:58 [Thompson]; 1907:56 [Salish]). The roof may also have been used as a place to lounge and keep a lookout (See Wilson 1934:365 [Hidatsa]).

The following description of life inside a Hidatsa earth lodge may be used a model for activities inside a Plateau pithouse.

> The space in front of each woman's bed was considered her workroom. Here she sat when making baskets or pottery, embroidering quills, or sewing of clothing, moccasins, robes, etc. Her raw materials and implements for this work were stored under the bed towards the foot, wrapped in bundles or in envelope-shaped skin bags, and kept in a workbox which was placed on a board . . . hides were often dried at the fireplace. . . . The skin-dressing tools were kept in a parfleche hung with the bags containing clothes from thongs pendent from the [roof] poles . . . space about the fire was used for lounging, as a work place, or for meals (Wilson 1934:392–393).

A Thompson woman's duties included a number of activities that may have taken place inside the pithouse. They included: washing, cooking, lighting the fire, and cleaning the inside of the house; fetching the water, firewood and brush for the floor and beds; preparing skins, mats, baskets, sacks, bags, clothing and moccasins; and looking after the children (Teit 1900:182, 295–296). Women's activities that informants clearly state took place inside the pithouse are the manufacture of clothing and baskets, spinning wool, and the dressing of skins (not including the cleaning and removal of hair) (Surtees 1975 [Shuswap]; Kennedy and Bouchard 1977:Tape 1 [Lillooet]; Laforet and York 1981:121 [Thompson]; Teit 1900:186 [Thompson], 1909a:477 [Shuswap]).

Men's duties that may have taken place inside the pithouse included: the manufacture of tools and weapons from stone, bone and wood; and sometimes the tanning of buckskin (Teit 1900:182, 295–296 [Thompson], 1906:239 [Lillooet]). Some men also cut and sewed their own clothes and moccasins and cooked those parts of animals that women were forbidden to eat or touch (Teit 1906:257 [Lillooet]). Smoking was also largely confined to elderly men and shamans (Teit 1906: 250 [Lillooet]). "There was a certain amount of division of labor, inasmuch as workmen skillful in any particular line of work exchanged their manufactures for other commodities" (Teit 1900:182 [Thompson]). This division of labor may be reflected in the archaeological record with some housepits or hearths exhibiting a disproportionate representation of certain activities.

No one bathed inside the pithouse. Instead, men and women used separate shelters by the creek equipped with a large fire for heating rocks, used to heat bath water in a basket (Laforet and York 1981:121 [Thompson]). It is possible that the residents of Keatley Creek might have built a small annex to the pithouses (as did the Carrier in their winter lodges), to use as a bath area for old men and a kennel for the dogs (Hill-Tout 1907:60). Every family also kept a birch bark urinal near the sleeping place for the children (Laforet and York 1981:121 [Thompson]).

Hunting for small and large game, and ice-fishing seem to be the main subsistence activities that were conducted from the pithouse during the winter. However, some river fishing for salmon, and plant gathering took place, primarily just prior to abandoning pithouses in the spring (Alexander 1992:154–158 [Interior Salish]). Dogs and snowshoes were used for winter hunting (Teit 1900:248 [Thompson]). The types and abundance of tools in the archaeological assemblage should reflect the above activities.

Those activities that required a large space or created a lot of debris were probably not conducted inside the houses, where space was limited and the traffic was heavy. Therefore, while stone tool resharpening and hafting may have taken place inside, the primary stages of large tool production were more likely to occur outside. The primary butchering of animals (Kennedy and Bouchard 1978:49 [Lillooet]) and the dehairing and defleshing of hides (Teit 1909a:717 [Shuswap]) also took place outside, while secondary butchering, meat drying, and hide softening appear to have continued inside the pithouses (Kennedy and Bouchard 1977:Tapes 1 and 2 [Lillooet]). On some special occasions primary butchering may have taken place inside the pithouses, as recounted in a number of oral histories that describe entire animals being dropped into pithouses during feasts (Kennedy and Bouchard 1977:Tape 2; Romanoff 1992). It is not clear whether men or women did this butchering, but this may be related to the occurrence of broken bifaces in the center of the floor of HP 7 (Vol. II, Chap. 11). Hide soaking began outside by soaking dried hides in a stream for several days, but this activity may have continued indoors for 1 or 2 days while the hide soaked in a basket with a mixture of water and deer brains (Post 1938:11 [Southern Okanagan]).

Some of these activities, such as the smoking of fish and meat, and tool manufacture, occurred in old abandoned pithouses (Bouchard and Kennedy 1990:278 [Shuswap]; Kennedy and Bouchard 1978:37 [Lillooet]). Others occurred in mat lodges. A Nicola informant explains that as the weather warmed in February people would temporarily move out of the pithouse to a circular mat lodge nearby. "That would be a working area also where through the winter months when it's not too cold, they'd go in it to do their weaving, sewing, hide tanning, all the men working on their bows and arrows and moccasins. This might be a communal place. There might be three or four of the keekwilees in a circle so they'd build a kind of a community place where they'd meet through the day (James and Oliver 1991:25)."

Feasting and dancing were common during the winter months. Among the Stalo "gatherings of all sizes, from very small to very large, were held almost continuously during the dance season" (Duff 1952:107). The Lillooet are also reported to have danced at least once a month during the year, with the majority of these dances occurring in the winter, especially around the winter solstice in December (Teit 1906:284 [Lillooet]). These dances and feasts were held inside the pithouse (Teit 1900:296, 350 [Thompson], 1909a:610 [Shuswap]). Marriage feasts typically took place in the winter in the family pithouse (Nastich 1954:59–60 [Lillooet]). These feasts were accompanied by dancing, singing, dramatizations of myths and stories by the elders, and the distribution of blankets, skins, and foods to everyone including the poor (Nastich 1954:59–60, 66 [Lillooet]).

Winter spirit or power dances were held when the spirit commanded, but were usually in January and February (Cline 1938:145–146 [Southern Okanagan]; Teit 1906:286 [Lillooet]). The dance leader always gave his first winter dance in his own house and subsequent dances were also held in his house, if it was large enough. If more room was needed, the largest house in the village was used, which commonly meant that the chief would lend his house (Cline 1938:145–146 [Southern Okanagan]). The Shuswap also were known to gather in the largest pithouse (Teit 1909a:610). In the Southern Okanagan dances, the dancer circled around the inside of the house, while the others sat—with men on one side, women on the opposite, and age mates usually together (Cline 1938:148). During the Stalo winter dances, the people from each village were seated in separate sections. People became possessed, and danced one at a time, but everyone joined in with singing and drumming. "The dancers danced only in the area between the [main] posts and the beds, not in the central area enclosed by the four posts" (Duff 1952:47). Keddie (1987:1 [Shuswap]) reports that the floors of large pithouses used as "dance houses" were prepared with clay "to keep the dust down."

The dance leader provided most of the food, with his family doing most of the cooking, though each family brought some food and utensils. Blankets and skins were also given away. The dances lasted from one to fourteen days (commonly five to six days), and included people from neighboring and occasionally, more distant villages (Teit 1906:284–285 [Lillooet]; Cline 1938:147 [Southern Okanagan]; Duff 1952:107 [Stalo]). Interaction was probably greatest among fellow band members, that is, people from nearby villages who used the same camping and fishing sites (Nastich 1954:32 [Lillooet]). Much food was distributed at these dances and an individual could subsist all winter on the provisions of others offered at these events (Commons 1938:185 [Southern Okanagan]).

Many feasts were simply social gatherings between neighboring families, families from other villages, or groups of people from other bands who might be wintering at the village (Teit 1900:385, 296–297 [Thompson]). The feasts could last two or three days. A feast for all the residents of a pithouse was also given following a ceremonial ordeal for the children intended to build courage. Potlatches also occurred during the winter. While some ethnographers suggest that potlatches were a post-contact phenomenon (Teit 1900:297 [Thompson], 1909a:574 [Shuswap]), in the prehistoric past, Interior peoples may have adopted (and later abandoned) elaborate feasting practices when economic conditions stimulated intense trade. Whatever the case, during any large ceremonial or feasting events, decorative elements of dance or ritual costumes could break or become detached and lost in the dust. Such elements might include parts of eagle feathers; copper and bone tubes and beads; dentalium; antler decorations; wolf, elk, and other animal teeth; fawn and deer hooves; claws of bear; beaver; and silver berry seeds (Appendix II). Other items found at Keatley Creek may have also been used in similar contexts including bird wings, copper or shell ornaments, small stone or bone sculptures, chipped eccentric stones, incised and shaped pieces of bone, and pieces of mica. Sometimes costume elements like dentalium shells were arranged so that they would fall off during dances as incidental gifts to guests (Teit 1912b:358–359). At other ceremonies, such as the piercing of infant ears and noses, sharpened deer bones (presumably awls) were used for piercing and beaver teeth or deer bones were inserted into these openings as ornaments (Nastich 1954:64).

One account states "as many as forty people could be seated in the largest underground house" (Bouchard and Kennedy 1979:129). Since we know that very large pithouses had a resident population as high as 70 people, this description must refer to the high end of the most common pithouse size used at contact, about 9 m across with a resident population of about 26 people (see Section 5.1.). In fact, a large Shuswap pithouse (13.7 m^2) built after contact especially to accommodate large gatherings held up to 300 people (McDonald 1826 as cited in Kennedy and Bouchard 1987:259). The Southern Okanagan considered 100 people a large gathering for a power dance (Cline 1938:147), a figure that may more accurately reflect the pre-contact norm.

The physical evidence of many of the activities conducted inside the house may be scarce. The floor, except around the hearth, was said to be covered in a layer of small evergreen boughs (typically fir, spruce or Douglas-fir) that were regularly discarded and replaced every three or four days (Hill-Tout 1978a:58 [Thompson], 1907:56, 60 [Salish]; Kennedy and Bouchard 1978:36 [Lillooet]; Laforet and York 1981:121 [Thompson]; Post and Commons 1938:41 [Nicola Valley]). The Sanpoil covered the floor, except near the fire, with 10–13 cm of rye grass (Ray 1932:32). Tule or bulrush mats or grass were also used as floor coverings, sometimes over the boughs (Post and Commons 1938:41 [Nicola Valley]; Condrashoff 1974 [Shuswap]; Green 1972:1 [Shuswap]; Teit 1909b:775 [Chilcotin]; Ray 1942:177–178 [Wenatchi]; Smyly 1973:50 [Shuswap]). Much of the debris from the activities must have become trapped in the flooring and discarded with it. Stray needles from the floor boughs may have been swept up with a twig broom or goose wings, after first sprinkling the floor with water to make the floor hard and sweeping easier (Laforet and York 1981:121 [Thompson]; James and Oliver 1991:25 [Nicola]; see also Wilson 1934:394 [Hidatsa]). Given the relatively small living area, a strong incentive must have also existed to keep the central, more heavily trafficked area clear of debris. The scarcity of evidence for such floor coverings at Keatley Creek (Vol. II, Chap. 4) suggests either that practices differed in the past or the cleaning was relatively intense.

Accumulation zones were probably limited to the outer margins of the floor, especially where "dead" spaces may have been created under the wooden sleeping benches. Archaeologists (Spafford 1991:179–180) speculate that remnants of the food and bones may have been tossed on the roof (as was noted by Wilson 1933:94 at Mexican pithouses in the American Southwest).

Some of the patterns noted by Binford (1978) in Nunamuit houses are similar to those seen in Interior Plateau pithouses, and his observations on the resulting distribution of cultural material can be used to predict possible patterning in the pithouses at Keatley Creek. Binford defined three zones: 1) a "drop" zone near the fire where small items were deposited and heavy items such as mortars were cached, 2) a "toss" zone where larger garbage accumulated, and 3) a "dump" zone where collected debris was redeposited. As in the pithouses, Nunamuit sleeping areas were also used as working and eating areas and may be expected to contain refuse like that of a drop zone. Any areas that were more intensively used, such as the area around the hearth, were cleaned more often suggesting a generally low accumulation of cultural material in communal work areas. Storage was against the walls and outside on racks as in the pithouses, suggesting that large, lost, or abandoned items may be more common along the pithouse wall. The dump zones were typically just outside the door suggesting pithouse garbage was tossed on the roof. Butchering, pit roasting, and hide working were activities that took place outside Nunamuit houses, and are also expected to occur outside the pithouses.

Who Built and Used the Pithouses

Although single family houses did occur, the larger, late prehistoric pithouses in the study area commonly contained four or five nuclear families (Bouchard and Kennedy 1973:42 [Upper Lillooet]). Early historic Thompson pithouses are described as containing three or four families (Champness 1971:92) or four to eight families producing crowded conditions ("as much as they could handle"—Kennedy and Bouchard 1977:Tape 1[Lillooet]). An early account of Chilcotin houses describes 53 families living in six large "ground lodges" or an average of 8.8 families per house and 131 families living in 29 "lodges" or 4.5 families per lodge (BCARS n.d.:4). Since each family had their own sleeping space and storage racks and shelves and sometimes their own hearth, a large pithouse could contain as may as nine hearths and sleeping areas.

The core resident population of the pithouse was typically comprised of a number of closely related nuclear families (Teit 1900:192 [Thompson]; Hill-Tout 1978a:58 [Thompson]). Since most marriages were patrilocal, men typically formed the nucleus of the household (Nastich 1954:23 [Lillooet]; Teit 1906:255 [Lillooet]). Common configurations included a group of brothers and their wives and children, three or four generations of men from the same lineage, or a father and his married sons (Duff 1952:84 [Stalo]; Teit 1898:52, 64, 66, 69, 78; 1909a:644, 676; 1912b:321, 328[Shuswap]). Unrelated families also sometimes shared the pithouse with the residential group, formed by special invitation to make a congenial group (Walters 1938:87 [Southern Okanagan]). The resident group was comprised predominantly of the same people from year to year, with stability dependent on personalities and the treatment of others' children (Post 1938:87 [Southern Okanagan]). Some laziness was tolerated, but disapproved of (Post 1938:87 [Southern Okanagan]).

The average nuclear family probably comprised two adults and three to five children. Studies of traditional hunter-gatherers in other parts of the world suggest that each family had an average of about three children, with a median of one or two, and a range of zero to nine (Lee 1979:49 [!Kung San]; Dunning 1959:67 [Ojibwa]). Estimates for the Interior Plateau are sketchy but suggest a similar pattern. The Lillooet after contact wanted to have three or four children (Nastich 1954:63). Thompson's (1914:53 as cited in Smith 1987:151) population estimate for two long tule dwellings with a resident population of 800 people or 120 families suggests 4.6 children per couple. Teit's estimate of 20–30 people in an average pithouse with four families suggests three to 5.5 children per family.

As previously noted, each nuclear family was assigned its own sleeping area in the pithouse, in a "corner" between the posts. When a man had more than one wife, each woman had her own sleeping area and blanket and the man visited each wife's area in turn (Nastich 1954:62 [Lillooet]). Within the family corner, grown women slept with female children who had not yet reached puberty, men slept with male children apart from the women, and young children often slept with grandparents (Laforet and York 1981:120 [Thompson]). A widow or a woman with new born child was sometimes isolated in a corner of the pithouse. Single girls and bachelors each had separate corners (James and Oliver 1991:24 [Nicola]) while menstruating women and adolescent girls slept in a separate structure (Alexander 1992:136–138 (Interior Salish]; Nastich 1954:64, 69 [Lillooet]). All residents of the house worked in close harmony, but each family also had their own cooking rocks, baskets, blankets, and eating utensils (Nastich 1954:61 [Lillooet]) which they may have stored in their own space.

Indicators of Wealth and Status

In traditional societies, large domestic dwellings were generally occupied by wealthy, high-ranking individuals (Netting 1982), and on the Interior Plateau the largest pithouse in the village was typically that of the chief (Walters 1938:87 [Southern Okanagan]; Post 1938:39 [Southern Okanagan]). A chief was not necessarily the wealthiest individual in the village, but this was usually the case (Walters 1938:94 [Southern Okanagan]). The chief needed a larger house because he attracted more families to live in his house (Post 1938:39 [Southern Okanagan]), and he may have had 2 or 3 wives (usually sisters) (Nastich 1954:61 [Lillooet]; Teit 1906:255, 269 [Lillooet, Thompson]).

Wealthy households were large and included the offspring of polygynous marriages, slaves, and poor relatives who were generously allowed to reside in the house (Nastich 1954:23 [Lillooet]; Duff 1952:84 [Stalo]). These "poor, lazy or incompetent" people dressed poorly, and depended on the generosity of richer people for whom they were expected to perform some task in exchange for favors (Nastich 1954:24 [Lillooet]). Post (1938:87 [Southern Okanagan]) states that the lazy, improvident and unfortunate were provided with food without expectation of return. Wealth in general was measured in deer hides, food, and blankets (Teit 1898:54; 1909a:734; 1912a:261, 270, 328; 1912b:343–344; 1930:202; Boas 1917:30–31, 88; Nastich 1954:50 [Lillooet]), while evidence from myths suggests wealth was also represented by clothes, horses, dentalium, feathers, elk teeth, copper, canoes, and nephrite. Wealthy and high status parents tried to acquire the same advantages for their children with careful training (usually only offered to wealthy families) and marriage into similar families (sometimes with childhood betrothals), so that high social status tended to be retained by families from one generation to the next (Nastich 1954:23–24, 31, 57–58, 83; Teit 1909a:591) [Lillooet]).

Each household had a head, typically the eldest male (Nastich 1954:23 [Lillooet]). His powers were limited. His authority, both within the household and the larger village community, was based on respect for the individual and was not heredity, while his social status was based on achievement (Nastich 1954:24

[Lillooet]). In villages with more than one pithouse, the heads of each household were ranked with the highest ranked head assuming the role of chief (Nastich 1954:25 [Lillooet]). The chief's position was hereditary in the male line, with the eldest and/or most competent son succeeding the father (Nastich 1954:25 [Lillooet]). The chief typically advised, rather than ordered and his duties included announcing the start of the food gathering season, directing day-to-day activities, arbitrating disputes, and acting in a ceremonial capacity at winter dances and other festivities (Nastich 1954:25–26 [Lillooet]; Teit 1900:257, 1909a:570–575).

An individual was required to recognize the chief of that area as leader and if he was displeased with the methods of a specific chief he could move himself and his family to any one of the village sites belonging to his immediate band or a friendly band (Walters 1938:87 [Southern Okanagan]). On the other hand,

> Family ties are very strong. The same group often winters at the same site year after year. The wealthy are respected and residence in their proximity is desirable, for practical reasons. In case of famine and extreme conditions, the wealthy assist the poor. Even a man who is poor because of laziness is not permitted to starve. He is cared for by his more enterprising and therefore more affluent relatives." (Walters 1938:87 [Southern Okanagan])

People sharing a pithouse with an especially skillful hunter were able to share his surplus of hides (Romanoff 1992 [Upper Lillooet]; Bouchard and Kennedy 1973:41 [Lower Lillooet]; Kennedy and Bouchard 1977:Tape 2 [Upper Lillooet]). If the poor borrowed winter clothing, they had to share the food obtained while wearing the clothes (Nastich 1954:24 [Lillooet]). Shamans, by virtue of their special powers, were very likely to become important and respected members of the village. They were usually also successful fishermen and hunters and likely to be wealthy men (Duff 1952:101–102 [Stalo]; Nastich 1954:81 [Lillooet]).

In many societies the spot opposite the main door of the house was assigned to the individual or family with the highest standing (Sproat 1987:33–4 [Nootka]; Deal 1987:177–178, 180 [Maya]; Frayser 1985:166 [Lamet]). In the Hidatsa lodge, this space was reserved as a sacred place (Wilson 1934:363). Among the Chilliwack, the chief occupied the center of the longhouse since his "loss would be most severely felt" and the center was "the securest portion of the structure" (Hill-Tout 1978c:47). This evidence suggests that in pithouses with a side door, the chief and his immediate family may have claimed the living space along the opposite wall. In pithouses with only a central doorway in the roof, this pattern may have little meaning. On the other hand, if distance from the entrance was the critical factor, then distance from the ladder may have a similar meaning. Since a person's belongings were commonly either buried with him or burned (Nastich 1954:68 [Lillooet]), few of the status items associated with pithouse leaders may be found at the site.

Prospects

The purpose of this paper has been to show how a detailed examination of the ethnographic record can be used to help interpret the archaeological record. This paper also tries to demonstrate that the ethnographic evidence does not present a single static view of pithouse construction and use. Much of the variability seen in the archaeological record can be explained by the different practices documented ethnographically. Individual and group preferences probably led to a greater deal of variability both within and between precontact native villages. Since many ethnographic accounts present only the most common practices, and provide little discussion of the variability in these practices, archaeologists relying on only one or two ethnographic accounts are not likely to recognize the range of potential variation. The information summarized here should assist archaeologists working on the Interior Plateau to both formulate more and better questions for research, as well as to answer some of the questions posed by the archaeological record.

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Appendix I: Pithouse Superstructure

The height of the main support posts and beams of the pithouses dictated the slope of the roof (Boas 1891 [Shuswap]; Teit 1900 [Thompson]). Based on an examination of early photographs, all of the three largely intact but abandoned pithouses in the Nicola Valley (see Section 1) had a roof slope of about 30 degrees. Teit's illustrations (1900:Figs. 135, 136) based on his observations of these same pithouses, suggest a roof slope of 35 degrees. This slope was considered too steep by informants who looked at Teit's diagram or saw a reconstructed pithouse based on this diagram (Smyly 1973:51 [Shuswap]; Kennedy and Bouchard 1987:259 [Shuswap]; 1978:36 [Lillooet]). The 40 degree angle noted in Dawson's (1892:7) sketch of a Nicola Valley pithouse is no doubt inaccurate. On the other hand, some Chilcotin pithouses are described as having a slope of 30–40 degrees (Lane 1953:158). This steep slope may be related to the beams of these pithouses resting on an inside ledge rather than the ground surface. Another possibility is that the smaller Chilcotin houses may have needed a steeper pitch to provide more headroom (Vol. II, Chap. 14). In summary, the ideal upper limit of roof slope was probably about 30 degrees in the average pithouse.

The lower limit of the ideal roof slope may have varied. The diagram provided by Boas (1891:633) shows only a 17 degree roof slope, though it may also be inaccurate given that the diagram seems to be based solely on informant testimony. However, the Wenatchi described the slope of 20 degrees or more and some Shuswap and Sanpoil also suggest a slope of 22 degrees (Ray 1942:177–178; 1932:31).

In reality, the ideal roof slope was not always achieved and variability should be expected in the archaeological record. Occasionally the posts were cut too short and the slope of the roof was too flat, or the posts were too long and the roof too high and steep (Teit 1895 [Upper Thompson]). All roof slopes should, however, be relatively gentle. If the ascent to the rooftop doorway/smokehole was too steep the women and children could not enter quickly (Kennedy and Bouchard 1987:259–260 [Shuswap]). A low angle would also help prevent the roof materials from following gravity to the bottom of the slope and would keep the pithouse warmer by minimizing the space to be heated (Hayden et al. 1996). Some slope was probably necessary to divert any precipitation to the side of the pithouse and provide enough head space inside the pithouse. Flat roofs are not recorded for the study area, but, where they are noted (Barnett 1944 [Coast]) the foundation pits are twice as deep.

Shuswap posts were about 1.8–2.1 m high (Boas 1891:634). In Lower Lillooet pithouses with a log roof the central doorway/smokehole was 2.5–2.7 m above the floor (Bouchard and Kennedy 1973:42). Lillooet pithouses with a post and beam superstructure also measured about 2.5 m from the floor to the doorway/smokehole (Kennedy and Bouchard 1978:361). In the Nicola Valley pithouses the doorway/smokehole was 1.2–1.5 m from the ground surface (Post and Commons

1938:41). With a pit of 1.2–1.8 m the Nicola Valley pithouses would have had roofs 2.4–3.3 m high. Other accounts describe Thompson pithouses that were 3.1 m high (Champness 1971:92) and Walla Walla flat-topped pithouses 3.1–3.7 m high (Kane as cited in Rice 1985:99). The description of small Chilcotin pithouses with roofs 4.3–4.9 m high is probably inaccurate (Lane 1953:157). This evidence suggests the average protohistoric pithouse had a roof ranging from 1.8–3.7 m high.

Horizontal poles (peeled and sometimes squared) 20–61 cm apart were usually tied to the beams and side braces to provide a support for the roof covering (Teit 1900:194 [Thompson], 1895 [Upper Thompson]; Laforet and York 1981:117 [Shuswap]; Bouchard and Kennedy 1987 [Shuswap]). The beams were sometimes notched to accommodate these poles (Teit 1895 [Upper Thompson]; Post and Commons 1938:41 [Nicola Valley]; Surtees 1975 [Shuswap]). Boas (1891:634) provides the only account that does not indicate use of such poles.

The poles or slabs of split wood used to cover this main supporting framework were placed at either right-angles (Teit 1900:194 [Thompson]; Laforet and York 1981:117 [Thompson]), or horizontal to the ground (Boas 1891:633–634 [Shuswap]; Bouchard and Kennedy 1973:42 [Lillooet]; Lane 1953:158 [Chilcotin]). They were not tied to the framework (Teit 1900:194 [Thompson]). Post and Commons note that cedar, or alternatively fir or tamarack, made the best cover (1938:41 [Nicola Valley]; see also Ray 1932:31 [Sanpoil]). Since these poles would be clearly visible from inside the standing structure, considerable care might have been expended to arrange these poles in an aesthetically pleasing fashion. Depending on the arrangement of the beams, side braces, and poles, the outline of the pithouse on the ground could be round, square or hexagonal (Kennedy and Bouchard 1978:36 [Lillooet]). The superstructure of pithouses with square holes was sometimes wedge-shaped or pyramidal rather than conical (Ray 1942:177 [Shuswap, Lillooet]).

A variety of materials was then placed over and between the poles and slabs to prevent the covering soil from falling through the poles into the house (Surtees 1975 [Shuswap]), to facilitate drainage (Kennedy and Bouchard 1978:36 [Lillooet]), and to prevent the rain from soaking through (Bouchard and Kennedy 1973:42 [Lillooet]; Teit 1900:194 [Thompson]). Covering material included straw, dry grass, dry pine needles, boughs, and/or birch or cottonwood bark (Boas 1891:634 [Shuswap]; Dawson 1892:7 [Shuswap]; Laforet and York 1981:118 [Thompson]; Teit 1900:194 [Thompson], 1895 [Upper Thompson]; Green 1972:1 [Shuswap]; Bouchard and Kennedy 1973:42 [Upper Lillooet]; Lane 1953:158 [Chilcotin]). The grass and brush used by the Sanpoil was about 15 cm thick (Ray 1932:31). Where cedar and rainfall were plentiful, as many as six layers of flattened cedar bark were used to cover the poles (Bouchard and Kennedy 1990:276 [Shuswap], 1973:41 [Lower Lillooet]; Kennedy and Bouchard 1987:260 [Shuswap]; Surtees 1975 [Shuswap]; Post and Commons 1938:41 [Nicola Valley]; Teit 1900:194 [Lower Thompson], 1906:213 [Lower Lillooet]). Woven mats and deer skins were also occasionally used (Surtees 1975 [Shuswap]). Moss chinking was also used in some areas (Kennedy and Bouchard 1978:36 [Lillooet]). The Thompson sometimes placed an additional layer of woven willow branches and honeysuckle fibre, held in place with blue clay, under the poles (Laforet and York 1981:117 [Thompson]). Additional poles could also be placed over the vegetation to help hold it in place (Boas 1891:634 [Shuswap]).

The final step was to use baskets to place a layer of soil over the roof that was then levelled, beaten and stamped down firmly with sticks, hands and feet (Boas 1891:634 [Shuswap]; Dawson 1892:7 [Shuswap]; Teit 1900:194 [Thompson], 1895 [Upper Thompson]; Bouchard and Kennedy 1973:41 [Lower Lillooet]). The soil used was often that which had been previously dug from the foundation pit. The roof was sometimes capped with 4 cm of clay, river silt or anthill fill to make a more waterproof cover (Romanoff as cited in Stryd 1973:232 [Lillooet]; Bouchard and Kennedy 1973:42 [Upper Lillooet]; Kennedy and Bouchard 1987:260 [Shuswap]; Green 1972:1 [Shuswap]; Kennedy and Bouchard 1978:36 [Lillooet]; Ray 1932:31 [Sanpoil]). Sod was also used as an additional or alternate cover (Surtees 1975 [Shuswap]; Lenihan 1877:4 [Stalo]) partly because it acted as camouflage (Kennedy and Bouchard 1987:260 [Shuswap]). If the soil layer was undisturbed, plants took root and made the pithouse less visible and more solid (Laforet and York 1981:121 [Thompson]). The Thompson also occasionally placed cedar bark over the soil to prevent erosion when the snow was swept away (Laforet and York 1981:119). A few informants recall pithouses without a soil capping (Bouchard and Kennedy 1990:277 [Shuswap]). Archaeological evidence from the Keatley Creek site suggests that the roof soil may have been thinner, absent, or only at the base of some of the earlier Plateau Horizon pithouses (Vol. III, Chap. 8).

The thickness of the soil used by the Lillooet and Shuswap is not clearly stated. A description of pithouses built by Mexicans in the American southwest may be used as a model (Woodward 1933:82–83). The soil covering on their pithouses was about 13 cm thick with a bank of soil around the base of up to 76 cm thick. These small talus slopes at the base of the wall helped divert precipitation away from the structure. If the earth was thin near the ridge pole, then rocks were used to hold the brush down. Similarly the Hidatsa used 30 cm of soil and 13–15 cm of sod (Wilson 1934:365), and the Southern Okanagan used 31 cm of soil on top of 31 cm of vegetation (Post and Commons 1938:40). A trench was also sometimes dug around the pithouse to carry away the water (Post and Commons 1938:40).

A square hole was left in the center top of the roof as a doorway (Boas 1891:634 [Shuswap]; Lenihan 1877:4 [Stalo]). Estimates for the size of the doorway vary from .9–1.8 m square (Lane 1953:157 [Chilcotin]; Kennedy and Bouchard 1978:36 [Lillooet]; Bouchard and Kennedy 1973:41 [Lower Lillooet]), with one account of a 3 m square door (Post and Commons 1938:41 [Nicola Valley]). The Chilcotin sometimes constructed a frame around this opening and then topped it with a log crib, chinked with mud on top (Lane 1953:158). Boas (1891 [Shuswap]) suggests something similar in his illustration.

In stormy weather, the doorway was covered with a mat or a piece of hide or buckskin stretched over a wooden frame to keep out the snow and rain while keeping in the warmth (Ray 1939:177–178 [Shuswap]; 1932:32 [Sanpoil]; Kennedy and Bouchard 1978:36–37 [Lillooet]; Post and Commons 1938:41 [Southern Okanagan]). The Thompson describe a door panel of willow withes, honeysuckle fibre, bark and split sticks (supported on two short and two long poles) that was slanted to divert the wind, rain, and snow in stormy weather (Laforet and York 1981:119). A mat of open-work woven sticks was used in calmer weather, since it gave some protection but allowed ventilation. The central entrance also provided the necessary exit for the smoke from the hearths and a screen of twigs and/or hides served as a shield to deflect the wind and prevent the smoke from blowing back into the pithouse (Kennedy and Bouchard 1978:36–37 [Lillooet]; Wilson 1934:368–369 [Hidatsa]).

Appendix II: Material Culture of Native Groups from the Interior Plateau: Selected Ethnographic Accounts

The following table summarizes some ethnographic evidence for the use of different raw materials by Native groups living on the Interior Plateau. The table is primarily intended to provide ethnographic information on material culture in such a way as to facilitate the interpretation of artifacts recovered from archaeological sites on the Interior Plateau.

Most of the information presented in the table has been derived from publications by Teit (1898, 1900, 1906, 1909a, 1909b, 1912a, 1912b, 1917), including descriptions of traditional life portrayed in the oral histories and myths he recorded. Other publications were also thoroughly examined including: Smith (1899, 1900), Dawson (1892), and Kennedy and Bouchard (1988). A few references from Morice (1890, 1893) and Turner (1992) are included, but these sources were not examined in detail.

The information in the original table was divided into 14 broad categories of raw material: stone, minerals, shell, bone/antler/horn, teeth, skins/hides/sinew/wool, feather/quills, wood, bark, grasses/rushes, pitch, plants, poison, and basketry. Due to printing constraints, only the categories most directly related to the stone and bone archaeological assemblage at Keatley Creek are included here (i.e., stone, minerals, shell, bone/antler/horn and teeth). Within each category (e.g., pipes, containers, knives) the information is primarily grouped according to the form of the object. Within each form, an attempt was made to group objects made from the same raw material (e.g., steatite, soapstone, basalt). The table also includes information on how the objects were used, and the source of the information.

Raw Material	Form	Use	Reference
STONE AND METAL			
Pipes steatite, soapstone, slate (some sandstone)	(1) tubular (past form) and shank; (2) larger than ordinary, carved or painted with guardian spirit, hung with eagle feathers, e.g., attached to stem by thong; (3) inlaid, high narrow straight bowl, long shank; (4) double bowled	(1) to smoke wild tobacco & kinnikinnick leaves (rarely used by women); (2,3,4) for shamans & to smoke at gatherings & councils	Teit 1900:182, 259, 300–301, 360, 363 (Fig. 271–276), 381–2 (Fig. 306–9); 1906:250, 282; 1909a: 575; 1909b:786; Morice 1893: 36–37 (Fig. 1, 2); Smith 1899: 154 (Fig. 103–105, 111–113); 1900:428–429 (Fig. 374 a, b, c)

Raw Material	Form	Use	Reference
Sculpture	rude ornament placed on top of house		Teit 1900:376–377 (Fig. 297)
soapstone	carved image: usually of men, some perforated to use as tubular pipe	kept in medicine bag, used rarely in past by Shuswap & Thompson	Teit 1909a:603
Beads and Tubes copper		clothing decorations, necklaces, and rattles (woman's)	Teit 1900:222; 1906:220, 264; 1909a:502–503, 506, 509–510
Ornaments copper	pendants, trinkets and bracelets	ear & nose ornaments, necklaces; symbols of sun and stars	Teit 1900:222; 1909a:509–510; 1909b:777–778; Morice 1890:138
Tweezers copper	tweezers (copper ones rare): single piece bent at middle	to remove facial hair (both sexes)	Teit 1900:227–228; 1909a:511; 1909b:778; Morice 1890:138
Containers or Mortars	mortar	to grind paint	Teit 1909a:500
stone, steatite	vessel or container or a dish: round & hollowed out slightly on one or both sides	for paint or ochre	Teit 1900:184, 202; 1909a:474; Smith 1900:413 (Fig. 343b)
stone	mortar or dish: zoomorphic c. 19 cm × 14 cm vessel: large, zoomorphic c. 13–17" long or dish: trough-shaped, most common form was large, oblong, shallow	to catch fat and oil drippings in front of fire or used in salmon ceremonies to serve fish or hold fire; to grind tobacco, berries, etc.	Teit 1900:202–204 (Fig. 153–154), 234; 1906: 204, 281 (Fig. 68, 97)
stone	pot or kettle		Teit 1906:204
stone	mortar: flat boulder with or without shallow depression	to pound or grind tobacco etc.	Teit 1906:274; 1909a:474, 500, 574; Smith 1900:413 (Fig. 342)
stone	anvil: (food sometimes placed between 2 pieces of skin & crushed with small pestle)	large, flat: to crush or grind meat, berries or bones for marrow food at villages small: when traveling	Teit 1900:202, 236; 1909a: 474, 675; Smith 1899:139 (Fig. 32–3); 1900:413
Hammers or Pestles	maul	to debark balsamroot	Turner 1992:429
stone	smooth flat (used with small pebble)	to crush bones for marrow	Teit 1909a:675
jade	pestle	to peck pestles & hammerstones	Teit 1909a:473
stone	hand hammer or elongated pebbles with one end battered flat or concave base pestle	to drive antler chisels, wedges, pegs & stakes; to cut & bark green house poles; to dig for paints, copper, etc.; to cut and fell trees; split firewood; some women-owned	Teit 1989:36; 1900:183, 192 (Fig. 120–1), 376 (Fig. 295); 1906:203 (Fig. 63 a, b, c); 1909a:473–5, 715; 1909b:764; 1912a:284; 1912b:349; 1917: 29; Smith 1899:138, 141, 143, (Fig. 27–8, 30–1)
stone	boulder: flat hammer: mallet shaped, hafted	to drive heavier weir stakes	Teit 1909a:474; 1909b:764
stone	pestle or hammer: variety of shapes	to crush dried meat, berries & other food; to pound trout & salmon	Teit 1900: 183, 236 (Fig. 120); Smith 1899:138 (Fig. 22–31); 1900:413
stone	pestle: smaller than ordinary pestle	to grind tobacco	Teit 1909a:500, 574
Boiling Stones	(used with basket)	to boil salmon	Teit 1906:280

Raw Material	Form	Use	Reference
Net Weights stone	smooth stones of various sizes, in net sacks, with string to attach to lines	for fish nets or lines	Teit 1900:253; 1909a:525–6
Stone Balls	3" diameter, in skin/, attached to stick	to play ball or lacrosse (men); to play game (boys)	Teit 1900:277, 279 (Fig. 269a); 1909a:564
Hide Press jasper	large flake with smooth surface & rounded edges	to press skin flat on mocassin board	Teit 1909a:508
Clubs	flat sided	to drive wedges	Teit 1900:183
stone	(1) short, square cross-section (2) ovate, flat (3) round stone encased in thick hide, attached to handle	for warfare	Teit 1900:263-264, 381 (Fig. 247–8, 250–1, 303); 1906:234; 1909a: 538; 1909b:785
stone		to kill bear/ deer/fish	Teit 1900: 248-50; Teit 1909a: 659–660
copper	ovate, 19" long, 3" wide, 1/8" thick	for warfare; given in marriage	Teit 1900:264; 1912a: 261, 270; Smith 1899:150 (Fig. 82)
Club Head or Tomahawk Head groundstone, jade, serpentine, black rock	(1) spikes from stone spear head, (2) round grooved (3) stout stone knife, double ended (4) hafted tomahawk: celt, axe, adze or skin scraper	for warfare	Teit 1900:264–265 (Fig. 252), 379 (Fig. 299); 1906:203, 234; 1909a:538; 1912a:270
iron	(1) club head: spike from iron spear head, wood handle; (2) tomahawk head: from iron knife, double ended, wood handle	for warfare	Teit 1909a:538
Shields copper	small, circular, polished	for warfare	Teit 1900:263–264
Digging Stick Shafts iron	rod bent near point (used with wood handle)	to dig roots	Teit 1900:231
Arrow and Spear Points stone	spear point: (1) similar in shape & material to arrow point but larger leaf-shaped (2) very long sharp, hafted to stout handle	(1) for warfare (2) to kill deer or caribou (left in ground at creek crossing)	Teit 1900:263 (Fig. 245); 1906:234; 1909a: 521, 538; 1909b:785; Morice 1890:139 (Fig. 12)
glassy basalt, chert, obsidian, chalcedony, quartz, brittle green stone (volcanic), cherty quartzite, green-stone	arrow point: (1) leaf-shaped, side-notched or barbed, (2) leaf-shaped (3) very large (same as knives)	(1) for warfare (2) for hunting, to remove moles (3) used in dances	Teit 1900:24-2, 370 (Fig. 222a); 1906:225; 1909a:473, 519, 579; 1912b: 368; Dawson 1892:35; Morice 1890:139 (Fig. 11–12)
jade, serpentine,	spear point: polished black rock		Teit 1906:203; 1909a:473 (Fig. 201)
Hooks and Barbs copper/iron	formerly bone and antler: hooks and 3 pronged spear barbs	to catch fish	Teit 1900: 251, 253 (Fig. 232, 234a, b); 1906:228
copper/iron	arrow points: (1) notched (2) triangular, spear point: 2 or 3 prongs	to catch fish	Teit 1900:242; 1906:225 (Fig. 222d, e); 1909a:519, 779
Drills glassy basalt; stone	flaked like arrow point, or drill	to drill, to make pipes	Teit 1900:183, 391 (Note 2); 1909a:474; Smith 1900:418 (Fig. 352, e–g)
Knives or Daggers stone	knife or dagger, or sharp flake; same as arrowheads	used by boys at puberty to cut themselves	Teit 1909a:590; 1912b:368

Raw Material	Form	Use	Reference
glassy basalt basalt (common)	knife: chipped, hafted in short wood or horn handles (like large spear point)	to cut carcass, to cut umbilical cord	Teit 1906:234; 1909a: 584, 751; Morice 1890:138
jade, serpentine, black rock	knife: polished, c. 15 cm long, ovate		Teit 1906:203 (Fig. 62), 234; 1909a:473
green stone (polished)	dagger: blade 3–3.5" wide, 2" long, knob for hand hold (rare)	for warfare	Teit 1900:264 (Fig. 249); 1909a:538
stone	knife or sharp stone	to peel or scrape roots	Teit 1900:187
slate	knife: semi-lunar with straight side insert in handle (common shape)	to cut up fish (used by Lillooet, Upper Thompson)	Teit 1900:234; 1906:204; Smith 1899:140 (Fig. 34)
iron	(1) semi-lunar with straight side inserted in handle (2) triangular with long ears or barbs & narrow stem inserted in handle (3) saber-like (4) war knife: iron handle	(1) and (2) to process fish and cut skin (3) to beat wool & hair prior to spinning (4) warfare	Teit 1900:263 (Fig. 240); 1906:204, 211(Fig. 67, 76); 1909a:508 (Fig. 230)
Crooked Knives stone, basalt	with curved blade or point, short handle	to cut and carve wood, antler or bone	Teit 1900:183–4 (Fig. 125–126); 1909a:474; Smith 1899:184 (Fig. 125, 126)
Hide scrapers stone	(1) thin pieces flaked from pebbles, slightly chipped on one edge, in wood handle (2) adze-shaped of jade, serpentine, black rock	to scrape skins, used as adze (see below)	Teit 1900: 146–147, 182, 184–185 (Fig. 61–64, 127, 185); 1906:203; 1909a:473
iron	scraping knife	to scrape hides resting on log	Teit 1900:185
Wedges stone	(rare)		Teit 1906:204; 1909a:474
Celts, Adzes or Axes jade, serpentine, black rock	adze (used with hammer & wedge), axe, skin scraper, chisel, club	to cut & bark green house poles; to cut wood for sculptures and canoes; women used to cut firewood	Teit 1900:183, 192 (Fig. 122–123); 1906:203; 1909a:473; 1909b:764; 1912a: 222, 227; 1917:11
jadeite	adze	to make hole in boulder by boy in training	Teit 1900:320
Abraders or Cutting Stones sandstone or gritstone	different coarseness	whetstone or file for sharpening & smoothing bone awls, horn & wood	Teit 1906:203–4; 1909a:474; 1912a: 365
sandstone, gritstone, nephrite, quartz crystals, agate		to cut nephrite, jade & serpentine boulders and celts	Teit 1900:182; 1906:203; 1909a:473; Dawson 1892:19; Smith 1900:416
sandstone; stone	arrow shaft smoother: fine grained		Teit 1900:241; 1906:203; 1909a:519; Smith 1899:146 (Fig.57–58)
Features stone	breakwater: 20 ft. long, corral or basin: built on river bank	to catch or to hold freshly caught fish	Teit 1909a:530, 569–660; Kennedy & Bouchard 1988:28, 37
stone	burial markers: heap of boulders	to mark Upper Thompson grave	Teit 1900:329–331; Smith 1900:405
MINERALS			
Dolls clay	dolls		Teit 1906:250
Abrasives sand	with thong or piece of wood	to polish bone, trim nephrite	Teit 1900:184; Dawson 1892:19
Insulation earth		to cover lodges & pithouses	Teit 1900:192, 196; 1909a:494
Paint	red & black (Thompson occasionally used yellow & white), blue	to paint face and body for important activities	Teit 1900:267–268, 309, 311–2, 317-8, 321, 344, 347, 349, 351, 357, 371, 381, 386; 1909a:543, 564, 588–90, 601, 605, 608; 1909b:789

Raw Material	Form	Use	Reference
ochre, paint, micaceous haematite	red & yellow (fixed by rubbing with heated cactus)	to paint bow/arrows 224; 1909a:520	Teit 1898:38; 1900:241; 1906:205,
micaeous iron or graphite	black paint		Dawson 1892:18
mica	decoration	on breastplates; on clothes	Teit 1900: 650
Wealth Item jade copper		to display wealth clubs	Teit 1912a: 261, 270; 1917: 88
SHELL			
Beads shell	may be flat, disc-shaped	to decorate clothing; wealth	Teit 1900:222; 1909a: 502–3, 506, 509; 1917:88
Ornaments dentalium or abalone		to make ear & nose ornaments	Teit 1900:222–223 (Fig. 195–197), 441; 1906:206, 220; 1909a: 509–510; 1909b:777–778; Smith 1899:153 (Fig. 99)
Necklaces dentalium or abalone		to make necklace (woman's or some worn at dances)	Teit 1900:223 (Fig. 199); 1906: 220, 264; 1909a:509–510; 1909b: 778
Decorations dentalium or shell		to decorate clothing and other objects (noses and ears); wealth; given in marriage	Teit 1898: 54; 1900:206, 222–3, 225,351,382 (Fig. 306); 1906: 220; 1909a:502–503,506,509,511 (Fig. 231),579,588; 1909b:777; 1912a:328; 1917:30–1,73,88
Coals shell	clamshells	to carry fire coals	Teit 1898:56; 1912a:338; 1912b: 300
BONE, HORN AND ANTLER			
Dog Toggles bone, horn	carved to represent deer, etc.	to prevent noose from tightening on dog halter	Teit 1900:245–246 (Fig. 227a,b), 376 (Fig. 296a,b), 442; 1906:227; 1909a:520; Smith 1899:158 (Fig. 114)
Net Rings horn	generally 8 for set net, 6 for dip net	to attach fishing bag net to hoop (not used with small fish)	Teit 1900:249; 1909a:527; Kennedy and Bouchard 1988: 26–27
Fishing Reel bone	cross piece for line fishing: held in hand, attached to line	to fish with hook & line	Teit 1909a:530
Fishing Lure bone or antler	carved like fish fry	to lure fish	Teit 1909a:530; 1909b:779–80; Morice 1890:130 (Fig. 4); 1893: 72 (Fig. 58)
Whistle or Drinking Tube bird leg bone	(woman's): long, cylindrical tube, decorated, attached to neck string (no whistles used by Chilcotin)	used by girl or boy at puberty (no whistles used by Lower Thompson); used by women for magic	Teit 1900:313 (Fig. 283–4), 316, 318; 1906:264 (Fig. 94); 1909a: 588–9; 1909b:787–8; 1912a: 370, 349, 381–2; 1912b: 317; Smith 1899:154 (Fig. 102); 1900:441
Call bone	long tube	to call bull-elk, geese & birds	Teit 1909a:520
Healing Tube bone	tube	used by a few shamans to suck out sickness	Teit 1909a:612
Pipe horn	pipe	to smoke	Teit 1900:300–301 (Fig. 277); 1906:250; 1909a:575
Beads and Tubes bone, horn, antler		to decorate clothing, necklaces and cradles	Teit 1900:206, 223, 261, 305–306; 1906: 220; 1909a: 502–503, 506, 509–510

Raw Material	Form	Use	Reference
Ornaments bone, horn	pendants, discs and rods	to decorate clothing and make necklaces and ear and nose ornaments	Teit 1900:222–223 (Fig. 198); 1906:220; 1909a:509–10
Gaming Pieces bone, wood	1 with sinew tied around middle	to play lehal (men, women & children)	Teit 1900:275–6 (Fig. 262), 391; 1909a:564; 1909b:785
Combs bone	small, worn on string	used by girls at puberty	Teit 1909b:788
Tweezers horn	(1) 2 pieces tied at one end (2) single piece incised	to remove facial hair (both sexes)	Teit 1900:227–228 (Fig. 210); 1909b:778
Rattles horn	with shot inside	used in dances	Teit 1900:386
Spoons and Stirrers: horn/antler	spoon: (common) (1) large, oval, with short handle (2) smaller, round, with longer handle; stirrer: wide palmated part at end	to stir food	Teit 1900:203(Fig. 158), 259; 1906:216 (Fig. 84); 1909a:501; 1909b:776–7 (Fig. 273);
Needle Cases bone/antler		to store needles & awls	Teit 1909a:490; Smith 1900:420
Needles bone/horn		to sew	Teit 1900:186; 1906:205; 1909a: 474; Smith 1900:421 (Fig. 358)
Awls bone	split & pointed bone (common)	to split roots, for sewing & basket making; to pierce joints, cataracts, noses, ears, sew shoes, to pierce wood, hide; to kill people	Teit 1898: 23; 1900:187, 370; 1906:205; 1909a:474, 508; 1909b:775; 1912a 336–7; Nastich 1954: 64
Scratchers bone	scratcher	used by girl at puberty also by Thompson boys, by man at wife's death	Teit 1900:312 (Fig. 282a, b), 318; 1906:264, 271; 1909a:588; 1909b:788; Smith 1900:424 (Fig. 362)
Arrowhead Flakers antler	incised, 2 sharpened tines joined to antler base; double ended	magical properties	Teit 1900:183 (Fig. 118); 1906:2 03; 1909a: 473, 645; 1917: 4, 17, 19–20; Smith 1899:145 (Fig. 55); 1900:441
Picks antler	spike, pick or pinch-bar	to dig for paints, copper, etc.	Teit 1909a:475
Digging Sticks bone/antler/ wood	single piece of antler, shorter than wooden sticks	to dig roots (used by Shuswap & Chilcotin), to dig house pit	Teit 1900:192; 1909a:513–4 (Fig. 234)
Digging Stick Handles horn/ antler/wood	(1) sometimes bow-shaped (2) incised, hole in centre	to dig roots (used by Lillooet & Thompson, not Shuswap)	Teit 1900:231 (Fig. 212b); 1906: 223 (Fig. 86a,b); 1909a:514; Smith 1899:137–138 (Fig. 21); 1900:409
Club Heads antler, bone	spike from antler prong	for warfare	Teit 1909a:538; 1912a: 270
Tomahawk Heads bone, horn		for warfare, to beam skin (scrape while lying over log)	Teit 1900:264; Smith 1900:420
Clubs antler, bone		to kill deer, wolf, fisher, mink, fox, marten, fish	Teit 1900:248; 1909a:559–660
antler: caribou or elk	(1) long, ovate, with incised design, 60 cm long, (2) sharp edges to cut, from split antler	for warfare	Teit 1900:264–265 (Fig. 251); 1906:234; 1909a:538
bone: elk or caribou (rib or other bone)			

Raw Material	Form	Use	Reference
Wedges and Chisels antler of elk, caribou	(1) wedge: base of antler, cut off diagonally (2) chisel: large (3) chisel: small (also bone)	to fell trees (used with hand hammer) and split firewood (by women who owned)	Teit 1898: 336; 1900:182–3 (Fig. 119); 1906:203–204; 1909a:474, 709, 715; 1909b:764; 1912a: 284; 1912b: 349; 1917: 29; Smith 1899:141 (Fig. 36–37)
antler, bone	chisel (driven with stone hammers); scraper	to dig for paints, copper, etc.	Teit 1909a:475
horn, bone	chisel: same form as used in wood working	to remove hair when scraping skins, used without frame	Teit 1900:185
Hammers antler	base of antler with tine for handle, c. 26 cm		Teit 1906:203 (Fig. 64b)
Ice Breakers antler	ice breaker: long chisel pointed piece of antler	to break hole in ice when ice fishing	Teit 1909a:530
Axes, antlers			Teit 1909a:644
Draw Knives bone	sharpened a little, ends covered with sagebrush & skin	to beam deer skin	Teit 1900:185–186 (Fig. 128–129); Smith 1899:147–148; 1900:420
Sap Scrapers antler/horn/bone	single piece, perforated, sometimes incised, many double ended, c. 21 cm; sometimes knife-shaped	to remove cambium from pine, spruce, balsam & Douglas-fir, cottonwood, red alder	Teit 1900:233 (Fig. 214); 1906: 222–223; 1909a:515–516 (Fig. 235c); 1909b:780–781 (Fig. 275a, b,c); Smith 1899:152 (Fig. 95); 1900:412, 441
Bark Peeler antler/horn/wood	single piece, sometimes incised, c. 44–49 cm	to strip bark off trees	Teit 1900:223; 1909a:515–6 (Fig. 235a,b); 1909b:781
Daggers bone/horn/antler	adze, knife, dagger (double pointed)	for warfare (not used by Lower Thompson), to kill deer	Teit 1900: 249, 263; 1906:234; 1909a: 474, 645, 666; Smith 1899:183 (Fig. 123)
Bits bone	notched point, bit: with two points (rotated in hand like fire drill); chisel: with one or more points; with round edge to fit shaft	to incise decorations on bone, antler, or wood; to make groove in arrow shaft	Teit 1900:183; 1909a:474
Foreshafts bone/antler	detachable, barbed & poisoned (not used by Chilcotin)	for some war arrows	Teit 1900:241–3 (Fig. 222b); 1906:225; 1909b:782
Beaver Harpoons bone, antler	point: (1) with 1 barb & wedged shaped base (2) detachable, e.g., 2 barbs each side, incised (3) harpoon	to spear beaver	Teit 1900:249; 1906:226 (Fig. 87); 1909a:523 (Fig. 240); Morice 1890:132 (Fig. 5); Smith 1899:137 (Fig. 20); 1900:440
Points antler	detachable, not poisoned	for war arrows	Teit 1909b:782; Morice 1893:56 (Fig. 27)
bone, antler, horn	point (1) lanceolate with narrow stem (2) same with 2 or more barbs, may be detachable, with perforation for attached line	for hunting small game (esp. in underbrush) e.g., hare, squirrel, grouse	Teit 1900:249, 242–3 (Fig. 222g); 1906:225; 1909a:519; 1909b: 781–2 (Fig. 276a,b)
bone, antler ?	spear point: detachable	to pull fish from weir or dam; for warfare	Teit 1900:254; 1906:228; 1909b:785
antler	spear point: decorated, 16 cm long, perforated at base		Smith 1900:423 (Fig. 360)
Fish Harpoons bone	short handle	to spear fish	Morice 1890:130 (Fig. 2)
bone	harpoon point: detachable, 2" long, fitted between 2 wood valves	to spear spring salmon	Kennedy & Bouchard 1988:31

Raw Material	Form	Use	Reference
bone, antler	spear point: 1 long barbed point, may be detachable	to catch fish	Teit 1900:251
Barbs for Fish Leister bone, antler	barbs for spearhead: (1) single pronged head (not used by Chilcotin), (2) double or 3 pronged (like Shuswap)	to catch fish	Teit 1909a:525, 659–660; 1909b:779; Dawson 1892:16; Morice 1893:73 (Fig. 60)
bone, antler	barbs for spearhead: double pronged head, barb attached to shaft by line, some heads with detachable foreshafts	to fish salmon from shore	Teit 1900:251 (Fig. 231)
bone	barbs for spearhead or leister: 3 pronged head, 2" barbs on outer prongs, bone point at center	to catch steelhead, trout, whitefish in clear water	Kennedy & Bouchard 1988:32
bone, antler: deer	barbs for spearhead: (1) single or double pronged head , (2) 3 pronged head, fixed barbs, short sharp prong in middle	to catch trout & smaller fish, esp. from canoe	Teit 1900:252 (Fig. 232); 1906:228
bone, antler ?	barbs for spearhead: 3 pronged head	to spear fish caught with hook & line	Teit 1909a:530
Shafts for Fish Leister bone, antler	shafts for pronged spearheads	to catch fish	see references to barbs for spearheads
Spear Point bone, antler	with very long handle or gaff hook	to fish in muddy pools or large eddies	Teit 1906:228
Gaff Hook antler, bone	barbed, with short handle	to pull fish from weir or dam	Teit 1906:228; 1909a:530
Fish Hooks and Barbs bone (or wood)	used with bait & lines	to catch fish, esp. catfish, trout, salmon-trout	Teit 1900:253–4; 1906:228
bone: hare, dog, deer	barbs for hook: (1) 2 bone barbs tied together at right angles (2) bone barb in rosewood shank (3) large, .5" diameter, with wood shank 5–6" long (4) 2 or 3 times larger than trout hook (5) made from splinters	(1, 2) for ice fishing (3) to catch sturgeon (4) salmon-trout (5) fish	Teit 1900:253-4 (Fig. 234a,b); 1909a:525; 1909b:779
bone	hook: on end of stick up to 15 ft. long	to collect dry limbs	Teit 1900:205
Handles antler/horn	handle for iron or stone knife, celt or chisel: (a) cylinder with socket at 1 end, (b) antler tine with socket in wide end; boiled with blade driven into end		Teit 1900:263, 391 (note 2); 1906:204,234 (Figs. 66 & 67); 1909a:474, 508 (Fig. 230); Smith 1900:415
Spindle Whorls whale bone	spindle disk: (1) 1 ft. diameter, circular disk, hole in centre, (2) spindle shaft: c. 100 cm, needle-shaped	to spin wool & hair	Teit 1906:211–2 (Fig. 77)
Talismans and Games skull (bear)	elevated on pole	at dances and whenever bear is killed	Teit 1909a:603; 1909b:789
silver salmon (dried tail & lower back)		placed in cradle	Teit 1900:308
bone: deer, elk (humerus)	bone: cut crosswise	used as target by boys in training	Teit 1900:319; 1909a:589
Decorations antler, deer bone		worn at dances; nose or ear ornament	Teit 1909a:578; Nastich 1954:64

Raw Material	Form	Use	Reference
TEETH			
Dice beaver, marmot	dice: 4 marked on 1 side with lines or spots, e.g., set of 6 in 3 pairs	for gambling (by women)	Teit 1900:272–3 (Fig. 256); 1906: 248 (Fig. 92); 1909a:564; 1909b: 785; Smith 1899:153 (Fig. 100)
Knife beaver	knife	(1) to groove sandstone arrow smoother, (2) to carve or incise wood, copper, steatite & other soft stone (3) to chip arrowheads (4) to cut & work jade & serpentine celts and boulders	Teit 1900:182; 1906:203; 1909a: 473–474; Morice 1890:138; Smith 1899:144 (Fig. 49); 1900:440,416
Arrow Point beaver	arrow point		Teit 1906:225, 1909a:519; Morice 1890:139
Necklace animal teeth		to make necklace	Teit 1906:220; 1909a:509–10; 1909b:778
Ornament teeth, beaver teeth		to make ear & nose ornaments	Teit 1909a:509; Nastich 1954:64
Prestige Item elk teeth			Teit 1917: 88
Decoration elk/caribou		to decorate clothing & canoe	Teit 1900:222, 255; 1906:206; 1909a: 502–3, 506, 509; Smith 1899:152
CLAWS/ HOOVES			
Rattle hooves	attached to drum; or ankle or knee band	to make rattling sound on drum or for rattle	Teit 1900:299, 385 (Fig. 315a); 1906:264, 271, 287; 1909a:575
hooves: fawn, deer (Shuswap also use dew claws of fawn)	strings of hooves	(1) worn at dance; (2) worn by girl or boy at puberty; (3) to hinder ghost from entering winter house; (4) worn by shaman while dancing	Teit 1900:316, 318, 332, 363–4, 384; 1909a:579, 590
Necklace claws (clan animals, grizzly bear, beaver)		to make necklace	Teit 1900:203; 1906:257, 264; 1909a:509–10; 1909b:778
Decoration hooves (fawn, deer)		to decorate cradle	Teit 1900:305, 307
claws: beaver hooves: fawn		to decorate knuckle cover for playing lehal	Teit 1900:276; 1909b:785 (Fig. 278)

Chapter 3

Functional Analysis of Stone Tools in the Western Sector of Housepit 7

Sylvie Beyries

The following study deals with the use-wear analysis of lithic material taken from about 25 square meters of the western part of the floor of HP 7, which has a total surface area of about 113 square meters. Because only 20% of the living floor has been studied, the results to be presented cannot be used to interpret the overall organization of activities either within HP 7 or to ascertain the place of HP 7 within the entire community. However, a number of interesting issues and questions about socioeconomic differences within and between houses are raised that are pertinent to the issue of socioeconomic organization at Keatley Creek. Use-wear analysis is particularly suited to the identification of activities as represented by stone tools and the detection of activity patterns on living floors.

The nearly 120 structures at Keatley Creek vary both in size (from 5–20 m in diameter) and in locational characteristics. Most structures are tightly clustered in the core of the site, however, a certain number are located on the peripheries. Both the size and position of these structures is the product of a specific social organization. In order to interpret this organization in terms of activities and behavior, a much broader investigation would be required, including the study of all the lithic material from the floors of several houses as well as material from outside these structures (Petrequin and Petrequin 1988, Beugnier 1997). In my opinion, the present study should be considered as a feasibility study for a more comprehensive functional study of the lithic material at the site. The corpus of ethnography that is related to the Keatley Creek site (Vol. II, Chaps. 1, 2, 17; Teit 1900, 1906; Hayden 1992) helps considerably in understanding the general nature of social organization within the site, and especially within the houses.

The western floor sector of HP 7 (Squares MM, BB, RR, Z, SS, H, G) contained 139 retouched lithic tools, mostly of small size (< 4 cm). Most of this material (66%) was clustered in Squares MM, RR, and SS, near the wall of the structure. The distribution of these tools in the center of the western sector is very variable (Fig. 1, Table 1):

Table 1: Distribution of Tools in the Western Sector:

Square	Number of Tools	Tools with Use Wear
MM	20	0
RR	38	11
SS	34	10
BB	5	2
Z	11	0
H	17	9
G	14	1
Total	139	33

The entire study assemblage was derived from small nonstandardized primary flakes of trachydacite. Previous studies have shown that this material is relatively soft and easily develops smoothed surfaces from use. On the other hand, this material exhibits poor development of the other kinds of wear traces, especially the polishes characteristic of different contact materials (Rousseau 1992). Although all pieces in the study assemblage were retouched, only 33 tools displayed interpretable use wear traces, probably due either to the relatively short periods of use of most pieces (many "expedient tools"—Vol. I, Chap. 12) or to resharpening before discard.

Four activities were identified from the tools in this sample: processing mineral substances, working plant materials, skin working, and lastly, hunting.

Working Mineral Substances

Thirteen tools display contact traces from minerals. This is the most common activity represented in the sample. Two types of activities can be identified: those involving mineral pigments and those involving other types of stone.

Actions Involving Pigment Minerals

Five tools carry traces of red mineral pigment. No scanning electron microscope backscatter analysis or elemental mapping were undertaken; however, it seems very likely that the red pigment is ochre. There are ochre quarries relatively close to Keatley Creek (Alexander 1992).

Teit (1900:241, 371; 1906:224) and Tepper (1994) observe that among the Lillooet and the Nlaka'pamux (located close to the Lillooet region) pigments were abundantly used. Pigments could be of different types. On one hand, mineral pigments were crushed and were especially used for coloring faces, the body, hunting weapons, or painting pictographs on rock surfaces. On the other hand, vegetal pigments were made from roots, branches, stalks, bark, or fruits and underwent more specific kinds of processing. These pigments were more specifically used for coloring hair, skin clothes, and wood objects (Vol. II, Chap. 2, Appendix II).

On three tools, the traces of pigment did not involve the working edge of the tools. These traces may have been due to accidental contacts. The remaining two are small tools with convex working edges and very abrupt edge retouch. The line of the working edge is very rounded and displays short, very deep striations perpendicular to the working edge. These could have been tools that served to scrape pieces of pigment in order to obtain powder (Beyries and Walter 1996).

Frequently, the hardness of mineral pigments, and especially those that are very crystallized, prevents the direct use of these natural pigments. Even if such pigments are pointed in order to form a "crayon," their use in forming lines will act to scratch the contact material rather than coloring it. Reducing pigments into fine powders before using them is therefore often indispensable. Besides this, for certain pigments, the reduction into powder enhances the brightness of the color as well as the adhesive properties of the pigment. Perhaps it is in this fashion that the use wear traces

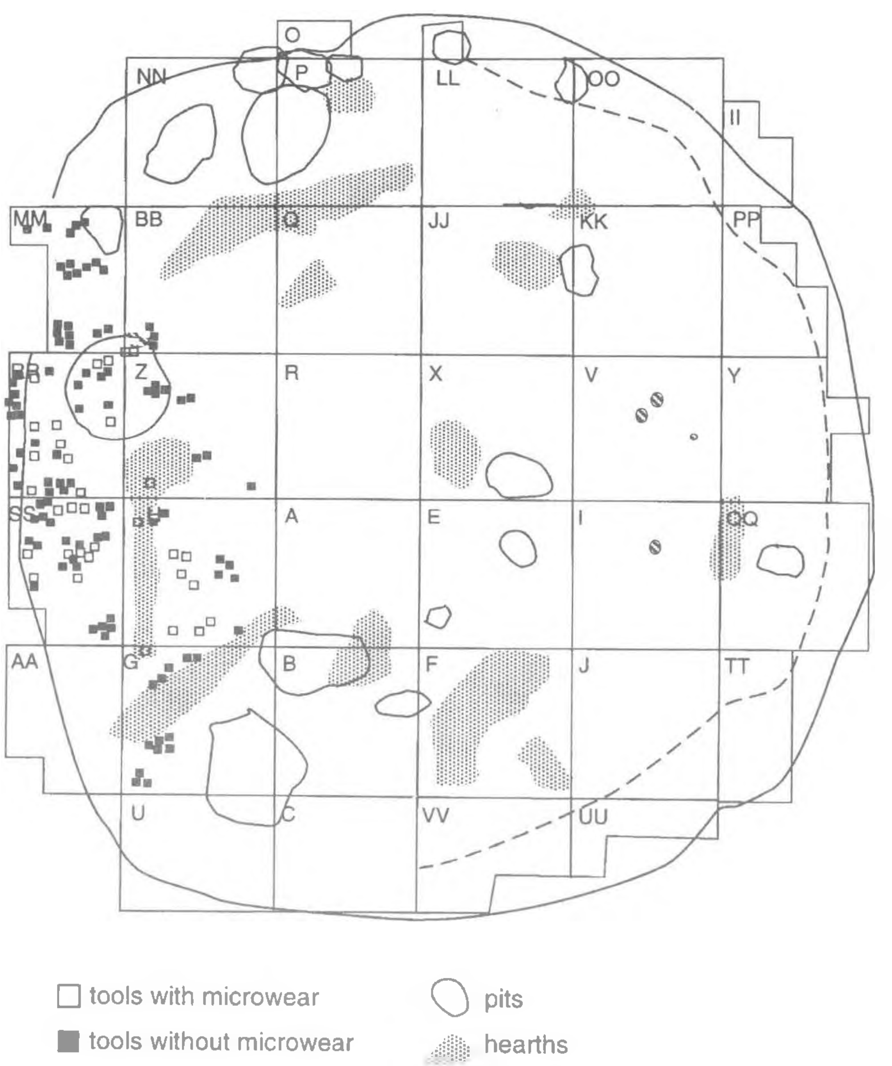

Figure 1. Floor plan map of HP 7 showing the distribution of tools with use wear traces. Note: only tools from the west sector of the house floor were examined in this analysis.

observed on the tools at Keatley Creek should be interpreted (Beyries and Walker 1996).

Actions Involving Other Minerals

Eight tools with straight cutting edges and direct retouch display very clear use traces of contact on mineral substances. The edges are strongly rounded with a mat luster, striations are pronounced and oriented either parallel or transversely to the cutting edge (Fig. 2). These traces appear to be the result of grooving a soft mineral such as soapstone or shale. These materials were used to make certain kinds of containers such as figurine bowls, or for specially crafted items such as beads, pendants, bracelets, and pipes (Moeller 1984; Desmond Peters, personal communication). Craft items described by Hayden as lithic prestige objects have been described for the site (Vol. II, Chap. 13), including pipe fragments, small serpentine sculptures, pendants, copper sheets and beads, and sculptured mauls. The flake tools under discussion could therefore result from the production of these objects. These flake tools were therefore probably used either for detaching small blocks destined to be sculpted later into desired forms (tools with striations parallel to the cutting edge), or for the following stage involving the creation of a specific form or the removal of material for the polishing of the object (transverse striations).

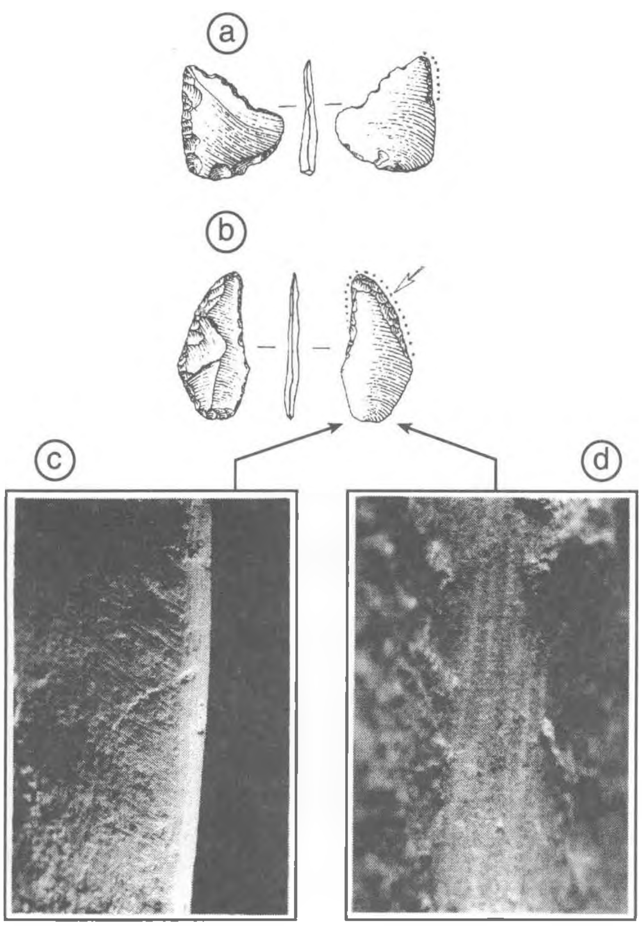

Figure 2. (A) and (B) tools with wear indicating mineral contact; (C) striations (×100) showing the different use modes of tool b with longitudinal striations indicating a sawing action and the relatively perpendicular striations indicating a scraping action; (D) detail of the working edge (×200).

In contrast, the substantial productions of objects in nephrite found at Keatley Creek should not be associated with the flake tools described above. In effect, these rocks are much harder and would not have been able to be shaped with tools made of the much softer trachydacite materials used for chipped stone. These results tend to indicate that there was a certain degree of specialization among craftsmen; specialists who worked soft mineral substances were not the same as those who concentrated on the production of harder crystalline rocks.

For the production of the softer mineral objects, both stages of the "chaîne opératoire" are represented: the preparation of the initial block and the creation of the desired shape. It therefore seems probable that an activity area for the production of sculpted objects in stone is present in Squares SS and H since all the tools related to this function are found in this part of the housepit.

Working Plant Materials

Use wear indicating contact with plant materials is present on nine tools. Four tools with straight working edges display signs of having been used for cutting woody plants; these pieces have alternating retouch and a very reflective vegetal polish (Figs. 3–4). Although the pieces involved are among the largest tools (maximum length 4.5 cm), the size of these tools which are small in absolute terms, indicates that they were intended to be used for the procurement or working of moderate sized plants such as those that might be used for wicker baskets.

Seven small endscrapers display transversal striations and a very pronounced reflective polish. These pieces should be related to a scraping action on plant material, therefore involving the processing or working of these materials.

It is extremely difficult to interpret these results in more specific terms. On the one hand, working plant materials is complex; on the other hand, their composition and their condition at the time of

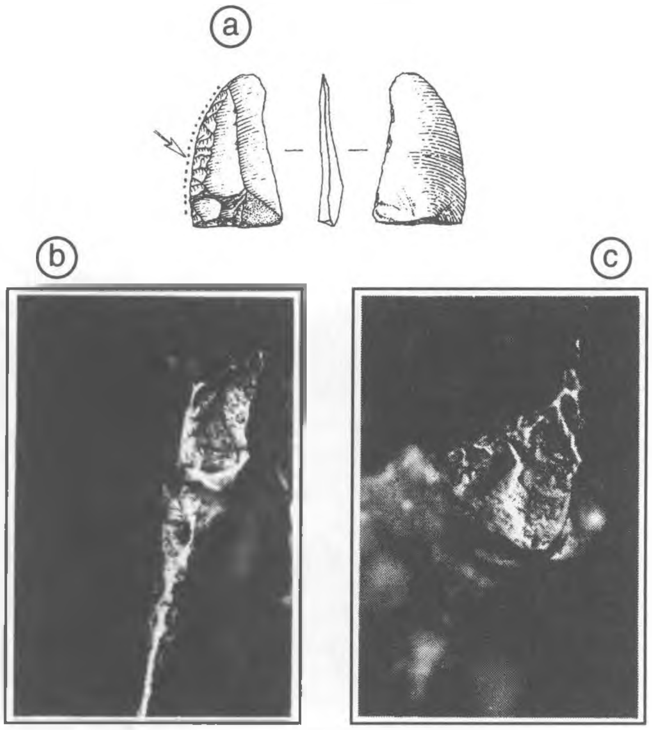

Figure 3. (A) An implement displaying a tranverse action on soft plant materials; (B) ×100 magnification; (C) ×200 magnification detail.

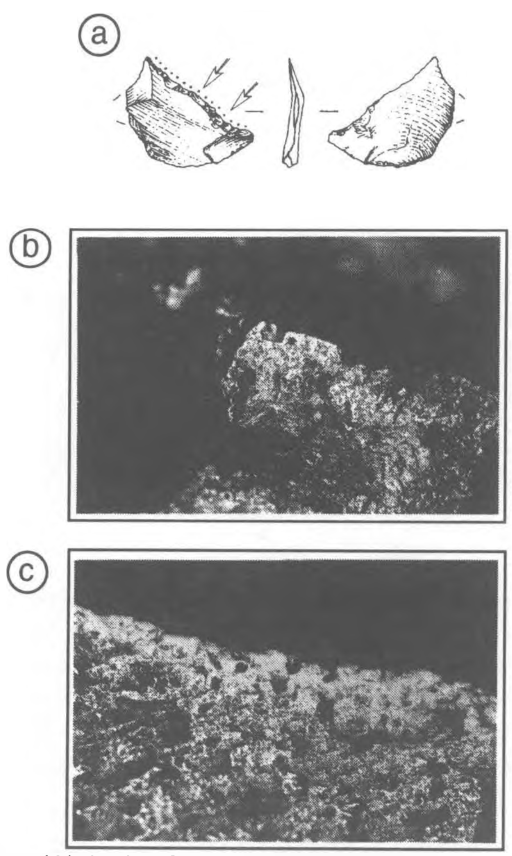

Figure 4. (A) An implement displaying a tranverse action on soft plant materials; (B) ×100 magnification; (C) ×200 magnification detail.

processing has a very important effect on the morpology of wear traces on tools (orientation of striations, extension of polish, patterns of micro-fracturing, and other attributes). A better interpretation of these plant working use wear traces would require a larger sample of archaeological tools in order to undertake comparisons (morphology of the cutting edge, distribution and extension of the various traces). As well, an extensive body of experimental tools and observations needs to be established, taking into account numerous parameters of importance (function of the tool, species worked, precise location of procurement for each species or raw material, ability of the artisan—Beyries 1993) as well as ethnographic sources.

Working Hides

Nine endscrapers show the very typical characteristics of hide working: very pronounced rounding skewed to one side along the working edge. The tools showing these wear traces are not very thick (less than 1.5 cm) and display a cutting edge that is not very wide (less than 3 cm). The size of these tools as well as their intended use seems to have required that they be hafted.

One re-fit was obtained between two tools (in Squares H and SS). This refit seems to indicate that the tool was broken in this area (Fig. 5 b–e).

Observations of artisans who still work hides using traditional techniques provide information which enable us to interpret these tools in a more precise fashion (Beyries, In press). In order for a tool in use to be effective, it is necessary for it to transmit a force (in the case of hide working, this force gives the tool the "bite" which enables the worker to remove material from the hide) and as well for this force to be given a direction (this is the movement of the tool). There are two possible scenarios.

In the first case, both the force applied and the direction of movement combine and work together. In this case, the tool works in the direction of its axis. For hideworking, this is what happens when a person works very thick hides such as those of moose. These tools are heavy, about 400 g, the hides are stretched in such a manner that the worker can sit on the hide while holding her tool in both hands together which permits the worker to place all her force in the movement of the tool. In this case, the wear patterns of the tools are always symmetrical about the center of the tool. The distribution of the wear on the cutting edges of the archaeological tools examined and the size of these tools excludes the possibility of having been used on thick hides stretched in this fashion or being used in this fashion.

In the second case, the direction of force and the direction of movement do not work in tandem. This is the case when a person works moderately thick hides such as deer or elk. These hides are prepared when dry on frames that are placed more or less perpendicular to the ground. The artisan works standing and faces the hide. In this case, the tools can be hafted in elbow (or straight) handles. This type of haft is held with one hand on the bend (or shaft end) to provide the requisite force while the other hand is placed on the main part of the shaft to direct the tool's movement. In this case, during the contact of the cutting edge with the hide, the hand providing most of the force is always at risk of slipping away from the axis of movement. Moreover, the wear on the tool's edge will always be skewed either to the right or to the left depending on the hand placed on the bend (or the end) of the haft (Beyries, in press). At Keatley Creek, the size of the tools and the distribution of the use wear clearly indicate that the second scenario was being followed.

Hunting: Projectiles

Two implements display long fractures on their distal ends. One implement is a triangular piece with a wide base (Fig. 6), and one is a bifacial projectile. Both of these pieces should be interpreted as projectile points.

Summary

Although these results cannot be used to establish a view of the overall organization of the household group, they merit a certain number of comments. The activities are all craft activities: working of minerals, plants, and skin. There is no indication of activities involving the acquisition or the processing of animal flesh for consumption (butchering or preparation of fish). In terms of the preparation of fish, and salmon in particular, it has been shown that this type of work leaves few if any interpretable traces of wear on tools in general and on basalt or trachydacite in particular (Flenniken 1981; Beyries 1995). In addition, it is probable that this activity took place near fish procurement locations. As for butchering, if some of the tools examined had been used for defleshing or the preparation of meat, they should have been identifiable. In fact, these activities leave very distinctive wear traces on lithic tools, especially very specific types of micro-fractures. It is curious that there is no indication of cutting skins for making clothes, since this is an activity that is recorded ethnographically (Vol. II, Chap. 2).

The concentration of ochre working, rock sculpting, and hide working in the western sector of HP 7 is also interesting since this has been identified as a high status domestic area within the house (Vol. II, Chap. 1), and since all three of these activities are ethnographically

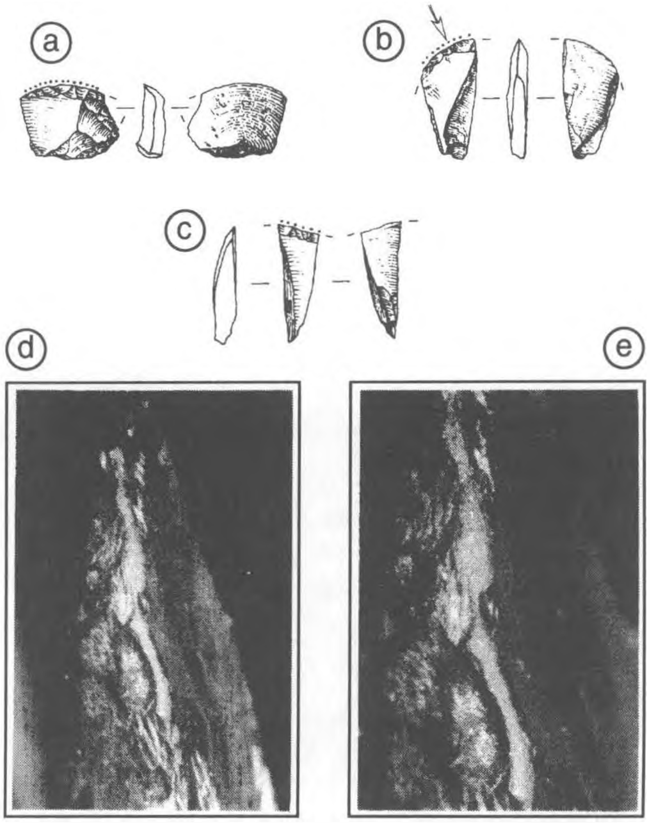

Figure 5. (A) A hidescraper; (B) and (C) fragments from a single tool; (D) pronounced edge smoothing from hide scraping (×100); (E) a detailed view of the edge (×200).

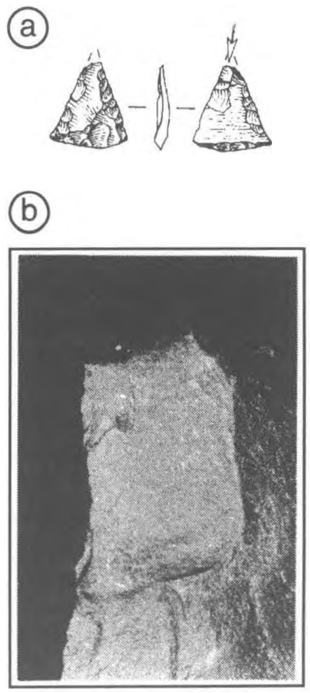

Figure 6. A projectile point.

or logically related to high status individuals and families (Hayden and Schulting 1997). Therefore it would be very interesting to compare these results with a use wear analysis of tools associated with lower status domestic groups within the same house (e.g., those on the eastern half of the floor), as well as with tools from other smaller houses which appear to have been poorer and of a relatively low socioeconomic rank (for example, HP 12 or HP 90). However, this work must await the future.

It is also interesting that almost half of the tools with endscraper morphology do not appear to have been used for hide working, but rather were used on woody plants. This means that the simple equation of endscraper frequency as a measure of the relative importance of hideworking in a household is not reliable.

Although the results of this analysis may seem disappointing in terms of the small percentage of tools that bear interpretable use wear traces, the activities of certain craftsmen has, nevertheless, been able to be documented. It is certain that these results will increase in their relevance with a more comprehensive study of the material both from within this structure and in relation to other structures in the community.

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Organic Analysis

Chapter 4

Socioeconomy at Keatley Creek: The Botanical Evidence

Dana Lepofsky

Introduction

This chapter reports on the paleoethnobotanical analyses of floor sediments from a small (HP 12), medium (HP 3), and large housepit (HP 7) at Keatley Creek. The specific goals of the paleoethnobotanical analyses were to delineate patterning of floral remains across the floors of the three housepits, and make comparison between the structures which could yield insights into socio-economic differences. To that end, I examined 123 flotation samples from pithouse floor contexts, including 69 samples from HP's 7, 38 samples from HP 3, and 16 samples from HP 12. Roughly 15% of the total subsquares on the excavated portion of the floors of HP's 7 and 3 have been analyzed for archaeobotanical remains. Approximately 12% of the HP 12 floor was examined. Details concerning methods, raw data, and site formation processes have been discussed in Volume I, Chapter 9.

The results from site formation analyses indicated that the housepit floor deposits are relatively intact and undisturbed. Patterning across the floors seems to represent the accumulated effect of repeated activities in discrete areas. The Keatley Creek archaeobotanical remains, then, are ideal for examining the archaeological correlates of socio-economic behavior in the housepits.

Results

The results of the paleoethnobotanical analyses of HP's 7, 3, and 12 are discussed in turn below, followed by comparisons of remains among the three structures. Distributions of archaeobotanical remains across the three housepits are presented in Figures 1–3. The archaeobotanical remains were divided into the three major plant categories recovered on the floor: charcoal, needles, and seeds. Seeds were further divided in the large (HP 7) and medium (HP 3) structures into food seeds, non-food seeds, and unidentified seeds (see Vol. I, Chap. 9 for ethnobotanical descriptions). High concentrations of charcoal, needles, and food and non-food seeds are circled on the figures. In HP 12, where so few seeds were recorded, the total number of seeds recovered per sampling subsquare is presented All analyses are based on the number or weight of specimens recovered per one liter flotation sample.

Housepit 7

Plant Distributions Across the Floor

There are several clusters of charcoal concentration along the floor of HP 7 (Fig. 1). The greatest concentration of charcoal centers around the hearth feature in Square Q, which was no doubt the source of much of the charred wood. The other concentrations are less easy to explain. Some (Squares RR and SS, Squares G and B) are adjacent to fire-reddened areas. However, the remaining clusters are not clearly in association with fire reddening, and there are some fire reddened areas with no associated charcoal concentrations. Likewise, there is only a weak relationship between charcoal and fire cracked rocks across the floor (Vol. II, Chap. 11, Fig. 9).

Except for a few high density areas, there is a relatively low concentration of charcoal across the floor of the housepit. Given the proposed model for intensive use of this housepit (see Vol. II, Chap. 1), I would expect a much greater density of charcoal on the floors. The low density of charcoal suggests either that fires were infrequent in the pithouse (as proposed by Hayden et al. 1996) and/or that the floor was regularly cleaned of the large charcoal pieces so that only the small, scattered fragments remain. The center of the floor (Square A and part of adjacent squares) is particularly devoid of charcoal. Since this may have been a communal, high traffic, or ritual area (Vol. II, Chaps. 1, 11) greater care may have been taken to keep it clear of debris.

Six taxa make up the assemblage of identified charcoal species from the floor of HP 7 (Vol. I, Chap. 9, Table 7). The assemblage is dominated by three taxa: Douglas-fir, ponderosa pine, and *Populus*. Douglas-fir is considerably more abundant than the two other dominant taxa, which occur in relatively equal percentages. Coniferous charcoal generally dominates the samples; only 3 of the total 23 floor samples contain less than 60% coniferous charcoal. There is no apparent patterning across the floor among deciduous-dominated samples.

The distribution of needles across the floor of HP 7 is distinctly non-random (Fig. 1). There is a nearly continuous concentration of needles along the periphery of the floor. The concentration is especially dense along the southern and southeastern periphery of the structure, near what has been identified as a bench (Vol. III, Chap. 4). The concentration of needles along the periphery is particularly striking when compared to the center of the structure where needles are relatively absent. All needles are Douglas-fir and ponderosa pine, with the former dominating.

There are three discrete concentrations of food seeds across the HP 7 floor (Fig. 1). The cluster in the north-central floor area contains the highest density and diversity of food seeds in this category. The density and diversity are especially high when the unidentified seeds are included in the totals (usually

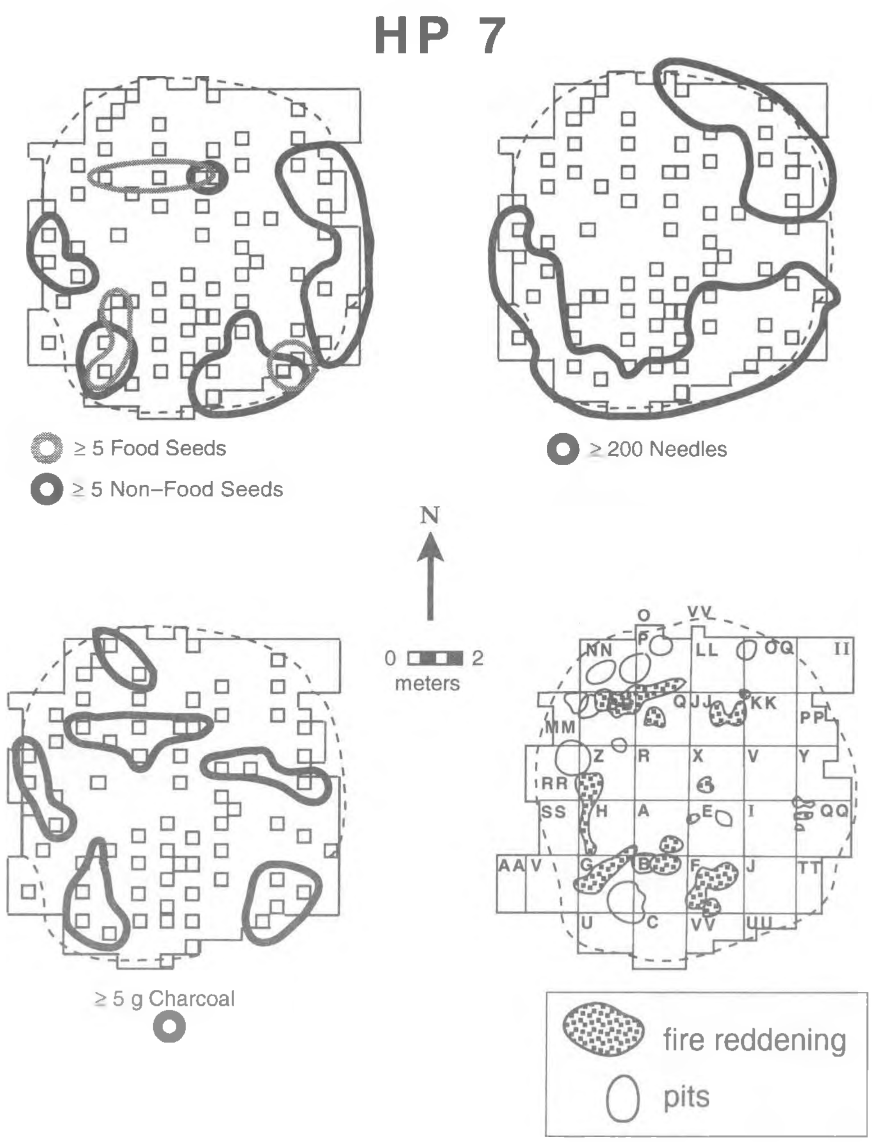

Figure 1. The frequency and distribution of plant remains across HP 7 with high density areas circled and sampled subsquares indicated by small squares. The arrangement of excavated squares is shown at lower right.

each specimen representing only a single taxon). This concentration of seeds correlates well with a charcoal concentration, both of which cluster around the hearth area in Square Q. The wide diversity of seed types in tight association with the hearth strongly suggests that the hearth in Square Q was repeatedly used for plant processing. Another possible (but less likely) explanation is that this hearth was a regular discard area for all plant foods used in the pithouse. Square Q is a good candidate for a special activity area.

Located in the southern end of the housepit floor are the other two food seed clusters. Both, formed only by two subsquares, overlap with concentrations of non-food seed clusters. Both of these food seed clusters also correspond closely to concentrations in charcoal. However, these small clusters may represent more minor plant processing areas. The analysis of additional subsquares adjacent to the clusters would help to better define their nature. Plant food processing that did not involve fire may have occurred elsewhere on the floor, but the residues from these events are not likely to show up in the archaeological record.

Non-food seeds occur in five clusters on the large housepit floor, and are generally spatially distinct from the food seeds (Fig. 1). The southern and eastern peripheries of the floor contain four of the clusters. Although I have separated these periphery concentrations into four discrete clusters, I suspect that the gaps between the clusters have more to do with gaps in our sampling than actual breaks in the distribution.

The concentration of non-food seeds along the south and east periphery of the pithouse corresponds well with the zone of highest needle concentration, and may be related to the proximity of the earthen bench along the northeast, east, and southeast sides of the housepit floor. These clusters are predominantly composed of charred *Chenopodium* and *Poaceae* seeds. The grass seeds and needles may be the remains of a covering for the bench composed of grass stems and conifer boughs. One possible explanation for the concentration of seeds and needles is that the bench was covered by planks or poles which acted as traps for the seeds and needles. No clear explanation for the associated charred chenopods is evident but they may have been accidentally collected along with the grasses.

The north-central part of the housepit floor contains the final concentration of non-food seeds (Squares JJ-7 and JJ-8). This concentration is located at the edge of a hearth which also has a high concentration of food seeds. *Phacelia*, a weedy species, reportedly used medicinally in ethnographic times (Steadman 1936, cited in Turner et al. 1990), dominates the non-food seeds in this square and the adjacent hearth. We cannot at this time determine what purpose the *Phacelia* seeds served, but it is unlikely that their association with the hearth in Square JJ is an accidental one. As with the other two classes of botanical remains, the center of the pithouse is relatively devoid of all seeds.

In general, there is little relationship between seed and faunal concentrations across the floor of HP 7. The one notable exception is in the northwest area of the house. The concentration of food and non-food seeds here corresponds to a cluster of fish bones (Vol. II, Chap. 7) both of which are associated with a fire-reddened area. This area likely functioned as a plant and animal food processing area.

Features on the Floor

The floor of HP 7 has little "featureless" floor space and is composed of a complex array of features (Vol. III, Chap. 4). No pit hearths or rock lined hearths appear on the floor. Evidence for fires is largely based on more diffuse fire reddened areas. In addition to the hearths there are pits of varying sizes. Time constraints restricted us to sampling only one of these pits for plant remains.

Flotation samples were analyzed from three hearths in HP 7 (located in Squares Q-7, JJ-8, and NN-13). A high density of seeds and charcoal was recovered from the first two hearths in Squares Q and JJ, paralleling the results from the adjacent sampled subsequences. The Square Q hearth has relatively few needles in it, typical of the center of the housepit as a whole. Unfortunately, the needles in hearth JJ were not quantified, but judging from the concentrations in adjacent squares, needles in that hearth may be slightly more abundant than expected for that portion of the floor.

The hearth in Square Q is dominated by food remains. The hearth in Square JJ has a relative abundance of both food and non-food remains. It seems likely that hearth Q was the center of the plant processing activities that took place in the adjacent squares. I have already mentioned that the majority of the non-food remains in JJ are *Phacelia* and may indicate some special use for that feature. The presence of a high density of both food remains and non-food remains suggests that this hearth functioned as part of the same plant processing area as hearth Q.

The hearth in the northwest corner of the pithouse (NN-13), like the surrounding floor area, has a low density of all categories of remains. The low density of charcoal within the hearth suggests that it had not been used for some time, was used less frequently, or was kept relatively cleaner than the other analyzed hearths.

In addition, I identified charcoal from a select number of hearths and fire reddened areas (Vol. I, Chap.

9, Table 9). The burn areas are classified by size to determine if different species of wood were used in different sized burn features. Conifers clearly dominate all the samples, regardless of feature size. Ponderosa pine and Douglas-fir appear in roughly the same abundance when all the samples are considered together, although there is a great deal of variation between samples. *Populus* follows in abundance. One specimen of *Betula* sp., from the hearth in Square Q, is the only other taxon represented. These results suggest that there is no apparent difference in the kinds of woods selected for burning in large, as opposed to small, burn features.

Only a single pit feature (I-3) was analyzed for archaeobotanical remains. This deep depression appears to have been formed by the intersection of a shallow pit with a deeper post hole. The archaeobotanical remains in the pit consist of a moderate amount of charcoal, a relative abundance of needles and almost no seeds.

The archaeobotanical contents of the pit feature suggest that, at the time of abandonment, it was no longer serving its original function. Instead, the presence of charred remains in the pit indicates that the pit had been at least partially filled with secondarily deposited refuse. This supports Hayden's (Vol. I, Chap. 1) suggestion that large pits within the housepits may have been filled with loose floor deposits and domestic debris in between their use for storage. I have already suggested that the floor was regularly cleaned of larger debris. The charcoal and needles in the pit feature may suggest that the pit served as a repository for such sweepings when the feature was not being used for food storage.

There are significant differences in charcoal species abundance between the hearths and general floor of HP 7 (Vol. I, Chap. 9, Tables 1 and 2). When the average percent for all samples are considered, Douglas-fir is significantly more abundant in the floor samples than in the hearth areas (Mann Whitney U test, $p = 0.02$; Pmen floor $X = 62.5 \pm 20.2$, Pinus floor $X = 18.0 \pm 13.7$, Pop floor $X = 14.5 \pm 19.7$, N = 23; Pmen hearth $X = 39.0 \pm 23.9$, Pinus hearth $X = 39.3 \pm 36.5$, Pop hearth $X = 19.3 + 19.2$, N = 8), and there is a trend for pine to be more abundant in the hearth areas than the floors (Mann Whitney U test, $p = .10$). The overall abundance of *Populus* is similar in both contexts ($p = 0.5$).

These results suggest that the floor and hearth charcoal result from different processes. As discussed elsewhere (Vol. I, Chap. 9) the charcoal on the floor has several potential sources. Unless the contents of the hearths are "secondary refuse," which is not suggested, we can assume that the charcoal from the hearths originates from the last, or perhaps the last few fires burned in that hearth. The species of floor charcoal surrounding the hearths are not found in the same abundance as that found in the hearth. This suggests that the floor charcoal represents an accumulation of hearth (and other) debris from a longer time period than represented in the hearth itself. Thus, whereas the hearth gives us a glimpse of a single (or close sequence of) burn event(s), the area surrounding the hearth gives us a more general picture of wood use over time.

Housepit 3

Plant Distributions Across the Floor

There are three concentrations of charcoal on the floor of HP 3, along the northwest, southeast and southwest edges of the floor (Fig. 2). Two of the three areas designated as "concentrations" are represented by a high density of remains in only a single subsquare. Archaeobotanical analyses of adjacent subsquares would no doubt serve to clarify the patterning. Each of the charcoal concentrations corresponds closely to domestic fires indicated by fire-reddened areas on the floor. As in HP 7, the center of HP 3 is relatively devoid of charcoal.

As in HP 7, I identified charcoal from select areas on the floor of the medium housepit (Vol. I, Chap. 9, Table 8). Like HP 7, conifers, primarily Douglas-fir, dominate the assemblage. Pine and *Populus* occur, on average, in relatively equal abundance across the floor as a whole.

There is a concentration of charred conifer needles along the periphery of the HP 3 floor, particularly along the southern edge (Fig. 2). It is unfortunate that we do not have any samples analyzed from the extreme western edge, but it seems as if there is a steady decline in abundance of needles northward from the southern concentration. There are few needles in the center of the floor, a pattern seen also in HP 7. The needles are both Douglas-fir and ponderosa pine, with the former dominating.

Food seeds cluster in three discrete areas, one along the northwestern periphery, and two areas in the southwest quadrant of HP 3 floor (Fig. 2). The concentration along the northern and southwestern edges of the floor correlate with concentrations of charcoal and relatively denser accumulations of needles. The northern cluster is significantly larger, more dense, and more diverse than the smaller concentrations. The northern cluster likely represents a major plant food processing area associated with the hearth is Square EE. The two smaller concentrations to the south may either be smaller plant processing areas or may represent accidental or idiosyncratic depositional events.

As in HP 7, most food seed concentrations appear to correspond to activity areas involving fire. Since the presence of fire increases the likelihood of seed preservation (often via accidents), the correlation between seeds and hearths and fire-reddened areas may be an artifact of preservation. That is, the *absence* of seed concentrations in areas without fire activities may just be a preservational bias.

Non-food seeds concentrate along the periphery of HP 3 floor. Charred chenopods make up the bulk of the non-food seeds. This pattern differs from HP 7 where the non-food category consists primarily of chenopod as well as grass seeds. Without the presence of grass seeds, I cannot formulate a parsimonious cultural explanation for the chenopods along the periphery of the floor of HP 3. The distribution of chenopods along the periphery of the structure may indeed be due to post-occupation depositional processes, but parsimonious "natural" explanations are equally difficult to formulate (Vol. I, Chap. 9). As in HP 7, food and non-food seeds distributions are generally mutually exclusive in HP 3.

Two of the three clusters of food seeds generally correspond to concentrations of faunal remains (Vol. II, Chap. 7). However, given the generally diffuse distribution of faunal remains on the floor of HP 3, the correspondence with seeds may be fortuitous. Paralleling HP 7, all three classes of botanical remains are rare in the center of HP 3 floor.

Features on the Floor

Two hearths from HP 3, in Squares G and F, were analyzed for botanical remains. The feature in Square F is characterized by relatively few remains in all categories, in contrast with the other burn feature analyzed. The hearth in Square G contained fewer needles and more charcoal than the surrounding floor. The relative absence of needles may indicate that the area around the hearth was kept clean of needle matting. Perhaps a clean surface was needed for the various activities which were conducted around the feature or, as prevention against run-away floor fires. The associated small concentration of food seed remains surrounding this hearth may indicate that the feature, like the one in Square F, was the center of a minor food plant processing area. Douglas-fir was the predominate wood charcoal recovered from the feature (Vol. I, Chap. 9, Table 9).

A single pit feature in Square F was analyzed for archaeobotanical remains. This pit was of moderate depth and was used during the most recent occupation of the housepit. The most striking result of the analysis is the relative absence of all categories of plant remains

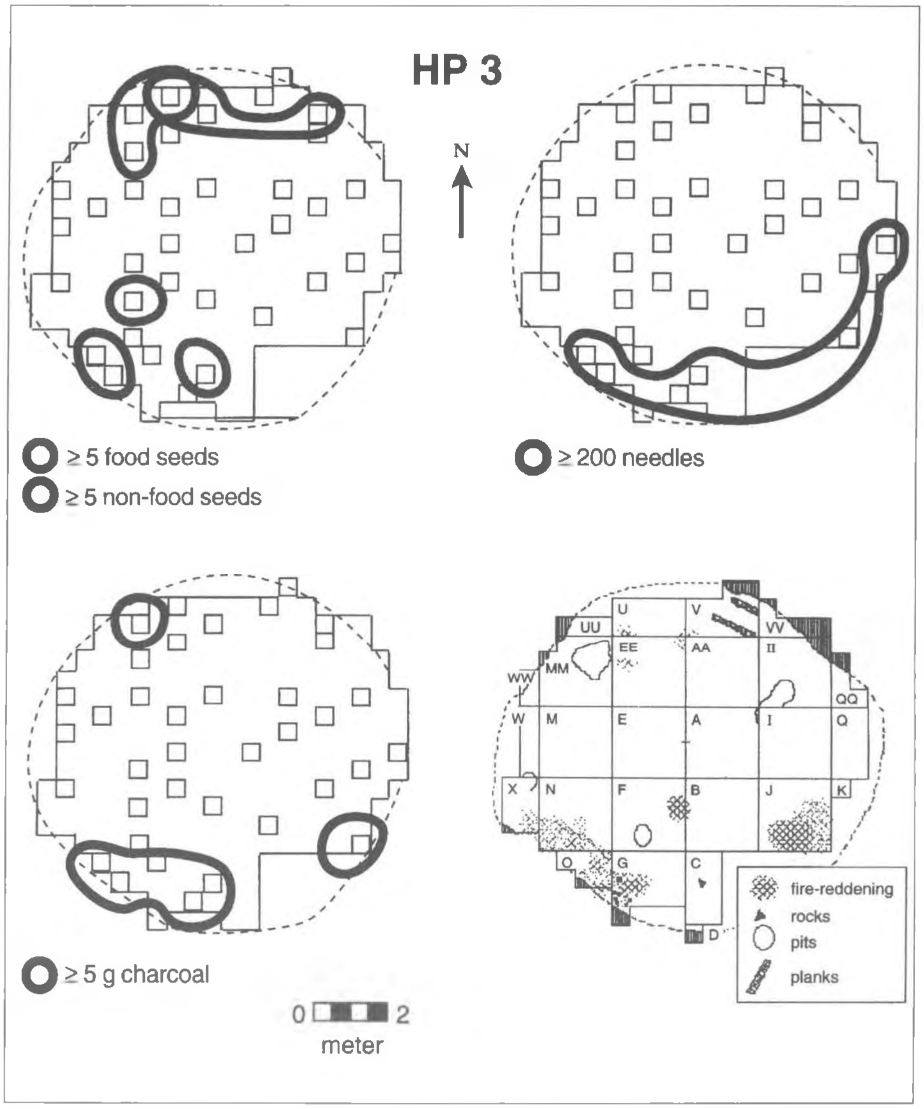

Figure 2. The frequency and distribution of plant remains across HP 3 with high density areas circled and sampled subsquares indicated as small squares. The arrangement of excavated squares is shown at lower right.

in the pit. Faunal analysis of the bottom strata of the pit feature indicates that the pit was used to store salmon, and was not used subsequently for garbage disposal (Vol. II, Chap. 7). The floral analysis supports this latter conclusion. Had the pit been used as a receptacle for waste, a higher proportion of charred remains would be expected; those few plant remains contained within are likely accidental introductions into the feature. It is possible that uncharred plant resources were also stored in the pit, but did not survive in the archaeobotanical record.

Housepit 12

Plant Distributions Across the Floor

Distinguishing patterning across the floor of HP 12 is more problematic than in the two larger housepits (Fig. 3). Because HP 12 has such limited floor space, clusters of remains may be more spatially restricted than in the other housepits. Thus, although we analyzed roughly the same percent of surface area in the three structures for archaeobotanical remains, we may be missing relatively more information in the unsampled subsquares of HP 12. Given the nature of the sampling strategy in HP 12, any missed concentration of remains is likely to be defined by very few subsquares.

Three areas on the floor of HP 12 stand out as containing significantly more charcoal than the surrounding squares (Squares I-9 and J-15, A-2, E-11). The charcoal concentration in the north is associated with a fire reddened area, as well as relatively higher densities of bones and FCR. However, other areas of fire reddening on the floor display a much lower density of charcoal (and other) remains. No charcoal specimens from the floor of HP 12 were identified.

There are also three areas of needle concentration on the floor of HP 12 (Squares I, E, and A; Fig. 3). Each of which roughly correspond with charcoal concentrations. Douglas-fir and ponderosa pine comprise the needle assemblage, with the former far outweighing the latter in number. Nowhere on the floor of HP 12 are needles as densely concentrated as in the two larger structures.

Seed densities are strikingly low in all areas across the floor (Fig. 3), and no area appears to have a greater or lesser concentration than another. Even the areas which have a concentration of both charcoal and needles have few or no seeds. Indeed, only 16 seeds were found across the floor, representing only five taxa. The most ubiquitous seed remain is *Chenopodium*, which is of questionable ethnobotanical significance (Vol. I, Chap. 9), and even its total number is very low.

While each class of remains appears to be less concentrated in the center of HP 12 than the periphery,

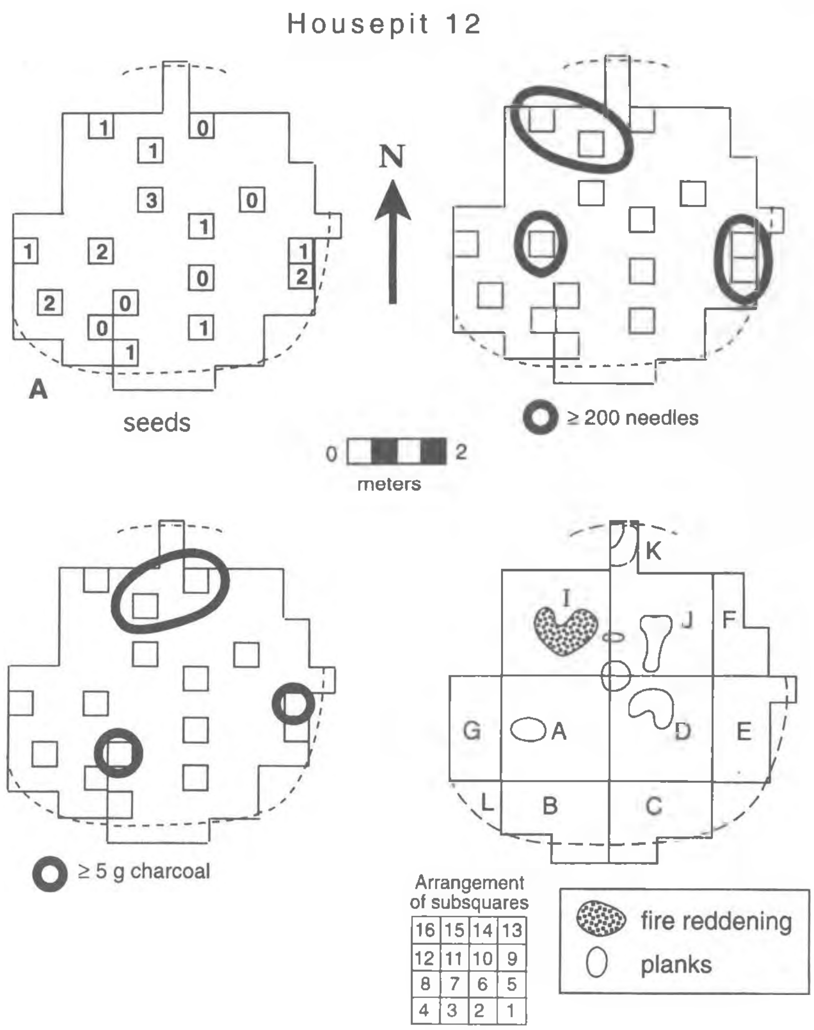

Figure 3. The frequency and distribution of plant remains across HP 12 with high density areas circled and sampled subsquares indicated by small squares. The arrangement of excavated squares is shown at lower right.

this patterning is less marked here than in HP's 7 and 3. The pattern of high needle concentration along the periphery, which is so clear in the other two housepits, is likewise less evident in HP 12.

Features on the Floor

One sample from the fire reddened area in the north of the floor (I-9) was examined for archaeobotanical remains. The sample contained a high density of charcoal, an extremely high density of needles, and virtually no seeds. The same pattern holds for adjacent sampled subsquares. This suggests that the fire reddening may be the result of burning for warmth but not plant processing.

Comparisons of Patterning Across the Floors of the Three Housepits

The relative absence of archaeobotanical remains in the center of the three housepit floors is a consistent pattern in all three categories of remains. This pattern generally parallels that of the faunal remains (Vol. II, Chap. 7). Given the absence of remains in the center, the palaeoethnobotanical remains offer few insights into how the area was used. Given the ease with which charcoal can be displaced, and how difficult it is to clean up, it seems clear that considerable care was taken to keep the housepit center clear of debris. The center may have been a communal use area for the inhabitants of each structure.

Interpreting the variation of charcoal densities across the three floors was accomplished with uneven success. In cases where charcoal frequency correlates with evidence of domestic fires, the source of the floor charcoal is clear. However, this was not always the case.

In HP 7 there is a clear association of charcoal and the hearth in the northcentral portion of the floor. However, the relationship between charcoal densities and other fire reddened areas or non-reddened areas is not straightforward. In HP 3, on the other hand, there is a close relationship between most fire-reddened areas and charcoal frequencies. The only deviation from this pattern is in association with the "last occupation hearth." In HP 12, only one of the three areas of charcoal concentration corresponds to fire-reddening.

How we are to interpret the charcoal densities is unclear. We know from the distribution in the center of the structure that the floor was likely regularly cleaned of large debris. I have suggested elsewhere (Vol. I, Chap. 9) that the absence of large archaeobotanical remains across all of the floor suggests that the floor as a whole was regularly cleaned. If sweeping was involved in clean up activities, it would blur any floor patterning; but the clear association between some categories of remains with discrete areas, suggests that if sweeping was employed the effect was not great. A possible explanation for the lack of charcoal associated with definite hearths may be the fact that these hearths were used infrequently.

The three dominant charcoal species (Douglas-fir, pine, *Populus*) were recovered in the same abundance from the floors of both HP's 3 and 7 (Tables 1 and 3; HP 7 Pmen $X = 62.5 \pm 20.3$, HP 3 Pmen $X = 62.5 \pm 21.6$, Mann Whitney U test, $p = 0.92$; HP 7 Pinus $X = 18.0 \pm 13.7$, HP 3 Pinus $X = 19.3 \pm 20.6$, Mann Whitney U test, $p = 0.80$; HP 7 Pop $X = 14.5 \pm 19.7$, HP 3 Pop $X = 14.7 \pm 7.1$, Mann Whitney U test, $p = 0.16$). Indeed, these taxa have almost identical abundance and standard deviations across the two housepit floors. Douglas-fir was by far the preferred wood, with the other two chosen in roughly equal proportions. There is a greater diversity of wood species represented on the floor of HP 7, but this may be a factor of sample size. In general, it seems that the same wood selection process was conducted by the inhabitants of HP 7 and HP 3. The question remains whether wood abundance reflects similar abundance of species in the natural environment, or more conscious wood selection. As I discussed elsewhere (Vol. I, Chap. 9), a sample from a greater number of housepits, as well as a detailed paleoenvironmental reconstruction, are needed before we are better able to solve this question. No charcoal was identified from the floor of HP 12, so comparisons with this housepit cannot be made.

The suggestion has been made that fuel wood was a relatively rare commodity at Keatley Creek, and that there was differential access to wood based on differences in wealth and status (Vol. II, Chap. 1). If this proposition is correct, there should be some indication in patterns of wood use in the three housepits, i.e., we would expect that the greatest diversity and abundance of fuel wood would be found in the largest, and supposedly the highest status structure (HP 7), whereas the least amount fuel wood should be recovered in the smallest, and supposedly the lowest status structure (HP 12).

I have dealt with this problem in two ways, both of which are not without problems. First, I calculated the average amount of charred wood found on the floor of the three housepits. Although charred wood on the floor of the structures may come from several sources (Vol. I, Chap. 9) it is likely that the majority of charcoal is fuel wood. If the supposition about differential access to fuel wood is correct, we would expect more charcoal in the largest, and supposedly the higher status structure than the other two smaller housepits.

Figure 4 illustrates the average amount of charcoal on the three housepit floors. Charcoal abundance on the three floors are statistically different from one another (ANOVA, $p = 0.05$; HP 7 char $X = 4.4 \pm 3.9$, HP 3 char $X = 2.8 \pm 2.0$, HP 12 char $X = .9 \pm 2.8$), but in a posthoc 2-way comparison only HP 7 and HP 3 floor charcoal are significantly different (Tukey HSD, $p = 0.06$). Thus, HP 7 has significantly more charcoal on the floor than HP 3, but not more than HP 12. From this, we can conclude, that on average more fires may have been burned in HP 7 than HP 3, but there was no difference in fire intensity in HP 7 versus HP 12, nor in HP 3 versus HP 12. This conclusion is supported by a greater degree of fire-reddening underlying the hearths of HP 7 than HP 3. Whether the burning of more fires has more to do with access to fuel or the intensity which HP 7 as a whole was used, cannot be determined.

A second method of evaluation of the possible connection between status and access to fuel wood is to examine the types of wood being selected for fuel in the different sized structure. As I mentioned earlier, on average, the three most common wood species occur in almost exactly the same proportions on the floor of HP's 7 and 3. This pattern suggests that if there was a shortage of wood it was across all species, and did not effect species selection for fuel.

Figure 4 illustrates the abundance of charred conifer needles across the floors of the three housepits. Although HP 7 appears to have a greater mean abundance of charred needles across the floor, the three housepits are not statistically different from one another in needle abundance (ANOVA, $p = 0.4$; HP 7 need $X = 444.7 \pm 971.8$, HP 3 need $X = 235.5 \pm 463.2$, HP 12 need $X = 278.1 \pm 536.6$). Although the absolute abundance of needles in the three housepits is similar, the presence of the peripheral concentrations in HP's 7 and 3 but not HP 12 indicates that the needles may have been used differently in the smallest housepit. The absence of remains of boughs or plants in HP 12 suggests that the inhabitants slept directly on the housepit floor, or the structure was not intended for sleeping. At present we cannot determine the source of the sporadic high concentrations of needles on the floor of HP 12.

The extremely high concentration of Douglas-fir and ponderosa pine needles around the southern periphery of HP 7 and HP 3 floors likely indicates the deliberate covering of the floor with boughs for bedding or floor covering, as was done in ethnographic times (Teit 1900:199). Hayden (Vol. I, Chap. 17) has proposed that several paired small post holes along the periphery of HP 7 are the remains of sleeping platforms and the boughs may have been used to cover these platforms. In HP 7 it seems likely that grasses were used as floor or bedding coverings as well.

The placement of floor or bench coverings along the edge of HP 7 and 3 delineates the periphery of those structures from the remainder of the pithouse. The conifer needles (and grass in HP 7) distinguish the area as a place where people regularly sat and/or lay. Planks near and parallel to the northeast and east walls of HP 3 indicate probable platforms. The relatively denser needles along the southern edges of the two structures may indicate that those areas in particular were preferred areas for sleeping. The south would have been the darkest portion of the structures, and if used primarily for sleeping may have freed up other areas for activities requiring more light.

The average number of seeds per liter flotation sample across the floors of the three housepits is illustrated in Figure 4. The three housepits differ from one another in the number of total seeds recovered (ANOVA, $p = 0.02$, HP 7 $X = 6.8 \pm 9.2$, HP 3 $X = 4.7 \pm 5.0$, HP 12 $X = 1.0 \pm 0.9$), but only HP 7 is significantly different from HP 12 in a post hoc 2-way comparison (Tukey HSD, $p = 0.02$). If number of seeds can be taken to represent intensity of use (an admittedly uncertain assumption), these results suggest more intensive use of seed plants in the large housepit than HP 12, but similar use in HP's 7 and 3, and HP's 3 and 12.

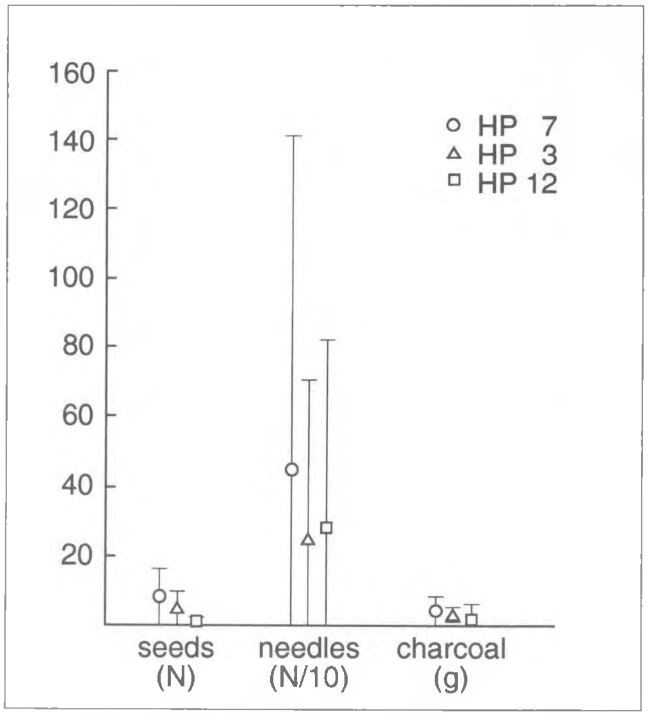

Figure 4. The average density of charcoal, needles, and seeds per one liter sample from the floors of the three housepits.

Another useful comparison is species richness represented by the number of seed taxa on the floors of the three housepits. Although I was only able to identify a limited number of taxa, the unidentified category represents many additional taxa (in most cases each unidentified specimen represents a single taxon). When number of taxa represented in the unidentified category are taken into account, it is clear that HP 7 floor has far more taxa represented by seeds than either of the other two housepits (HP 7 = 108, HP 3 = 28, HP 12 = 5).[1]

The role of sample size must be evaluated before we can draw conclusions about behavioral differences based on species richness in the three housepits. When the logged total number of seed taxa in the three structures is plotted against the total logged number of specimens (Fig. 5), the three structures fall on the same line suggesting that total number of seed taxa can be accounted for by sample size. However, a plot of the number of seed taxa against the number of specimens (Fig. 6) illustrates that the slopes are beginning to level off in HP's 3 and 7. Thus, although the addition of more samples would bring us closer to the true species richness, the larger structures seem to have been adequately sampled to draw conclusions about relative species richness.

Although we cannot yet estimate the true richness of HP 12 seed taxa, there do appear to be real differences in taxon abundance in the three structures. When we compare all three housepits at the total number of identifiable specimens of the small structure, the other larger structures have already accumulated more taxa than accumulated in the small house at this point (i.e., at NISP = 16, HP 7 = 12 taxa, HP 3 = 13 taxa [interpolated], HP 12 = 5 taxa). This indicates that the patterns observed in the small house are not merely an artifact of sample size. Thus, HP 7 has, by far, greater species richness than HP 3, which in turn is more rich than HP 12.

An examination of the rate of accumulation of species relative to the addition of new specimens is an another avenue for examining differences is species diversity between housepits. In Figure 7, the number of seed taxa and number of seed specimens have been logged and a regression line fit for the relationship within each housepit. When the slopes of the three lines are compared, HP 7 is significantly different than the medium and small housepits (ANOVA f-test for homgeneity of slope; $p < 0.0001$ in both cases), but HP 3

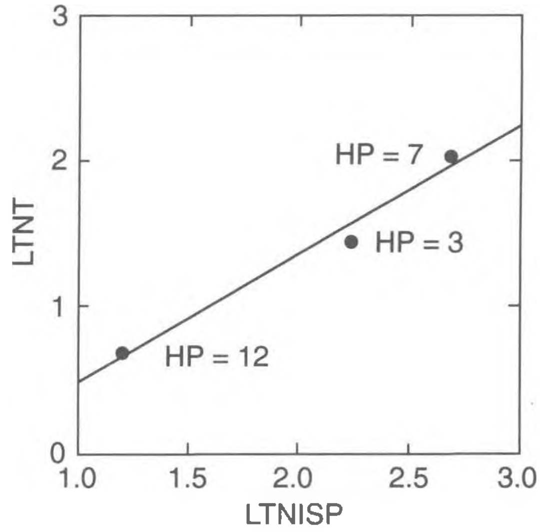

Figure 5. Logged total number of seed taxa in the three housepits plotted against the total logged number of specimens.

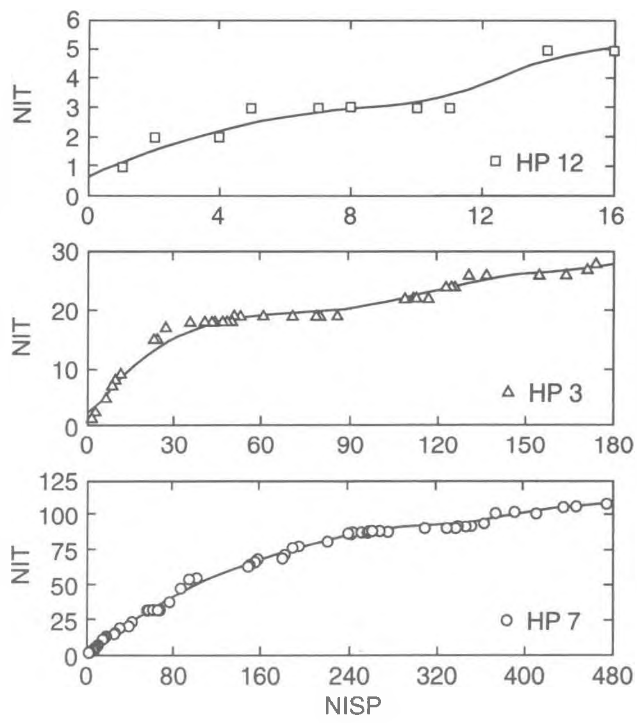

Figure 6. The number of seed taxa plotted against the number of specimens in the three housepits.

1. The number of taxa in HP's 7 and 3 are slightly inflated because I am unable to go back to many of the original samples and group the unidentifiable seeds into like taxa. Since the majority of taxa are represented by only a single specimen, this will not significantly alter the analysis. Any biases that are introduced should be parallel in both HP 3 and 7.

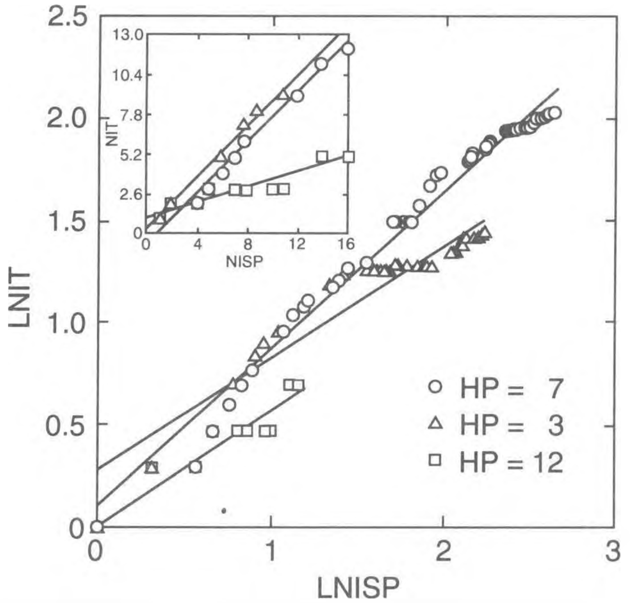

Figure 7. Logged number of seed taxa (LNIT) plotted against logged number of seed specimens (LNISP). Regression lines are fit for the relationship within each housepit. Inset: Comparison of number of seed taxa (NIT) plotted against number of seed specimens (NISP) when the same number of specimens is examined in all three structures.

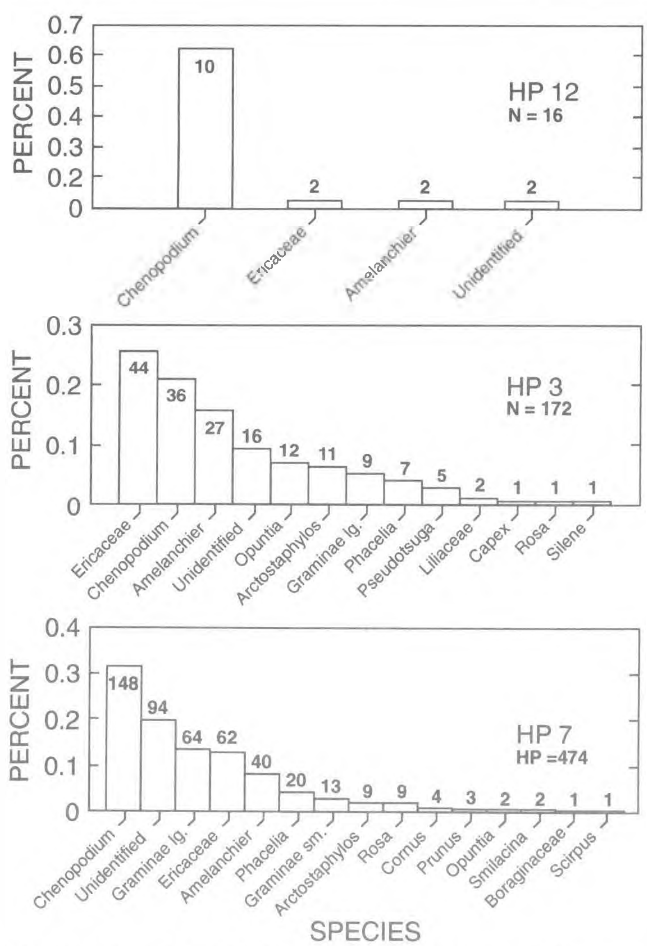

Figure 8. Abundance of plant species recovered from the floors of the three housepits.

and HP 12 are statistically similar ($p = 0.89$). When the same number of specimens is examined in all three structures (Fig. 7, inset) HP 12 has a considerably slower accumulation rate than the two larger structures. From this we can conclude that the accumulation rate of number of species/specimens generally corresponds to housepit size.

Finally, we can compare the three housepits in terms of species eveness, as represented by seed taxa (Fig. 8). HP 12 appears to be the least even distribution of the structures, and HP 3 and HP 7 appear relatively more even. However, the shapes of the frequency distributions in Figure 8 cannot be distinguished statistically (Kolmogorov-Smirnov test, HP 7 and 3: $p = 0.70$; HP 7 and 12: $p = 0.37$; HP 3 and 12: $p = 0.43$).

Although the shape of the HP 7 and HP 3 distributions are similar, there are important differences in the seed species composition of each, especially among the less common species. The three most abundant species in the medium and large structures (not including the unidentifieds) make up approximately 65% and 60%, respectively, of the entire distribution. In the case of the large housepit, the total includes chenopods, grass, and *Ericaceae*. In the medium structure the three most common taxa are *Ericaceae*, chenopods, and saskatoons. Of the seven most rare species in each distribution, only two are shared between the two structures. This may be the result of sample size, or may in fact represent actual differences in species use in the two housepits. Chenopods dominate the small housepit assemblage.

Taken together, the three different sized housepits are distinct in terms of abundance, richness, and distribution of plant species across the floors. HP 7 stands out as having the most dense remains, the greatest number of taxa relative to the density of remains, and the highest accumulation rate of taxa. On the opposite end of the spectrum is HP 12, with few remains, few taxa, and a low accumulation rate. HP 3 is intermediate in species density, richness, and accumulation rate.

The distribution of plant remains is similar on the floors of HP's 7 and 3, but distinct in HP 12. Discrete plant food processing areas on the floors of HP 7 and HP 3 are composed of one primary area, and two more minor areas. Both of the primary processing areas, and the two minor areas in HP 3 are associated with hearth areas. In HP's 7 and 3 the concentration of needles (and grass seeds and stems in HP 7) along the periphery of the floors distinguish these peripheral areas as places for sleeping or sitting. The relatively high abundance of remains along the southern periphery of HP 7 may indicate that this area served a slightly different use. No plant processing areas or peripheral concentration of needles were recognized in HP 12, and we can only conclude that a limited amount and kind of plant processing was conducted in this structure.

The only consistent pattern in all three housepits is the relative absence of remains in the center of the floors—a pattern paralleled in the faunal and lithic remains (Vol. II, Chaps. 7 & 11). The center of each structure may have been used equally by all members of each pithouse for some kind of communal events or activities. Given that the clear space is only about 3 m^2 in HP 12, these activities could not have required much room.

Discussion

The results of the paleoethnobotanical analyses offers some insights into the socioeconomy within and between the three different sized housepits. In general, there is a correlation between housepit size and density, diversity, and accumulation rates of floral remains. This may indicate that the large housepit (HP 7), followed by the medium housepit (HP 3), was used more intensively and was the location of more diverse activities. However, whether this patterning of plant remains can ultimately be related to status differences, to a larger work force having access to a more diverse resource base, or to differences in the length of use of the floor before abandonment, cannot be answered with the present data alone. The similarity in remains between HP's 7 and 3 does suggest the two structures were occupied by residential corporate groups which differed in size but not in basic nature (vs. HP 12).

Patterning of floral remains across the floors provides information on the internal organization of the three different sized structures. The presence of only one major plant processing areas on the floors of HP's 7 and 3 suggests either communal plant processing by the pithouse inhabitants or that the processing of plants was the responsibility of one subgroup or individual within the house (see Vol. II, Chap. 11). The relative absence of plant remains in HP 12 does not allow us to make strong conclusions about the nature of plant processing in that small house, and we can only hypothesize that any plant processing activities were conducted communally there. The lack of remains in the center of the three housepits argues for at least some communal activities within the structures.

In none of the housepits is there paleoethnobotanical evidence of internal social divisions. In contrast to the results of the lithic analysis (Vol. II, Chap. 11) there is no evidence for repeated sector activities involving plant food processing and consumption; indeed, the plant concentrations in HP 7 crosscut the sectors defined by the lithic remains. Likewise, the relatively continuous distribution of needles (and grass) around the peripheries of HP's 7 and 3 also suggests that the use of the periphery was the same for each domestic group along the wall or that there was a lack of well-defined internal divisions within these structures.

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Chapter 5

A Paleoethnobotanical Comparison of Four "Small" Housepits

Sara Mossop Cousins

Introduction

This chapter presents an initial comparison of the paleoethnobotanical analyses of four housepit floors, including HP's 9, 12, 90, and 104. These are all considered "small" housepits at the Keatley Creek site. A paleoethnobotanical analysis of three different-sized housepits (HP's 3, 7, and 12; Vol. I, Chap. 9; Vol. II, Chap. 4) suggests that small housepits were the homes of people with less access to resources, and perhaps less status. The paleoethnobotanical analyses of the four similar-sized small housepits discussed in this chapter have demonstrated that there were variations within house sizes as well as between house sizes, and that some of these variations may also have depended on status, while others depended on the function of the structure. Berry seeds are common in all of the small houses, as are chenopods and conifer needles. There are differences in the species of berries found in each home, however, possibly indicating a variation in access to resources. There are also differences in the amount of plant remains recovered from each housepit that are considered to be the remains of food plants versus those considered to be non-food plant remains. Non-botanical differences are discussed in Volume II, Chapter 1.

When the paleobotanical data is combined with the other material and ethnographic data, HP's 12 and 90 appear to have been small residential homes on the edge of the main Keatley Creek village area. Housepits 9 and 104 were located on terraces well outside of the village core. Housepit 9 appears to have been occupied by people with access to special resources. Housepit 104 appears to have been used for special activities. This distinction is based on the particular plant inventory of each housepit, and on the different types of activity areas they appear to contain.

This chapter begins with the two "residential" homes and then considers the two potential special purpose structures. The distribution of floral remains across each housepit floor is used, along with other archaeological and ethnographic evidence, to isolate probable activity areas within the homes. Housepits 9 and 90 are discussed in detail. The distribution of activity areas within each of the four "small" housepits are then compared, along with the actual species recovered from each home, in order to examine the function of these homes as part of the larger village. The chapter concludes with a number of recommendations for further paleoethnobotanical work at Keatley Creek, and perhaps other Interior Village sites, including the analysis of structures or features other than housepits.

A detailed cultural and environmental background has already been given in Volume I, Chapters 1, 4–6, and 9–10. The paleoethnobotanical analysis of the three different-sized housepits (HP's 3, 7, and 12) discussed in Volume I, Chapter 9 has shown that there are identifiable remains of plants left on the floors and in the rims of the housepits at Keatley Creek and that these remains vary between house sizes (Vol. II, Chap. 4). These plant remains have included plants clearly used for food, for technology, and perhaps also for medicine and for ritual. They have also included many plant remains that have not been identified to species or for which the past purpose is unclear. The distribution of the various types of remains and the different species have helped to identify sleeping, cooking, storage, and refuse areas and to examine differences in resource use, and perhaps status, between houses.

Housepit 12

The analysis of HP 12 was completed by Dana Lepofsky and included 16 samples from the late Plateau Phase floor of the housepit, dated at 1,550 BP (Vol. II, Chap. 4). Prior to this analysis, there were some indications that small pithouses were the homes of people with lower social and economic standing than those people who lived in the large pithouses. Any differential plant use patterns found to exist between housepit sizes was expected to reflect these apparent socioeconomic differences. Housepit 12 did, in fact, support this theory. It proved to have a much lower diversity, frequency, and density of plant remains than the large and medium housepits to which it was compared.

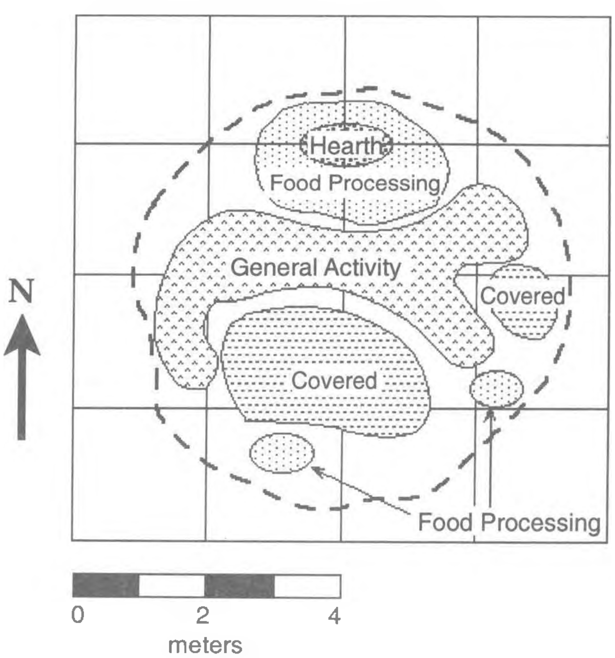

Figure 1: Housepit 12 activity areas based on soil chemical analysis (Chap. 6). See also Fig. 3 in Chap. 4.

Potential activity areas identified include sleeping or sitting areas covered in conifer boughs and a hearth that appears to have been used for warmth but not for plant processing. Another hearth area may have been used for cooking meat, but apparently it was not used for plant foods. These activity areas are shown in Figure 1 and in Figure 3 of Volume II, Chapter 4. The bedding areas are believed to be indicated by concentrations of conifer needles. Conifer boughs were used for bedding and other types of matting or lining ethnographically (Turner 1979; Parish et al. 1996). No concentrations of seed remains were identified on the housepit floor that might have identified plant processing areas or other features. In fact, only 16 seeds were recovered from the floor of HP 12, representing five taxa. This contrasts with the thousands of seeds and more than 25 taxa in HP 7 and hundreds of seeds and more than ten taxa in HP 3. There were also far fewer conifer needles in HP 12 than were found in the medium and large housepits. Species of Chenopodiaceae (Goosefoot), Ericaceae (Heather), Pinaceae (Pine), Poaceae (Grass), and Rosaceae (Rose) families were recovered, with Chenopodium being the most ubiquitous seed remain and *Pseudotsuga menziesii* (Douglas-fir) being the most common conifer needle remain. Food plants included *Amelanchier alnifolia* (Saskatoon) and an unknown species of Ericaceae.

Refer to Figure 1 and Table 1 (and Vol. II, Chap. 4) to review the distribution and other details of the floral remains recovered from HP 12.

Housepit 90

The analysis of HP 90 was completed by myself and included twelve samples from the late Plateau Phase floor of the housepit, dated at 1,410 BP (Vol. III, Chap. 10). This analysis also supported the socioeconomic theory mentioned above. Although HP 90 proved to have a higher diversity, density, and frequency of floral remains than the previous small residential housepit (HP 12), it was much lower than the medium or large housepits analyzed to date. Housepit 90 also appeared to have been occupied by people with little social or economic standing. According to Hayden (Vol. II, Chap. 1), single occupations were a common pattern in homes located on the site periphery. Ethnography suggests that these houses may have been lived in by people who were less permanent members of the village or who had to live apart for other reasons, and whose social status was perhaps less secure (Teit 1906). This theory is supported by the artifacts, and perhaps also the plant remains, which were recovered from HP 90.

Housepit 90 measured seven meters in diameter, which is comparatively small for a housepit at the

Keatley site, there were few lithic artifacts or fauna recovered from it, and few of these were "special" in nature, which might have indicated a special-purpose pithouse (Vol. II, Chap. 1). There were no clear hearth contexts and few large pieces of charred wood were recovered from it, which may indicate that the people who lived there had little access to firewood, which would likely have an adverse affect on the amount of charred plant remains left behind. In fact, the artifacts and features gave "an overall impression of poverty" (Vol. III, Chap. 12).

Possible activity areas identified on the basis of floral distributions include a sleeping or sitting area along the wall covered in pine boughs, a cooking area, and a storage area (Fig. 2A). These activity areas are consistent with what we might expect to find based on ethnographic descriptions of pithouses and on previous research at the site. The individual species recovered, including species of Chenopodiaceae, Ericaceae, Hydrophyllaceae (Waterleaf), Pinaceae and Poaceae, were also expected. Chenopods were the most common and most ubiquitous taxa once again, but it is not clear if these species were merely incidental weeds or if they were actually being used at the site.

The HP 90 analysis recovered approximately 700% more floral remains in total than the analysis of HP 12, and there were three more species identified which does not really support the "overall impression of poverty" given by the rest of the analysis of HP 90. Housepit 12 appears to be much less well off based on the plant remains alone, if access to plant materials is an indicator of status at the Keatley site, which it may be. To determine which of these small housepits is the atypical one will require further research of small, residential housepits.

Housepit 90 appears to have been burned on purpose, rather than accidentally, and the burning was relatively complete (Vol. III, Chap. 10). This burning probably enhanced the preservation of floral remains in HP 90. Stratum IV, the floor deposits, contained charcoal and burned wood in the matrix, with concentrations of burned wood along the east wall and northeast "corner." Several lithic flakes were found in these areas. Thick concentrations of smaller pieces of charred material were also found in several places near the southeast wall. What these small "charcoal dumps" might represent is unclear. They may be hearth sweepings pushed up against the wall, although the lack of ash and long segments of charred wood make this questionable, according to Hayden (Vol. III, Chap. 10). The deposits within 1 m of the wall are softer and darker than the gravely deposits in the center of the house. The only other explanation, in Hayden's opinion, is that these accumulations may have resulted from the burning of the house on abandonment, either as roof collapse, or as part of some organic material placed against the walls. The gravely deposits in the center of the floor may have helped to keep the working areas free of mud, along with the cobbles that appear to have been placed in a shallow pit in the middle of the floor. Samples for paleoethnobotanical analysis were taken from systematic grid locations and from subsquares that were noticeably high in charcoal content, such as the "charcoal dumps," and/or located within or near features.

Housepit 90 Procedures

Twelve one-litre samples from HP 90, from subsquares representing approximately 15% of the floor, were floated by hand using the "garbage can" method (Watson 1976) and the light fraction passed through 2.0 mm and 0.425 mm screens. The dried light fraction of each sample was then screened through 4.0 mm, 2.0 mm, 1.0 mm, and 0.50 mm mesh to facilitate sorting. Sorting was done using a dissecting microscope (6–40×) and subsamples were sorted into uncharred and charred constituents. Uncharred remains were not considered to be significant in this analysis as, according to Lepofsky (Vol. I, Chap. 9), these would not be prehistoric although she notes that housepit rim deposits could allow for uncharred preservation. Charred remains were divided into groups of seeds, needles, charcoal, and other plant parts, and then identified to species, where possible, with the aid of Lepofsky's reference collection, and with her assistance. Charcoal was not normally identified to species, and was only weighed. This was due to the time required for this type of analysis, and the fact that it would have little to add to this analysis as most of the organic material from the central floor of the deposit appears to have been burned to ash and no particularly large pieces were recovered. It would have been difficult to distinguish technological wood from fuel or construction wood with only fragmentary remains, for example. Nevertheless, several pieces were identified to species from the potential hearth area on the southeastern side of the pithouse (Fig. 2A) to attempt to identify the fuel source. Charcoal was not separated out from the 0.5 mm size in five out of the nine samples due to the time involved in this task, although this size class was examined for any seeds or other recognizable remains in all samples.

Species counts were absolute, rather than ubiquitous, as the final burning of the pithouse is likely to have concealed any cultural patterning that would make a ubiquitous count useful (Lepofsky 1997a). Unidentified species were labeled "Type A," "Type B," and so on.

Housepit 90 Results

A total of 52 seeds were recovered from the floor samples of HP 90, from a maximum of nine species. The total of conifer needles recovered equaled 68 fragments from a maximum of four species. This is a fairly low density without a great deal of diversity when compared to previous analyses of larger housepits that were also apparently used for residential purposes (Vol. I, Chap. 9). Along with HP 12, HP 90 demonstrates a paucity of floral remains in comparison to the larger housepits and this may indicate that people of lower status had less access to plant resources, or to firewood for cooking which would lead to less food plant remains becoming charred.

The plant species that were recovered and positively identified from HP 90 are listed below by family, with a discussion of their probable role in the culture and how they may have come to be preserved in the housepit floor context. In some cases it was only possible to determine identifications to family level, but this proved to be enough information to make some suggestions as to how these plants might have been used at the site. Several seed types and one species of conifer needle remain unidentified.

Housepit 90 Plant Inventory

Chenopodiaceae (goosefoot family)

Thirty-six seeds from this family were recovered, including one that was uncharred. Chenopods were found in nine of the twelve samples, with their frequency ranging from a single seed to ten in one sample. The species represented may include *Chenopodium album* as several of the seeds fit within the size range of 1.0–0.5 mm^2, as noted by Lepofsky (Vol. I, Chap. 9). If this is the case, these seeds are likely intrusive as *C. album* is an introduced species whose young leaves were used historically by Interior Salish peoples as a vegetable or potherb. Given the depth below surface at which all of the seeds were found (40–60 cm), and the fact that they were found in a patterned (vs. random) context that was clearly archaeological and not much disturbed, it would seem more likely that they are from a native species. Native species that might have grown in the area include *C. capitatum* (strawberry blite or Indian paint), whose seeds are known to have been used by Southern Interior peoples as a dye source (Turner et al. 1990; Parish et al. 1996; Turner 1998), and *C. botrys* (Jerusalem-oak goosefoot), whose use as a scent and charm has been documented for the Thompson (Nlaka'pmx) (Steadman, in Turner et al. 1990). *C. atrovirens*, or *C. fremontii* (dark lamb's quarters) may also be a potential species as its range extends into the Lillooet area (Ray Coupé, personal communication). Its oily seeds were ground into meal by the Klamath ethnographically and it has been recovered from archaeological contexts on the U.S. Interior Plateau ca. 2,700 BP (Lepofsky 1997b).

The chenopods recovered from HP 90 appear to be from at least two species as they vary in size somewhat, with one "species" measuring approximately 1 mm in diameter ("Type A"), and one that is distinctly larger, measuring approximately 1.5 mm in diameter ("Type B"). Whichever species are present, they may have been accidentally brought in and charred during the final burning of the pithouse on abandonment and not used at all. Chenopods produce very large numbers of seeds in the fall and the seeds recovered in archaeological contexts at Keatley Creek may have been brought in mixed with other grasses.

Chenopods were the most abundant taxon found in this analysis, making up 36 of 150 recovered items (approximately 23%). In fact, chenopods are the most common seed taxa in five out of the six housepits analyzed to date. There may be a bias here, however, as chenopods are easy to recognize and appear to preserve particularly well.

Ericaceae (heather family)

Arctostaphylos uva-ursi: One kinnikinnick seed was recovered near the side entrance of the housepit. Kinnikinnick berries were cooked and eaten by Interior peoples and kinnikinnick leaves were smoked like tobacco (Teit 1906; Parish et al. 1996). The seed recovered from HP 90 might have come from a berry incidentally included with leaves; however, hundreds of kinnikinnick seeds were also recovered in HP's 3 and 7 (Vol. I, Chap. 9) which would suggest that the berries themselves were important.

The nine "Type C" seeds were recovered from several contexts and appear to be from another species of Ericaceae. Many members of this berry family were utilized by the ethnographic Stl'atl'imx and small Ericaceae seeds have been a ubiquitous component in several contexts at the Keatley site (Vol. I, Chap. 9), including in HP 9 floor samples. The seeds recovered from HP 90 were found in two charcoal-rich deposits that together may represent a hearth area and one deposit that may represent a hearth dump, suggesting that these berries were being cooked. Another possible Ericaceae seed appears to be from a third species ("Type D") and was recovered from a sample taken near the side entrance of the housepit.

Hydrophyllaceae (waterleaf family)

Phacelia linearis: Three seeds of this species were recovered from HP 90. This species is noted to have had medicinal value in historic times (Steadman, in Turner et al. 1990). One seed was found in an apparent charcoal dump context near the wall of the housepit (Vol. III, Chap. 10), along with a chenopod and three

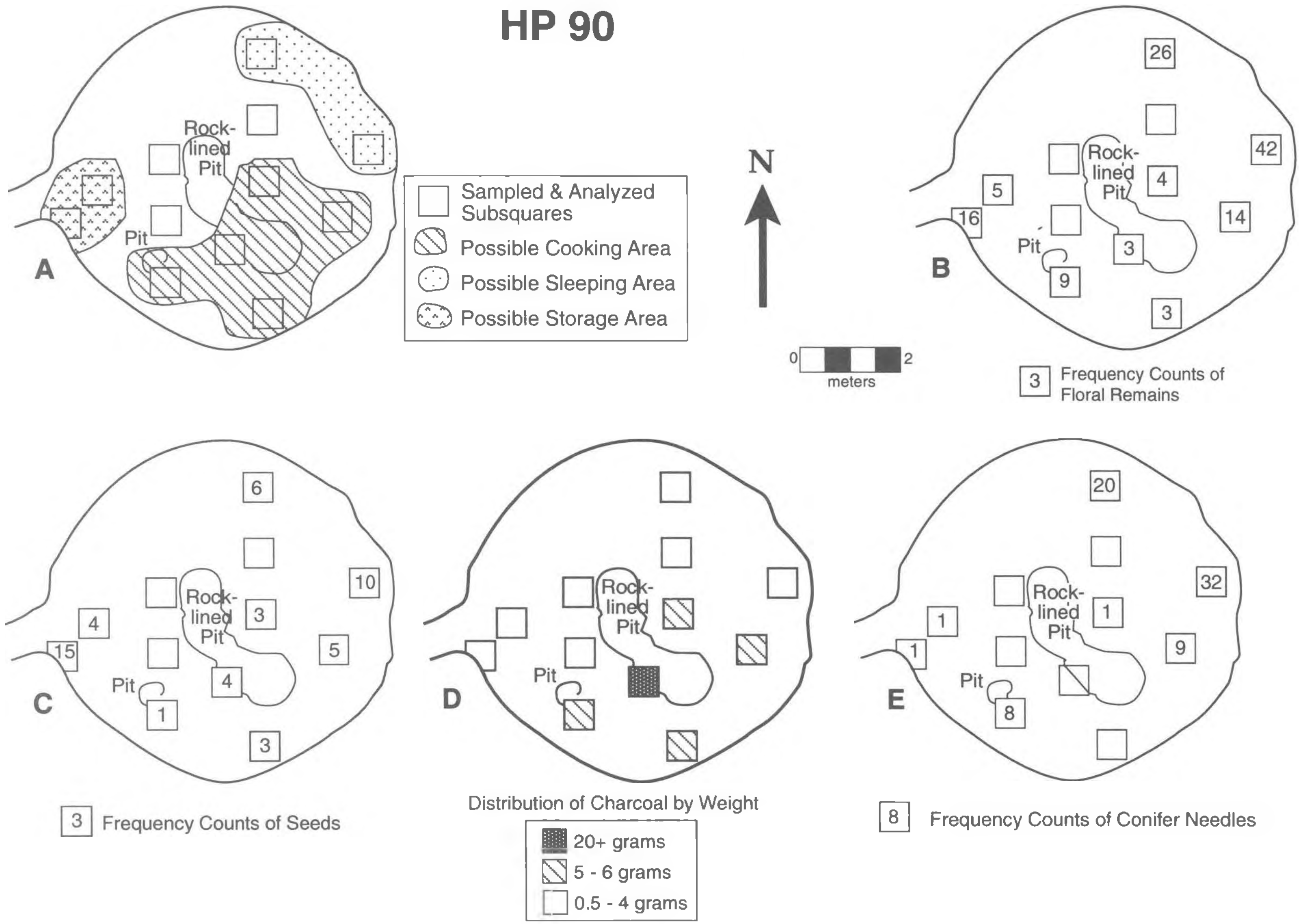

Figure 2: (A) Housepit 90 reconstructed activity areas and sampled subsquares and features; (B) total floral remains per subsquare; (C) total recovered seeds per subsquare; (D) charcoal concentrates by weight; (E) conifer needles.

seeds of an unidentified Ericaceae species ("Type C") that also occur in two other samples. Two more Phacelia seeds were found near the side door of the housepit. Phacelia seeds were also recovered during the analysis of HP's 3, 7, and 9.

It is often difficult to recognize medical or ritual plants as there is not much ethnographic information available for these categories, and without a clear context of use they might be confused with "weeds" (Lepofsky 1997a). The Phacelia seeds recovered in this analysis may have been "weeds" brought in accidentally as their context of use is unclear; however, the occurrence of this species in several housepits and at Squilax, another Interior Plateau village site (Lepofsky 1990) would suggest that this plant was used in some way. The distribution of Phacelia across the Keatley Creek site may provide clues as to who was providing or receiving medical care, for example if it appears in concentrations in particular types of structures or associations or if its distribution appears more random throughout the site. In the Lillooet cultures, according to Turner (1992), medicines were generally gathered, prepared and administered by specialists whose knowledge was passed down through generations.

Pinaceae (pine family)

Pinus ponderosa: Nine needle bundle bases were recovered from two subsquares along the east wall of HP 90. Ponderosa pine needles were also recovered from HP's 3 and 7. Ponderosa pine was a common fuel source at the site and the cambium was eaten by the ethnographic Lil'wet'ul and Nlaka'pmx (Vol. I, Chap. 9; Teit 1906; Turner 1992). The needle bundle bases recovered in HP 90 may have come from fuel wood used in cooking as eight of them were recovered in a possible cooking area. The ninth bundle base was recovered from a sample along the northeast wall and may have come from pine boughs used for bedding. The spicy smell of the boughs was appreciated for bedding, according to Turner (1998). According to the reconstruction of activity areas in other small housepits (Vol. III, Chap. 7), sleeping areas were probably located along one side of the pithouse perimeter. The concentration of conifer remains from all species in HP 90 was highest along the northeast wall, suggesting that this was where the sleeping areas were.

Pseudotsuga menziesii: Forty-five Douglas-fir needle fragments were recovered in five different samples. This species was also recovered in HP's 3 and 7. Ethnographically, Douglas-fir was a fuel source (Turner 1998) and the needles may have come from boughs used for fuel. Charred Douglas-fir wood was identified from three of the five samples which may represent a hearth area (Fig. 2A) which would be consistent with this use. Most of the needles came from deposits near the housepit wall, however, which may indicate that Douglas-fir boughs were used for bedding in a sleeping area along the east wall. According to Turner (1998), fir boughs were used for this purpose throughout the Interior. A similar pattern of Douglas-fir needle distribution was observed in HP's 3, 7, and 12. Eight needle fragments were also found together with a chenopod in one sample which was taken near a feature that may represent a small boiling pit. Douglas-fir twigs and needles were apparently used by Interior peoples to make a tea (Parish et al. 1996) which could explain the presence of these needles if the pit feature noted in Figure 2B does, in fact, represent a small boiling pit.

Poaceae (grass family)

One grass rachis, found together with ten chenopods, 31 conifer needles, and one conifer needle bundle base, was recovered from one of the samples thought to be from the sleeping or sitting area along the northeast wall of HP 90. Grasses were used for floor coverings, for lining cooking pits, and for basketry ethnographically (Teit 1906; Turner 1979; Parish et al. 1996). This rachis could have come from grass used in creating the sleeping or sitting area or it could be an incidental inclusion, either from a weed plant or from another activity area within or near HP 90.

Unidentified

Sixteen unidentified conifer needles ("Type E") were recovered from a sample along the east wall of HP 90. These needles may also have once been bedding material. A possible conifer bud was recovered in this analysis along with two species of chenopod (Types A and B) and several fragments of Ericaceae seeds (Type C) in a sample near the west wall and close to the side entrance of the pithouse. One unidentified seed ("Type F") was recovered from the sample next to the side entrance, which also included ten chenopod seeds (Type A), two Phacelia seeds, one kinnikinnick seed, one Ericaceae seed (Type D), and one Douglas-fir needle. This sample, together with its neighbor, may represent a storage area (Fig. 2A).

Distribution of Floral Remains (HP 90)

There appear to have been several ways that the floral remains recovered in this analysis became charred. Seeds and needles from food or medicinal plants may have fallen into hearths and been charred immediately, or they may have fallen onto the floor during cooking or processing and been pushed into "corners," or left in place to be charred during the burning of the pithouse. Food plants may have included Chenopodiaceae leaves or seeds and Ericaceae berries, with Douglas-fir needles being used in tea. Medicinal plants may have included *Phacelia linearis*. Technological plants may have included *Chenopodium capitatum* as a dye source, and *Pseudotsuga menziesii* and *Pinus ponderosa* as bedding materials and/or as fuel sources. Special use plants may have included *Chenopodium botrys* as a scent for pillows or personal adornment and *Arctostaphylos uva-ursi* for tobacco. Incidental inclusions of "weeds" may have been responsible for all or some of the chenopods, and perhaps also for the Phacelia. However, both of these plants have appeared in such quantity and in so many archaeological contexts at Keatley Creek, and at other Interior Plateau village sites that their intentional use seems likely to me.

The gross total of floral remains recovered from each subsquare is displayed in Figure 2C. The high concentrations of recovered items around the northeastern wall of the pithouse are partly a result of the conifer needles found there; however, there were also more seeds recovered from these two subsquares than in most of the other subsquares (Fig. 2D). They each contained a fair amount of charcoal in comparison to other samples (Fig. 2E) and large pieces of charred wood were recovered from them during the excavation. Various artifacts were also recovered along this part of the pithouse wall, most of which were broken. Previous research at Keatley Creek suggests that sleeping and sitting areas made with conifer boughs were located along the housepit walls and that garbage may have been swept out of the middle of the floor to be deposited along the walls or dumped outside, adding to the rim deposits (Vol. I, Chap. 9). The central floor area samples of HP 90 produced very few floral remains and that may also support this hypothesis. The concentration of seeds by the door in the western wall cannot be explained at this point as HP 90 is currently the only excavated housepit at the site with this style of entrance and no comparisons can be made. The seeds found by this door could represent the remains of garbage stored by the door to be taken out later and then forgotten, or perhaps the remains of parcels of food or other supplies stored by the door upon entering the home.

The two species of Ericaceae seeds are the only plant remains that can be considered likely to be food plants. Any of the chenopods and the Douglas-fir needles found near the possible boiling pit may be food remains, but there is not enough evidence to confidently include these as food plants. The Ericaceae seeds are found in several sample contexts, including one that is thought to be from a cooking area in the southeastern area of HP 90 (Fig. 2A). The other samples that contained Ericaceae seeds were thinly spread out in the central floor area and slightly more concentrated near the northeastern wall. The Ericaceae seeds probably came from dried berries that were cooked as they would be unlikely to be fresh if the occupation was limited to the winter season since Ericaceae species generally ripen during the summer. The berries may also have been misplaced from their storage area and subsequently charred during the burning of the pithouse.

If the chenopods were food plants they may have been ground and used as a cereal as they were in other parts of North America. The existence of mortars and pestles was noted ethnographically for the Lillooet people by Teit (1906); however, there is no archaeological evidence for seed grinding tools at the Keatley Creek or in the British Columbia Interior which makes this an unlikely explanation for their presence at the site. However, tools such as ground-stone mauls have been found in burial contexts along the Fraser River only a little to the north (Scott Cousins, personal communication). It is possible that the burials associated with the Keatley Creek site might also contain mauls or perhaps grinding tools. If chenopod greens were eaten as a vegetable, as they were ethnographically in the area (Vol. I, Chap. 9), the seeds would be unlikely to be present in the pithouses unless the plants were consumed in the homes during the late spring or summer. There has been little to suggest that most pithouses were occupied at that time of year. To say whether the Douglas-fir needles were used in a tea beverage would require more evidence of their presence near boiling pits or in association with the remains of other plants thought to be used in tea making.

The only plant remains believed to be from species used medicinally are the three Phacelia seeds, which were found next to the west side entrance and near the east wall of the pithouse. The door sample may represent a temporary storage area (see above). The east wall sample also includes food plant remains and conifer needles and may be a random collection of remains swept together as debris from a number of activities. The Phacelia seeds recovered in HP 90 do not appear to reflect discrete medical activities but suggest that medical activities involving them may have taken place in housepits of all sizes at the site since this type of seed was also recovered from HP's 3, 7, and 9.

Technological plants appear in several areas of the housepit. Eight of the 45 *Pseudotsuga menziesii* needles were recovered near the possible hearth or cooking area in the southeastern area of the housepit (Fig. 2A). This may indicate that this species was used as fuel and that the needles were an incidental inclusion. Douglas-fir was a popular fuel source ethnographically (Vol. I, Chap. 9) and a few pieces of Douglas-fir charcoal were identified from three of the hearth area samples. Thirty-four of the Douglas-fir needles, eight ponderosa pine needle bundles, and seventeen unidentified conifer needles were recovered along the northeast wall, which may indicate that this area was lined with conifer boughs, although concentrations of needles were much higher in the analyses of HP's 3 and 7 (Vol. II, Chap. 4). The remaining conifer needles appear to be randomly distributed and may simply have been dropped on the floor and been burned during the abandonment of the pithouse.

A hearth or cooking area may have existed in the southeastern area of the pithouse (Figs. 2A and 2D), based on the fact that the five samples from this area each contained more than five grams of charcoal, and one of them included more than 20 grams. These weights are notably higher than any of the other samples. This area also contained most of the food plants. Several pieces of Douglas-fir charcoal were identified from three of these deposits which may represent a fuel source as noted above. There were no obvious concentrations of fire cracked rock in that area or anywhere in the housepit, however, and the possible boiling pit (Figs. 2A) is the only recognizable cooking feature, unless the larger rock-filled pit was used for cooking in some way.

Several of the above mentioned samples were located near the southeast wall and identified by the excavators as "organic dumps." These dump samples each contained more than five grams of charcoal and included various seeds and needles. If the pithouse floor was cleaned or swept periodically the loose dirt might have been pushed up against the wall and any dropped seeds or needles included in the dumps this way. Hearth sweepings might also have occasionally been disposed of in this way, which would explain the high percentages of charcoal, although no ash concentrations were found in these dumps.

Housepit 90 Conclusions

The formation processes indicated by this analysis, including cleaning events, cooking events, and post-occupational burning seem to fit the conclusions made by Lepofsky (Vol. I, Chap. 9). The density and diversity of species recovered from HP 90 as a whole, however, are not exactly what we might expect following the analysis of HP 12, and from the artifacts and features noted during the excavation of HP 90. There were more floral remains in total and there were more species identified than were recovered from HP 12, which does not really support the "overall impression of poverty" suggested by the rest of the analysis of HP 90. Housepit 12 appears to be much less well-off based on the plant remains alone.

Housepit 90's plant remains and their distribution reflect its function as a residential housepit. Several of the activity areas identified in this analysis seem to fit the reconstruction of small housepits by Alexander (Vol. III, Chap. 7). These areas include a sleeping or sitting area that may be represented by conifer needle concentrations along the northeast wall of the housepit, and a cooking area that may be represented by a small boiling pit and concentrations of charcoal and food plants in the southeastern area of HP 90. A storage area for garbage or for supplies may have existed near the west side entrance where a variety of plant remains were found in a concentration that seems unlikely to be the result of random events.

The particular species recovered from HP 90 were not surprising or unique but the fact that chenopods were again recovered from several pithouse floor contexts may suggest that this species (or perhaps several species) were utilized at the site and not merely intrusive, as has been suggested by Lepofsky. There are several species that could have grown in the area that are known to have been used ethnographically in the British Columbia Plateau region. With further research with a more extensive reference collection it should be possible to determine if any of these species have been found at the Keatley Creek site or at the Squilax site near Little Shuswap Lake (Lepofsky 1990). The presence of Phacelia in HP 90, in addition to its presence in HP's 3 and 7 and at the Squilax site, supports its inclusion as an important taxa at the Keatley Creek site and perhaps in prehistoric medicinal practices on the Interior Plateau. Ericaceae seeds and conifer needles continued to be a ubiquitous component of the plant inventory.

Housepit 9

This analysis was completed by myself and included 17 samples taken from the Kamloops Horizon floor of the housepit (1200–200 AD). These samples represented approximately 20% of the floor area. It was expected that HP 9 would demonstrate a different pattern of plant use from HP 12 or 90 since HP 9 appeared to have been a special-purpose structure, based on the other artifacts and features it contained. Several loon bones were found, for example, which were not found anywhere else at the site. Loon bones are associated ethnographically with shamans (Vol. II, Chap. 1). Pipe fragments and prestige materials such as nephrite were also recovered. Housepit

9 also exhibited unusual storage capacity, and unlike every other structure tested to date, it was not burned. The individual plant remains were not found to be unique however, and did not suggest any special activities, although a relatively large amount of food plant remains were recovered when HP 9 is compared to HP's 12 and 90.

Housepit 9 is located on a terrace southeast of the main village at Keatley Creek on the south side of the creek. There are several other housepits and also several cache pits and roasting pits on that terrace, most of which have not been dated, and it is not yet clear if any of them are contemporaneous. With a diameter of 7.8 m, HP 9 is a little larger than HP 90. It appears to have been occupied by several groups of people at different times in its history. This analysis only considers one of those occupations, Stratum VIII.

Housepit 9 does not appear to have been particularly unique in terms of its floral remains based on their density, diversity, or distribution. Although several species were recovered that might have been used medicinally, the floral remains from HP 9 fit what might be called "the general residential pattern" observed for other small housepits at the Keatley site to date. They do not suggest the home of a specialist on their own. As noted above, more food plant remains were recovered from HP 9 than from HP's 12 or 90, with seventeen items compared to ten and two.

The remains of food species, and in fact all plant species, appear to have been similar to the other three small housepits analyzed to date (Table 1). The distribution of floral remains in HP 9 fits the general pattern of identifiable activity areas observed in HP's 12 and 90 as well, including a central plant processing area with bedding areas along the walls. There is a problem, however, in that the conifer needle concentrations, although minor, might suggest that the bedding areas are along the south wall of the housepit. Alexander's reconstruction of HP 9 suggests that the bedding areas are along the northeast and southwest walls (Fig. 3A). Perhaps the needles that were recovered in the south represent some other activity, such as the preparation of medicinal plants including pine species or use associated with the large storage pit.

Housepit 9 Procedures

Seventeen one-litre samples from HP 9 were processed to recover floral remains, as per the procedures discussed for HP 90 above. The reference collections of Dana Lepofsky and the author were used for identification in this case. Charcoal was not separated out of the 0.5 mm subsample due to time constraints and it was not identified to species in any size class as it all appeared to be from wood, rather than "root" plants, and was not expected to add any new information to the analysis at this point.

Housepit 9 Results

A total of 36 seeds were recovered from the Stratum VIII samples of HP 9, from a minimum of 10 species. Seventy-four conifer needles or other conifer parts were

Table 1. Recovered Taxa: Small Housepits

	HP 9	HP 12	HP 90	HP 104
Caprifoliaceae sp.				1
Chenopodiaceae sp.	10	10	36	3
Ericaceae sp.	16	2	9	
Arctostaphylos uva-ursi			1	
Vaccinium sp.	1			
Graminae			1	
Hydrophyllaceae sp.				
Phacelia linearis	3		3	
Pinaceae sp.	74			1,521
Pinus ponderosa		111	9	
Pseudotsuga menziesii		4,339	45	
Poaceae sp.				1
Rosaceae sp.				
Amelanchier alnifolia		2		
Unidentified seeds	7	2		13
Total Items	111	4,466	103	1,539

recovered, from a minimum of two species. (Note: most of the conifer needles were extremely fragmented and none of them were identified beyond the family level but they do appear to vary enough to include at least two species.) With an average of 6.5 items per subsquare sample, HP 9 demonstrates a lower density of floral remains than HP 90 with an average of 10 items per subsquare sample. Housepit 9 has a similar diversity of species to HP 90, however, with a minimum of 12 species compared to a maximum of 13. The density and diversity of HP 9 is lower than both HP 90 and the medium and large housepits analyzed by Lepofsky (Vol. I, Chap. 9).

The plant species that were recovered and positively identified are listed below by family, with a discussion of their probable role in the culture and how they may have come to be preserved in the housepit floor context. In some cases it was only possible to determine identifications to family level, but this proved to be enough information to make some suggestions as to how these plants might have been used at the site. Several seed types and one species of conifer needle remain unidentified.

Housepit 9 Plant Inventory

Chenopodiaceae (goosefoot family)

Ten charred seeds from the chenopod family were recovered (along with one that was not charred). Three out of the four samples that contained chenopods also contained relatively high (>8) concentrations of conifer needles. The fourth sample containing chenopods also contained four conifer needle fragments. The many chenopods that have been recovered from the Keatley site are generally thought to be from weeds that were incidentally introduced into the pithouses, perhaps with bedding materials, and then charred when the pithouse was burned on abandonment (Lepofsky 1997a). The distribution of the chenopods recovered from HP 9 (Fig. 3B) might be explained with this theory, as all of the samples that contained chenopods are located within or near the bedding areas, as reconstructed by Alexander in Figure 3A.

There may be two species of chenopod represented in HP 9 as two fairly distinct sizes of seeds were recognized. One "species" measures just less than 1 mm in diameter on average, while the other measures approximately 1.5 mm in diameter. This size variation was also observed in the chenopods recovered from HP 90, and from several other housepits as well, as noted above.

As discussed above, chenopods may have been used as food plants, technological plants, and/or as a perfume, or they may have been considered weeds. Any chenopod species might have been mixed in with grasses used in bedding or incidentally introduced as each plant produces thousands of seeds and even one plant could explain the seeds recovered from HP 9. However, there is no evidence of grass seeds in HP 9 and the chenopods do not produce burrs or anything that might stick to clothing etc. and the seeds are not dispersed by air. Chenopods do not grow with conifers and are therefore unlikely to have found their way into the pithouses mixed with fir or pine branches unless they were specially gathered for this purpose. It seems more likely that chenopods were used in some way. It is unfortunate that it is so difficult to identify chenopods to species. According to Pearsall (1989:149), their identification often requires scanning electron microscopy and detailed metric and shape data. This type of detailed analysis has not been available to date.

One uncharred chenopod seed looks quite fresh and may have contaminated the sample during the excavation. It is dark red in color and approximately 1.5 mm in diameter. Its red color may indicate that its species is *Chenopodium capitatum* (strawberry blite).

Ericaceae (heather family)

Sixteen seeds from the Heather family were recovered. This family includes many edible berry species, including blueberries, huckleberries, and kinnikinnick berries, and the seeds recovered from HP 9 probably represent food remains. The samples containing these seeds were clustered in the southeastern and central portions of the housepit (Fig. 3C), perhaps suggesting a food preparation or storage area. These clusters are within the hearth and food preparation and storage areas of HP 9 as reconstructed by Alexander in Figure 3A.

Two different species of Ericaceae are represented in the floral remains from HP 9, including a species of *Vaccinium* and an unknown species that was also recovered from HP 90. This second species is the most common species of seed recovered from HP 9, representing 40% of the total seed inventory. It was also a fairly common species in HP 90.

Hydrophyllaceae (waterleaf family)

Three seeds from the waterleaf family were recovered, and all of them appear to be *Phacelia linearis*. *Phacelia linearis* was used medicinally in ethnographic times, as noted above. The distribution of Phacelia within HP 9 is restricted to two samples; both located in the southern half of the housepit, near the center (Fig. 3D). This distribution may suggest a discrete medicinal preparation area, although it is difficult to make such an assumption based on three seeds. Conifer needles and food plant remains were also recovered from these samples. It appears more likely that this area of the housepit was used for several kinds of plant preparation.

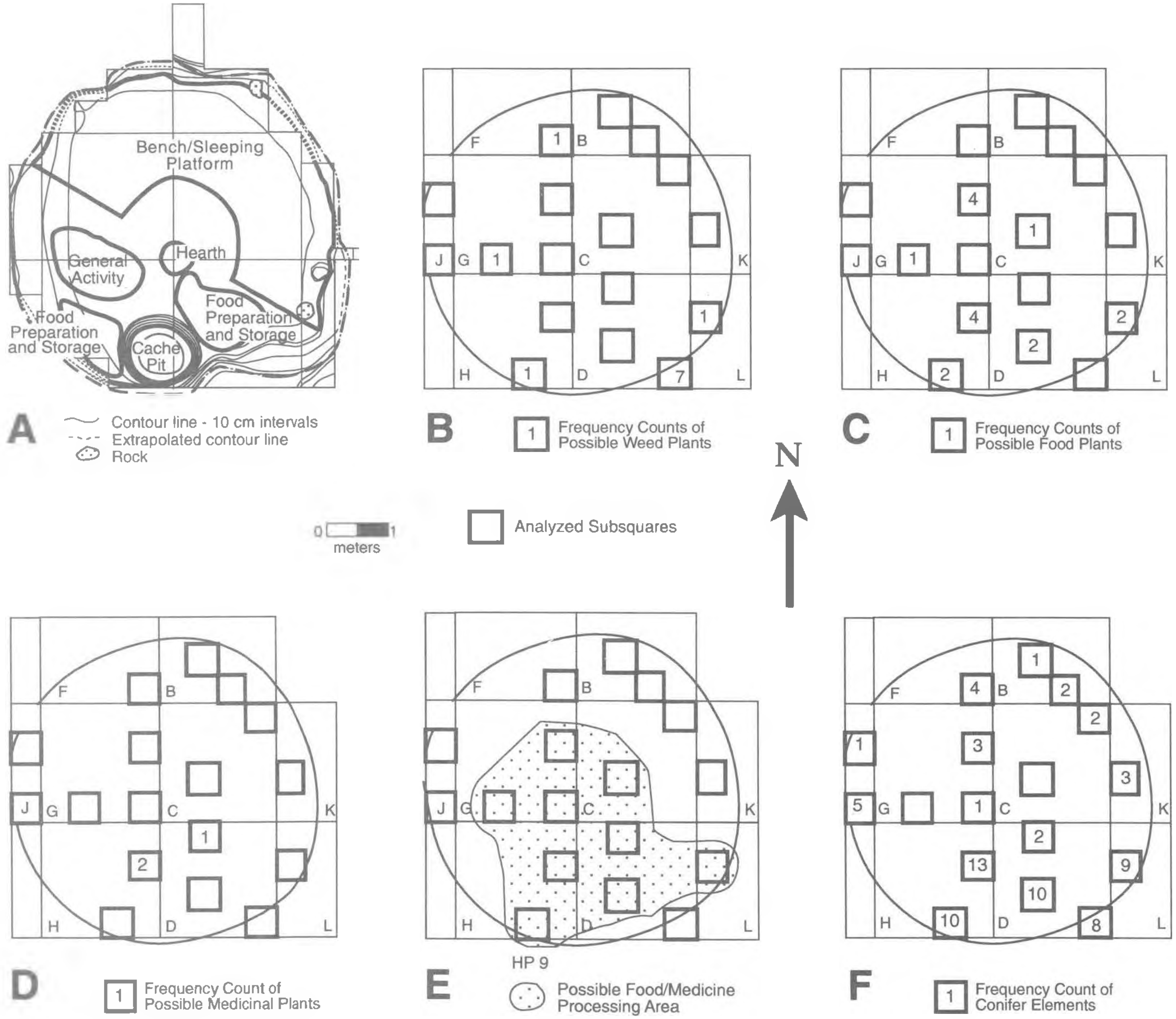

Figure 3: (A) Housepit 9 reconstructed activity areas; (B) distribution of potential weed plant remains; (C) distribution of potential food plant remains; (D) distribution of potential medicinal plant remains; (E) potential food/medicine plant processing area; (F) distribution of conifer parts.

Phacelia linearis seeds were also recovered from HP's 3, 7, and 90, as noted above. Three were recovered from HP 90, seven came from HP 3, and 26 were recovered from HP 7. If *Phacelia linearis* was a medicinal plant, it appears to have been used by, or at least in the treatment of, people of varying social status at the site.

Unidentified Seeds

Seven seeds remain unidentified. These seeds appear to represent four different taxa, possibly including a single example of a *Fragaria* (strawberry) species. Their distribution does not mean much at this point without their identification, but they are also clustered in the southern half of the housepit, near the center. When combined with the distribution of the Ericaceae and Hydrophyllaceae seeds, it suggests a general plant processing area of some kind in this part of the pithouse (Fig. 3E).

Pinaceae (pine family)

Seventy-four conifer parts that appear to be from the pine family (rather than the cypress family) were recovered from HP 9. At this point they have not been identified to a species level due to their fragmentation. Sixty-five of these were needles or needle fragments, one was a needle bundle, and nine were miscellaneous conifer parts. Pine cambium was eaten and the boughs were used for bedding ethnographically, as noted above.

There is a concentration of conifer parts in the southeastern/southcentral area of the housepit (Fig. 3F). This concentration is quite marked with these samples containing 8–13 conifer fragments, whereas other samples contained 0–5 fragments. This may not be significant as the numbers are all small; however, the overall density of floral remains in the housepit is low, and small differences may be considered notable. This apparent concentration does not really fit with Alexander's reconstruction of the bedding areas of HP 9 being along the northeastern and southwestern portions of the wall. In fact, these areas demonstrated quite a low concentration of conifer remains, except for perhaps on their extreme edges (Fig. 3F). The concentration found in the southeastern/southcentral area may represent some other activity, perhaps plant processing or storage.

Housepit 9 Discussion

Housepit 9 does not appear to have been particularly unique in terms of its floral remains, based on their density, diversity, or distribution. The remains of food plants, and in fact all plants, appear to have been similar in terms of species to the other small housepits. The distribution of floral remains in HP 9 fits the general pattern of identifiable activity areas observed in HP's 12 and 90, although the bedding areas are not identifiable based on the floral remains in this case. There are more remains of food than in the other small housepits, but more samples were analyzed for HP 9 than for the others and may account for this difference. However, considering that this housepit was not burned, the plant inventory is quite large.

The distribution of floral remains within HP 9 indicates a processing area for foods, and perhaps medicines, in the southern half of the pithouse, near the center (Fig. 3E). This distribution fits with Alexander's reconstruction of a food preparation and storage area, and also a hearth being located in this area. The distribution of conifer parts may reflect some type of conifer plant processing as it does not appear to reflect a bedding area, based on Alexander's reconstruction. The only floral-based activity area apparent within HP 9 is the general plant processing area. There does not appear to have been more than one area for these activities, which is consistent with what has been found in other small housepits to date. There are no marked differences between any of the small housepits analyzed to date, based on the floral remains, unless the higher amounts of food and medicinal plants recovered in HP 9 are not the result of sampling. If they are not, they may reflect greater access to these resources.

There may be one other potentially significant detail about the HP 9 floral remains. The unidentified Ericaceae species was by far the most common seed species recovered (representing 40% of the total seed inventory). This might suggest a preference for or access to this species by the inhabitants of HP 9. This species was also the most common food plant remain recovered in HP 90, while *Amelanchier alnifolia* (Saskatoon Berry) seeds were the most common food plant recovered in HP 12.

Housepit 9 Conclusions

Based on the floral remains alone, HP 9 does not appear to have been the home of a specialist, or specialists. No unique species of flora, except perhaps *Fragaria*, were recovered and the distribution of the floral remains matched the general pattern observed in the analyses of other small housepits at the Keatley Creek site. There may be some significance to the distribution of conifer parts in HP 9 that has not been identified yet, however, as the majority of needles were recovered from the apparent plant processing area, rather than the bedding areas as has occurred in other housepits. The density of food plants may also be significant, as it appeared to be somewhat higher than in other small housepits. Finally, the inhabitants of HP 9 did not appear to be especially "poor," unlike those of HP 12, but they appear to have had less access to the range of plant resources enjoyed by the inhabitants of HP 7. It is possible, of course, that the fact that HP's 12 and 90 housed less people meant that there was less food required and therefore fewer food remains to recover.

Housepit 104

Several Simon Fraser University students undertook this analysis as a class project and analyzed one sample taken from the late Kamloops Phase floor of the housepit, dated at 250 BP. This was the only occupation of HP 104. The date places it approximately one thousand years later in time than the other housepits discussed in this chapter, which of course lowers its comparative value. The sample discussed in this analysis was taken from the peripheral floor area (Fig. 4). It was expected that HP 104 would demonstrate a different pattern of plant use than HP 12 (the only other small housepit analyzed at that time), as it appeared to have been a special purpose structure, perhaps used for ritual events (Vol. II, Chap. 12; Vol. III, Chap. 11). The low density of lithics and the high density of burned bone compared to other housepits at the site may suggest this. It is difficult to compare this late dated, single paleoethnobotanical sample to the multiple samples taken from the other pithouses, but results do provide some support for the theory that HP 104 might have been a special structure. Its plant inventory and distribution is a little different than the other three small pithouses and does not fit the apparent "residential" pattern.

The HP 104 sample contained members of the Caprifoliaceae (Honeysuckle), Chenopodiaceae, Pinaceae and Poaceae families, along with several unidentified species. Chenopods, pine needles and grass seeds are common to most pithouse assemblages. Several unusual paleobotanical finds suggest that HP 104 may not have been an average residence. More than one thousand conifer needles were recovered in the single sample that was analyzed, which is an unusually high concentration. A dense mat of charred grass was found along the southern wall during the excavation (Fig. 4), which is also a unique find at the site. This matting might be explained as bedding areas, but it could also be explained as seating areas for a sweat ritual or other ceremony (Reimer 1995). A single Caprifoliaceae seed was also recovered, which was an unusual find at the Keatley site. Unfortunately, it has not been identified to species as yet.

Three seeds from the Caprifoliaceae family were also recovered from the rim of HP 7, the large housepit. One of these was identified as being *Sambucus* cf. *cerulea* (Blue Elderberry). This is an edible species that was used for a number of purposes ethnographically (Parish et al.; Turner 1998). The HP 104 seed could be from a number of species found in the Lillooet area and known to have been used ethnographically, including *Sambucus* cf. *cerulea*, *Lonicera ciliosa* (Orange Honeysuckle), *Lonicera involucrata* (Black Twinberry), *Symphoricarpos albus* (Common Snowberry), or *Viburnum edule* (High-bush Cranberry). According to Turner (1997), children would suck the nectar from Orange Honeysuckle flowers. The woody vines of Orange Honeysuckle were used for weaving, binding, and lashing and reinforcing suspension bridges according to Parish et al. (1996:84). Black Twinberry twigs were used by the Stl'atl'imx to make a tea and Common Snowberry berries were used for eye medicine (Parish et al. 1996). High-bush Cranberry berries were gathered in the autumn and eaten and the bark was steamed and inhaled for sore throats.

To determine whether HP 104 was used for ritual purposes, further excavation and paleoethnobotanical analysis would be required. The floor has only been partially excavated at this point. The plant remains could provide many clues. For example, if no food plant remains were found in the housepit at all this would be a strong indication that HP 104 was not a residential structure. If the conifer needle concentration remained high across the floor this might also suggest a ceremonial structure, or at least a non-residential structure requiring such flooring or seating. More grass matting might also suggest this. The presence of juniper

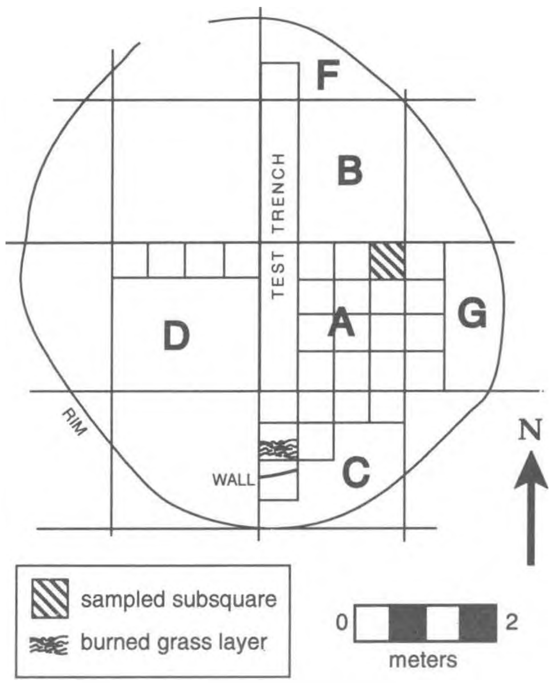

Figure 4: Housepit 104 showing single sampled subsquare location.

(*Juniperus*) or other ritually used plants would also suggest this. It seems clear at this point, however, that HP 104 was not the normal residence of high-status individuals, based on the ethnographic patterns noted a century later or on the archaeological patterns that are beginning to emerge from a thousand years earlier.

Overall Discussion

It would appear that the small housepits at Keatley Creek were generally the regular residences of lower status people, while in some cases they functioned as special purpose structures. This is suggested by the variation in the quantity and frequency of species found in each housepit and their distribution as tabled and discussed below.

Lepofsky's work at Keatley Creek has shown that the floors of the housepits were relatively intact and undisturbed at the time of excavation. This does not mean that they were undisturbed while people were living in them, however, as noted above. Modern plant intrusions, including uncharred and/or Eurasian introduced species, have been few and their density is typical of minor soil movement caused by roots and insects. The distribution of remains has suggested discrete areas of food processing, hearth areas, and sleeping or sitting areas. This was the practice in ethnographic pithouses as well.

The concentration of floral remains has been generally low, despite the apparent diversity found in the larger housepits, and may reflect frequent cleaning events in the housepits. It has been suggested by Lepofsky that most plant remains were dumped in the rim deposits, where floral remain density is much higher. Although many of the plant remains associated with the hearths would have been charred during processing, many others would have been charred during the burning of the entire pithouse structure upon abandonment. Without this burning event the density of remains in the floor deposits would probably be even lower.

This analysis suggests that general activity areas can be identified in small housepits at Keatley Creek on the basis of plant remains. These activity areas suggest residential homes (HP's 12 and 90) and may suggest places where specialized activities took place (HP's 9 and 104). The variation in species and distribution of species between housepits may suggest differential or preferential access to certain plant sources. For example, HP 9 appears to have had especially good access to the unknown species of Ericaceae in comparison to the other small housepits while none of the small housepits appear to have had much access to Saskatoon Berries which were ethnographically the most important berry resource (Turner 1992). Individual botanical remains may also be significant. For example, HP 104 contained a seed from the Caprifoliaceae family, which was a rare find at the site.

Results from the analysis of the HP 90 floor are comparable to results from HP's 3, 7, and 12 as HP 90 appears also to have been a residential housepit, rather than a special purpose structure. The plant remains that were recovered include common species used for technology and food, as well as what appears to be a common medicinal species. The activity area patterns fit the residential pattern of a number of activity areas for plant processing and storage with a sleeping area along the periphery. The percentage of the floor that was sampled is also comparable (approximately 15%). In terms of dates, however, HP 90 appears to have been occupied during the late Plateau Phase, making it slightly older than the housepits analyzed by Lepofksy (Vol. I, Chap. 9). Whether this small time difference had a significant effect on plant use patterns remains to be determined but there is no initial reason to think that this might have been the case.

The analysis of the HP 9 floor suggests that this housepit was a little out of the ordinary. More food plants were recovered from HP 9 than from HP's 12 and 90, in terms of quantity, and also of diversity for HP 12. This may be especially significant when it is considered that this housepit was not burned on abandonment, which probably means that its floral record is more scanty than other structures that were burned. The activity areas fit the expected pattern of several plant processing or storage areas in the center of the housepit, with bedding areas along the walls. It is also worth nothing that the distribution of Phacelia within HP 9 is restricted to two samples; both located in the southern half of HP 9, near the center (Fig. 3D). This distribution may suggest a discrete medicinal preparation area, although such an assumption should not be made based on three seeds. Conifer needles and food plant remains were also recovered from these samples. It appears more likely that this area of the housepit was used for several kinds of plant preparation. Approximately 20% of the floor was analyzed, which is a little more than has been completed for other housepits to date. Housepit 9 is approximately the same age as HP's 3, 7, and 12, making it slightly younger than HP 90, as noted above.

Housepit 104 does not appear to have been a residential housepit, although further excavation and analysis will need to be completed to support this view. The plant remains that were recovered included no known food plants and one rare species. The late date of HP 104 and the fact that only one sample has been analyzed make it of less comparative value but it appears that it would be worth investigating this pithouse further as it does seem to be a unique example.

Overall Conclusions

Small housepits at the Keatley Creek site appear to have been inhabited by people who had less access to resources than those people living in the medium or large housepits analyzed to date. A range of access to plant resources appears to have existed within the small housepits as well. For example, HP 12 contained a lower density and diversity of food and medicinal plant remains than HP's 9 or 90, but it contained a much higher density of conifer needles. Housepit 12 appears to have been the only household with access to Saskatoon Berries, however.

The species that have been recovered from the small housepits have been similar and are limited to several members of the chenopod, grass, heather, rose, waterleaf, and pine families, and a single example of the honeysuckle family. Each housepit has a slightly different floral record, which may or may not reflect access to plant resources. No medicinal plant remains were recovered from HP's 12 or 104. This may suggest that no one was sick there, rather than that they did not have access to medicinal plants.

The identifiable activity areas in the "residential" housepits include a central plant processing area and peripheral bedding areas. Housepit 104 is a little different, however. It does not appear to contain the remains of any food plants. The HP 104 sample also contained an unusually high concentration of conifer needles, which might suggest a special activity. It should be noted that all of the small housepits analyzed at this point may be atypical as they are located outside of the main village area and they may have been occupied by families that were not part of the "normal" social ranking (HP's 9, 12, and 90), or used for special activities (HP 104).

Suggestions for Further Research

As noted above, the analyses of HP's 9, 12, 90, and 104 have demonstrated that a range of plant use existed within the small housepits at the Keatley Creek site. Some of these small housepits were probably not pithouses at all, but small special-purpose structures not used for regular habitation. For the time being, enough paleoethnobotanical data has probably been collected for small housepits in general. The floral remains from several more medium and large housepits should be analyzed, however, to determine if the density and diversity recovered from HP's 3 and 7 are repeated, and if so, what kind of variation can be found within the class of larger housepits. Perhaps a demonstrated preference for, or access to, certain species of plants will be found in each of these larger housepits in the same way certain lithic materials have been shown to be associated with specific large houses (Vol. I, Chap. 16). The small housepits analyzed here hint at such differential access.

As well as the testing and analysis of a few more medium and large housepits noted above, there are a number of further paleoethnobotanical studies that should be carried out with the materials that have already been recovered. For example, the unidentified seeds from all six housepits analyzed to date should be compared to determine if any of the same species have been recovered and if any of the species can be identified, at least to a family level. Another study that should be undertaken is a comparison and identification of the chenopods recovered from the Keatley Creek site. For several reasons, it appears to me that at least one species was used in some way, rather than simply included in housepits on an incidental basis. A number of species of chenopods are known to have been used historically and prehistorically in the Lillooet area. Chenopods have been the most common seed recovered in five out of six housepits analyzed to date. Chenopods have also been found in pithouses at other sites on the British Columbia Plateau (Lepofsky 1990). In my opinion, there is currently no fully satisfactory explanation for their presence at Keatley Creek. If the species can be identified, their presence and distribution may have a significant contribution to make to our interpretations of plant use at the Keatley Creek site.

Finally, paleobotanical analyses of non-housepit features at the Keatley Creek site are currently being completed by the author. These analyses are expected to provide additional information on what plant species were used and how they were cooked. For example, it is apparent that there were large plant-cooking pits located on the terraces of the village periphery.

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Chapter 6

Chemical Identification of Activity Areas in the Keatley Creek Housepits

William D. Middleton

Introduction

Soil phosphate analysis has been used by archaeologists since 1926 (Arrhenius 1963) to locate sites and determine their extent. Although this has proven to be a useful technique (Arrhenius 1963; Cavanagh et al. 1988; Conway 1983; Eidt 1985; Konrad et al. 1983; Lillios 1992; Lippi 1988; Sjoberg 1976; Woods 1977, 1984), archaeological applications of soil chemistry have only recently ventured beyond this fairly simple application. Recent work has demonstrated that many compounds and elements other than phosphates also serve as indicators of past human behavior, and that these are especially effective in domestic contexts (Barba 1985, 1988; Barba et al. 1987; Barba and Ortiz 1992; Manzanilla and Barba 1990; Middleton 1994; Middleton and Price 1996).

In this study, multi-element characterization by inductively coupled plasma-atomic emission spectroscopy (ICP/AES), atomic absorption spectroscopy (AAS), and colorimetry of acid extracts of soils is used to analyze soils from the floors of housepits at the Keatley Creek site. These analyses aid the interpretation of structure function and patterns of activity within the structures. Two floors from one structure (HP 9), and a single floor from three other structures (HP's 3, 7, and 12) were extensively analyzed, as well as soils from a variety of reference profiles from undisturbed and minimally disturbed contexts.

Results show that the soils from the structures were chemically distinct from local, undisturbed soils and that there was clear patterning in the chemical residues in these floors. Temporary and permanent hearths and discrete activity areas were identifiable and these patterns can be seen to vary somewhat between the floors. The chemical data complement that of lithic, faunal, and paleobotanical analysis and observations made during the excavation to strengthen the interpretation of the organization of activities within the Keatley Creek housepit.

Methodology

A total of 253 samples were analyzed for the study. These samples were collected over several field seasons from floors, specific features, and reference profiles. Floor samples were not, however, uniformly collected, so in a number of cases portions of the floors remain uncharacterized. Samples from the reference profiles and HP 9 were analyzed by ICP/AES at the Laboratory for Archaeological Chemistry, while the samples from HP's 3, 7, and 12 were analyzed by a combination of AAS and colorimetry by Pacific Soil Analysis Inc. Several reference samples were collected, from immediately adjacent to a structure and from up to 50 m distant from a structure.

The samples were originally analyzed blind, with only x-y coordinate provenience, interpreted, and the results sent to the excavator (Brian Hayden). He reported a high degree of correspondence between the chemical analysis, other analyses, and field observations. Further data was then provided and interpretation of the chemical analyses completed.

Analysis

The samples for ICP/AES were prepared by oven drying the samples at 105°C for 48 hours, pulverizing the dried sample in a Coors porcelain mortar, screening the sample with a 2 mm geological screen to remove all particles larger than sand, and extracting .2 g of the sample in 20 cc of 1N HCl for two weeks at room temperature. The extracts were analyzed by ICP/AES, and scanned for twelve elements: Aluminum (Al); Barium (Ba); Calcium (Ca); Iron (Fe); Potassium (K); Magnesium (Mg); Manganese (Mn); Sodium (Na); Phosphorous (P); Strontium (Sr); Titanium (Ti); and Zinc (Zn). The concentration of these elements was measured in parts per million (ppm) and these concentrations converted to base ten logarithms for interpretation. The methodology is based on Burton and Simon's (1993) acid extraction method for ceramic characterization. The two week, room temperature extraction gives the technique a very good reproducibility (better than ±5%: Burton and Simon 1993).

This is not a total compositional analysis, but a partial extract of mobile elements. The partial extract is preferable to total compositional analysis because as a sediment is developed into a soil, it is characterized by changes in the availability of mobile elements and compounds, due both to the weathering of these elements from the parent material and the incorporation of new materials from both human and natural sources. The chemical composition of the parent material is not, per se, of foremost interest in this case, and can actually obscure the relationships of interest (see Linderholm and Lundberg [1994] for a more complete discussion of and comparison between partial extraction and total compositional analysis of soils). The values reported for P are equivalent to Eidt's (1985) total P.

The samples from HP's 3, 7, and 12 were not analyzed by the author, but by Pacific Soil Analysis Incorporated. The data were provided to the author by the excavator (Brian Hayden) for comparison with the data from HP 9. Samples were analyzed using a peroxide-sulfuric acid digest. Of the twelve elements used in the author's study, only phosphorus, potassium, calcium and magnesium were measured by PSAI. Phosphorus was measured colorimetrically, calcium, magnesium, and potassium were measured by atomic absorption spectroscopy. Concentrations of the four elements were reported as percent by weight. Although different extraction techniques, quantification techniques, and reporting units are used, and the data are not as precise as those from ICP/AES, the relative patterns are still comparable to the ICP/AES analyses.

Data Presentation and Interpretation

For preliminary analysis of the housefloors, log ppm or percent concentrations of each element were surface plotted for each floor level by x-y coordinates. Profile samples were coded by depth below surface and elemental concentrations were plotted as a function of depth for comparison with the floor levels.

Surface plots were visually examined for patterning in elemental concentrations, with particular attention given to element groups that have been determined through ethnoarchaeological studies (conducted by the author and other researchers) to be useful in identifying activity areas. The foremost of these, identified through ethnoarchaeological studies (Middleton 1994; Middleton and Price 1996), are Ca and Sr serving as indicators of high activity under roofed areas protected from weathering, and P and K serving as indicators of ash, hearths, firing, or perhaps other activities. P is also a general indicator of organic matter content (Birkeland 1974; Buol et al. 1989; Catt 1990).

Samples from the floors were compared by sample provenience and position in the solum with the

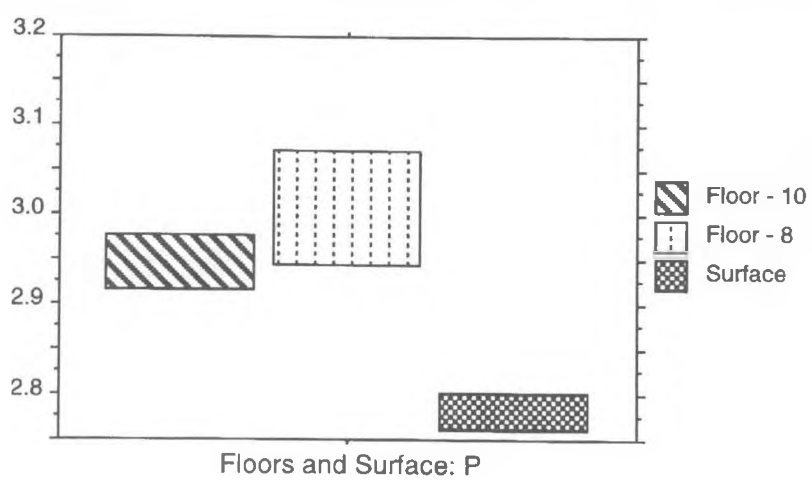

Figure 1. Phosphorus values (log ppm) from the floors of HP 9 and the prehistoric surface.

reference profiles to assess the integrity of the archaeological chemical residues. Principal component analysis was performed on elemental concentrations for each floor to separate major vectors of variation and further elucidate patterning.

Once more detailed information was obtained on the identification of features encountered during the excavation, floor samples were designated as hearth, food preparation area, general activity area, or covered area as specified by the excavator, and these designations tested by cluster and discriminant analysis.

Integrity of Anthropogenic Chemical Residues

Soils develop in a sediment as a function of natural processes and factors over time (e.g., Jenny's [1941] five factor model: a soil develops as a function of climate, organisms, relief, parent material, time, and local factors: also see Johnson and Watson-Stegner 1987; Simonson 1978). In human occupation sites human activity can dominate these natural processes to the extent of creating a new soil, and this new soil can persist, leaving indications of the activities that impacted its formation. Human influenced soils (anthropogenic or anthropic soils) are usually clearly distinguishable from their natural, undisturbed counterparts. Differences in the content of a number of naturally occurring soil constituents can distinguish the differences between natural and anthropogenic soils.

For this comparison, though, it is necessary to sample an undisturbed land surface contemporary with the anthropogenic soil, or at least an associated, culturally sterile context. As stated above, reference profiles were collected from units adjacent to housepits and from up to 50 m distant from the nearest housepit. This ensures a minimally disturbed, contemporary land surface with which the archaeological soils can be compared.

Soil P has long been used by archaeologists as an indicator of past human activity (Arrhenius 1963; Eidt 1973; Solecki 1951) and by soil scientists as a pedogenic indicator (Birkeland 1974, 1984; Buol et al. 1989). A major route for the incorporation of P in soil is as a constituent of organic matter, which typically has a high rate of incorporation in anthropogenic soils (Cook and Heizer 1962, 1965; Stein 1992). Anthropogenic soils should have higher levels of P than their natural counterparts, and this is the case with both floors from HP 9 compared with an undisturbed soil profile (profile 7, taken 50 m west of HP 90: Fig. 1).

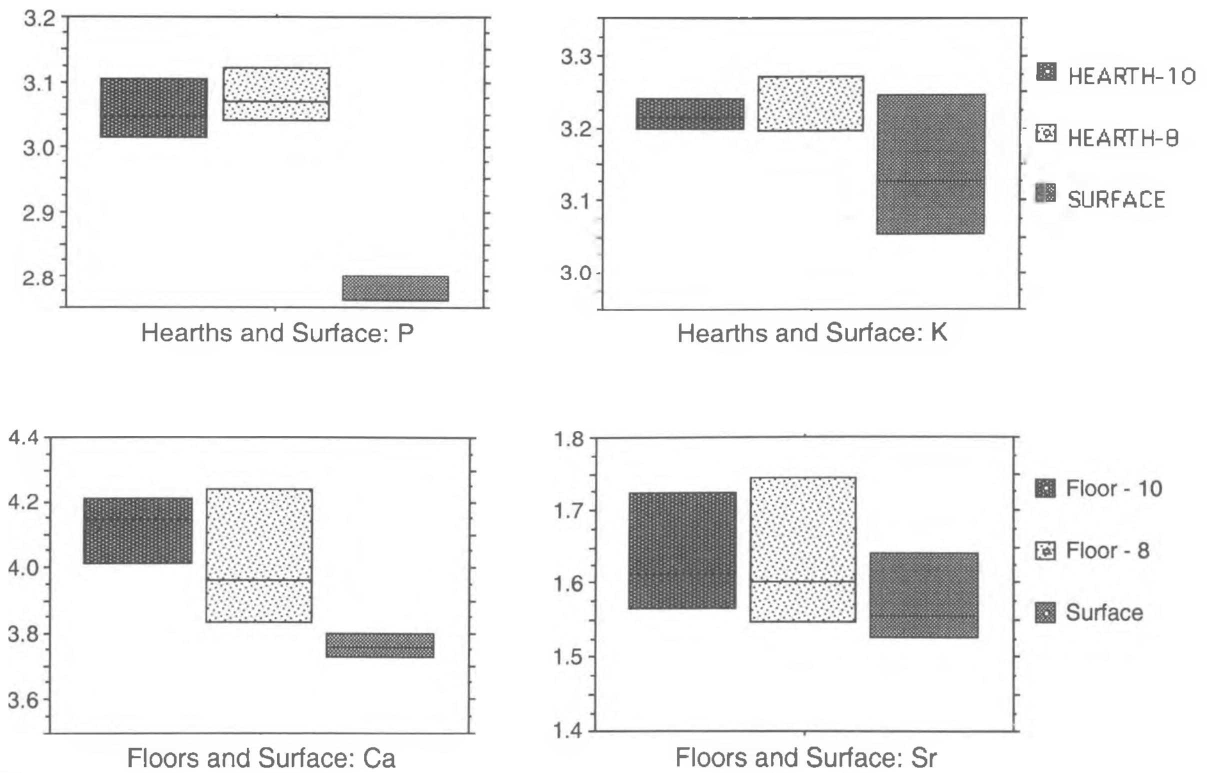

Figure 2. Values (log ppm) for phosphorus and potassium from the hearths of HP 9 and the prehistoric surface, and for calcium and strontium from the floors of HP 9 and the prehistoric surface.

Another major addition to anthropogenic soils is Ca (Cook and Heizer 1962, 1965; Griffith 1980, 1981; Heidenreich and Navatril 1973; Heidenreich and Konrad 1973; Heidenreich et al. 1971; Middleton 1994; Middleton and Price 1996). There are several mechanisms for the incorporation of Ca into anthropogenic soils, but none are yet clearly elucidated. Sr, as a related alkaline earth element, follows the behavior of Ca, and also occurs in elevated concentrations in house floors, though at a lower magnitude than Ca (Middleton 1994; Middleton and Price 1996). It can be seen that Ca and Sr are also higher in the HP 9 floor levels than in undisturbed soils (Fig. 2).

Finally, there are a number of elements (particularly K and P) introduced into anthropogenic soils primarily through wood ash (Heidenreich et al. 1971; Middleton 1994; Middleton and Price 1996; Scotter 1963; Tarrant 1956). These can be seen to be much higher in the hearths of HP 9 than in the reference profile (Fig. 2).

With these patterns established it is clear that the anthropogenic soils have remained distinguishable from the local natural soils. The chemical residues encountered in the anthropogenic soils should, then, be interpretable as accurate indicators of the behavior that contributed to their formation.

Results

Results of all analyses are presented in the Appendix. The soils from each floor showed distinct patterning in their chemical residues, and there were some differences in the patterning between the floors. These differences suggest that the floors had a somewhat different spatial organization.

Housepit 9, Stratum 10

HP 9 is a small structure (20.5 m^2) with two distinct occupation floors. The lower floor (Stratum 10) dates to the Plateau Horizon; the later floor (Stratum 8) dates to the early Kamloops Horizon (see Vol. III, Chap. 8). Stratum 10 is characterized by several patterns—concentrations of high values for K, Mn, P and Zn near the center of the floor, high levels of P in the south-eastern section of the floor, incompletely overlapping semi-circular concentrations of Al, Fe, Mg around the perimeter of the floor (primarily to the southeast of the center), and high levels of Ca in the southwestern half of the floor.

The excavators reconstruct the floor as having been divided into a hearth area, food preparation and general activity areas, a cache pit, and an area covered by a bench/sleeping platform (Fig. 3).

As wood ash contributes a number of elements to soil, particularly K, Mn and P, it seems likely that the concentrations of these elements near the center of the floor accurately reflect the location of a hearth (Figs. 4 &

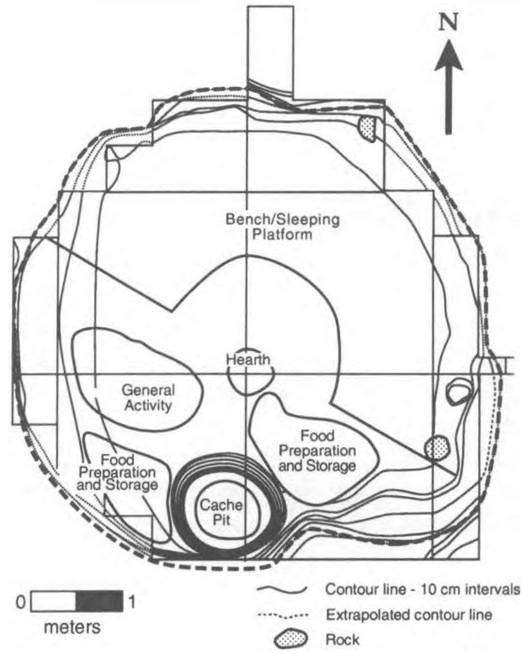

Figure 3. Excavator's reconstruction of HP 9, Stratum 10. Dashed line is for orientation of chemical plots.

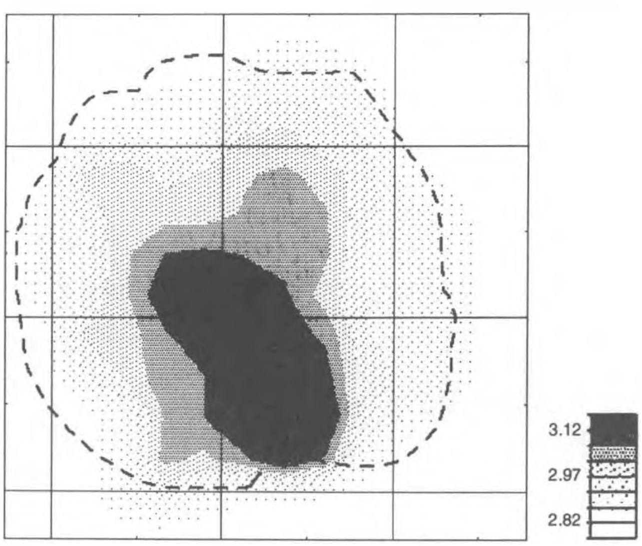

Figure 4. Concentrations (log ppm) of phosphorus, HP 9, Stratum 10.

5). This area, in fact, had the strongest signature for firing of any of the floors examined, and interestingly, contained the only stone lined (apparently permanent) hearth uncovered in the excavations (see Vol. III, Chap. 8).

The high levels of P (Fig. 4), and the semicircular concentrations of Al and Fe in the southeastern portion of the structure correspond to the food preparation area identified by the excavators. While elevated P is easily explained as reflecting the greater input of organic matter (in the form of food preparation residues), the correspondence of Al and Fe is not easily explained. Elevated levels of Mg, while partially overlapping with Al and Fe, are more concentrated in the part of the floor identified as a general activity area

The elevated levels of Ca and Sr are found across most of the floor that was not covered by the bench/ sleeping platform, with the highest levels in the food preparation and general activity areas (Fig. 6). Based

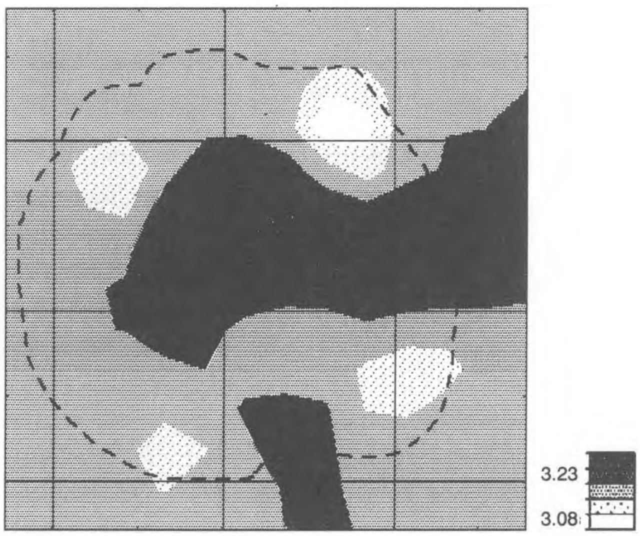

Figure 5. Concentrations (log ppm) of potassium, HP 9, Stratum 10.

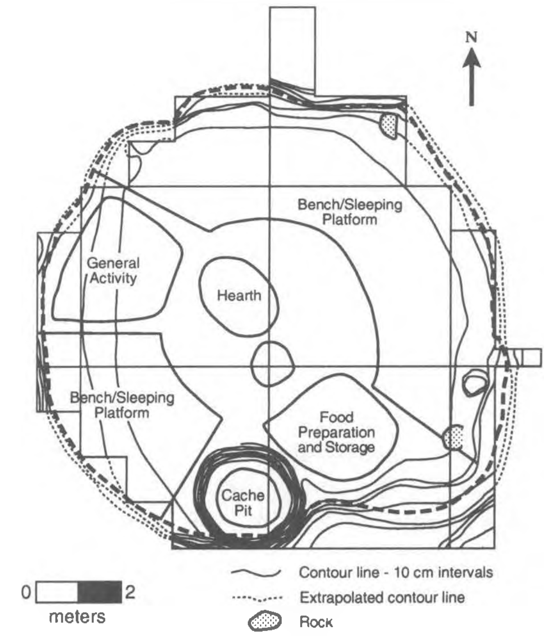

Figure 7. Excavator's reconstruction of HP 9, Stratum 8.

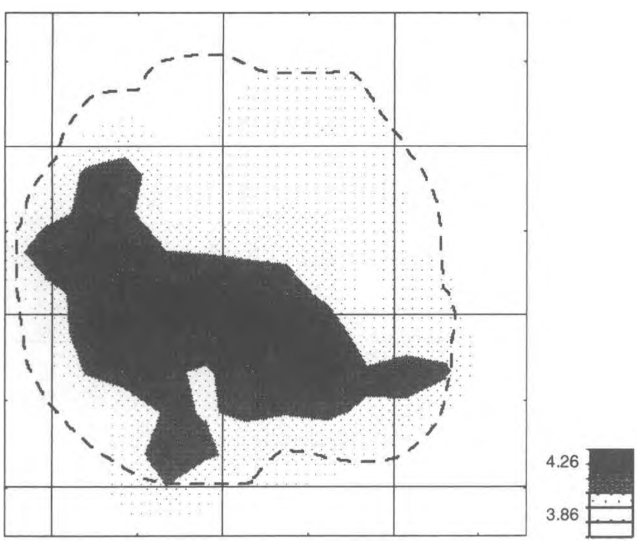

Figure 6. Concentrations (log ppm) of calcium, HP 9, Stratum 10.

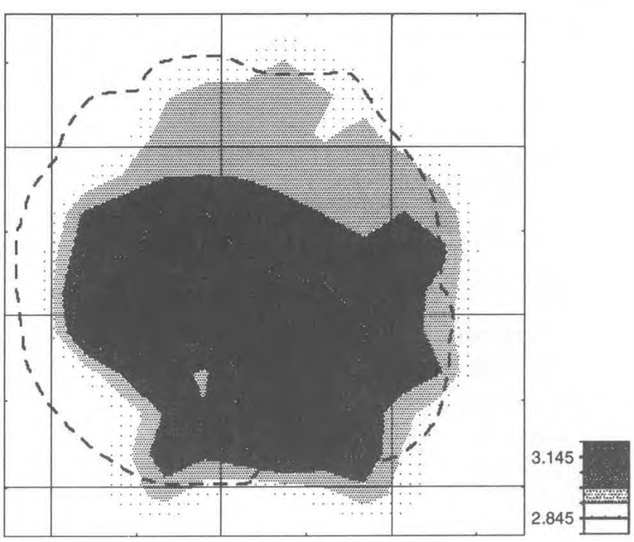

Figure 8. Concentrations (log ppm) of phosphorus, HP 9, Stratum 8.

on ethnographic studies, this is what would be expected in the areas of greatest activity.

Finally, the area covered by the bench/sleeping platform is generally (though not entirely) characterized by lower elemental values than the rest of the floor area, indicating that little material was entering the soil in this covered area (Figs. 4–6).

Statistically, the dominant chemical signature on the floor is the presence of the hearth: principal component analysis strongly reflects the presence of constituents of wood ash with K, Mn, P, and Zn all strongly positively weighted in the first factor and negatively weighted in the second. Both hierarchical and non-hierarchical cluster analysis (Ward's minimum variance and K-means) make a primary distinction between the covered (platform) portion of the floor and all other samples. When clustering on all elements, both techniques have some difficulty in separating the various activity areas, tending rather to make groups from central and more peripheral parts of the floor. When clustering only on the four key elements (Ca, K, P, and Sr), both clustering techniques are much more successful in separating the various activity areas. Using the activity areas designated by the excavator as the independent grouping variable, discriminant analysis distinguished between all floor areas with complete success.

None of the chemical signatures are as sharply bounded as the areas demarcated by the excavators. This is most likely due either to a blurring of the chemical signatures by subsequent soil development, to the division of space within the structure not being static over time or to "scuffage" effects of walking or other activities on the floor displacing soil sediments laterally. Given that the structures are estimated to have been occupied for 20–30 years before roofs were replaced (see Vol. I, Chap. 17), the latter explanation seems more likely.

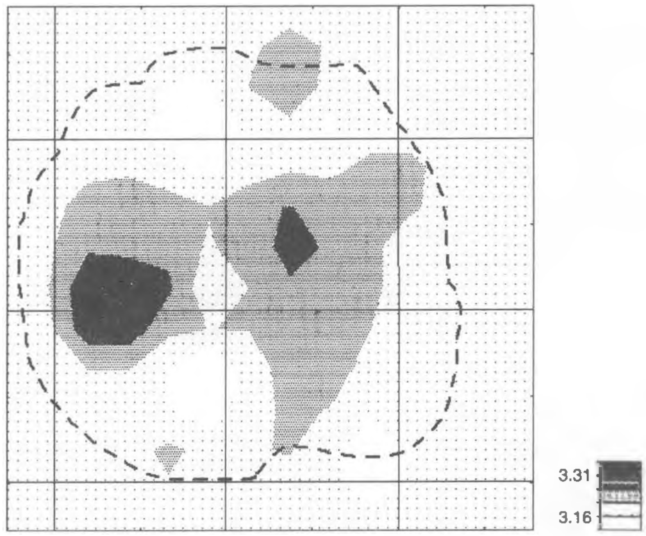

Figure 9. Concentrations (log ppm) of potassium, HP 9, Stratum 8.

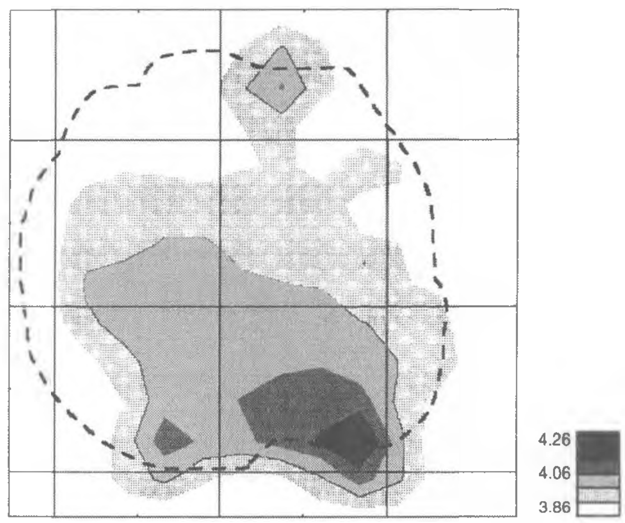

Figure 10. Concentrations (log ppm) of calcium, HP 9, Stratum 8.

Housepit 9, Stratum 8

The later floor of HP 9, Stratum 8, level 1, exhibited somewhat different patterning in the surface plots than Stratum 10. This is probably due in part to Stratum 8 having been formed on burned and mixed roof fill rather than on sterile till (see Vol. III, Chap. 8), but also undoubtedly reflects a somewhat different organization of space than Stratum 10.

Again K, P, Mn, and Zn have high levels near the center of the floor (somewhat west of center), though the highest values for P and K are actually to the west of the hearth. P is also very high in the southwest quarter of the floor. Ca and Sr are both quite high in most of the southwest half of the floor. On this floor, however, there are no anomalous concentrations of Al or Fe.

The excavators' reconstruction of Stratum 8 (Fig. 7) is somewhat (though not substantially) different from Stratum 10. The features are in roughly similar positions, though several are offset from their counterparts in Stratum 10. The same chemical signatures seen in the features of Stratum 10 are, for the most part, also found in the features of Stratum 8.

The hearth area is characterized by high, though not the highest, levels of P and K (Figs. 8 & 9). There is an area slightly to the west of the hearth that has the highest P and K values, suggesting that another hearth had been located at this point, and that the hearth, since it was temporary, did not have a set or consistent location on the floor.

The second area of high levels of P corresponds again to the food preparation or perhaps consumption area (in more or less the same location as in Stratum 10). That there is no corresponding increase in Al or Fe in this area suggests that their correspondence in Stratum 10 was independent of food preparation.

Ca and Sr are both highest on the uncovered part of the floor (lacking a sleeping platform), with the highest levels occurring in the food preparation area. Ca illustrates this pattern most clearly (Fig. 10). The high levels, however, do not extend very far into the general activity area, suggesting that this part of the floor was not as intensively utilized as it was in Stratum 10, or perhaps that it was also covered for part of the occupation of the floor.

Principal component analysis indicates that while the hearth is still an important factor, it is not as strongly weighted as in Stratum 10. The major constituents of wood ash are still heavily weighted, but a number of other elements are as well. Both Ward's minimum variance and K-means cluster analysis again distinguish between the covered (platform) and uncovered portions of the floor, but are not completely successful in separating all of the activity areas. Repeating the analysis with only the four major elements (Ca, K, P, and Sr), improves results somewhat, but not greatly. Discriminant analysis, however, again using the excavators' designations as the independent grouping variable, separated all samples with complete success.

Housepit 12

With 38.5 m^2 of floor area, HP 12 is almost twice the size of HP 9, and its organization seems to be a little more complicated. The distributions of P and K have their highest levels in the north and south central areas of the floor. The concentrations of K, however, are fairly high across the much of the floor, particularly the southern half. The highest concentration of Ca is situated on the northwestern portion of the floor, with fairly low concentrations across the rest of the floor (Figs. 11–13).

The high levels of P and K in the north and south suggest that there may have been at least two hearths in the structure. Both of these areas correspond with high counts of charcoal, but only the northern concentration also corresponds with fire reddening and FCR. The highest concentrations of Ca roughly correspond with the highest concentrations of animal bones. The excavators suggested that the southwestern portion of the floor may have been covered by a platform, as in HP 9, and this area roughly corresponds to an area of high K concentration.

Repeated discriminant analysis tests produced ambiguous results (Fig. 14). Only one hearth was identified, in the northern part of the structure (the area corresponding to fire reddening, charcoal, and FCR). The hearth is associated with food processing areas, and there are also food processing areas in the southeast, and the area in the southern part of the floor that appeared might also be a hearth. General activity areas were identified in the west, central, and eastern portions of the floor, which correspond to high counts of lithics. Finally, the

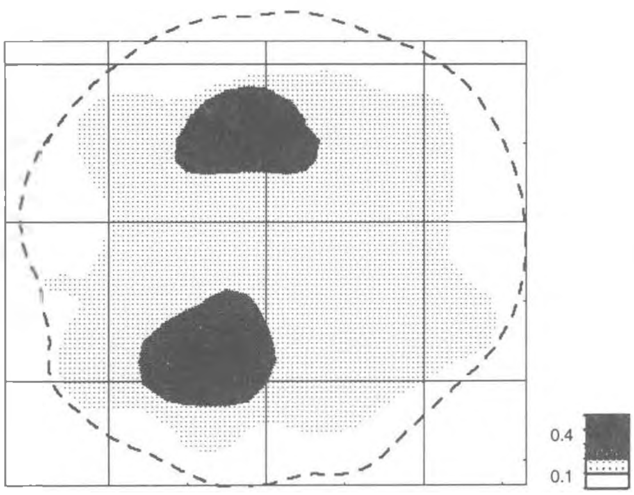

Figure 11. Concentrations (log ppm) of phosphorus, HP 12.

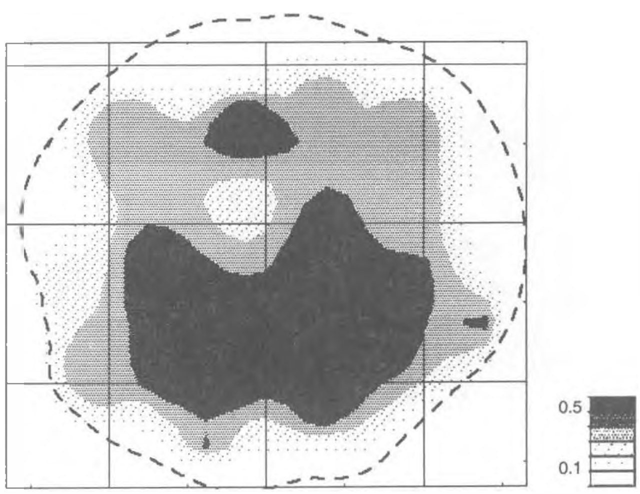

Figure 12. Concentrations (log ppm) of potassium, HP 12.

(possibly) covered portion of the floor was partially distinguishable, with another area on the northeastern portion of the floor also being identified.

This presents a somewhat chaotic picture of the organization of HP 12. The lack of coherence may indicate that the organization was more transitory/dynamic than the other housepits, and that a platform over a portion of the floor was moved or installed after the open floor had been utilized for some time or that mats were used instead of platforms for sleeping on.

Housepit 3

At roughly 78.5 m^2, the floor of HP 3 is almost four times larger than HP 9. Although the patterning in chemical residues is less clear, it appears that the organization of HP 3 was quite different from that of HP 9. The concentrations of Ca and P are semi-circular and circular, with the highest concentrations of P in the southwestern, and northern parts of the floor. The highest concentrations of K are in the southwestern half of the floor (Figs. 15–17) corresponding in a striking fashion to the division of the floor into two distinct activity zones based on stone tool distributions (see Vol. II, Chap. 11).

Given the distribution of Ca, it would seem that activity was most intense along the perimeter of the structure from the northeast, counter clockwise to the south. It also seems likely that there would have been a hearth in the southwest, given the elevated levels of P and K in this region. This corresponds fairly well to the distribution of faunal (fish and animal) remains, charcoal, and areas of fire reddening (see Vol. II, Chaps. 1, 4, 7; Vol. III, Chap. 6).

As an exploratory technique, the samples were schematically divided by activity based on the artifactual data provided by the excavator into hearth, food preparation or consumption, and general activity areas and these designations tested by discriminant analysis. The first several models were not completely successful, so following each test, samples that did not fit were assigned to new groups and re-tested. When a perfect fit was attained, the designations for the samples were plotted back onto the floor for comparison with artifact data (Fig. 18).

In addition to the one, large hearth area already apparent in the southwestern portion of the floor, there is a second hearth in the southeastern portion of the floor. This corresponds to another area of fire reddening and charcoal (a third area of fire reddening and charcoal in the northwestern area of the floor does not show up in the chemistry because there were no samples collected from this area). By far the most prevalent chemical signature is that of food preparation and perhaps consumption, which covers much of the perimeter of the floor. This area corresponds to high counts of bone, particularly fish bone. The third distinguishable signature, of other, general activities, covers the central, eastern, and southeastern portions of the floor. These areas correspond to the excavators' identification of a possible wood or hide working area (central) and light activity area (eastern and southeastern) on the basis of recovered lithics. These two work areas could not be statistically resolved on the basis of their chemistry.

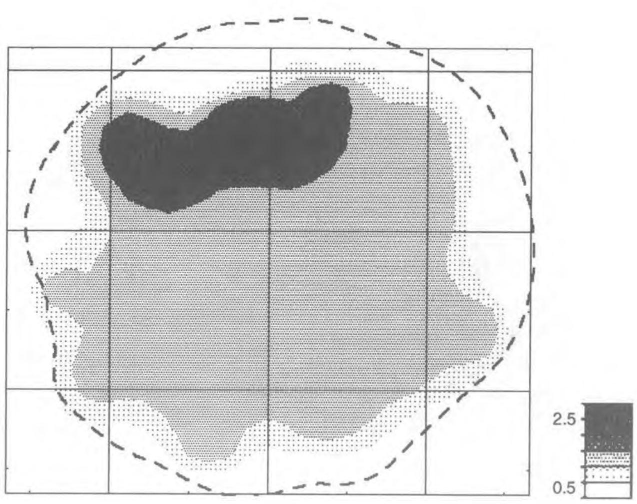

Figure 13. Concentrations (log ppm) of calcium, HP 12.

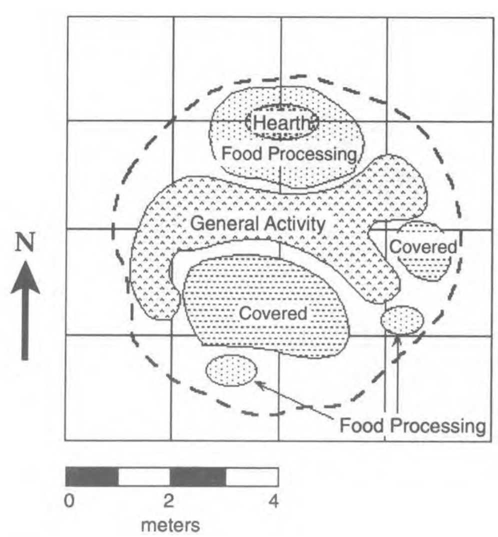

Figure 14. Chemically identified activity areas, HP 12.

Housepit 7

The floor of HP 7 was substantially larger (about 113 square meters) than HP 9, and also appears to have a different organization. Overall, it seems to be organized similarly to HP 3 in exhibiting concentric or perimeter activity zones, but is slightly different in the details. Though not completely overlapping, the highest concentrations of Ca, K, Mg, and P are located around the west, north, and east perimeter of the floor with the southern portion of the floor having lower concentrations (Figs. 19–21) (there were no samples from the central portion of the floor, so this area remains uncharacterized). This distribution corresponds fairly well to the excavators' division of the floor into three basic zones (based on the distribution of lithics): semi-circular inner and outer floor zones around the west, north, and east of the structure surrounding a central zone and separate from the southern sector (see Vol. II, Chap. 11).

Concentrations of P and K are fairly strongly correlated, and their highest concentrations coincide at four locations on the floor: the west central, east central, southwest, and southeast. The distribution of K and P also correspond fairly well with concentrations of fire cracked rock, suggesting that there were at least four frequently used, or principal, hearth locations within the structure. The highest concentrations of Ca are along the west central and eastern perimeters of the floor. These roughly correspond with food preparation or consumption and general activity areas identified by the excavators.

Again, the associations between features, artifacts, and chemistry were explored through repeated discriminant analysis tests, and the final results mapped back onto the floor (Fig. 22). Many more hearths are apparent (eight as compared to two in HP 3) scattered around the perimeter of the floor. Each of these hearths is associated at least with an area of fire reddening, and several with FCR and/or charcoal concentrations. Food preparation and perhaps consumption areas cover a similar proportion and area as in HP 3. These areas correspond fairly well with concentrations of animal bones (see Vol. II, Chap. 7), though they are less extensive in HP 7 than in HP 3. Several of the hearths occur within this area, and there are several areas with no samples, so the area may not actually be as extensive or continuous as it seems.

The general activity areas (again, specific activities could not be chemically distinguished) occur in the southwest and southeast of the floor, and do not appear to cover quite as wide an area of the floor as in HP 3. Finally, the south central area of the perimeter was identified by the excavators as a possible elite/ceremonial/sacred area. While only one sample was available from this area, it stands out as chemically distinct from all other areas on the floor.

Discussion and Conclusions

Although it is possible that there has been some diminution of the anthropogenic chemical residues in the Keatley Creek soils, the house floor soils are chemically distinct from corresponding natural soils in the same area. They should, therefore, reflect the human behavior that affected their development to a greater extent than they reflect the local, natural, processes of soil formation.

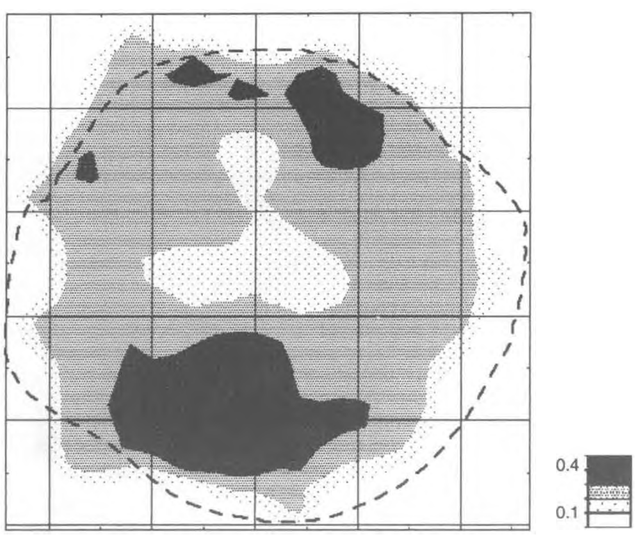

Figure 15. Concentrations (log ppm) of phosphorus, HP 3.

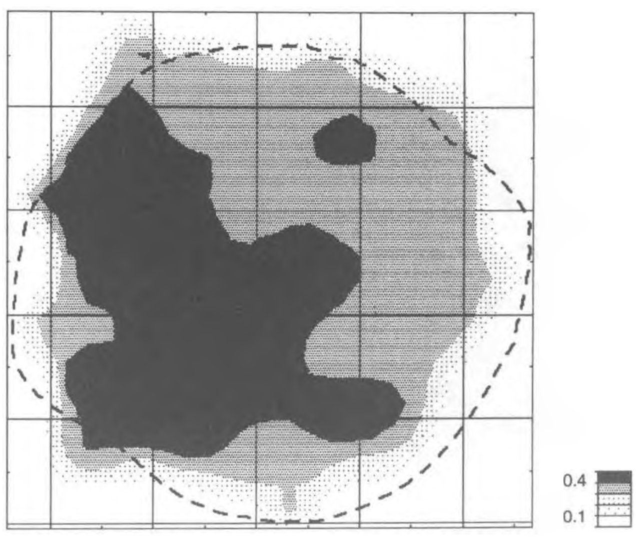

Figure 16. Concentrations (log ppm) of potassium, HP 3.

The chemical signatures that were expected to be encountered based on ethnoarchaeological studies (elevated levels of Ca and Sr in roofed, interior spaces and elevated levels of K and P in Hearth areas) were encountered in all structures (though Sr was not measured for HP's 3, 7, 12). The features identified by the excavators were, for the most part, clearly distinguishable by their chemistry, and there is a high degree of correspondence between the chemical signatures of the features observed on each floor. The major differences between the features are summarized in Table 1. These patterns strengthen the excavator's reconstruction of the spatial organization of housepits.

An important methodological point is that the exploratory techniques used to interpret the data (particularly discriminant analysis) are designed to find and maximize differences between groups. Furthermore, they do not explain or interpret these differences, they simply indicate that the differences can be found. In the case of the Keatley Creek house floors, this is complicated by the fact that hearths and food preparation are the dominant signatures (due to the fact that both contribute very high amounts of material to the soil). It is therefore quite possible that portions of the floor that were only peripheral to these activities have been included with them simply by virtue of their strong signature. Also, if there was any diachronic variation in the organization of these houses, any areas that were ever used for these "strong signature" purposes would probably maintain the chemical signature simply because it is stronger than that of any subsequent or previous activity. Food

Table 1. Characterization of Activity Areas

Area	Signature
Hearth	High Phosphorus, High Potassium
Food Preparation	High Phosphorus, High Calcium, High Strontium
General Activity	High Calcium, High Strontium
Floor	High to Moderate Calcium and Strontium
Cache Pit	High Phosphorus, Low to Moderate Calcium, Strontium, and Potassium
Sleeping Platform	Lower Values for all Elements

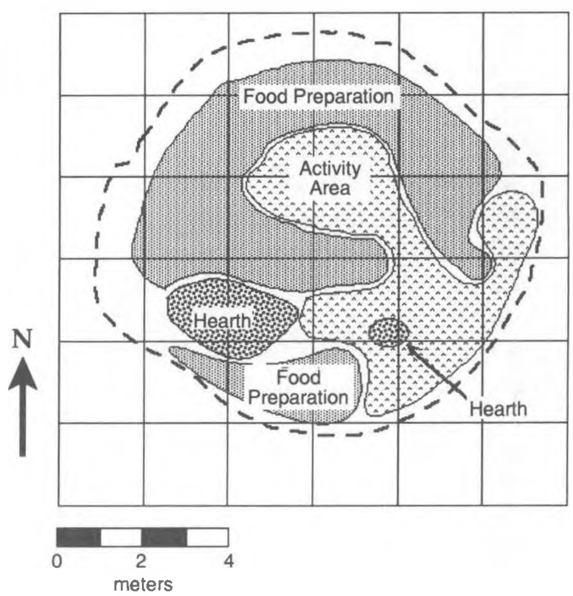

Figure 18. Chemically identified activity areas, HP 3.

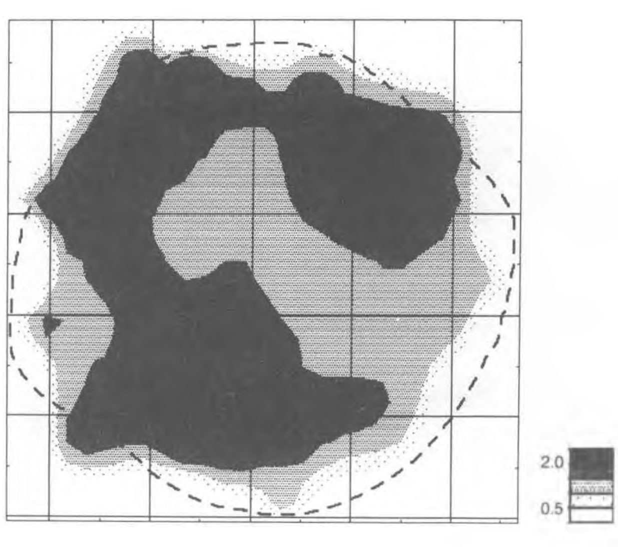

Figure 17. Concentrations (log ppm) of calcium, HP 3.

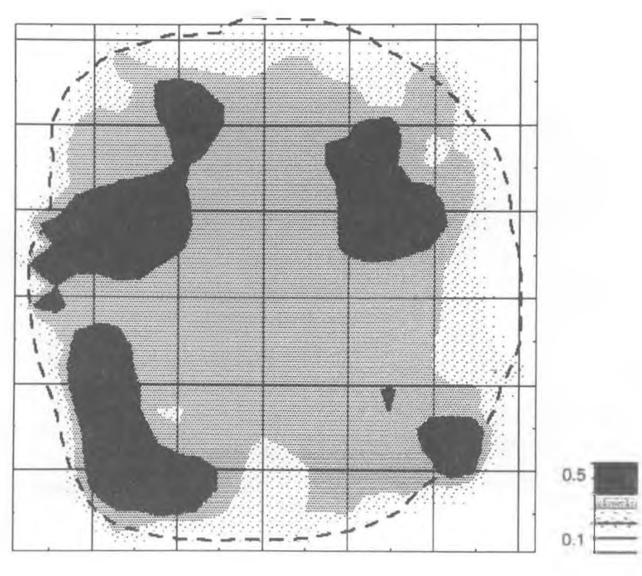

Figure 19. Concentrations (log ppm) of phosphorus, HP 7.

preparation and hearths, then, may be over represented in the chemically identified activity areas.

The differences in the patterning of chemical residues between the two levels of HP 9 correspond quite well to the differences in the spatial organization identified by the excavators. The differences between the levels also indicate that the chemical residues have remained in situ and were not leached from the upper (Stratum 8) to the lower (Stratum 10) floor.

Much of the variation in the chemical signatures suggests that the organization of the floor, though more or less consistent, was not permanently fixed. Temporary features such as hearths could have been placed wherever space permitted or convenience demanded and the sleeping platforms may have been enlarged, reduced, or moved with fluctuations in household size.

The most interesting differences, however, are between the smaller structures (HP's 9 and 12) and larger structures (HP's 3 and 7). The smaller structures are characterized by single hearths and bilateral organization while the larger structures are characterized by multiple hearths and a more radial organization. Activities in the smaller structures seem to be more concentrated in a single location while there are either multiple or fairly extensive activity areas in the larger structures. This supports the suggestion that the larger structures were multi-family dwellings. HP's 3 and 7 are especially interesting in that they appear to have such extensive food preparation and/or consumption areas.

To summarize the results of this study: multi-element chemical characterization of domestic sediments is a useful technique to identify activity areas and interpret the organization of domestic space. Chemical signatures identified in modern earthen floored houses are found in the Keatley Creek house floors. These signatures correspond to artifactual and feature evidence encountered during the excavation of these house floors; and similar house types are found to be similarly organized. The correspondence between these independent lines of evidence supports the interpretations of household organization made by the excavators as well as confirming the basic integrity of the living floors as unmixed, intact deposits.

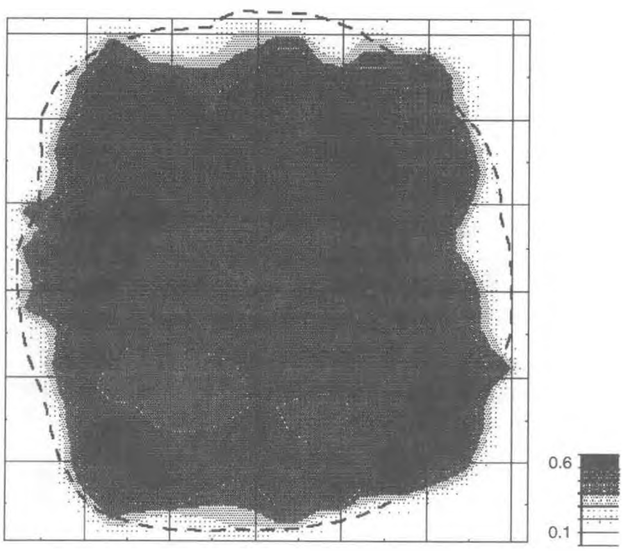

Figure 20. Concentrations (log ppm) of potassium, HP 7.

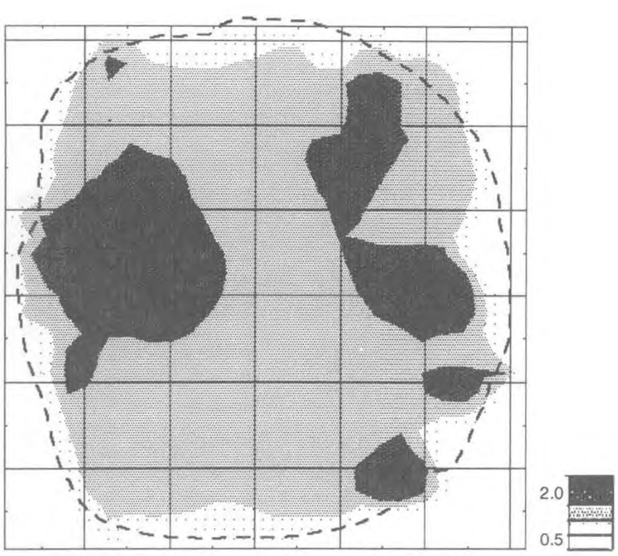

Figure 21. Concentrations (log ppm) of calcium, HP 7.

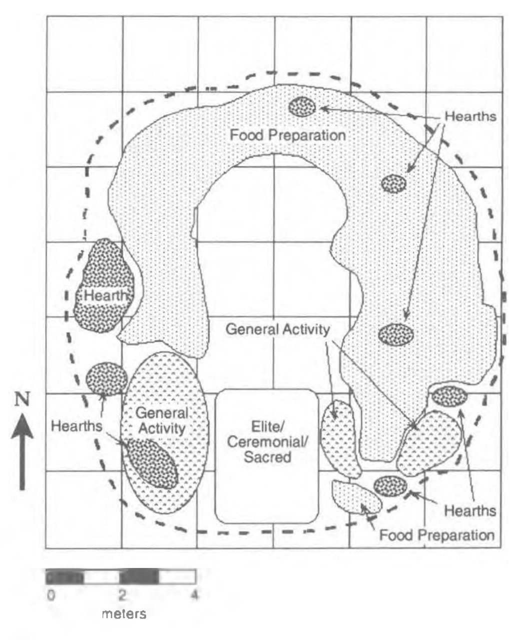

Figure 22. Chemically identified activity areas, HP 7.

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Appendix: Elemental Values and Interpretations for All Samples

House Pit	Location	North	East	P	Ca	Mg	K
HP12	Bench	3.25	2.75	0.15	1.41	0.57	0.44
HP12	Bench	2.25	3.25	0.35	1.31	0.60	0.55
HP12	FoodPrep	1.25	3.25	0.15	1.50	0.68	0.42
HP12	Bench	1.75	4.75	0.15	1.31	0.57	0.45
HP12	Activity	3.75	4.75	0.17	1.03	0.59	0.45
HP12	Bench	2.75	4.75	0.13	1.41	0.53	0.47
HP12	Activity	3.25	5.75	0.13	1.13	0.68	0.42
HP12	FoodPrep	2.75	6.75	0.17	1.50	0.68	0.44
HP12	Activity	2.25	1.75	0.15	1.13	0.66	0.38
HP12	Activity	3.25	1.25	0.11	1.22	0.65	0.26
HP12	Activity	4.25	3.75	0.11	1.31	0.67	0.26
HP12	FoodPrep	5.25	2.25	0.17	1.69	0.61	0.39
HP12	Hearth	5.25	3.75	0.41	2.53	0.63	0.48
HP12	Bench	4.25	5.75	0.15	1.41	0.57	0.34
HP12	FoodPrep	5.75	4.75	0.15	1.78	0.82	0.36
HP12	Activity	5.25	5.75	0.15	1.22	0.61	0.35
HP3	FoodPrep	4.75	6.75	0.17	1.22	0.93	0.44
HP3	FoodPrep	6.25	7.75	0.26	1.59	0.75	0.38
HP3	FoodPrep	7.25	7.75	0.33	1.78	0.75	0.41
HP3	Hearth	2.25	7.75	0.31	1.59	0.80	0.44
HP3	Activity	3.25	7.75	0.22	1.41	0.66	0.36
HP3	FoodPrep	1.25	6.75	0.31	1.59	0.72	0.39
HP3	FoodPrep	0.25	6.75	0.28	1.59	0.68	0.41
HP3	FoodPrep	4.25	5.75	0.20	1.69	0.78	0.46
HP3	Activity	5.75	4.75	0.22	1.13	0.68	0.42
HP3	FoodPrep	4.75	4.75	0.17	1.50	0.68	0.41
HP3	FoodPrep	5.25	5.75	0.20	1.50	0.83	0.40
HP3	Activity	6.25	5.75	0.20	1.41	0.91	0.35
HP3	FoodPrep	7.75	4.75	0.22	1.59	0.83	0.38
HP3	FoodPrep	6.75	4.75	0.22	1.50	0.80	0.41
HP3	Activity	7.25	5.75	0.17	1.41	0.79	0.38
HP3	FoodPrep	3.75	4.25	0.24	1.50	0.62	0.44
HP3	Hearth	2.75	4.75	0.37	1.59	0.64	0.43
HP3	Hearth	3.25	5.75	0.37	1.78	0.83	0.45
HP3	Hearth	1.75	4.75	0.41	1.97	0.69	0.45
HP3	FoodPrep	1.25	5.75	0.35	1.78	0.73	0.39
HP3	FoodPrep	4.25	9.75	0.24	1.50	0.75	0.37
HP3	FoodPrep	5.25	9.75	0.24	1.50	0.69	0.36
HP3	FoodPrep	6.25	9.75	0.26	1.59	0.82	0.37
HP3	FoodPrep	7.25	9.75	0.20	1.69	0.80	0.33
HP3	FoodPrep	4.25	3.75	0.20	1.59	0.75	0.41
HP3	FoodPrep	5.75	2.75	0.24	1.69	0.72	0.46
HP3	FoodPrep	4.75	2.75	0.22	1.50	0.78	0.41
HP3	FoodPrep	5.25	3.75	0.20	1.59	0.76	0.42
HP3	FoodPrep	6.25	3.75	0.22	1.59	0.67	0.45
HP3	FoodPrep	6.75	2.75	0.31	1.78	0.83	0.44
HP3	FoodPrep	7.25	3.75	0.24	1.69	0.83	0.42
HP3	Hearth	2.25	3.75	0.33	1.50	0.72	0.42
HP3	FoodPrep	3.75	2.75	0.26	1.41	0.69	0.39
HP3	Hearth	2.75	2.75	0.28	1.50	0.66	0.45
HP3	Hearth	3.25	3.75	0.31	1.59	0.84	0.40
HP3	FoodPrep	1.75	2.75	0.28	1.69	0.82	0.41
HP3	Activity	4.75	10.75	0.20	1.31	0.57	0.32

House Pit	Location	North	East	P	Ca	Mg	K
HP3	FoodPrep	8.25	5.75	0.31	1.59	0.88	0.39
HP3	FoodPrep	8.75	4.75	0.33	2.06	0.90	0.37
HP3	FoodPrep	9.25	3.75	0.33	2.06	0.80	0.46
HP3	FoodPrep	8.75	7.25	0.33	1.69	0.82	0.38
HP3	FoodPrep	6.25	1.75	0.28	1.97	0.84	0.47
HP3	FoodPrep	3.75	1.75	0.28	1.78	0.68	0.40
HP7	Foodprep	4.25	7.75	0.31	1.13	0.68	0.59
HP7	Activity	2.25	7.75	0.35	1.22	0.52	0.49
HP7	Activity	3.25	7.75	0.33	1.03	0.51	0.44
HP7	Activity	3.75	2.75	0.41	1.31	0.49	0.43
HP7	Hearth	2.75	2.75	0.57	1.50	0.41	0.66
HP7	Activity`	3.25	3.75	0.28	1.03	0.39	0.47
HP7	Activity	4.25	3.75	0.37	1.31	0.59	0.46
HP7	FoodPrep	5.25	3.75	0.37	1.59	0.86	0.57
HP7	Hearth	5.75	9.25	0.39	1.59	0.57	0.64
HP7	FoodPrep	4.75	8.75	0.33	1.22	0.68	0.54
HP7	FoodPrep	3.75	8.75	0.41	1.41	0.73	0.59
HP7	FoodPrep	2.75	8.75	0.37	1.41	0.61	0.60
HP7	FoodPrep	8.75	6.75	0.33	1.41	0.53	0.56
HP7	FoodPrep	9.25	7.75	0.41	1.59	0.73	0.59
HP7	FoodPrep	8.25	9.75	0.44	1.41	0.68	0.59
HP7	Hearth	9.75	8.75	0.48	1.97	0.74	0.60
HP7	FoodPrep	8.75	8.75	0.46	1.50	0.78	0.62
HP7	FoodPrep	9.25	9.75	0.28	1.41	0.81	0.58
HP7	FoodPrep	10.25	7.75	0.37	1.31	0.62	0.57
HP7	Hearth	11.75	6.75	0.37	1.41	0.51	0.64
HP7	FoodPrep	10.75	6.75	0.35	1.50	0.66	0.54
HP7	FoodPrep	9.25	1.75	0.39	1.50	0.67	0.57
HP7	FoodPrep	11.75	2.75	0.39	1.88	0.83	0.56
HP7	FoodPrep	10.75	3.75	0.46	1.50	0.64	0.53
HP7	FoodPrep	10.75	2.75	0.28	1.50	0.80	0.58
HP7	FoodPrep	10.25	9.75	0.31	1.41	0.75	0.45
HP7	FoodPrep	11.75	8.75	0.24	1.50	0.64	0.50
HP7	FoodPrep	10.75	8.75	0.26	1.69	0.67	0.55
HP7	FoodPrep	11.25	9.75	0.33	1.50	0.61	0.53
HP7	FoodPrep	8.75	10.75	0.31	1.31	0.68	0.57
HP7	FoodPrep	4.25	11.75	0.35	1.69	0.76	0.54
HP7	FoodPrep	5.75	10.75	0.26	1.97	0.66	0.57
HP7	FoodPrep	4.75	10.75	0.26	1.31	0.61	0.56
HP7	FoodPrep	6.25	1.75	0.35	1.59	0.79	0.61
HP7	Hearth	7.75	0.75	0.46	1.69	0.57	0.55
HP7	Hearth	6.75	0.75	0.55	1.88	0.68	0.62
HP7	Hearth	7.25	1.75	0.52	1.88	0.68	0.64
HP7	Hearth	4.25	1.75	0.50	1.59	0.69	0.61
HP7	Hearth	5.75	0.75	0.48	1.59	0.62	0.59
HP7	Hearth	3.75	10.75	0.31	1.78	0.63	0.65
HP7	Activity	2.75	10.75	0.52	0.17	0.49	0.61
HP7	Hearth	1.75	2.75	0.50	1.13	0.42	0.60
HP7	Activity	0.75	2.75	0.44	1.22	0.53	0.55
HP7	Hearth	1.25	3.75	0.52	1.41	0.57	0.63
HP7	Hearth	1.75	9.25	0.33	2.25	0.70	0.62
HP7	FoodPrep	1.75	6.75	0.28	1.31	0.72	0.54
HP7	Elite	0.75	6.75	0.35	4.78	0.63	0.59
HP7	FoodPrep	1.25	7.75	0.35	1.41	0.68	0.62

Chapter 7

Zooarchaeological Analysis at Keatley Creek II. Socioeconomy

Karla D. Kusmer

Introduction

One of the goals of the Fraser River Investigations in Corporate Group Archaeology research project was to investigate social and economic organization at the site and within pithouses. In particular, we wanted to understand the internal organization of the pithouses and the role of the different sized residential structures in the socioeconomy. This chapter discusses the patterns of faunal remains on housepit floors and roofs and how they may contribute to our understanding of socioeconomic organization at Keatley Creek. Possible natural processes responsible for the formation of the faunal assemblage are examined in (Vol. I, Chap. 10). Human activities and possible socioeconomic factors responsible for bone distribution and condition within the housepits are considered and discussed in this chapter. Within this context, the spatial distributions of faunal remains, species composition, and species richness from four housepits are examined: a large housepit (HP 7), a medium housepit (HP 3), and two small housepits (HP 12 and HP 9: Stratum VIII).

Clearly defined floor and roof deposits were identified in HP's 7, 3, 12, and 9 on the basis of field criteria. Subsequent faunal analysis indicated little evidence for contamination between deposits (see Vol. I, Chap. 10). Since non-random distributions of remains were apparent, the spatial patterning of faunal remains in floor and roof deposits were examined for evidence of activity, storage, or living areas. The identification of non-random distributions in floor deposits was particularly interesting since floor bones are those at the site most likely to be in primary context and ethnoarchaeological evidence suggests primary refuse will most likely represent the last period prior to abandonment (Bartram et al. 1991; Stevenson 1991). Distributions of faunal remains on the floors of longhouses at Ozette, a Northwest Coast site, have also been used to discern living and activity areas and social status information (Samuels 1991).

As a guide to understanding the socioeconomy of the site and the different sized residential structures, Hayden et al. (1985) hypothesized that Keatley Creek was occupied by residential corporate groups of differing social and economic status. They postulated that the different sized housepits were occupied by groups with different status, wealth, and control. In this scenario, the larger houses should have been occupied by groups with relatively greater status. They also postulated that these larger houses would have maintained greater internal socioeconomic differentiation than the smaller houses because of the range of individuals/families that may be associated with the most powerful residential groups.

With respect to faunal remains, assuming that wealthier groups produce a greater amount of, and more varied refuse, the hypothesis predicts that the larger houses should contain a greater relative density and diversity of remains and a greater number of special or restricted items than the smaller houses. Also, the greater internal socioeconomic differentiation in the larger houses may be reflected through the division of the floor into separate areas used by distinct domestic groups. This can be distinguished by the regular, repeated patterning of animal remains across the floor suggesting similar use of animal goods in each area. Differences in status, wealth, and/or occupation among these groups may be reflected by the presence of special or restricted items associated with only some of the groups. The absence of regular, repeated patterning of remains would suggest that internal domestic groups were less pronounced, and that activities were more communal. With these predictions in mind, the goal of the faunal analysis was to examine and compare the patterning and characteristics of animal remains within different-sized housepits.

Bartram et al. (1991) have shown with ethnoarchaeological data that distributions of bone refuse may be the result of three factors: 1) the locations of activities producing bone refuse, 2) the intensity of secondary disposal activities, and 3) the intensity of other post-depositional (i.e., trampling, dogs) and post-occupational taphonomic factors. Consumption, butchering, and marrow processing activities seem to be the most important factors determining the location of primary refuse (Bartram et al. 1991; Hayden 1979; O'Connell et al. 1988; Yellen 1977). Recent ethnoarchaeological research also suggests that animal food preparation areas are characterized by relatively high concentrations of larger bones (>25 mm) and that traffic areas are characterized by lower bone density and smaller bone fragments (Stahl and Zeidler 1991). Although sweeping may occur in both types of areas, trampling between sweeping events will fragment and incorporate small bones into floor deposits (Stahl and Zeidler 1991 and references therein). Stahl and Zeidler (1991) suggest that bone refuse accumulates in food preparation areas because of higher bone use in these areas, the intensity of trampling, and because the soft matrix around ashy hearths facilitates the incorporation of debris and makes sweeping clean more difficult. Secondary disposal activities were probably intensive at permanent, seasonally reoccupied winter villages such as Keatley Creek. On the other hand, the condition of the bones suggests that post-occupational taphonomic factors such as weathering or carnivore activity were not of great importance within the housepits.

Methods

Faunal remains were recovered from 6.35 mm mesh dry screens of excavated floor and roof deposits and from the heavy fraction of flotation samples from floor deposits, which allowed recovery of bones down to 1 mm in size. All the faunal remains recovered from the 6.35 mm screens were examined. In the large and medium housepits, faunal remains from flotation samples were examined from about 25% of the floor subsquares; about 16% of the remains from the small housepit were examined. Faunal remains from the flotation samples consist of salmon fragments and tiny, unidentifiable mammal fragments. These data add nothing to our knowledge of species present at the site.

Thus, my analysis and discussion of relative frequencies of taxa, taxonomic richness and evenness are based on the data from the 6.35 mm screens. The distributions of fish bones from the flotation samples from the housepit floors are used to supplement discussions of patterning of bones recovered from the larger screens. For the most part, the distributions of remains from the larger screens were similar to the distributions from the flotation samples. Any differences are discussed below.

The Large House: Distribution of Bones from Floor Deposits

The frequency and distribution of bones from floor deposits in HP 7 are presented in Figure 1. Approximately 2,400 bones were recovered from floor and hearth deposits. About 60% of these are fish (*Onchorynchus* sp.) bones, about 5% are identifiable mammal bones (primarily artiodactyl/deer), and about 35% are unidentifiable mammal bone fragments (probably mostly deer [*Odocoileus* sp.]) (Table 1). The non-random distributions strongly suggest that we are dealing with intact floor deposits with little contamination. The distribution of fish remains, in particular, is convincing since small remains appear to be those most likely to reflect original primary refuse patterns (Gifford 1980; O'Connell 1987; Bartram et al. 1991).

The distribution of different size categories of bones, with larger bones occurring primarily towards the periphery of the floor, suggests housecleaning activities kept the floor clear of large debris. Bones in the 0–2 cm size range follow the same general pattern as the total mammal bones (identified and unidentifiable) do. This is to be expected since 75% of the bones fall into this size range. Bones in the 2.1–8 cm size range follow a similar pattern, although more bones occur towards the periphery of the floor, especially in the south and east (Fig. 1). The concentrations within 2 m of the walls may indicate the position of wooden sleeping platforms under which larger pieces of unwanted or unused materials would tend to accumulate or be stored. Only a few bones larger than

8 cm were recovered and most of these occur near the periphery of the floor, where they may have been tossed or stored under benches or against the wall. Two bones, a deer mandible and the dog skull, may have been left shortly before abandonment, or perhaps intentionally placed in a central location in the case of the dog skull.

Burned bones are scattered in low amounts over the floor, with concentrations associated with hearths and fire-reddened areas, again indicating the relatively undisturbed nature of the floor deposits. The percentage of burned mammal bones is higher in the west (73%) than in the east (44%), suggesting differential use of fires and mammal bone processing or consumption practices between the west and east. In the west, fire use may have been more frequent and used to get rid of garbage (the larger hearths support this), and/or mammal bones may have been roasted more in the west. In the east, mammal bones may have been boiled in the small pits, and/or mammals may have been butchered there for cooking in the west.

About 80% of the artiodactyl elements (N=68) from floor deposits are teeth, metapodials, carpals/tarsals, and phalanges. These are the bones that survive destructive forces well (whether natural or cultural) and are also relatively easy to identify as small fragments. Since the condition of the bones and the presence of even the finest fish ribs indicates bone preservation in floor deposits at the site is good, attrition of elements is most likely due to intensive bone reduction due primarily to marrow extraction and grease production and secondarily to housecleaning and trampling. The high degree of bone fragmentation and loss, due to burning, marrow extraction, tool making, clearing of the floor of large debris, and trampling resulted in few identifiable fragments. These identifiable fragments reflect their resistance to the above processes and their relative identifiability as small fragments, rather than reflecting butchering and sharing practices.

The remaining 20% of the artiodactyl bones are as follows. Two clusters of deer foot bones were found on the floor. One cluster of right front foot bones (unbroken) was found associated with a hearth in the south-center and one cluster of left hind foot bones (unbroken) was found at the edge of the floor in the east. A bighorn sheep (*Ovis canadensis*) mandible was found in the north-center and fragments of two deer mandibles, one femur, and one humerus were found in the northeast. In the southeast, two deer scapulae,

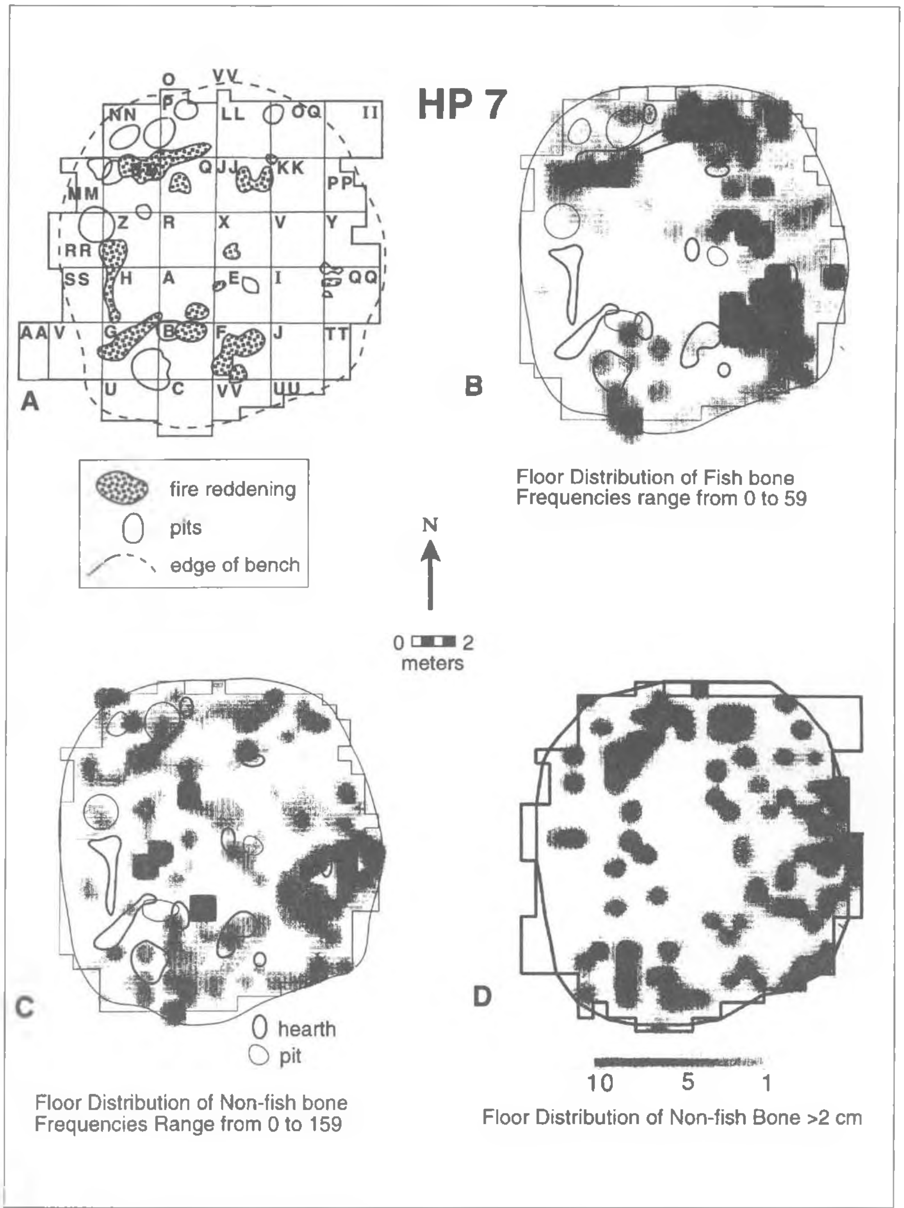

Figure 1. Distributions of faunal remains on the floor of the large housepit (HP 7): fish, non-fish, non-fish > 2 cm.

one mandible, one humerus, one rib, and two sternums were recovered. Differential access to parts of the skeleton cannot be ascertained from the data because of the low number of identified elements and likelihood of redeposition of large remains after food preparation and consumption. The types of skeletal elements present indicate all parts of artiodactyls were utilized in the pithouse, suggesting winter kills within a few kilometers of the site. Ethnoarchaeological evidence suggests axial parts and phalanges in primary context may reflect post-butchery consumption areas because these parts take more time to process for consumption (Bartram et al. 1991). The location of these elements on the floor may therefore support other evidence for consumption areas. The clusters of unbroken foot bones, however, could be the remains of ritual paraphernalia.

Four areas on the floor contain high frequencies of fish, along with less distinct concentrations of mammal bone (primarily artiodactyl/deer) (Fig. 1). These fish concentrations are also well represented in the flotation samples. The only difference is a cluster of fish bones along the wall in the southwest which shows up in the flotation sample, but not in the larger bone sample. This area also has many tiny, identifiable fragments and may have been an area of heavy trampling or extreme bone reduction.

Fish bone concentrations in the northwest, southeast, and south/southwest are associated with large storage pits and hearths. In the south/southwest there is also a concentration of mammal remains. A small concentration of artiodactyl remains and unidentifiable mammal fragments in the northwest is associated with a fire-reddened area and suggests consumption here. In the northwest, in addition to the fish and artiodactyl, are the remains of grizzly bear (*Ursus arctos*), red fox (*Vulpes vulpes*), and bighorn sheep (*Ovis canadensis*), found only in this area. Also, the large pits in this area contain unusual remains such as a dog burial, hawk wing bones, and trade shells (dentalium and *dogwinkle*).

Scattered fish are present in the northeast and artiodactyl bones here are near a small hearth which contains little lithic debitage and fire cracked rock. Since small bone fragments are relatively rare in the northeast, marrow processing apparently did not occur here frequently and food may have been brought into this area in edible units, rather than butchered here. The presence of two deer mandibles and a number of phalanges supports the idea of a post-butchering consumption area (Bartram et al. 1991). The mammal and fish bones may be refuse tossed aside from people working in the area. An abundance of beaver incisors in the northeast may indicate a locus of woodworking.

In the southeast, the artiodactyl concentration is relatively high, as is the fish density. Fish consumption seems to have been particularly high in this area. The presence of both axial and appendicular artiodactyl fragments near the hearth suggests these animals were consumed here also. Hare (*Lepus americanus*) and grouse (Tetraonidae) remains occur only in this area. Small pits suitable for boiling and hearths suggest food preparation activities occurred here. This area also contains moderately dense fire cracked rock and debitage. The presence of more types of artiodactyl skeletal elements here than on the rest of the floor suggests that this may have been an important area for reduction of large artiodactyl parts prior to cooking. The relatively high frequency of small bone fragments here compared to the other areas of the floor further suggest processing for marrow extraction and grease in this area.

In the south/southwest, where debitage and fire cracked rock are found in low quantities, artiodactyl remains in association with hearths suggest deer were consumed. Fish in the area in association with a large storage pit and probably reflect the fish storage function of the pit.

Each of these four areas, in the northwest, northeast, southeast, and south/southwest, likely represents discrete activity areas for animal consumption and/or processing. This repeated patterning of remains also suggests the presence of independent domestic groups within this structure. Based on the presence of rare faunal remains and major storage pits and hearths, the group occupying the northwest may have held relatively high status. In the southeast, the concentration of artiodactyl remains, along with extensive fish bones and hare and grouse, may indicate greater access to animals due to proficient hunting or socioeconomic status within the house, or it may indicate an especially intensively used food preparation and consumption area.

The Large House: Distribution of Bones from Roof Deposits

About 3,050 bones were recovered from roof deposits in HP 7. Ten percent are fish bones, 8% are identified non-fish, and 82% are unidentifiable mammal and bird bones (Table 1). Non-random patterning of faunal remains is apparent in the roof deposits, though evidence of historic camp sites indicates many of the dense concentrations of burned artiodactyl bones are post-occupational. Based on the presence of historic artifacts, hearths dug into roof deposits, and surficial concentrations of bones, the roof may be divided into a 2–3 m zone around the perimeter where bones were deposited during the pithouse occupation and a zone in the center of the roof where post-occupation deposition of bones largely occurred. This division was further checked by noting the location of the bones vertically within roof deposits. Bones in the central zone were primarily found within the first 5–10 cm (roof surface) of deposit. Bones found in the perimeter zone were found primarily below 5–10 cm (i.e., in roof fill and roof bottom deposits).

Fish bones occur almost exclusively in the perimeter zone and almost all of them were recovered from deposits beneath the roof surface. This supports the contention that bones in the outer zone were deposited during occupation, when both fish and mammal debris would likely be thrown up onto the roof or when new roofs were constructed and old living floor deposits were incorporated into the dirt put onto the roofs. The fish bones concentrate primarily in the east, especially in the southeast, with a small cluster in the northwest (Fig. 2).

A number of clusters of identifiable, mammal remains are evident (Fig. 2). The majority of identified bones are artiodactyl/deer, with small amounts of bighorn sheep, beaver, grouse, and hare. The clusters of artiodactyl remains in the northwest, northeast, and east/southeast occur in the zone apparently deposited

Table 1. Taxa recovered from major deposits in HP 3 and HP 7. Numbers are numbers of identified specimens

	HP 7					HP 3			
Taxon	**Floor**	**Roof**	**Rim**	**Pits**[1]	**RF/Rim**[2]	**Floor**	**Roof**	**F. Col.**[3]	**Pits**
Margaritifera falcata	2	4	0	0	0	0	1	0	2
Freshwater shellfish	5	21	5	16	9	2	5	1	0
Nucella sp.	0	0	0	1	0	0	0	0	0
Hinnites giganteus	1	0	0	0	0	0	0	0	0
Dentalium sp.	0	0	1	2	0	0	0	0	0
Oncorhynchus sp.	1,344	319	177	3,161	70	314	14	2	1,713
Accipiter sp.	0	0	0	2	0	0	0	0	1
Buteo sp.	0	0	0	0	0	0	1	0	0
Tetraonidae	4	5	0	1	0	0	0	0	0
Passeriformes	0	0	1	0	2	0	0	0	0
Tyranidae	0	1	0	0	0	0	0	0	0
Bird	0	12	0	3	0	1	2	0	0
Lepus americanus	19	3	2	1	1	0	1	0	0
Tamiasciurus hudsonicus	0	2	0	0	0	0	1	0	0
Castor canadensis	16	8	1	31	2	4	4	0	0
Peromyscus sp.	1	0	0	5	0	0	0	0	0
Neotoma sp.	0	13	0	0	0	0	0	0	0
Microtus sp.	9	4	0	9	0	0	0	0	0
Ondatra zibethica	0	0	1	0	0	0	0	0	0
Canis sp.	1	0	9	1,265	0	41	0	0	1
Vulpes vulpes	1	1	0	0	0	0	0	0	0
Ursus arctos	1	0	0	0	0	0	0	0	0
Martes pennanti	0	1	1	0	0	0	0	0	0
Lynx sp.	0	1	0	0	0	0	0	0	0
Cervus elaphus	1	0	0	1	0	0	0	0	0
Odocoileus sp.	42	75	12	25	10	5	2	4	1
Ovis canadensis	1	3	1	2	3	0	0	0	0
Artiodactyla	27	70	11	13	10	12	18	3	1
Large mammal	176	586	149	77	100	35	29	6	7
Mammal	750	1,917	266	342	105	147	215	137	25
Total	2,401	3,046	637	4,957	312	561	293	153	1,751

1. Medium and large storage pits.
2. Roof/rim deposits on east edge of housepit.
3. Filtered collapse deposits.

during pithouse occupation and almost all of these bones were recovered below the roof surface deposit. The cluster in the southwest occurs nearer the center zone and is associated with a post-occupational hearth. These remains are apparently the result of a post-abandonment hunting camp.

Like the fish and identifiable mammal bones, the unidentifiable bones occur primarily on the eastern side of the roof and distinct clusters are evident (Fig. 2). The clusters in the northwest, northeast, and east/southeast correlate with the identifiable artiodactyl bone clusters within the perimeter zone, and most of the remains were recovered from below roof surface deposits. A number of clusters also occur in the center zone and are associated with surficial hearths and remains. These bones were recovered from roof surface deposits.

Bones in the 0–2 cm size range follow the same pattern as that for all the bones, which is to be expected since 70% of the bones fall into this size range. Bones in the 2.1–8 cm size range follow a similar pattern, as do the few >8 cm bones, except for slightly higher frequencies of larger bones occurring in the northeast.

The patterns of burned bones and artiodactyl elements furnish useful information concerning the depositional and post-depositional processes responsible for the clusters of bones from roof deposits. Although 60% of the total roof bones are burned, only 10% of the bones in the northeast are burned. This is also one of the only areas on the roof where bones other than teeth, metapodials, and phalanges are found. The bone fragments in this area are slightly larger than average roof bones and fragments from artiodactyl humerus, radius, ulna, tibia, scapula, skull, ribs, and vertebrae are found in addition to foot bones and teeth. This is different from most other areas of the roof, where the majority of bones are small, burned fragments, and artiodactyl elements are almost exclusively teeth, metapodial, carpal/tarsal, and phalange fragments. These data, and the location of the bones in the perimeter well below roof surface deposits, suggest that the northeast section of the roof was used for artiodactyl butchering during occupation of the pithouse. A concentration of bones in rim deposits in the north has been interpreted as being the result of refuse dumping and possibly some butchering (Vol. I, Chap. 10).

A major cluster of bones apparently, deposited during pithouse occupation, occurs in the southeast. Forty percent of the bones here are burned, less than the post-occupational concentrations, but more than the cluster in the northeast. Except for the partial skeleton of an immature deer, most of the artiodactyl elements are metapodials, phalanges, and teeth. The characteristics of the bones and the presence of fish indicate this is probably the main area on the roof for disposal of debris from food processing activities which occurred in the pithouse. Rim deposits in the east also contain relatively high amounts of bone that have been interpreted as being the result of refuse dumping, and possibly some butchering.

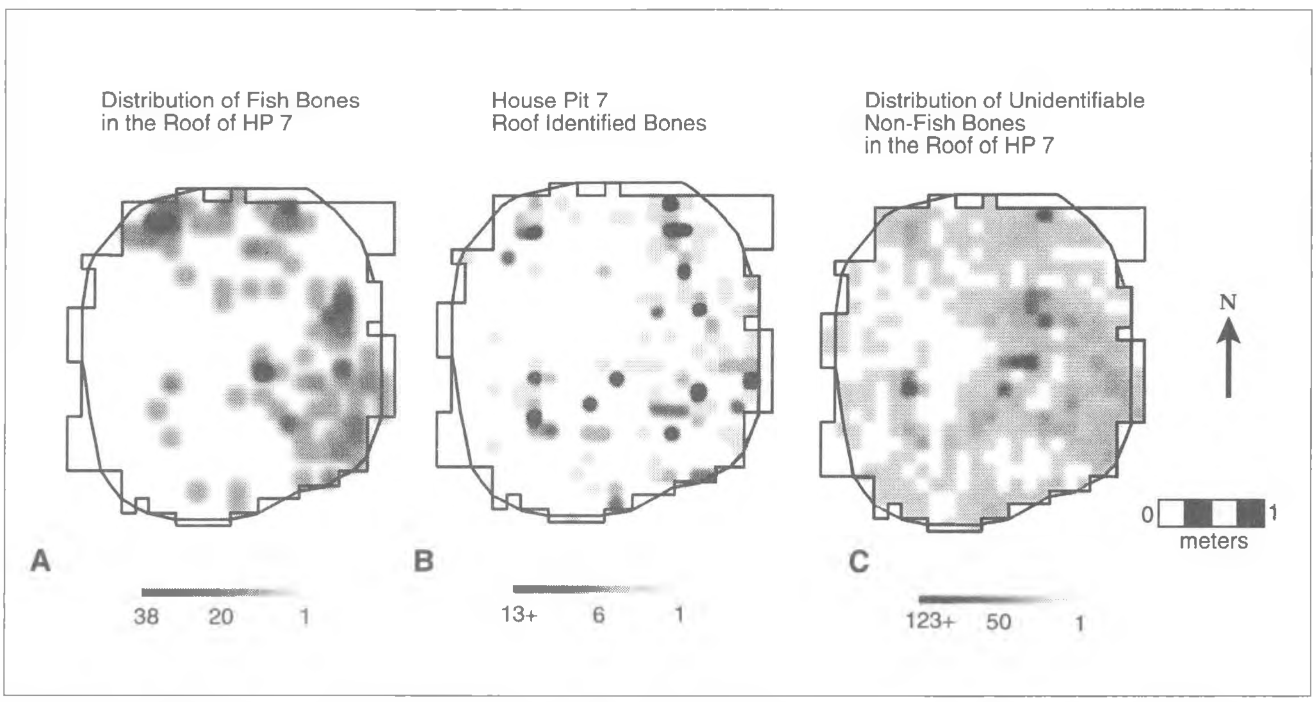

Figure 2. Distributions of faunal remains on the roof of the large housepit (HP 7): fish, identifiable non-fish, unidentifiable non-fish.

The other cluster, apparently deposited during pithouse occupation, appears to be a small refuse dump also. In the northwest, 70% of the bones are burned, there is a cluster of fish bones, and artiodactyl elements consist of phalanges, carpals/tarsals, and metapodials. The presence of a concentration of fire cracked rock in this area supports this interpretation (Vol. I, Chap. 14).

The clusters of bones in the center zone, deposited after abandonment, are mostly burned, small fragments. The identifiable artiodactyl elements are primarily those that would survive butchering and burning and retain identifiability (teeth, metapodials, phalanges). Contextual information indicates these clusters of burned bones probably represent debris from post-occupational hunting camps.

Over 90% of the roof bones from which the type of break could be discerned (generally non-burned, larger fragments) exhibit spiral fractures or step-fractures. This suggests most bones were broken while fresh, probably during butchering (on the roof in the northeast, and in the house) and/or tool making. The majority of identified artiodactyl skeletal elements (73%) are teeth, metapodials, carpals/tarsals, and phalanges, which are relatively easy to identify when fragmented and also survive well. All skeletal elements are heavily fragmented corroborating evidence from the floor that intense bone reduction activity occurred, probably for marrow and grease extraction. Langemann (1987) also suggests intensive bone reduction activities occurred at other pithouse sites around Lillooet. Weathering processes probably also contributed to the fragmentation of some of the roof bones.

The Medium House: Distribution of Bones from Floor Deposits

Approximately 560 bones were recovered from floor deposits in HP 3. Fifty-six percent of these are fish bones, 32% are unidentifiable mammal, and 12% are identifiable mammal (Table 1). As in the large house, most of the remains on the floor are small, suggesting the inhabitants were keeping the activity area clear of large debris. The largest bones occur most often near the periphery, except for a partially articulated post-cranial canid skeleton found on the floor in the west-center area.

The mammal remains on the floor are extremely reduced, as in the large house, meaning that much information concerning artiodactyl butchering and distribution of meat has been lost. Only 17 artiodactyl/deer elements were identified and 53% were metapodials, carpals/tarsals, phalanges, and teeth (elements that survive fragmentation well). A scatter in the east also includes fragments of antler, humerus, vertebra, and sternum.

Fish bones occur around the perimeter of the floor, except for the southeast (Fig. 3). Articulated salmon remains occur near the walls in the east and in the north, suggesting these were areas of little trampling, perhaps under benches. This distribution is similar to the fish distribution from the flotation samples, except more fish were recovered from flotation samples from the northeast. The presence of tiny fish fragments here may be due to heavy trampling. Fish concentrations in the north and southwest are associated with fire-reddened areas. The bottom of a small storage pit was filled with numerous articulated vertebral columns of pink salmon (Vol. I, Chap. 10).

The two largest non-fish concentrations near the west-center are portions of an immature dog (*Canis* sp.) skeleton (Fig. 3). The dog skeleton was found in the top of the floor deposits and may have been deposited during the terminal occupation or shortly after abandonment. The burning of the housepit and the occurrence of a dog skull in a similar position on the floor of the large house (HP 7) suggest that its deposition was an intentional act during the terminal occupation of the housepit.

Other non-fish bones (primarily artiodactyl/deer) are found in the highest frequencies in the north and east/center of the floor, with lightly scattered remains across much of the floor (Fig. 3). The concentration of artiodactyl (and fish) in the east is associated with a small storage pit and fire-reddened areas and may also represent a food processing area. However, a small number of bones in this area, including artiodactyl bones, are larger than other floor bones. Their size and location against the house wall suggests that these bones may represent debris from housecleaning activities. Surprisingly, there are few faunal remains near the large hearth in the southwest.

The patterning of faunal remains, fire cracked rock, and the presence of only one to two hearths on the floor in the medium house suggests that two (possibly three) areas near hearths and storage pits were used in a relatively communal fashion for animal food preparation and consumption rather than distinct social subgroups performing the same animal food-related activities. The fish concentrations associated with fire-reddened areas may represent two discrete fish consumption/processing areas in the north and southwest.

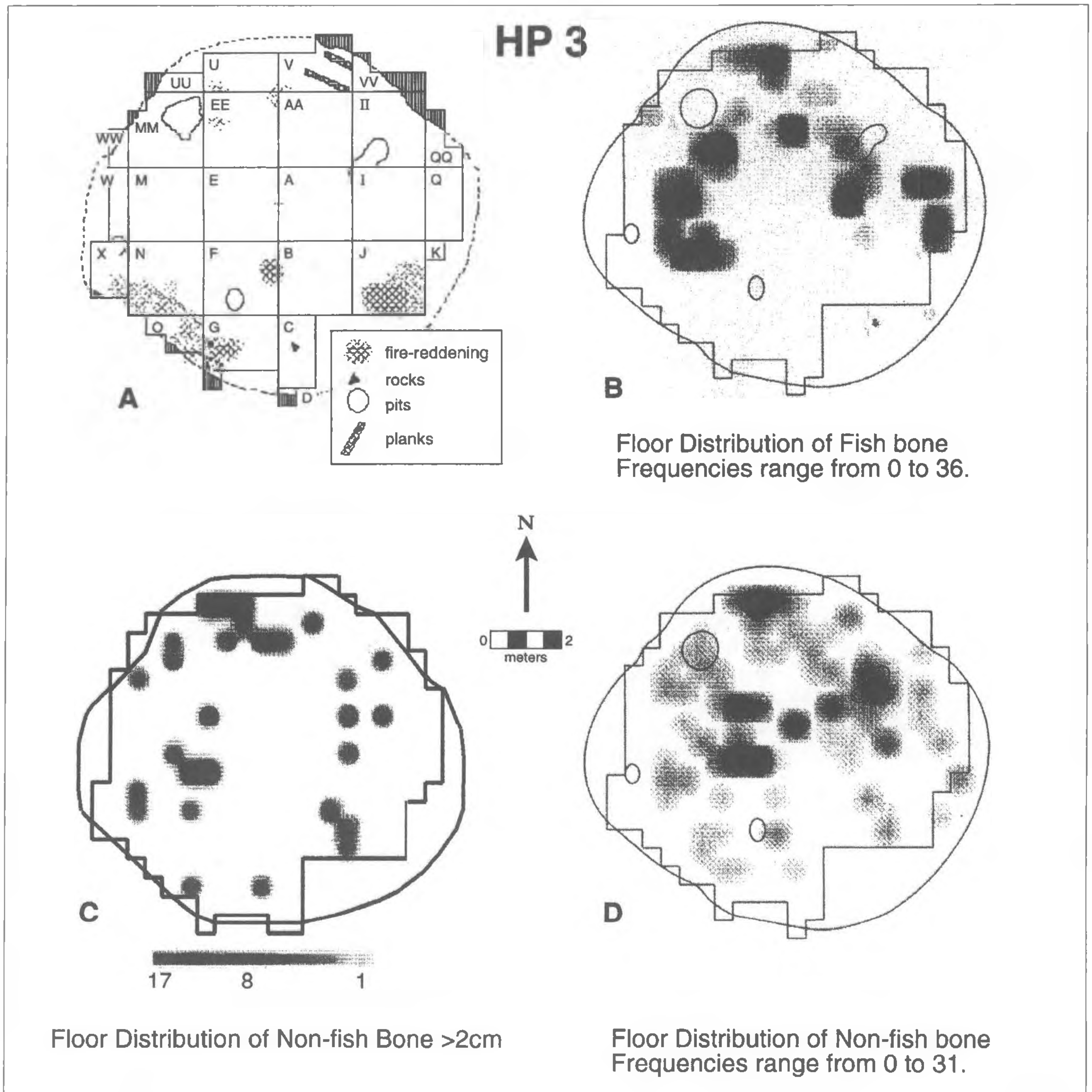

Figure 3. Distributions of faunal remains on the floor of the medium housepit (HP 3): fish, non-fish > 2 cm, non-fish.

The Medium House: Distribution of Bones from Roof Deposits

Approximately 300 bones were recovered from roof deposits. Five percent of these are fish bones, 11% are identifiable mammal, and 84% are unidentifiable mammal (Table 1). As in the large house, non-random clusters of faunal remains are present around the periphery of the roof.

The identifiable remains and bone artifacts clearly cluster around the edges of the roof, especially in the southwest, northwest, and northeast (Fig. 4). This peripheral pattern confirms inferences concerning the peripheral roof deposits in the large house since there is no evidence of post-occupational camps in the medium house. Fish remains and artiodactyl remains (all identified artiodactyl are deer) are found in each of the clusters in small amounts. More bones occur in the north than in the south. The artiodactyl elements (N=20) are all metapodials, carpal/tarsals, phalanges, or teeth, except for a few rib and antler fragments, indicating that survivability had the dominant influence on the pattern of element occurrence and that bone reduction was intensive.

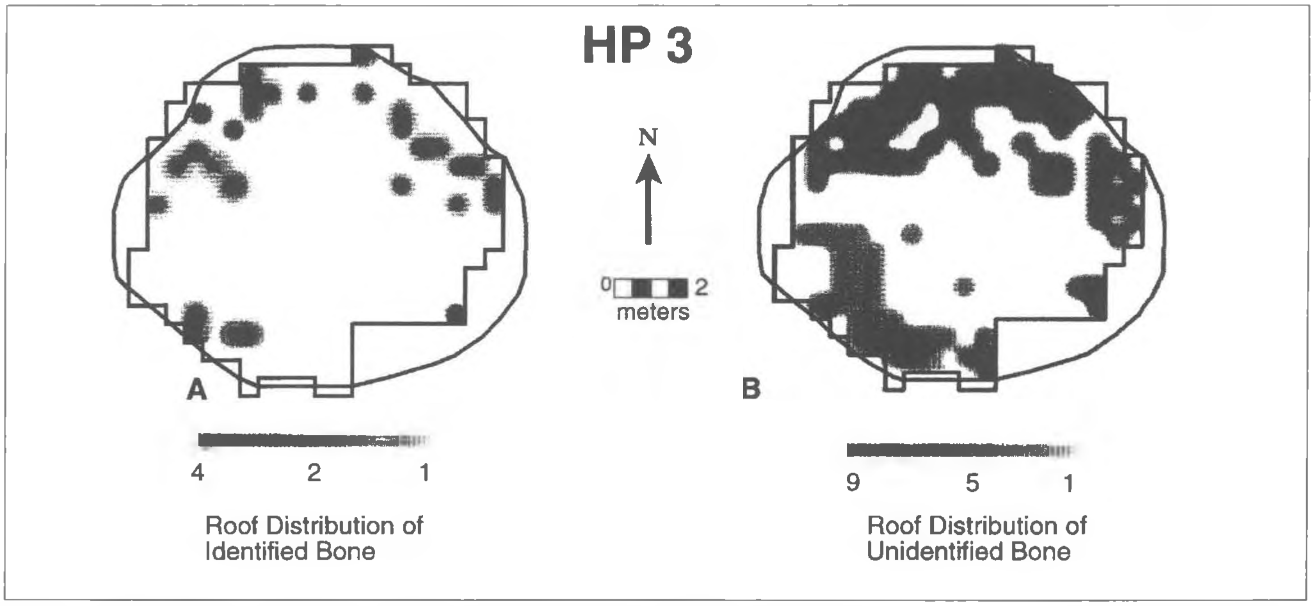

Figure 4. Distributions of faunal remains on the roof of the medium housepit (HP 3): identifiable bones (including fish), unidentifiable bones.

The unidentifiable remains follow the same pattern (Fig. 4) as the identifiable. Most remains occur around the periphery in the north, northwest, and northeast, with a cluster in the southwest. Bones in the 0–2 cm size range and in the 2.1–8 cm size range follow the same pattern, indicating there is no special area where larger bones occur. Burned bones (about 50% of the bones) are also distributed in the same pattern. Basically, the clusters of bones on the roof all have the same attributes.

The patterning of bones in roof deposits parallels the distribution of fire cracked rock in roof deposits (Vol. I, Chap. 14) suggesting the north half of the roof was used as a dump area for refuse from food preparation activities within the house. The similarity in attributes of bones (size, degree of burning, weathering, and taxa represented) in all areas of the roof, and the distribution of bones around the perimeter of the roof may indicate either that a homogeneous type of bone refuse was systematically discarded on the roof, or that floor deposits were mixed with roof deposits by repeated re-roofing events. Mixing of debris on the roof surface with deeper roof deposits may have occurred during the pulling down of sediments for the final burning of the roof with subsequent additional mixing and slumping of roof sediments as the structure burned. If the deposits do reflect relatively intact patterns, the distributions suggest the perimeter of the roof was used primarily to dump small, partially burned debris from interior food processing/consumption activities. There is no evidence that primary butchering of artiodactyls occurred on or adjacent to the roof. Even if some mixing did take place, it is still clear that debris was preferentially thrown on certain sectors of the roof (in the north and southwest).

Housepit 12: Distribution of Bones from Floor and Roof Deposits

About 630 bones were recovered from HP 12 (Table 2). Nineteen percent came from floor deposits, 42% from roof deposits and 39% from interior pits (prior to the excavation of extensive fish remains found at the bottom of a large pit). In general, most of the mammal remains are sharp, pointed, small bone fragments (i.e., bone splinters) indicating extreme bone reduction.

Twenty-six percent of the floor bones are fish and these are clustered in the northeast corner of the floor (Fig. 5). Fish remains from the flotation samples occur in the northern part of the floor only. The majority of remaining floor bones are small, unidentifiable fragments. They are found primarily in the north half of the floor near a fire-reddened area (Fig. 5). Fourteen percent of the bones are burned.

The distribution of faunal remains on the floor indicates animal food processing activities took place in the northern part of the house. The single concentration of bone and fire cracked rock and single hearth suggests animal food processing activities took place communally in this small house.

About 90% of the roof bones are unidentifiable fragments. Artiodactyl elements were found in roof fill or roof bottom deposits, not near the surface of the roof. Most of the identifiable bones occur in the north part of the roof, with a few in the east (Fig. 5). The unidentifiable bones also occur primarily in the north, with a major cluster occurring in the northwest. The distribution of fire cracked rock also follows this pattern (Vol. I, Chap. 14) indicating a disposal zone with the northwest as the preferred area of the roof to dump refuse. The use of the roof as a refuse area and the use of a large interior pit for initial salmon storage and a subsequent waste retainer indicate disposal activities at this small housepit were similar to that at the larger housepits.

Table 2. Taxa recovered from HP 12 and HP 9 (Stratum VIII). Numbers are numbers of identified specimens.

	HP 12			HP 9
Taxon	Floor	Roof	Pits	VIII
Freshwater shellfish	0	0	0	4
Fish (*Onchorynchus* sp.)	31	10	206	2183
Bird	0	0	0	2
Common loon (*Gavia immer*)	0	0	0	4
Unidentified mammal	81	234	29	296
Beaver (*Castor canadensis*)	3	3	0	6
Vole (*Microtus* sp.)	0	0	0	2
Canid (*Canis* sp.)	0	1	2	1
Artiodactyla	4	11	1	12
Deer (*Odocoileus* sp.)	1	7	4	0
Elk (*Cervus elaphus*)	1	0	0	4
Total	121	266	242	2514

Comparisons between Housepits

One of the reasons HP 7, HP 3, and HP 12 were chosen for analysis was to explore possible causes for the different sizes of housepits at Keatley Creek and assess potential differences between different size pithouses that might be related to socioeconomic status. These three housepits are well suited for this study since they appear to have been occupied at essentially the same time, were residential structures, and the floors were apparently not substantially altered after abandonment (Vol. I, Chap. 17). The large and medium housepit floors were last occupied during the early Kamloops Horizon (ca. 1,000 BP) while the small housepit appears to have been occupied a few hundred years earlier (Vol. I, Chap. 2).

The distribution of faunal remains on the floors of the three housepits becomes increasingly complex as housepit size increases. Two similarities between the houses stand out. First, remains are relatively scarce in the southern parts of the houses and second, remains, especially fish, are virtually absent from the centers of the houses.

The relative frequencies of important taxa from the three housepits are listed in Table 3. The large and medium houses contain similar proportions of fish, canids, artiodactyls, and large mammal bones on the floor, while the small house contains less fish. When floor and roof deposits are considered, fish are slightly more important in the medium than in the large housepit and mammal plus artiodactyl are slightly more important in the large than in the medium or small houses. It appears that the large housepit utilized proportionately more artiodactyl/large mammal than the medium or small housepits.

In terms of average abundance per square meter of floor, the three housepits are significantly different in total number of bones, number of fish bones, and number of mammal bones (ANOVA, $P<0.0001$ in all cases; Table 4). However, in post hoc 2-way comparisons only the large and medium, and the large and small differed significantly (Tukey HSD, $P<0.01$). Thus the large housepit has a significantly greater density of animal remains than the medium and small structures, but the medium and small structures do not differ in terms of average density of remains. Taking size differences into account, the large house contains more fish, artiodactyl, and mammal (including beaver, hare, grouse and canid) remains than the medium and small housepits.

Table 3: Relative frequencies (percentages) of selected animal taxa.

		HP 7	HP 3	HP 12
Relative frequencies of select taxa from total bones in each housepit floor deposit.				
	N =	2,401	561	121
Fish		.56	.56	.26
Canid		<.01	<.01	0
Artiodactyl		.03	.03	.05
Large mammal		.07	.06	.06
Relative frequencies of select taxa from total bones in each housepit floor and roof deposit.				
	N =	5,447	854	387
Fish		.30	.38	.11
Canid		<.01	<.01	<.01
Artiodactyl		.04	.04	.06
Large mammal		.14	.07	.07

When species richness is examined, the large housepit has far more taxa than the medium or small structures (HP 7=18, HP 3=6, HP 12=3). However, the total logged number of specimens for each housepit (not shown) falls on the same line indicating a correlation between assemblage size and number of taxa. Thus, while a larger number of exotic and trade items are found in the large housepit, we may expect more taxa simply because of the relative size of the assemblage. However, since the examined faunal assemblages from the houses are virtually 100% samples of recovered remains identifiable to taxon, sample size effects are not a major issue, behavioral factors should be considered. The presence of more taxa in the large house is probably due to more diverse activities involving animal remains by its inhabitants (i.e., hunting, trade, ritual) compared to the smaller houses.

When species evenness is examined, the three housepits have similar distributions (Fig. 6), and the shapes of the slopes of the three housepits cannot be distinguished statistically (Kolmogorov-Smirnov test, all P values approaching 1.0). The relatively high frequencies of artiodactyl and beaver in the three housepits is notable, as is the absence of shellfish and relative abundance of elk in the small house. With the exception of hare, sheep, and grouse in the large housepit, the large and medium housepits have very similar distributions of remains.

While we have information on only part of the presumed salmon fishery (fish from the fall-fishery stored in underground caches), differences in the species of salmon present between the large and medium and small houses appear to suggest differential access to salmon resources (Vol. II, Chap. 8). Over 90% of the fish in the medium and small houses were found to be pink salmon, while in the large house, a broader range of age-categories of salmon, including mostly pink, but also 3-year-old salmon and a few 4- and 5-year-olds were present. The 3-year-olds probably represent sockeye, although the possibility that they are spring cannot be ruled out (see Vol. II, Chap. 8). Pink salmon spawn in the early fall. Spring and sockeye salmon spawn primarily in the spring and summer, although there is a

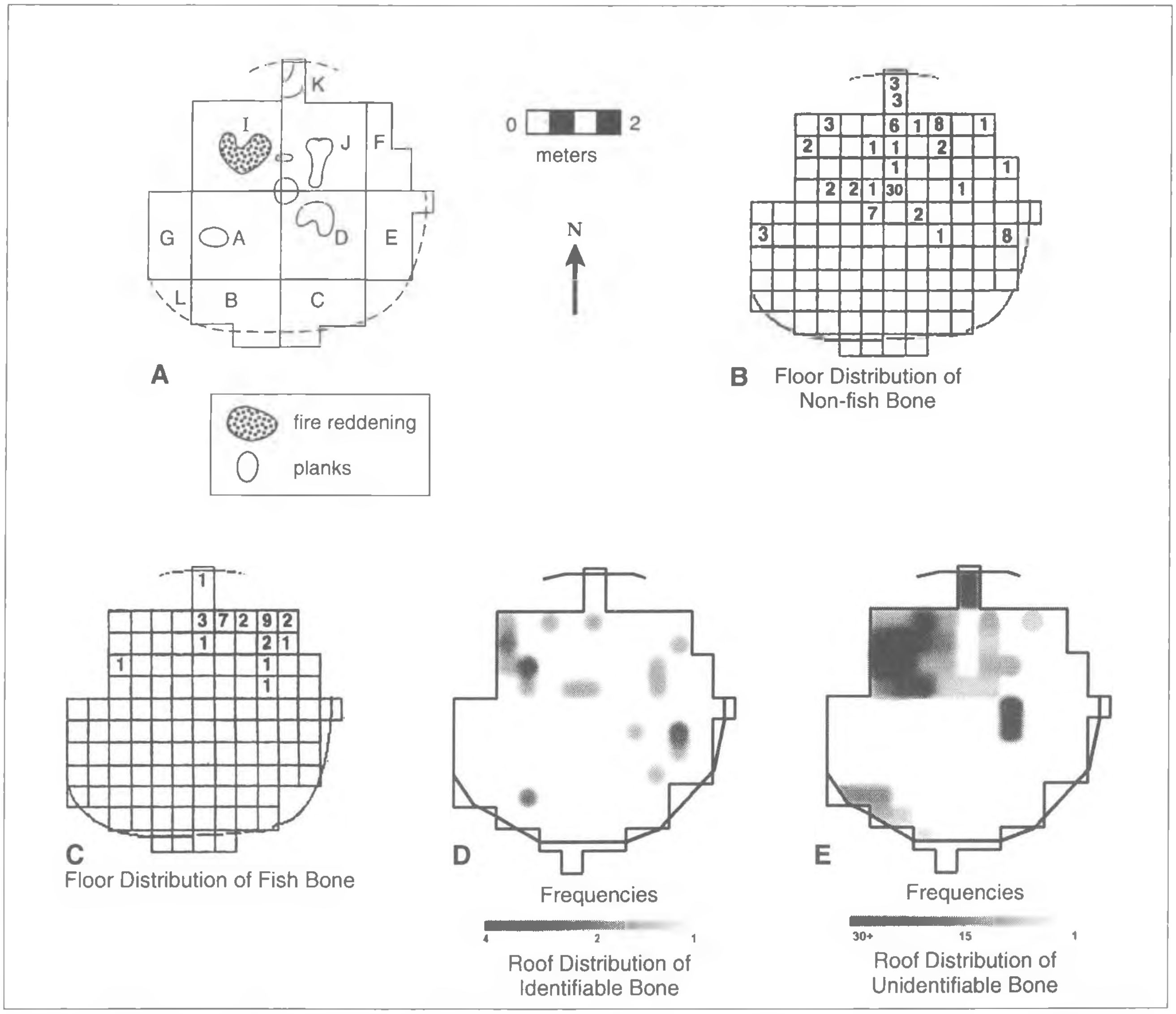

Figure 5. Distributions of faunal remains on the floor and the roof of small housepit (HP 12): fish on floor, non-fish on floor, identifiable bones (including fish) on roof, unidentifiable bones on roof.

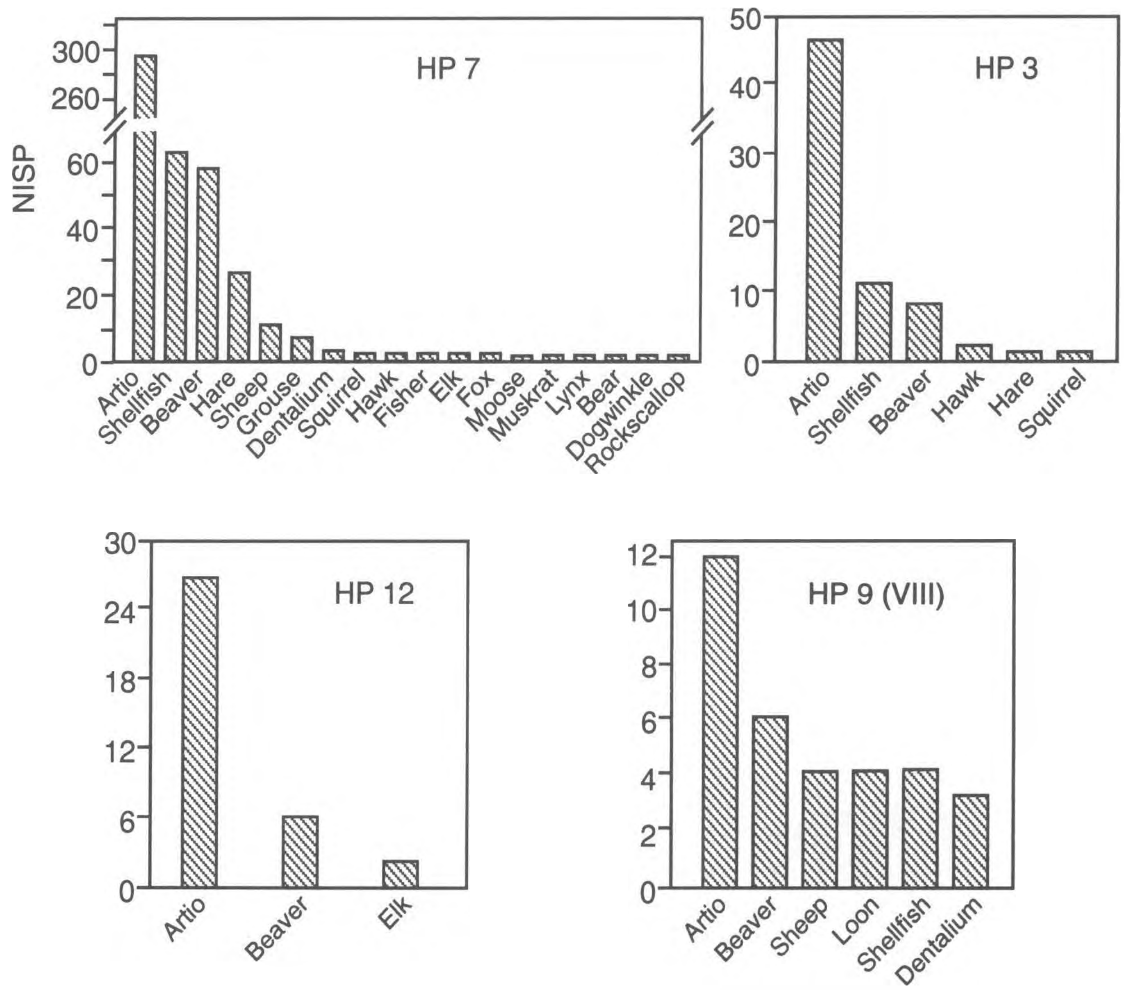

Figure 6. Abundance of faunal taxa from the housepits, excluding fish and dogs. Artiodactyl includes identified deer, elk, and sheep remains. Shellfish means freshwater shellfish.

small sockeye run in November. The presence of sockeye or spring salmon in the large house may be indicative of special access to fishing stations from which species other than pink salmon could be caught.

Ethnographically, important fishing stations were often owned and ownership was associated with privileged access to the most desirable salmon and resulting prestige, although owners had access to public fishing sites as well (Romanoff 1992a). Ownership of the most productive stations, where the most desirable species could be caught in most abundance, generally was an important means of acquiring wealth and status. Thus, it is possible that access to different species of salmon by inhabitants of the large housepit may be related to higher status and wealth. A number of taxa are present in the large housepit which have not been found elsewhere in the site (purple-hinged rock scallop, dogwinkle, fisher, fox, bear, lynx, and moose). The access to special fur-bearing taxa and trade items supports other indications of the possible high status of the inhabitants of the large housepit.

Table 4. Frequencies of selected animal taxa per square meter of floor. Numbers are based on numbers of identified specimens.

	Frequency/Sq. M. Floor Space		
	HP 7	**HP 3**	**HP 12**
Fish	11.9	4.0	0.8
Artiodactyl	0.6	0.2	0.2
Large mammal	1.6	0.4	0.2
Uniden. mammal	6.6	1.9	1.9
Total bones	21.2	7.2	3.1

Housepit 9 (Stratum VIII)

Housepit 9 was excavated after the analysis of fauna from HP's 3, 7, and 12 was completed. However, its fauna is important for understanding variability in small housepits. Like HP 12, HP 9 (Stratum VIII) is a small, completely excavated late transitional Plateau/early Kamloops Horizon floor. This is where the similarities end. Stratum VIII has a larger and more varied assemblage than HP 12 (Table 2). Although species richness correlates with assemblage size for the four examined housepits, the fact that we have virtually 100% samples suggests that other factors are influencing the greater number of taxa present in Stratum VIII compared to HP 12 (Plog and Hegmon 1993). Also, HP 12 and HP 9 (Stratum VIII) approach opposite confidence limits around the regression line (not shown), suggesting again that Stratum VIII has a higher species richness than HP 12. When species evenness is examined (Fig. 6) the HP 9 (Stratum VIII) and HP 12 assemblages do not statistically differ (Kolmogorov-Smirnov test, $p=.944$). Stratum VIII contains more mammal bones per floor space, and a relatively large number of mammalian taxa, with relatively equal importance of representation, than HP 12. Most of the mammal fragments are small and the size range of the fragments is not different from that of the other houses (64% are less than 2 cm, 35% are 2–8 cm, and 1% are greater than 8 cm).

In addition, Stratum VIII has a significantly higher density of fish remains than do the floors of the other three housepits (86% of the assemblage are fish, as opposed to 26% from the HP 12 floor). A large number of these remains are articulated fish spines and ribs, indicating relatively intact fish parts were left on the floor. This suggests little disturbance has occurred to floor deposits since the remains were left and that fish may have been handled or processed differently in Stratum VIII than in HP's 7, 3, and 12. Earlier occupations in HP 9 also contain frequent, articulated fish remains on the floor (Vol. I, Chap. 10), suggesting fish handling in HP 9 did not change through time.

The distributions of fish and non-fish remains in HP 9 (Stratum VIII) indicate that the bones are densest in the southeast part of the floor; and this is where the few large bones were recovered. Remains in the other sections concentrate near the floor periphery and no clear domestic units can be identified with the faunal data. Rather, the southeastern part of the floor may have been used for animal food processing or garbage dumping, while other areas were cleared through trampling and/or cleaning. The presence of concentrated cobbles in the southeast suggests that the accumulated fish and mammal remains in that area are more likely debris from dumped floor material.

The differences between HP 12 and HP 9 (Stratum VIII) could be explained by differences in abandonment conditions and/or differences in usage of the two structures. Differential housecleaning is not probable because the remains from Stratum VIII are not larger than remains from the other structures. It is the frequency of small fragments which differs. HP 9 apparently did not burn down as the other structures discussed here did, supporting the idea that different abandonment conditions contributed to the differences in the remains. Few bones are burned (5%) relative to the other structures (14% in HP 12, 33–50% in the other houses). While this is probably partly due to the fact that the structure did not burn, the lack of fire-reddened areas on the floor suggests bones may have been butchered there for consumption elsewhere and that garbage bones were not put into hearths (or that the hearths were cleared out prior to abandonment), and/or that the fragments are debris from bone toolmaking. Different usage is also suggested on the basis of the artifact analysis. Alexander (Vol. III, Chap. 7) suggests that Stratum VIII was used on an intermittent basis for hideworking and antler processing and preparation for hunts. She notes that the relatively high diversity of stone, bone, and antler artifacts suggests special activities and that some of these suggest high status. The unusual attributes of the faunal assemblage and the presence of loon (*Gavia immer*) bones (found nowhere else at the site), dentalium, and many large antler fragments supports this assessment. The large amount of remains on the floor, particularly in the southeast, suggests small faunal debris was left/dumped on the floor at the time of abandonment, while the unusual faunal assemblage attributes, taxa, and artifacts suggest the structure was used for activities differing from those in HP 12.

Conclusions

In support of our hypothesis, the density and diversity of faunal remains correlates well with housepit size. The largest housepit has the greatest density of remains, followed by the medium housepit. Similarly, faunal species richness was correlated with housepit size. Density of faunal remains across house floors at the Ozette site are also found to correspond to social status differences among the occupants of the structures, although the highest status house contained the least faunal debris (Samuels 1991). This is explained by different housecleaning practices among the occupants of the structures (Samuels 1991).

The largest structure examined at Keatley Creek exhibits regular, repeated patterning of faunal remains. Faunal remains in the large housepit are associated with a number of storage pits and fire-reddened areas, and artiodactyls and fish seem to have been processed and consumed in four distinct areas of the house. In contrast, faunal remains in the medium structure are less discrete, although concentrations of fish associated with fire-reddened areas and storage pits suggest two animal consumption/processing areas within the house. This suggests that activities related to the consumption and processing of animals in this house were more communal than in the large house. The small housepit has the simplest pattern, with a single, diffuse concentration of remains, suggesting that animal processing activities were communal in this structure as well.

The four distinct consumption/processing areas associated with storage pits and hearths indicate the presence of four domestic groups in the large housepit. These faunal consumption/processing areas are distinguishable form each other by the presence of special faunal items or evidence for distinct types of activities, such as woodworking. This suggests differential socioeconomic rank among the four domestic groups in the large house.

The presence of more artiodactyl in the large house may indicate differential access to deer and the presence of dog remains in the large house, apparently treated in a special way, may be related to the use of hunting dogs documented ethnographically. Ethnographically, hunters were afforded high status and wealth (Romanoff 1992b). There were few formal hunters because it required a great deal of difficult training and energy output. Also, deer may have been a very important source of protein during times when salmon runs failed, when salmon stores were depleted, or when salmon stores went rancid (Romanoff 1992b).

The patterning and size distributions of remains on the floors of the large, medium, and small housepits indicate housecleaning activities and trampling kept the floors relatively clear of large debris and suggest that most of the remaining fragments were in primary context. The small remains from floor deposits were useful for discerning probable living and animal processing areas within housepits, as Stahl and Zeidler (1991), among others, have predicted from ethnoarchaeological research. Also, the patterning of remains from roof deposits yielded information concerning refuse dumping and butchering areas.

Most mammal remains recovered from all housepit deposits at Keatley Creek were highly fragmented, probably for marrow extraction and bone tool manufacturing. In addition, evidence for cleaning up of large bone fragments from the floors implies that any large bone remains originally left on the floors were removed. Thus, much of the detail concerning butchering patterns and sharing of parts of artiodactyls within the pithouses is lost, although the few deer obtained in the winter appear to have been widely shared in the houses.

The faunal data support the hypothesis that larger residential housepits will exhibit greater internal socioeconomic differences than smaller housepits. The regular, repeated patterning of faunal remains on the floor of the largest housepit indicate that it was divided into distinct domestic groups. These subgroups exhibit variability with respect to the characteristics of animal remains, some of which may be attributable to variability in socioeconomic ranking within the house. Inhabitants of the medium-sized housepit appear to have processed and consumed animal food communally in a few areas of the house and there are no indications of status differences related to animal remains. Inhabitants of the small housepit appear to have processed and consumed animal food communally as might be expected of several closely related nuclear families or a cooperating extended family.

The faunal data also support the hypothesis that housepit size correlates with socioeconomic status. The large housepit has the greatest density and diversity of remains, and has particularly high densities of artiodactyl, fish and dog. Differences in species richness indicate that more diverse activities took place in the largest housepit. These data, apparently less communal animal food processing, and special access to exotics and trade items, suggest that the large housepit was a relatively wealthy household compared to the medium and small houses and that the wealthy inhabitants may have included hunters. The suggested access to different species of salmon in the large housepit may be another indication of higher status and wealth.

The faunal assemblage from HP 9, Stratum VIII, a housepit floor similar in size and time of occupation to the small housepit, suggests that this small pithouse was used for different activities than the other houses. It may have been used as a special purpose structure rather than primarily as a dwelling, and suggested animal-related activities include antler-tool processing and artiodactyl butchering. The assemblage contains items that suggest the structure was used by high-status individuals.

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Chapter 8

Prehistoric Salmon Utilization at Keatley Creek

Kevin Berry

Introduction

This analysis of prehistoric salmon remains from near Lillooet, British Columbia shows how salmon species were differentially used within one prehistoric community and how salmon utilization has changed from prehistoric to historic times. The documentation of differential use of salmon species between housepits is one of the most important ways of investigating socioeconomic organization due to the high value of some species and the low value of others. Five species of salmon make their way up the river systems of Northwest North America each year to spawn. Each of these species played a unique role in the cultures of various peoples in the Pactfic Northwest. Within the Plateau Pithouse Tradition on the Canadian Plateau, dependence upon local salmon resources has been identified as one of the main characteristics of the culture (Richards and Rousseau 1987).

These anadramous fish exhibit very predictable behavior, at least in terms of such things as subsistence, mobility and seasonality. Each of these species of salmon exhibit unique qualities which influence the ways in which a culture might procure, process, and use the fish. Such qualities as fat content, difficulty of catching the fish, the season of spawning, the number of fish of each species which return up the river each year, the size of the fish, and even the taste are important traits. These differences can dictate which species are used, how fish are processed (drying, filleting, immediate consumption, extraction of salmon oil, pulverization) and how they are preserved and stored (Kennedy and Bouchard 1992; Romanoff 1992). Given these considerations it is reasonable to assume that certain species would be more desirable than others, and we know that ethnographically such things as status and inherited rights were related to the harvesting of specific species from owned locations (Romanoff 1985). It is the question of whether this cultural practice existed in prehistoric times on the British Columbian Plateau to which this study is oriented.

Methodology

Most fish accrete new bone material to their vertebra as they grow and develop throughout their lifespan. In temperate environments a fish will experience different rates of growth between summer and winter, creating rings which may be seen on a vertebrae. These rings are formed by the slower growth rate in winter leaving a narrower, more dense structure, and the summer growth being seen as a wider, less dense ring (Casteel 1976).

The occurrence of annual growth rings on fish vertebrae was first recognized over two hundred years ago. This trait has since been noted as a potential tool in estimating seasonality through either visual examination of the vertebrae in some cases, or by thin

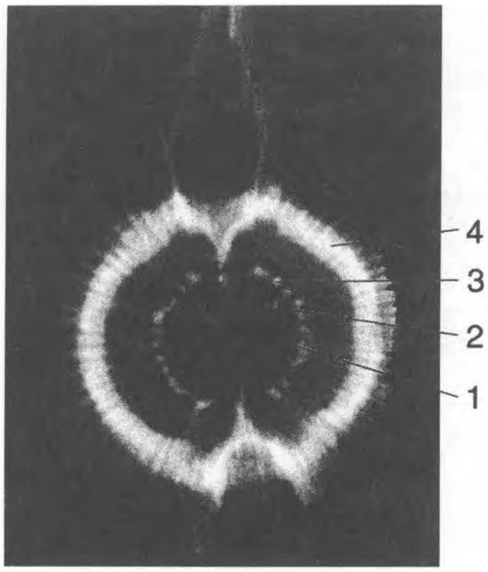

Figure 1. A four-year-old salmon vertebrae from the Keatley Creek site showing four winter growth rings.

sectioning, polishing and examining under a microscope in others (Casteel 1976). This phenomenon had not been exploited much by archaeologists until a recent study by Cannon (1988) used radiography in an attempt to differentiate species within a collection of salmon vertebrae from the Namu Site on the Central B.C. coast. The growth annuli on the vertebrae was quite readily visible with the dense winter rings appearing as white (radio-opaque), and the less dense summer rings seen as dark (radiolucent). Cannon verified that these rings were in fact measuring the age of the fish by correlating his test results on known comparative specimens of salmon, comparing ages based on vertebrae to those determined using scales, and by comparing weight estimates based on each ring to known average weights (Fig. 1). Cannon's study seems to indicate that this method is quite efficient for determining the biological age of large numbers of vertebrae. Because each species of salmon has a distinctive age range during which it will spawn, the study of large samples from riverine locations can allow inferences to be made as to the species of salmon represented and hence the season, nutritional value, and necessary fishing technologies.

Oncorhynchus sp. (Pacific Salmon)

Pink salmon *(Oncorhynchus gorbuscha* also known as Humpback), invariably spawn at two years of age during the months of September and October. They are found in most river systems from California to Alaska and are generally a weak fish, not being able to traverse more than four or five hundred miles upriver. Because they are not generally strong swimmers, pink salmon may commonly be found near the banks of fast moving sections of the river. Pink salmon are not a preferred species by natives and ethnographically these salmon seemed to be quite insignificant to the everyday diet of the Interior peoples (Romanoff 1985; Teit 1906; 1909). Often this aversion to pinks has been attributed to their small size and their lack of taste when compared to the spring and the sockeye, although it is acknowledged that they are one of the easiest fish to catch and to dry, probably second only to the chum in their qualities of preservation.

Spring salmon (O. *tshawytscha*, also known as king, chinook, or tyee) spawn at three to eight years of age, but most commonly at four or five years old. In the Fraser River the two main runs occur in March–April and in late summer (August–September). Spring salmon are also found throughout the Northwest Coast and, being strong swimmers, they may travel well over a thousand miles upriver. These salmon will almost always stick to the deeper and/or swifter parts of the river and thus are the most difficult to catch. These fish are the largest of all the salmon, and also one of the most preferred by natives. They are generally quite oily and generally require more attention in the processing and drying stages than any other species. Ethnographically among the Lillooet they were the most valued of fish and the locations at which these fish could be caught were generally owned. Because of their size, strength, and habitat, these salmon required a more complex fishing technology than any other species (Romanoff 1985).

Sockeye salmon (O. *nerka*, also called bluebacks or red salmon) usually spawn at four or five years, although they have been reported as old as eight years of age on occasion. The sockeye salmon spawn as far as 650 miles up the Fraser River from June to November, peaking in July. These salmon are relatively strong swimmers and are able to navigate quite strong rapids, similar to the spring salmon. In terms of desirability among the peoples of the Fraser River, these fish were and are second only to the spring salmon. Some individuals would argue in favor of these fish above all others in terms of their balanced oil content and rich flavor. This factor also makes the drying of sockeye difficult, and many ethnographers note that this type of salmon is often immediately consumed or traded (Romanoff 1985; Bennett 1973; Kennedy and Bouchard 1978).

Chum salmon (O. *keta* also called dog salmon) usually spawn in the northern areas of their range at five years of age, and in some central and southern areas such as the Fraser River system, they are more commonly present at four years of age, although five-year-olds may be found. Chum salmon spawn quite late, in

October and November, following the pink runs. These fish are not commonly found any great distance from the salt water, however, in the Yukon river they do travel over 2,000 miles upriver. They do not run more than 200 miles up the Fraser at the present time, although this may not have always been the case (Healy 1986). The popularity of this fish varies throughout the Northwest, some scorn it as a tasteless fish, while others praise it for its preservation qualities. Boas (1921) observed that the chum dried to the point that it resembled a board; he noted it also tasted like one.

Finally, coho salmon (O. *kisutch*, also known as silver salmon) invariably return upriver to spawn at three years of age, in November and December. This species of salmon is found in nearly all accessible rivers in the Northwest. However, they are not commonly found in the upper reaches of the Fraser, although some are occasionally caught. Coho are slightly larger than pink salmon and their preservation qualities are considered to be average (Romanoff 1985). The preceding biological data regarding salmon characteristics are taken from Healy (1986), Cannon (1988), and Bennett (1973).

The Keatley Creek Site

Based largely on ethnographies by James Teit (1906) it is assumed that the prehistoric occupants of the Keatley Creek site were moving between fishing camps by the river in the summer and the pithouse village in the winter. At present no substantial fishing stations have been identified in the immediate vicinity of the Keatley Creek site, but there are important fishing stations several miles to both the north and south of the site. The rapids located near Fountain (10 Mile Rapids), about four miles south of the site have been recognized as one of the most important salmon procurement sites in the region (Romanoff 1985). It was from here and the rapids at Bridge River farther south that both fresh and dried salmon were traded to other groups for various products, ranging from oolichan oil and dentalium shells to obsidian (Teit 1906; Romanoff 1985). The rapids here are such that a wide cross-section of the available salmon resources may be easily obtained, and there are numerous archaeological sites adjacent to the rapids, including the Fountain, Bridge River and Bell sites.

Salmon remains at the Keatley Creek site are found in three basic contexts: 1) as isolated individual bones found on occasion in floor fill, roof deposits, pits, or posthole fill; 2) as partially articulated backbones or individual vertebrae or other bones (usually post-cranial) in living floor contexts and; 3) as groups of articulated remains in pit contexts (often with ribs, rays, and sometimes cranial remains). This indicates that the salmon remains found at the site are either refuse or stored salmon which was never recovered. For the purposes of this study it was decided to examine the salmon remains from three housepits which had been completely excavated, and two housepits which had been tested, having storage pits containing large quantities of articulated salmon remains. A wide range of different size housepits was excavated in order to determine if there were any differences in wealth, resource use, or hierarchical organization in small versus large housepits. One of the possible differences between large and small housepits was postulated to be in salmon use. Two of the housepits analyzed were quite large (HP's 1 and 7 are about 20 m in diameter), two were of a medium size (HP's 3 and 6 are about 12 m in diameter), and one was relatively small (HP 12 being about 6 m in diameter). These housepits all represent early Kamloops Horizon occupations (ca. 1,200 BP).

From the three completely excavated housepits, all the remains from floor contexts as well as all remains from abandoned storage pits inside the dwelling were analyzed. By abandoned storage pit it is meant only those pits which had some of their contents remaining, including fully articulated salmon vertebral remains. Other pit and posthole fill contexts were not examined. The radiographs for this study were produced using the H.G. Fischer model FP200 portable x-ray unit in the Department of Archaeology, Simon Fraser University. After preliminary tests it was decided that an output of 80 keV x-rays, at 15 mA, at 60 cm, for 1.5 seconds would best reveal the growth annuli in the salmon vertebrae.

Salmon Age Category Distributions

Combined with samples from pit contexts associated with that specific floors, each sample from a housepit floor can be considered as an analytical unit. It is possible to consider the samples of salmon drawn from the different housepits on this site as independent of one another. It should be remembered that these housepits are not in fact sub-samples of the same deposit but are cluster samples drawn from separate and possibly unrelated housepit deposits. Therefore the data now presented will focus on the distributions for individual housepits and individual pits and floors within those housepits.

It is obvious from the first glance at the data that there is a very real preponderance of two-year-old salmon remains in most of the samples (Fig. 2). The deposits from the smaller HP's 6 and 12 are 100% two-year-old salmon. The medium sized HP 3 is over 90% two-year-olds, with the remaining vertebrae almost entirely composed of four-year-olds. It should be noted that 10 three-year-old vertebrae were found in an articulated floor context, representing a single fish. Housepits

1 and 7, the largest on the site, contained a much broader range of age categories than any of the other housepits examined. The samples from these two large housepits also differed greatly in terms of proportions of salmon species represented. Housepit 1 contained over 70% four-year-old vertebrae with the remaining vertebrae being composed of two-year-olds (although the HP 1 assemblage may not be representative due to limited testing of its deposits). Housepit 7 on the other hand revealed substantially less in the way of four-year-old vertebrae and substantially more three-year-old vertebrae. As was the case in other housepits, the majority of vertebrae in HP 7 were from two-year-olds. It should be noted that HP 7 also contained a small quantity of five-year old vertebrae. When examined more closely, HP 7 reveals interesting differences within the structure. While the distributions in feature number 4 (likely a storage pit) and the floor contexts were quite similar, having moderate quantities of two, three, and four-year-olds, the slamon age distributions of feature number 3 (also probably a storage pit) were quite different, being totally composed of two-year-olds.

When examined as raw quantities of vertebrae, as opposed to proportions, it is clear that two-year-old salmon make up the bulk of all the samples. While there are never more than 100 vertebrae from three, four, or five-year-olds in the housepit assemblages, the vertebrae from two-year-olds occur in numbers ranging from under 50 to over 1,200.

Species Inferences and Discussion

When the age distributions of salmon vertebrae found in housepits at Keatley Creek are compared with the spawning ages for each species of salmon it becomes clear that certain inferences about the species of salmon found at the site can be made. Because the only salmon to spawn at two years of age is the pink salmon *(Orcorhynchus gorbuscha)*, it is safe to assume that there are large proportions of pink salmon represented in the samples. As has already been stated, this species of salmon is small, easy to catch and process (preserve), and spawns in the early fall (September–October). Traditionally this has not been considered to be an important species to the people of this area (Romanoff 1985).

The second-most abundant age category is that of the four-year-olds. There are three species of salmon known to spawn at this age: spring, sockeye and chum. The age ranges of these species are 3–8 years, 4–8 years and 2–7 years respectively. However, we know that most of the spring and sockeye that migrate this far up the Fraser are four and five-year-olds (Healy 1986). Coho, which are not abundant this far upstream, spawn only at three years of age. Healy (1986) notes that spring salmon in the Fraser are almost always within the four to seven-year-old bracket, and that the modern-day chum salmon in the Fraser are invariably four-years-old. It would seem that much in the same way

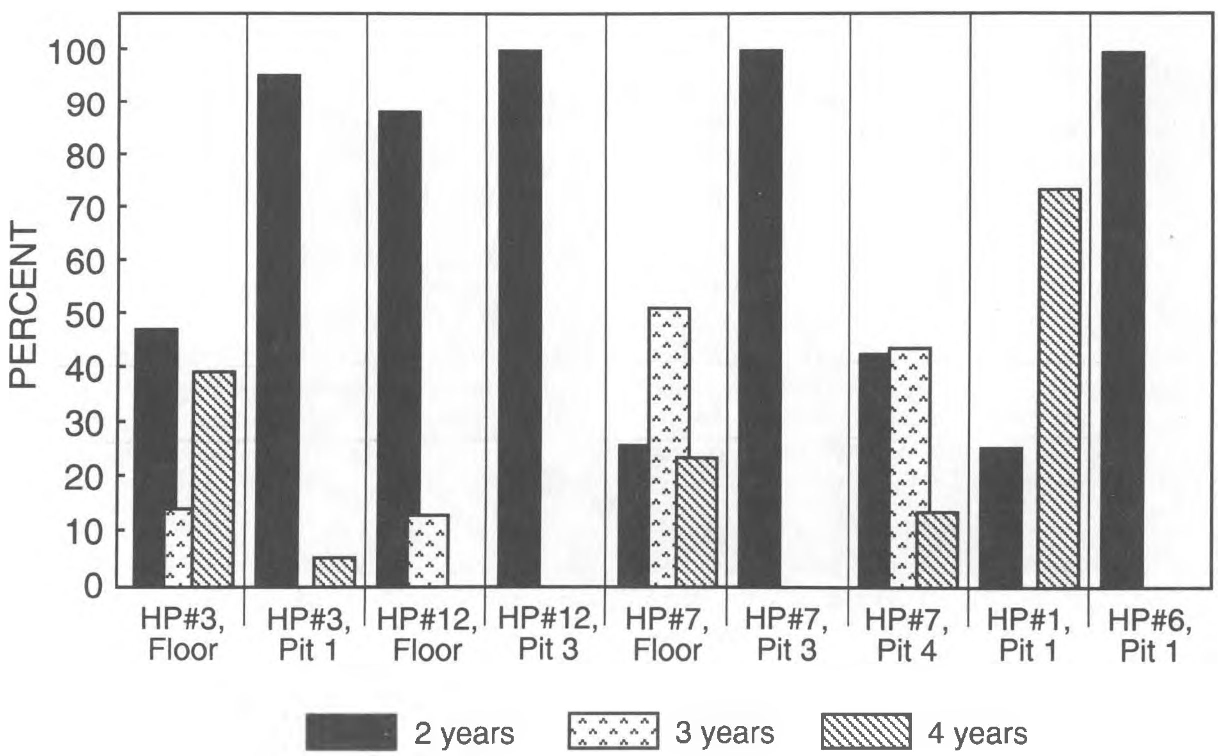

Figure 2. Distribution of salmon age-categories from within each housepit.

that pink salmon found in upriver locations are genetically selected to be stronger swimmers, chum salmon's spawning age is genetically selected in a river-specific manner (Healy 1986; Ricker 1989). Because of the complications of these overlapping age ranges, it is only possible to make a best-guess as to the species represented by the three to five-year-olds.

It was initially thought that the high proportions of three-year-olds in HP 7 might suggest the presence of coho salmon. However, Cannon (personal communication) has pointed out that despite the absence of any significant quantities of fish older than four years, these three, four and five-year-old individuals could represent spring or sockeye. He suggests that the older and larger salmon might have been more difficult to catch if they were able to travel against the stronger currents in the middle of the river channel. Romanoff (1985) also suggests that prehistoric populations in areas may not have been able to effectively exploit the populations of larger, stronger fish, given the more advanced fishing technologies required. Based on these arguments and the somewhat skewed distribution towards smaller fish it seems very likely that the salmon remains in HP 7 represent either three-year-old spring or sockeye salmon. These arguments can also be applied to the remains from the floor of HP 3.

From the seasonality of the spawning runs in the Fraser it could also be argued that only sockeye and chum runs would probably have been concurrent with runs of pink salmon. Since pink salmon are represented in greatest abundance in all housepits, it could also be argued that the other species represented were captured at the same time as the pinks, (e.g., if fish procurement was scheduled so as to take advantage of the best yielding runs). On this basis it is more likely that the salmon found in HP's 7 and 3 represent sockeye, rather than spring salmon.

Another possible way to explain the relative proportions of different species of salmon vertebrae involves different methods of processing between spring, fall, and summer runs, as well as between different species of salmon (Romanoff 1985). Romanoff relates that the early runs of salmon are more fatty than later runs and therefore are more difficult to dry. Generally, it was necessary to remove the backbone and belly sections of these fish before any attempt was made to preserve the flesh. When possible these oily, but tasty, fish would be eaten immediately, processed into salmon oil, or traded after labor intensive smoking and drying. Romanoff writes that because it was difficult to process and dry the first runs of spring and sockeye these would often be rendered into oil. Because this salmon oil production was a difficult process, only certain individuals who knew the procedure for this form of reduction could utilize these salmon. This factor may have been related to the ownership of fishing spots from where the large, oily fish could be obtained. Given such ethnographic behavior, it would be reasonable to expect early runs of spring and sockeye salmon to have a low level of visibility in the archaeological deposits at winter villages.

The proportions of species represented in HP 1 is quite different from that of HP 7. The remains from HP 1 are bimodal, with only two- and four-year-old salmon represented. In fact, although the sample is very limited, over 70% of the remains from this housepit are four-year-olds. If these remains represent spring or sockeye salmon one would also expect to see some quantity of three-year-olds and substantial numbers of five-year-old vertebrae. Since chum currently run in the Fraser at only four-years of age the high proportion of four-year-old vertebrae provide a good fit for this species, although chum currently do not run this far upstream.

Differences also exist in the seasons at which the various species of salmon spawn favoring the chum interpretation of the four-year-old vertebrae. While the majority of spring and sockeye spawn in the spring and summer (with some small runs of sockeye in November), pink and chum both spawn in the fall and would be logically procured at the same time if fall was the primary fishing season in the past—as indicated by the preponderance of pink salmon remains. If chum salmon ran farther upstream in prehistoric times we would conclude that the four-year-olds found in HP 1 were most likely chum. This inference could also be supported by the distinctive qualities of these fish. While chum and pink salmon are particularly easy to dry and preserve with the backbone intact, sockeye and spring do not usually fare well with this method although it should be noted that late fall runs of sockeye are less fatty than their counterparts which spawn earlier in the year (Romanoff 1985). However, they are still not as easy to dry as pink or chum. Because these late sockeye runs occur in November, even later than pinks and chum, the hot climate required for drying has largely passed although late catches were sometimes freeze-dried or even dried whole (Teit 1906; Kennedy and Bouchard 1992).

It should be noted that ethnographically, pithouse villages were considered to be winter villages, and were abandoned in the spring of each year. Investigations at Keatley Creek largely support this seasonal pattern (Vol. I, Chaps. 9, 10). Thus it seems most likely that the salmon being stored at the site would represent a fall fishery, as the age and species data suggest. Other species may also have been captured, but stored near the river in elevated caches as documented ethnographically (Vol. II, Chap. 2; Romanoff 1985; Kennedy and Bouchard 1992).

In 1913, landslides forming high velocity rapids at Hell's Gate, north of Yale, destroyed pink and sockeye runs and weakened the spring salmon runs for many years. Pink and sockeye salmon spawneries north of Hell's Gate were not re-established until fish ladders were built in the late 1940's (Ricker 1987; 1989; Healy 1986). If a prehistoric landslide were to block the river or create large rapids, salmon populations could not be re-established upstream until natural erosion and downcutting processes made the river passable for the weaker species of salmon (i.e., pink, chum, and coho).

Hayden and Ryder (1991) have proposed that the abandonment of numerous large pithouse villages, including the Keatley Creek site, about 1,000 to 1,200 years ago, may have been the result of a large scale landslide which dammed the river and destroyed the salmon runs upon which these villages depended for food. As support for this hypothesis they cite the evidence for a large landslide affecting the Fraser River at Texas Creek, 16 km south of Lillooet. In addition to the landslide remains at Texas Creek, cache pits located on a river terrace in Lillooet, covered by thick deposits of fluvial sediments, date to around the same period (Hayden and Ryder 1991). There are also indications that there may have been massive landslides at about the same time at Jones Bench, just a few kilometres south of Lillooet (Ryder and Church 1986). The Cheam Slide on the Fraser River near Chilliwack, B.C. is a well known event which may be from the same general time period as well (Fladmark 1992).

Given the fact that these landslides could explain a shift in salmon runs along the Fraser and the similarity in seasonality and methods of processing between chum and pink salmon, it is a distinct possibility that the large numbers of four-year-old vertebrae found in HP 1 represent chum salmon.

As the location from which the fishing is taking place will often dictate what species are most likely to be caught, the differences in salmon represented at each housepit might serve to indicate ownership of fishing rocks or stations. Ethnographically ownership of fishing stations was common, and such ownership meant that individuals might have access to more species of salmon, while those not owning a fishing station would have more limited access and would have had to rely upon public fishing locations or upon other individuals who had salmon (Romanoff 1985; Kennedy and Bouchard 1992).

The possible lack, or at least under-representation of spring and sockeye salmon in the smaller housepits could mean that in these houses the fishing technology was simply not developed enough or was not being used to catch these larger, stronger fish. It also could be interpreted as meaning that the occupants of some dwellings did not have the rights to acquire these species of fish, or at least access to locations where these species could be caught, or that occupants of smaller dwellings had different processing or storage practices —although this does not seem as likely. This argument may tie in with the fact that there are currently not many good fishing stations within several miles of the Keatley Creek site making ownership of fishing stations seem plausible. It should also be noted that the lack of good fishing spots near the site may not have always been typical of the locality (Hayden and Ryder 1991).

On the basis of the radiographic analysis we have good indications that either spring or sockeye were being taken by the occupants of HP 7 and to a lesser degree, HP 3. This implies that the occupants had either: a) the rights and ability to acquire these fish; b) traded for these fish or; c) occupied the site at a time when these species of salmon were spawning. Hayden et al. (1985) and Hayden (1992) have argued that complex social structures involving priviledged access to important food resources operated in this area historically and prehistorically. Kusmer (Vol. II, Chap. 7) has also found evidence of differential use of terrestrial food resources, while Spafford (Vol. II, Chap. 11) has identified different storage capacities and spatial organization within the different sized housepits. However, it is perhaps premature to link the different proportions and types of salmon found within the different sized housepits at Keatley Creek to interpretations of socioeconomic differentiation.

There are numerous variables at play in this situation which may dictate which species and what proportions will be found in the archaeological record. A first major variable is natural and cannot be predicted or controlled at this point in time, and this is the problem of cyclical variability in the size of the run.

It has been known for some time that there are cyclical variations in the spawning runs of various species of salmon. These variations can be in two, three, or four year cycles, depending on the species, and sizes of the same runs can vary by as much as 2–42 million fish (Ricker 1987; 1989). In addition to these annual variations, there are also variations in individual runs of a single species within a river on a day-to-day basis. This means that on any given day in a prehistoric fishery the activity could be very intense or quite slow. Romanoff (1985) noted that this will in turn affect processing of the fish. When fish are running in great numbers, the processing is the main limiting factor in how much fish is actually caught. Thus minimal processing is necessary to make a fish useful and the degree to which a fish may be butchered and processed may not be a constant.

Another factor in the degree to which a fish may be processed is the fat content of the fish. As has already been noted, the earliest runs of salmon, particularly the spring and sockeye, may need to have the backbone and belly removed before drying. In other cases, it is not desired, or even possible to dry the fish, and it is rendered into oil, salmon powder, soup, given away, or immediately consumed. In some instances backbones would be removed and stored separately, to be used as a form of insurance in the event of famine (Romanoff 1985; Kennedy and Bouchard 1978).

Variability also exists in the methods of storage. Ethnographies record storage either inside or outside the pithouse. The methods of storage outside of the pithouse were in the form of juniper-lined pits and wooden boxes built on platforms. These types of storage could be either at the village site or near the river. Romanoff (1985) notes that often the early spring and summer runs would be stored in box caches near the river. The reasoning for this form of storage was two-fold. First, since the winter pithouse village site would not normally be occupied in the summer (exceptions have been noted in the case of old or infirm individuals—Vol. II, Chap. 2) it would be inconvenient to transport the salmon to the winter village. In the case of Keatley Creek, the site is nearly 2 km away from, and 300 m above, the Fraser River. As has already been noted, at the present time the closest good fishing spots on the river are at least 5 km north and south of the site, at Pavilion and Fountain. The second advantage to caching the first catches in boxes near the river was that these oily fish would be given more opportunity to dry, as the strong winds moving up the Fraser Canyon would blow through the slat wood constructions, while the structures would keep out scavengers. These boxes could then be easily accessed in the winter, as opposed to external cache pits which might be covered with snow, and be quite frozen. The unfortunate characteristic of these box caches is that they are not preserved in the archaeological record. Thus we are confronted with the possibility that the only species of salmon which we might expect to find in the housepits in any quantity would be the fall runs of salmon (pink, coho, late sockeye, and possibly chum).

Conclusions

As this study has shown, Cannon's method of radiographic examination and species inferences can be valuable in reconstructing the prehistoric use of salmon resources in the Interior Plateau. We know that contrary to what modern ethnographies would suggest, pink salmon may have been utilized quite intensively prehistorically, as may be seen by the large quantities in the housepits examined from Keatley Creek. Conversely, the evidence examined here tends to support the ethnographic record documenting differential treatment of the various species of salmon, and possibly the differential access to such resources as well. The seasonal inferences which can be drawn from these examinations strongly suggest an active fall fishery was taking place near the time of year when the winter pithouse villages were occupied. There is the possibility that chum salmon may have run further upstream than they do currently, as seen in the salmon remains in HP 1. This certainly seems to be true of pink salmon. This also lends weight to Hayden and Ryder's hypothesis for the prehistoric damming of the Fraser and changing salmon resources being a causal factor in the abandonment of large village sites during the early Kamloops phase. Future research on other Fraser Canyon faunal collections and pithouse village sites may shed more light on some of these questions about the role of salmon in the late prehistoric Interior Plateau.

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Chapter 9

The Analysis of Mesodebitage and Mesofauna at Keatley Creek

Brian Hayden & Martin Handly

Introduction

As part of the research into the prehistoric socio-economy at Keatley Creek, a program was established to systematically sample four subsquares within each two meter excavation square across all floor deposits (Vol. I, Chap. 1). The purpose of sampling the floor deposits in this fashion was to obtain information on relatively small cultural remains that would otherwise pass through the 6 mm mesh that was being used to screen all deposits. All floor samples were processed using water flotation thereby separating the light organic fraction from the heavier clasts, lithic, and faunal residues. Screens at the bottom of the flotation chamber retained all heavy material larger than 1 mm. Recovered remains included charred botanical remains (Vol. I, Chap. 9; Vol. II, Chaps. 4, 5), small mammal bone fragments, small fish bones and fragments, small debitage, occasional fragments of retouched stone tools, and very rare bone artifacts such as beads. Flotation samples were standardized at 1 liter of sediment. Because floor sediments were generally 3–5 cm thick, the taking of these samples from 50 × 50 cm subsquares frequently involved removing the majority of the floor sediments from sampled subsqures for flotation sampling purposes.

There were several reasons for undertaking the analysis of relatively small lithic and faunal remains. First, Schiffer (1987:267–269), Fladmark (1982) and others had argued that large cultural remains were those most likely to be picked up to be used elsewhere or cleaned up as secondary refuse to be dumped at a distance from the activity locations of manufacture and use. Thus, by monitoring the small size range of cultural remains, it should be possible to more accurately identify actual manufacturing loci on living surfaces and thus more accurately identify the activity areas on living floors that were critical for making inferences about the socioeconomic organization at Keatley Creek.

The second reason for using this approach is that the production of individual flakes is much more abundant, by several orders of magnitude, in the smaller size ranges than in the larger size ranges during tool manufacturing (Fladmark 1982). Therefore, Fladmark has proposed that the study of "microdebitage," that is, flakes less than 1 mm in size, should be highly sensitive to, and indicative of, site and activity locations. By extension, monitoring the small size range of flakes and fauna should provide a relative idea of the magnitude of manufacturing activities occurring at different locations on a living surface. We opted to modify Fladmark's original approach due to the excessive amount of time that the analysis of sediment samples less than 1 mm would require using micro-scopes, especially considering the large number of samples involved in our analyses. However, the same logic used by Fladmark should also be applicable to slightly larger lithic and faunal remains. Thus, we chose to examine the distribution of lithic and faunal remains in the 1–10 mm size range. To distinguish these remains from Fladmark's "microdebitage" and the macro-sized remains recovered from the 6 mm mesh screens (Vol. I, Chaps. 12–16; Vol. II, Chaps. 11–14), we decided to refer to this size level of remains as "mesodebitage" and "mesofaunal remains." Separation of these remains from the heavy fraction of one liter soil samples could be accomplished relatively efficiently (in about an hour per sample) using jewelers' magnifying headglasses or large mounted magnifying glasses.

A third reason for undertaking this analyis was that contemporary studies had shown that significant information on faunal use could be missed by employing only 6 mm mesh screens, especially where fish and small rodents were present or economically important. Thus, we wanted to determine whether or not the macro-sized faunal remains that were recovered from the 6 mm mesh screens represented a biased view of faunal utilization or distribution across the floors.

A final reason for using these sampling procedures was that they represented a reasonable compromise between the time and effort-intensive procedures of screening all floor sediments through 1 mm mesh screens on the one hand, and the desirability of documenting the basic types of patterning represented by these remains across the housepit floors on the other hand. Without knowing what types of results might emerge, or even whether floor deposits were being successfully identified in the field, the taking of samples from each square meter across living floors seemed appropriate for providing adequate monitoring of any recurring prehistoric activities on those floors. While a more intensive level of sampling would have certainly increased the clarity of the patterns that emerged, it would have required greatly increased processing and analysis time as well as higher levels of funding to achieve any increased clarity. In the case of botanical remains, it simply would have been impractical to have any more material analyzed.

Table 1. Summary Data for Heavy Fraction Floor Samples from Keatley Creek (EeR17); Housepits 3, 7, and 12 (1991)

	Number of Elements	Mean	S. Dev.
Housepit 3 N = 57 ssq			
Lithic	1,171	20.54	31.72
Salmon	670	11.75	24.87
Non-salmon Fauna	164	2.88	10.59
Housepit 7 N = 109 ssq			
Lithic	2,990	27.43	24.13
Salmon	2,260	20.73	39.13
Non-salmon Fauna	828	7.60	20.26
Housepit 12 N = 21 ssq			
Lithic	226	10.76	22.95
Salmon	310	14.76	31.56
Non-salmon Fauna	13	.62	1.32

Results

This section presents the results of our analyses of the heavy fractions of soil samples that we were able to analyze on a housepit by housepit basis. The squares depicted in the figures represent actual locations that soil samples were obtained from. Deviations from intended systematic sampling locations were due to local factors such as roots and pits, or to excavator forgetfulness, as well as to subjective assessments that some areas were important to sample due to the proximity of various features such as hearths or indications of activity areas using other excavational observations. The range of absolute frequencies represented by the shading of the sampled squares was determined by probability levels of random item occurrences established using Poisson distributions. Thus, shading used on these maps indicates that the lithic or faunal counts in those squares were below the 5% probability level of occurring on the basis of a Poisson distribution (white squares), that the actual counts fell within the 5–95% range of probability of occurring using a Poisson distribution (gray squares), or that the actual counts were above the 95% level of occurring as a non-random pattern on the basis of Poisson distributions (black squares). For instance, in HP 7, there are 109 sampled locations across the floor. A Poisson distribution predicts that there should be 5 sampled locations with counts below a 5% probability. In reality, there are 45. Summary data are provided in Tables 1 and 2.

Housepit 12

Housepit 12 is one of the smaller housepits to be completely excavated (Vol. III, Chap. 8). It corresponds to the poorer, more ephemeral, and more communally organized type of residence at Keatley Creek (Vol. II, Chap. 1).

Fauna (Fig. 1): Only salmon elements are shown because the very low numbers of non-salmon fauna rendered analysis of little use. The more abundant salmon remains, however, clearly cluster in a single area against the north wall of HP 12, very close to the location of the ephemeral hearth observed on the floor. This corresponds to a communal food preparation and consumption pattern, supporting similar inferences made on the basis of larger salmon and non-salmon remains recovered from the 6 mm mesh screens (Vol. II, Chap. 6).

Lithics (Fig. 2): As with the macrodebitage and artifact distribution, there are several localized occurrences of mesodebitage that correspond quite precisely in general to the major macrodebitage distributions, including a major concentration along the east wall and south of the hearth and against the north wall. The central and peripheral concentrations may simply reflect places where activities with different space requirements occurred. Activities that could be done in small spaces, such as basketry or clothes making or making foreshafts, probably occurred in bedding or eating areas, as in other housepits. In fact, utilized flakes are strongly concentrated in these areas in HP 12 as well as in HP 3 (Vol. II, Chap. 11). Activities requiring more space such as spear maintenance, probably occurred toward the center of the floor not far from the hearth locations and it is in these areas that notches are strongly concentrated in all three houses discussed here.

Table 2. Summary Data for Cumulative Poisson Distributions for Housepits 3, 7, and 12 for Lithic, Salmon, and Non-salmon Faunal Elements

	Actual <5%	Expected <5%	Actual Mean	Expected Mean	Actual >95%	Expected >95%
Housepit 3						
Lithic	25	3	24	51	8	3
Salmon	28	3	23	51	6	3
Non-salmon Fauna	0	3	54	51	3	3
Housepit 7						
Lithic	45	5	40	99	24	5
Salmon	69	5	21	99	19	5
Non-salmon Fauna	44	5	52	99	13	5
Housepit 12						
Lithic	11	1	8	19	2	1
Salmon	15	1	2	19	4	1
Non-salmon Fauna	0	1	19	19	2	1

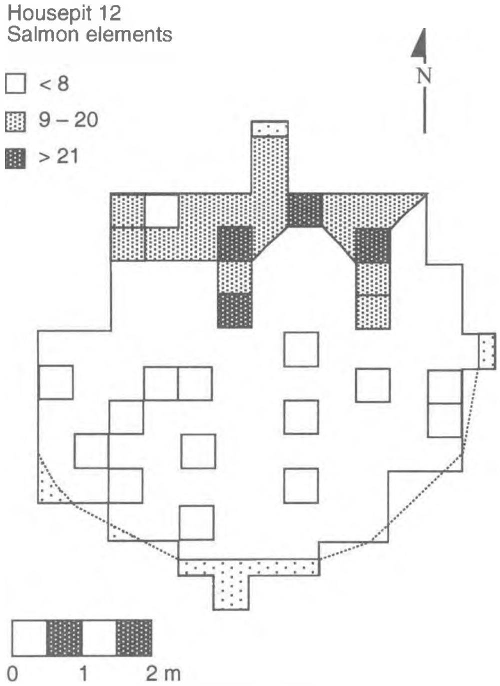

Figure 1. The distribution of fish bones (>1 mm) across the floor of HP 12, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

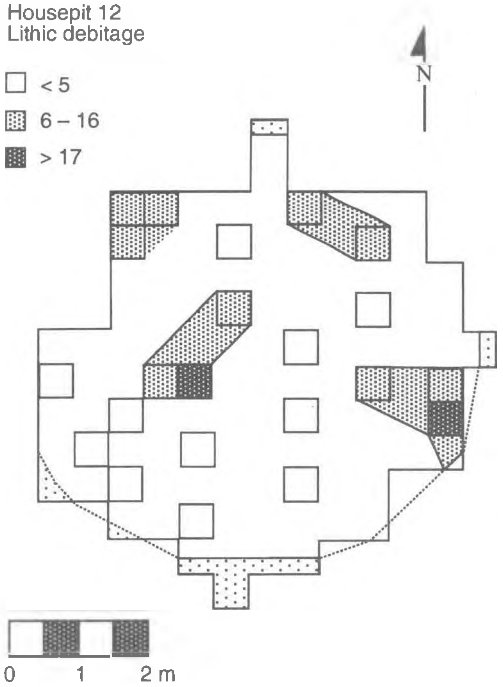

Figure 2. The distribution of mesodebitage across the floor of HP 12, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

Housepit 3

Housepit 3 is a moderate sized housepit that corresponds to a moderately wealthy and enduring corporate group with some characteristics of both communal activities and hierarchical organization.

Fauna (Fig. 3): The distribution of salmon remains again corresponds relatively closely to the distribution of macro-sized salmon elements with several concentrations around the center of the floor plus one high concentration against the north wall. Some of the minor discrepancies between the macro-remain analyses and the flotation analysis of distributions can be attributed to the lack of samples taken from areas of high densities of macro-sized remains. The separateness of the observed concentrations of macro- and meso-sized remains probably reflects the independent domestic status of several domestic groups within HP 3, however, as discussed in Volume II, Chapters 1 and 7, the precise interpretation of salmon remains is consistent with several different scenarios. The non-salmon meso-faunal remains did not exhibit any interpretable patterning possibly due to the limited absolute counts of these remains; the results have not therefore been illustrated here.

Lithics (Fig. 4): The distribution of HP 3 mesodebitage also corresponds very closely to the distribution of macrodebitage and artifacts (Vol. II, Chap. 11) with most discrepancies accounted for by the lack of sampling in some areas of high macrodebitage occurrences. Of special note is the fact that most of the concentrations occur around areas that were interpreted as ephemeral peripheral hearths on other grounds, and that like macrodebitage, the mesodebitage concentrations occur between these hearth locations and the house walls. This strongly indicates that the preferred area for stone working or resharpening was in the general sleeping and in some cases eating areas. The relatively limited occurrence of mesodebitage near the center of the floor may indicate that working space in this larger house was generally adequate near the walls for most purposes.

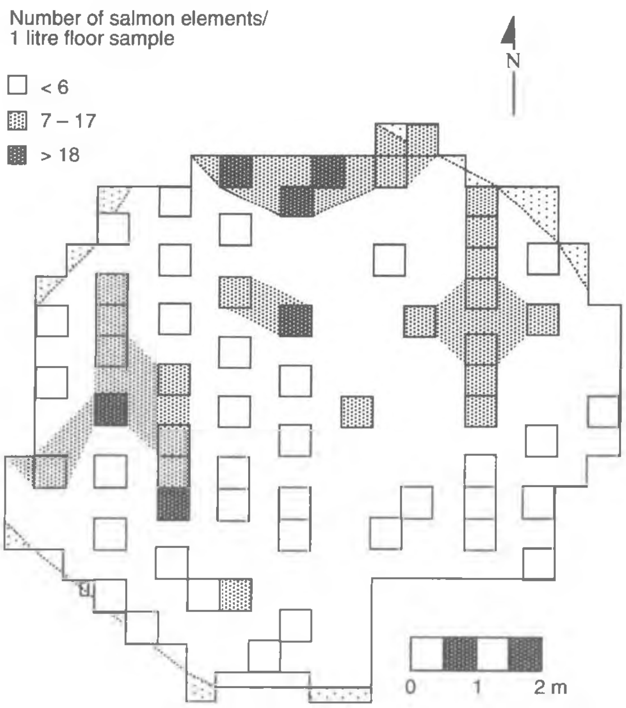

Figure 3. The distribution of fish bones (> 1mm) across the floor of HP 3, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

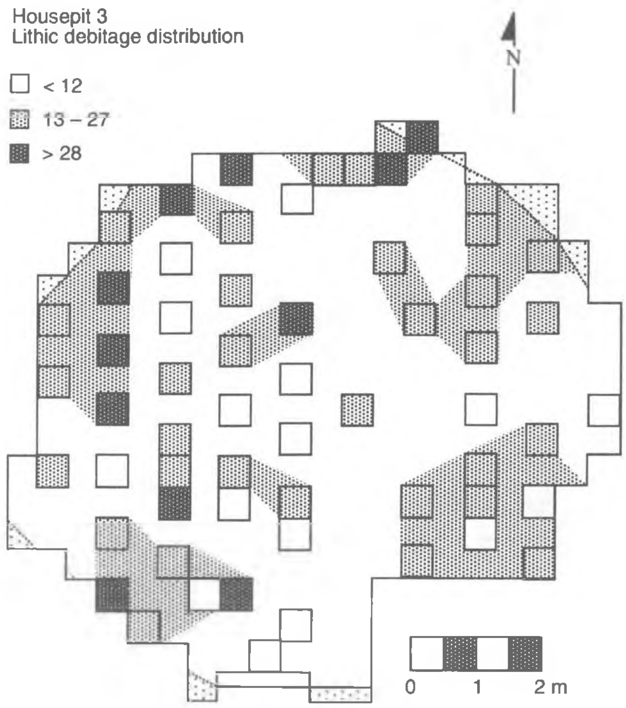

Figure 4. The distribution of mesodebitage across the floor of HP 3, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

Housepit 7

Housepit 7 is the largest housepit that was completely excavated. It exhibits the most hierarchical internal organization of any housepit fully excavated and was also the wealthiest and probably the longest lasting.

Fauna (Fig. 5): The distribution of small salmon elements bears a strong resemblance to the distribution of macro-sized elements (Vol. II, Chap. 7). Both distributions show a very strong concentration in the southeast, the northeast and the northwest sectors. As discussed in Volume II, Chapter 1 , there are a number of scenarios that can account for these concentrations. Irrespective of which scenario is chosen, however, these results indicate that the preparation or consumption of boney parts of salmon was occurring on both sides of the house, with the greatest intensity on the east side of the house. However, a few additional details are of interest. These include the localized clusters of small salmon remains along the southern and western walls in sleeping or storage areas. For the most part, these also appear to correspond to separate domestic groups as indicated by hearth locations in front of these concentrations. Other concentrations also occur in proximity to hearths, including the extensions into the center of the floor near small hearths in the floor center. The lack of dense macroremains in some areas where meso-remains are strongly represented (e.g., along the southwest wall) may be due to the more fastidious and systematic cleanup of the higher status individuals in these domestic areas as documented ethnographically (Vol. II, Chaps. 1, 7).

The non-salmon faunal elements (Fig. 6) also correspond generally to the macro-sized faunal element distribution (Vol. II, Chap. 7). However, in contrast to the macroremains, the distribution of mesoremains makes it abundantly clear that the most intensive reduction of bone occurred in the south and southwest, i.e., in sectors where other indicators suggest that the highest status domestic groups may have resided (Vol. II, Chap. 1). Since deer meat was of exceptionally high value, this distribution would seem to support inferences of high status for residents in these sectors. The discrepancy between these meso-sized concentrations and the weak occurrence of macro-sized remains in the south and southwest may again be due to the more fastidious cleanup behavior of the higher ranking domestic groups. The lack of any concentration in the northeast and east also reinforces other inferences about these areas being the least desirable or the lowest status domestic locations within HP 7.

Figure 5. The distribution of fish bones (> 1mm) across the floor of HP 7, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

Lithics (Fig. 7): The distribution of mesodebitage again corresponds quite closely to the distribution of macrodebitage (Vol. II, Chap. 7). As in the previous housepit floors, it is interesting to observe that there are strong concentrations associated with hearth areas and that many of the densest occurrences occur between the hearths and the walls thereby indicating that considerable stone working did, in fact, occur in these sleeping and eating locations. That is, the occurrence of lithics in these areas is not primarily due to storage of material produced elsewhere along the walls. Similarly, if sweeping had displaced significant amounts of material, this would be expected to concentrate small remains in the least used middle of the floors rather than in the intensively used sleeping and eating peripheral zones. What we observe is exactly the opposite and it therefore seems unlikely that sweeping constituted a significant factor in the formation of deposits inside houses.

There are also considerable concentrations of mesodebitage around the hearths even extending into the central floor area in some cases. These probably represent people taking advantage of the warmth and light of fires when they were lighted. Of special interest is the heavy concentration represented in the southeast sector, which is also the locus for the single most important concentration of salmon remains. Since other indicators for this domestic group are more consistent with a low ranking family within the house, this evidence for high levels of food and stone processing may support the inference that slaves were doing many of the most onerous tasks in the household such as cooking and much of the simple repetitive wood-working, basketry preparation, and hide working tasks, as documented ethnographically (Vol. II, Chap. 1). The much more pronounced indication of stoneworking in the southern half of the house as compared to the north is also intriguing since this is not apparent in the much more balanced overall distribution of macrodebitage around all of the peripheral hearths of HP 7. It is possible that more stoneworking activity was taking place in the south but that, like the faunal remains, domestic groups in the south cleaned up the larger pieces of waste more systematically and regularly.

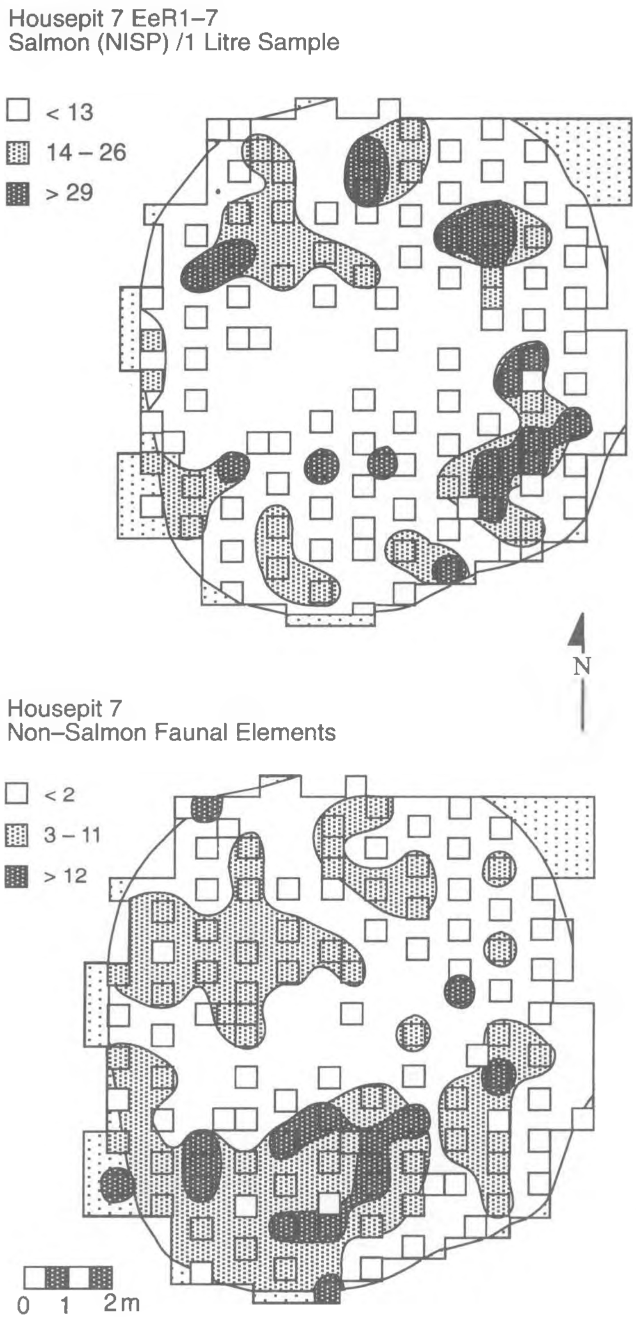

Figure 6. The distribution of non-fish bone fragments (>1 mm) across the floor of HP 7, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

Conclusions

The analysis of the mesoremains at Keatley Creek has provided extremely valuable confirmation of many of the results obtained from the analysis of macroremains and in some cases has added interesting refinements to interpretations based on those analyses. In particular, analysis of the faunal remains from the heavy fraction of the flotation samples has shown that the assemblage recovered from the 6 mm mesh screens is not biased in any significant way and has not left out or misrepresented any species or their relative importance. Moreover, both the mesofauna and mesodebitage have displayed a very high degree of correspondence with their macro-sized complements. Distribution patterns at both size levels of analysis display consumption and production activites primarily focused around hearths and sleeping areas, as might be expected. All analyses indicate that the central floor areas were not frequently used for any of these activities except in the smallest house where headspace and working space would have been especially constrained except for the central areas of the house. Some of the more interesting new insights that the analysis of mesoremains have provided are the indications that fish bones were also being consumed in the southwest and south sectors of HP 7 and that almost the entire southern half of the HP 7 floor seems to have been the site of much more intensive bone reduction and stone working activities than the northern half of the house. This may be related to different status-related activities and productivity levels of the south versus the north domestic groups. It will certainly be interesting to see if other large housepits exhibit a similar kind of dichotmous organization.

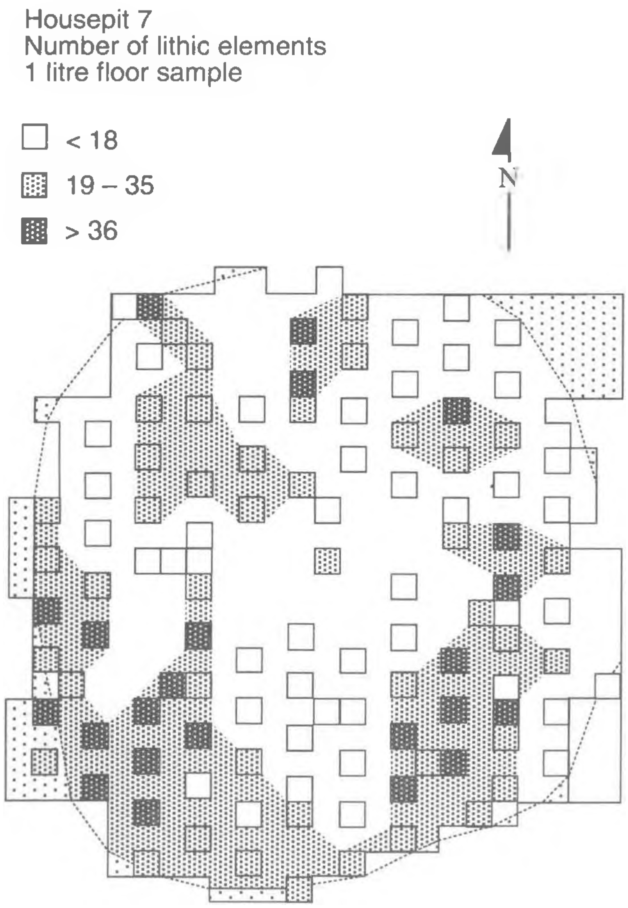

Figure 7. The distribution of mesodebitage across the floor of HP 7, as recovered from the heavy fraction of flotation samples taken from the outlined squares.

These strongly patterned results reinforce the conclusion that floor deposits were accurately identified by excavators and that there has not been significant mixing of deposits. Moreover, as in the analysis of floor materials at the Ozette site on the Coast (Samuels 1991:268), the results of the mesodebitage analysis indicate that there has not been any significant lateral displacement of sediments or cultural remains between floor sectors or zones. This strongly supports the suggestion that sweeping was of minimal importance in the cleanup of materials on the floors and, if used at all, may have only been used to clean off mats used for sitting and eating (Vol. I, Chap. 17). The results also indicate that most of the macrodebitage recovered from the floor was, in fact, left at the place of production, although clearly the largest elements from core reductions were removed from the assemblage and stored or used elsewhere (Vol. I, Chap. 13). This helps explain the generally small size of the debitage and tool fragments in the housefloor assemblages.

Finally, given the generally high absolute amounts of debitage in the 1–10 mm range produced by most core reduction activities, the absolute levels of mesodebitage recovered from all the housepit floors indicates a rather surprisingly low intensity of reduction activities, and even of resharpening activity. For a single 50 cm square to contain less than 40 pieces of mesodebitage as the cumulative result of an entire winter's occupation, not to mention 10–20 such winter occupations, seems remarkably little. Yet this is roughly the level used for identifying the most intense activity areas and there are very few sampled squares that manage to exceed this level of occurrence. The great majority of sampled squares fall well below this level. The same observation can be made of the even lower levels of bone fragmentation reflected in these samples, especially considering the fact that the vast majority of mammal bones were heavily reduced. To us, the low incidence of small remains indicates that indoor winter manufacturing activities were episodic and infrequent at best and that relatively few animals were killed and butchered during the average winter occupations of housepits, an inference also derived from environmental considerations and macroremains (Vol. I, Chaps. 10, 17). Undoubtedly, some lithic-using and manufacturing activity took place outside when weather permitted (Vol. I, Chap. 14). All these observations are valuable insights for understanding what life inside pithouses was like during the coldest and darkest part of the year.

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Chapter 10

The Cultural Significance of Domestic Dogs in Prehistoric Keatley Creek Society

David F. Crellin & Ty Heffner

Introduction

Dog remains are remarkably common in some Keatley Creek housepits. Because dogs play important economic and social roles in some traditional cultures, it was important to try to identify their roles in the prehistoric Keatley Creek community. It was hoped that an in depth analysis of dog remains at the site would contribute significant new information to our understanding of socioeconomic organization at the site.

Dogs were probably the first species to be domesticated by humans, and, in Canada, they were the only domestic animal in prehistoric times. Their roles in society likely included use as food, clothing, protection, status items, and hunting and transportation aides, as well as being part of myth and ritual (Driver 1976). Canid remains are present on the Plateau in all three late prehistoric horizons (Richards and Rousseau 1987), including some in human burial contexts (Smith 1900; Sanger 1968; Pokotylo et al. 1987; Langemann 1987). The initial appearance of dogs at the Baker Site (ca. 4,500 BP) is evidence of early exploitation of dogs on the Plateau and probably coincided with the beginning of a seasonally sedentary lifestyle, when resource surpluses were available to support these domestic animals. Very few interpretations exist, however, concerning the significance of domestic dogs in Plateau prehistory despite the ethnographic information and archaeological evidence available. In addition, there are few published analyses of behaviorally induced or culturally produced skeletal pathologies in domestic dogs.

In an attempt to remedy the present interpretive void, this study will use the available information to consider existing hypotheses, as well as to develop new hypotheses, concerning the cultural significance of domestic dogs for the residents of Keatley Creek. These hypotheses will be evaluated using data obtained from an osteological analysis of all canid remains found on the site. Where appropriate, ethnographic information and data from other archaeological sites will be incorporated into the discussion. It is hoped that this approach will lead to a meaningful reconstruction of the human and animal behaviors responsible for formation of the assemblage.

Context and Analysis

Canid remains were recovered from four housepits at the site: HP's 3 (HP 3) and 7 (HP 7), which were completely excavated, and in HP's 109 (HP 109) and 110 (HP 110), where bones were recovered from test trenches across the diameter of the cultural depressions. Dog remains are discussed with reference to their contexts and the osteological analysis. The goals of this analysis were to determine the physical function, specific treatment, health status, age at death, cause of death, and sex of each individual. In some instances it was not possible to identify individual animals; in these cases, associated or articulated elements are treated as a unit.

Housepit 3

This was a medium-sized dwelling in the central village core. Artifacts and features within the house were concentrated in the periphery, the central area being clear (Vol. II, Chap. 1; Vol. III, Chap. 6). Most of the faunal remains recovered were found around a pit feature, designated 89-P2, that was used by the latest occupants; three projectile points found in the pit, known to date to the Kamloops Horizon (1,200–200 BP), support this scenario. A number of artifacts regarded as status items have also been found in HP 3, suggesting a fairly wealthy household (Vol. II, Chap. 13). The partial post-cranial remains of a juvenile canid (Dog 1) were found in the central area of the floor. It could not be determined whether the animal had been deliberately placed or had died there after the dwelling was abandoned (Vol. III, Chap. 6). No other canid remains were found in this housepit.

Dog 1

This individual is represented by a total of 48 elements. These remains were highly fragmented, with the skull, many forelimb elements, and most vertebrae and ribs missing; the hindlimbs, however, were still in the articulated position. Elements present, included the left humerus and distal left radius, left femur and tibia, fragmented right tibia, portions of both scapulae, and parts of the pelvic girdle. Many foot elements were also present: left and right calcaneus and talus, six metacarpals, eight metatarsals, and seven proximal phalanges. Eleven fragments less than 2 cm in size could not be identified to element. No epiphyseal union had occurred on any of the bones, suggesting an age of less than five months (Getty 1975). The small size of the bone elements brings this estimate closer to two to three months. Owing to the young age of this animal, its sex could not be determined. There was no evidence of burning or stone tool cutmarks on any of the elements. It appears, however, that the skeleton had been scavenged extensively: many elements were missing, and most of those present showed signs of gnawing and tooth puncture marks.

Housepit 7

Housepit 7 was one of the largest housepits at the site and was located in the eastern area of the village core. Both artifact (Vol. I, Chap. 13; Vol. II, Chap. 11) and faunal clusters (Vol. II, Chap. 7) suggest that three or four extended domestic household areas were present in this dwelling. It appears that this housepit was occupied, probably intermittently, for over 1,500 years (Hayden and Spafford 1993). This housepit contained more canid remains than any other dwelling excavated at Keatley Creek. Like HP 3, the central section of this dwelling was free of features; a single dog cranium was found in this area lying directly on the floor. Large storage pits and hearths were all located on the west side of the dwelling. Two of these pits, designated 88-P31 and 89-P5 for the year and order in which they were found, contained numerous canid remains, including one complete and articulated individual. Like most of the other storage pits, these underlie and predate existing floor deposits. The single cranium will be described first, followed next by the context and contents of Storage Pit 88-P31, and then Pit 89-P5.

Cranium 1

This specimen was recovered in very poor condition: many elements of the cranium were missing and those present were damaged. Full dental eruption had occurred and, along with heavy wear on the teeth, implies that this individual was an older adult. Two premolars had been lost, an event that occurred while the animal was still alive, as evidenced by alveolar resorption. The two upper canines were broken and, because this condition recurred in some other dogs, probably represented intentional human breakage, as has been recorded in the Arctic (Freuchen 1935). Of the anterior teeth, only one left incisor was present.

Storage Pit 88-P31

The dimensions of this pit were approximately 135 cm in diameter, by 115 cm deep. A birch bark lining was unearthed at 62 cm below surface, and canid remains were encountered at 90 cm. One complete dog skeleton, still in the fully articulated position, appeared to have been tossed in the pit, given its vertical orientation. One skull lay nearly nose to nose with that of the above individual, and two others, along with some fragmentary post-cranial elements, were found directly beneath it (Fig. 1). Post-cranial elements as a group, though, were largely lacking from this feature. Direct dating of one dog from this pit resulted in an age of 2,160 ± 60 BP, placing it within the Plateau Horizon (2,400–1,200 BP) (Vol. I, Chap. 2). This pit also contained fire cracked rock, lithic flakes, coprolites, and other faunal remains associated with the canid bones. An MNI (Minimum Number of Individuals) of five dogs has been established for Storage Pit 88-P31 based on the four skulls recovered and associated whole elements. The NISP (Number of Identified Specimens) for these four dogs is 293. Each of these animals will now be discussed, in turn, beginning with the complete individual.

Figure 1. Articulated individual and other canid remains at the bottom of pit feature 88-P31.

The spinal column was in a much better state of preservation than the skull or mandibles and exhibited a number of abnormalities. Dorsal curvature was evident on the left wing of the axis vertebra and was probably associated with the exostosis of the left occipital. The cervical vertebrae exhibited reinforced muscle attachments, while the spinal process of the 1st thoracic vertebra was significantly enlarged and leaned caudally; this is abnormal, as it should be either vertical or leaning towards the cranium (Fig. 2; Miller 1964:49,51). A pronounced flattening of the spinal process was evident on the 2nd thoracic vertebra, and must have been produced by excessive pressure from above. Flattening of the spinal processes was also evident on the 3rd to 9th thoracic vertebrae, which were additionally deformed and sculptured by exostosis at the tips. The 10th and 11th thoracic vertebrae were the most affected in this way, having been completely fused at the neural arches. The spinal process was broken off of the 12th thoracic, but the flattening pattern was again evident on the 13th. The spinal processes of the last thoracic and 1st lumbar vertebrae had fused together. It is possible that these points came into contact, became infected as a result, and then healed under stress. Remodeling of the rib articular facets was apparent on all thoracic vertebrae, particularly the 9th, 10th, 11th, and 12th vertebrae, which exhibited osteophyte formation in this area. This type of alteration may indicate that an animal was overworked, or had been put to work too young (Siegel 1976:362). Evidence for stress, however, was much more noticeable on the first four lumbar vertebrae than on any of the thoracic vertebrae; the spinal processes of one of these elements was completely table-topped in appearance (Fig. 3). The 5th to 7th lumbar vertebrae appeared normal, but there was evidence for bone necrosis on the sacrum; this could have been caused by osteomyelitis or osteoperiostitis (Baker and Brothwell 1980:63). Infection was also evident on the 1st caudal

Dog 1

Dog 1 from Pit 88-P31 was the only fully articulated individual recovered from Keatley Creek. The skull was uncovered in a damaged state, with some fragile elements missing. A notable feature of this skull was a grossly enlarged occipital protuberance, resulting from extensive exostosis (bony outgrowth). This feature was more pronounced on the left side and was likely caused by long-term, localized mechanical stress. A number of partially healed fractures were evident on the cranium. The mandibles were also found in a fragmented condition. Cranial teeth were extremely worn, and a few were lost during the individual's lifetime, as evidenced by alveolar resorption. One canine and molar had been broken and there was some evidence of tooth caries, which are four times more prevalent in domestic than in wild canids (Baker and Brothwell 1980:146).

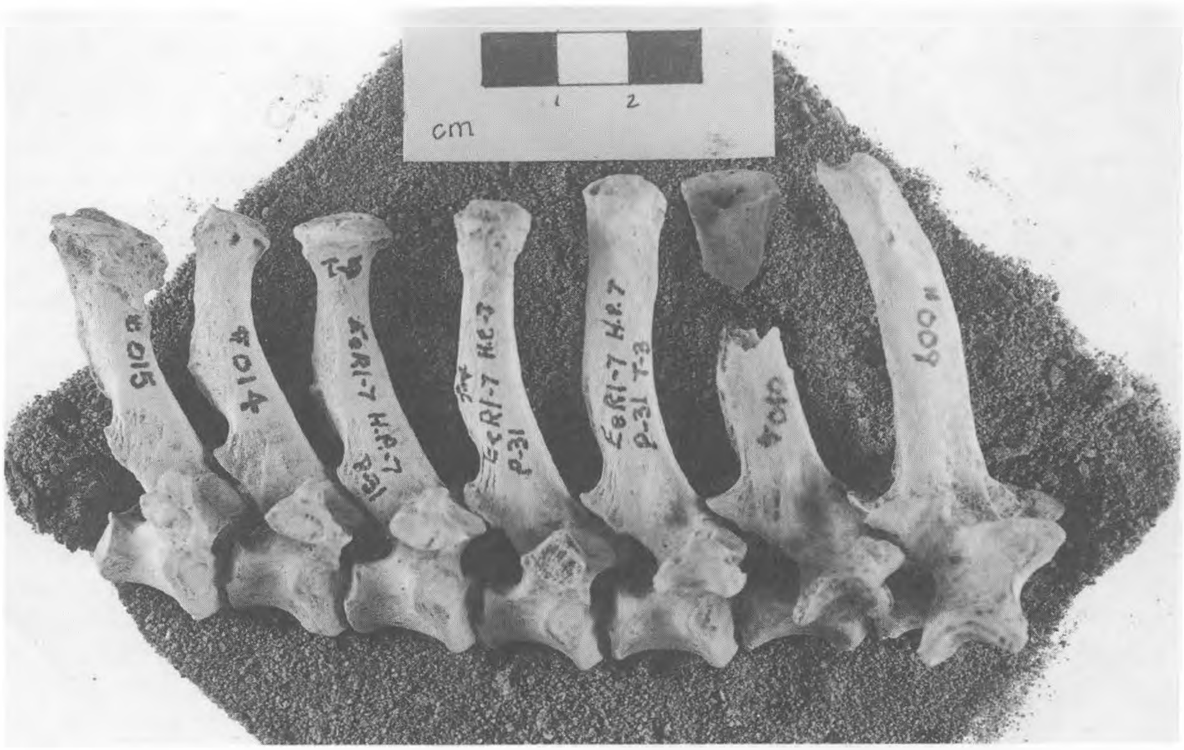


Figure 2. Thoracic vertebrae of Dog 1 showing the spinal process of the first element leaning caudally instead of towards the cranium.

vertebra, but the rest appeared unaffected. The entire vertebral column seemed to have undergone significant and constant pressure from above; this probably began at a young age while the spinal processes were still growing.

All of the ribs were present, but not complete. Healed fractures were visible on the shafts of the left 4th and right 9th ribs, and active infection was present in fresh fractures of the left 6th and 7th ribs. The sternum, though, was completely normal in appearance.

Evidence of stress deformation and pronounced muscle attachments were present on the left scapula; the right scapula was similarly affected, but to a lesser degree. Evidence of bone infection was apparent on the right element and resembles either osteomyelitis or osteosarcoma. Osteosarcomas are common in older individuals of large dog breeds, and probably result from excessive weight stress (Baker and Brothwell 1980:100). Additionally, these types of infection are common on flat bones, such as the scapula, and usually occur in the same areas as on this specimen (Siegel 1976:361). Stress related abnormalities were also exhibited on the front forelimbs of Dog 1, with pronounced muscle attachments on both humeri, and on the left and right radius and ulna. In all cases, these features were more prominent on the left elements. The left 3rd metacarpal was similarly affected.

Well-defined muscle attachments were also present on the pelvic girdle and both femora and tibiae. Lesions were evident on the right femur and both tibiae; these conform to the criteria outlined for osteosarcoma (Baker and Brothwell 1980:99–100). Aside from the lesions, no abnormalities were present on the hindlimb longbone elements. This was not the case, however, for the left hind foot. Improper healing of a fracture on the distal end of the 5th metatarsal had led to displacement of the articular facet, which subsequently reconnected off-center; the corresponding phalanx had, as a result, become flared at the articulating end. In addition to this problem, the 2nd metatarsal and proximal phalanx of the left foot displayed osteoarthritic symptoms (Baker and Brothwell 1980:115). It may be that the 2nd metatarsal and phalanx counteracted the injured 5th elements and the noted pathological changes resulted from their increased use. This hind foot injury may also explain why most of the skeletal alterations were more pronounced on the dog's left side; the left forelimb likely took on an increased stress load as it compensated for the injured hindlimb.

These types of osteoarthritic symptoms usually do not occur in dogs of less than 6–8 years (Baker and Brothwell 1980:99); this, in combination with the well-worn teeth of the individual, suggested that it was an older animal. The presence of the os-penis bone made it possible to identify Dog 1 as male. This particular canid was comparable in size and robusticity to the wolf *(Canis lupus)*. With a femur length of 160 mm, this individual had a stature similar to those in the Wildcat Canyon, Oregon canid assemblage, which exhibited a mean femur length of 162 mm (Dumond 1983).

Dog 2

Dog 2 was represented by a gracile cranium and matching slightly fragmented mandibles (NISP = 7). Using criteria established by Onodera et al. (1987), this animal was identified as female. Numerous abnormalities were evident on the skull. A tooth puncture near the right orbit showed a sharp break with no subsequent healing, suggesting it was a post-mortem event. Both left and right zygomatic arches were missing and there was a furrowed mark across the right occipital condyloid process. A fracture immediately above the right 4th maxillary premolar appeared to have become infected while healing. In the right mandible, the 4th premolar was broken and exhibited subsequent wear. It is possible that the same impact produced both of these fractures and that the infection in the maxilla gained access through the exposed pulp chamber of the premolar. Two incisors and the 1st and 2nd premolars were absent from the right maxilla. The remainder of the teeth were present and showed little wear, suggesting a fairly young age for this animal. A recently fused femur epiphysis was found in the pit and probably belonged to this animal. Fusion occurs at around 18 months of age (Schmid 1972), and provides a relative age for Dog 2.

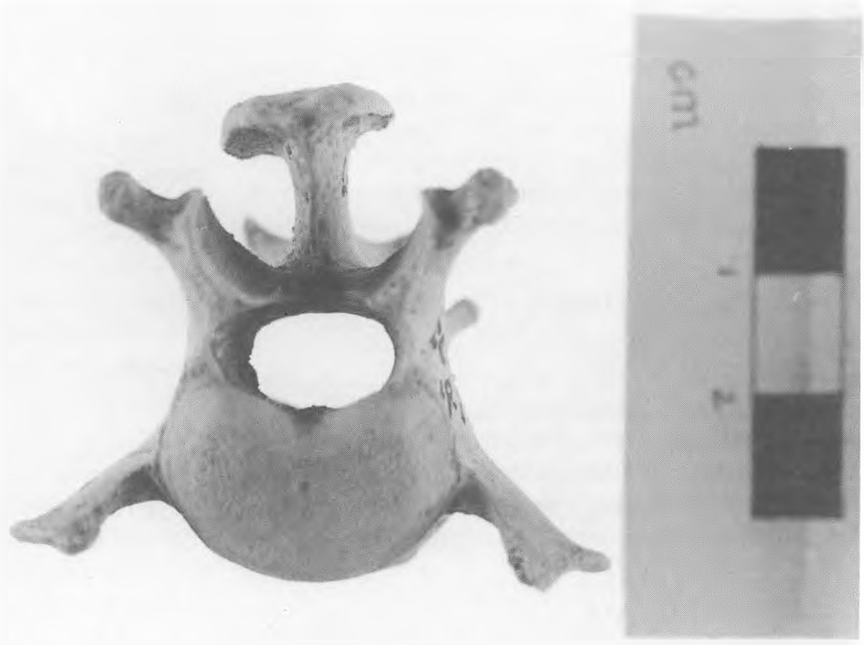


Figure 3. Lumbar vertebra 1 from Dog 1 88-P31 showing the severity of the flattening producing a table-top appearance.

Dog 3

Dog 3 was represented by the skull, both mandibles, and the axis and atlas vertebrae. Portions of the zygomatic arches, frontals, and lacrimals were missing. Cranial criteria (Onodera et al. 1987) suggested that this animal was male. There was a tooth indentation on the right maxilla and the atlas and axis vertebrae showed signs of extensive gnawing. Gnawing was similarly evident on the right mandible, and indications of periodontal disease were present on the left mandible. All teeth had erupted and exhibited little wear, suggesting an age of approximately 1 year. A left calcaneus in the process of fusing, which occurs at around 14–15 months (Schmid 1972:75; Getty 1975: 1451), and an unfused femur, less than 18 months, recovered from the pit probably belonged to this animal. With the inclusion of these elements, the NISP for this individual is 9.

Dog 4

Dog 4 was the youngest dog recovered from the pit and was represented by only the frontal portion of a skull, a right mandible, and a number of bone fragments (NISP = 89). All teeth anterior to the carnassials were not fully erupted, indicating an age of 4–5 months (Schmid 1972); the teeth in the right mandible were at a similar stage of eruption. All the bone fragments were identified to element and their unfused state suggests an age of 5–6 months. A lesion below the mandibular 1st molar, resembling osteoperiostitis (Baker and Brothwell 1980:68–74; Siegel 1976:368), is evidence of poor health.

Signs of carnivore scavenging were evident in addition to the highly fragmented nature of the bone elements; no post-cranial elements were identified, and the skull, ischium, and radius were gnawed. Two fragments also exhibited signs of gastric etching, suggesting that they had previously been consumed.

Dog 5

A number of elements (NISP = 42) identified in the pit were determined to be unrelated to the four skulls and these likely represent a fifth dog. These fully mature elements included cranial fragments and some teeth, plus a number of whole bones. Tooth punctures and crushed, crenulated edges were present on the distal right femur and right calcaneus fragments, and gnawing was apparent on many of the broken elements. No cutmarks or signs of burning were present. The lower left and upper right canines were both broken and show subsequent wear. Considerable wear on the other teeth, in combination with the fully mature elements, suggests an age of approximately 2 years. Due to the absence of an intact cranium or an os-penis, the sex of this dog could not be determined.

Miscellaneous Remains

Many fragments (NISP = 66) were identified to element and could belong to any of the mature dogs, except Dog 1, which was complete; half of these were from the foot or paw. In addition to these, 127 fragments were not identified to element but were probably canid given their size. Signs of gnawing and gastric etching were present on many of these fragments.

Storage Pit 89-P5

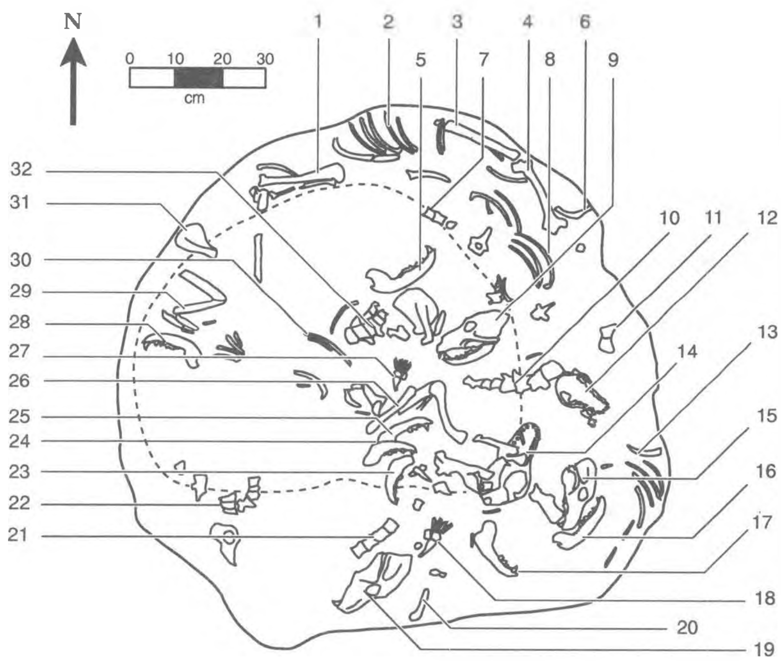
This feature was of a similar size to Storage Pit 88-P31 with a diameter of 101 cm and a depth of 130 cm, and was located immediately next to it. At 105 cm below surface a skull, two mandibles, a partial forelimb, and a group of ribs were encountered. In addition, numerous canid remains lay scattered at the bottom of the pit within a 20 cm cultural deposit (Fig. 4). A few elements were still in their articulated positions, although most were not. These bones were identified to element, while the fragmentary nature of some precluded this assessment. Fire cracked rock, charcoal, lithic flakes, coprolites, and uncommon faunal remains were also present in the pit, which appeared to represent a single, large dumping event (Vol. III, Chap. 4). An associated Plateau style projectile point may date this event. Archaeological evidence suggests that storage pits were quickly filled in when no longer being used (Vol. I, Chap. 10); this may have occurred each fall when pithouses became re-inhabited. Since the deposits overlying the canid remains resembled refuse from floor cleaning activities, it at first appeared that the remains were also considered to be garbage. The dog bones at the bottom of the pit, however, occurred in a light soil matrix with few other cultural inclusions. Those remains found in an articulated position in the pit that could not be confidently attributed to any one individual are treated as discrete units. They are summarized in Table 1. Identified individuals will be dealt with first.

Dog 1

Dog 1 (NISP = 18) was represented by a skull, mandibles, atlas vertebra, and numerous cranial fragments. All teeth were present in the maxilla, while the mandibles, which were fragmented as a result of poor preservation, were missing two incisors and two left premolars. Lack of a well-defined saggital crest and other cranial features (Onodera et al. 1987) suggests that this animal was female. All teeth had fully erupted and were slightly worn, indicating she was of adult age.

Dog 2

A complete skull in excellent condition, with features indicating it belonged to a male (Onodera et al. 1987), two mandibles, and an atlas vertebra were assigned to this dog (NISP = 4). A depressed fracture was evident on the right frontal (Fig. 5). This injury likely happened while the bone was still soft and may have led to the death of this animal. The right zygomatic arch was also fractured, but had partially healed. A



1 Hind Limb #1
2 Ribs #2
3 Tibia #2
4 Femur #2
5 Mandible #2
6 Illium #2
7 Vert.Col. #3
8 Ribs #3
9 Cranium #5
10 Vert.Col #1
11 Vert. Col #5
12 Cranium #4
13 Ribs #5
14 Cranium #2
15 Cranium #3
16 Mandible #1
17 Mandible #8
18 Foot #2
19 Cranium #1
20 Humerus
21 Vert.Col #6
22 Vert. Col #4
23 Mandible #4
24 Mandible #3
25 Mandible #6
26 Forelimb #1
27 Foot #1
28 Mandible #5
29 Forelimb #2
30 Ribs #1
31 Scapula #1
32 Vert.Col #2
- - - Limit of Pit Opening

Figure 4. Distribution of Canid remains on bottom of pit feature 89-P5 (taken from field drawing).

well-defined occipital protuberance shows signs of excess bone proliferation, while the occipital and saggital crests appear normal. The left 3rd premolar was missing from the maxilla and the 1st premolar had erupted on the right side only. Both mandibles were complete, although missing three incisors, and the 1st premolars had not yet erupted. Breakage and subsequent wear were evident on the left canine. Wings on both sides of the atlas vertebra were broken off and appear to have been chewed while still fresh.

Dog 3

Dog 3 was represented by a fragmentary skull and the atlas vertebra (NISP = 7). The cranium, which was smaller than that of Dog 1 or 2, was missing the right sphenoid and both temporal bones, while both mandibles were slightly damaged and gracile in appearance. All maxillary teeth were present except the right 1st premolar. The lower incisors, left 2nd premolar, and right 1st and 2nd premolars were missing, while the left 1st premolar had not yet erupted. Holes, gouges, and furrow marks were present on the mandibles, indicating probable carnivore gnawing. Cranial traits, including lack of a saggital crest (Onodera et al. 1987) suggest that this canid was female; the nearly fully erupted dentition was slightly worn, indicating that she was a young animal. Both wings of the atlas vertebra were broken and were chewed in a manner similar to Dog 2.

Dog 4

Only the palate and tooth bearing portions of this individual's cranium, along with both mandibles, were present (NISP = 3). The left fourth and right third premolars were missing, while enlarged first premolars had replaced the second premolars, which were absent. Both mandibles were complete, except for the ascending rami, which were chewed off. All teeth had erupted but exhibited little wear, suggesting an age of no older than a year. The sex of this dog could not be determined, as most of the cranium was missing.

Dog 5

A nearly complete skull with a reconstructed left zygomatic arch represents the fifth canid (NISP = 7) from this storage pit. Notable on this cranium is an occipital protuberance, which was significantly defined by bone proliferation, and the saggital crest, that had a roughened appearance and had folded at its junction with the frontals. These features probably resulted from stresses similar to those encountered by the fully articulated animal of Storage Pit 88-P31. In the maxilla, the right 3rd molar and both 1st premolars were missing, while the left 1st molar had been broken during the animal's life and was surrounded by evidence of periodontal disease. The left mandible was complete, but missing the 3rd molar, while the right mandible was fragmentary and missing a 1st premolar

Figure 5. Depressed fracture on right frontal bone of Dog 2 89-P5 cranium.

and all molars. All teeth were fully erupted and well worn, indicating advanced age, and, along with cranial traits and a marked saggital crest, suggest that Dog 5 was an older male animal.

Articulated Post-cranial Remains from Storage Pit 89-P5

A number of articulated elements units were present in the pit that could not be confidently associated with a specific individual; these are summarized below (Table 1). Many features were evident on these units that parallel those of the identified individuals. Most notable were the signs of skeletal stress: three incidences of spinal process alteration, two occurrences of pronounced muscle attachments, two bone infections, one healed fracture, and a case of arthritis. A common characteristic shared by the majority of these units and the miscellaneous fragments was the high degree of carnivore scavenging, including evidence of gnawing and gastric etching.

Housepit 109

This structure was located outside of the central village core and has been interpreted as a possible special function structure during at least the earliest occupation (Vol. III, Chap. 11) The last occupation of the house probably occurred during the Kamloops Horizon (1,200–200 BP), when the structure was likely a mat lodge dwelling. Canid remains were encountered in this later deposit, wrapped in birch bark and associated with a hearth and food remains. It is possible that additional canid remains are present in this housepit, as it was not fully excavated. The remains consisted of only a portion of the lower axial skeleton, including the sacrum, four articulated vertebrae, and vertebral fragments. The sacrum had been wrapped or covered in birch bark and possibly protected by an overlying cobble. Bark was also found under the vertebrae and had been burnt (Vol. III, Chap. 11). The bones had been blackened, although it was unclear whether this was a result of burning or staining by the highly organic soil matrix. If burnt, the temperature could not have been very high, as the bark survived. A collapsed and burnt roof is the likely source of the charcoal rich sediments.

Dog 1

These articulated canid remains (NISP = 9) consist of a sacrum, four lumbar vertebrae (3rd, 4th, 6th, and 7th), one thoracic vertebra, a spinal process and neural arch of a second thoracic vertebra, and one other vertebral fragment, possibly a lumbar. The sacrum and 6th and 7th lumbar vertebrae were unburnt, while the 3rd and 4th lumbar vertebrae and vertebral fragment were burnt black. It is possible that the presence of flesh protected the rear elements from the heat. In addition to the

Table 1. Summary of 89-P5 Post-cranial Remains

Unit	Elements
Vertebral Column 1	2nd, 3rd, 4th, 5th, and 6th Cervical
Vertebral Column 2	11th and 12th Thoracic; 1st, 2nd, and 3rd Lumbar
Vertebral Column 3	2nd Cervical; 7th and 8th Thoracic
Vertebral Column 4	4th, 5th, and 6th Lumbar; Sacrum
Vertebral Column 5	4th, 5th, and 9th Thoracic
Vertebral Column 6	8th, 9th, and 10th Thoracic
Vertebral Column 7	7th Cervical; 1st, 2nd, 3rd, and 9th Thoracic
Ribs 1	5th, 8th, and ? Left; 9th Right
Ribs 2	9th and 10th Left; 3rd, 4th, 8th, 10th, and 11th Right
Ribs 3	2nd, 3rd, 4th, 5th, 6th, and 7th Left; 5th and 6th Right
Ribs 4	1st, 2nd, 11th, and 12th Left; 1st, 2nd, 3rd, 8th, 9th, and 10th Right
Ribs 5	4th, 9th, 10th, and 11th Right
Forelimb 1 (Left)	Scapula, Humerus, Ulna, Radius, 6 Carpals, 5 Metacarpals, 3 Phalanges, and 1 Sesamoid
Forelimb 2 (Left)	Scapula, Humerus, Ulna, Radius, 7 Carpals, 5 Metacarpals, 3 Phalanges, and 1 Sesamoid
Forelimb 3 (Left)	Ulna, Radius, 6 Carpals, 5 Metacarpals, 3 Phalanges, and 1 Sesamoid
Hindlimb 1 (Left)	Tibia, Fibula, Calcaneus, Talus, and 4 Metatarsals
Hindlimb 2 (Left)	Pelvis, Femur, Tibia, and Fibula
Forefoot 1 (Left)	3 Metacarpals and 1 Phalanx
Forefoot 2 (Right)	5 Metacarpals, 3 Phalanges, and 1 Sesamoid
Hindfoot 1 (Left)	Talus, 1 Tarsal, 4 Metatarsals, 3 Phalanges, and 1 Sesamoid
Miscellaneous	303 Unassigned Elements and 291 Unidentifiable Fragments

articulated elements, 35 fragments less than 3 cm were present and appeared to have been naturally broken; of these, eight showed signs of extensive burning. All vertebral plates had fused, suggesting that this individual was a mature adult. The absence of a cranium or os-penis precluded the identification of its sex.

Housepit 110

Located on the periphery of the site, this housepit showed evidence of four occupations, including one with a hearth and storage pit. Plateau Horizon (2,400–1,200 BP) projectile points were present during all occupations, which are represented by thick cultural deposits, suggesting long term, but episodic periods of habitation (Vol. III, Chap. 11). In the lowest cultural layer, beneath the hearth and above sterile soil, were the burnt and partially articulated remains of a small canid. This area had been fire-reddened and was surrounded by burnt fish and mammal bone. No canid remains were found in the other levels, but were likely present beyond the test trench, as the atlas and axis vertebrae were recovered from the trench wall. It appears that initial roof collapse, followed by trampling and compaction during later occupations had dispersed the remains. High heat during burning had caused discoloration and cracking of the bones; this degree of alteration suggests that little flesh could have remained during burning. A lack of fire-reddened sediment below the dog does not support the idea that the fire was present on the floor.

Dog 1

The recovered remains represent a highly fragmented, but nearly complete and partially articulated individual (NISP = 52). Two mandibles and two cervical vertebrae were the only elements over 4 cm in size. All bones had been burnt but exhibit differing degrees of heat modification. Ten teeth were recovered, including eight from the mandibles and both upper canines; these were all loose and fragmentary, burnt, and slightly worn. The axis vertebra posterior was unfused, while the anterior cervical vertebrae were in the process of fusing, an event that occurs at approximately 20 months of age (Schmid 1972). Thirteen occipital fragments were the only cranial elements recovered; this lack of cranial remains along with the absence of an os-penis means that sex could not be determined.

Additional Evidence

Coprolites

A number of canid coprolites had been preserved at the site and, although they probably belonged to dogs, there exists the possibility that they were coyote coprolites. These were found to contain salmon bone, as well as mammal bone that resembled dog (Vol. I, Chap. 10). Canid coprolites were also recovered from the Bridge River site; they contained fish and mammal bone, but no dog remains (Langemann 1987:250).

Isotopes

Carbon isotope (C13) tests were performed on HP 7 canid remains and analyzed by Berry (1991). Results showed that 75% of the dogs' protein was acquired from marine sources. It is possible, though, that an undetermined proportion of this protein was obtained through the consumption of human feces (no human coprolites have ever been recovered from the site) instead of by direct consumption. Regardless of the source, salmon was the dogs' principal diet.

Summary of Context and Analysis

Housepits 3 and 7

Kamloops Horizon type projectile points were found in both of these housepits and they share the same date (1,080 ± 70 BP) of terminal occupation; these two facts support the idea that the pithouses were contemporaneous during the Kamloops Horizon (1,200–200 BP). The dog skull in central floor area of HP 7 and the juvenile dog in the center of the HP 3 floor are, therefore, both directly associated with this time period.

As noted, the centrally located canid remains in both housepits were not associated with any artifacts or features. Two explanations exist for this context: 1) the animals were placed on the center of the floor upon pithouse abandonment, or 2) the dog remains arrived after the houses were abandoned, but before the structures burned and collapsed. No burning was evident on the bones of either canid, despite their presence on the floor before burning of the structure. The presence of flesh on the bone could have protected it from heat, but the HP 7 skull was recovered in poor condition, suggesting that it had been weathered for some time before arriving on the floor. It seems more likely that their location below the central roof opening protected the bones from burning; this is supported by Hayden's (1986) observation that few roof deposits were encountered in the centers of HP 3 and HP 7.

A notable difference between the two housepits was a much greater frequency of artiodactyl compared with fish bones in HP 7 than HP 3. If the greater number of canid remains in HP 7 represents a larger living dog population in this structure, and the dogs regularly ate fish bones, this might help explain the discrepancy in faunal proportions. Lord (1866, as cited by Crellin 1994) provided ethnographic evidence for the use of salmon as dog food; this observation, in combination with the presence of salmon vertebrae in canid coprolites, lends support to the present explanation for the disparity in the number of fish bones between HP 3 and HP 7

Additionally, the artiodactyl bones were highly fragmentary and probably represent the practice of marrow extraction by the human inhabitants. The canid elements, on the other hand, were mainly whole and do not seem to have been processed in the same manner (Vol. I, Chap. 10). Also, except for the skull and juvenile on the housepit floors, identifiable canid remains were only present in the HP 7 storage pits, indicating different treatment from other mammal remains, which were largely absent from these features. Although the articulated individual in Storage Pit 88-P31 clearly did not suffer the same fate as the other dogs, it was still not carefully placed or associated with any artifacts.

Housepits 109 and 110

Like some of the other canid remains, those found in HP 109 and HP 110 were also recovered from living floors; however, they are found in strata associated with the Plateau Horizon (2,400–1,200 BP) and have been burnt to some degree. The wrapped sacrum and vertebrae in HP 109 may have held flesh when placed on the floor, as evidenced by differential heat modification, and could represent either a meal or a ritual offering before pithouse abandonment. The semi-articulated nature of the HP 110 canid, however, argues against use as a food resource.

Taphonomy

Carnivore scavenging was well represented in the Keatley Creek canid assemblage. An overwhelming feature of the collection was the relative lack of post-cranial remains. Of the over 3,700 elements possible for the number of dogs identified, only 1,229 were recognized in the analysis; the missing bones had to have been removed by some medium. Crania (NISP = 9) proved to be the most prominent element, while vertebrae and vertebral fragments (130), and phalanges (138) were the most numerous. A low limb bone recovery rate has been noted, with only 55 long bone and long bone fragments recovered, out of 180 possible whole elements. These element frequencies are indicative of a scavenged assemblage.

According to criteria set out by Haynes (1983), the element frequencies of the assemblage equate to a Stage 4 or "Heavy Utilization" scenario, which results from the seven month exposure of a carcass. It was also noted that bone damage of this magnitude is only observed when the carnivores responsible are captive or sedentary animals. Thus, it was most likely the Keatley Creek dogs that were responsible for scavenging the canid assemblage. Intense competition between the dogs, then, probably led to the removal of elements from the site (Kent 1981, 1992:375). The presence of dog bone in the canid coprolites supports this scavenging hypothesis.

Health Status

Dog 1 of Storage Pit 88-P31 was evidently in poor health: nine lesions representing active bone infection and distinct injuries were present on the right side of its face, on two ribs, and on its left hind foot. Injuries to the face were also present in Dog 2 from 89-P5 and Dog 2 of 88-P31. Facial injuries to canids form a consistent pattern in the archaeological record that has been attributed to human action (Baker and Brothwell 1980:94). It should be recalled that both canines of Cranium 1 in HP 7 (found on the floor) had been broken off. Beating by humans may explain the zygomatic arch injuries to Dogs 1 and 2 from 89-P5. These injuries, though, would have left the animals unable to work for some time. The only ethnohistoric evidence for dog beating is from the Arctic (M'Clintock 1860:289–290; Hantzsch 1977:143). Danial Williams Harmon (1800–1806, in Lamb 1957), however, recorded that "Indian Dogs" west of the Rocky Mountains and on the Plains were treated with great affection. Alternative explanations for these injuries can be found in packing related accidents (falling rocks), hunting wounds (a kick from a deer), or fighting between dogs. Other individuals and element units also showed evidence of fractures and infections, although these were less notable than the above and exhibited no discernible pattern.

Sex, Age, and Cause of Death

Most dogs were found to be between 18–24 months of age, but two were younger and two much older than this interval. Four males and three females were identified, while the sex of the rest could not be determined.

The most likely indication of humanly caused death was found in Dog 2 from 89-P5, with a fracture on the right frontal behind the orbit. Other animals, though, could have been killed in ways that left no skeletal traces, or traces that were more ambiguous as to their cause.

Interpretations

Domestic dogs were clearly a significant component of Keatley Creek society during the Plateau (2,400–1,200 BP) and Kamloops Horizons (1,200–200 BP). Canid remains from Storage Pit 88-P31 have been directly dated to Plateau Horizon times and two of the six distinct sub-assemblages were directly associated with Kamloops Horizon occupations: the partial immature remains from HP 3 and the single cranium from the HP 7 floor. We will now take a look at how these dogs contributed to Keatley Creek society by evaluating the five hypotheses developed by Driver (1976) and by introducing reasonable alternatives.

Hypothesis Evaluation

Hunting

This important economic function has proven difficult to identify archaeologically, with sources of evidence probably lying solely in burial contexts and the identification of distinctive hunting injuries. Good hunting dogs were valuable during ethnographic times on the Plateau, but there was no discernible evidence for this function at Keatley Creek. The dogs killed or abandoned in HP 7 could not have been considered valuable in this sense.

Clothing

No cutmarks at the distal ends of long bones, indicative of skin exploitation, were observed on any of the canid remains; it is possible, though, that if done correctly, marks would be absent. The apparent wealth of some households (i.e., HP 7), and the presence of large numbers of artiodactyl bones, would probably preclude the use of dog skins for clothing.

Transportation

Savage (1986) has noted that dogs used as draft animals show distinctive patterns of bone changes in the lower thoracic and lumbar vertebrae. Arthritic changes at the sacro-iliac joint and substantial muscle attachments on the femora have been attributed to sled pulling. Like a sled dog, the fully articulated individual of Storage Pit 88-P31 was also subjected to prolonged stress, but of a clearly different nature. The enlarged and flattened spinal processes, from just behind the shoulder to the front of the hip, correspond to the placement of a pack. This individual was probably exploited as a pack dog for the majority of its life. Other element units in the assemblage showed similar pathologies. Vertebral Column 3 exhibited the same flattening of the spinal processes, while Forelimb 1 had exaggerated muscle attachments on the humerus. The cranium of Dog 5 from Storage Pit 89-P5 had an exostosis on the occipital protuberance. It is possible, then, that all of these elements belonged to Dog 5, which was also exploited as a pack dog.

With the location of Keatley Creek 1.5 km from the Fraser River, and the importance of the salmon resource to Plateau culture, pack dogs would have proven highly useful animals. The uphill travel required around the steep canyon walls could explain the well-defined muscle attachments on these individuals, and the common rockfalls in the area could account for the observed injuries. It is equally possible that dogs were used as pack animals in upland areas when people went hunting or root gathering. Teit (1909:532) observed that the Shuswap regularly used dogs as beasts of burden.

Food

The dog bones at Keatley Creek did not undergo the same heavy processing as other faunal remains at the site and were not distributed in the same manner (i.e., around hearths), so they were probably not regularly exploited as a food resource. Partial burning of the HP 109 canid remains, though, could represent use of dogs as food.

Ritual (Sacrifice and Feasting)

With the majority of post-cranial bones missing, it was difficult to evaluate the feasting hypothesis. Of the midden assemblages on the Plains, only 15% of the canid elements exhibited cutmarks (Snyder 1991). The possibility exists that people or dogs removed all of the feasting remains from Keatley Creek. Alternatively, the dogs may have been pit-roasted and then disarticulated by hand, leaving no distinguishing marks. These scenarios could explain the lack of evidence for dogs being used in feasting. At least two of the dogs were obviously sick and would have made poor feasting animals, although they might have been prime targets for ritual sacrifice. By the ethnographic period, the Western Shuswap, Chilcotin, and Carrier, but not the Thompson or Lillooet, had adopted the coastal Dog Dance, or Dog Eating Ceremony. In order for this event to have the proper effect, participants had to regard dog flesh as repulsive and, therefore, not as a suitable feasting food. In fact, most groups that were in regular contact with the coast did not regularly eat dogs. The above factors detract from feasting as a viable hypothesis. Ritual sacrifice of dogs at Keatley Creek, however, is supported by much of the available evidence, including the apparent intentional killing of several dogs.

Dog sacrifices were common on the Plateau, ethnographically, when their owners died. These sacrificed dogs were then hung from poles or trees near the grave (Smith 1900; Teit 1900, 1909; Simon Fraser 1808, in Lamb 1960:85). In fact, a number of native groups in Canada hung sacrificed dogs from poles (Dublon 1677, in Thwaites Vol. 60:227; Henry 1809); Siberian groups, particularly the Koryak, also exhibited this cultural trait (Jochelson 1908). For reasons stemming from death, illness, prolonged foul weather, or perhaps after a Dog Dance ceremony, carcasses may have been hung outside on poles. These dog remains would have decomposed there over time and, eventually, some portions would have fallen to the ground, where they could have been scavenged by other dogs. Some carcasses would have been accessible to scavengers longer than others and would, as a result of their exposure, be more heavily weathered. These bones may have been collected afterwards to bring inside the house. Once there, the remains seem to have been preferentially deposited in one of two areas: on the center of the floor or in a storage pit.

The pattern of leaving a dog, or part thereof, on the center of the floor may represent a form of ritual sacrifice performed, perhaps only prehistorically, upon the abandonment of a dwelling, or at other important household events. The single dog skull from HP 7, the partial juvenile from HP 3, and the burnt canid remains from HP 110 were all recovered from the center of the floor. An articulated individual from HP 2 at the Baker Site was also found in this context (Wilson 1992). Conceivably, this recurring theme represents a sacrificial event performed by dog owners only, with the purpose of spiritually protecting the dwelling or signifying ownership during vacancy.

In Storage Pit 89-P5 of HP 7, floor-like deposits were only found above the canid remains, not in the surrounding matrix; thus, the deposition of these dog remains probably does not represent a simple house-cleaning event. Two hundred small bone fragments less than 3 cm in size were collected and placed in this pit, and identifiable dog remains were absent from all parts of the house, other than the center of the floor or the other storage pit. Ethnographically, dogs were considered to have magical power or could provide spiritual protection (Teit 1900:354); the collection and special placement of small dog bone fragments may represent that belief. In addition, the wing bones of a hawk and a beaver humerus and femur (both burnt) were also found in the lower part of the pits, while bones from other species were largely lacking (Vol. I, Chap. 10, Appendix III). Among many native groups, the first beaver of the season was used in a ceremony (Jenness 1932). It is possible, then, that this storage pit was used as a receptacle for ritual remains only. Similar concentrations of dog bones in pits at the Bridge River site (Langemann 1987) indicate that some such special treatment of dog remains was a recurring pattern in the Lillooet region.

Protection and Companionship

Dogs that performed this function should have undergone careful burial and probably would have lived to old age. The inclusion of dogs in human burials elsewhere on the Plateau (Langemann 1987; Pokotylo et al. 1987; Sanger 1968; Smith 1900) may represent an affectionate bond. There is no evidence of this at Keatley Creek.

Status Display

The greatest number of canids at the site were recovered from HP 7 (MNI = 12), meaning that some groups had surplus dogs. Salmon was the principle food given to dogs and people would have needed a food surplus to support the additional animals. This can be seen as evidence of status display and accords well with the wealth items found in this housepit. The fact that 75% of the dogs' diets was salmon indicates a relatively high cost for keeping and breeding dogs, consistent with their roles as status display items.

Natural Formation

Finally, it is worth considering possible non-cultural scenarios for the formation of the large canid assemblage. For example, it is possible that in times of stress many groups abandoned unwanted (old or sick) dogs. On the Plateau, this might occur when villages were abandoned in the spring. Packs of stray dogs could then have wandered around the abandoned village during the summer. Some of these animals may have subsequently died of illness or starvation, perhaps after gaining entry to an empty pithouse. Once there, other canids could have scavenged the carcasses; some elements would have been removed because of competition. Upon their return in the fall, people might have cleaned up the remains on the floor and placed them in the pits. Given the special placement of some dog remains in the center of the floor, and the burial of others in storage pits, this scenario does not seem to satisfactorily explain all the key observations from the site.

Conclusion

The remains of at least fifteen domestic dogs were recovered from Keatley Creek during the 1988 and 1989 field seasons. This constitutes the largest prehistoric canid assemblage to date on the British Columbia Plateau. Dog bones were present in four of the housepits excavated at the site in contexts spanning the Plateau (2,400–1,200 BP) and Kamloops (1,200–200 BP) Horizons. Through the osteological analysis of these bones and the examination of archaeological information from the site, our understanding of the relationship between humans and dogs in Plateau prehistory, including functional roles, has been significantly enhanced. Two dogs were clearly exploited as pack animals for most of their lives, and at least two others appear to have been part of a ritual surrounding pithouse abandonment. A few possible indications of beating by humans were present, and one such instance probably led to the dog's death. In fact, many of the dogs were in poor health and most died before reaching two years of age. Differences were noted in the number of dogs found in the housepits, particularly the concentration in HP 7, and may be a manifestation of status display. Although none of the other relationships explored could be substantiated by the available data, special treatment is evident in the intentional burial or placement of many canid remains encountered at the site. Besides the cultural factors responsible for the formation of the assemblage, extensive carnivore scavenging took place, probably by other dogs and before people deposited the bones. These observations all support the conclusion that dogs were an integral component of Keatley Creek economy and society, and may have been used for ritual or prestige displays as well.

Note: The information contained within this paper is derived from an unpublished M.A. thesis by the principal author in 1994 entitled *Is There a Dog in the House: The Cultural Significance of Prehistoric Domesticated Dogs in the Mid-Fraser River Region of British Columbia*. Department of Archaeology, Simon Fraser University, Burnaby. Researchers are encouraged to consult this document for a more in-depth look at the Keatley Creek canid remains.

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Lithic Analysis

Chapter 11

Patterns in Lithic Artifact Distributions and the Social Organization of Space on Housepit Floors

Jim Spafford

Introduction

This chapter is a summary analysis of patterns in the distribution of lithic artifacts on the floors of three housepits at the Keatley Creek site. A more complete analysis can be found in Spafford (1991). Assuming that the patterned use of space on housepit floors during the last occupation can be a major source of artifact patterning in the floor deposits, it is possible to make inferences about the social and economic organization of the residents of these housepits. The statistical and visual analyses of the data indicate that the largest house was divided into several separate spaces, each used by somewhat independent domestic groups for similar activities, while in each of the two smaller houses, a single domestic group shared a space divided into areas used for different activities. These patterns in the social organization of space are consistent with a model of social organization, based on the work of earlier researchers in this region (Stryd 1971, Hayden et al. 1985), arguing that the largest pithouse in large pithouse village sites in the Mid-Fraser River region might have been occupied by groups which were more hierarchical in their social organization than contemporaneous groups in smaller houses. The most recent occupations of the three housepits dealt with here (HP's 3, 7, and 12) all date to the Kamloops Phase of the Plateau Pithouse Tradition (ca. 1,200–200 BP—Richards and Rousseau 1987).

In the model of social organization proposed for Keatley Creek (Hayden et al. 1985), competition between groups within a society for control of important resources leads some groups to seek competitive advantages through new forms of social organization. Hayden et al. (1985) have suggested that some groups living in large pithouse villages in the Mid-Fraser River region might have gained a number of competitive advantages by organizing themselves into large, hierarchically-organized co-residential corporate groups. I argue that within a co-residential corporate group organized for this purpose, somewhat independent domestic groups would have been in competition with each other for wealth and power and would have maintained physically separate domestic economies in an effort to control and display their individual wealth and status. Each domestic group would be expected to deposit a largely redundant collection of artifacts within the bounds of its domestic space. The most influential group might be expected to occupy a somewhat larger area than the rest and this area might exhibit greater evidence of wealth, status and craft specialization. The largest domestic area might also be situated at some particularly desirable location within the structure; in the warmest part of the house or close to an important feature.

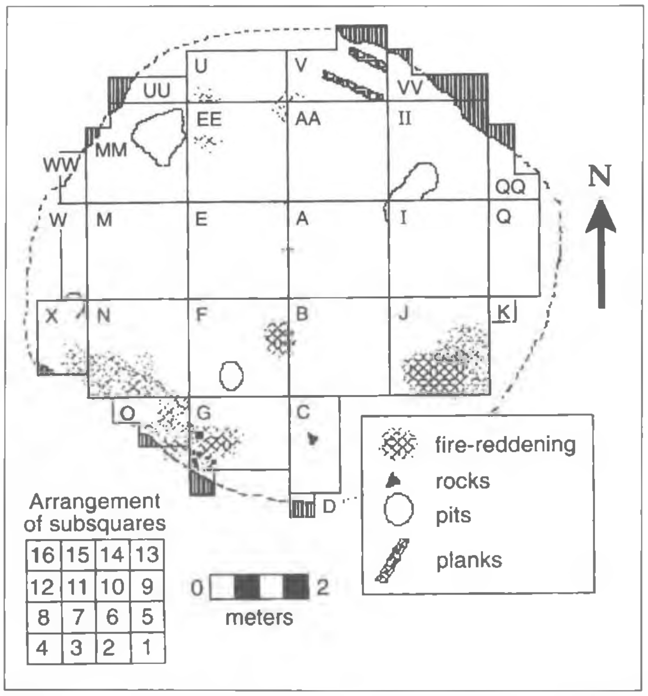

Figure 1. Arrangement of squares and subsquares on the floor of HP 3.

In a household organized primarily as a large family unit, with less internal competition between constituent groups for rank and status, activities such as sleeping, food preparation, refuse disposal and various manufacturing tasks would have been conducted communally in separate areas. Archaeologically, it would be expected that various classes of artifacts would have been deposited in quite different proportions in areas used for different activities.

The rim-crest to rim-crest diameter of HP 12 is 9 m, somewhat below the 11.13 m average diameter for housepits at the Keatley Creek site. Housepit 3 has a diameter of 14 m which is above average but considerably below the maximum diameter of 21 m, and HP 7 has a diameter of 19 m, near the upper end of the range. Population estimates for the three housepits based on Teit's (1906) observations from B.C.'s interior plateau in the late nineteenth century and Hayden et al.'s (1996) analysis of ethnographically recorded HP sizes and numbers of residents put the population of HP 12 at 19, HP 3 at 31, and HP 7 at 45 (see Spafford 1991: 19). Any of these populations is large enough to have been divided into several somewhat independent domestic groups within a large, hierarchically organized, co-residential corporate group. However, the model proposed by Hayden et al. specifically associates large, hierarchically-organized co-residential corporate groups with the pithouses at the high end of the size distribution. Patterns in the distribution of lithic artifacts on the floor of HP 7 are, therefore, expected to be consistent with those predicted for the residences of large corporate groups. Patterns in the distributions of lithic artifacts on the floors of the two smaller HP's could reasonably be expected to be consistent with either type of social organization, though it is predicted that smaller houses are more likely to have been organized around a single domestic economy.

In this analysis, the housepit floors were divided into sectors distinguished by the locations of hearth and pit features and by visibly discrete clusters of artifacts (Figs. 1, 2, & 3). In order to identify artifact classes with distributions more likely to have resulted from patterned human behavior than from a random distribution process, the frequencies of various classes in the different sectors on each floor were compared using chi-squared tests or, for rarer artifact classes, the binomial distribution. Distributions which were not considered to be attributable to random processes were then examined visually in order to identify areas used for different activities. Finally, some activities which might have occurred in each of the identified "activity areas" were suggested on the basis of the artifact classes present.

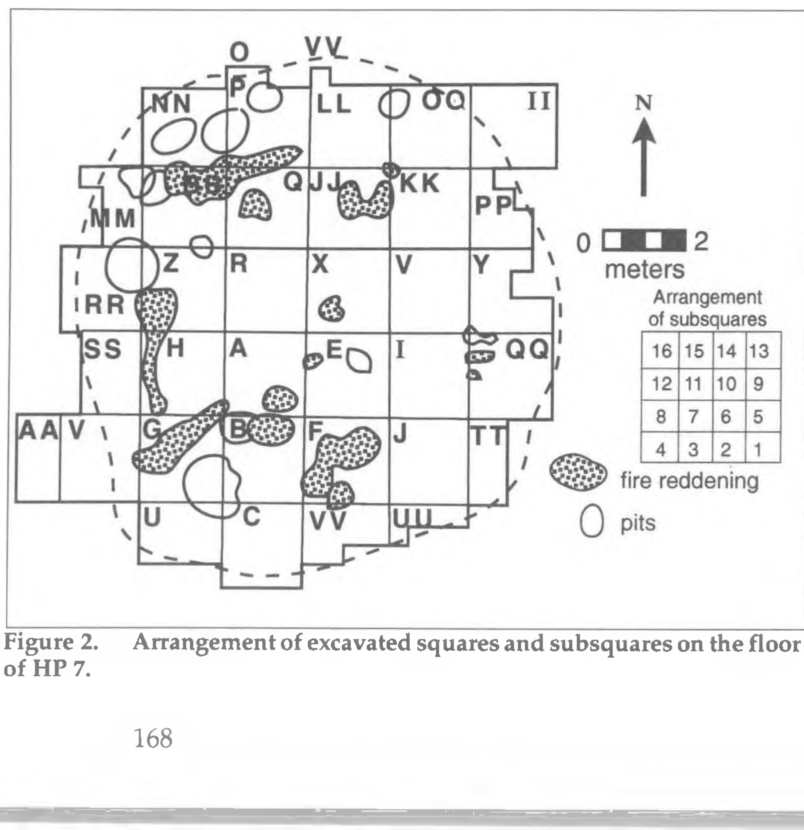

Figure 2. Arrangement of excavated squares and subsquares on the floor of HP 7.

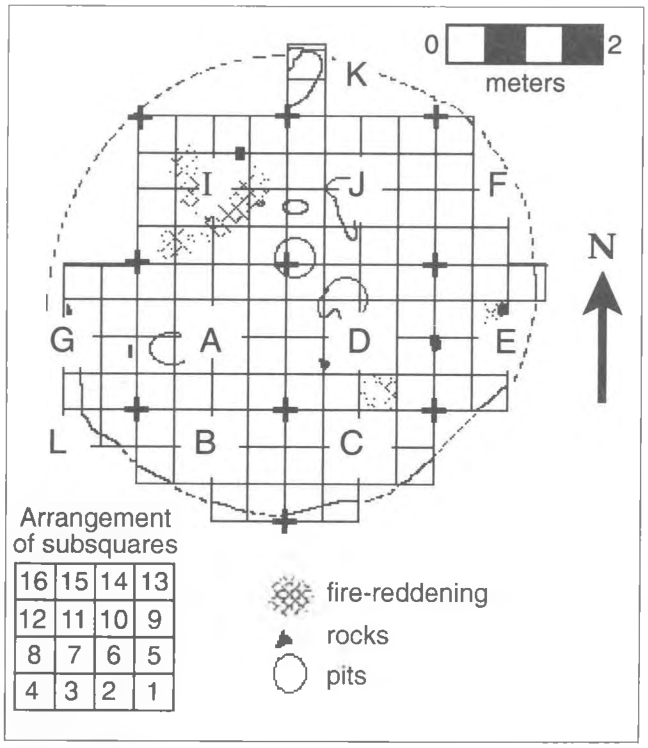

Figure 3. Arrangement of excavated squares and subsquares on the floor of HP 12.

Thus, there is little to suggest that this floor was divided among several domestic groups each of which used its own area for similar activities. Instead it seems that the southwest and northeast sides of the floor were each used for a distinct set of activities. The artifacts which characterize the southwest side tend to be acute-edged tools or by-products of the manufacture of acute edges and, since acute edges are probably best suited to working soft materials such as foodstuffs, birchbark, skins, and some fibres, this area was interpreted as a possible "kitchen" and/or women's work area. The relative abundance of heavily-retouched scrapers, hammerstones, and debitage on the northeast side suggests an emphasis on the working of harder materials such as wood and bone, materials which would have been used extensively in the manufacture and maintenance of equipment for activities such as fishing and hunting. For the sake of convenience I refer to the area distinguished by these artifact types as a "workshop." The central area probably served primarily as a traffic area. It may also have been used for activities requiring a large open work space. Large notches have been interpreted as tools used in working shafts and extra space would have been required for the manipulation of long objects.

In the absence of any clear evidence that this floor was divided into distinct areas used for similar activities, I argue that the residents of this house were organized into a single, economically cooperative, domestic unit. By this I mean that competition for status

Housepit 3

Since the patterns observed in the distribution of lithic artifacts on the floor of HP 3 (the medium-sized housepit) are in some respects the clearest, and provide a good basis for comparison with the other two housepits, they are presented first.

In HP 3, lithic artifact types which occur in some sectors in frequencies considered improbable ($p < 0.10$) in a random distribution include: utilized flakes (Fig. 4), bifacial knives, small piercers, and small billet flakes, which are unexpectedly abundant in the southwest sector but rare in the northeast sector; whereas heavily-retouched scrapers (Fig. 5), hammerstones, and debitage in general (Fig. 6) are improbably abundant in the northeast sector and rare in the southwest sector. Visual examination of distribution maps for these types confirm the impression that these distributions distinguish opposite sides of the floor. Between these areas, the center of the floor, represented by the center sector, is distinguished by a general scarcity of debitage and modified artifacts, though visual examination of the distribution of large notches suggests that the center of the floor was preferred for some activity involving the use of this modified artifact type.

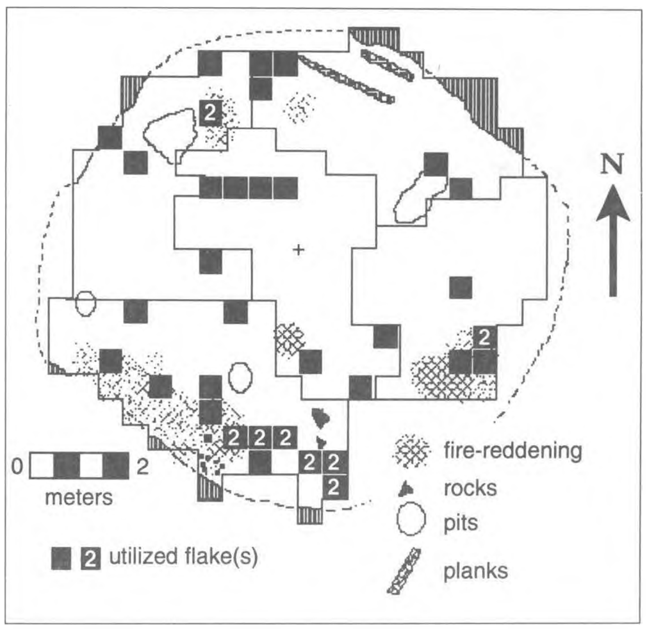

Figure 4. Distribution of utilized flakes on the floor of HP 3.

and resources would generally have been limited to competition between individuals rather than competition between groups or families. The most important distinctions within the co-residential group would have been based on sex, age, and individual status.

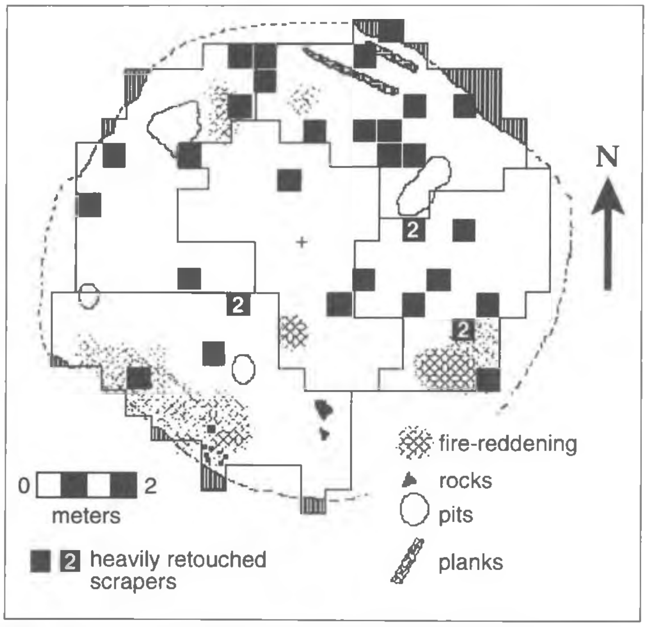

Figure 5. Distribution of heavily-retouched scrapers on the floor of HP 3.

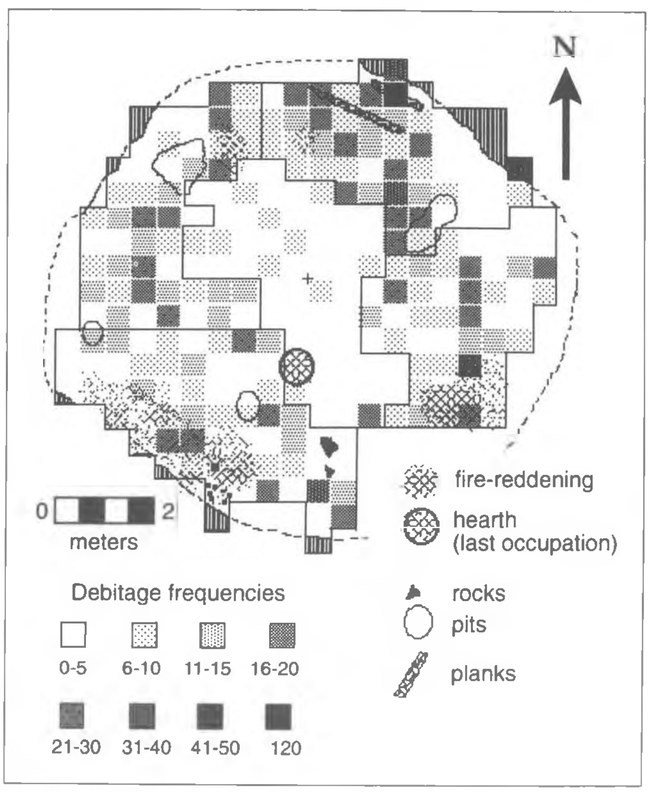

Figure 6. Distribution of debitage on the floor of HP 3.

The population of this housepit was estimated at 31. In a polygamous society, a large extended family, centered, perhaps, on two or three brothers with their wives, children, parents, elders, slaves, and other dependents, might have approached this size. Possibly, close bonds of kinship maintained this household as a cohesive social unit.

Housepit 12

The patterns observed in the distribution of lithic artifacts on the floor of HP 12 (Fig. 7) were similar in some respects to those on the floor of HP 3. In HP 12, acute-edged expedient flake tools are improbably abundant in the southwest sector and present in the southeast sector but absent in the east and northeast sectors. Expedient scrapers are improbably abundant in the east sector and present in the northeast sector but absent in the southwest and southeast sectors. There is less debitage than expected in a random distribution in the southwest and southeast sectors and more debitage than expected in the east and northeast sectors (Fig. 8). While different artifact types are involved, these complementary distributions, like those in HP 3, suggest that opposite sides of the floor were used for quite different activities. Another interesting similarity is that the center sector of HP 12, like the central area in HP 3, is rich in notches.

There are important differences between the two housepits, as well. Utilized flakes are associated with high debitage frequencies in HP 3 and with low debitage frequencies in HP 12. Also, the center sector of HP 12 is rich in fire cracked rock, debitage, and modified artifacts while the northwest sector is poor in all classes of lithic artifacts. The center sector of HP 3 is poor in both debitage and modified artifacts.

In fact, the use of space seems to have been organized somewhat differently in the two houses in functional terms. In HP 12, the center of the floor appears to have been used more intensively for activities involving heavy use of lithic artifacts. This may be because HP 12 is only 8 m in diameter as compared with 15 m for HP 3. Housepit 12 is also much shallower. Headroom and working space would, therefore have been more restricted near the edge of the floor in HP 12.

As far as the social organization of space is concerned though, the similarities between HP 3 and

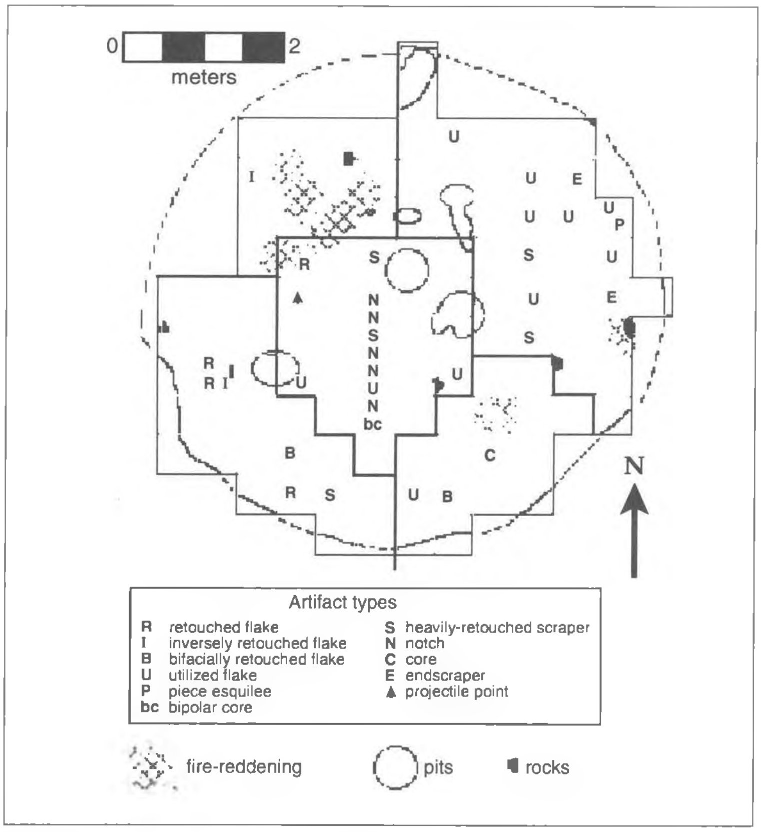

Figure 7. Distribution of modified artifact types on the floor of HP 12.

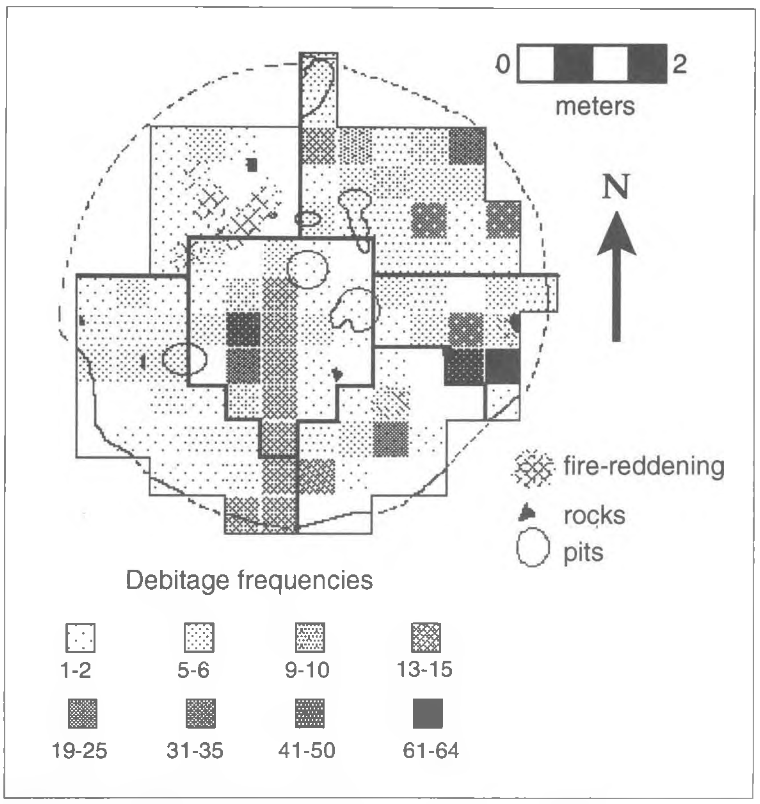

Figure 8. Distribution of debitage on the floor of HP 12.

HP 12 outweigh the differences. In both houses, the northeastern area of the floor appears to have been used for some activity which resulted in the deposition of relatively large quantities of debitage. Possibly, this location was chosen for lithic reduction because it received more daylight than other areas. In both houses the center of the floor appears to have been preferred for some activity involving the use of notches. While it does not appear that the southwest and northwest sides of the floor of HP 12 were used for the same sorts of activities as in HP 3, it seems clear that, in both houses, the most important division of space was between opposite sides of the floor, in which different activities occurred.

In HP 12, as in HP 3, there is no indication that separate areas of the floor were used by different domestic units for similar purposes. Instead, four distinctive areas were identified on the floor of HP 12, each of which appears to have been used for different activities. Again, I interpret this as evidence that social distinctions based on age, sex, and individual status were more important to the residents of HP 12 than was identification with any group within the co-residential group. I have not, however, identified specific areas on the floor of HP 12 as "kitchen" or "workshop" areas. The concentrations of debitage and utilized flakes which, to a large extent, distinguished a possible workshop from a possible kitchen in HP 3 occur in the same sector in HP 12. This may be because space was so constricted near the periphery of this floor that both "kitchen" and "workshop" tasks were confined to a relatively small area in the center.

The population of HP 12 was estimated at 19, which is few enough to be included in one large extended family centered around two or three adult siblings, but certainly more likely to represent several (probably related) families.

Housepit 7

In HP 7, lithic artifact types which occur in some sectors in frequencies considered improbable ($p < 0.10$) in a random distribution include: fire cracked rock (Fig. 9), debitage in general (Fig. 10), utilized flakes (Fig. 11), acute-edged expedient flake tools, expedient scrapers, heavily retouched scrapers (Fig. 12), notches, drills/perforators, key-shaped scrapers, spall tools, and early projectile point types.

As in HP 3, heavily-retouched scrapers tend to be abundant where utilized flakes are scarce and vice versa. Also, heavily retouched scrapers are associated with high debitage frequencies in both houses. However, visual examination of the distributions of these types reveals quite a different pattern on the floor of HP 7.

In HP 3 utilized flakes were concentrated on one side of the floor and debitage and heavily retouched scrapers are concentrated on the other. In HP 7, the complementary distributions of heavily-retouched scrapers and utilized flakes are concentrically distributed. Assuming that areas rich in these two artifact types were associated with similar activities in both houses, it seems clear that space was organized somewhat differently in each house. Activities involving heavily-retouched scrapers and heavy deposition of debitage, which were concentrated on the northeast side of HP 3, were distributed around the northern perimeter of HP 7 while activities involving utilized flakes, which were concentrated on the southwest side of HP 3, were distributed in a band extending from slightly north of the center of the floor towards the southwestern and southeastern perimeter.

On the basis of these distributions, I have defined three concentric zones on the floor of HP 7 (Fig. 13). In the southern part of the floor, an "Inner zone" was distinguished from the remainder of the floor by relatively low frequencies of debitage and modified artifacts and by higher than expected frequencies of chert flakes. A "Central zone," surrounding the Inner zone, was distinguished by higher than expected frequencies of utilized flakes. Both the Inner and Central zones are

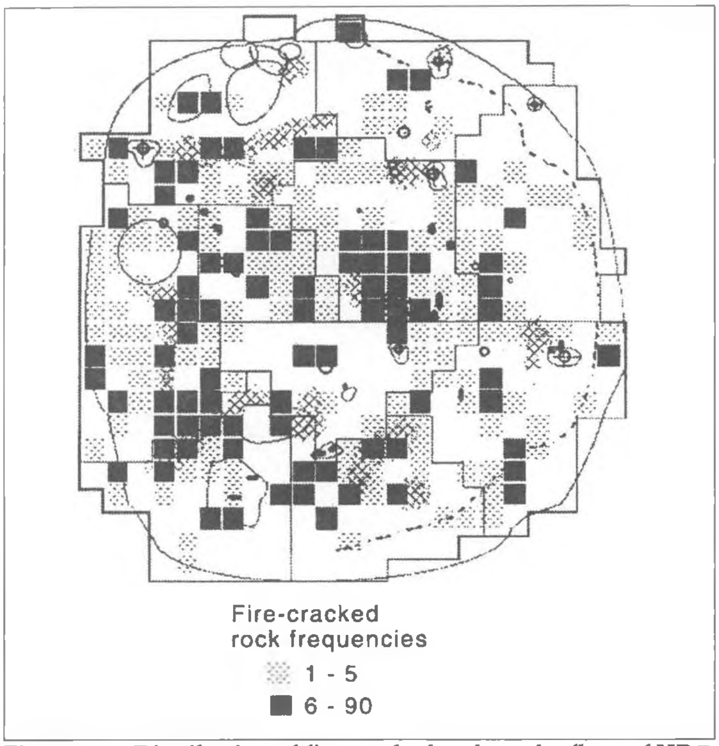

Figure 9. Distribution of fire-cracked rock on the floor of HP 7.

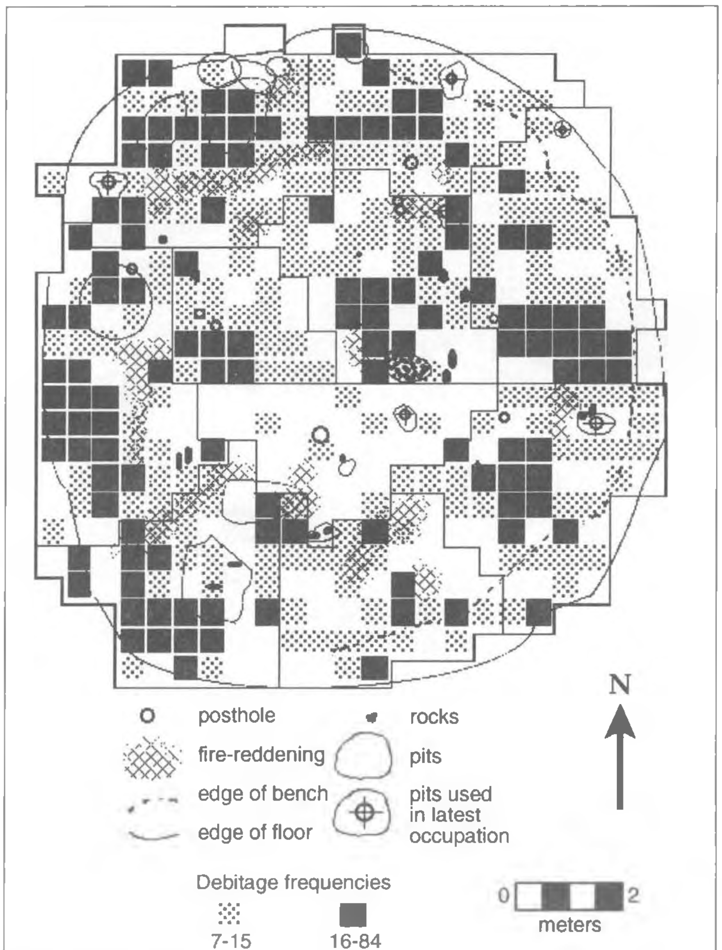

Figure 10. Distribution of debitage on the floor of HP 7.

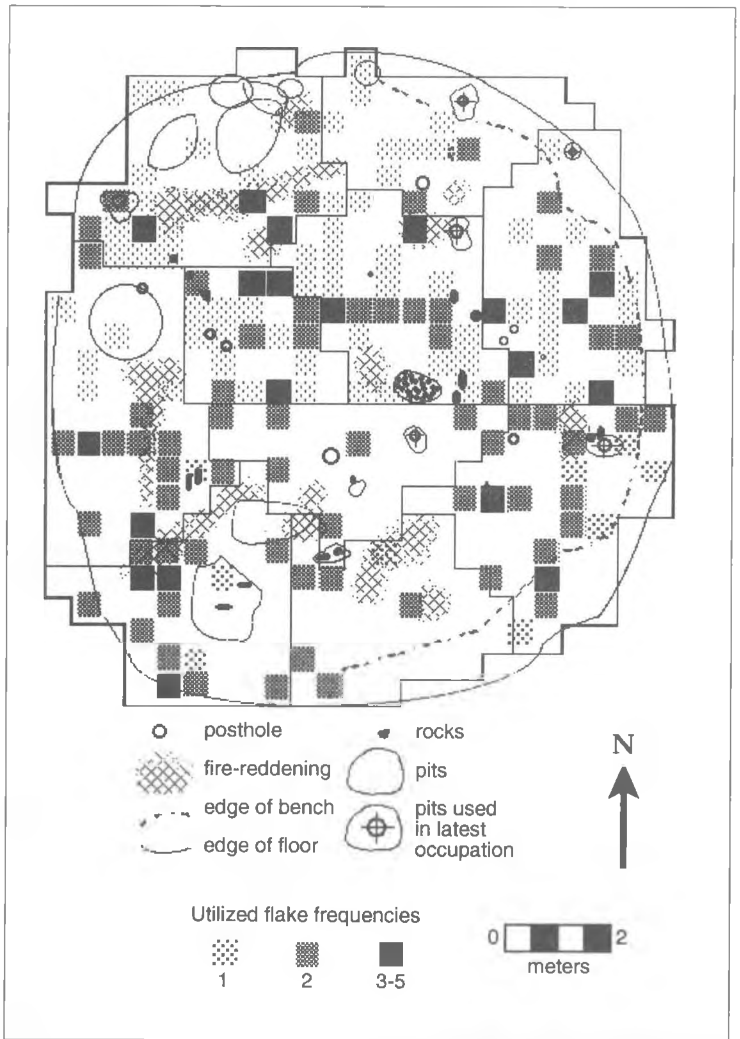

Figure 11. Distribution of utilized flakes on the floor of HP 7.

relatively rich in fire cracked rock, but in the Central zone, fire cracked rock is concentrated along the boundary with the Inner zone. Along the northern half of the perimeter, an "Outer zone" was distinguished by an abundance of debitage, higher than expected frequencies of heavily-retouched scrapers and a relative scarcity of fire cracked rock.

Similarities in the distributions of lithic artifacts suggest similarities in the activities which occurred in different spaces. Thus, the Central zone in HP 7, like the southwest side of the floor of HP 3, is interpreted as a possible "kitchen" area, used for handling foodstuffs and other relatively soft materials, while, the Outer Zone, like the northeast side of the floor of HP 3, is interpreted as a "workshop" area used for manufacturing, maintaining, and repairing equipment such as hunting and fishing gear.

In HP's 3 and 12 opposite sides of the floors appear to have been used for different activities and this was interpreted as evidence that a single domestic unit occupied each house. On the other hand, the concentric Inner and Central zones in HP 7 could readily have been divided among several separate domestic units so that each would have access to a portion of both the "kitchen" and "workshop" areas. The distribution of hearths, pit features, and discrete clusters of artifacts around the perimeter of this floor provide an additional indication of such an arrangement and suggest some possible lines along which the Outer and Central zones might have been divided.

In the Inner zone, despite the overall scarcity of modified artifacts, almost every modified artifact type is represented in proportions which are not improbable ($p > 0.10$) in an even distribution. This was interpreted as an indication that the Inner zone was used less intensively than the Central and Outer zones but for many of the same activities. I have suggested that the Inner zone, in association with a hearth in the southwestern part of the Central zone, might have been a domestic area occupied by a group whose high status entitled it to a larger living space than other domestic groups in this house. A possible hide-working area in the southeastern part of the floor, distinguished by an abundance of spall tools improbable in a random distribution, could also have been attached to the Inner zone. Hide-working and control over hides is a probable indicator of high status, as argued by Hayden (1990).

Additional indicators of possible higher status for a group residing in the southern part of the floor include: the presence of a stone bead and a fragment of a nephrite ornament (the only artifacts in any of the three housepit floor assemblages which can be interpreted as status goods) and unexpectedly high frequencies of cores and of chert and chalcedony flakes, which may indicate control over lithic resources. Key-shaped scrapers, and drills/perforators represent an unexpectedly high proportion of the modified artifacts in the southern sectors and may be evidence of some form of craft specialization in the Inner zone.

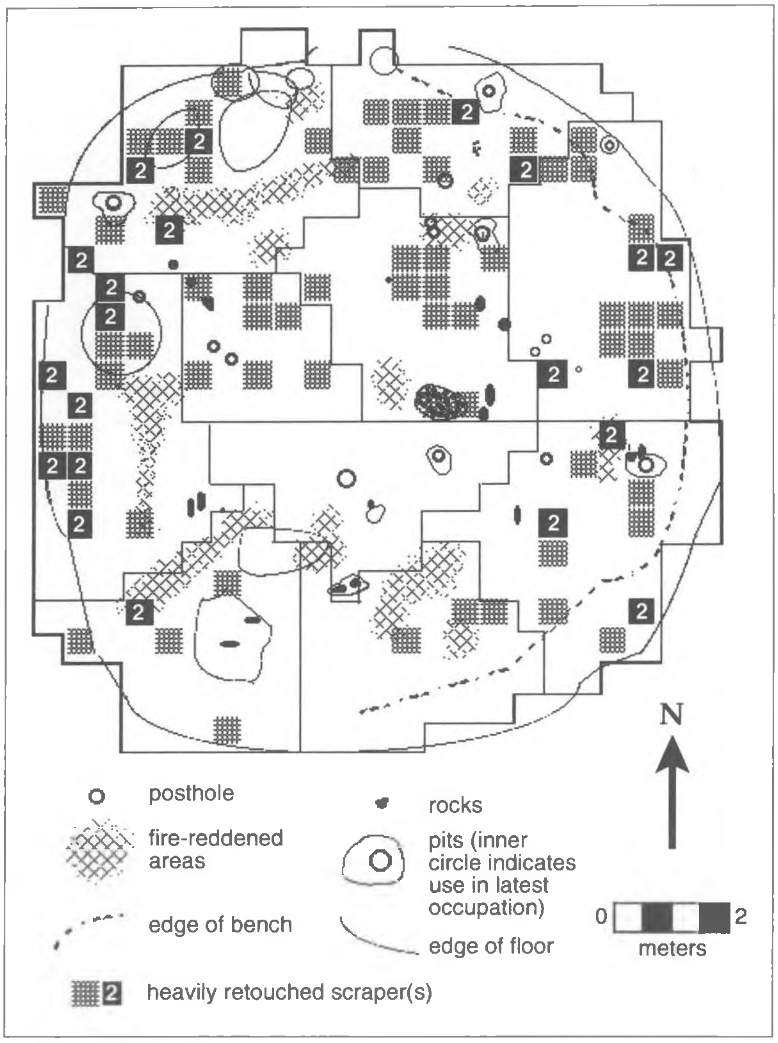

Figure 12. Distribution of heavily-retouched scrapers on the floor of HP 7.

Comparisons

The concentric zones on the floor of HP 7 are more consistent with the model of a space divided among several sub-groups, each of which had a similar role within a co-residential corporate group, than is the bilateral division of space described for HP's 3 and 12. If the activities represented by utilized flakes on the one hand and heavily-retouched scrapers and debitage on the other represent a fundamental division in general domestic behavior, possibly female vs. male activities, then it is likely that both components would be present in each area occupied by an economically independent sub-group within a co-residential corporate group. The concentric zones of HP 7 can be radially divided into several similar areas each incorporating a portion of each zone. Hearths are distributed on the floor of HP 7 in a manner which suggests the existence of several such areas, each containing a hearth. In addition, boundaries between artifact clusters in these zones suggest boundaries between independent domestic areas. In HP 3, areas incorporating both the utilized flake component and the heavily-retouched scraper component would have to be laid out in longitudinal bands across the floor, parallel to the southwest-to-northeast axis. Such longitudinal bands would be split into two parts near the center of the floor, a presumed high traffic area. Bands farther from that axis would include only peripheral parts of the two important artifact concentrations. If, as the distributions of Kamloops points, expedient scrapers, and exotic flakes indicate, the Northwest sector was also used for different activities from the remainder of the floor, it would have been nearly impossible to devise a division of this floor into two domestic areas which each included part of any two activity areas, let alone all three. Similar difficulties arise in trying to divide the floor of HP 12 into areas which incorporate parts of each of the distinct distributions there. Assuming that all domestic areas would have been used for the same basic activities and that these activities would be represented archaeologically by collections of artifacts in which most artifact types are represented in similar proportions, it is hard to imagine how the floor of either HP 3 or HP 12 could have been divided so as to include multiple domestic areas. In addition, there is good evidence for only a single hearth associated with the most recent occupation in either HP 3 or HP 12. Since it seems likely that each domestic area would have been organized around a hearth, this is further evidence that, in each of the two smaller houses the residents were organized into one domestic group.

Thus, of the three floors examined in this study, only the floor of the largest house, HP 7, has artifacts distributed on it in patterns which are clearly consistent with a division of the living space into several domestic areas. This is the arrangement predicted for the social organization of space in the residences of large, hierarchically-organized, co-residential corporate

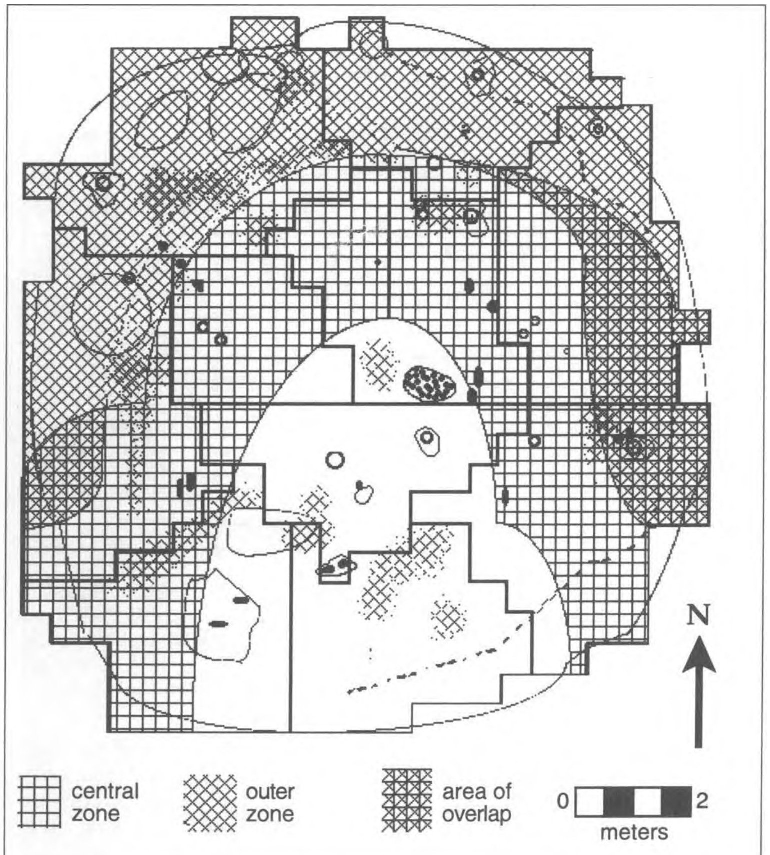

Figure 13. Sketch showing the boundaries of the Inner, Central, and Outer zones identified on the floor of HP 7.

groups. So, as far as these three housepits are concerned, the observed data is consistent with the model.

More detailed questions related to status differentiation, craft specialization, and the sexual division of labor cannot be so easily dealt with. Housepit 12 has substantially fewer lithic artifacts in relation to floor area than either of the two larger houses. It also has less diversity in artifact types, suggesting a narrower range of activities, and is relatively poor in exotic lithic raw materials. All of this could be interpreted as evidence of relative poverty for the residents of this house or of a shorter occupation span. There is less discrepancy between HP's 3 and 7.

All three houses contain spatial concentrations of exotic debitage, which might have been controlled by high status individuals, and all three have areas where artifact densities are relatively low. Special attention has been given to the southern part of the floor of HP 7 as an area which might have been occupied by a high-status domestic unit or complex. This suggestion was made on the basis of: the relatively clear space in the South Center sector (indicating some special use of part of the Inner zone as a space from which ordinary activities were excluded), low artifact densities (indicating less involvement in mundane tasks) combined with a desirable southerly location, an abundance of fire cracked rocks and large hearth areas (associated with access to firewood), a concentration of desirable chert and chalcedony flakes, large storage pits in the sector, and proximity to an area which may have been used for hide-working.

The concentration of spall tools in the southeastern part of the floor of HP 7, which has proportionately more tools of this type than either of the other houses, may be the strongest indicator of an area set aside for a specialized activity in any of the three houses. However, in every house, some types of modified artifacts which may have been used for particular crafts have localized distributions. It is difficult to determine whether these concentrations represent areas set aside for a particular activity which was practiced by most residents of a house, or constitute areas used by a single craftsperson in the context of their domestic space or generally accessible spaces. It is also possible that several members of a sub-group, within a co-residential corporate group, may have specialized in a particular craft.

Thus, while there is evidence that HP 7 was organized differently from the two smaller houses, there is no clear indication that the residents of HP 3 had less wealth or status than the residents of HP 7 or that they were less active in specialized crafts. The argument that the residents of HP 12 may have been poorer and less specialized rests, to a great extent, on the size of the housepit itself and the relative richness of the larger assemblages in the larger houses. Since assemblage richness has been shown to be a function of assemblage size, this evidence is not compelling.

As far as the sexual division of labor is concerned, I have suggested that the artifact types which distinguish the southwest sector of HP 3 and the central zone of HP 7 could have been associated with female tasks. Similarly, the tools which distinguish the northeast sector of HP 3 and the Outer zone of HP 7 could have been associated with male tasks. I did not identify any similar distinction in HP 12. On the basis of ethnographic data, a sexual division of labor and of activity areas might be expected but there may be other reasonable explanations of these distributions.

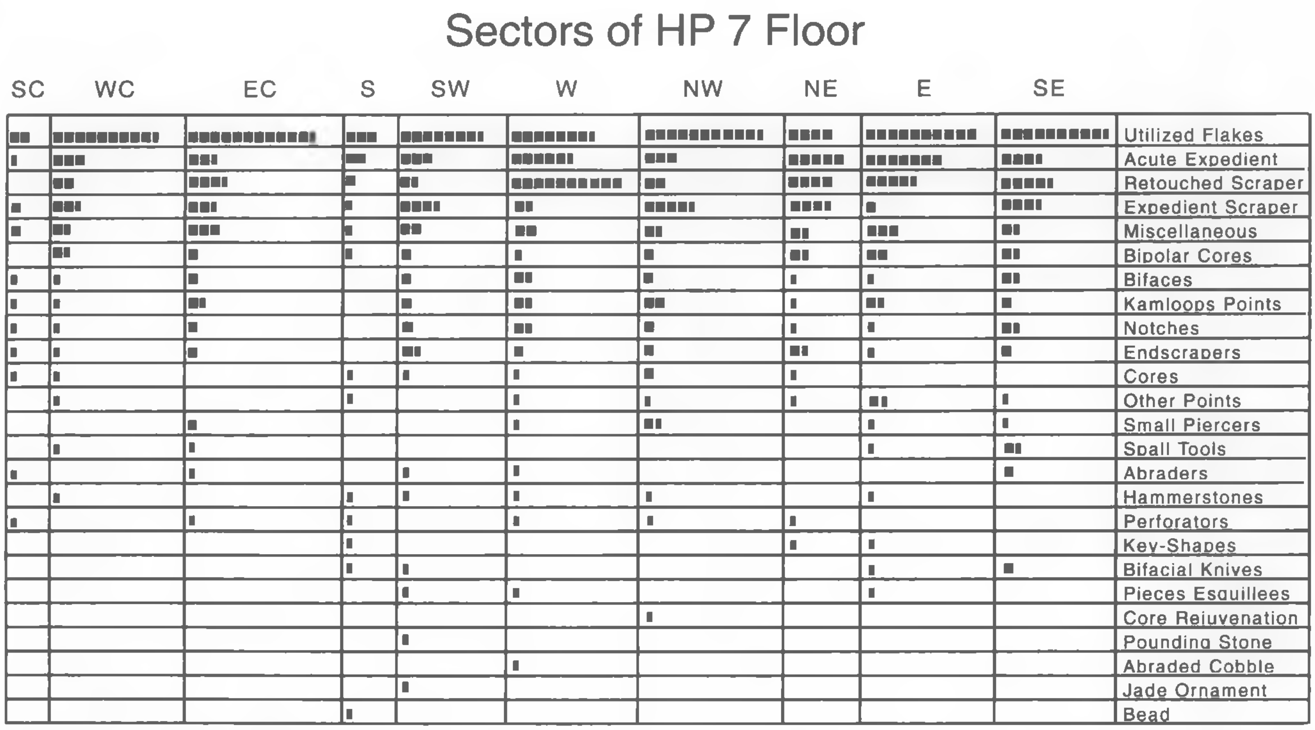

Figure 14. This chart represents the number of specific artifact types that occurred in each sector of the floor of Housepit 7. Note the general similarity between all of the sectors with the exception of the unusually low counts of modified tools in the south and south central sectors. Each completed point (■) represents three artifacts; partial points represent one or two artifacts. Sectors are: south center (SC), west center (WC), east center (EC), south (S), southwest (SW), west (W), northwest (NW), northeast (NE), east (E), and southeast (SE). From Spafford (1991).

Conclusion

The rim-crest to rim-crest diameter of HP 3 is 14 m which is above the 11.13 m average diameter for HP's at the Keatley Creek site but considerably below the maximum diameter of 21 m. HP 7 has a diameter of 19 m, near the upper end of the range, while HP 12 is only 9 m in diameter. Pithouses as large as HP 3 have been attributed to all phases of the Plateau Pithouse Tradition (Richards and Rousseau, 1987) and were being constructed until early historic times (Teit 1906).

If the full development of large, hierarchically-organized co-residential corporate groups was associated with the construction of the largest houses, patterns in the distribution of lithic artifacts on the floor of HP 7 would certainly be expected to be consistent with those predicted for the residences of large, hierarchically organized corporate groups. While HP's 3 and 12 may have been large enough to accommodate several sub-groups within a large, hierarchically organized, co-residential corporate group, they are also small enough to have been shared by a single domestic unit. Patterns in the distributions of lithic artifacts on the floor of HP 3 could, therefore, be reasonably expected to be consistent with either type of social organization.

This study demonstrates that patterns can be identified in the distributions of lithic artifacts on housepit floors and indicates that, in some cases, those patterns can be most reasonably interpreted as the products of cultural processes which occurred on the floors during the periods when the structures were last occupied. Differences between housepits in the patterns observed can reasonably be interpreted as the result of differences in the spatial organization of activities on the floors arising out of different forms of social organization. While it cannot be definitely stated, on the basis of data from only three housepits, that all of the largest housepits at the Keatley Creek site were occupied by large, hierarchically-organized corporate groups, the observed patterns are consistent with those predicted by the model for the social organization of space in the residences of such groups.

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Chapter 12

The Lithic Assemblages of Two Small Housepits: HP 90 and HP 104

Ty Heffner

Introduction

The nature of small pithouses plays a critical role in the conceptualization of socioeconomic organization at Keatley Creek. It is not only important to document how small pithouses differed from large pithouses, but it is also necessary to determine how the socioeconomic organization of small pithouses varied among themselves. Two small housepits have thus far been excavated and analyzed (HP's 9 and 12—see Vol. II, Chap. 11; Vol. III, Chaps. 7 & 8), and display markedly different social and economic characteristics. Housepit 9 appears to have been the residence of a ritual or hunting specialist, with substantial high status connections, while HP 12 appears to have been home to much more common and poorer residents.

In order to extend the understanding of small housepit variability, several additional small housepits were sufficiently excavated to assess their socioeconomic characteristics: HP's 90 and 104. This chapter presents an analysis of the lithic industries for both housepits and compares them to the other small housepit assemblages at the site. While the HP 90 assemblage is roughly similar to the HP 12 assemblage in general composition and time (both are late Plateau occupations), the HP 104 assemblage is markedly different both in composition and in dating. Housepit 104 dates from the protohistoric period and the lithic assemblage is unique in terms of the activities represented, the tools present, point styles, and non-lithic associations. Because it was not contemporaneous with the main site occupation, HP 104 was not completely excavated.

Housepit 90, on the northwest periphery of the site core, was chosen for extensive excavation as an example of a smaller housepit because of its desirable qualities: it contained a single occupation with no cross-cutting building events and had easily identifiable floor deposits (Vol. II, Chap. 9). It was initially hoped that HP 90 was Kamloops Horizon (1,200–200 BP) in age, but it was subsequently discovered to date to the late Plateau Horizon (1,500–1,200 BP). A radiocarbon date obtained from a charred roof beam in contact with the living floor showed the house was used at approximately 1,410 ± 60 BP (Vol. I, Chap. 2). Although it is not contemporary with most of the other excavated housepit floors, it is still of interest in understanding household variation during the Plateau Horizon.

Analysis of the lithic assemblage from HP 90 followed the same methodology as that of the other housepits at the site, with the goal being to interpret spatial divisions within houses, socioeconomic differentiation, and other factors relevant to prehistoric occupations. The topics to be discussed in this analysis include: length of occupation; activity areas; domestic spaces; and socioeconomic standing. Evidence for the interpretations is derived from the lithic and spatial analysis, but other observations will be included whenever they are pertinent to the discussion.

HP 90

The Lithic Assemblage

All lithic materials recovered during excavation were cleaned and separated into debitage and modified artifacts. Debitage was further divided into four size classes; the percentage of each size class was then calculated for the roof and floor strata and then compared to the housepit as a whole (Fig. 1). The frequency of each size class throughout the house appears to be quite similar. A notable exception is the higher frequency of large flakes (8%) on the floor, compared to none on the roof. This is to be expected, however, as large flakes are most suitable for later use as tools and would not have been discarded. The majority of debitage from the entire housepit is found in the roof strata (54%), while the floor contained only 20%. This is most likely a product of re-roofing and cleaning, as floors were periodically cleaned and debris was probably thrown onto the roof during this process. Of the size categories, flakes between 1 and 2 cm in size dominate the assemblage (ca. 60–65%). This indicates intensive use of lithic materials with the final stages of lithic reduction occurring in houses. Debitage density and distribution will be examined further in the spatial analysis.

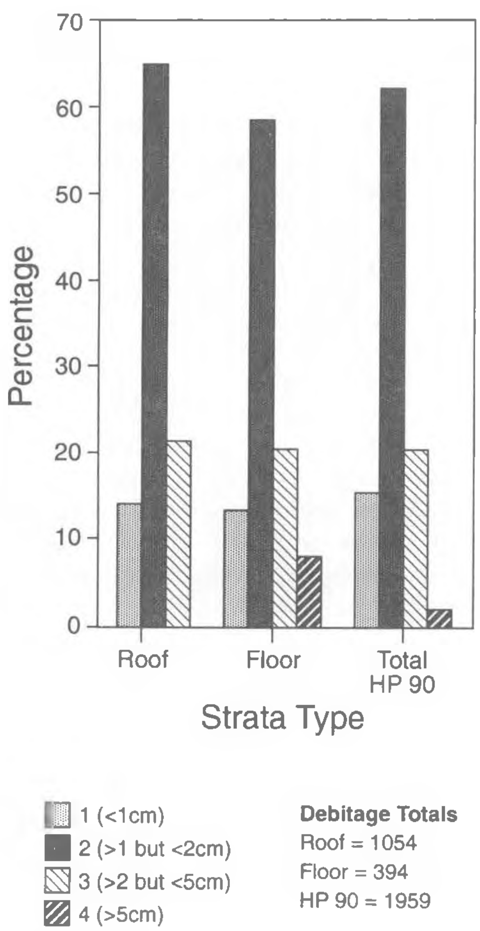

Figure 1. Percentages of debitage size categories in HP 90.

Modified artifacts were identified to type using the Keatley Creek Artifact Typology (Vol. III, Chap. 1). A total of 76 modified lithic artifacts were identified in the roof strata, while 45 came from the floor (Fig. 2). Some of the more common types included utilized flakes, expedient knives, bifaces, scrapers, and notches. The density and spatial distribution of these artifacts will be discussed below. Lithic raw materials utilized by the inhabitants of HP 90 were fairly limited, being dominated by trachydacite (77%), followed by jasper (15%), and a few other materials (8%).

Length of Occupation

It is possible, using evidence from the lithic analysis, to determine approximately how long HP 90 was occupied. Other indicators include nature and size of the structure; density of pits and postholes; and re-roofing episodes (Vol. I, Chap. 17). Housepit 90 has been characterized as a small housepit with a relatively long period of occupation and low lithic density (Vol. II, Chap. 14). A few possible postholes were identified in the floor strata and six pit features were excavated into it, none of which appear to have been used for major food storage.

It appears that between one and three re-roofing episodes occurred in HP 90, based on the two to three identifiable layers in the roof stratigraphy. Together with a low overall lithic density and assuming that roofs lasted between ten and twenty years (Vol. I, Chap. 17), this indicates a length of occupation on the order of 20 to 60 years. Evidence for this scenario can be found in the lithic assemblage as well. An almost identical suite of artifact types occurs in the roof strata as on the floor, with the exception of the more highly specialized artifacts (i.e., bifaces and groundstone objects; Fig. 2). The frequencies of these artifact types in the roof strata are very close to twice that in the floor deposits. When analyzed as percentages instead of frequencies (Fig. 3), the similarities between the assemblages are even more apparent. This would seem to indicate that HP 90 was re-roofed twice and that floor scrapings from this event were, indeed, placed onto the roof.

Activity Areas

In his analysis of the use of space in housepits, Spafford (1991) identified a number of criteria pertinent to the determination of activity areas. Some of these are: fire cracked rock density; debitage density; artifact

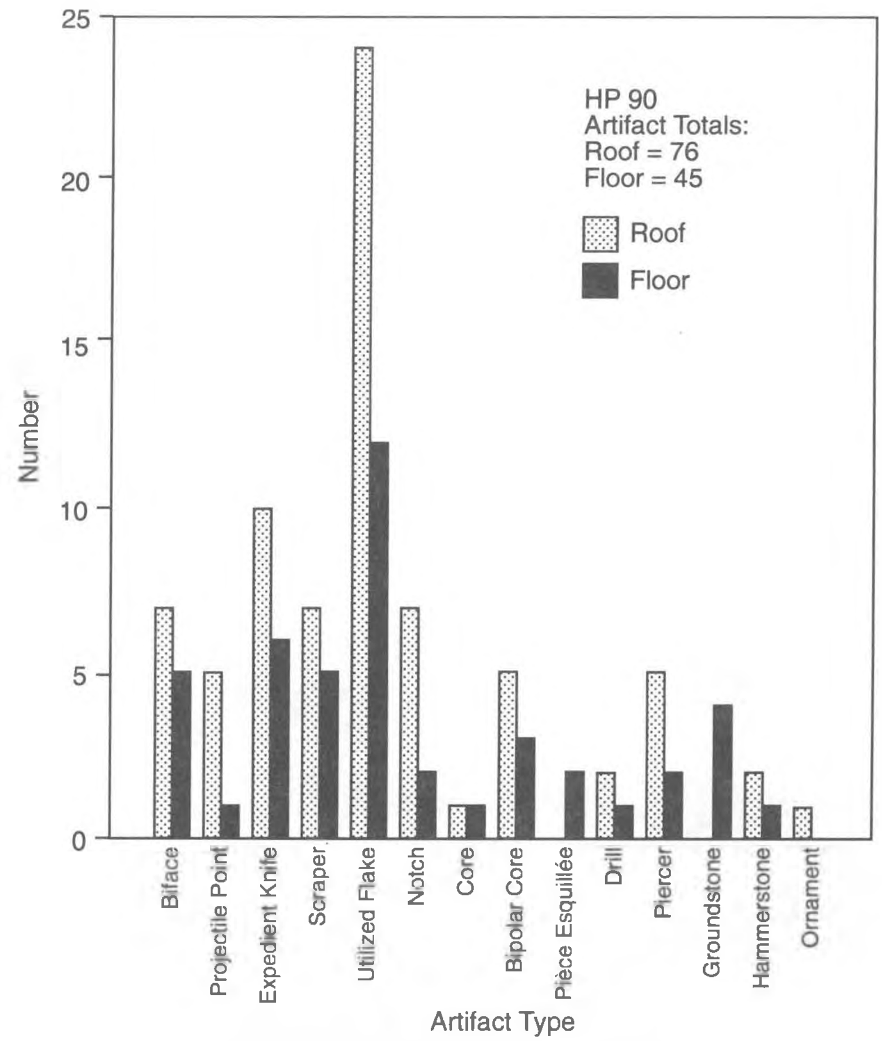

Figure 2. Artifact frequencies in HP 90.

density; functional artifact distribution; and hearth and storage pit locations. Each criterion will now be discussed, along with distribution maps, as represented in HP 90. The criteria used to establish domestic areas are slightly different and will be dealt with next.

Fire cracked rock (FCR) is produced in hearths or through use as boiling stones; in other housepits it is closely associated with fire reddened areas (Spafford 1991:53), so it is a reasonable assumption that FCR should concentrate around hearth areas. No definite hearth has been identified in HP 90 so FCR density offers the best line of evidence for the location of hearth features. Almost no FCR is present in the northern part of the floor, while diffuse amounts are present on most of the southern half (Fig. 4). Additionally, two notable concentrations occur, one in the center of the floor and another near the west wall near the side entrance. It seems that the central FCR concentration represents the main hearth area, while that near the side entrance represents a storage or provisional discard location. The uniform distribution of FCR across the southern half of the floor, and that near the entrance as well, would then have been derived from the central hearth. Other lines of evidence to be discussed below support this assessment.

Like FCR, the distribution of debitage across the floor of HP 90 also concentrates in the southern half of the floor (Fig. 5). Since debitage is produced and deposited during the manufacture and maintenance of stone tools, it will concentrate where these activities were undertaken most frequently. So it would seem that activities involving stone tools were more common in the southern half of the floor. Notable concentrations of debitage are present on the eastern side of the floor not far from the proposed hearth location and the southeast area as a whole, and also a small concentration in the southwest, and again near the side entrance. The concentration near the entrance is unusually large (62 flakes), again suggesting a storage area of items intended for discard. Stone tool manufacture and use certainly appears to have been much more common in the southern half, particularly the southeast corner of the floor. A glance at the total lithic distribution across the floor area reinforces this impression, with the only difference being a slight change in the lithic density (mainly modified artifacts) in the northern area. The central area of the housepit is relatively free of all lithic artifacts.

The lithic density dichotomy apparent in the debitage disappears, however, when one looks only at the artifact density (Fig. 6); the modified artifacts are nearly equally distributed between the northern (24) and southern (21) halves of the floor. The distribution becomes even more balanced if the tool concentration near the entrance is excluded (N=20 vs. S=21). It seems as though stone tool use (or possibly storage) was fairly even throughout the house, despite the majority of manufacturing and retouch occurring in the southern half. There is an additional pattern evident in the distribution of stone tools that is not as pronounced in the debitage: nearly twice as many artifacts are to be found in the east half of the floor (29) than in the west

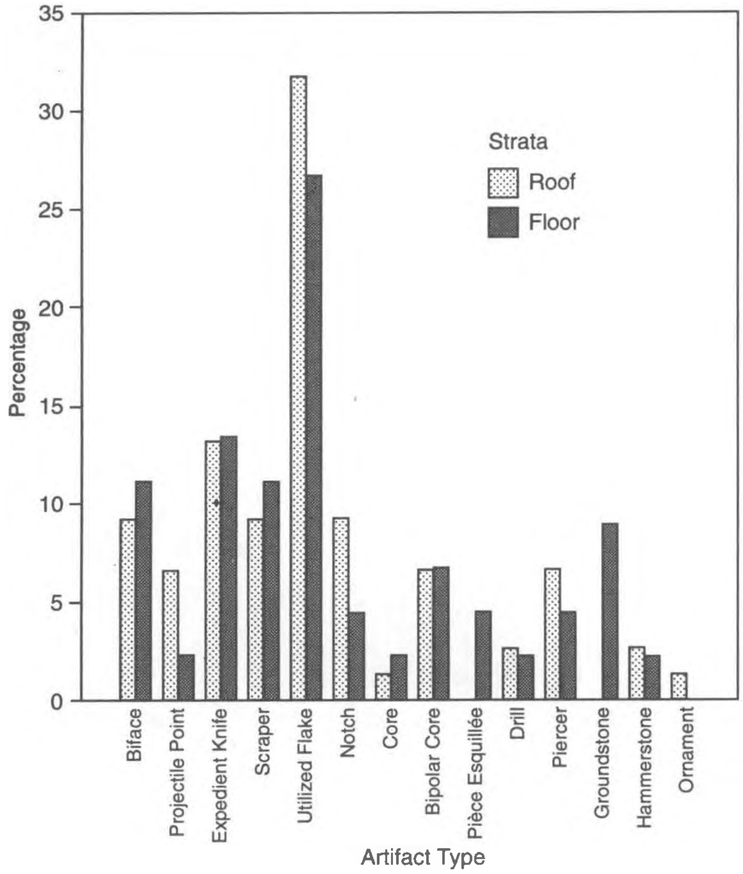

Figure 3. Artifact percentages in HP 90 calculated separately for roof and floor deposits.

half (16) despite the concentration near the western entrance. This indicates that the tools were more commonly used (or kept) on the eastern half of the floor, and especially in the northeast and southeast corners of the house. Since the most important household members generally sleep the farthest from household entrances, the concentration of tools in the northeast and southeast may reflect household head (adult) sleeping and adjacent activity areas. Again, the central area is almost devoid of artifactual material. Much more evidence can be derived from the tools than just density, however; their degree of modification and assumed functions can also offer critical insights to the use of space in HP 90.

Spafford (1991:39) separated artifacts at Keatley Creek into types that he thought would be useful to identify areas used for different activities. Those types found in HP 90 are summarized in Table 1. He cautions that the intent here is not to associate specific tasks to certain artifacts, but instead is to determine whether aggregations of artifacts represent different activity areas by using broad functional distinctions (Spafford 1991:40). This differentiation takes place at two levels:

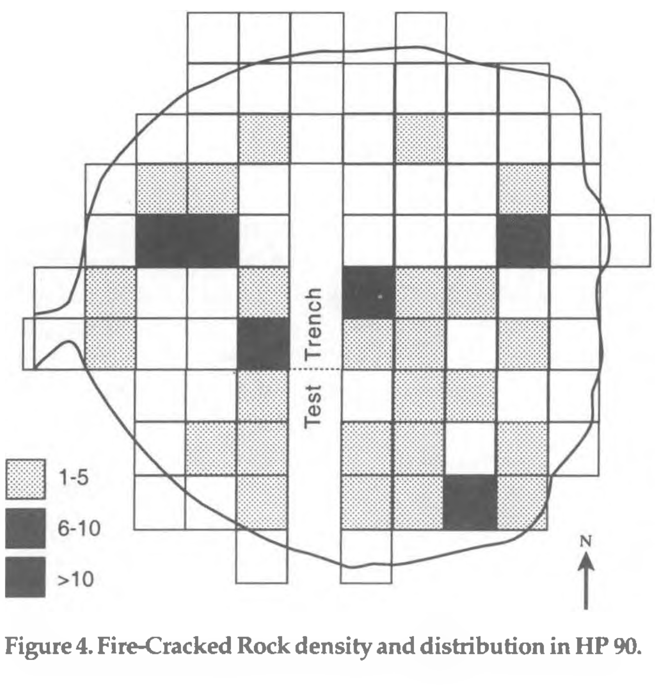

Figure 4. Fire-Cracked Rock density and distribution in HP 90.

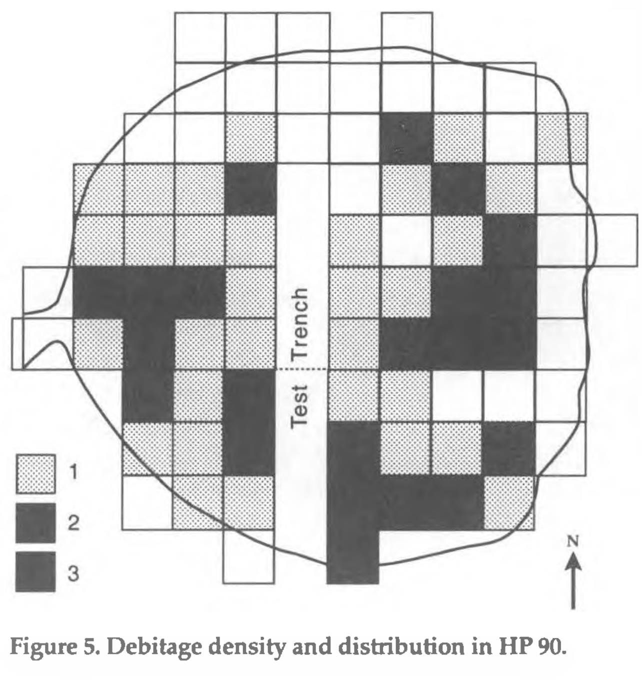

Figure 5. Debitage density and distribution in HP 90.

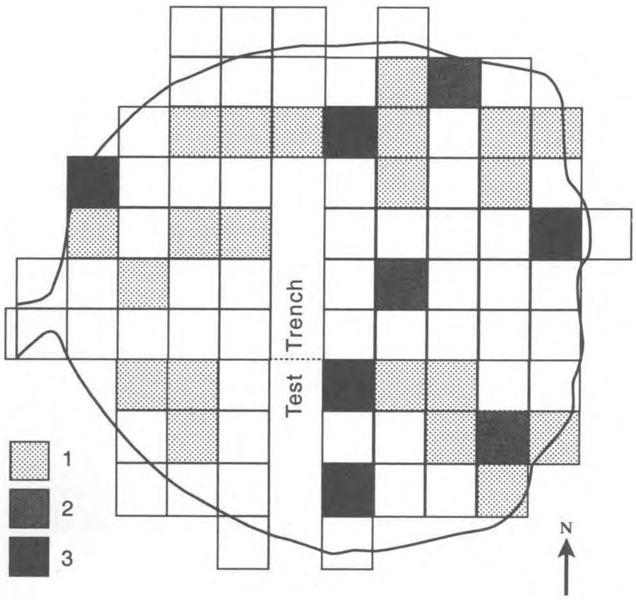

Figure 6. Modified artifact density and distribution in HP 90. Note that 3 artifacts were recovered from the south half of the test trench.

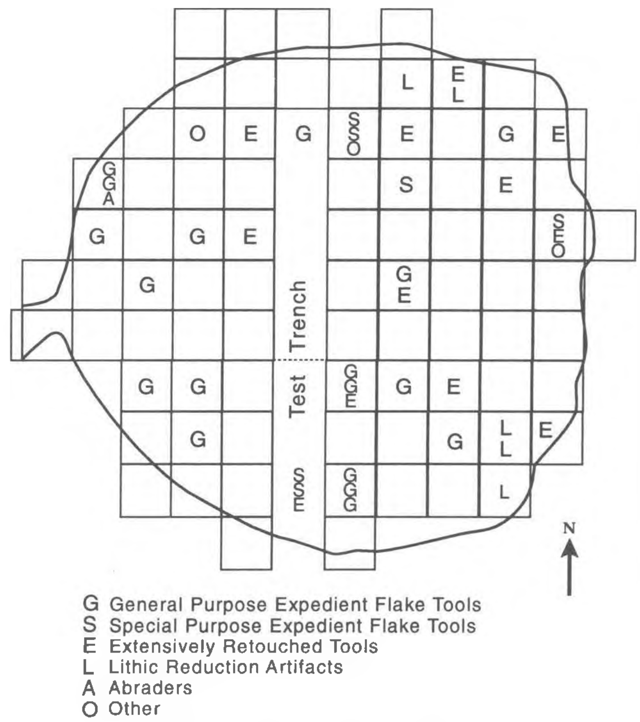

Figure 7. Distribution of functional artifact categories in HP 90.

1) road categories of manufacturing characteristics, and 2) a range of activities for which the tools are suitable.

The distribution of artifacts assigned to each category of manufacture in HP 90 is presented in Figure 7. It has already been noted that artifacts cluster in the northeast and southeast corners, while the central area is relatively clear, but looking at this map, a few additional observations can be made. The majority of tools on the western half of the floor are general purpose and expedient in nature, suggesting that activities here were mainly of the common variety and undertaken wherever space was available. The assemblages from the northern and southern halves of the floor are much more varied, particularly in the northern half (Fig. 8). Meshing well with the pattern identified in the debitage density and distribution in the housepit, the southern half of the floor has more abundant general purpose flake tools and lithic reduction artifacts, while the northern half of the floor contains more special purpose and extensively retouched tools, in addition to all of the groundstone artifacts, including a damaged nephrite adze, a maul fragment, and a sandstone abrader (all clearly in storage contexts—Vol. III, Chap. 9). Another factor which becomes apparent is that the suite of artifacts on the northern and southern halves of the floor are basically similar in the types of activities that they are suitable for, only the northern area has more extensively retouched tools and all of the groundstone artifacts. This distinction allows three observations which are important to the following discussion: 1) both halves of the house show evidence of a similar range of activities, suggesting the possibility of two independently functioning groups (Spafford 1991); 2) the northern area appears to have more desirable tools and artifacts, a possible indication of some sort of social or spatial distinction; and 3) items that one might expect to be stored are concentrated in the north.

Domestic Areas

Now that we have uncovered some indications that possibly two separate domestic units are represented in HP 90, it is important to pursue the issue. Domestic areas of a house should contain a number of common features: a hearth and FCR (possibly shared); a sleeping area; activity areas with similar proportions of tools; and a wide spectrum of tool types (Spafford 1991). We have already discussed the stone tools and, since it is most likely that only one main hearth was present in HP 90, it must be assumed that it was shared by all residents. Thus, two other criteria may offer a little more insight into this question: number of occupants and location of sleeping areas.

Spafford (1991) estimates that a large domestic unit would be composed of twelve people, while a small one

Table 1: Types of Modified Tools Present in HP 90 and Their Assumed Functions

Functional Categories and Artifact Types	Presumed Function	Materials Worked
General Purpose Expedient Flake Tools		
expedient knife	slicing and cutting	soft materials
utilized flake	slicing and cutting	soft materials
Special Purpose Expedient Flake Tools		
notch	working cylindrical objects	basketry elements, shafts
piercer	performating	birch bark, leather
pièce esquillée	splitting wedge	bone, wood
Extensively Retouched Tools		
scrapers	scraping hard materials	bone, wood, hides
borers/perforators	drilling hard materials	bone, wood
knife	slicing and cutting	soft materials
biface	no assigned function	
projectile point	hunting, arrow-making	
Abraders		
sandstone abrader	grinding	bone, stone, antler
Lithic Reduction Artifacts		
hammerstone	detaching flakes, pounding	stone
core	raw material	
bipolar core	raw material	

could contain as few as three or four. Based on his study of space requirements per inhabitant for the smaller houses (1.5 m^2/person), HP 90 (20 m^2) could house a maximum of 13 people, or two average sized domestic units. This seems to fit well with the discussion so far.

During the excavation of HP 90 a number of observations indicated that some kind of platform or bench extended around much of the perimeter of the floor. These observations included possible postholes near the walls; flat cobbles spaced a little over 1 m apart around much of the floor perimeter; floor deposits within 1m of the wall were thicker, softer, and darker compared to the lighter, compact, gravely central floor sediments; and evidence for storage areas and organic "dumps" in these peripheral areas, probably underneath a platform (Vol. III, Chap. 9). Of particular interest here is that the flat cobbles, which are possibly pole or log supports, occur mainly along the north and south walls.

Socioeconomic Status

Prestige items found on the northern half of the floor included a damaged nephrite adze, a broken groundstone maul, and a broken palette with ochre staining. Observations during excavation, however, indicated that HP 90 presented a general picture of poverty. There were few lithic and faunal remains found relative to other housepits, and no salmon storage pits were identified. Additionally, in their ethnoarchaeological study, Hayden and Cannon (1982) observed that it was not uncommon to find broken or damaged prestige items in poor households. This could explain the occurrence of these items in HP 90, although it is suggestive that they only occur on one side of the house.

All evidence discussed so far is consistent with two very different notions: 1) two separate domestic units lived in HP 90 which differed in a few important ways: the residents of the northern half of the house may have had more access to better quality stone tools and prestige items (albeit damaged ones), while the residents of the southern half of the house may have done the majority of manufacturing and cooking, as evidenced by the debitage and FCR distributions; 2) alternatively, the artifact and FCR distributions may represent two very different uses of space, the northern half of the floor being a sleeping platform used by all residents and the southern half as a communal activity area. In this scenario, the extensively retouched tools and prestige items which are concentrated on the northern half of the floor were probably stored beneath a sleeping platform.

In her analysis of HP 9, a similarly sized housepit occupied during the Kamloops Horizon, Alexander (Vol. III, Chap. 7) interpreted activity areas in the same way as scenario two, with a northern sleeping platform and southern work area. Floral analyses of HP 90 sediments hint that this may also have been the case here; plant remains associated with sleeping areas (i.e., conifer needles) concentrate around the northern perimeter of the floor (Vol. II, Chap. 4).

Summary

HP 90 was occupied for approximately 40 years during the late Plateau Horizon, during which time it underwent two re-roofing events, as indicated by artifact frequency and debitage size category similarities between the roof and floor strata. Fire cracked rock distribution

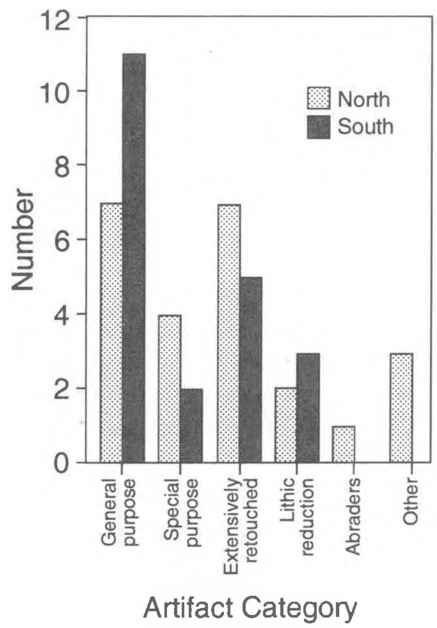

Figure 8. Artifact categories represented on the north and south halves of HP 90 floor.

suggests that one intermittently used hearth was present in the central area of the floor and that cooking activities were more common on the southern portion of the floor. The manufacturing and maintenance of stone tools was also more frequent on the southern side of the floor as shown by the significant difference in debitage densities. There appears to have been a storage area near the side entrance where FCR and debitage were stored for eventual discard or reuse. Two distinct areas are represented in HP 90, which housed approximately thirteen people; these areas exhibit similarly functioning sets of stone tools but the tools found on the southern portion of the floor were more expedient in nature.

Although there is a possibility that two separate domestic units inhabited HP 90, evidence is not sufficient to prove that they were socioeconomically differentiated or even that they lived in separate areas of the house; instead it seems more reasonable that all residents shared communal activity and sleeping areas. The socioeconomic differences so clearly evident in large houses during Kamloops Horizon times, do not appear to have been as clearly manifested in smaller houses during the preceding late Plateau Horizon.

HP 104

Housepit 104 is located about 200 m away from the site core on the north side of Keatley Creek. Initially, it was believed that HP 104 could either be a peripheral dwelling or a special purpose structure. Excavations were undertaken to determine the function of this relatively isolated cultural depression. Approximately 25% of the total area of HP 104 was excavated. Results of the excavation showed that HP 104 had a low lithic density in comparison to most housepits at Keatley Creek, but sandstone artifacts and debitage and burned animal bone were unusually abundant (Vol. III, Chap. 12.13). The occupation appeared to have been short and the presence of Kamloops style projectile points in the floor and roof sediments suggested that it was occupied during the Kamloops Horizon (1,200–200 BP); radiocarbon dating confirmed this, as floor sediments were subsequently dated to 250 BP (Vol. I, Chap. 2). This analysis explores HP 104's function based on lithic and spatial analysis of the recovered artifacts. After a description of the analytical methods employed in this study, the information obtained from that analysis will be applied to the question of HP 104's function by exploring issues such as length of occupation, and internal spatial divisions.

The Lithic Assemblage

Analysis of the lithic assemblage from HP 104 followed the same methodology as that of the other housepits at the site: lithic artifacts were divided into debitage and modified artifacts. Debitage was further separated into four size categories. Most debitage found in HP 104 was between 1 and 2 cm in size and no flake was larger than 5 cm, indicating that only the final stages of lithic reduction occurred here. Relatively few flakes were recovered: 37 flakes were excavated from floor sediments while 24 came from the roof. The distribution of flake sizes was similar in both the roof and the floor (Fig. 9) which could suggest that lithic

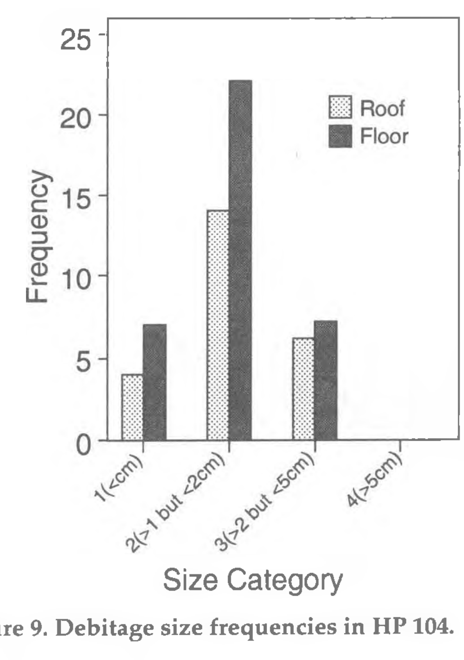

Figure 9. Debitage size frequencies in HP 104.

reduction activities were of a similar nature in both locations but slightly more intensive on the floor where the larger number of flakes were found. Another possibility is that the flakes recovered from the roof deposits originated as floor sweepings, probably a common occurrence at Keatley Creek (Vol. I Chap. 14).

A total of 18 modified artifacts were recovered from floor sediments and 17 came from the roof. Artifact frequencies (Fig. 10) were very similar but two slight differences were notable. Scrapers were present on the floor and absent on the roof while the opposite was the case with notches. Perhaps this is indicative of a difference between indoor and outdoor activities, but the small sample size and similarity of the other artifact frequencies tended to argue against that idea.

Sandstone abraders, presumed to have been used for grinding bone, stone, or antler, were relatively abundant in HP 104 on both the floor and the roof, indicating that some specialized activity was undertaken there. A large, concave sandstone abrader, abrader fragments, and a sandstone saw, in addition to relatively large amounts of sandstone debitage (N=12), were found only in HP 104 at Keatley Creek, while the sandstone saw may be a rare if not unique find in the Interior (Vol. II, Chap. 13). Although no nephrite was recovered from the housepit, it was certainly present at the site and specialized manufacturing of nephrite artifacts may have taken place in HP 104 using sandstone saws and abraders. As mentioned, however, bone was also plentiful in the housepit and some abraders may well have been employed in the fashioning of bone implements. A very unique small leaf-shaped point was also found in HP 104 (see Vol. I, Chap. 3) which may be the result of protohistorical contacts or other processes.

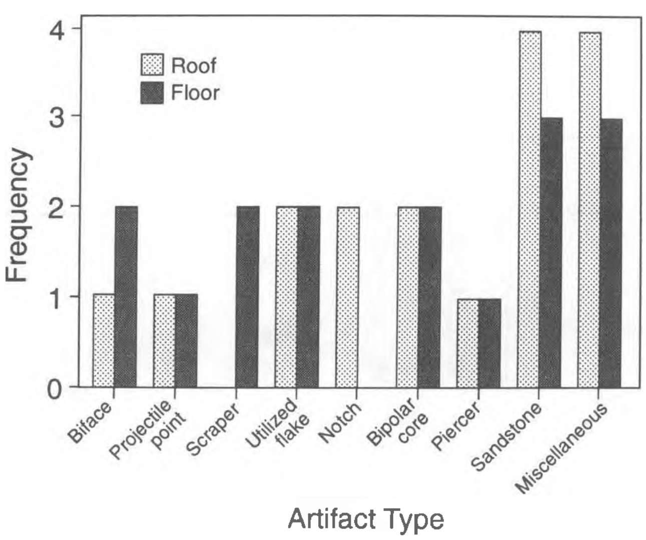

Figure 10. Frequencies of artifact types in HP 104.

Length of Occupation

It was possible, using evidence from the lithic analysis, to determine approximately how long HP 104 was occupied. Other indicators include the nature and size of the structure; density of pits and postholes; and re-roofing episodes. At 8 m in diameter, HP 104 was classified as a small housepit. Only single event postholes occurred in the floor. Lithic density was quite low and artifact frequencies and debitage counts in the roof did not attest to any re-roofing episodes unless the lithics in the roof were from the removal of a previous floor during re-roofing. Most of these indicators pointed towards a short occupation of HP 104, perhaps as short as 1 to 5 years or as long as a generation (20 years).

Activity Areas

The application of Spafford's (1991) criteria for identifying activity areas was problematical in the case of HP 104 due to the limited excavation area and small sample numbers, but was not without merit. Each criterion will now be discussed, along with distribution maps, as it was manifested in HP 104.

Again, it was a reasonable assumption that FCR should concentrate around hearth areas. Excavations in HP 104 did not reveal a definite hearth so FCR was a good means of locating areas where a hearth may have existed. A notable concentration of FCR was located in the east-central area of the floor (Fig. 11) and it is likely that a hearth would have been located near this area.

Debitage in HP 104 was more evenly dispersed than FCR. There did seem to be a slight concentration in the southeast corner of the housepit (Fig. 12) but given that this was also where the majority of the excavation was focused, the suggestion that most lithic reduction activities occurred there must be a tentative one.

Modified artifacts (Fig. 13) were also fairly evenly distributed in the excavated floor area. Most artifacts were recovered from the southeast corner but no significant concentrations occurred and it would be difficult to locate activity areas based on artifact density alone. Spafford (1991:39) separated artifacts at Keatley Creek into types that he thought would be useful for the identification of areas used for different activities. Those types are summarized in Table 1. The distribution of artifacts assigned to these categories in HP 104 is shown in Figure 14. Again, it was difficult to discern one particular location as being distinct from the others, except for the location of most of the abraders in the extreme southeast corner of the floor. All functional artifact categories except "Special Purpose Expedient Flake Tools" were present in HP 104 suggesting a rather broad range of activities were undertaken in addition to the specialized manufacturing of, and use of, sandstone.

Domestic Areas

The identification of domestic areas within a housepit was logically the next step after the examination for potential activity areas. Given that no specific activity areas were located and that there was no firm evidence to suggest that HP 104 was a dwelling, the identification of domestic areas was extremely problematical. Estimation of the approximate population of the housepit if used as a dwelling (or the maximum capacity if used as a special purpose structure) can be done using the formula developed by Spafford (1991): if each occupant required 1.5 m^2 of space then HP 104 with a floor area of 38 m^2 could hold a maximum of 25 people. If used as a multipurpose structure, the occupancy of HP 104 might have been even be more.

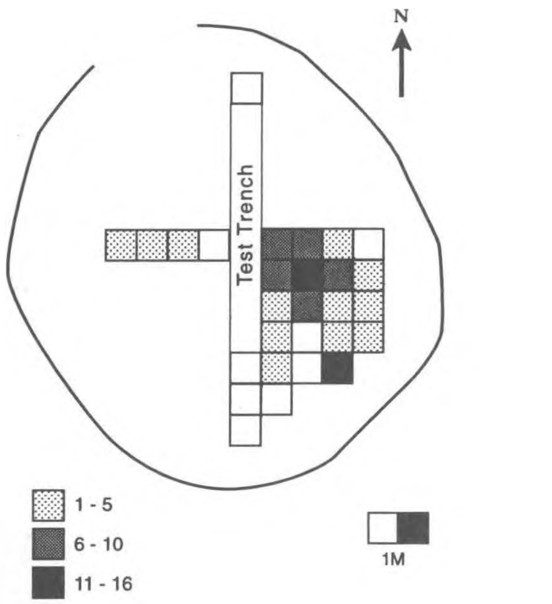

Figure 11. Density and distribution of FCR on HP 104 floor.

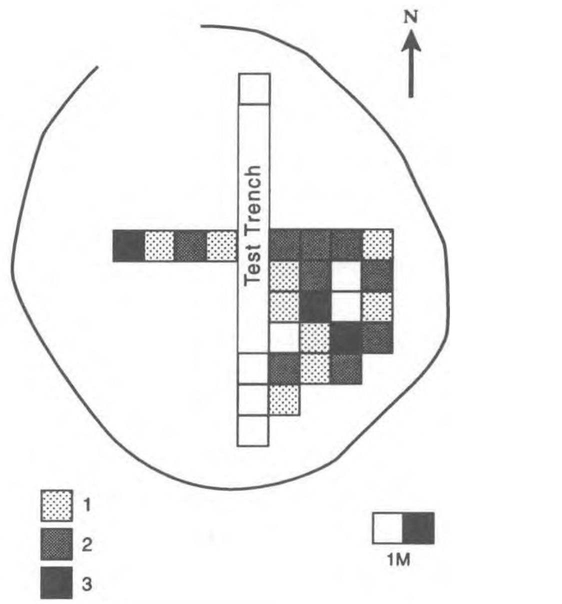

Figure 12. Density and distribution of debitage on HP 104 floor.

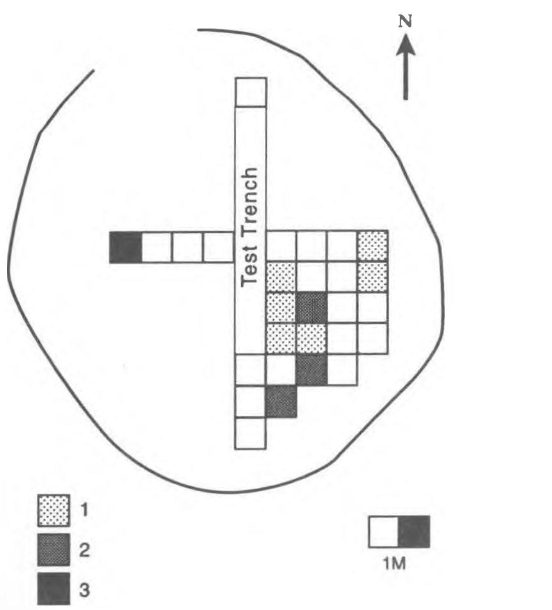

Figure 13. Modified artifact density and distribution on HP 104 floor.

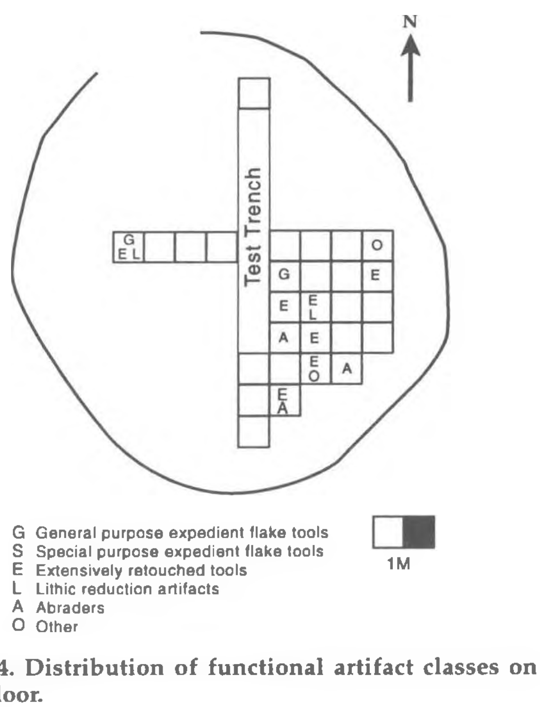

Figure 14. Distribution of functional artifact classes on HP 104 floor.

Summary

Housepit 104 appears to have been used for only a few years during the late Kamloops Horizon at around 250 BP. Lithic density was quite low and the characteristics of the lithic assemblage suggested that flake tools were used and maintained but not manufactured in the housepit. Specialized manufacturing, probably of nephrite, but possibly also of bone and antler, seemed to have been a common activity in HP 104 as indicated by the large quantity of sandstone artifacts and fragments. It appeared that a hearth was located in the center of the housepit and that these activities were undertaken around the perimeter. There were no firm indications that HP 104 was used as a dwelling. Instead, it seemed to have functioned as a special purpose structure for activities involving bone reduction and specialized groundstone tool manufacturing.

Conclusion

The analysis of the lithic assemblages from HP's 90 and 104 seems to confirm earlier interpretations of variability among small housepits at Keatley Creek. At least two, and probably three major types of housepits can be distinguished at this point in research at the site. First, there were small housepits that were residences of relatively poor families. Both HP's 90 and 12 seem to represent this type and are similar in many respects including overall lithic and faunal assemblage characteristics, division of space, infrequent use of hearths, and the paucity of features or postholes. Second, there are small housepits that seem to have been the residences of more affluent specialists such as hunters, ritualists, or perhaps craftspeople. Both HP's 9 and 104 may represent this type of small housepit, although other interpretations are possible in the case of the protohistoric HP 104 structure. This may have been the residence of a nephrite specialist or it may have been a specialized ritual lodge and meeting place for men. It seems unlikely that the high concentrations of abrading and sawing sandstone items in this structure would be the result of any general change over time during the Kamloops horizon and no such suggestions have been made by others. Whether HP 104 represents a ritual lodge or the residence of specialists may have to be resolved through the continued excavation of other small housepits.

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Chapter 13

Prestige Artifacts at Keatley Creek

Brian Hayden

Formation Processes

This chapter describes prestige objects recovered from Keatley Creek in order to assess socieconomic inequalities between residents of the prehistoric community. Of all the classes of artifacts, prestige items are certainly the most directly related to socioeconomic status differences. Yet, in transegalitarian societies, the analysis of such objects and the interpretation of the socioeconomic standing of various domestic groups using prestige objects is not always straightforward. Part of the problem in using prestige objects to interpret individual domestic group socioeconomic status is due to the relatively modest socioeconomic differences between most domestic groups in most transegalitarian societies. Another factor is the relative rarity of prestige items in *domestic* deposits (a phenomenon that Cunliffe (1986:151) and Bradley (1984:126,161) remarked on as well for the much more complex Celtic chiefdom-level prehistoric societies of Europe). Indeed, as in chiefdoms most prestige items in transegalitarian societies appear to end up as grave goods or at least in depositional contexts far removed from domestic structures. I suggest that the burial of prestige items with their owners was probably promoted by many aggrandizers in order to obligate surviving offspring to indebt themselves in order to acquire prestige items necessary for the attainment of their own aggrandizer roles. This explanation stands in contrast to others that view the burial or destruction of wealth as a means of preventing inflation in prestige values (Winters 1968:209). Indebting others is, above all, the major strategy aggrandizers use to obtain power and ensure the production (and surrender) of surpluses (see Hayden 1995).

In addition, wealth would have been difficult to manage and pass on via inheritance in seasonally sedentary societies compared to more fully sedentary societies. Not only is it difficult to carry or store many items of wealth during seasons of high mobility (unless one owns pack dogs or slaves), but those who inherit wealth items may not have the means of transporting much wealth or of supporting the infrastructure needed for their transport (maintaining dogs or slaves) or their use (lack of ability to host feasts or reciprocate in exchanges). Because of these constraints, large amounts of wealth may have been destroyed upon the death of owners (dogs were killed, canoes broken, slaves killed), and accumulations of prestige times may never have been very large or very frequent among Interior Salish individuals or families.

Ultimately, whatever, the reason, only items that were broken or lost or hidden (and subsequently forgotten, or remained hidden due to the death of the owner), seem to have been deposited in domestic contexts. In addition, after breakage, prestige items were undoubtedly also subject to lateral displacement due to retrieval and play behavior by children, an aspect of prestige assemblage formation processes that was documented by the Coxoh Ethnoarchaeological Project among the Highland Maya (Hayden and Cannon 1983). Many items were undoubtedly broken or lost during use, i.e., during visits to others households or during dances and energetic displays in which individuals moved widely about a house interior and were not confined to any specific domestic area.

In addition to the above factors, the interpretation of domestic group status on the basis of associated prestige items may be difficult because many kinds of prestige items appear to be widespread among community domestic groups. This occurs when aggrandizers try to involve as many community members as possible in their surplus-generating schemes. By making pipe-smoking, the wearing of dentalium beads, or other prestige displays a part of required etiquette for engaging in feasts, or borrowing, or other aggrandizive activities, aggrandizers are able to make participating domestic groups use surpluses for the acquisition of prestige items necessary for "entry-level" participation in these activities.

Thus, given the very low frequency of prestige items, the widespread use of some of the items, and chance breakage or loss determining the final resting place of many items, we have not generally relied on the spatial distribution of prestige items to identify high status households. The best arguments that can be made at Keatley Creek for differential status based on prestige items are: that the residents of HP 9 were of unexpectedly high status, especially given the small size of that housepit (prestige objects were unusually numerous and diverse in that housepit, as described in Vol. II, Chap. 1; Vol. III, Chaps. 2 & 7); and that some of the residents of HP 7 were of elite status, especially those on the west half of the house floor where almost all of the most important prestige objects in floor contexts were found (i.e., the copper bead, nephrite knife fragment, marble maul tip, the complete andesite maul) see Vol. II, Chap. 1; Vol. III, Chap. 5). Higher than normal diversity of prestige objects is probably especially reliable as an indicator of high status, since it is more resistant to random perturbations of material patterning (Cannon 1983). However, absolute and relative frequencies are also useful.

Despite these limitations on the utility of prestige objects for identifying the socioeconomic status of *specific* domestic groups in most transegalitarian societies, prestige objects are nevertheless of great importance in documenting the *overall* production and control of surpluses in communities such as Keatley Creek. They also help document regional interaction networks (Hayden and Schulting 1997) and may reveal important specific aspects of prehistoric aggrandizer social structure or even social rituals such as the use of shell rattles, the prestige roles of dogs (Vol. II, Chap. 10), the underwriting of craft specialization and perhaps even slavery, shamanistic practices involving bowls (Hannah 1996) or animal parts, as well as costumed dances and pipe smoking etiquette. Thus, it is worth describing in some detail the archaeological items from Keatley Creek that were most likely to have been used as prestige items.

Keatley Creek Prestige Items

The prestige items at Keatley Creek exist in a wider Plateau culture context as recently discussed by Schulting and myself (Schulting 1995; Hayden and Schulting 1997). Diana Alexander provides many ethnographic descriptions of the items to be discussed below as prestige items (Vol. II, Chap. 2, Appendix II). Some of the more notable finds of prestige items in the Lillooet region include a remarkable series of bone and stone carvings plus marine shells from a burial at the Bell site including a club carved from whale bone (Stryd 1981); bone and steatite carvings and nephrite adzes from burials at Texas Creek (Sanger 1968a); decorative bone from Cache Creek (Pokotylo et al. 1987); eccentrics, shells, nephrite, carved clubs, and carved seated figurine bowls from Lytton (Smith 1900; Baker 1970), a small carved zoomorphic bowl from Shalalth (Oleman 1986), and several loosely provenienced figurine bowls, nephrite, and shell items (Duff 1975; Darwent 1996), including one burial from Lillooet reported to me that contained over ten meters of strung shell disk beads. In the Simon Fraser University Museum, there are also donated collections from The Moha (at the confluence of the Bridge and Yalacom Rivers near Lillooet) containing marine shells, and in particular dentalia and abalone shells associated with an adult burial. Other burials at Cayoosh Creek contained nephrite adzes. In the private collections around Lillooet, there are many examples of nephrite celts, and Bert Lehman has recovered examples of quartz and amethyst crystals from his garden at the Lochnore-Nesikep locality (see Sanger [1970] for other items such as shells, carved bone and stone, copper, pipes and nephrite from this site). Very recently, a small elaborate, highly polished stone club was found at the Six Mile fishing location (now curated at the Upper Statimc Language, Culture and Education Society).

At Keatley Creek, almost all prestige items are either faunal or lithic. One exception is a piece of coiled basketry found on the floor of HP 104, dating to about 250 BP. I argue that coiled basketry was probably a prestige item because of its rarity and high value in early ethnographic times (Teit 1900:87; 1906:205–7; 1909:477) and because of the high labor investment involved in making these baskets especially when compared to bark baskets. In fact, this is the only archaeological example of coiled basketry that has thus far been recovered from the Interior, while only one other example has been recovered on the Coast of British Columbia.

Fauna

Faunal items that are suggested as prestige items include unmodified animal parts that were probably used as parts of costumes, prestige clothing, or in other display contexts. Due to its relative rarity and importance in tool making, even unmodified cervid antler may also have been considered a prestige item (Romanoff 1992). Animal remains thought to have been used in status displays and their distribution by housepit are present in Table 1. Some of these species such as the marine shells and moose antler must have been traded into the Lillooet region from sources hundreds of kilometers away. Reimer (2000:36–39) has argued that mountain goats were hunted as important prestige animals. Dog remains probably also represent a special class of prestige animals. I have suggested (Hayden 1997) that dogs were probably domesticated as elite display animals, similar in function to slaves. The display use of dogs may have taken a number of forms such as: protective animals, sources of warmth, sacrificial animals, feasting animals, hunting aids, or transport aids.

With a few exceptions, such as bone awls and fishing bipoints, which are easily made, I would like to suggest that most modified bone and antler artifacts probably represent prestige items. Bone, and especially antler would have been comparatively rare given the low ungulate densities and killing rates estimated for the Keatley Creek community exploitation range (Alexander 1992). Moreover, most bone artifacts can be much more easily manufactured out of hard woods. For instance, Desmond Peters Senior (personal communication) told me that digging stick handles were easily made from wood and that antler (and perhaps ocean spray wood) were harder to work and were probably frequently obtained by trade. He thought only families of hunters and traders might have had antler digging stick handles. Teit (1909:660) also remarked that "spearhead" harpoons (presumably

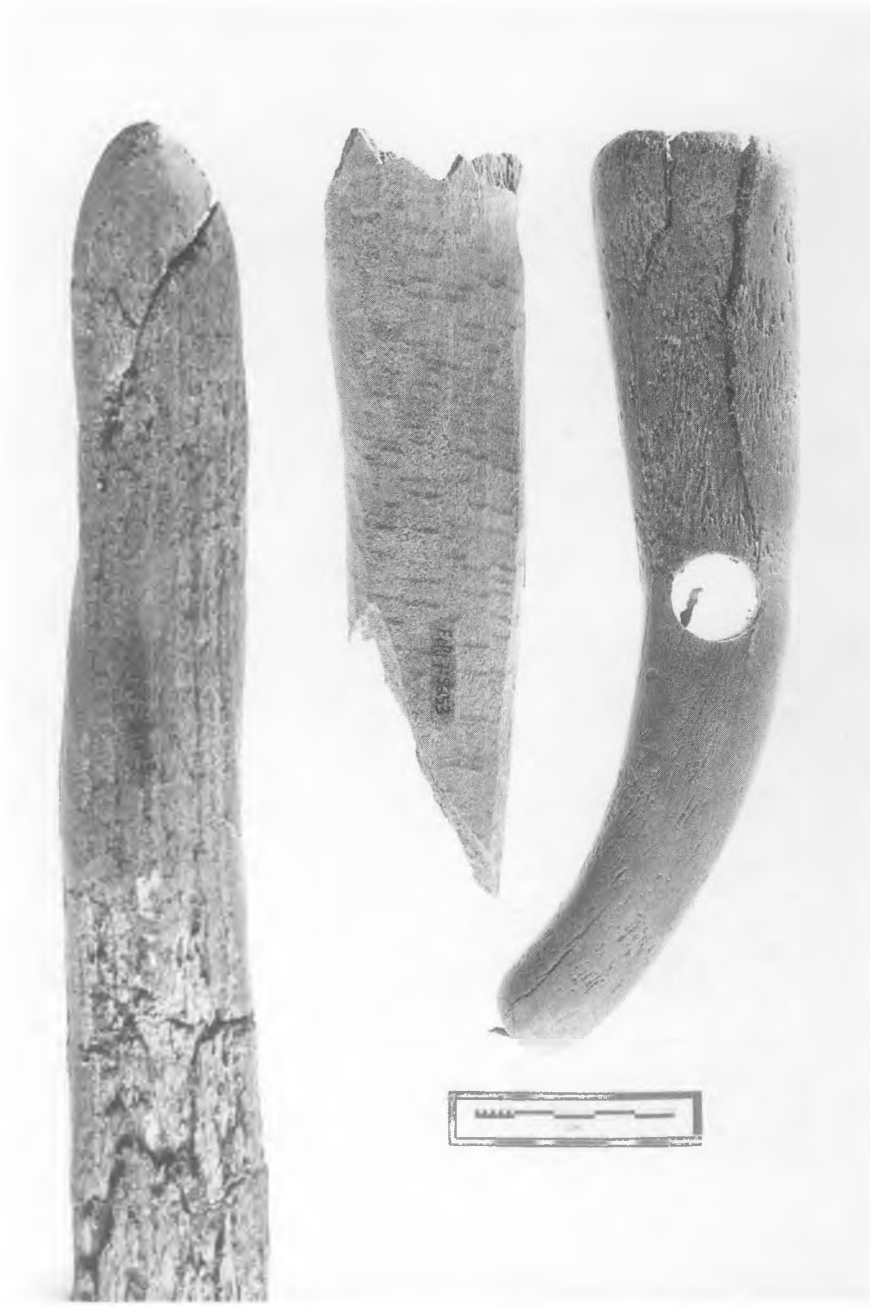

Figure 1. Prestige antler pieces from HP 9 included a bevel-tipped bark peeler that had been halved longitudinally and straightened (left), a piece of unfinished adzed antler (center), and an antler digging stick handle (right).

Table 1: NISP of Faunal Remains Regarded as Prestige Items at Keatley Creek

Species	HP 1	HP 3	HP 7	HP 8	HP 9	HP 11	HP 12	HP 19	HP 47	HP 58	HP 101	HP 109	HP 110	Total
Eagle					1									1
Hawk		2	2											4
Loon					4									4
Perching Birds			4	1										5
Moose			1											1
Bear			1											1
Dog		48	1,320		6		3					9	52	1,438
Mountain Goats										1				
Fox			2											2
Lynx			1											1
Fisher			2											2
Freshwater Shellfish	2	11	63	2	18	3			2	2	2			105
Dentalia			3		4							1		8
Whelk			1											1
Scallop			1											1
Dogwinkle			1											1
Total	2	61	1,402	3	33	3	3	0	2	2	2	10	52	1,574

Table 2: Distribution of Bone Artifacts Considered to be Prestige Items

Prestige Item	HP 3	HP 4	HP 6	HP 7	HP 8	HP 9	HP 11	HP 12	HP 47	HP 58	HP 101	HP 105	HP 109	HP 110	Total
Bead: Bone/Shell	1			2		4			1			1			9
Blanket Pin				1											1
Bracelet: Shell				1											1
Handle: Antler						1									1
Needle											1 (netneedle)				1
Pendant: Bone/ Tooth	1			1		2					1 (bullroarer)				5
Rectangular Button												72			72
Triangle: Decoration				1											1
Tube: Drinking/ Whistle						1									1
Antler: Worked	1			2		3		1			1				8
Dentalium				3		4							1		8
Shell					1										1
Tooth				1		1									2
Bone: Barbed Point	1														1
Bone: Beveled/ Perforated				1											1
Bone: Incised	1	1		7		19				4					32
Bone: Incised/ Polished				1										1	2
Bone: Perforated	2		1	1											4
Bone: Polished	3			5				2							10
Bone: Polished/ Worked				1				1							2
Bone: Polished/ Striated				1											1
Total	9	1	1	29	1	35	0	4	1	4	2	73	1	1	162

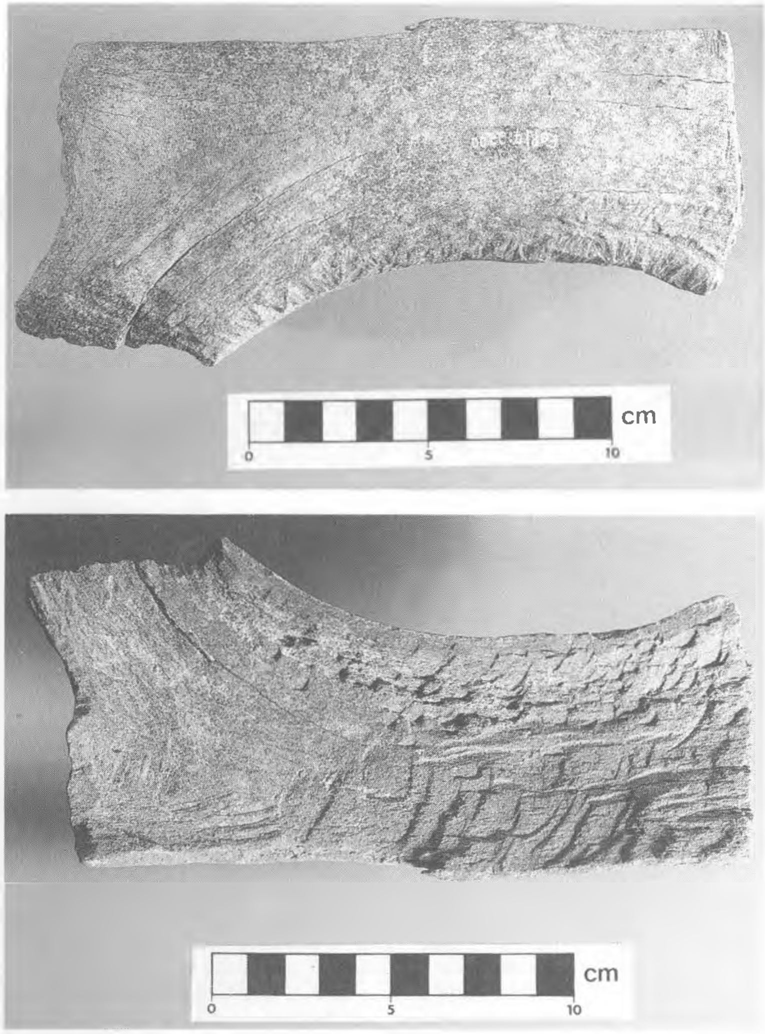

Figure 2. A piece of split and hollowed out moose antler from HP 7 early rim deposits. This represents a trade item since moose do not appear to have ranged farther south than Prince George prehistorically. The item was perhaps part of a container for fragile items.

made of bone or antler) were especially valuable. Antler billets, too, may have been prestige items. Only two antler billets (Vol. III, Chap. 2) were recovered from Keatley Creek, despite the copious evidence for soft hammer work everywhere at the site (both in the form of bifaces and billet flakes). Antler billets are even more rare archaeologically elsewhere in North America (Hayden and Hutchings 1989). On the basis of this evidence, it is worth considering that most billets may have been made of hardwoods.

In general, the strikingly low frequency of all bone artifacts at Keatley Creek (Table 2) indicates that bone tools were not employed by every domestic group for most daily tasks. The strongest arguments for bone artifacts as prestige items can clearly be made for beads, bracelets, pendants, blanket pins, antler headdresses, bullroarers, net needles, buttons, and incised, polished, carved, or decorated pieces. However, strong arguments can also be made for antler digging stick handles, bark peelers (Fig. 1), and "L" shaped awls as prestige items (Hayden and Schulting 1997). For detailed descriptions and illustrations of the artifact types listed in Table 2, see Volume III, Chapter 2. Of particular note is a large segment of moose antler from a Shuswap Horizon context in HP 7 (Fig. 2). This piece was cut in half and hollowed out as if it were half of a container for delicate objects such as feathers or dentalia. This appears to be a unique specimen in the archaeological literature. However, hollowed out antler containers for dentalia have been recorded for aboriginal groups at the mouth of the Rogue River in Oregon (Miller and Seaburg 1990: 584). According to the archaeological distribution of moose, this antler must have originated at least from the Prince George area in Shuswap times, some 300 km to the north of Keatley Creek.

Other unique or extremely rare items for the Interior include part of a purple hinged rock scallop bracelet, a mussel shell adze blade, a bullroarer, a probable bone net needle, as well as loon and hawk remains (Fig. 3). In addition, the canid and bone button assemblages are the largest from any site in the Interior. Both of these are characterized by deposits in the bottoms of large storage pits (Vol. II, Chap. 10; Vol. III, Chap. 10.14). The 72 bone buttons in the bottom of a large storage pit in HP 105 all appeared to have been oriented with the convex surface facing up and were most likely attached to some form of garment or blanket as design elements, probably the first documented button blanket in the Northwest. A curious thin, ovate-tipped spatula with a cross engraved on it was also recovered from a pit in HP 104 (possibly used for skin working), together with a fragment of a gaming piece. One bone fragment has an eye carved in a fashion reminiscent of Coastal styles (Fig. 2).

Lithics

Lithic prestige items can also be divided into minimally modified prestige raw materials and worked artifacts. Among the relatively unmodified prestige materials at Keatley Creek, is a single piece of

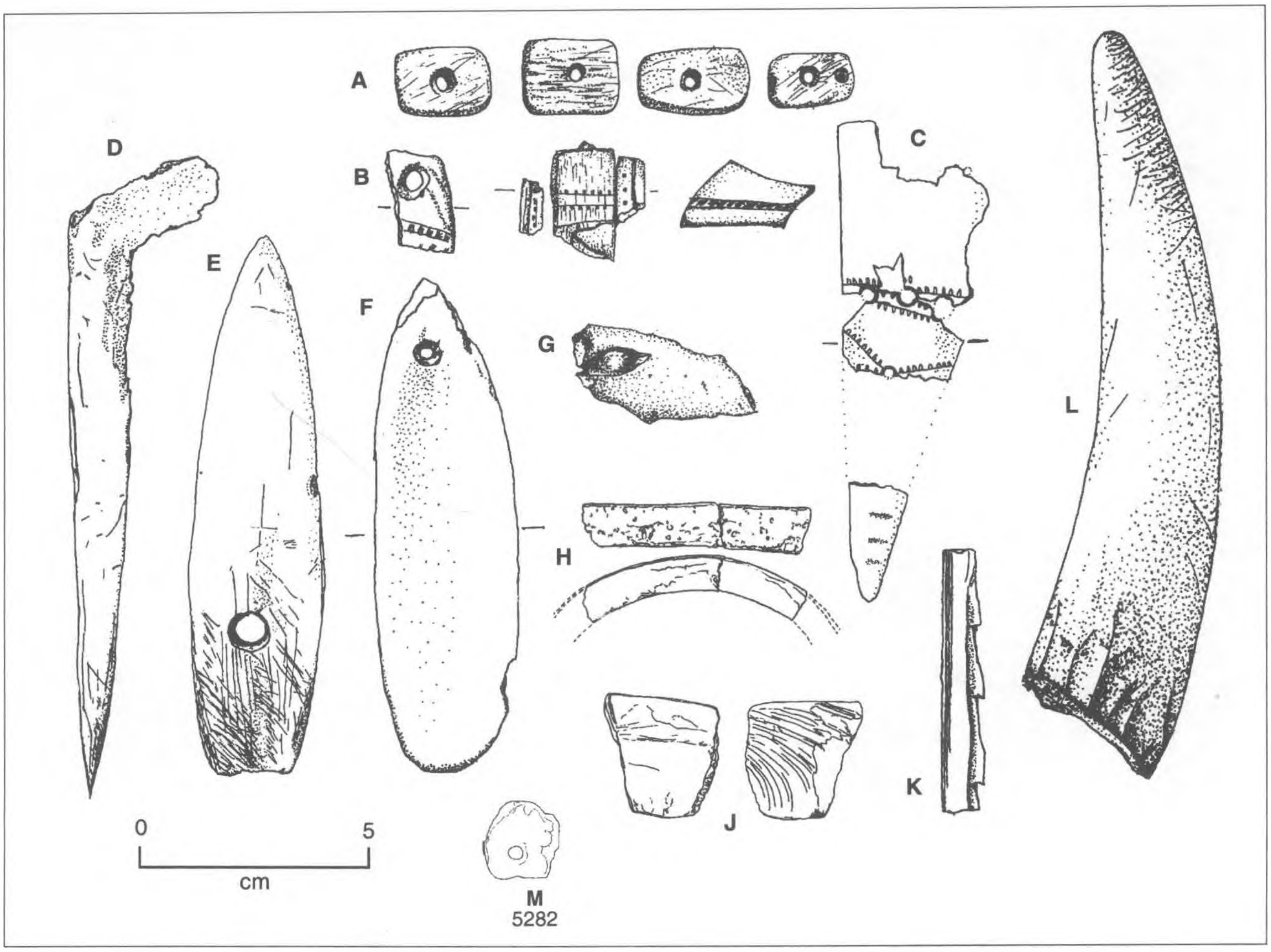

Figure 3. A selection of bone items that were probably considered prestige objects at Keatley Creek. (A) bone buttons; (B and C) incised and shaped pieces of flat bone; (D) "L" or scapula awls; (E) a probable bone net needle; (F) a probable bull-roarer; (G) a Coastal style sculpted eye on a long bone; (H) pieces of a probable shell bracelet made from purple-hinged rock scallop from the coast; (J) part of a mussel shell adze from the Coast; (K) part of a barbed bone point; (L) an antler with a shaped based probably for insertion into a headpiece or mask; (M) an unprovenienced piece of drilled shell from HP 3. For additional examples of bone prestige items such as antler digging stick handles or antler bark peelers, and detailed proveniences, see Vol. III, Chap. 2.

graphite from HP 3 (Fig. 4A), and small bits of mica, soapstone, nephrite, and obsidian debitage. Obsidian and mica flakes, as well as quartz crystal, lead ore, and gypsum were also recovered from the nearby Bell site (Stryd 1973:46, 34–8, 404, Table 6, Table 34; Stryd 1971:202). Stryd sourced many pieces of obsidian and found that most came from Anaheim Lake, about 300 km to the northwest. Reimer (2000:203–4) has argued that obsidian was an important prehistoric prestige material in the Northwest. Mica flakes, pendants, 14 gypsum crystals, and about 200 dentalia shells were recovered from a grave bundle at the Bell site, indicating that all these items were treated as prestige objects. Smith (1900) also records mica pieces from his excavations in Lytton. Although many of the pieces of mica that we recovered were small, there is a clear reference to their use on Shuswap breastplates (Teit 1909:650), presumably for decorative or ritual purposes. In recent excavations, Bill Prentiss (Prentiss et al. 2000:242) recovered a drilled piece of mica and four stone beads from the rim deposits of HP 7. Apparently the only source of gypsum crystals in the Interior (perhaps the only source) is reported to be located by local rock enthusiasts at Monty Lake rodeo near Armstrong, between Vernon and Kamloops. A piece of chert identified by Ed Bakewell as Hosamine chert from the Ross Lake area of Washington State might also be considered a prestige material, as well as some of the larger and finer pieces of chert-like materials, however, most exotic pieces of chert are difficult to source or assess at this point.

Except for the possible use of thin bifaces as prestige items there are far fewer substantially

Table 3. Lithic Prestige Items from Keatley Creek (EeRl7)

Housepit		Prestige Materials					Prestige Manufactured Items										Lithics Used to Make Prestige Items								
		Obsidian Artifacts	Obsidian Debitage	Mica	Nephrite	Steatite	Stone Pendant	Stone Bead	Ground Nephrite	Pipe	Copper Bead/Pendant	Stone Maul	Celt	Crescent Biface	Paint Cup	Stage 4 Biface	End Scraper	Hide Polish	Polished Flake	Spall Tool	Retouched Spall Tool	Sandstone Saw	Drill	Arrow Shaft Straightener	**Table Total**
1	Roof	1					5									6	1					1			14
	Rim																							1	1
	Pit														1						1				2
	Floor															2	2	1							5
2	Roof																1								1
	Floor	1					1									3	1								6
3	Roof	3	3		1	7		1		6	1		1			21	7	2		2	5		2		62
	Rim															6									6
	Floor	1	12													7	4	21	1	2	4				52
4	Roof															1									1
	Floor	1															1			2					4
5	Roof						1									4	1	3							9
	Rim		2													20	3	6					1		32
	Pit																1								1
	Floor															2									
6	Floor																1								1
7	Roof	5	4			5	4			5		1				49	34	19	3	8	10		8		155
	Rim		47				3									16	8	42	1	1	1		2		121
	Pit						2				1					20	1			1	3		3		31
	Floor	3	23		1		1*	1	1			1			1	20	27	11	3		11		1		104
8	Roof															4					1				5
	Rim																						1		1
	Floor						1									2									3
9	Roof	1		1	3	3	2			3			2			2	2	2		1			2		24
	Floor				1		1						1			3	1	3	1						11
12	Roof					1				1						1	1	2	1	1					8
	Floor																2								2
47	Roof																	1			1				
58	Roof																1	1							
90	Roof			1												1	1	2			1				6
	Pit																						1		1
	Floor			6	1							1	1		1	2		1					1		14
101	Roof			1												1				1			1		4
	Floor			1												1		1	1						4
105	Roof		138													3	1	4					1		147
	Pit		76													2		1							
	Floor															3		1							
106	Roof																				2				2
	Pit													1											1
	Floor																1	1							2
108	Floor															1									
109	Roof		31													2									33
	Pit		56																						
	Floor		2	1												1		1							5
110	Roof																1								1
	Pit																1								1
	Floor		1													2	2						1		6
EHPE 2	Roof																	1							
EHPE 8	Roof	1																							
EHPE 9	Roof																	1							
EHPE 11	Roof					1	1																		
EHPE 12	Roof																1								
Totals		16	395	11	7	16	20	2	1	15	2	3	5	1	3	208	107	126	11	19	40	1	25	1	1,035

* Turtle pendant.

Unknown Strata and Potted Artifacts are included in the Roof Stratum

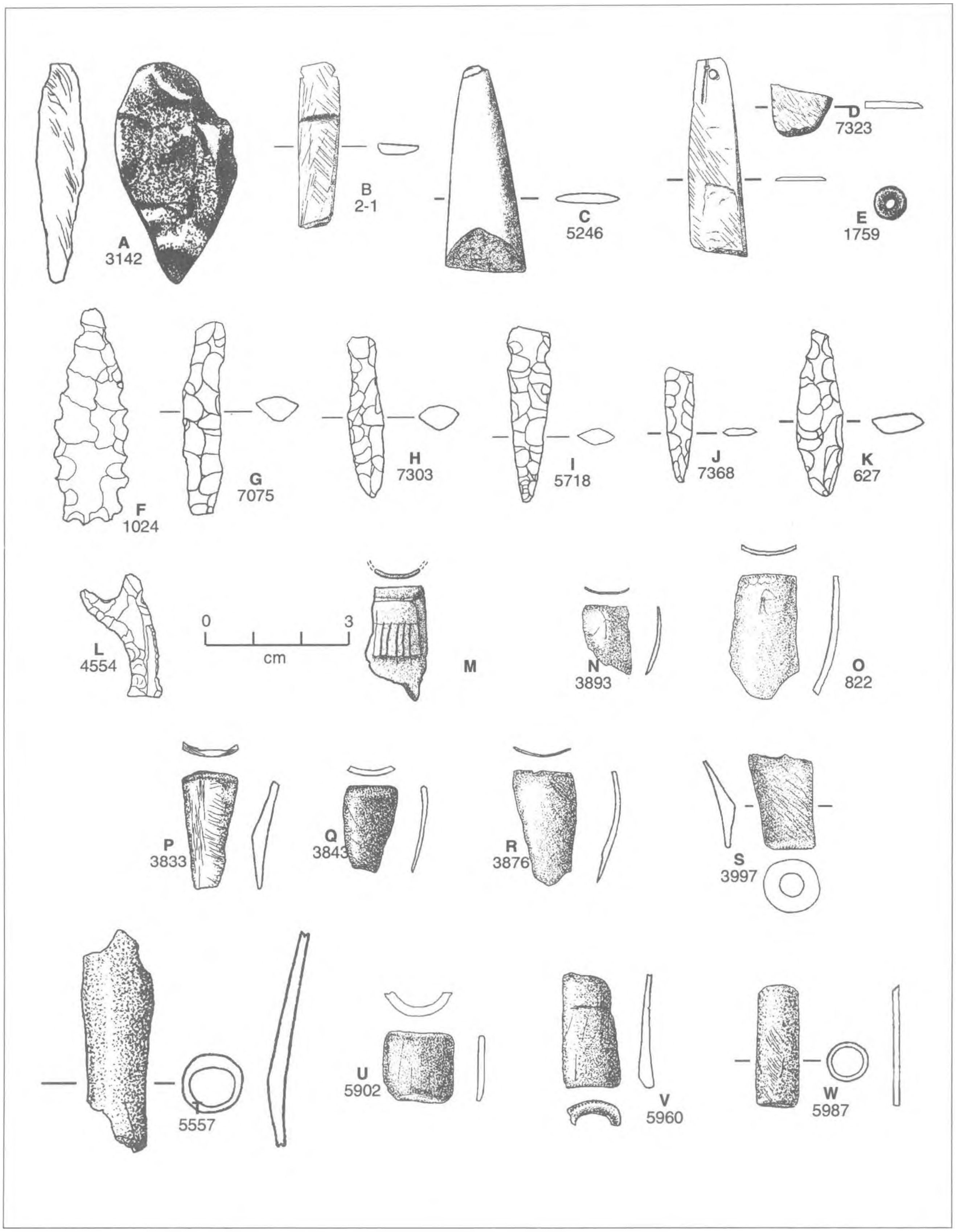

Figure 4. Smaller stone prestige items at Keatley Creek include: (A) a piece of graphite shaped into a "crayon" from HP 3; (B–L) ground stone and chipped stone pendants and eccentric chipped stone items; (E) a stone bead; and (M–W) pieces of soapstone pipes or tubes.

modified prestige lithic artifact than there are unmodified lithic prestige items. Few are common, and some are unique. These items are listed in Table 3. The most common prestige items (Fig. 3) were stone pendants, obsidian artifacts, thin biface fragments, and steatite pipe fragments (only found in roof deposits). In addition to the pipes themselves, it is entirely possible that the materials smoked in the pipes were prestige items, especially if these materials were tobacco or similar to it. Since the implications for the presence of tobacco in the Interior during the Keatley Creek occupation would be far-reaching in terms of factors responsible for domestication, I had carbonized residues inside a number of the pipe bowls analyzed to see if their origin could be determined. Unfortunately, both the analysis conducted by Dr. B.M. Kapur of the Addiction Research Foundation in Toronto, and the analysis conducted by Wayne Jeffrey of the R.C.M.P. toxicology laboratory in Vancouver failed to result in the positive identification of any nicotine or its breakdown product, cotinine. Both laboratories used Gas Chromatography–Mass Spectrometry for their analysis. Both laboratories demonstrated that abundant organic compounds were indeed present but that none contained alkaloids. Hydrocarbons such as decane, undecane, dodecane, hydrocarbon acids, fatty acids, sterols, and many unidentified compounds were all present. Other stones that we tested from the archaeological contexts produced no significant residues. Whether the residues from the pipes were so degraded that original alkaloids have completely disappeared, or whether no alkaloid containing plants were ever used for smoking in these pipes cannot be determined at this time. Today, a wide range of plant mixtures are used for smoking by local Natives, none of which include tobacco.

Thin bifaces (Stage 4 bifaces) are included among prestige items because of the high degree of skill required to make them, the high quality and larger size of stone material required for making thin bifaces, and the many ethnographic and archaeological contexts elsewhere that clearly show that large thin bifaces were used as prestige objects. Olausson (1998) has also argued that few people would have had the necessary aptitudes for making good thin bifaces. Despite these considerations,

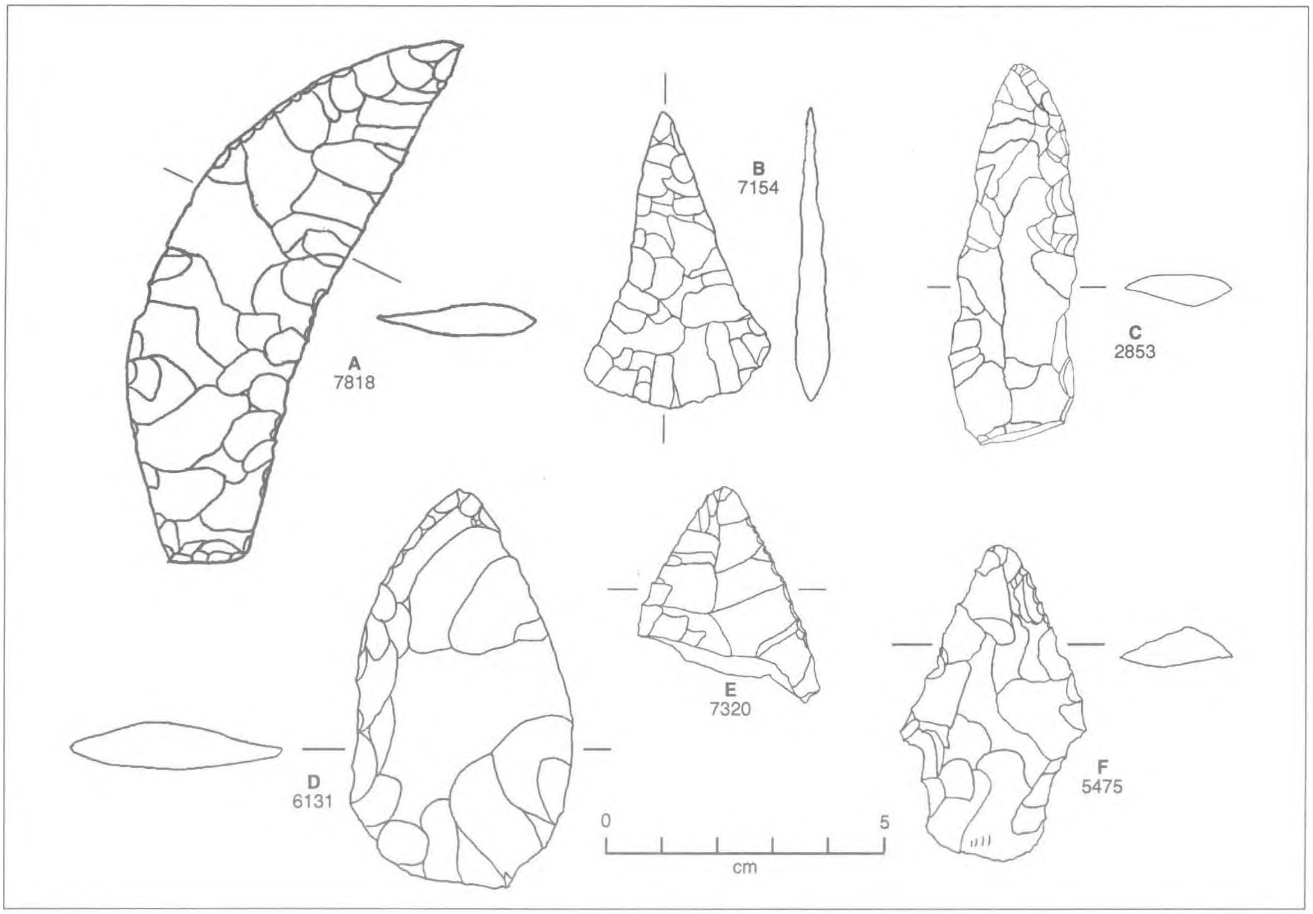

Figure 5. Finely made thin bifaces were probably also used as prestige objects. The most striking example (A) is a unique crescent-shaped thin biface laid horizontally at the bottom of a meat roasting pit under the rim of HP 106. Other examples include finely made fan-tailed bifaces (B); sinuous bifacial knives (C); and more typical leaf shaped bifaces (D,E), or bifaces with squared bases (F).

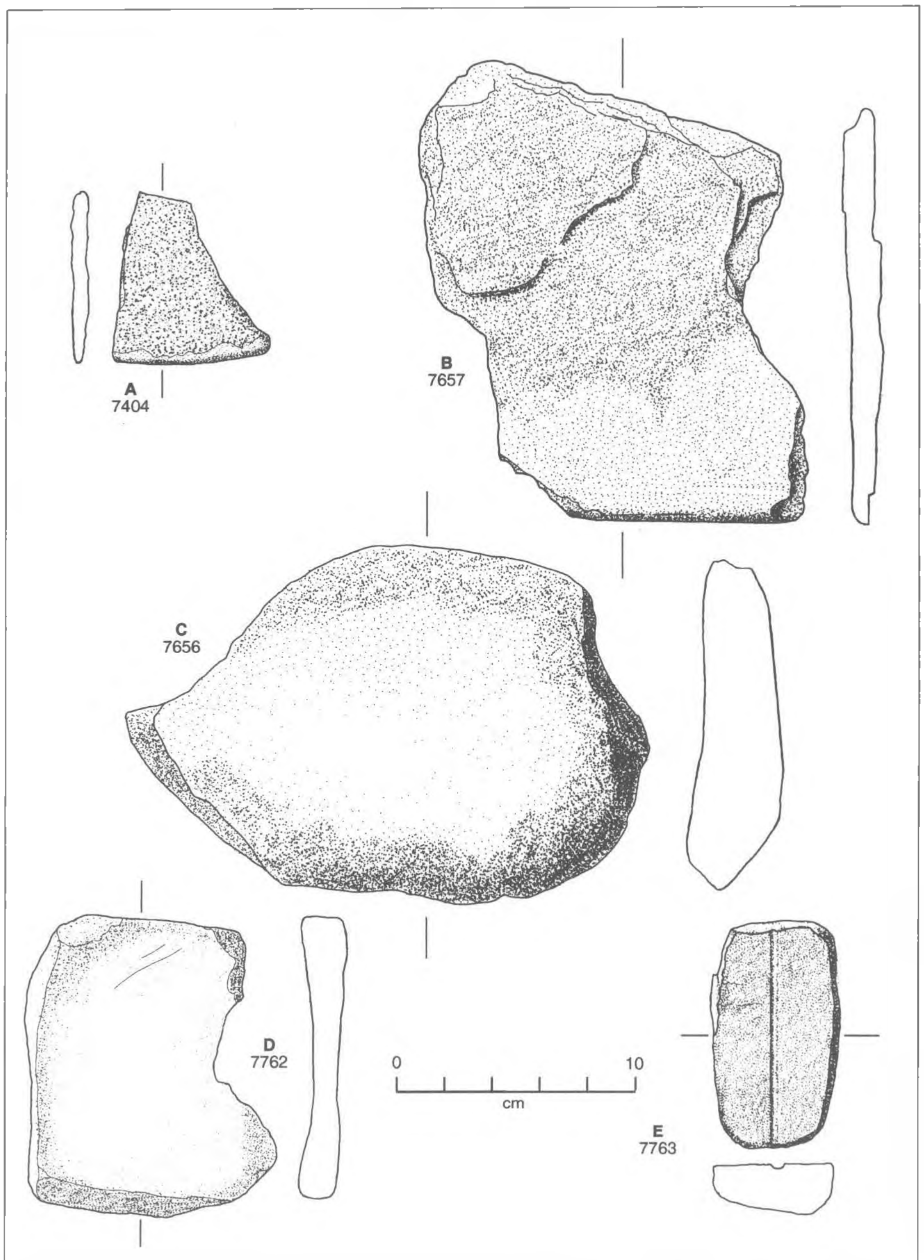

Figure 6. Ground stone items associated with prestige activities or with the manufacturing of prestige items included sandstone "saws" used to cut nephrite (A and B); large sandstone grinding stones (C) apparently used in conjunction with saws in the manufacturing of nephrite objects in HP 104; ochre stained "pallettes" (D is covered with ochre); and arrowshaft straighteners (E — see Vol. I, Chap. 3).

many bifaces may have been largely utilitarian tools. Although I am confident that the thinnest, largest, and best examples were prestige items, I am not completely certain that our classification of Stage 4 (thin) bifaces entirely corresponds to prestige bifaces with no inclusion of more prosaic utilitarian type bifaces. Similarly, when first introduced, bows and arrows (vs. atlatls and spears) may have largely been high status weapons (Vol. I, Chap. 3). The best example of a prestige biface from Keatley Creek is an unusual biface that was recovered from the very bottom of a meat roasting pit under the rim of HP 106 (Fig. 5A). The finely crafted crescentic shape of this biface makes it unique for the Plateau, and arguably manufactured to represent some specialized role. It was carefully placed horizontally in the center of the bottom of the roasting pit, as though it was a prestige offering.

Table 3 also lists endscrapers, flakes with probable hide polish, and spall tools (see Vol. III, Chap. 1) since these tools were probably used to produce buckskin. On the basis of Teit's observations as well as comparative accounts from elsewhere on the continent, I have argued that buckskin was a prestige item used to make prestige clothes (Hayden 1990). Similarly, I have included well made sandstone saws plus a sandstone grinding stone that were undoubtedly used for making nephrite adzes (Fig. 6A–C). Similarly, drills (Vol. III, Chap. 1) are included because they may well have been used for making prestige items such as beads. A few stone eccentrics (listed as pendants or ornaments) were also found (Fig. 4F,G,L). These are rare but widespread in the Plateau, even extending down into the Great Basin and up to Alaska (Tuohy 1986:237). Tuohy records their use in Alaska as hunters' amulets. Specialized hunters were noted as wealthy people in Lillooet communities and probably belonged to elite families as a rule (Romanoff 1992). The "multinotch" points of later Kamloops times may have served a similar function. A single example of a palette or "paint cup," crudely fashioned from a naturally concave piece of rock, but cached in a pit together with an antler billet, may have also been part of a prestige toolkit (Fig. 6D). Krieger (1928:10) reports similar paint cups from Wahluke in Washington State.

Of far greater value are the nephrite celts, or celt fragments, recovered from Keatley Creek (Fig. 7). They were probably the most valuable prestige items of the entire Plateau. Darwent (1998) estimates that it would have taken at least 110 hours of work simply to cut out the blanks for these adzes and argues that they were clearly prestige items traded over very great distances. In fact, they are so labor intensive to manufacture, and the work is so monotonous, that they may indicate the presence of slave, or at least servile, labor on the Plateau. The only complete celt (from HP 90) was apparently hidden under the sleeping platform where it was left, perhaps because its owner had died before he could retrieve it. It is damaged and of poor quality. The rarity of nephrite celts in winter village refuse undoubtedly reflects both the value of these items, their low frequency within the communities, and the tendency to bury these items with their owners. That Keatley Creek is not unusual in reporting a low frequency of celts among domestic sites is evident when comparisons are made to other sites such as the Meier site, where Ames et al. (1992) recovered only two celts. A small fragment of what was probably a nephrite knife or ornament (Fig. 8C) was also recovered at Keatley Creek from a storage pit in the west side of HP 7. It is a unique specimen.

Carefully shaped and sculpted mauls must have also been prestige items. The only complete example was apparently hidden in a hole dug into the wall at the base of the northwestern rim (Fig. 7A). It too was probably lost because its owner never returned to recover it. The beautiful zoomorphic head (Fig. 7B) of the maul used as the cover illustration for this volume was borrowed from a private collection and was reported to have come from HP 93 which, in fact had been heavily looted. One further example of a probable highly prestigious maul head was recovered from the west half of HP 7. Only the head is present, but it is made of white marble (Fig. 7C). The form resembles a zoomorph, but has only been roughed out. The piece is unique in the Northwest. The only other piece of stone sculpture recovered at the site is a small, serpentine, zoomorphic pendant in the form of a snake, or at least an animal with reptilian features (Fig. 8D). This was recovered from on top of wall deposits in HP 7 and was likely lost by one of the housepit children or their guests climbing on the walls, or it may have been lost while in storage along the wall. A carved steatite serpent is also reported by Sanger (1968b: 108) from Chase, but no illustration was published. It might also be recalled that one of the most remarkable bone figurines recovered at the Bell site was of a serpent woman with an exposed vagina. Stryd (1981) relates this to the widespread myth of a female serpent ogress who would kill men with her poison vagina and the teeth within it.

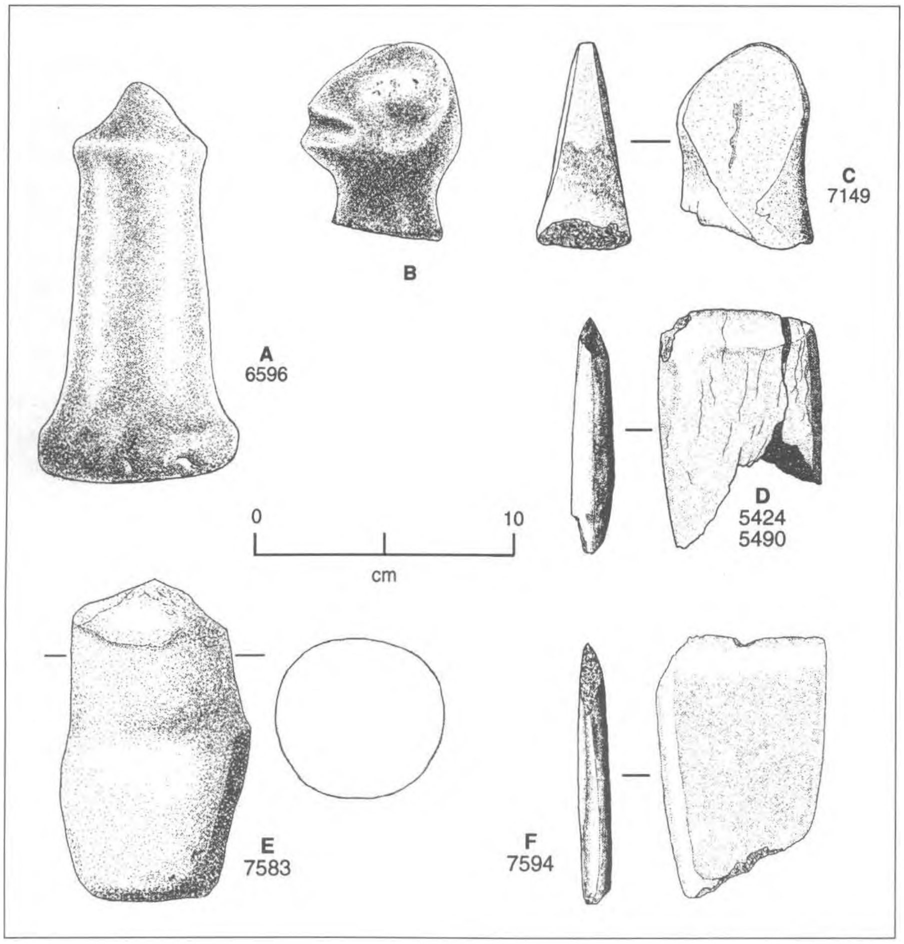

Figure 7. Large ground stone prestige tools included mauls with a range of shapes including nipple-topped mauls (A, from HP 7); zoomorphic-topped mauls (B, also shown on the volume cover); and indeterminate shapes (C, from HP 7). This last item (C) is unique in that it is made of marble and may never have been completed due to breakage, or it may have had a function other than that of a functional maul. Other mauls were so fragmentary that no determination of shape could be made such as the base from HP 90 (E). Nephrite adzes (E, from HP 9; and F, from HP 90) were probably the most valuable prestige objects of the region.

Finally, two pieces of copper were recovered at Keatley Creek (Fig. 8A,B). One was a fragment of a thin copper sheet with a definite small hole, probably for the attachment of the copper to a backing. This piece was found in wall or rim deposits in HP 3. A complete rolled, tubular copper bead, was recovered from a medium sized storage pit in the west half of HP 7. Stryd (1973: 405, Fig. 36) also recovered a few pieces of copper at the Bell site: a tubular bead and a pendant. Sources for the copper used in the Lillooet region may have been as close as the Bridge River where placer miners report finding nuggets in the gravel; however, this is not recorded as a source that was known or used by Natives. Alternatively, the copper may have come from some of the more distant sources actually reported to have been used by Natives ethnographically (see Hayden and Schulting 1997). There are many reasons for considering copper to have been an important prestige material (see Hayden 1998), including the intensive labor necessary to find and work it (Shimada and Griffin 1994), its attractive luster and sound, and its association with the sun or stars in the Interior (Teit 1917:44).

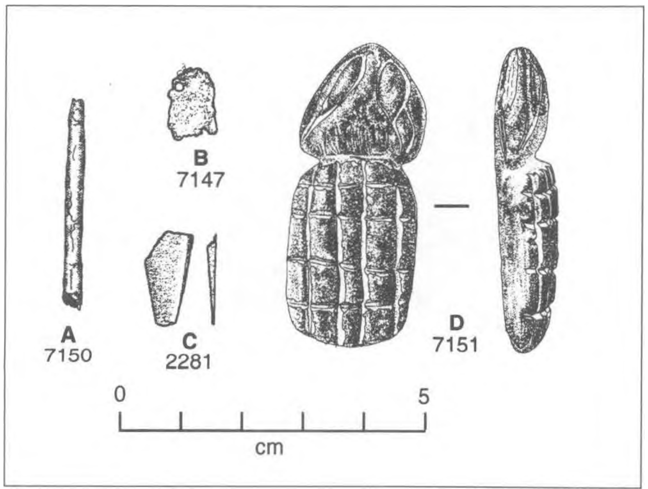

Figure 8. Among the most valued prestige ornaments at Keatley Creek were almost certainly: copper tubular beads (A); copper sheet ornaments (B); nephrite knife-like tools or ornaments (C); and zoomorphically sculpted serpentine objects (D).

Conclusions

This completes the description of prestige items recovered at Keatley Creek. While the record is quite fragmentary and most prestige objects have undoubtedly been deposited in graves or other non-housepit contexts, these objects are sufficiently common to indicate that they functioned as a major part of the overall prehistoric economy. They represent the conversion of surplus food production into storable wealth which must have been used to create debts, broker important social relationships and alliances, and host impressive feasts. These items are, above all, display items indicating success. They are meant to impress and to make membership in specific groups attractive for ambitious aspiring individuals. The amount of surplus labor required to manufacture some of these items (e.g., nephrite adzes) or to acquire them from distant sources is considerable and is a general indicator of just how far the Classic Lillooet communities had come from the more rigid egalitarian and sharing communities of their ancestors. In fact, the mere existence of prestige items is a strong demonstration that private (or corporate) ownership had largely superseded the sharing ethics of generalized hunter/gatherers since it makes no sense to invest large amounts of labor in the production of flashy, non-utilitarian objects only to have them borrowed and never returned, as usually happens in generalized hunter/gatherer societies.

While these prestige objects may not have been frequent enough in the overall assemblage to make detailed distribution studies across housefloors very meaningful, the diversity and overall frequency of prestige items associated with individual housepits does seem to provide a good indication of the relative general economic standing of housepits in the community. In his analysis of the Bell site, Stryd (1973:89) also noted that "art objects" were more frequently associated with the large housepits. As Tables 1–3 shows, this parallels the case at Keatley Creek, with the exception of HP 9, which appears to be the residence of an elite-sponsored specialist such as a shaman or hunter.

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Chapter 14

Comparison of Lithic Assemblages from All Excavated and Tested Housepits at the Keatley Creek Site

Jim Spafford

Introduction

The primary goal of the excavations at the Keatley Creek site was to investigate the development of social complexity and socioeconomic differentiation among hunter/gatherers in the Mid-Fraser River region of British Columbia's Interior Plateau. It was thought that these developments might have culminated, by the beginning of the Kamloops Horizon of the Plateau Pithouse Tradition (about 1,200–1,100 BP), in the establishment of large, hierarchically-organized, co-residential corporate groups in large pithouses at large sites like the Keatley Creek site. For the purposes of this investigation, four housepits (HP's 3, 7, 9, and 12) representing a broad range of sizes were selected for extensive excavation. All have well defined, relatively undisturbed, living surfaces dating to the early Kamloops Horizon. (Vol. I, Chap. 1 presents a more detailed discussion of the social complexity model and the criteria for housepit selection.) A fifth housepit (HP 90), whose final occupation may date to the earlier Plateau horizon was also extensively excavated. In the process of identifying housepits suitable for extensive excavation, test trenches were excavated in an additional 15 housepits (HP's 1, 2, 4, 5, 6, 8, 47, 58, 101, 107, 108, 109, 110, 111, and 119). This chapter describes the analysed lithic assemblages from 20 excavated or tested housepits and attempts to account for the similarities and differences observed among them. It was hoped that assemblages from test trenches might be used as reliable indicators of the relative socioeconomic status of prehistoric housepit residents. However, many other factors also seem to be reflected in test trench assemblages. Subsequent to this analysis, several other housepits were also tested (HP's 104, 105, 106, and 115).

In addition to representing a wide range of sizes, the different housepits represent different time periods and vary considerably in terms of such environmental conditions as elevation, proximity to other housepits, and access to water, firewood, and other resources. The analysis is further complicated by the fact that the different housepits have very different depositional histories. Some appear to have been occupied only briefly while others have been repeatedly rebuilt, and reoccupied during the 3,000 year history of the site. All are believed to have functioned primarily as dwellings but some may also include deposits resulting from use as temporary campsites or refuse dumps. In addition, different strata types (floors, roofs, rims, hearths, and features) are represented in substantially different proportions in the analysed excavation units from different housepits. Strata were also more clearly distinguished in some housepits than in others.

All of these factors have probably influenced the characteristics of the lithic assemblages deposited in and recovered from the different housepits in varying degrees. So it would not be surprising if clear relationships between the characteristics of the lithic assemblages and the size or age or locations of the housepits could not be identified. Indeed, some additional significance may be attached to the patterns which do emerge in spite of these confounding influences.

The Data

The lithic assemblages were compared in terms of lithic density (in each housepit as a whole and in the floor strata of each housepit), exotic flake ratio, small flake ratio, and in terms of the proportions in which different modified artifact types were represented. A summary of these data is presented in Tables 1 and 2. Table 1 also shows the diameter of each housepit and the types of temporally diagnostic projectile points recovered, and ranks the housepits by length of occupation, strength of association with the Kamloops Horizon, and distance from the area of the site core, where housepits are most densely distributed Vol. I, Chap. 1, Figs. 17–19; Vol. III, Chap. 11, show the actual locations of the excavated or tested housepits at the Keatley Creek site). All of the variables employed in the analysis are defined and discussed below.

Lithic Density

Lithic density is simply defined as the number of lithic artifacts (i.e., modified artifacts and debitage) recovered per litre of excavation. In some cases the thickness of excavated units was not recorded and the excavated volume of these units had to be estimated from the average thickness of excavation units from the same type of stratum (roof, floor, rim, hearth, or pit feature) in the same housepit, or if this data were unavailable, from the average thickness of excavation units of that stratum type for all excavated housepits. Table 3 presents the data on which the volume estimates are based.

Lithic artifacts are presumed to have been deposited on the floor and roof of a pithouse while it was occupied, and redeposited, first on the rim and then on the roof, each time the pithouse was rebuilt. So lithic density, in a housepit as a whole and in the roof and rim strata in particular, can be expected to have increased the longer a pithouse was occupied.

Lithic density might also be high in housepits whose floors and roofs were regularly used by relatively large numbers of people for activities involving lithic reduction or the use and/or manufacture of stone tools. Pithouses which served primarily as places to eat and sleep and which were only occasionally the sites of manufacturing activities would accumulate lithic artifacts more slowly. If large pithouses housed influential groups who exerted some control over the labor of their neighbors they may have been preferred over smaller housepits as sites for manufacturing activities. They might also have been the most convenient places for large groups to gather, especially for tasks which would probably have required a fair bit of space. Hide-working, butchering, and the preparation of shafts and poles might be examples of such activities.

On the other hand, lithic artifacts might also accumulate in high densities in smaller pithouses which were occupied by specialists in certain crafts or in pithouses which were used for certain specialized activities. Some of these activities may have occurred most frequently in particular parts of the site. One possible example is large-scale woodworking, which may have involved heavy use of stone tools and quite likely occurred most frequently on the periphery of the site, where raw materials would have been most readily available.

Of course, lithic density values are also likely to be high in housepits where strata types, such as floors, hearths, and pits, which tend to have high lithic densities, make-up high proportions of the analysed excavation units.

Floor Density

Floor density was calculated for the floor stratum (or strata) in each housepit in the same manner that lithic density was calculated for each housepit as a whole. Each floor stratum, and the lithic artifacts in it, probably accumulated in the course of a single occupation (usually comprised of 20–30 successive yearly winter stays). Floor density will be higher in floors that were occupied for more yearly winter stays. However, the duration of a housepit's total occupation history, which may include many re-roofings and the simultaneous creation of new floor surfaces (see Vol. I, Chap. 17), should not greatly influence floor density. So floor density is probably a better indicator of the level of activity in a housepit than overall lithic density.

Exotic Flake Ratio

The exotic flake ratio for each housepit is defined as the total number of unmodified chert, chalcedony, and obsidian flakes divided by the total number of

Table 1. Comparison and classification of housepits on the basis of size, duration of occupation, strength of association with the Kamloops Horizon, location, lithic density, and other attributes of the lithic assemblages

Housepit	Lithic density (all strata)	Lithic Density (floor strata)	Tool: Flake Ratio	Exotic Flake Ratio	Small Flake Ratio	Diameter (m)	Diagnostic Point Types *	Duration of Occupation Rank	Strength of association with Kamloops Horizon	Location	Distance from "Center" Rank
Group 1. Large housepits with long occupation histories and fairly strong Kamloops associations located in or adjacent to the densest concentration of housepits.											
HP1	0.618	1.64	0.11		0.7	20	K/S	4	5	W main	2
HP2	2.004	5.39	0.13			18.5	K/P/S	5	5	SE main	1
HP3	0.772	0.74	0.13	0.04	0.7	14.25	K/P/S/E	6	5	Center main	2
HP4	1.124	1.73	0.12		0.8	10.25	K/P/S	5	4	SW main	1
HP5	0.803	1.14	0.23		0.9	20	K/P/S/E	6	4	S main	1
HP6	1.009	0.77	0.15			13	K/P	3	5	E main	2
HP7	1.121	1.17	0.15	0.09	0.7	18.75	K/P/S/E	6	5	SE main	1
HP8	1.964	3.46	0.12			17.5	K/P	3	4	E bank edge	1
Group 2. Small housepits with short occupation histories.											
HP107						7	P	2	2	S terrace	4
HP108	0.700	3.93	0.06	0.06	0.8	6.5	none	1	1	S terrace	4
HP109	0.310	0.77	0.25		0.7	9.5	fragment	1	1	N terrace	4
HP111	0.439	0.33	0.04	0.27	0.8	5	none	1	1	N terrace	4
HP47	0.389	0.57	0.09	0.04	0.8	6	P	2	2	C bank edge	1
HP119	0.582	0.27	0.05	0.18	0.2	9.8	K	2	6	N terrace	4
Group 3. Small housepits with longer occupation histories and low lithic densities.											
HP12	0.447	0.63	0.08	0.03	0.7	9.25	K/P	3	3	NW main	3
HP58	0.629	0.48	0.04	0.12	0.8	8.5	K/P	3	4	SW main	1
HP9	0.272	0.28	0.17	0.10	0.6	7.8	K/P/S	5	4	S terrace	4
HP90	0.252	0.38	0.08	0.10	0.8	6	P/S	3	2	NW main	3
Group 4. Small housepits with longer occupation histories and high lithic densities.											
HP101	1.675	2.07	0.12	0.74	0.5	7.75	K/P	3	5	W main	2
HP110	7.917	25.4	0.05	0.06	0.9	5.75	K/P	3	3	S terrace	4
Median Values		0.665	0.77	0.12	0.10	0.7	9.75				

* Projectile points are classified as diagnostic of: Kamloops Tradition (K); Pleateau Tradition (P); Shuswap Tradition (S); or earlier cultural phases (E). Where more than one type is present, the types are listed in order of frequency, and if one type represents 50% or more of the points collected from a housepit the symbol for that type is shown in uppercase.

Table 2: Cross tabulation of modified artifact type frequencies by housepit showing absolute frequencies (Count), and percentage of each housepit assemblage represented by each type (Col Pct), the percentage of the total number of artifacts of each type which occurs in each housepit (Row Pct), and the percentage of the total assemblage represented by each type in each housepit (Tot Pct).

Count Row Pct Col Pct Tot Pct	HP 1	HP 2	HP 3	HP 4	HP 5	HP 6	HP 7	HP 8	HP 9	HP 12	HP 47	HP 58	HP 90	HP 101	HP 107	HP 108	HP 109	HP 110	HP 111	HP 119	Row Total
Type																					
expedient knives	56 6.2 22.7 1.2	34 3.8 30.9 .8	83 9.3 13.9 1.8	33 3.7 19.3 .7	176 19.6 31.3 3.9	7 .8 15.2 .2	293 32.7 16.4 6.5	18 2.0 12.8 .4	47 5.2 25.0 1.0	16 1.8 17.6 .4	4 .4 23.5 .1	5 .6 27.8 .1	38 4.2 30.2 .8	31 3.5 17.4 .7	2 2.9 33.3 .0	5 .6 55.6 .1	6 .7 21.4 .1	15 1.7 22.1 .3	2 .2 50.0 .0	26 20.0 26.0 .6	897
utilized flakes	64 7.1 25.9 1.4	19 2.1 17.3 .4	75 8.4 12.5 1.7	60 6.7 35.1 1.3	137 15.3 24.3 3.0	11 1.2 23.9 .2	335 37.3 18.8 7.5	31 3.5 22.0 .7	22 2.5 11.7 .5	22 2.5 24.2 .5	4 .4 23.5 .1	3 .3 16.7 .1	20 2.2 15.9 .4	54 6.0 30.3 1.2		2 .2 22.2 .0	1 .1 3.6 .0	14 1.6 20.6 .3	1 .1 25.0 .0	22 2.5 22.0 .5	897 20.0
scrapers	26 4.8 10.5 .6	9 1.7 8.2 .2	82 15.3 13.7 1.8	10 1.9 5.8 .2	37 6.9 6.6 .8	6 1.1 13.0 .1	276 51.4 15.5 6.1	18 3.4 12.8 .4	12 2.2 6.4 .3	11 2.0 12.1 .2	1 .2 5.9 .0	1 .2 5.6 .0	12 2.2 9.5 .3	20 3.7 11.2 .4		7 1.3 25.0 .2	5 .9 7.4 .1		537 11.9	4 .7 4.0 .1	
endscrapers	2 2.2 .8 .0	3 3.3 2.7 .1	10 11.0 1.7 .2	1 1.1 .6 .0	4 4.4 .7 .1	1 1.1 2.2 .0	53 58.2 3.0 1.2	1 1.1 .7 .0	2 2.2 1.1 .0	3 3.3 3.3 .1		1 1.1 5.6 .0	3 3.3 2.4 .1	1 1.1 .6 .0		1 1.1 3.6 .0	3 3.3 4.4 .1		91 2.0	2 2.2 2.0 .0	
key-shaped	1 3.4 .4 .0		4 13.8 .7 .1		1 3.4 .2 .0	1 3.4 2.2 .0	20 69.0 1.1 .4		1 3.4 .5 .0	1 3.4 1.1 .0					29 .6						
bifaces	11 5.8 4.5 .2	2 1.1 1.8 .0	26 13.8 4.3 .6	3 1.6 1.8 .1	21 11.1 3.7 .5		85 45.0 4.8 1.9	5 2.6 3.5 .1	9 4.8 4.8 .2	4 2.1 4.4 .1	1 .5 5.9 .0		6 3.2 4.8 .1	3 1.6 1.7 .1	1 .5 16.7 .0		4 2.1 14.3 .1	3 1.6 4.4 .1		5 2.6 5.0 .1	189 4.2
bifacial knives	2 3.7 .8 .0	2 3.7 1.8 .0	7 13.0 1.2 .2		11 20.4 2.0 .2		18 33.3 1.0 .4	2 3.7 1.4 .0		2 3.7 2.2 .0		1 1.9 .8 .0	1 1.9 .6 .0	3 5.6 3.0 .1		5 9.3 7.4 .1		54 1.2			
points	7 1.6 2.8 .2	6 1.4 5.5 .1	99 23.3 16.5 2.2	14 3.3 8.2 .3	23 5.4 4.1 .5	3 .7 6.5 .1	203 47.8 11.4 4.5	10 2.4 7.1 .2	20 4.7 10.6 .4	9 2.1 9.9 .2	1 .2 5.9 .0	2 .5 11.1 .0	5 1.2 4.0 .1	3 .7 1.7 .1	1 .2 16.7 .0		1 .2 3.6 .0	11 2.6 16.2 .2		7 1.6 7.0 .2	425 9.5
notches	25 8.9 10.1 .6	11 3.9 10.0 .2	35 12.5 5.8 .8	13 4.6 7.6 .3	38 13.5 6.7 .8	3 1.1 6.5 .1	85 30.2 4.8 1.9	10 3.6 7.1 .2	10 3.6 5.3 .2	2 .7 2.2 .0		2 .7 11.1 .0	9 3.2 7.1 .2	21 7.5 11.8 .5	1 .4 16.7 .0		2 .7 7.1 .0	2 .7 2.9 .0		12 4.3 12.0 .3	281 6.3

Table 2: *(continued)*

Count Row Pct Col Pct Tot Pct	HP 1	HP 2	HP 3	HP 4	HP 5	HP 6	HP 7	HP 8	HP 9	HP 12	HP 47	HP 58	HP 90	HP 101	HP 107	HP 108	HP 109	HP 110	HP 111	HP 119	Row Total
Type																					
bipolar cores	9 3.5 3.6 .2	7 2.7 6.4 .2	36 13.9 6.0 .8	16 6.2 9.4 .4	36 13.9 6.4 .8	5 1.9 10.9 .1	83 32.0 4.6 1.8	16 6.2 11.3 .4	23 8.9 12.2 .5	6 2.3 6.6 .1	1 .4 5.9 .0	1 .4 5.6 .0	8 3.1 6.3 .2	12 4.6 6.7 .3			259 5.8				
sm. piercers	8 10.5 3.2 .2	1 1.3 .9 .0	11 14.5 1.8 .2	1 1.3 .6 .0	18 23.7 3.2 .4		23 30.3 1.3 .5	4 5.3 2.8 .1	2 2.6 1.1 .0	1 1.3 1.1 .0		2 2.6 1.6 .0	2 2.6 1.1 .0	1 1.3 1.0 .0		1 1.3 3.6 .0		76 1.7		1 1.3 16.7 .0	
drills	2 4.4 .8 .0		3 6.7 .5 .1	1 2.2 .6 .0	3 6.7 .5 .1		17 37.8 1.0 .4	4 8.9 2.8 .1	2 4.4 1.1 .0	1 2.2 1.1 .0		2 4.4 1.6 .0	5 11.1 2.8 .1	2 4.4 2.0 .0		3 6.7 4.4 .1		45 1.0			
spalls	1 1.9 .4 .0		10 18.9 1.7 .2		1 1.9 2.2 .0	33 62.3 1.8 .7	1 1.9 .7 .0	2 3.8 1.1 .0	1 1.9 1.1 .0	1 1.9 5.9 .0		1 1.9 .8 .0	1 1.9 .6 .0	1 1.9 1.0 .0			53 1.2				
cores	5 4.7 2.0 .1	1 .9 .9 .0	11 10.3 1.8 .2	1 .9 .6 .0	12 11.2 2.1 .3	1 .9 2.2 .0	54 50.5 3.0 1.2		8 7.5 4.3 .2	3 2.8 3.3 .1	1 .9 5.9 .0		5 4.7 4.0 .1	3 2.8 1.7 .1	1 .9 11.1 .0	1 .9 3.6 .0		107 2.4			
hammerstones	1 3.3 .4 .0	1 3.3 .9 .0	7 23.3 1.2 .2	1 3.3 .6 .0	1 3.3 .2 .0	1 3.3 2.2 .0	11 36.7 .6 .2		2 6.7 1.1 .0			3 10.0 2.4 .1	1 3.3 .6 .0		1 3.3 1.5 .0		30 .7				
ground stone	3 5.7 1.2 .1	1 1.9 .9 .0	15 28.3 2.5 .3		2 3.8 .4 .0		24 45.3 1.3 .5	1 1.9 .7 .0	4 7.5 2.1 .1	1 1.9 1.1 .0		1 1.9 .8 .0	1 1.9 .6 .0			53 1.2					
ornaments	7 14.6 2.8 .2	1 2.1 .9 .0	7 14.6 1.2 .2		1 2.1 .2 .0		11 22.9 .6 .2	1 2.1 .7 .0	12 25.0 6.4 .3	1 2.1 1.1 .0		2 4.2 1.6 .0	3 6.3 1.7 .1	1 2.1 1.0 .0	1 2.1 3.6 .0		48 1.1				
other	17 4.0 6.9 .4	12 2.8 10.9 .3	78 18.4 13.0 1.7	17 4.0 9.9 .4	42 9.9 7.5 .9	6 1.4 13.0 .1	162 38.1 9.1 3.6	19 4.5 13.5 .4	10 2.4 5.3 .2	7 1.6 7.7 .2	3 .7 17.6 .1	3 .7 16.7 .1	8 1.9 6.3 .2	16 3.8 9.0 .4		1 .2 11.1 .0	3 .7 10.7 .1	6 1.4 8.8 .1	1 .2 25.0 .0	14 3.3 14.0 .3	425 9.5
Column Total	247 5.5	110 2.4	599 13.3	171 3.8	563 12.5	46 1.0	1786 39.7	141 3.1	188 4.2	91 2.0	17 .4	18 .4	126 2.8	178 4.0	6 .1	9 .2	28 .6	68 1.5	4 .1	100 2.2	4496 100.0

Table 3: Lithic debitage density estimates by housepit and stratum. M = d/c. Estimated density = a/(2.5(d + M (b-c))). If no excavation units of a given stratum type in a given housepit have recorded thicknesses, the mean thickness for all excavation units of that stratum type with recorded thicknesses is used in place of M.

Housepit/ Stratum Type	Debitage Count (a)	Number of excavation units (b)	Number of excavation units with recorded thickness (c)	Total thickness of excavation units with recorded thickness (d)	Mean thick-ness of units with recorded thickness (M)	Estimated total volume (litres)	Estimated Density (flakes per litre)
HP1							
surface	213	13				148	0.58
roof surface	216	4				28	3.04
roof	471	34				286	0.66
floor	359	20				88	1.64
subfloor	9	2				42	0.09
feature	194	12				100	0.78
rim	452	68	52	480	9.23	628	0.29
HP2							
surface	66	3				34	0.77
roof surface	71	2				14	2.00
roof	116	3				25	1.84
floor	295	5				22	5.39
subfloor	17	1				21	0.33
feature	18	1				8	0.87
rim	176	9				88	0.80
HP3							
surface	93	18	4	20	5.00	90	0.41
roof surface	357	50	43	306	7.12	356	0.40
roof	1122	95	69	471	6.83	648	0.69
floor	2292	276	240	1081	4.50	1243	0.74
subfloor	9	3				63	0.06
feature	10	5				41	0.10
rim	288	17				167	0.69
HP4							
surface	476	27				307	0.62
roof surface	99	4				28	1.39
roof	290	16				135	0.86
floor	265	14				61	1.73
subfloor	4	2				42	0.04
feature	46	6				50	0.37
rim	132	4				39	1.34
HP5							
surface	0	4	2	18	9.00	36	0.00
roof surface	0	5	5	50	10.00	50	0.00
roof	0	8	4	35	8.75	70	0.00
floor	159	6	3	30	10.00	60	0.00
subfloor	0	1	1	4	4.00	4	0.00
feature	0	12	10	95	9.50	114	0.00
rim	1909	75	63	604	9.59	719	1.06
HP6							
surface	80	6				68	0.47
roof	81	5				42	0.77
floor	84	4				18	1.92
rim	19	2				20	0.39
HP7							
surface	898	74	3	30	10.00	740	0.49
roof surface	402	38	35	191	5.46	207	0.78
roof	4044	208	96	914	9.52	1980	0.82
floor	5424	470	440	1739	3.95	1858	1.17
subfloor	30	7	1	4	4.00	28	0.43
hearth	3	1				7	0.18
feature	365	23				191	0.77
rim	5576	277	264	2379	9.01	2496	0.89
HP8							
surface	83	2				23	1.46
roof	432	10				84	2.05
floor	303	8				35	3.46
subfloor	6	2				42	0.06
hearth	2	1				7	0.12
feature	120	5				41	1.16
rim	49	4				39	0.50
HP9							
surface	11	7	7	80	11.43	80	0.06
roof surface	13	6	4	40	10.00	60	0.09
roof	52	9	9	66	7.33	66	0.32
floor	799	199	179	1109			
feature	7	3	3	30	10.00	30	0.09
rim	4	1	1	10	10.00	10	0.16

Table 3 *(continued)*: Lithic debitage density estimates by housepit and stratum. M = d/c. Estimated density = a/(2.5(d + M (b-c))). If no excavation units of a given stratum type in a given housepit have recorded thicknesses, the mean thickness for all excavation units of that stratum type with recorded thicknesses is used in place of M.

Housepit/ Stratum Type	Debitage Count (a)	Number of excavation units (b)	Number of excavation units with recorded thickness (c)	Total thickness of excavation units with recorded thickness (d)	Mean thickness of units with recorded thickness (M)	Estimated total volume (litres)	Estimated Density (flakes per litre)
HP12							
roof surface	132	25	25	156	6.24	156	0.34
roof	310	47	47	502	10.68	502	0.25
floor	672	106	106	430	4.06	430	0.63
HP47							
surface	16	2	2	13	6.50	13	0.49
roof	2	1	1	5	5.00	5	0.16
floor	78	6	6	55	9.17	55	0.57
rim	20	1	1	10	10.00	10	0.80
HP58							
surface	46	2	2	10	5.00	10	1.84
roof surface	35	2	2	20	10.00	20	0.70
roof	62	8	8	61	7.63	61	0.41
floor	6	1	1	5	5.00	5	0.48
subfloor	90	7	7	70	10.00	70	0.51
feature	33	3	3	55	18.33	55	0.24
rim	125	7	4	20	5.00	35	1.43
HP90							
roof surface	301	82	82	618	7.54	618	0.19
roof	518	74	73	672	9.21	681	0.30
floor	280	55	52	277	5.33	293	0.38
subfloor	16	3	3	20	6.67	20	0.32
hearth	14	5	5	43	8.60	43	0.13
feature	112	24	24	350	14.58	350	0.13
HP101							
surface	63	5	2	66	33.00	165	0.15
roof surface	35	7	7	47	6.71	47	0.30
roof	155	17	16	128	8.00	136	0.46
floor	943	18	14	142	10.14	183	2.07
feature	1254	7	5	105	21.00	147	3.41
rim	79	4	1	7	7.00	28	1.13
HP108							
surface	18	3	3	30	10.00	30	0.24
floor	86	2				9	3.93
hearth	24	2	1	10	10.00	20	0.48
rim	3	1				10	0.12
HP109							
surface	1	1	2	17	8.50	9	0.05
roof surface	0	1				7	0.00
roof	2	2	1	5	5.00	10	0.08
floor	3	1	3	45	15.00	15	0.08
subfloor	27	3				63	0.17
feature	26	4	1	5	5.00	20	0.52
HP110							
surface	112	2				23	1.97
roof	166	1				8	7.89
floor	1669	6				26	25.40
feature	563	4				33	6.79
HP111							
surface	29	2	1	4	4.00	8	1.45
roof	28	1	1	10	10.00	10	1.12
floor	15	2	2	18	9.00	18	0.33
feature	21	3	3	32	10.67	32	0.26
HP119							
surface	155	4	3	65	21.67	87	0.72
roof surface	52	1	1	35	35.00	35	0.59
roof	2	1				8	0.10
floor	3	1				4	0.27
feature	822	24	16	565	35.31	848	0.39
9	82	1				7	4.59
All surface units	2,360	175	31	353	11.39	1,993	0.47
All roof surface units	1,713	227	99	704	7.11	1,614	0.42
All roof units	7,853	540	209	1,758	8.41	4,542	0.69
All floor units	13,546	1,185	706	3,093	4.38	5,192	1.04
All subfloor units	208	31	39	814	20.87	647	0.13
All hearth units	43	9	1,092	7,160	6.56	59	0.29
All feature units	3,591	136	229	1,900	8.30	1,128	1.27
All rim units	8,832	470	520	5,107	9.82	4,616	0.77

unmodified flakes. Some of the modified artifacts manufactured in the pithouses will have been removed to other locations, and chert, chalcedony, and obsidian artifacts may have been more or less likely to have been removed than artifacts made from vitreous trachydacite, the most common raw material type. Debitage is more likely to have been left where it was generated, and it is less likely that debitage of a particular material type was selectively removed. So the exotic flake ratio for debitage is considered a better indicator of proportions in which different lithic raw materials were used at a pithouse than the same ratio for all lithic artifacts.

Hayden et al. (1996) have suggested that influential co-residential groups living in the largest of the Keatley Creek housepits may have controlled access to desirable lithic raw materials such as obsidian and high quality cherts and chalcedonies. If so, exotic flake ratios could be expected to be highest in the largest housepits. Unfortunately exotic flake data is only available for two of the eight housepits with diameters over 10 m: HP 3, with a diameter of 14.25 m, and HP 7, with a diameter of 18.75 m. Both have exotic flake ratios below the median value, contrary to the expectations of Hayden's argument. Overall, though the data do not indicate a clear relationship between exotic flake ratio and housepit diameter, or between exotic flake ratio and any of the other variables described in this section.

Exotic flakes may be associated with pit features in housepits. Where exotic flake data is available, 65.3% of the debitage recovered from pit features consists of chert or chalcedony flakes versus 20.9% of debitage in all lithic samples. A single pit feature in HP 101 contained 1,134 chalcedony flakes which heavily biased the exotic flake ratio for this entire house. However, housepits where a high proportion of the lithic samples were recovered from pit features do not always have high exotic flake ratios. In HP 110, for example, 30.1% of the lithic samples were taken from pit features, far more than in any other housepit, yet the exotic flake ratio for HP 110 is one of the lowest in the sample.

Small Flake Ratio

The small flake ratio for each housepit is defined as the total number of modified flakes with maximum dimensions greater than 1 cm and less than or equal to 2 cm divided by the total number of modified flakes with maximum dimensions greater than 1 cm. High proportions of small flakes may indicate the reduction of relatively small cores and thus, relatively intensive use of raw material. Alternatively, different activities and different stages of lithic reduction may have generated assemblages with different small flake ratios.

The possibility that high small flake ratios might also be the result of heavy trampling of debitage was also considered. However, trampling was expected to be greatest in large housepits, where there would have been greater freedom of movement, and no relationship was identified between small flake ratio and housepit diameter or between small flake ratio and any of the other variables described in this section.

Relative Frequencies of Modified Artifact Types

For the purposes of this analysis, the full range of artifact types described in Volume III, Chapter 1 has been condensed to the list of 20 types presented in Table 2. The condensed typology is intended to preserve the major functional distinctions developed in the full typology. Ideally, the relative frequencies of various modified artifact types in a housepit's lithic assemblage should provide some indication of the activities which occurred there, and lithic assemblages which contain the various modified artifact types in similar proportions should be considered more likely to be the products of similar activities than assemblages which include these types in markedly different proportions. Differences between housepits may be related to craft specialization, socioeconomic distinctions, and/or technological change over time.

Regrettably, differences between housepits may also be the product of several confounding factors. Modified artifact types may be represented in different proportions in different types of strata. So differences between housepits may be attributable to the proportions in which different strata types are represented. In addition, the proportions in which different artifact types are represented may vary considerably in different areas of a housepit. In HP 3, for example, modified artifact types occur in quite different proportions in the initial test excavation than they do in the remainder of the excavated area. The proportions in which the various artifact types are represented in the assemblages from individual housepits will also depend, to a large extent, on assemblage size and sampling biases. Assemblage diversity generally increases with assemblage size, so assemblages in which rare types are represented are likely to be large assemblages. Assemblage size ranged from 4 modified artifacts in HP 111 to 2,838 modified artifacts in HP 7. In order to minimize small sample effects, relative frequencies of modified artifact types are compared only between housepits which yielded 40 or more modified artifacts.

Efforts to classify the housepits into groups in which lithic assemblages include the various modified artifact types in similar proportions have so far proved frustrating. No clear pattern has been identified, especially none which relates the relative frequencies of modified artifact types to any of the other variables described in this section. Accordingly, the housepits have been classified on the basis of these other variables and the modified artifact assemblages from the groups defined by those variables have been compared. A more detailed discussion of the distribution of modified artifact types is presented below.

It may be possible, using more sophisticated statistical techniques, to classify these housepits according to the proportions in which different modified artifact types occur in their lithic assemblages. These methods should be considered with caution, however, given the confounding factors involved.

Length of Occupation History

Richards and Rousseau (1987) have proposed the Plateau Pithouse Tradition as a cultural sequence for the Canadian plateau. They divide this tradition into three horizons: the Shuswap Horizon, estimated to extend from between 4,000 and 3,500 BP to 2,400 BP, the Plateau Horizon, estimated to extend from 2,400 to 1,200 BP, and the Kamloops Horizon, estimated to extend from 1,200 BP to 200 BP, and describe projectile point types considered diagnostic of each horizon. Housepits in which lithic assemblages include projectile points diagnostic of all horizons of the Plateau Pithouse Tradition are assumed to have been occupied for longer than houses in which only one or two horizons are represented. Length of occupation ranks were assigned to the excavated housepits as follows:

1) housepits with no identified projectile points;
2) housepits with projectile points diagnostic of a single horizon;
3) housepits with projectile points diagnostic of two consecutive horizons;
4) housepits with projectile points diagnostic of two temporally separated horizons;
5) housepits with projectile points diagnostic of all three horizons;
6) housepits with projectile points diagnostic of all three horizons and "early" point types.

As was suggested above, lithic artifacts probably accumulated in the rim and roof deposits each time a housepit was rebuilt. So, longer duration represented in occupation ranks may be expected to be associated with high lithic densities.

Strength of Association with Kamloops Horizon

Housepits were ranked according to the strength with which their lithic assemblages appeared to be associated with the Kamloops Horizon on the basis of the types of projectile points present. Strength of association with Kamloops Horizon ranks were assigned to the excavated housepits as follows:

1) housepits with no identified projectile points;
2) housepits where only Plateau points are present;
3) housepits where more than 1/2 of the points present are Plateau points;
4) housepits where Plateau and Kamloops points are present in equal numbers or points from three horizons are present and each horizon is represented by less than 1/2 of the points;
5) housepits where more than 1/2 of the points present are Kamloops points;
6) housepits where only Kamloops points are present.

Distance from Densest Cluster of Housepits

Finally, housepits were ranked according to their distance from the core area of the site, along the banks of the creek bed, where housepits are most densely concentrated. Distance from densest cluster of housepits ranks were assigned to the excavated housepits as follows:

1) housepits located in the densest cluster of housepits;
2) housepits located at the edges of the densest cluster of housepits;
3) housepits located removed from the densest cluster but still in the main part of the site;
4) housepits located on terraces above the main part of the site.

Diameter

Housepit diameter was measured from rim crest to rim crest. Figure 14 (Vol. I, Chap. 1) shows a histogram of the diameters of the housepits at the Keatley Creek site. The distribution has two distinct peaks which suggest that the housepits may be classified as either large or small. The boundary between the two size categories seems to be between 12 and 14 m. A small group of very large housepits (diameter > 17 m) can also be distinguished.

Classification of Housepits

Large and very large housepits located in or adjacent to the densest concentration of housepits make up almost half of the excavated housepits. The data summarized in Table 1 suggest that these housepits consistently have long occupation histories and relatively high lithic densities, both on the floor and in the housepit as a whole. Among the smaller housepits, short occupations appear to be associated with relatively low lithic densities. Lithic densities vary widely in small housepits with longer occupations. On the basis of this data the housepits were sorted into five categories:

1) large and very large housepits with long occupation histories, fairly strong Kamloops associations, and located in or adjacent to the densest concentration of housepits;
2) small housepits with short occupation histories;
3) small housepits with longer occupation histories and low lithic densities; and
4) small housepits with longer occupation histories and high lithic densities.

Large and Very Large Housepits with Long Occupation Histories, Fairly Strong Kamloops Associations, and Located in or Adjacent to the Densest Concentration of Housepits

All of the excavated housepits with diameters greater than ten meters (HP's 1, 2, 3, 4, 5, 6, 7, and 8) have occupation histories spanning at least two Plateau Pithouse horizons. All except HP's 6 and 8 have occupation histories spanning all three Plateau Pithouse Horizons. Housepits 3, 5, and 7 also have evidence of earlier occupations. Strength of association with the Kamloops horizon is greater than three in all of these housepits, so Kamloops Horizon occupations were probably at least as important as earlier occupations in the formation of their analysed lithic assemblages.

Generally, lithic densities and floor densities in these housepits are equal to or greater than the median values for all houses. Exceptions are HP 1, with a relatively high floor density but an overall lithic density of 0.62, just below the median value of 0.63, and HP 3 with a relatively high overall lithic density but a floor density of 0.74, which is the median value. Interestingly, HP 1 has evidence of Kamloops Horizon and Shuswap Horizon occupations, but no Plateau Horizon points. Possibly, a long period of abandonment resulted in a lower lithic density in this housepit. More probably, though, the absence of Plateau points in the assemblage from this housepit is the result of insufficient sampling.

The high floor densities in these housepits may indicate either that individual occupations lasted longer in these housepits than in many of the smaller housepits, or that large housepits were used more often than small housepits for activities involving stone tools, or both. These factors may also have contributed to the high lithic densities in the housepits as a whole (roof and rim deposits included), though the long occupation histories of these housepits is probably largely responsible for these high overall lithic densities.

Among the large and very large housepits, exotic flake data is available only for HP's 3 and 7, both of which have relatively low exotic flake ratios. These data do not support the argument that groups residing in the larger housepits controlled access to all sources of exotic materials. Small flake data is available for HP's 1, 3, 4, 5, and 7. Four of these housepits (HP's 1, 3, 4, and 7) have small flake ratios less than or equal to median value of 0.75 but HP 5 has the second highest small flake ratio of any excavated housepit at 0.86. This suggests that higher small flake ratios are not the product of increased trampling associated with greater freedom of movement in large housepits. Instead, variability in small flake ratios may be related to variability in the kind or intensity of lithic reduction activities.

Small Housepits with Short Occupation Histories

This group includes the two housepits on the north terrace (HP's 111 and 109), two housepits from the south terrace (HP's 107 and 108), one housepit located adjacent to the densest concentration of housepits (HP 119), and one from the dense concentration of housepits at the edge of the stream bank (HP 47). Only Plateau Horizon projectile points were found in HP 47 and HP 107. Only Kamloops Horizon points were found in HP 119. The other three housepits in this group contained no points except for a fragment in HP 109. Overall lithic densities are relatively low in all of these housepits. Even in HP 108, where floor density is quite high at 3.93 lithic artifacts per litre, the lithic density value of 0.70 lithic artifacts per litre is only slightly above the median value of 0.70.

(No lithic density data is available for HP 107 and it is included in this category only on the basis of its size and its apparently short occupation history.)

Low overall lithic densities are expected in housepits with short occupation histories, since it is argued that lithic artifacts accumulated over time in most strata. The high floor density in HP 108 may indicate that some unusual activity occurred there or may simply be a product of sampling bias.

Small flake ratios and exotic flake ratios vary widely within this group which again suggests that these variables are not dependent on housepit size.

Small Housepits with Longer Occupation Histories and Low Lithic Densities

This group includes HP 9, which has evidence of Shuswap, Plateau, and Kamloops occupations, HP's 12 and 58, which have evidence of Plateau and Kamloops occupations, and HP 90, which has evidence of Plateau and Shuswap occupations although the Shuswap occupation may not have been part of the housepit. Housepit 58 is in the part of the site where housepits are most densely concentrated and HP's 12 and 90 are located on the northern periphery of the main part of the site. Housepit 9 is on the southern terrace, well removed from the central area. Overall lithic densities and floor densities are relatively low in these housepits. Small flake ratios are generally near the median value, though HP 58 scores low on this variable. Exotic flake ratios are close to the median value in all of the housepits in this group except HP 12, which has a very low exotic flake ratio.

Small Housepits with Longer Occupation Histories and High Lithic Densities

This group includes HP 101, in the central area of the site, and HP 110, on the southern terrace, both of which have evidence of both Plateau and Kamloops occupations. Lithic density and floor density are high in both housepits, but in HP 110 the values are far higher than in any other excavated housepit, with a lithic density of 7.92 artifacts per litre (compared to the median value of 0.70 artifacts per litre) and a floor density of 25.40 lithic artifacts per litre (compared to the median value of 0.77 lithic artifacts per litre). Housepit 110 scores low on both the small flake ratio and the exotic flake ratio, while HP 101 has the highest exotic flake ratio of any excavated housepit (0.74) and a small flake ratio equal to the median. (The exotic flake ratio in HP 101 is inflated somewhat by the inclusion, in the analysis, of a pit feature containing 1,134 chalcedony flakes. However, even when the contents of this feature are excluded from the analysis, HP 101 has an exotic flake ratio of 0.59, significantly greater than in any other housepit.)

Relationships Between Variables

Overall lithic density and floor density appear to be dependent, to some extent, on housepit diameter and duration of occupation. Relationships between these variables are discussed below. No other striking relationships between the recorded variables were noted. There is no indication, for example, that the exotic flake ratio is dependent on either the size of a housepit or the strength of its association with the Kamloops Horizon (or any other horizon of the Plateau Pithouse Tradition). Nor does housepit size appear to be related to the small flake ratio.

Diameter, Duration of Occupation, Lithic Density, and Floor Density

The large housepits tested consistently have long occupation histories, and relatively high lithic densities. In small housepits with short occupation histories, overall lithic densities are uniformly low, even in housepits whose floor densities are relatively high (HP 108 and HP 109). Presumably, lithic artifacts had a tendency to accumulate in the housepits over time. However, in some of the smaller housepits (HP's 9, 12, 58, and 90), relatively long occupation histories also appear to be associated with low lithic densities, so length of occupation history is not the only factor determining lithic density. In small housepits with longer occupation histories, low overall lithic densities are associated with low floor densities, which suggests that the intensity of manufacture and use of lithic artifacts varied considerably from house to house, and was important in determining overall lithic density. Apparently, most large houses, but only some small houses were used intensively for activities involving stone tools. This observation suggests a possible refinement of the initial scheme for the classification of housepits; small housepits with short occupation histories and high floor densities (HP's 108 and 109) are distinguished from small housepits with short occupation histories and low floor densities (HP's 47, 119, and 111). Since no lithic density data was recorded for HP 107 it cannot be classified at this level.

Relative Frequencies of Modified Artifact Types in the Housepit Categories

As noted above, no meaningful classification of the housepits based solely on the relative frequencies of modified artifact types in the housepit assemblages has been identified in this study. Examination of the data in Table 2 will show that there is not necessarily more similarity, in terms of the relative frequencies of modified artifact types, between housepits within the categories defined above than between housepits in different categories. Some of this variability within housepit categories may reflect differences in the activities which occurred in different housepits within each housepit class, but most of the inter-housepit variability in the relative frequencies of modified artifact types can be attributed to sampling factors. Since probabilistic sampling methods were not employed in the selection of excavation units in tested housepits, only the modified artifacts which were collected from extensively excavated housepits (HP's 3, 7, 9, 12, and 90) can confidently be considered to be representative samples.

Two of these housepits (HP's 3 and 7) were classified as very large housepits with long occupation histories and fairly strong Kamloops associations located in or adjacent to the densest concentration of housepits. The remaining three (HP's 9, 12, and 90) were classified as small housepits with long occupation histories and low lithic densities. Comparisons of the relative frequencies of modified artifact types between these housepits may, therefore, suggest hypotheses regarding different types of activities which may have typically occurred in these two housepit classes. Since the sample of housepits in each class is extremely small, such hypotheses are necessarily preliminary, and are only intended to suggest questions for future analyses.

The relative frequencies of modified artifact types in HP's 3, 7, 9, 12, and 90 are shown in Table 2 and are represented graphically in Figure 1. Generally, the similarities between these housepits are more striking than the differences, suggesting a broadly similar range of activities in both housepit classes. The most notable difference between the two classes is in the relative frequencies of the most common modified artifact types: utilized flakes, expedient knives and scrapers. In the large housepits (HP's 3 and 7) the proportional differences between these types are relatively small; in the small housepits (HP's 9, 12, and 90) they vary more widely. Expedient knives represent very high proportions of the modified artifacts in HP's 9 and 90, while utilized flakes are, proportionately, extremely abundant in HP 12. Possibly this difference reflects a broader range of activities in the large houses and a greater emphasis on a few activities in the small houses. However, assemblage size may also be a factor, since small differences in actual frequencies will result in larger differences in relative frequencies in smaller assemblages. Scrapers are proportionately more abundant in larger houses. Since this modified artifact type is believed to have been used in the working of relatively hard materials, this suggests that activities such as hide-working, bone working and woodworking may have been more common in larger houses. No other modified artifact type is consistently significantly more abundant in one housepit class than the other, though HP 3 is distinguished by an abundance of projectile points and HP 9 by an unusually high proportion of ornaments.

In Table 4 and Figure 2 modified artifact assemblages from each of the four housepit classes are compared. Except in the housepits which were extensively excavated (HP's 3, 7, 9, 12, and 90), these data are derived from test excavations and must, therefore, be considered with caution. Housepits which yielded fewer than 40 modified artifacts (HP's 47, 107, 108, 109, and 111) have been excluded from this analysis. Small housepits with short occupation histories are, therefore, represented only by HP 119. Housepits 101 and 110, which comprise the class of "small housepits with longer occupation histories and high lithic densities," are both included. Since the modified artifacts collected from the test excavations cannot confidently be considered representative of the individual housepits and since the sample of housepits in each housepit class is extremely small, hypotheses based on the comparison of relative frequencies between housepit classes are extremely tenuous, but may suggest questions for future analyses.

The comparison of the relative frequencies of modified artifact types between housepit classes, like that between extensively excavated housepits, gives a general impression of similarity rather than difference. The greatest variability is in the relative frequencies of two of the most abundant artifact types: utilized flakes and scrapers. Utilized flakes are, proportionately, most abundant in small housepits with short occupation histories (i.e., HP 119) and in small housepits with longer occupation histories and high lithic densities. They are very rare in small housepits with longer occupation histories and low lithic densities and comparatively rare in large housepits. Scrapers are, proportionately, most abundant in large housepits and scarcest in small housepits with short occupation histories (i.e., HP 119).

Housepit 119 has an extremely low floor density value, an overall density value below the median, and a duration of occupation rank of. This suggests that it may have had only a single, comparatively short occupation. The high proportion of utilized flakes among the modified artifacts collected from this housepit may also indicate a single short occupation. Over time, an increasing proportion of utilized flakes are likely to be re-used as expedient knives and other modified artifact types. The proportional scarcity of scrapers in this housepit may indicate that activities such as hide-working, woodworking, and bone-working were relatively unimportant there.

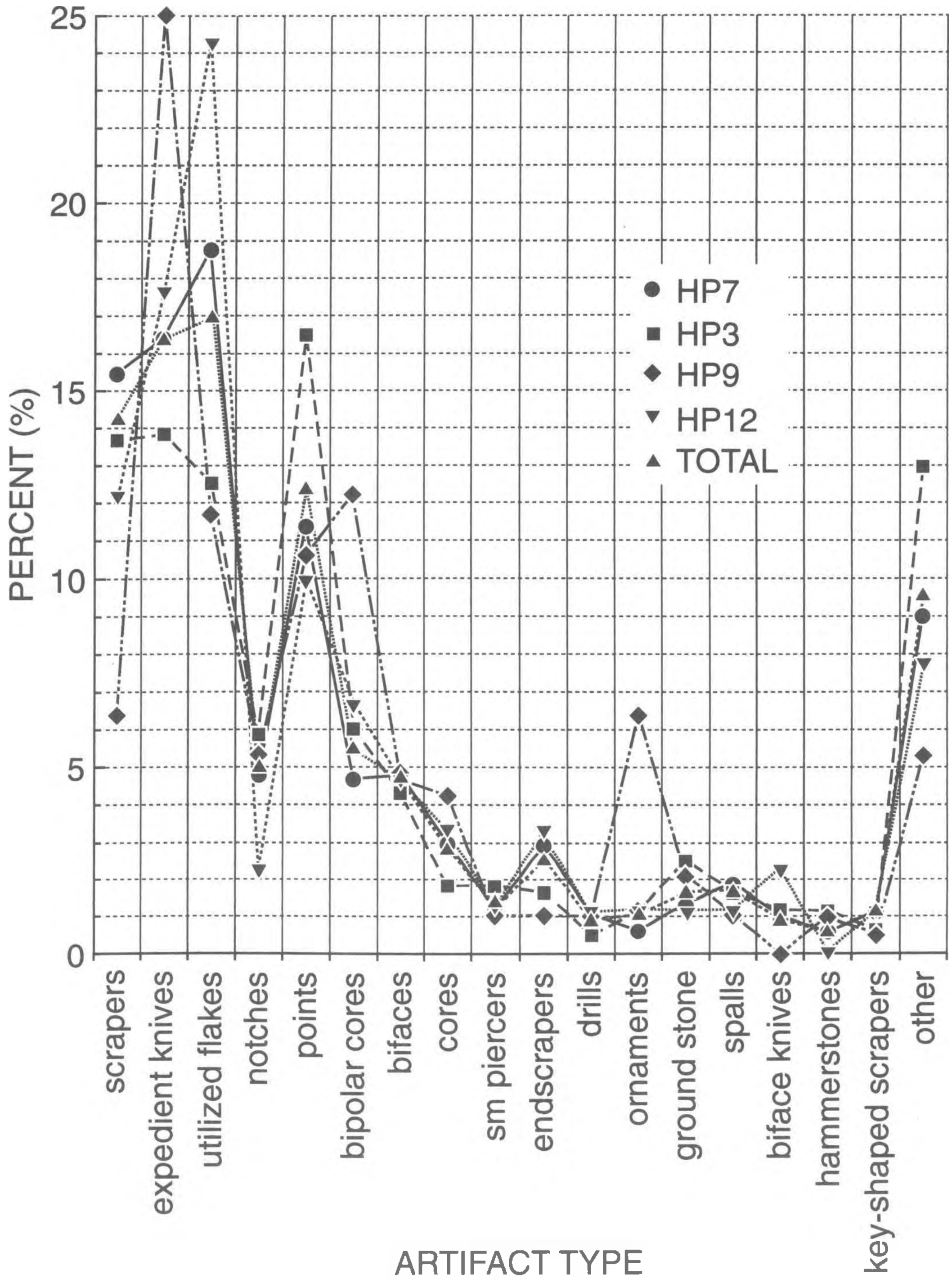

Figure 1: Proportional frequencies of major artifact types from four completely excavated housepits including small (HP's 9 & 12), medium (HP 3), and large (HP 7) structures.

Table 4. Frequency and percentage of modified artifact types by housepit class. Extensively excavated housepits are included for comparative purposes.

Modified Artifact Type	Large HPs (HPs 1,2,5& 8)	Small HPs with short occupation histories (HP 119)	Small HPs with long occupation histories and low lithic densities (HPs 12, 9, & 90)	Small HPs with long occupation histories and high lithic densities (HPs 101 & 110)	Extensively excavated HPs (HPs 3, 7, 12, 9, & 90)
scrapers	464 *12.67%*	4 *4.00%*	35 *8.64%*	25 *10.16%*	393 *14.09%*
expedient knives	700 *19.11%*	26 *26.00%*	101 *24.94%*	46 *18.70%*	477 *17.10%*
utilized flakes	732 *19.98%*	22 *22.00%*	64 *15.80%*	68 *27.64%*	474 *16.99%*
notches	220 *6.01%*	12 *12.00%*	21 *5.19%*	23 *9.35%*	141 *5.05%*
points	365 *9.96%*	7 *7.00%*	34 *8.40%*	14 *5.69%*	336 *12.04%*
bipolar cores	208 *5.68%*	0 *0.00%*	37 *9.14%*	12 *4.88%*	156 *5.59%*
bifaces	153 *4.18%*	5 *5.00%*	19 *4.69%*	6 *2.44%*	130 *4.66%*
cores	85 *2.32%*	0 *0.00%*	16 *3.95%*	3 *1.22%*	81 *2.90%*
sm. piercers	66 *1.80%*	1 *1.00%*	5 *1.23%*	2 *0.81%*	39 *1.40%*
endscrapers	75 *2.05%*	2 *2.00%*	8 *1.98%*	4 *1.63%*	71 *2.54%*
drills	30 *0.82%*	2 *2.00%*	5 *1.23%*	8 *3.25%*	25 *0.90%*
ornaments	28 *0.76%*	1 *1.00%*	15 *3.70%*	3 *1.22%*	33 *1.18%*
ground stone	46 *1.26%*	0 *0.00%*	6 *1.48%*	1 *0.41%*	45 *1.61%*
spalls	46 *1.26%*	1 *1.00%*	4 *0.99%*	1 *0.41%*	47 *1.68%*
bifacial knives	42 *1.15%*	3 *3.00%*	3 *0.74%*	6 *2.44%*	28 *1.00%*
hammer stones	23 *0.63%*	0 *0.00%*	5 *1.23%*	2 *0.81%*	23 *0.82%*
key-shaped scrapers	27 *0.74%*	0 *0.00%*	2 *0.49%*	0 *0.00%*	26 *0.93%*

On the other hand, the proportional abundance of utilized flakes in small housepits with longer occupation histories and high lithic densities (HP's 101 and 110), clearly does not reflect either short occupation histories or short duration of individual occupations. Both of these housepits have duration of occupation ranks of 3 and high floor densities. Also, scrapers, while proportionately scarce in comparison to utilized flakes in these housepits, are abundant in actual terms. More scrapers were collected per unit of excavated volume in these two housepits than in any other housepit class. So activities which involved working hard materials were probably as important in HP's 101 and 110 as they were in even the largest pithouses. One possible explanation of the proportionate abundance of utilized flakes among the modified artifacts collected from these two housepits may be that large numbers of utilized flakes were deposited over a relatively short period of time near the end of the last occupations of these houses. The great majority of the utilized flakes collected from HP's 101 and 110 were found in the floor strata.

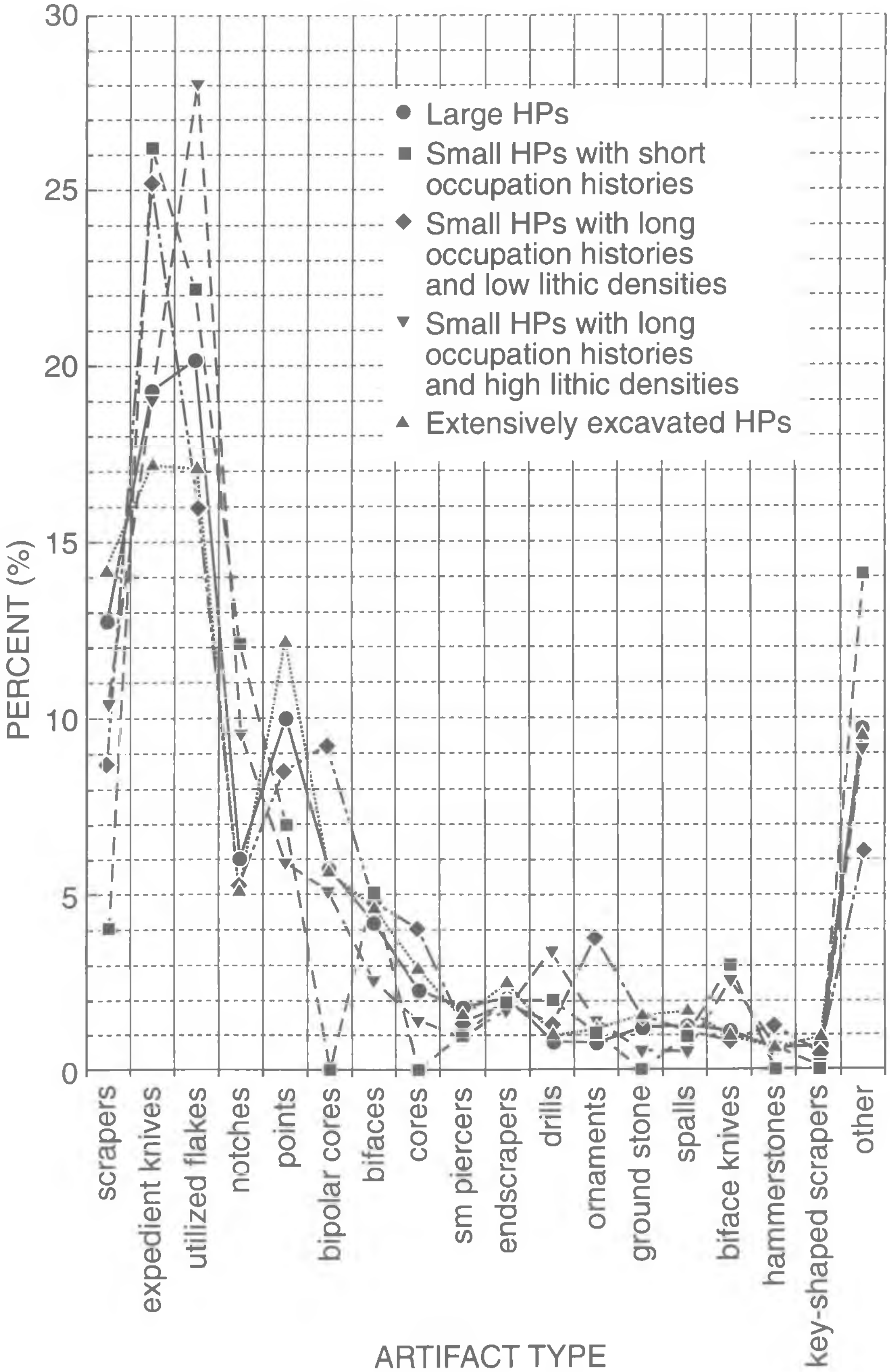

Figure 2: Proportional frequencies of major artifact types from housepit test trenches, grouped by structure size and occupation characteristics.

Summary and Conclusions

Large and very large housepits with long occupation histories and fairly strong Kamloops associations, located in or adjacent to the densest concentration of housepits, exhibit broad similarities to one another in terms of several characteristics of their lithic assemblages including: overall lithic density, lithic density in floor strata, and the proportions in which some types of modified artifacts (e.g., utilized flakes and scrapers) are represented. Generally, these data are consistent with a model of comparatively high levels of activities involving the use of stone tools, in these houses, with particular emphasis on activities involving the working of hard, durable materials such as hides, bone, and wood. The lithic assemblages collected from smaller houses are more diverse in terms of the characteristics examined in this analysis and no clear relationship was identified between any characteristic of the lithic assemblages and any of the other variables considered. This suggests greater diversity among smaller housepits in terms of the kinds of activities that occurred there, but offers little in the way of explanation for that diversity. Such explanations must await analyses, involving more extensive excavations in a larger sample of small housepits.

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Chapter 15

Structural Strategies for Pithouses on the Keatley Creek Site

Richard MacDonald

Introduction

Of the multitude of housepits located at the Keatley Creek Site, a number have been subject to extensive examination. These include two housepits in the very small size range (HP 9 and HP 90), one in the small range (HP 12), a medium sized housepit (HP 3) and a large sized housepit (HP 7). These "study housepits" have been excavated so as to determine floor depths, wall slopes, rim heights and posthole locations as well as to investigate many non-structural concerns. With the information that was discovered, it appeared possible to start to piece together potential structural strategies employed by the builders of these ancient structures. The purpose of this article is to propose reasonable types of roof and support architecture that would have covered the pithouses at Keatley Creek based on architectural principles, ethnographic observations, and archaeological evidence. Reconstructing the basic structural designs of housepits of varying size was viewed as an important element in interpreting activity patterns within houses. Entrance locations, posts, and headroom considerations were particular factors that might affect the patterning of activities within the houses. As will become evident, there appear to have been a surprisingly diverse set of pithouse structures at Keatley Creek.

To begin to develop these proposed strategies, historical documentation was consulted to examine methods of pithouse construction described elsewhere in the British Columbia Interior. Most of this documentation was relatively limited in terms of the descriptions of physical structures. An example in the Thompson area though, has been elaborately described including drawings and photographs (Teit 1900:192–194), and has become the model generally used for depicting the typical pithouse. This typical model, however, does not respond to regional variations in climate, topography, materials, or to the local variations in household size, wealth, or permanency. In addition to these constraints, issues of convention should be considered. Techniques in response to physical concerns could become ethnic identifiers defining a particular group of people. The various uses of specific structures such as ritual houses would likely have physical manifestations as well. Social classes of dwellings may be indicated by size. Work or storage structures may be less carefully constructed. Some pithouses may be designed for occasional or temporary use as with women's seclusion houses.

Teit himself alludes to variations from the "typical" pithouse in his observations of the Interior Salish pithouse construction:

> In winter it was pitched over a few inches to a foot and a half in depth, and the excavated earth banked up around the base. Dry grass, dry pine needles, or pieces of bark were placed around the bottom of the mats to prevent decay. Double and treble layers of mats were used in wintertime. These lodges vary in diameter from about 5 to upward of 10 meters. It seems that the foundation was always made of three poles. (Teit 1904:58)

While the typical soil cover has been used on this structure, it is limited to the base only with mats acting as the main roofing component. Teit describes another variation of roofing in the Lillooet area where "mats were sometimes used . . . although old skins were perhaps more common" (Teit 1906:776).

A number of pithouse sizes and shapes have been documented from conical to flat and from round to square. In the Thompson area Teit also describes a smaller lodge:

> In building circular lodges, . . . a dozen or more long poles were placed some distance apart, with their butts upon the ground, outside the cleared space, forming a complete circle from 15 to 20 feet in diameter. The poles were placed with their small ends toward the center of the space, where they met and supported one another without being fastened together. (Teit 1900:196)

At a site near Squamish, Barnett records a deep, square, flat-roofed pithouse:

> A supporting post reaching to ground height was placed in the center of the excavation and two timbers traversing the excavation rested on top of this post at right angles. Planks were then radiated from this central point to the periphery of the excavation. Poles, mats, and finally earth were placed on top. The entrance hole was either at the center of the ceiling or at one corner, and the descent was made by means of a notched log ladder. The dimensions of the pit were fifteen feet by fifteen feet, by ten feet deep. (Barnett 1955:55)

At a site on Toba Creek (about 70 km northeast of Powell River), Barnett describes another flat-roofed and rectangular structure with a main entrance and escape tunnel:

> Describing the situation as it existed in the days of his great-great-grandfather, a Klahuse informant asserted in 1936 that the winter houses of his people at the head of Toba Inlet were all underground. The Village was about ten miles up the Toba River, and the informant claimed to have seen the remains of the pits. Originally, they were about ten feet deep, and rectangular, with a pole lying on the midline across the excavation. Two or three posts supported this member, which in turn supported cross pieces reaching it from two sides of the pit. Poles, brush, and bark were added for the roof and the whole was covered with earth. There was no top entrance; a gangway sloped down to the main level for entry, and for flight in case of attack a tunnel led out the back way. (Barnett 1944:266)

An example by Teit (1906:236) of Lillooet winter village pithouses that "were sometimes equipped with underground escape tunnels leading from the pit houses to the bank of a stream or nearby gulch," begins to suggest alternate entries. He further documents a case where the side entrance replaces the typical top access.

> It seems that they [Columbia Salish pithouses] were constructed in the same way as among the Thompson, only a majority had the entrance on one side . . . Ascent and descent were by a short ladder or notched log. A few had entrance only through the smoke-hole, and a long ladder like the common kind among the Thompson. (Teit 1908:114)

Another area of potential variation is in the use of support posts. Some structures appear to have made little or no use of interior supports. Others seemed to employ many, either angled or vertical in orientation. Other than in the rim locations, there was no evidence of angled posts on any of the study housepits at Keatley Creek. Some structures seemed to be without posts. Hayden and Spafford (1993:119) address this issue in their study of the small housepits:

> . . . all such structures excavated to date appear to be characterized by a scarcity or absolute lack of interior structural postholes. This seems to indicate that any interior posts were simply set on the surface of the floor (which seems unlikely given the risk of knocking such posts out of position), or that all structural posts were set on the rim of the pithouses. . . . This is a considerably different type of architecture than Teit (1900) illustrates as being the typical pithouse.

An informant for Duff (1952:47) describing the Stalo Indian pithouses in the Fraser Valley "denied the existence of any posts in the floor other than the ladder . . . [but instead used a system] in which four rafter-struts holding up the main rafters were against the wall of the pit." An example of a pithouse with a single central support post has been included in a publication of archaeology in Washington State (Kirk and Daugherty 1978:69) and seems to have been employed at the Bear River Site in Utah (Shields and Dalley 1968:62). The potential for variation in structure due to its size for pithouses in the Chilcotin Plateau has been described by an informant:

> There were either four or six center-posts, fourteen to sixteen feet tall, which formed the corners of a square or hexagonal opening three to five feet in diameter. The rafters, poles peeled to prevent rotting, radiated from plates on top of the center-posts. If the house was small, or had six center-posts, the rafters rested over the posts. . . . If the house were large, with four center-posts, as many rafters as were needed were used and they did not necessarily rest over the center-posts. (Lane 1953:157)

Roof slopes were another source of variation. It would seem likely that in desert conditions rain penetration or excessive snow loads would not have been a problem and the roof slopes could have been more shallow. Cultural preferences and the use of the roof top for entry may also have played a part in determining roof angles. Kennedy and Bouchard (1978:36) cite an account of a pithouse roof slope that varies from that described by Teit (1900:192–194):

> Present-day Fraser River Lillooet informants' statements concerning construction of the superstructure appear to be in agreement with the Thompson pit house construction so thoroughly described and illustrated by Teit (1900:192–194, Figs. 135, 136). However, it is believed that the pitch of the roof was not as severe as illustrated by Teit and that the distance between the floor and the entranceway of the Lillooet pit house was approximately 2.5 m.

Given these various accounts, it seems reasonable to suggest that many different styles of pithouses were employed, and that these varieties could even occur within the same settlement. Each variant would be subject of course to certain physical limits inherent in its structural type. By analyzing a small number of basic structural options and their roof slope possibilities, the appropriateness of certain schemes for the different study housepits can be determined. Using the study housepit floor plans with the locations of existing postholes established, these structural options can be "overlaid" and evaluated for their suitability. At this point, possible structural schemes can be further detailed and critiqued on their performance as residential structures.

Structural Strategies

While there may be numerous possibilities for constructing frameworks over the study housepit excavations, it seems reasonable to focus on four basic physically and perhaps culturally viable structural strategies. These selected schemes relate to documented accounts of pithouse construction around British Columbia and in areas immediately to the south. Through a brief analysis of these different schemes without the burden of contextual issues, the rationale of individual structural moves may become clearer.

Type A: Post, Girder, and Beam (Fig. 1)

This structural strategy appears to be somewhat similar to the well documented Thompson pithouse (Teit 1900:192–194). The main girders rest on vertical posts and continue inwards with a cantilever to form a central opening. Stabilizing lateral beams rest on each girder near the post location. Their purpose is twofold. They act to brace the girders in position and to cut down the long purlin spans between the girders. Variations

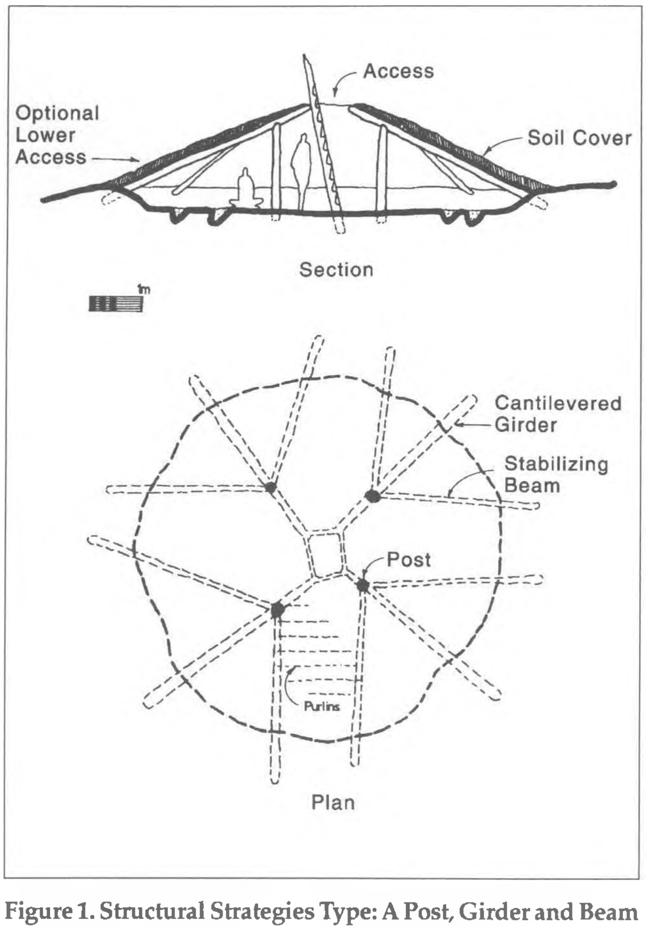


Figure 1. Structural Strategies Type: A Post, Girder and Beam

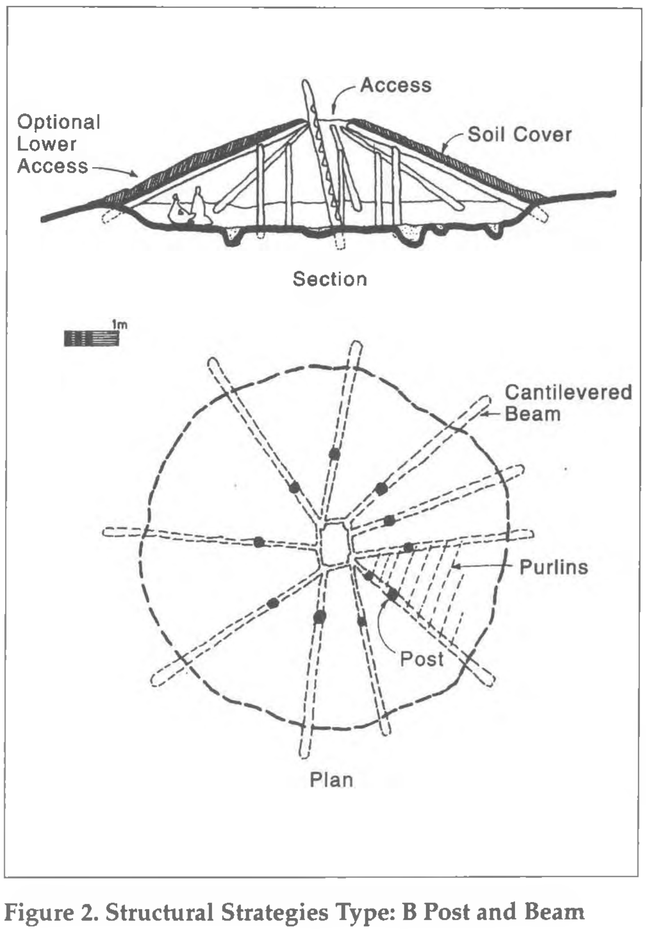


Figure 2. Structural Strategies Type: B Post and Beam

on this theme may include additional post-girder-beam elements from four to six or more. Alternatively, a three post-girder-beam configuration could also be possible.

By increasing the depth of the excavation to provide sufficient headroom, there would be no minimum size for a structure of this type. The maximum size would only be limited to the length and diameter of local trees and a sufficient number of workers for the erection of the superstructure. On a very large scale, the introduction of a second set of posts between the rim and the first set may be required to support the extra weight carried by the girders. The stabilizing beams may also require intermediate posts on very large structures.

In his description of the Chilcotin Indian pithouses, Lane refers to some of the components of what appears to be a Type A structure:

> The rafters were lashed to the central frame with spruce roots. The rafter butts rested on a step inside the edge of the pit. The pitch of the roof was steep, between thirty and forty degrees. Rafter sheathing was laid rafter to rafter. (Lane 1953:158)

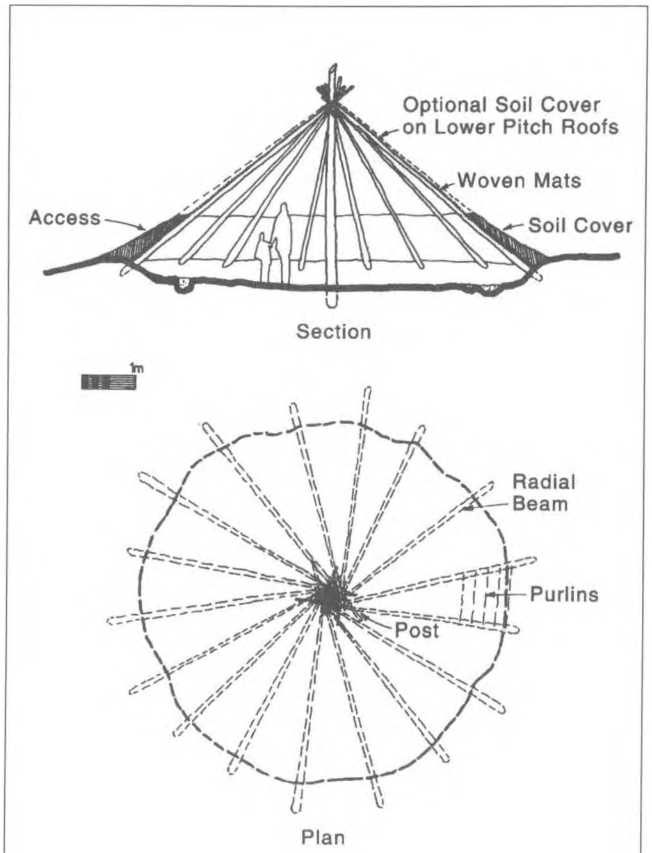


Figure 3. Structural Strategies Type: C Radial Beams and Post

Type B: Post and Beam (Fig. 2)

Similar to the Type A structure but without the stabilizing beams, this next system employs lighter supported members (cantilevered beams) in place of the heavy girders. The elimination of heavier girders demands a closer beam spacing to avoid overloading and to keep the purlin spans to a minimum. There are several possible benefits to using a system of this nature. The lighter members would be easier to handle and small segments could be repaired without having to remove large sections. Aside from the clutter of posts near the center of the floor, the major drawback to this system is one of stability. The posts would need to be buried deeply and all the beam connections would have to be extremely rigid to maintain structural integrity.

With an additional set of support posts nearer the rim, there would likely be no maximum size limits (other than material sizes) for a Type B pithouse. The smaller size structures, however, would suffer from the dense cluster of posts in an area where the headroom is the most usable.

Type C: Radial Beams and Post (Fig. 3)

While there appears to be minimal concrete documentation for a structure of this type, an illustration of a housepit using one center post does appear in one publication (Kirk and Daugherty 1978:69) and is titled a "Columbia Plateau Pithouse." At the Bear River No. 3 site (Sheilds and Dalley 1968:63), another probable example of this type of structure exists, although with two central posts rather than one. The roof slope employed on this example (Structure 5) appears to be about 45 degrees over a floor size of about 3 m in diameter.

In the Type C system, a large number of moderately slender beams radiate about a large central post. The top ends of these beams are lashed to each other and to the post itself to form a rigid assembly. The lighter the beams, the greater number that would be required to carry the load. This increase in beam numbers would act to reduce the span and therefore the size of the purlins. Without the central post the structure would still be viable (as shown in Type D, Fig. 4), but only by incorporating a steeper pitch. With the addition of the post however, the roof pitch could be reduced to that of housepit Type A.

While this Type C system affords a reasonably clear floor space, it suggests the requirement for a side entrance only due to the steepness of the roof. The maximum size limit imposed by this method would depend on the roof slope and the type of cover (soil or mats), but would likely be limited to small or perhaps medium sized structures due to the tremendous weight that would be bearing on the top lashing connections at the larger size. Unlike housepit Types A and B, a post does not rest below each beam and if the lashing were to decay and fail, the entire structure could collapse. This system would therefore be most successful when employed on the smaller structures with the least weight on the top lashed beam connections.

Type D: Radial Beams (Fig. 4)

While similar to the Type C housepit described above, this structure has no central post but relies on the rigid top lashed connections for its stability. The light radial beams are located closely together on the rim and overlap at the top to form a conical shape. This connection is lashed together to make the entire structure rigid. Without any posts the roof slope would have to be reasonably steep so that the weight of the structure would be efficiently transferred down to the base of each beam. This type of system would likely be satisfactory only for the smallest pithouses due to the difficulty of erecting large timbers at a steep pitch and lashing them all together. The floor diameters for this type of structure in the Thompson Area has been documented as ranging from about 3–6 m (Teit 1900:196). Although there would be no minimum size for a structure of this type, it would appear that an upper size limit would be reached with a floor diameter of about 9 m.

Slope Comparisons

Each of the above pithouse types have inherent limitations in their roof slopes. These limitations affect the maximum and minimum slopes of each structure type and involve issues such as access, water penetration, headroom and loading. To isolate these issues effectively the slope studies are examined independently of any contextual constraints (such as the sloping nature of the site) so their effects might be more clearly understood.

Types A and B (Fig. 5)

Both the Type A and Type B pithouses are grouped together for this analysis because they share very similar concerns with regard to roof slopes. The roofing strategies would likely have been limited to sod roofs similar to those described in the Shuswap area (Boas 1891:81–82). These sod roofs consisted of soil over bark and grass or pine needles, placed on tightly spaced lathing.

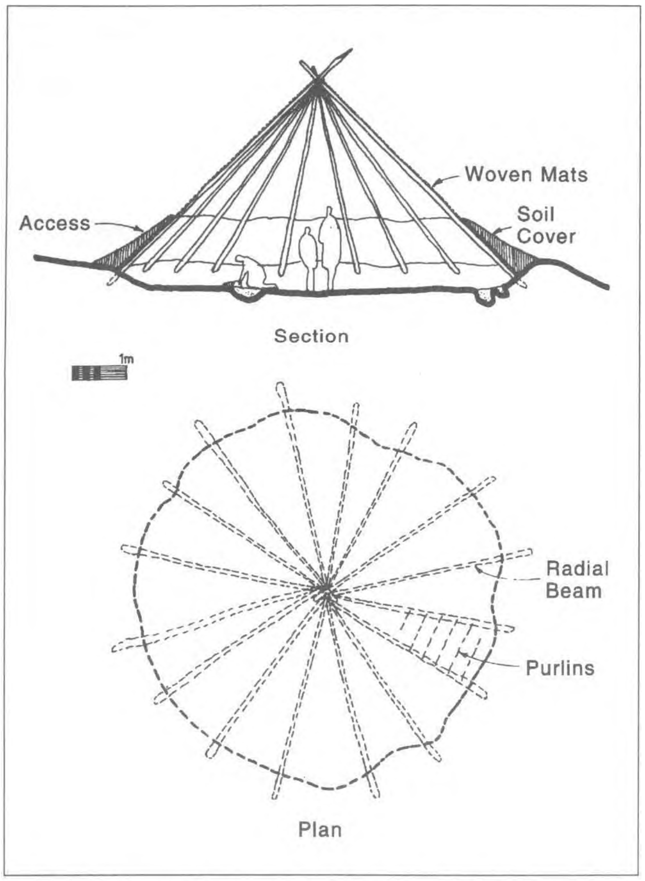


Figure 4. Structural Strategies Type: D Radial Beams

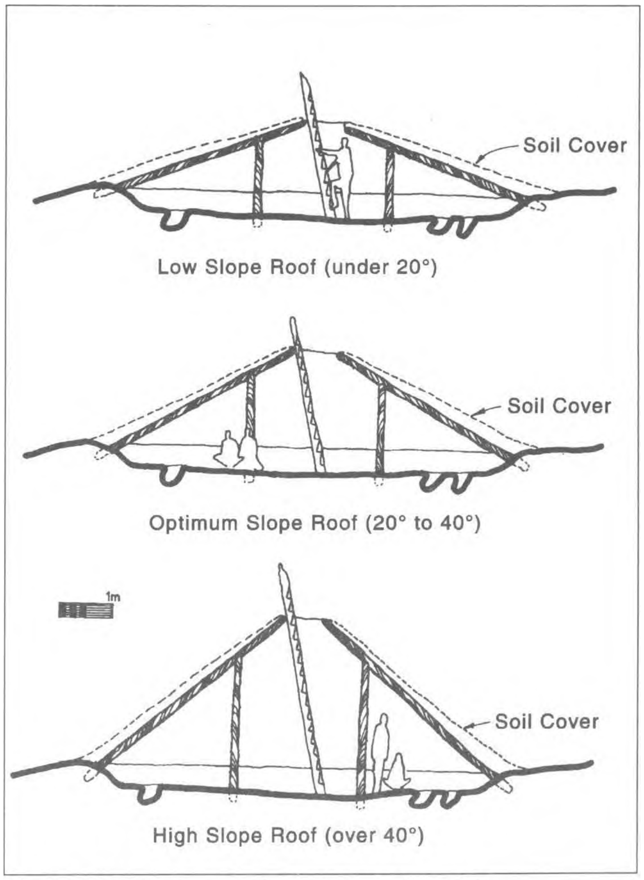


Figure 5. Slope Comparisons Types A and B

Low Slope Roofs: While there are benefits to having a roof slope under 20 degrees (such as easy access, lower volume to heat and shorter length of structural components and ladder), there are important drawbacks. The base of the girders or beams would have insufficient underpinning to support much of a cantilever at the top end and would require extra ballast (rocks or soil) to be placed over the girders at the base. Water would likely penetrate the roofing at a slope of less than 20 degrees, which would cause damage to the structure and make living conditions uncomfortable during times of heavy rainfall. At lower slopes, the girders and beams begin to approach the horizontal and their loads act predominately in a vertical direction. Additional snow loads, which would build up on the leeward side, could add to these loads causing severe deflections of the beams and purlins. Another concern would be headroom, especially on the smaller pithouses. During the course of a long winter it would seem necessary to have some room to carry out activities in a standing position.

Optimum Slope Roofs: A roof slope between 20 and 40 degrees begins to address the drawbacks of the low slope roof without compromising the benefits. Access is reasonable and the structure volume is not excessive. The structural components and ladder are marginally longer but manageable. The angle of the girders and beams at the base provides satisfactory underpinning. Water would tend to run off before it could penetrate even the outermost roofing materials. Snow may still build up at the lower slope ranges (20 to 30 degrees), but there is a greater vertical load component carrying more of the load to the base of each member, hence, minimizing deflection of the roof components. Headroom, even on the smaller structures, is much more reasonable.

High Slope Roofs: A roof slope of beyond 40 degrees begins to develop a new set of problems. Issues of headroom, snow load, water penetration and roof member deflection all but disappear. The top access would now be problematic, both because of the steepness of the pathway up the structure, and the dangerous height of the ladder. More critical is the issue of soil stability. Water runoff would carry away soil and roofing materials. Even when dry, 40 degrees is approaching the limit for angle of repose of earth. The larger volume created by the increased slope is located mainly in the upper areas inside the structures where the heat would migrate and be of little use to the occupants. The physical size and weights of the structural elements also become difficult to handle. As the posts become longer they must increase in diameter to resist buckling (slenderness ratio). The post to beam connection angle becomes more acute to a point where the post may tend to kick out from under the beam.

It would appear from these studies that an optimum roof slope for a Type A or Type B pithouse would fall within the 20 to 40 degree range. Documentation of a pithouse in the Chilcotin Plateau supports this range with an example of a roof slope (for a Type A pithouse) between 30 and 40 degrees (Lane 1953:158). On a sloping house site (most of the Keatley Creek site is situated on slopes of various magnitude), the roof slope would vary side to side to compensate for the ground slope. In this case a single structure may have a roof slope that varies 15 or 20 degrees and may border on the upper and lower limits mentioned above.

Type C (Fig. 6)

Inherently, with this type of structure, an upper roof access seems unlikely. By using a side entrance, the problems of a steep climb up and a dangerous ladder descent can be avoided. Since there is limited documentation for this type of structure, little evidence of the choice of roofing that would have been used exists. On the Bear River No. 3 site there was no evidence of any earth cover over the Structure 5 housepit (Shields and

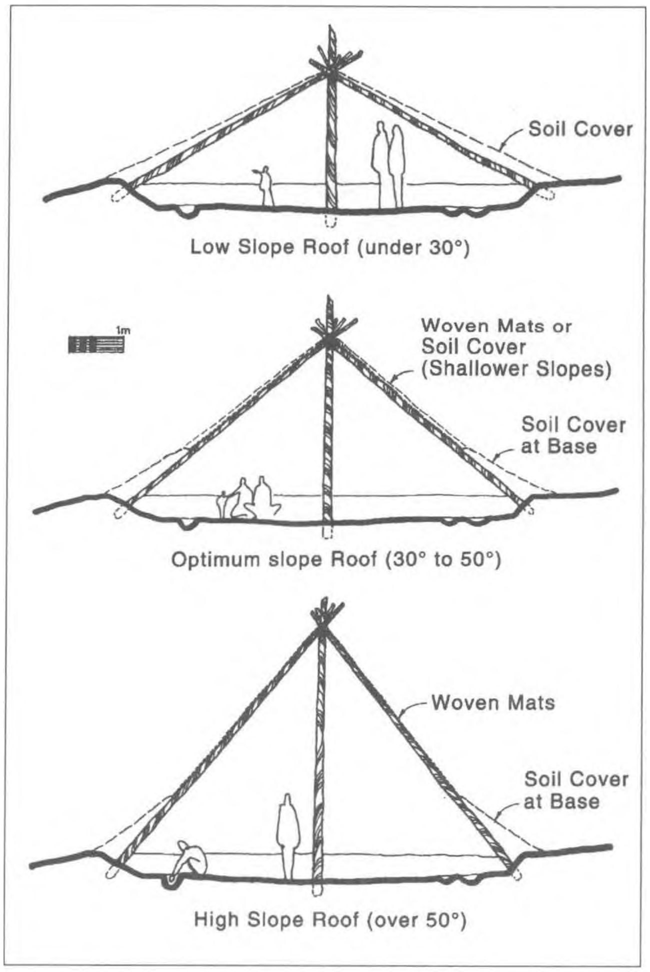


Figure 6. Slope Comparisons Type: C

Dalley 1968:63). It would appear that for very low Type C roof slopes, soil cover could have been possible. For steeper structures this would not have been an option and woven mats or possibly animal skins would have been required for winter occupation cover.

Low Slope Roofs: With a roof slope of less than 30 degrees woven mats would probably be insufficient to provide adequate rain protection for the occupants. With a soil cover, the minimum roof slope could be reduced to about 20 degrees (as discussed in Types A and B Low Slope Roofs). The combination of low slope and the increased weight of the soil cover would demand large sized roof members which would be difficult to lift into place. A structure built in this way would therefore have to be very small (probably under 5 m) or have some additional posts installed to support sagging members at times of high snow loads. Building this type of structure at a very small scale with a low slope roof would provide little area of adequate headroom.

Optimum Slope Roofs: With a roof slope between 30 and 50 degrees, woven mats or animal skins would likely provide adequate rain protection. The combination of increased roof slope and light loading (no soil cover) would make deflection problems negligible, even with extremely small roof members. Headroom in smaller pithouses, including those with shallow floors and low rims would appear to be reasonable.

High Slope Roofs: Beyond 50 degrees the structure becomes more difficult to erect. The materials are longer and consequently heavier and harder to manage. While headroom is definitely not an issue, the large upper level volume that has been created would cause heat stratification and adversely effect any heating strategies.

Considering the above criteria, it would appear that with a Type C structure, an optimum roof slope of between 30 and 50 degrees would be the most appropriate. The example on the Bear River Site (Shields and Dalley 1968:63) of Structure 5 seems to support this. With the floor diameter and height above floor at which the roof members would meet (as derived from the post hole angles recovered in excavations), the roof slope can be calculated to be about 38 degrees.

Type D (Fig. 7)

This type of structure is very similar to that of Type C but without the center post. By comparing Figures 6 and 7 it can be seen that much the same conditions apply to both types, including the requirement of soil cover at the lower roof slopes. The omission of a central support, however, does have certain ramifications.

Low Slope Roofs: Without the center post this scheme becomes problematic at a roof slope of under 35 degrees. With this low slope, the roof loading including both dead and live loads (loads from the structure itself and introduced loads such as snow or people) acts primarily to drive the opposing beams apart at the base. At the same time the smaller lashed beam tops are being forced to slide through the lashed joints. The shallower the roof pitch, the easier it would be for the structural members to move slightly and cause the assembly as a whole to collapse while still remaining intact. This would be similar to flipping a shallow woven basket inside out. The requirement for soil cover to provide rain protection (as discussed in the Type C Low Slope Roofs) adds further complications. Along with this, the additional drawbacks as discussed in Type C Low Slope Roofs still apply.

Optimum Slope Roofs: With a roof slope ranging from between 35 and 60 degrees, the structure becomes much more stable. More of the structural load is acting as a vertical component and is therefore effectively transferred down to the base of the beams. Again, as with the Type C Moderate Roof Slope, light woven mats would have been used instead of soil to provide rain protection. With this, the radial beam framework could be quite light and easy to erect. Sufficient headroom

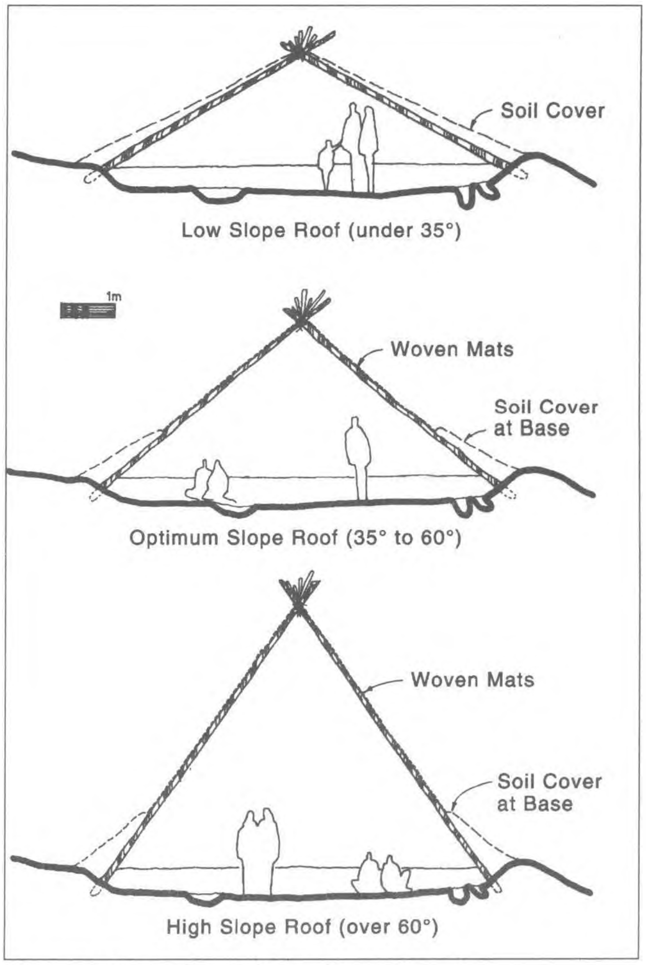


Figure 7. Slope Comparisons Type: D

could be achieved without creating a large volume overhead that would draw the heat.

High Slope Roofs: Roof slopes beyond 60 degrees would become heavier and unwieldy making them difficult to erect. As with Type C pithouses, heat stratification combined with a large radiating surface area would adversely affect the heating strategies during the winter.

Considering the above arguments, it seems probable that a roof slope in the optimum range would have been employed on a Type D pithouse.

Structural Options

Four structural options have been selected for each study housepit location. It is important to note that none of these options are meant to represent the exact structures used, but instead, are used to examine the implications of a number of possible strategies. All "last occupation" postholes that were found have been shown, with those corresponding to post positions of specific structural models being darkened (Figs. 8–12). Much of the rim area was unexcavated and, as a consequence, very few girder emplacements or postholes have been located outside the floor area. Locating the positions of postholes in the rim would have been very useful in determining the exact locations of the main girders and beams and perhaps the slope of the roof, although in most cases this was a difficult endeavour.

HP 3 Floor Plan (Fig. 8)

While there are a profusion of post locations scattered throughout HP 3, it remains among the most clear structurally. While there seems to be a particular pattern for interior main support posts, it is interesting to see the variety of options still available within this pattern for this 10 m floor diameter structure.

Option 1: This Type A system represents a variation of the type well documented by Teit (1900:192–194) in his study on the Thompson. Four main girders each rest on posts fairly evenly spaced from the center roof access. For the most part, the stabilizing beams rest over these main posts. The spans between the support members are relatively equal and certainly not excessive (under 3 m at the worst).

Option 2: Although the radial beams of this Type B system produce a viable structural scheme, there are certain weak elements. The purlin spans between the beams have become excessive (up to 4 m). The cantilevered sections of some beams are probably beyond reasonable limits as well.

Option 3: This structural strategy is actually a hybrid of a Type A and Type B system. There are girders on posts with span-reducing stabilizing beams typical of Type A schemes and cantilevered beams typical of Type B schemes side by side. This mix seems like a logical one to employ on larger pithouses in that additional beams can be added if required during construction to achieve short purlin spans and reasonable stability. Although this option may not look as tidy as that of option 1, it is probably just as effective.

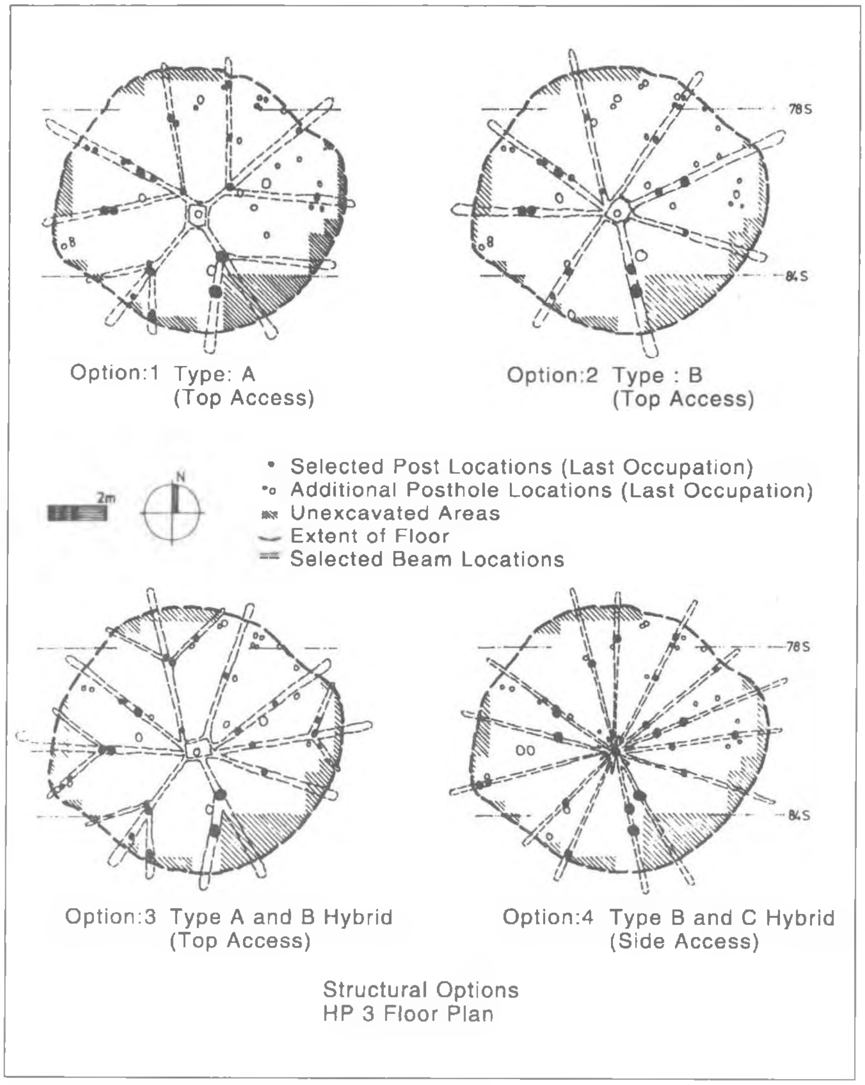


Figure 8. Structural Options HP 3 Floor Plan

Option 4: By mixing structure Types B and C, many of the posthole locations have been utilized which would reduce the beam sizes to a minimum. Access here would probably be limited to a side entrance for which there was no evidence during the excavation.

While both options 1 and 3 appear reasonable, the former seems more logical and has been chosen for a more detailed study in the following section of this article. A Type D structure was not included due to the large size of the floor and the abundance of posthole locations.

HP 7 Floor Plan (Fig. 9)

HP 7, the largest of the study housepits with a 12 m diameter floor, is very similar to, but larger than HP 3. It also has an abundance of postholes throughout most of the floor areas, although they do not read as clearly as those of HP 3. It is interesting that many of the last occupation posthole locations (shown on Fig. 9) and those of the prior occupations were very similar. This tends to suggest that earlier structural systems were repeated when the structure was rebuilt, perhaps indicating that there was a clearly understood system for the construction of this size of pithouse.

Option 1: As in HP 3, option 1 represents a clear Type A structural system, although the spans and structural members are all slightly larger. The increased spans of the purlins (upwards of 4 m) would necessitate that the purlins be quite large in diameter, making the roof extremely heavy and hard to build.

Option 2: The radial beams of this scheme are similar to those of HP 3, option 2 although a key posthole is missing. Even if this missing posthole could be assumed to have been present, the purlin spans would still be considered excessive (almost 5 m in the worst case).

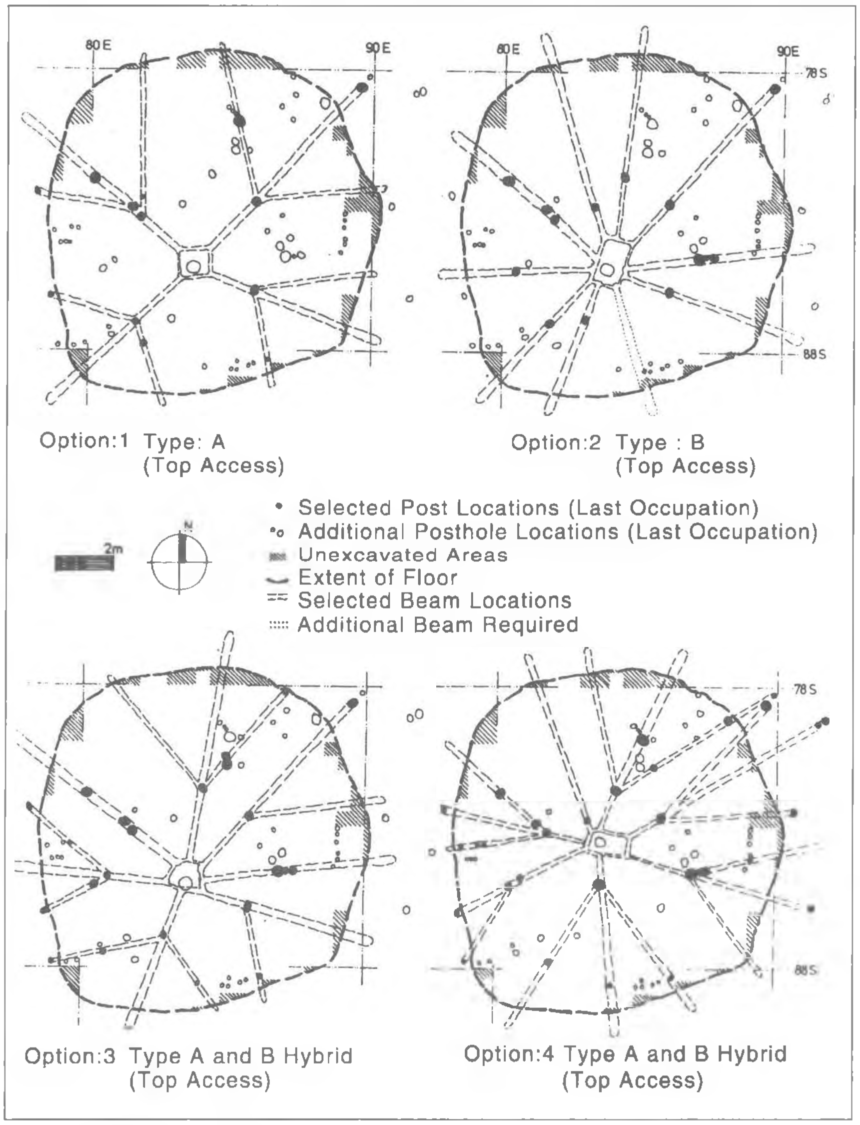


Figure 9. Structural Options HP 7 Floor Plan

Option 3: This Type A and B hybrid utilizes several unstabilized or semi-stabilized cantilevered beams to dramatically reduce the span of the purlins (just under 3 m in the worst case). Many of the smaller unused posts could have served for non-bearing partitioning purposes.

Option 4: By utilizing the posthole locations on the uphill rim for girder and brace supports, a Type A and B hybrid scheme with very short purlin spans has been developed. Similar to option 3, a mix of cantilevered beams and stabilized girders have been employed, although unlike option 3, the entrance on this scheme is placed squarely in the center of the structure.

Although the structural system employed in the option 1 scheme appears to provide the simplest fit with the archaeological floor plans, the hybrid scheme of option 4, with its shorter purlin spans, is more structurally sound, and therefore, more likely to have been used. This option has been chosen for more detailed study in the following section. As in the case of HP 3, a Type D configuration would not be viable at this scale.

HP 9 Floor Plan (Fig. 10)

During the course of HP 9 excavations, only four small posthole locations were found. It is quite possible that these postholes contained non-bearing posts for racks, partitions, or other types of furniture given their relatively small size. It is also possible that the posts were added later to repair sagging support members of this relatively small (5 m floor diameter) house.

Option 1: This hybrid option could perhaps be described as a Type C (central post) structure that has had several posts added over time. It would appear unlikely that on such a small structure the builders would have chosen to locate the central post so far from the center of the floor unless it served the purpose of allowing for a side access.

Option 2: With several support posts but without the main central post, this scheme could be described as a Type B and D hybrid. It may also have been constructed as a Type D structure and had repair posts added over time as required. If there was snow accumulation on the south-east side of the structure, the addition of three posts may have been sufficient to bolster a sagging section of roof.

Option 3: By moving the peak of the roof towards the north, the spans of the south beams increase. This may account for the requirement of extra support posts. On a small structure like HP 9, however, it would seem reasonably easy to design a structure that would not require any additional posts, especially with a steeply sloped roof.

Option 4: This appears to be the most obvious option. Here the posthole locations serve partitioning or other non-structural uses. With the small size of HP 9, spans between beams would not be excessive (1.5 m maximum). It would also be easy to add additional beams to further reduce these spans if required.

Given the lack of evidence for bearing post supports, neither Type A nor Type B models are appropriate to consider. While option 4 appears to be the most logical to choose for a more detailed study, a similar scheme will be elaborated for HP 90. Given this, it may be useful to look more closely at option 1 in order to broaden the detailed analysis for heuristic purposes.

HP 12 Floor Plan (Fig. 11)

Structurally, HP 12 seems most closely related to HP 3 and 7, but at just over 6 m in floor diameter it is much smaller. There are a number of large and small posts scattered apparently at random throughout the floor area. As with the other study housepits, rim posthole locations would have been very useful in determining the actual structural system used.

Option 1: While options 1 and 2 both share the Type A strategy, option 1 places the access closer to the center

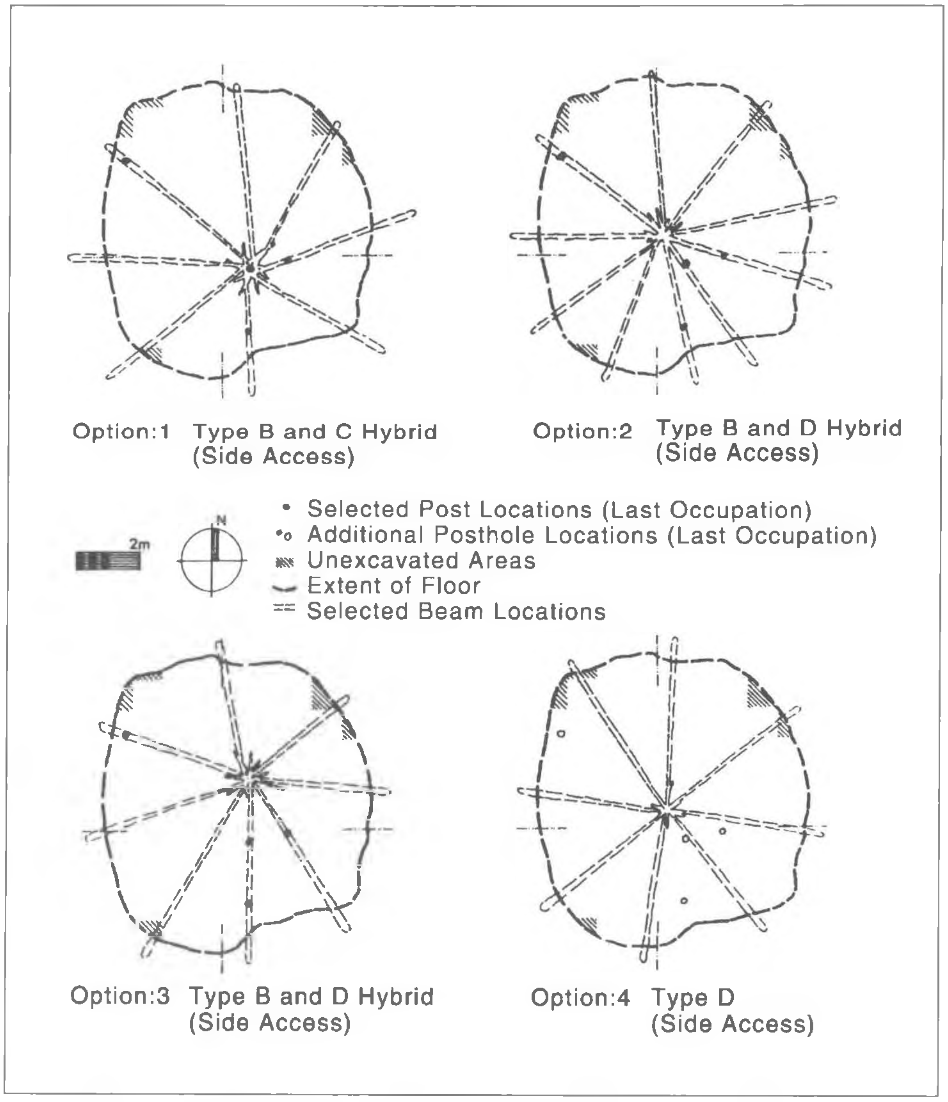


Figure 10. Structural Options HP 9 Floor Plan

of the structure creating a more even roof slope. Except for one 3 m span, the purlin spans are generally small. With the inclusion of another central post to support the longest north beam, this scheme would appear much more rational.

Option 2: Although this scheme displays most of the typical Type A components, their arrangement is somewhat problematic. The south side slope of the roof would have to be very steep and the north side quite shallow. The eastern girder is not a standard cantilever and its stabilizing beams are located too close to the rim to be of much use either in bracing the girder or reducing the purlin spans.

Option 3: By mixing Type A and B systems the spans are minimized and the structure appears quite orderly. With the absence of a key central posthole, the possibility of a roof entrance seems unlikely. From the abundance of unexcavated outer floor and rim areas that appear on Figure 11, it is possible that evidence of a side entry could exist at the north part of the rim and still remains to be discovered.

Option 4: With a housepit of this size, it would seem logical to use either a Type C or Type D system; however it is hard to explain the profusion of large postholes. Many look too large to have been introduced at a later time for the purposes of repair. Given this, it is possible that a single center post or perhaps several center posts were used to support the roof beams with several additional mid-beam supports added later.

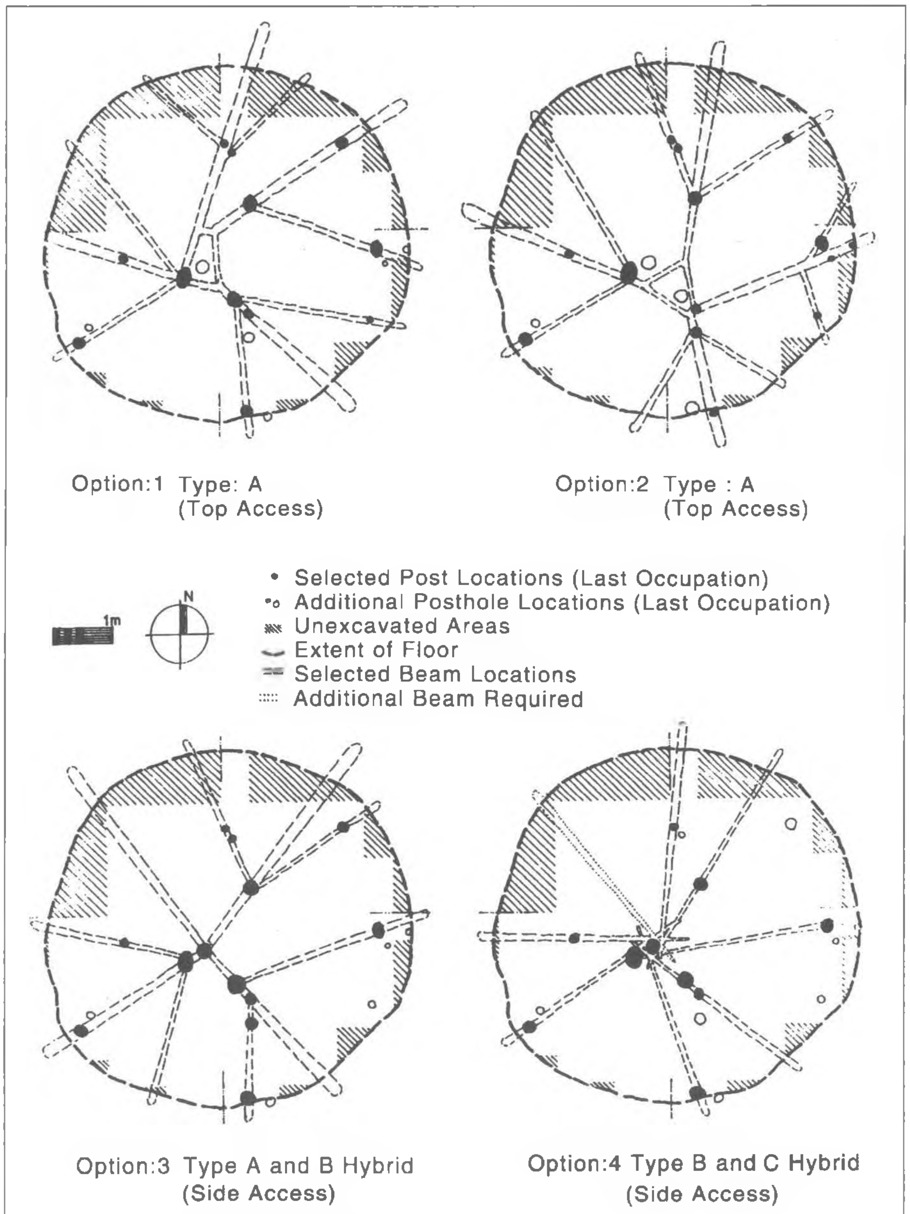


Figure 11. Structural Options HP 12 Floor Plan

Given the possibility of a side entrance, option 1 could be amended slightly to eliminate the top access without changing the general structural layout. It is also possible that this structure (and others as well) may have employed both a top and side entrance. Either way, option 1 appears the most logical and has been selected for a more detailed study in the following section.

HP 90 Floor Plan (Fig. 12)

HP 90 is strikingly similar to HP 9 in the size of the floor (5 m in diameter) and the quantity and distribution of postholes. This is the only housepit of the five study housepits in which a side entrance was uncovered. Given the small size, lack of evidence for substantial posts, and obvious entry location, it would seem unlikely that this structure would have employed either the Type A or Type B system.

Option 1: This scheme seems to represent a Type C roof system that has had additional support posts added to some of the beams. Using the posthole location closest to the

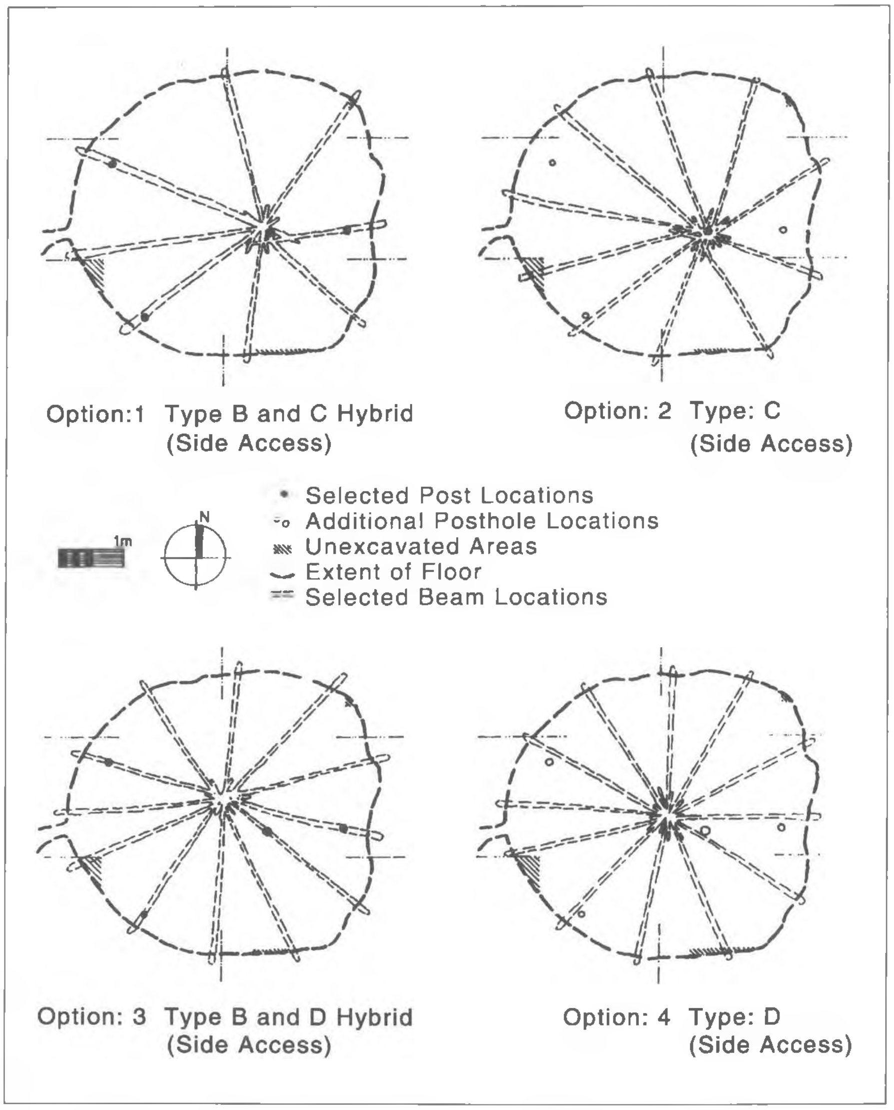


Figure 12. Structural Options HP 90 Floor Plan

center for the main support, a roof is produced that is shallowest over the entry and very steep on the opposite side. This seems contrary to the logical requirement of having sufficient headroom immediately inside the entrance. The additional posts have not been located at the points of maximum deflection and there fore may serve other than structural functions.

Option 2: Assuming, as mentioned in option 1 above, that the additional posts were not required structurally, the radiating beams are free to move and be spaced closer together. While the beam spacings now seem more reasonable, the drawback of the low slope over the entry is still unresolved.

Option 3: By moving the apex of the structure nearer to the center of the floor, the entry headroom would improve somewhat. Given the depth of the entry floor, the clearance of the roof structure would not be a problem. Most of the posts in this scheme appear to be non-structural given their more peripheral locations below the beams.

Option 4: Considering the locations of the postholes in the floor of HP 90, it would be logical to explore a Type D roof strategy that does not use structural posts. This structure employs relatively even, short spans and a uniform roof slope.

Given the drawbacks to options 1 through 3, and the clear documentation for this type of structure (Teit 1900: 196), it would seem reasonable to select option 4 for further study in the following section.

Selected Layouts

A structural layout and roof slope has been selected for each study housepit location from the preceding housepit options. This selection is not meant to imply that any layout exactly represents the roof which was built prehistorically. A number of points make that task difficult. Some posthole locations may have been from prior occupations rather than from the latest occupation. Postholes may have been missed or misinterpreted during excavation. Important postholes may lie in unexcavated areas. Some posts undoubtedly served purposes other than structural. It is also possible that some support posts sat directly on the floor and therefore left no remaining holes. A number of postholes (especially the smaller ones) may have been from posts added later in the life of the structure to repair or bolster sagging sections including purlins and roof lathing.

In spite of these qualifications, the selection and analysis of possible structural layouts may prove valuable in better understanding the problems encountered by their early builders, and some of the more likely solutions.

HP 3 Floor Plan and Section (Fig. 13)

HP 3 is located on a slight slope which would necessitate having an off-center top access to achieve a uniform roof slope. Conversely, if the roof slope varied slightly around the structure, the access could be located in the center of the floor. The selected scheme, option 4, places the entrance near the center of the floor and is considered to be the most likely basic type of roof to have been used prehistorically on this pithouse. A moderate roof slope was chosen in the slope comparison section. Given the slight grade of the site, a required roof slope variation within the 25 to 30 degree range would likely optimize the roof slope physical requirements and keep the access in the center of the structure. Some of the structural posts indicated on the floor plan may be shoring applied some time after the construction of HP 3. It is also possible that some of these posts may be acting as partitions only and do not have structural functions. Three bays of purlins have been located on the floor plan to give an indication of the probable direction and spacing of these members.

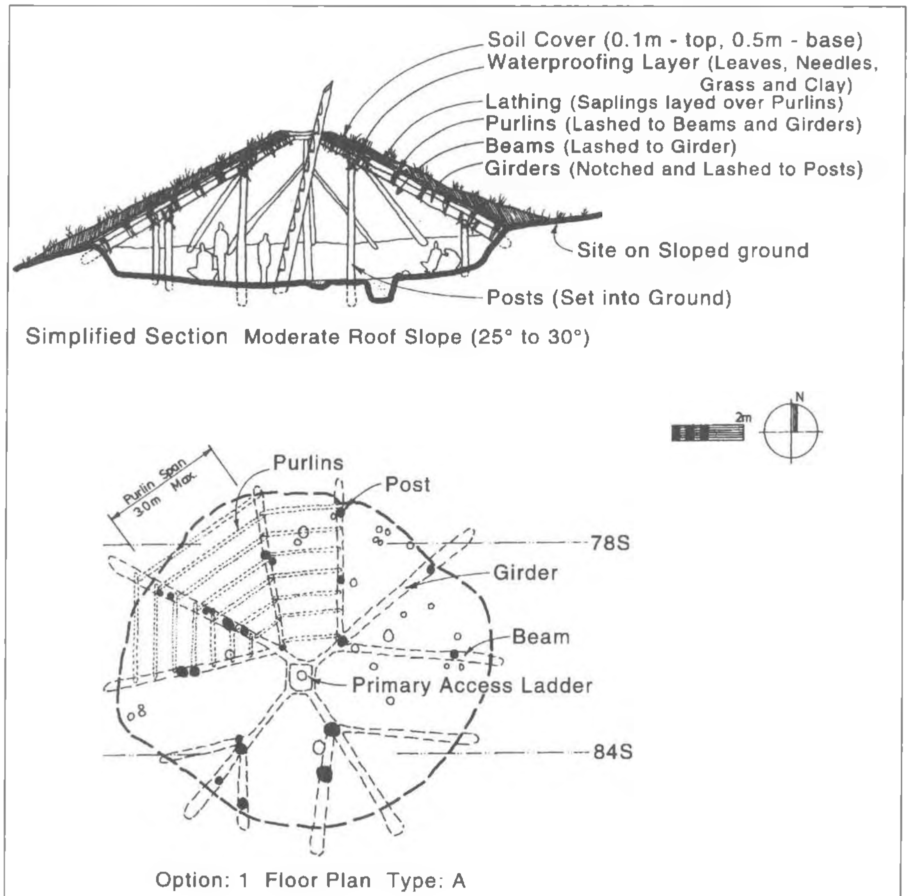


Figure 13. Selected Layout HP 3 Floor Plan and Section

The complete roofing and structural assembly has been detailed on the simplified section. The thickness of the soil cover is based on excavations at HP 7 and may have varied slightly. The lathing appears to have been laid at 90 degrees to the purlins which would make sense from a structural point of view. The locations of charred structural remains excavated in HP 3 tend to support the locations, spacings and directions of the purlins.

It would seem likely that as the structure aged and sections of the roof began to sag, additional posts and perhaps beams as well, would have been brought into the structure and wedged into place to make the structure last another few years with minimal work. This repair process, in fact, could have carried on to the point where the floor was cluttered with posts. At this point posthole locations would appear quite confused, perhaps much in the way they do on the detailed archaeological floor plans.

HP 7 Floor Plan and Section (Fig. 14)

This housepit is located at the base of a hill and is graded quite steeply. The roof pitch would change as the girders radiate from an uphill position to a downhill position. Since the downhill girders would require a steeper slope to maintain adequate underpinning, the slope of the uphill girders must gradually decrease to provide a uniform opening elevation.

The central posts forming the cantilevers on the girders are roughly equidistant from the top access hatch. The lengths of these cantilevers do not exceed a distance of roughly half the backspan (1/3 cantilever) which seems to be quite sound. A top end supported, unstabilized beam cuts the purlin span down to the size of the other purlin spans around the structure. Mixing stabilized girders with unstabilized beams seems an appropriate way to minimize long purlin spans and to create a more even superstructure over a slightly asymmetrical floor.

There are a number of small post groupings whose placements appear highly organized. These do not appear to serve any structural purposes and are likely

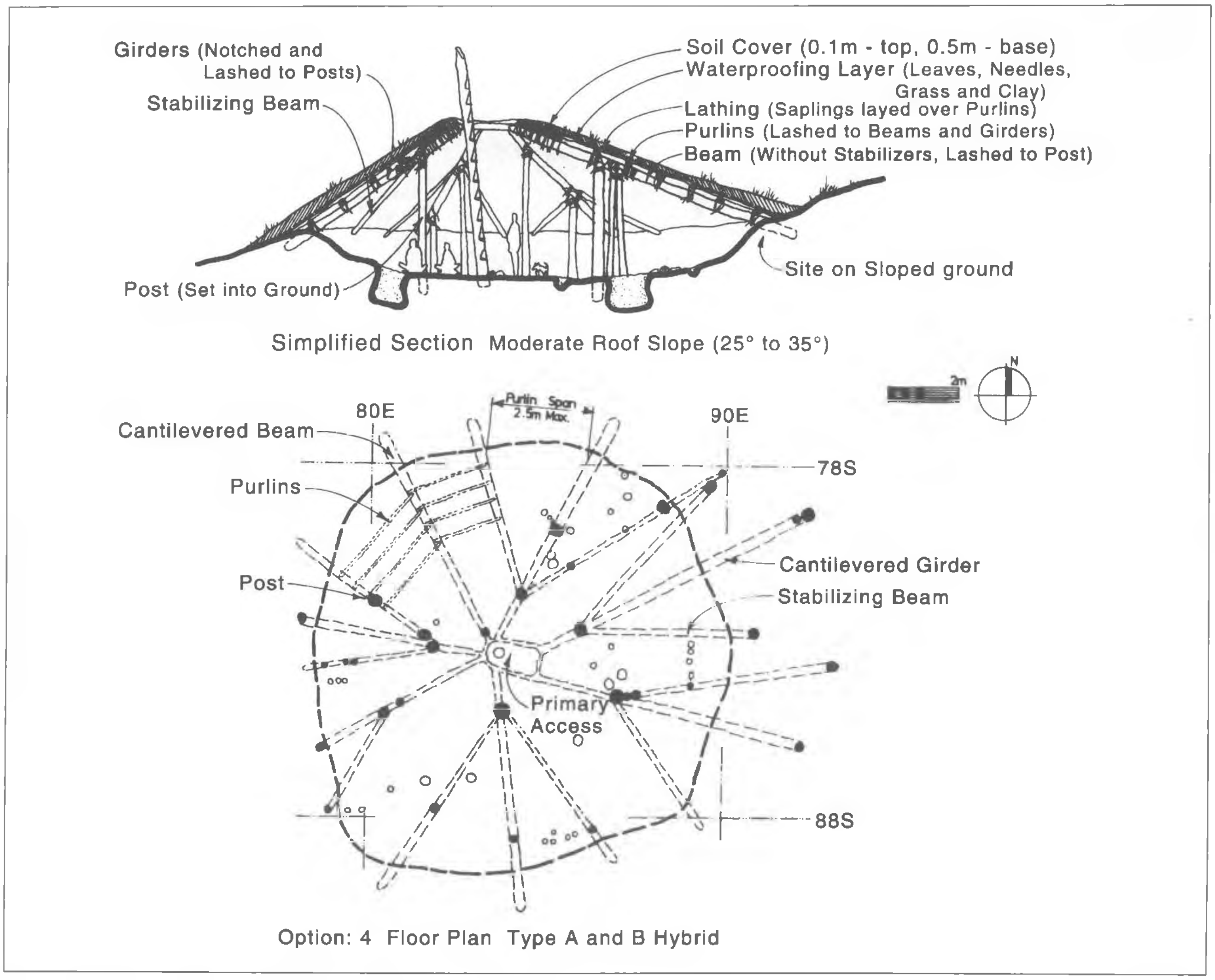


Figure 14. Selected Layout HP 7 Floor Plan and Section

partitions separating different activities. The simplified section indicates a reasonably accurate floor profile and the inclusion of people in the sketch serve to illustrate the large relative size of this structure.

The relative thickness of soil cover indicated on the section represents amounts actually recovered in excavations.

HP 9 Floor Plan and Section (Fig. 15)

The grade around HP 9 is nearly level. The off-center location for the main support post would act to increase the southeast side roof slope. A possible side access has been located at this steep sloped section to provide adequate headroom upon entering the structure. If subsequent excavation indicates that a side entrance was located elsewhere (e.g., in the northeast where excavators think it may occur), then this reconstruction will be much less attractive than option 4, which, as previously discussed, probably is most realistic for this housepit in any event. The direction and extent of the purlins supporting the soil cover have been located on the floor plan. The simplified section illustrates that the soil cover, roofing and roofing support structure carried part way up the base of the housepit and is similar in construction to that shown on HP 3 and HP 7. Above this point, woven mats or perhaps animal skins act as the roofing system.

The roof slope chosen (ranging anywhere from 35 to 50 degrees) provides sufficient headroom while keeping the volume of the structure to a minimum for sufficient heating. The additional posts under the beams may have been used to shore up undersized members or provide a framework to fix partitioning to.

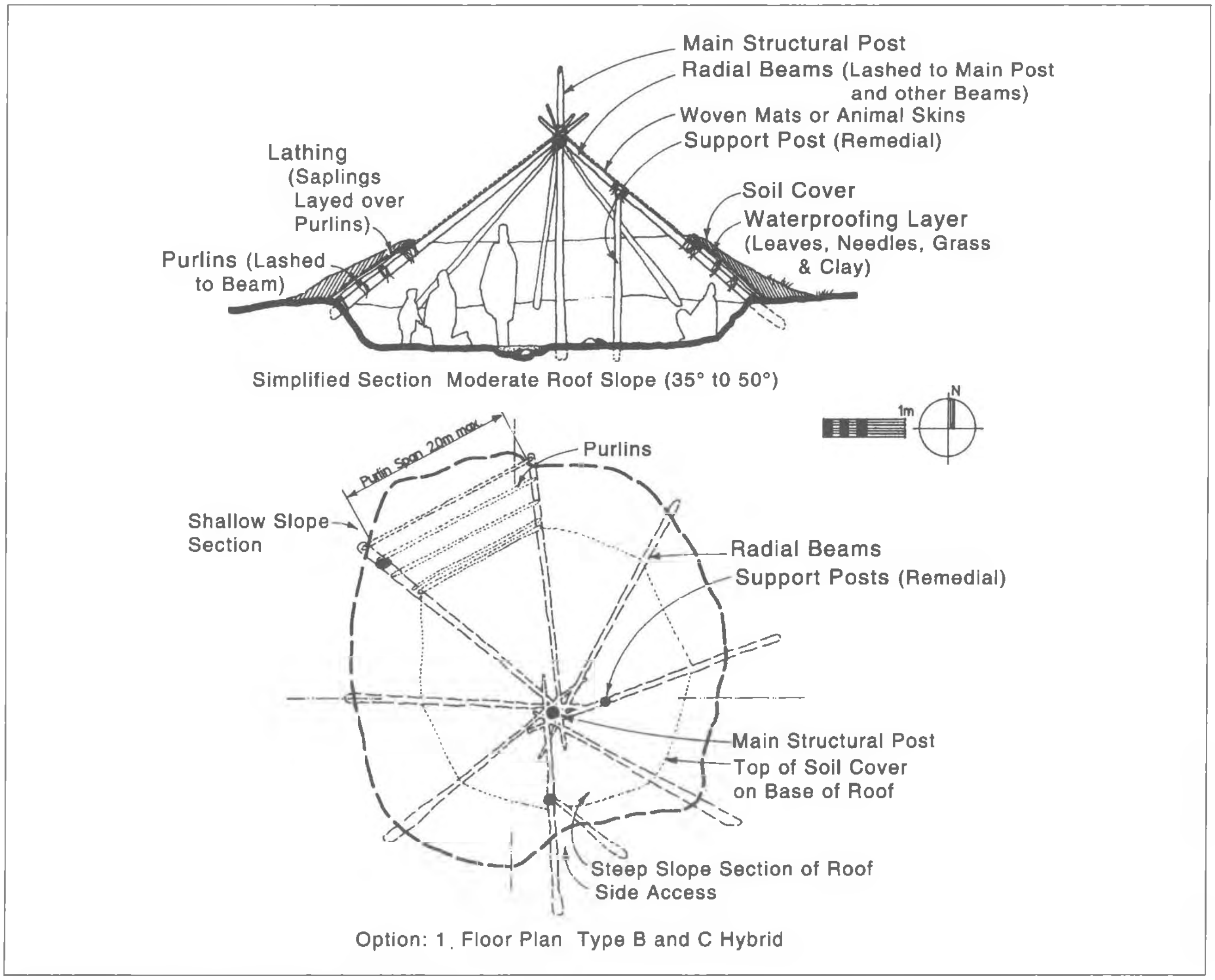


Figure 15. Selected Layout HP 9 Floor Plan and Section

HP 12 Floor Plan and Section (Fig. 16)

This structural system is essentially the same as those employed on the selected layouts of HP 3 and HP 7 (Figs. 13 & 14). The gently sloping grade of the natural ground surface could be accommodated with a minimal variation in roof slope. A moderate roof slope has been utilized, possibly ranging from 30 to 35 degrees. With the depth of the excavation indicated on the simplified section and the roof slope chosen, much of the central floor area would have sufficient headroom. The interior volume to be heated would not be excessive in this scheme. Most purlin spans are just over 2 m in length and the one long span on the southwest section could be halved with the addition of another light beam at the mid-span point. As mentioned in the previous section, even if a side entrance was actually used in this housepit (which might be determined by future excavations), the roofing strategy would require only minimal change.

HP 90 Floor Plan and Section (Fig. 17)

The system of radial beams employed on this Type D scheme responds to "frame in" the side entrance. Similar to HP 9 (Fig. 15) but without the center post, the roof slope is probably less arbitrary, requiring a steeper roof slope to achieve structural stability. With a 45 degree roof, the excavation depth can be kept to a minimum without affecting the headroom. The steep roof effectively transfers the load to the base of the beams causing minimal deflection. With this argument, the beams therefore can be quite small and light. The purlin spans supporting the lower soil cover are minimal (1.5 m maximum at the lowest point and 1 m at the highest point) and would also be small and light. This would be an easy structure to build, but due to the small sized structural members, the lifespan would likely be quite short.

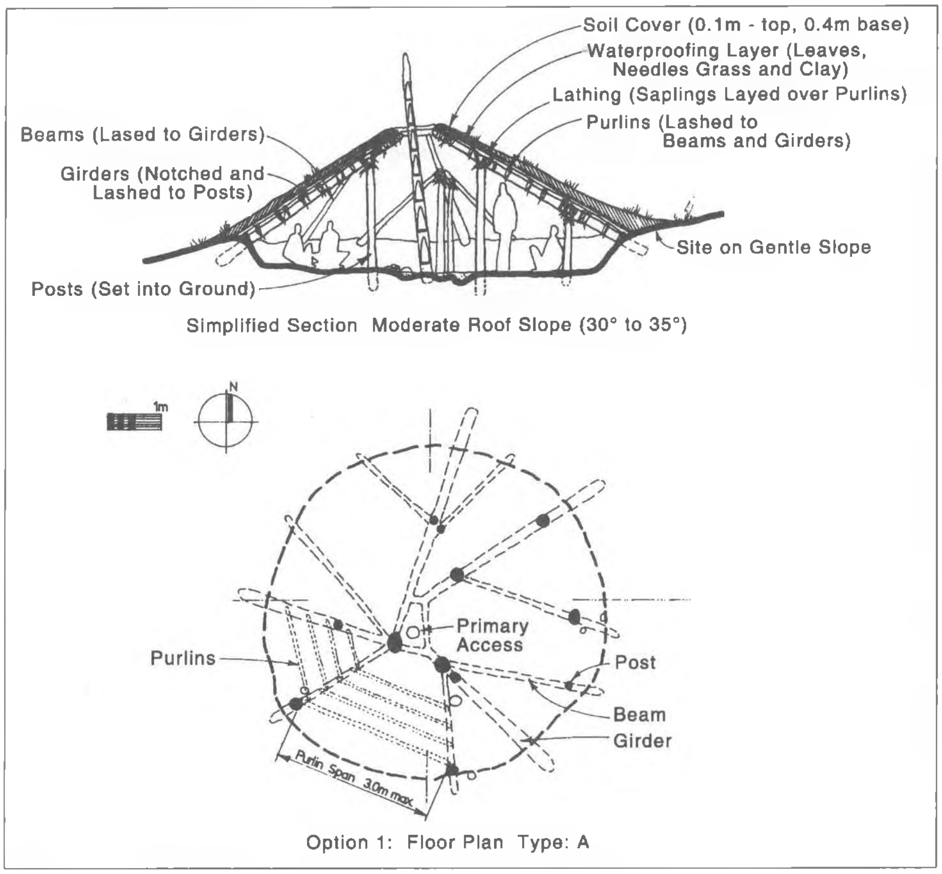
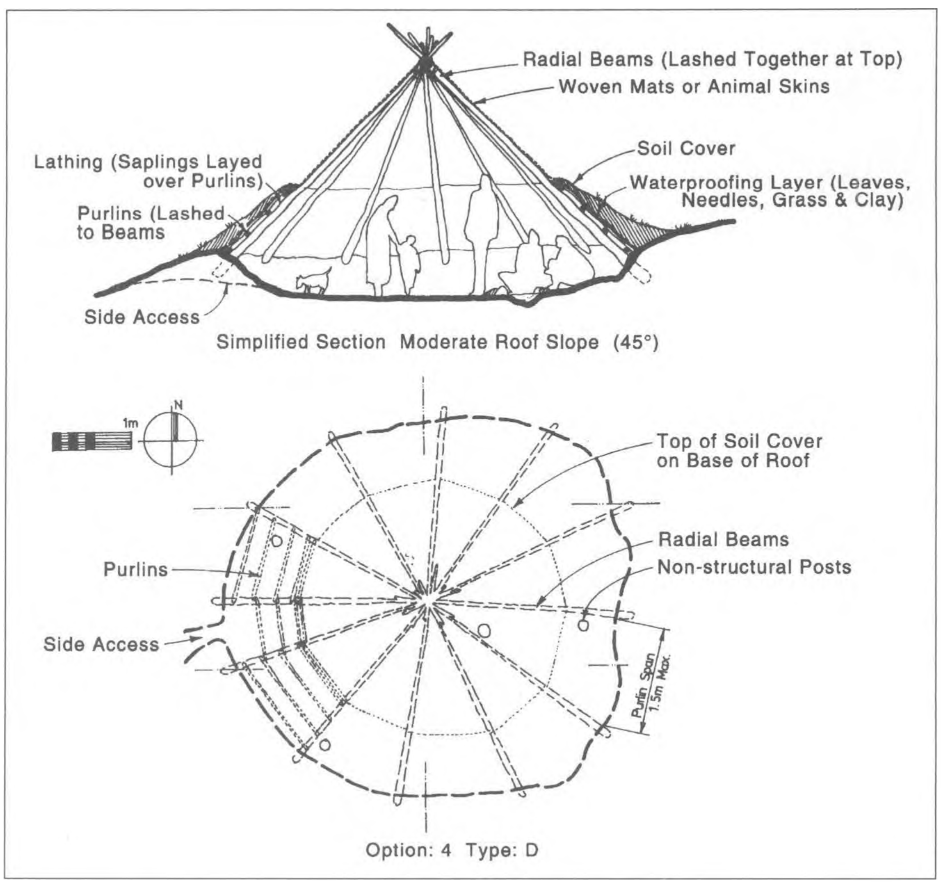


Figure 16. Selected Layout HP 12 Floor Plan and Section

Figure 17. Selected Layout HP 90 Floor Plan and Section



Conclusions

Without the complete rim posthole locations it is impossible to determine the definite structural layout that would have been employed at each studied location. Some housepit floor plans are much clearer and more highly patterned than others and the selected layouts look very plausible. For those that are less clear, the general type of system that was used can still probably be deduced. By analyzing the various layout options for the five study housepits, it can be determined that there was likely a much wider variety of building types used at the Keatley Creek Site than is generally assumed by archaeologists or in popular portrayals of prehistoric Plateau cultures. In fact, all but one of the structures dealt with here appears to have varied greatly from the "typical" pithouse described by Teit.

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Chapter 16

Body Heat as a Strategy for Winter Survival in Housepits

Richard MacDonald

Introduction

Heating strategies in pithouses during the very coldest times of the year would likely be focused on the element of basic survival rather than one of comfort. As was suggested by Hayden et al. (1996), some pithouse dwellers may have employed a strategy of using body heat at relatively high occupant densities as the principle heating method. While there are few historical references to the heating or insulating properties of pithouses, one such account documented by Reverend J.B. Good during the mid-1800s, describes a pithouse in the Lytton area during a very cold winter day that was crowded with people to a point where the temperature became uncomfortably warm:

> These underground dwellings for winter occupation were delightful places to enter on days when the wind was blowing fiercely from the north, sending the thermometer at times to twenty below zero provided only three or four families held possession of them. . . . But during what we may term our revivals, when we used to crowd these places or dens with hearers thick as bees in a hive, then the heat would grow insufferable. (Good as cited by Kennedy and Bouchard 1987:261)

In a similar account from the same period, artist Paul Kane related his observations of a housepit at Walla Walla in the winter:

> . . . twelve or fifteen persons burrow through the winter, having little or no occasion for fuel; their food of dried salmon being most frequently eaten uncooked, and the place being excessively warm from the numbers congregated together in so small and confined a space. They frequently obliged, by the drifting billows of sand, to close the aperture, when the heat and stench become unsupportable to all but those accustomed to it. (Kane as cited by Rice 1985:99)

A question arises from these accounts which warrants investigation. Would body heat, under optimum circumstances, be enough alone to keep a pithouse temperature at a minimum to ensure occupant survival? If so, does structure size affect the suitability of this strategy?

To test the hypothesis of this heating strategy, a model of heat generation from occupant body heat versus heat loss through the building envelope has been developed for three sample housepits (HP's 90, 12, and 7), each located at Keatley Creek in the Lillooet area. This hypothesis is being tested under the following constraints:

1) The use of fire was limited to food preparation only and not as a heating source. (If a fire had been used as a heating source, a smoke hole in the roof would be required as well as a lower opening to provide fresh air for occupant survival. This influx of cold air would likely negate any heating benefits of the fire.)
2) The occupants of the test housepits were poor and had only the most basic of clothing and blankets. (Willow or sagebrush bark robes and leggings, fish skin moccasins and sage bark or dog skin blankets as discussed by Hayden 1990:90–91.)

Methodology

The sample housepits for this study were chosen for several reasons. They represent a satisfactory cross section in the range of sizes from very small (HP 90), small (HP 12), to large (HP 7). More importantly, these housepits have been among the most thoroughly studied of those at the Keatley Creek site.

Simplified versions of these structures (see Figs. 1–3) were evaluated using current building design analysis methods described in mechanical engineering handbooks (Stein and Reynolds 1992; Ashrae 1989). From this, occupant heat gain and heat loss through the various components of each housepit was calculated. Given that some materials which were used in pithouse construction are not represented by present day building materials, comparable materials were selected that most closely represent the thermal properties of prehistoric building materials.

The following issues will be considered in each of the following sections:

1) Climatic Data
2) Occupant Heat Gain
3) Population Ranges for Study Housepits
4) Total Heat Gain From People
5) Area and Volume Calculations for Study Housepits
6) Heat Loss Calculations

Climatic Data

Given the close proximity of Keatley Creek to the Lillooet weather reporting station, the temperature values given (Appendix I) can be considered very accurate for the site conditions at the present time. The assumption was made that these values would be relevant to the Keatley Creek area at the time of occupation.

A value of -25°C (Appendix I.1) is listed as the outdoor design temperature for the Lillooet area and will be used for this study. Included in Appendix I.1 is a brief definition of the outdoor design temperature.

The external design temperature of the ground, which is essentially the earth temperature next to a structure below grade, takes into account a time lag for the soil at a given depth to become colder as the adjacent outside air temperature cools (refer to definition in Appendix I.3). A temperature difference of 15.6°C from the mean January air temperature (Appendix I.3) was derived from tables and will be used in the below grade heat loss calculations (Appendix VI).

While there are no precise data available for winter indoor temperatures, there is evidence that early hunters lived at temperatures below what we consider adequate, and possibly did so with some degree of comfort (Hayden 1990:89–102). Historical observations record minimally clothed natives in Terra del Fuego as surviving temperatures as low as 2°C for long periods (Cena and Clark 1981:16). An indoor temperature range from 5°C to 10°C was selected for use in the calculations as determined in Appendix I.4.

Occupant Heat Gain

Three different methods were used to calculate the heat gain from a typical occupant in watts per person. Two contemporary building design methods were examined using comparable activities with consistent results. A third method was used to account for the unusual variables associated with this non-standard building type. From this, an occupant heat gain in the range of 90W to 107W per person (Appendix II) was derived.

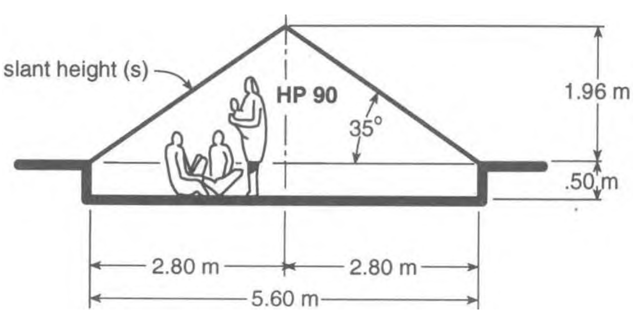

Figure 1. Simplified Sectional Diagram of Housepit 90.

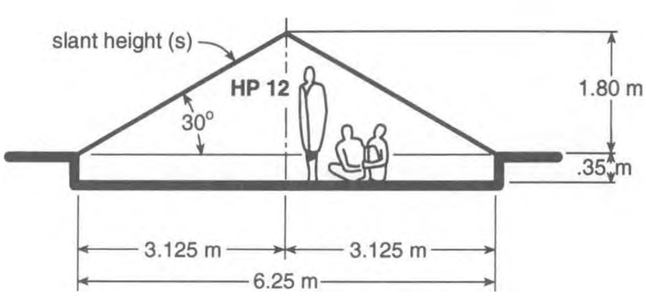

Figure 2. Simplified Sectional Diagram of Housepit 12.

Population Ranges for Study Housepits

The populations for each housepit have been determined by two different methods. The first method assigns a fixed density to each housepit (Hayden et al. 1996) which relates to their floor areas. The population estimates derived from these fixed densities are listed in Appendix III.1.

In order to better compare the body heating strategy in different sized housepits, a range of densities have been applied to both the smallest and largest housepits. This method is important to develop a model of how body heating of the inside of a housepit is affected by both the density of people and by the size of the house. The population estimates from the range of densities are listed in Appendix III.2. Other estimates by Alexander (Vol. II, Chap. 2) indicate that even the highest density estimates used in this study may be too conservative.

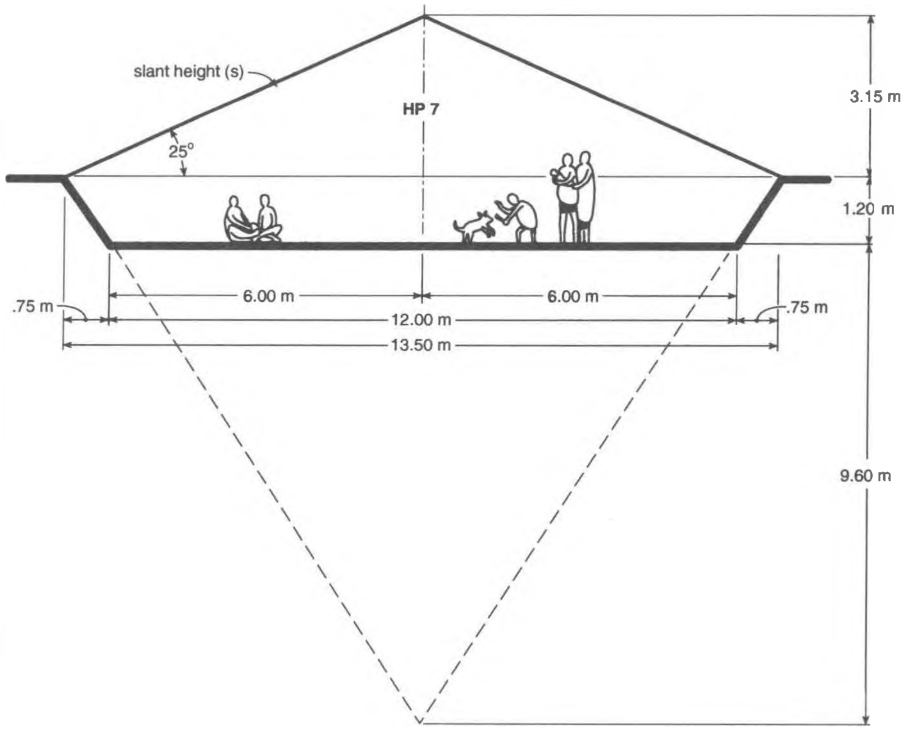

Figure 3. Simplified Sectional Diagram of Housepit 7.

Total Heat Gain from People

The occupant heat gain has been multiplied by the population of each housepit to get a range of total heat gain in watts. This procedure has been applied to the three methods for determining housepit populations as discussed in the previous section. The occupant heat gain derived from population estimates at fixed densities are listed in Appendix IV.1. Occupant heat gain derived from population estimates through a range of densities are listed in Appendix IV.2. Appendix IV.3 lists the occupant heat gain from actual population range estimates.

Area and Volume Calculations for Study Housepits

While it is possible to accurately determine the floor areas of the study housepits from the remaining ground depressions, the volumes are less certain. There is little evidence remaining to determine the roof pitch. Given this, however, there are a number of roof slope requirements which are useful in determining a range of probable roof pitches. A minimum roof pitch of 20° was chosen to maintain adequate headroom, limit rainwater penetration and provide sufficient underpinning for the roof beams (Vol. II, Chap. 15). In order to prevent earth cover from washing off of the roof, and to provide a low grade for easy access through the smoke hole by the occupants, the maximum pitch chosen was 35°. In each case it was assumed that the pitches would be as low as is practically possible to lessen the structure volume to be heated.

For the smallest of the study housepits, HP 90, a pitch of 35° was assumed in order to provide sufficient headroom space and because the entrance was from the side rather than via the smoke hole. For HP 12, which is slightly larger, a roof pitch of 30° was assumed adequate for headroom requirements. An average roof pitch of 25° was assumed for the largest structure, HP 7, which is located on a hillside and would likely incorporate both maximum and minimum pitches. The area of each housepit floor, wall, and roof, together with the total volume of the structure has been calculated (Appendix V) for use in the heat loss section.

Heat Loss Calculations

Heat loss through the floors and walls and into the ground has been calculated for each housepit (Appendix VI) and added together to get a total below grade heat loss in watts. The heat loss through the roof has been derived from the summation of the thermal resistance values of each component of the roof construction. The reciprocal of this value (or thermal transmittance value) is applied to each housepit roof that, when factored with the roof areas and temperature differences, yield a heat loss range in watts. Although a snow cover would increase the overall insulating efficiency of the roof assembly, it has not been factored in the calculations. The purpose of this study is to consider occupant survival during the coldest conditions.

Given both the need by the occupants of some fresh air, and the potential for leaks through both the structures themselves and their openings, some warm air would certainly leave the structure and be replaced by cold air. This process is called infiltration and accounts for a portion of the overall heat loss. A range of this heat loss has been calculated (Appendix VI) based on a range of number of air changes each hour. The volume of each housepit is multiplied by the number of air changes per hour and the temperature difference to give a heat loss range in watts.

The total heat loss for each structure is the sum of all of the above heat loss values. The total heat loss for HP 90 has been calculated to fall within the range of 1104W and 1495W (Appendix VI.1.f). For HP 12, the total heat loss ranges from 1204W to 1600W (Appendix VI.2.f). The largest structure, HP 7, has a heat loss range from 6478W to 9982W (Appendix VI.3.f). A simplified diagram (Fig. 4) has been included to clarify and relate the different calculations used to quantify the transfer of heat from an occupant to the housepit and the transfer of heat from the housepit to the exterior environment.

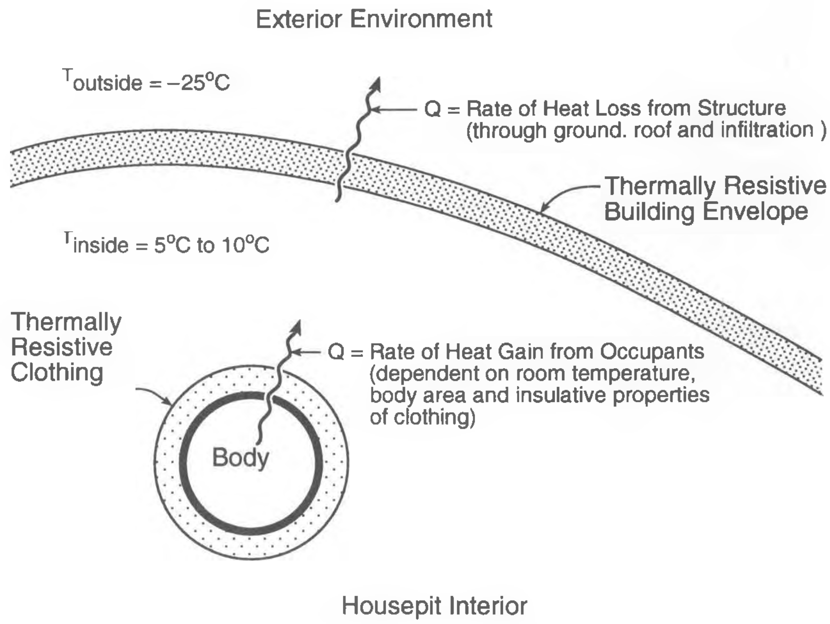

Figure 4. Diagram of Heat Gain Process.

Analysis

The summary of heat loss values (Appendix VI.4) indicates the effects that the size and shape of housepits have on the heat losses from the different components. The heat losses from the walls, floors and roofs of the two smaller housepits (HP 90 and HP 12) vary greatly from those of the larger housepit (HP 7). This can be explained using a simplified model. The area of a circle when doubled in size, increases by the square, or four times. This is roughly the magnitude of difference between the smaller and larger housepits (refer to heat loss range, Appendix VI.4.a).

The smallest housepits would likely have employed the assumed maximum roof pitch to gain headroom within the structure (refer to Figs. 1–3). The result of this would be a greater proportional roof area on the smaller housepits as compared to the larger one. With this larger proportional roof area comes an increase in roof component percentage heat loss (refer to percent average of total heat loss, Appendix VI.4.b).

While heat loss from the walls, floor and roof are governed mainly by area, the infiltration heat losses relate directly to volume. These heat loss values vary substantially between the large housepit and the smaller ones. Again in simple terms, when the size of a cone is doubled, the volume increases by the cube, or eight times the volume. This is roughly the magnitude of difference found with the large and smaller housepits (refer to heat loss range, Appendix VI.4.a). Moreover, the number of heat sources (bodies) increases only as a function of floor area and not volume.

Given that the assumptions made on housepit sizes, shapes, materials and construction are correct, then the heat loss for any given structure is static. Heat gain (assuming occupant body heat only), on the other hand, is not. Occupant populations are difficult to determine and generally change to some degree over time. This can have a major effect on heat generation. The population estimates derived from fixed densities (Appendix III.1) may be generally accurate, but do not allow for easy comparisons of the effects of housepit size at a given occupant density or occupant density at a given housepit size. By employing a wide range of densities (Appendix III.2) for a given housepit, the required population for effectively heating the structure through body heat can be examined.

By comparing the total heat loss values (Appendix VI.4.a) with the occupant heat gain values derived from ethnographic population estimates of housepits with fixed densities (Appendix IV.1), it can be seen that there is a very close balance between heat loss and heat gain in the smaller housepits. The larger housepit, however, does not have enough heat generated to even begin to offset the heat losses. For this heat balance to be achieved in HP 7, the occupant density would have to be increased to about one person for each 1.5 m^2 (Appendices IV.2 and IV.4.a) from the 2.5 m^2 deemed adequate for smaller structures. In simple terms this would mean a population of HP 7 of about 75 rather than 45. While densities of one person per 2.0 m^2 are recorded with some frequency for ethnographic housepits, densities of 1.5 m^2 per person are probably at the absolute limit and may only occur with the smallest structures in the coldest climates (Hayden et al. 1996), although Alexander's density estimates approach this value (Vol. II, Chap. 2).

Conclusions

Given all assumptions, it would appear from the near exact balance of the heat loss and heat gain in the smaller housepits that the assumed indoor design temperatures could be easily maintained by body heat alone for the outdoor design temperature of -25°C. Even with the steeper roof pitch as discussed earlier, the accompanying increased roof heat loss would not be sufficient to negate this heating strategy. If the smallest housepit had a very deep floor and a lower pitch roof, the indoor temperatures could be much higher.

As explained in the analysis section above, HP 7 does not even begin to come close to being able to be heated by body heat alone. A state of equilibrium between heat loss and heat gain could exist, but only at an indoor temperature of approximately 0°C. At this temperature survival would be unlikely over a longer period.

Another factor working against the body heat strategy in the largest housepits is the process of heat stratification. With the large volume and the high upper ceiling void that is created in large housepits, body heat would migrate upwards into this ceiling void where it would be of less use in creating a warmer environment. The warmer air being located next to a part of the roof with the least earth cover would be lost to the exterior environment at a much high rate. Inherently, as with any structure of this size, the laws of physics prevent this heating strategy from working unless the occupant population could be dramatically increased.

The above analysis and conclusions are based on a number of assumptions, some of which could be more accurately defined through further research, and others which will remain difficult to determine reliably. Given this situation, the research conducted here seems to suggest that heating some pithouses, particularly those in the smaller size range, at Keatley Creek using body heat alone, would likely have been viable. Thus other methods of heat generation or heat conservation were probably used in the larger structures, involving supplementary costs.

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Appendix I — Climatic Data (Lillooet Area)

1) Outdoor Design Temperatures [National Building Code of Canada, Supplement 1990]

The winter outdoor design temperature listed below represents the lowest temperature at the weather recording station (Lillooet) below which only a small percentage of the hourly outside air temperatures in January occur. The 1.0% value depicts a frequency level of hours that temperatures have been equalled or exceeded by 99% of the total hours in the months of December, January, and February.

January 1.0% = *-25°C*

2) Mean January Temperatures [Environment Canada Statistics]

day mean temperature = -2°C
night mean temp. = -9°C
overall mean temp. = *-5.6°C*

3) External Design Temperature of the Ground [Ashrae 1989:25.6]

Heat transfer through walls and floors to the ground depends on the difference between the room air temperature and the ground temperature outside as well as the wall and floor materials and the conductivity of the surrounding earth. Thermal inertia causes a time lag between outside air temperature changes and corresponding changes in ground temperature. This results in a variation in ground temperature at different depths. The ground surface temperature fluctuates about a mean value by a specific amplitude, which varies with geographic location. External design temperatures of the ground can be determined by subtracting the amplitude value from the mean winter air temperature. The amplitude for the Lillooet area has been determined by referring to the map of Lines of Constant Amplitude [Ashrae 1989:25.6 figure: 4].

from map of lines of constant amplitude (A)
= 10°C

mean January air temp. (t_a)
= -5.6°C

design temp. difference
= $t_a - A$ = -5.6°C – 10°C = *15.6°C*

4) Indoor Design Temperature = 5°C to 10°C

While no data exist for room temperatures in the Keatley Creek pithouses at the time of occupation, it has been assumed that room temperatures colder than 2°C would make survival unlikely. Heat given off from the occupant's bodies along with some ground heat would likely have regulated winter indoor temperatures well above the minimum for bare survival. A minimum room temperature range from 5°C to 10°C has therefore been assumed.

Appendix II — Occupant Heat Gain (body heat as only heat source)

Heat flow from the body of a person into the immediate environment can be slowed using insulation (clothing and blankets). With an increase in body height or, more specifically, in surface area, comes a corresponding increase in heat loss. Another factor affecting the rate of heat flow from a body is the temperature of the immediate environment (room temperature). This heat loss from the body acts as a source of heat gain for the environment and is often an important factor used in building design. While there are several methods for calculating this heat gain for building design (as shown below), each assumes an environmental temperature of approximately 20°C (normal room temperature) and the user wearing certain clothing (light shirt and slacks).

1) Occupant Heat Gain — method: 1 [Ashrae 1989:26.7, table: 3]

using comparable activity of "seated, very light work" sensible heat per person (adjusted to account for normal proportion of men women, and children) = 70W/person

2) Occupant Heat Gain — method: 2 [Stein and Reynolds 1992, table: 5.8]

using comparable activity of "office"
area per person = 9.29 m^2/person
sensible heat gain = 7.88W/m^2
9.29 m^2/person × 7.88W/m^2 = 73W/person

The heat gain values derived from methods 1 and 2 may be useful to begin to look at the rough impact of heating a pithouse with body heat, but another method which accounts for other variables could be employed. The lower environmental temperature, different body sizes, higher consumption of caloric rich food and greater use of clothing could be factored using the basic formula to determine heat flow as described in the following section.

3) Occupant Heat Gain — method: 3

$$[Q = U \times A(T_b - T_r)]$$

where:

Q = rate of heat flow
U = reciprocal of thermal resistance values
A = surface area of human body
T_b = body temperature (37°C)
T_r = room temperature (5 – 10°C) [Appendix I.4]

It should be noted that this formula does not allow for the many variables of body heat loss such as losses due to evaporation of body moisture, latent respiration, radiation and skin diffusion, all of which are covered in detail by Fanger (1970:19–37). Certain assumptions have been made regarding clothing and average body surface area.

Clothing used by the poorer families that lived in the Keatley Creek pithouses included willow bark and sagebrush bark robes and leggings, moss filled ponchos, fish skin moccasins, and blankets of sagebrush bark (Teit 1906:218). It appears that only the richest families had high quality fur and animal skin blankets and clothing. Insulative or thermal resistance values (clo-values) for clothing used have been interpolated from comparables compiled by Fanger (1970:33) along with standard surface air film values as follows:

surface air film = .030m^2°C/W
bedding (1 clo assumed) = .155m^2°C/W
(1 clo = .155m^2°C/W)
airspace = .050m^2°C/W
clothing (1 clo assumed) = .155m^2°C/W
total R-value = .390m^2°C/W
U-value = 1/R-value = *2.564W/m^2°C*

The average body surface area has been determined by Jennings (1978) at roughly 1.9 m^2 for a man and 1.6 m^2 for a woman. A value .85 m^2 for children was assumed to be a reasonable approximation. Since there is no information available on the ratios of men, women and children for the study pithouses at the time of occupation, the following proportions have been assumed:

25% men (at 1.9 m^2)
25% women (at 1.6 m^2)
50% children (at .85 m^2)
average body surface area =
.25(1.9 m^2) + .25(1.6 m^2) + .5(.85 m^2) = *1.30 m^2*

If people slept tightly together the effective surface area for any given body would be reduced, thereby reducing body heat loss. This condition has not been assumed for this study.

Occupant Heat Gain

$$Q = U \times A(T_b - T_r)$$

lower range:

Q = (2.564W/m^2°C) (1.30 m^2) (37°C - 10°C)
= 89.99W

upper range:

Q = (2.564W/m^2°C) (1.30 m^2) (37°C - 5°C)
= 106.66W

range: 90W to 107W/person

Appendix III — Population Ranges for Study Housepits

1) Population Estimates from Fixed Densities

Housepit population estimates as a function of floor area have been explored and determined to be roughly 2 m^2/person for small housepits and 2.5 m^2/person for large housepits (Hayden et al. 1996, Spafford 1991). By using these density values the resident populations of each study housepit can be determined as follows:

HP 90 (area from 5.1.1 = 24.6 m^2) ×
2.0 m^2/person = 12 people

HP 12 (area from 5.2.1 = 30.7 m^2) ×
2.0 m^2/person = 15 people

HP 7 (area from 5.3.1 = 113.1 m^2) ×
2.5 m^2/person = 45 people

2) Population Estimates from a Range of Densities

In order that the body heating strategy can be compared for all housepits at a fixed resident density or conversely for several densities at a fixed housepit size, population estimates as a function of floor area have been determined through a range of densities (1.0 m^2/person to 4.0 m^2/person) for the smallest and largest housepit as follows:

HP 90 (24.6 m^2)

(at 1.0 m^2/person) = 25 people
(at 1.5 m^2/person) = 16 people
(at 2.0 m^2/person) = 12 people
(at 2.5 m^2/person) = 10 people
(at 3.0 m^2/person) = 8 people
(at 3.5 m^2/person) = 7 people
(at 4.0 m^2/person) = 6 people

HP 7 (113.1 m^2)

(at 1.0 m^2/person) = 113 people
(at 1.5 m^2/person) = 75 people
(at 2.0 m^2/person) = 57 people
(at 2.5 m^2/person) = 45 people
(at 3.0 m^2/person) = 38 people
(at 3.5 m^2/person) = 32 people
(at 4.0 m^2/person) = 28 people

3) Actual Population Range Estimates

From the space per capita studies discussed in Appendix III.1, variable densities have been determined (Spafford 1991:24) which consider evidence from the excavation of the three study housepit sites. These variable densities yield a probable population range for each housepit as follows:

HP 90 = 9 to 12
[24.6m^2 ÷ (2.73m^2/person to 2.05m^2/person)]

HP 12 = 15 to 25
[30.7m^2 ÷ (2.04m^2/person to 1.23m^2/person)]

HP 7 = 37 to 56
[113.1m^2 ÷ (3.05m^2/person to 2.01m^2/person)]

Appendix IV — Total Heat Gain From People

1) Occupant Heat Gain from Population Estimates (Fixed Densities) (occupant heat gain [from II.3] × specific population [from III.1])

HP 90
lower range: 90W/person × 12 people = 1080W
upper range: 107W/person × 12 people = 1284W
range: *1080W to 1284W*

HP 12
lower range: 90W/person × 15 people = 1350W
upper range: 107W/person × 15 people = 1605W
range: *1350W to 1605W*

HP 7
lower range: 90W/person × 45 people = 4050W
upper range: 107/person × 45 people = 4815W
range: *4050W to 4815W*

2) Occupant Heat Gain from Population Estimates (Range of Densities) (occupant heat gain [from II.3] × specific population [from III.2])

HP 90
1.0 m^2/person 25 people × (90W–107W/person) = 2250W to 2675W
1.5 m^2/person 16 people × (90W–107W/person) = 1440W to 1712W
2.0 m^2/person 12 people × (90W–107W/person) = 1080W to 1284W
2.5 m^2/person 10 people × (90W–107W/person) = 900W to 1070W
3.0 m^2/person 8 people × (90W–107W/person) = 720W to 856W
3.5 m^2/person 7 people × (90W–107W/person) = 630W to 749W
4.0 m^2/person 6 people × (90W–107W/person) = 540W to 642W

HP 7
1.0 m^2/person 113 people × (90W–107W/person) = 10170W to 12091W
1.5 m^2/person 75 people × (90W–107W/person) = 6750W to 8025W
2.0 m^2/person 57 people × (90W–107W/person) = 5130W to 6099W
2.5 m^2/person 45 people × (90W–107W/person) = 4050W to 4815W
3.0 m^2/person 38 people × (90W–107W/person) = 3420W to 4066W
3.5 m^2/person 32 people × (90W–107W/person) = 2880W to 3424W
4.0 m^2/person 28 people × (90W–107W/person) = 2520W to 2996W

3) Occupant Heat Gain from Actual Population Range Estimates (occupant heat gain [from II.3] × population range [from III.3]

HP 90
lower range: 90W/person × 9 people = 810W
upper range: 107W/person × 12 people = 1284W
range: *810W to 1284W*

HP 12
lower range: 90W/person × 15 people = 1350W
upper range: 107W/person × 25 people = 2675W
range: *1350W to 2675W*

HP 7
lower range: 90W/person × 37 people = 3330W
upper range: 107/person × 56 people = 5992W
range: *3330W to 5992W*

Appendix V — Area and Volume Calculations for Study Housepits

1) Area and Volume Calculations for HP 90 (refer to Fig. 1)

a) Area of Earth Floor (HP 90) (@ 5.60 m diameter) [$A = \pi r^2$]

$A = p(2.80\ m)^2 = \mathit{24.6\ m^2}$

b) Area of Earth Walls (HP 90) [$A = \pi Dh$]

$A = \pi(5.60\ m)\ (.50\ m) = \mathit{8.8\ m^2}$

c) Area of Roof (HP 90) [$A = \pi rs$ (s = slant height of roof, $s^2 = r^2 + h^2$)]

r = 2.80 m
h = 1.96 m
s = 3.42 m
$A = \pi\ (2.80\ m)\ (3.42\ m) = \mathit{30.1\ m^2}$

d) Volume of Structure (HP 90)

i) volume above grade [$V = 1/3\pi r^2(h)$]
$V = 1/3\pi\ (2.80\ m)^2\ (1.96\ m)$
$= 16.1\ m^3$

ii) volume below grade [$V = \pi r^2(h)$]
$V = \pi(2.80\ m)^2\ (.50\ m)$
$= 12.3\ m^3$

iii) total volume of structure
$= 16.1\ m^3 + 12.3\ m^3 = \mathit{28.4\ m^3}$

22) Area and Volume Calculations for HP 12 (refer to Fig. 2)

a) Area of Earth Floor (HP 12) (@ 6.25 m diameter) [$A = \pi r^2$]

$A = \pi(3.125\ m)^2 = \mathit{30.7\ m^2}$

b) Area of Earth Walls (HP 12) [$A = \pi Dh$]

$A = \pi(6.25\ m)\ (.35\ m) = \mathit{6.9\ m^2}$

c) Area of Roof (HP 12) [$A = \pi rs$] (s = slant height of roof, $s^2 = r^2 + h^2$)

r = 3.125 m
h = 1.80 m
s = 3.61 m
$A = \pi(3.125\ m)\ (3.61\ m) = \mathit{35.4\ m^2}$

d) Volume of Structure (HP 12)

i) volume above grade [$V = 1/3\pi r^2(h)$]
$V = 1/3\pi(3.125\ m)^2\ (1.80\ m)$
$= 18.4\ m^3$

ii) volume below grade [$V = \pi r^2(h)$]
$V = \pi(3.125\ m)^2\ (.35\ m)$
$= 10.7\ m^3$

iii) total volume of structure
$= 18.4\ m^3 + 10.7\ m^3 = \mathit{29.1\ m^3}$

3) Area and Volume Calculations for HP 7 (refer to Fig. 3)

a) Area of Earth Floor (HP 7) (@ 12.00 m diameter) [$A = \pi r^2$]

$A = \pi(6.00\ m)^2 = \mathit{113.1\ m^2}$

b) Area of Earth Walls (HP 7) = area of cone: 1 (below grade) less area of cone: 2 (below floor)

[$A = \pi rs$ (s = slant height of roof, $s^2 = r^2 + h^2$)]

cone: 1 r = (6.00 m + .75 m) = 6.75 m
h = (9.60 m + 1.20 m) = 10.80 m
s = 12.74 m
$A1 = \pi(6.75\ m)\ (12.74\ m) = 270.2\ m^2$

cone: 2 r = (6.00 m)
h = (9.60 m)
s = 1.32 m
$A2 = \pi(6.00\ m)\ (11.32\ m) = 213.4\ m^2$

Awall = A1 - A2 = $\mathit{56.8\ m^2}$

c) Area of Roof (HP 7) [$A = \pi rs$ (s = slant height of roof, $s^2 = r^2 + h^2$)]

r = (6.00 m + .75 m) = 6.75 m
h = 3.15 m
s = 7.45 m
$A = \pi(6.75\ m)\ (7.45\ m) = \mathit{158.0\ m^2}$

d) Volume of Structure (HP 7)

i) volume above grade [$V = 1/3\pi r^2(h)$]
$V = 1/3\pi(6.75\ m)^2\ (3.15\ m) = 150.3\ m^3$

ii) volume below grade = volume of cone: 1 (below grade) less volume of cone: 2 (below floor)
[$V = 1/3\pi r^2(h)$]

cone: 1 r = (6.00 m + .75 m) = 6.75 m
h = (9.60 m + 1.20 m) = 10.80 m
$V1 = 1/3\pi(6.75\ m)^2\ (10.80\ m)$
$= 515.3\ m^2$

cone: 2 r = (6.00 m)
h = (9.60 m)
$V2 = 1/3\pi(6.00\ m)^2\ (9.60\ m)$
$= 361.9\ m^2$

V (below grade) = V1 - V2 = $153.4\ m^2$

iii) total volume of structure
$= 150.3\ m^3 + 153.4\ m^3 = \mathit{303.7\ m^3}$

Appendix VI — Heat Loss Calculations

1) Heat Loss Calculations for HP 90

a) Heat Loss Through Earth Floor (HP 90)

HP 90 floor area [from V.1.a] = 24.6 m^2
[from Ashrae 1989:25.6 table: 4]

at .5 m below grade and @ 5.60 m diameter floor interpolate to get .22W/m^2°C

[total floor heat loss = ave heat loss/m^2 × floor area (m^2)] = .22W/m^2°C (24.6 m^2) = *5.4W/°C*

b) Heat loss Through Earth Walls (HP 90)

i) area of wall from 0 m to .3 m below grade [A = πDh]

D = 5.60 m
h = 0.30 m
A = π(5.60 m) (0.30 m) = *5.3 m^2*

ii) area of wall from .3 m to .5 m below grade [A = πDh]

D = 5.60 m
h = 0.20 m
A = π(5.60 m) (0.20 m) = 3.5 m^2

iii) [Ashrae 1989:25.6 table: 3]

0 m – .3 m below grade: 2.33W/m^2°C × 5.3 m^2 = 12.3W/°C

.3 m – .5 m below grade: 1.26W/m^2°C × 3.5 m^2 = 5.1W/°C

total wall heat loss = *17.4W/°C*

c) Total Below Grade Heat Loss (HP 90)

total floor heat loss = 5.4W/°C

total wall heat loss = 17.4W/°C

total below grade heat loss = *22.8W/°C*

design temperature difference [from I.3] = 15.6°C

maximum rate of heat loss below grade floor and walls = 22.8W/°C × 15.6°C = *356W*

d) Heat Loss Through Roof (HP 90)

The following assumptions of roof components have been made based on historical accounts (Teit as cited by Kennedy Bouchard 1987:260) and will be treated as typical for all housepits:

i) outside surface film (6.7 m/s wind at winter)

ii) compact earth on roof (.25 m thick average)

iii) leaves, bark and conifer needles (.05 m thick)

iv) spaced joists (.15 m diameter at 1 m on centre)

v) inside surface film (still air)

Assume top roof opening closed with a cover (mat, skin, or other) and a covered lower exit allowing some infiltration air.

i) outside surface film [from Ashrae 1989:22.2 table: 1]
= *.030 m^2°C/W*

ii) compact soil on roof (.25 m thick average) comparable: "Chena River gravel" [Ashrae 1989:22.21 table: 12]

thermal conductivity (k) = 1.3W/m°C

thermal resistivity (r) = 1/k = .769 m°C/W

thermal resistance (R) = r × thickness
= .769 m°C/W (.25 m)
= *.192 m^2°C/W*

iii) leaves, bark, and conifer needles (.05 m thick) comparable: "sawdust and shavings" [Stein and Reynolds 1992: table: 4.2]

thermal resistivity(r) = 15.39 m°C/W

thermal resistance(R) = 15.39 m°C/W (.05 m)
= *.770 m^2°C/W*

iv) decking of aspen saplings laid tight (.10 m dia) comparable: "birch" [from Ashrae 1989:22.9 table: 4]

thermal conductivity (k) = .171W/m°C

thermal resistivity (r) = 1/k = 5.85 m°C/W

area of 1 sapling = .0079 m^2

rectangle of similar area = .0079 m^2/.10 m
= .079 m

thermal resistance(R) = 5.85 m°C/W (.079 m)
= *.462 m^2°C/W*

v) spaced joists (.15 m dia @ 1 m o.c.) comparable: "D.fir" [from Ashrae 1989:22.9 table:4]

thermal conductivity(k) = .141W/m°C

thermal resistivity(r) = 1/k = 7.09 m°C/W

area of 1 joist = .0177 m^2

rectangle of similar area = .0177 m^2/.15 m
= .118 m

spacing factor 1 m spacing/.15 m = 6.66 spaces/m

ave. continuous thickness = .118 m/6.66 = .0177 m thermal resistance(R) = 7.09 m°C/W (.0177 m)

= *.126 m^2°C/W*

vi) inside surface film [from Ashrae 1989:22.2 table: 1]

= .110 m^2°C/W

vii) sum of thermal resistance values (ΣR)

(.030 + .192 + .770 + .462 + .126 + .110) = 1.690 m^2°C/W

thermal transmittance (U)

U = 1/ΣR = 1/1.690 m^2°C/W

= *.592W/m^2°C*

viii) maximum rate of heat loss(Q) through roof [Q = U × A × (T_i - T_o)]

T_{inside} = 5 to 10°C [from I.4]

$T_{outside}$ = -25°C [from I.1]

U = .592W/m^2°C [from VI.7]

A = 30.1 m^2 [from V.1.3]

lower range:

Q = (.592W/m^2°C) (30.1 m^2) (5°C - (-25°C)) = 534.6W

upper range:

Q = (.592W/m^2°C) (30.1 m^2) (10°C - (-25°C)) = 623.7W

range: 535W to 624W

e) Heat Loss Due to Infiltration (HP 90)

assuming air leakage out past covered top entry and infiltration air leaking in through covered side entry

number of air changes per hour (N) in North American house construction ranges from .2/h (tight) to 2.0/h (leaky) [Ashrae 1989:23.9]

assume appropriate range for housepits would fall within .75/h to 1.5/h

using air change method [from Ashrae 1989:25.9] [Q = 1/3(N)(V)(t_i-t_o)]

Q = heat loss(W)

N = air changes/hr (.75/h to 1.5/h) [from VI.1.e]

V = volume of room (28.4 m^3) [from V.1.d.iii]

t_i = inside design temp (5 to 10°C) [from I.4]

t_o = outside design temp (-25°C) [from I.1]

lower range:

Q = 1/3 (.75/h) (28.4 m^3) (5°C - (-25°C)) = 213.0W

upper range:

Q = 1/3 (1.5/h)(28.4 m^3) (10°C - (-25°C)) = 497.0W

range: 213W to 497W

f) Maximum Rate of Total Heat Loss from HP 90

lower range:

walls and floor = 356W

roof = 535W

infiltration = 213W

total lower range = 1104W

upper range:

walls and floor = 356W

roof = 642W

infiltration = 497W

total upper range = 1495W

range: 1104W to 1495W

2) Heat Loss Calculations for HP 12

a) Heat Loss Through Earth Floor (HP 12)

HP 12 floor area [from V.2.a] = 30.7 m^2

[from Ashrae 1989:25.6 table: 4]

at .35 m below grade and @ 6.25 m diameter floor interpolate to get .22W/m^2°C

total floor heat loss = ave heat loss/m^2 × floor area (m^2)

= .22W/m^2°C (30.7 m^2) = *6.8W/°C*

b) Heat loss Through Earth Walls (HP 12)

i) area of wall from 0 m to .35 m below grade [A = πDh]

D = 6.25 m

h = .35 m

A = π(6.25 m) (.35 m) = 6.9 m^2

ii) [Ashrae 1989:25.6 table: 3]

0 m – .35 m below grade: 2.33W/m^2°C × 6.9 m^2 = 16.1W/°C

total wall heat loss = *16.1W/°C*

c) Total Below Grade Heat Loss (HP 12)

total floor heat loss = 6.8W/°C

total wall heat loss = 16.1W/°C

total below grade heat loss = *22.9W/°C*

design temperature difference [from I.3] = 15.6°C

maximum rate of heat loss below grade floor and walls = 22.9W/°C × 15.6°C = *357W*

d) Heat Loss Through Roof (HP 12)

refer to section VI.1.d (HP 90 roof heat loss calculations) for typical roof component descriptions and their thermal properties which are considered typical for all housepits

maximum rate of heat loss(Q) through roof [Q = U × A × (T_i - T_o)]

T_{inside} = 5 to 10°C [from I.4]
$T_{outside}$ = -25°C [from I.1]
U = .592W/m^2°C [from VI.6]
A = 35.4 m^2 [from V.2.c]

lower range:
Q = (.592W/m^2°C) (35.4 m^2) (5°C - (-25°C))
= 628.7W

upper range:
Q = (.592W/m^2°C) (35.4 m^2) (10°C - (-25°C))
= 733.5W

range: 629W to 734W

e) Heat Loss Due to Infiltration (HP 12) [refer to assumptions F.1.e] using air change method [from Ashrae 1989:25.9] [Q = 1/3(N)(V)(t_i-t_o)]

Q = heat loss (W)
N = air changes/hr (.75/h to 1.5/h) [from VI.1.e]
V = volume of room (29.1 m^3) [from V.2.d.iii]
t_i = inside design temp (5 to 10°C) [from I.4]
t_o = outside design temp (-25°C) [from I.1]

lower range:
Q = 1/3 (.75/h) (29.1 m^3) (5°C - (-25°C))
= 218.3W

upper range:
Q = 1/3 (1.5/h) (29.1 m^3) (10°C - (-25°C))
= 509.3W

range: 218W to 509W

f) Maximum Rate of Total Heat Loss From HP 12

lower range:
walls and floor = 357W
roof = 629W
infiltration = 218W
total lower range = 1204W

upper range:
walls and floor = 357W
roof = 734W
infiltration = 509W
total upper range = 1600W

range: 1204W to 1600W

3) Heat Loss Calculations for HP 7

a) Heat Loss Through Earth Floor (HP 7)

HP 7 floor area [from V.3.c] = 113.1 m^2

[from Ashrae 1989:25.6 table: 4]

if floor was a square of same area it would have a side dimension of 10.6 m, therefore from table: 4 use 10.5 m (shortest width)

at 1.20 m below grade interpolate to get .13W/m^2°C

total floor heat loss = ave heat loss/m^2 × floor area (m^2)
= .13W/m^2°C(113.1 m^2) = *14.7W/°C*

b) Heat loss Through Earth Walls (HP 7)

i) area of wall from 0 m to .3 m below grade

surface area of total cone below grade [A = πrs]

r = (6.00 m + .75 m) = 6.75 m
h = (9.60 m + 1.20 m) = 10.80 m
s = 12.74 m (slant height of cone where $s^2 = r^2 + h^2$)
A = π(6.75 m) (12.74 m)
= 270.2 m^2

surface area of total cone below .30 m deep

r = 6.56 m
h = (10.80 m - .30 m) = 10.50 m
s = 12.38 m
A = π(6.56 m) (12.38 m)
= 255.1 m^2

area of wall from 0 to .3 m deep
= 270.2 m - 255.1 = 15.1 m^2

ii) area of wall from .3 m to .6 m below grade

surface area of total cone below .3 m deep = 255.1 m^2

surface area of total cone below .60 m deep

r = 6.38 m
h = (10.80 m - .60 m) = 10.20 m
s = 12.03 m
A = π(6.38 m) (12.03 m)
= 241.1 m^2

area of wall from .3 to .6 m deep
= 255.1 m - 241.1 = 14.0 m^2

iii) area of wall from .6 m to .9 m below grade

surface area of total cone below .6 m deep = 241.1 m^2

surface area of total cone below .90 m deep

r = 6.19 m
h = (10.80 m - .90 m) = 9.90 m
s = 11.68 m
A = π(6.19 m) (11.68 m)
= 227.2 m^2

area of wall from .6 to .9 m deep
= 241.1 m - 227.2 m = 13.9 m^2

iv) area of wall from .9 m to 1.2 m below grade

surface area of total cone below .9 m deep = 227.2 m^2

surface area of total cone below 1.20 m deep

r = 6.00 m

h = 9.60 m
s = 11.32 m
A = π(6.00 m) (11.32 m)
= 213.4 m^2

area of wall from .9 to 1.2 m deep
= 227.2 m - 213.4 m = 13.8 m^2

v) [Ashrae 1989:25.6 table: 3]
0 m – .3 m below grade: 2.33W/m^2°C × 15.1 m^2 = 35.2W/°C
.3 m – .6 m below grade: 1.26W/m^2°C × 14.2 m^2 = 17.9W/°C
.6 m – .9 m below grade: 0.88W/m^2°C × 13.9 m^2 = 12.2W/°C
.9 m – 1.2 m below grade: .67W/m^2°C × 13.8 m^2 = 9.3W/°C
total wall heat loss = *74.6W/°C*

c) Total Below Grade Heat Loss (HP 7)

total floor heat loss = 14.7W/°C

total wall heat loss = 74.6W/°C

total below grade heat loss = *89.3W/°C*

design temperature difference [from I.3] = 15.6°C

maximum rate of heat loss below grade floor and walls

= 89.3W/°C × 15.6°C = *1393W*

d) Heat Loss Through Roof (HP 7)

refer to section VI.1.d (HP 90 roof heat loss calculations) for typical roof component descriptions and their thermal properties which are considered typical for all housepits

i) maximum rate of heat loss(Q) through roof [Q = U × A × (T_i - T_o)]

T_{inside} = 5 to 10°C [from I.4]

$T_{outside}$ = -25°C [from I.1]

U = .592W/m^2°C [from VI.6]

A = 158.0 m^2 [from V.3.c]

lower range:
Q = (.592W/m^2°C) (158.0 m^2) (5°C - (-25°C))
= 2806.5W

upper range:
Q = (.592W/m^2°C) (158.0 m^2) (10°C - (-25°C))
= 3273.8W

range: 2807W to 3274W

e) Heat Loss Due to Infiltration (HP 7) [refer to assumptions VI.1.e] using air change method [from Ashrae 1989:25.9] [Q = 1/3(N)(V)(t_i - t_o)]

Q = heat loss (W)
N = air changes/hr (.75/h to 1.5/h) [from VI.1.e]
V = volume of room (303.7 m^3) [from V.3.d.iii]
t_i = inside design temp (5 to 10°C) [from I.4]
t_o = outside design temp (-25°C) [from I.1]

lower range:
Q = 1/3 (.75/h) (303.7 m^3) (5°C - (-25°C))
= 2277.8W

upper range:
Q = 1/3 (1.5/h) (303.7 m^3) (10°C - (-25°C))
= 5314.8W

range: 2278W to 5315W

f) Maximum Rate of Total Heat Loss from HP 7

lower range:
walls and floor = 1393W
roof = 2807W
infiltration = 2278W
total lower range = 6478W

upper range:
walls and floor = 1393W
roof = 3274W
infiltration = 5315W
total upper range = 9982W

range: 6478W to 9982W

4) Summary of Heat Loss Values for Study Housepits

a) Heat loss range of components (Watts) and total heat loss.

i) HP 90
walls and floor = 356W *(from VI.1.c)*
roof = 535–642W *(from VI.1.d.viii)*
infiltration = 213–497W *(from VI.1.e)*
total heat loss = 1104–1495W (from VI.1.f)

ii) HP 12
walls and floor = 357W *(from VI.2.c)*
roof = 629–734W *(from VI.2.d)*
infiltration = 218–509W *(from VI.2.e)*
total heat loss = 1204–1600W (from VI.2.f)

iii) HP 7
walls and floor = 1393W *(from VI.3.c)*
roof = 2807–3274W *(from VI.3.d)*
infiltration = 2278–5315W *(from VI.3.e)*
total heat loss = 6478–9982W (from VI.3.f)

b) (Percent Range) and [Percent Average] of Heat Loss by Components *(from VI.4.a) (component heat loss as percentage of total heat loss and [average of percentage range]*

i) HP 90

walls and floor	(24–32%)	[28%]
roof	(43–49%)	[46%]
infiltration	(19–33%)	[26%]

ii) HP 12

walls and floor	(22–30%)	[26%]
roof	(46–52%)	[49%]
infiltration	(18–32%)	[25%]

iii) HP 7

walls and floor	(14–22%)	[18%]
roof	(33–43%)	[38%]
infiltration	(35–53%)	[44%]

Conclusions

Chapter 17

An Overview of the Classic Lillooet Occupation at Keatley Creek

Brian Hayden

Introduction

After 13 years of excavation, research, and analysis, what can be said about the nature of the Keatley Creek community at its height, or just prior to abandonment? What conclusions have been reached concerning the initial problems that we sought to resolve concerning the reasons for the existence of unusually large housepit residences? In this chapter, I will deal first with the resources available to Keatley Creek residents followed by a discussion of the relationship of resources to socioeconomic organization at the household and village level.

There are some conclusions that can be presented with a great amount of confidence. In these cases, the archaeological and ethnographic records are clear and unambiguous; they make logical sense and agree with each other. Other conclusions are more tentative; and still other conclusions only represent interesting possibilities requiring further information to either confirm or refute. I will try to identify each of these levels of confidence (relatively certain, probable, and possible) in the following discussion.

Much of the following summary builds upon previous work that is extensive in its own right (Hayden 1992a, b; 1995). Rather than repeat this research in detail, I will try to briefly summarize the main concepts and refer readers to the more complete presentations for other details.

Resources

Modifications to Previous Reports

As argued earlier (Vol. I, Chap. 1) and elsewhere (Hayden 1992a, b), the nature of the resources that a community can extract with its existing technology should have substantial ramifications for the community's size and socioeconomic organization. This may be especially true for hunter/gatherers, and we are very confident that the prehistoric residents of Keatley Creek were hunter/gatherer/fishers. Considerable effort was therefore expended in trying to understand what those resources were and whether they had any reasonable relationship to socioeconomic organization at Keatley Creek, particularly as it pertained to the large residential corporate groups. The comprehensive results of our initial inventory based on the ethnographic use of resources by the two Stl'atl'imx bands nearest to the site (the Ts'kw'aylaxw Band at Pavilion and the Xaxli'p Band at Fountain) have already been published (see Hayden 1992a). At that time, we considered the existing hunting, fishing, and plant gathering boundaries of these two bands to most likely reflect prehistoric boundaries. In these studies, traditional band territories met in a vaguely defined zone around the summits of the Clear Range mountains.

Subsequently, in discussions with David Pokotylo, it seems that these boundaries should probably be extended to the east, down onto the floor, or even throughout, Upper Hat Creek Valley (Vol. I, Chap. 1, Figs. 3 and 7). Pokotylo's research in this valley established that it was largely used by transient groups, probably hunting; but that substantial numbers of root roasting pits also occurred on the upper valley slopes and in the valley floor. Interestingly, the largest root roasting pits only occurred from 2,250 to 1,150 BP after which only small roasting pits were used (Pokotylo and Froese 1983:152). This coincides almost exactly with the time period that large residential corporate groups were occupied at Keatley Creek, and Pokotylo suggests that their large size might have been due to larger cooperative economic units exploiting the valley for roots prior to 1,000 BP. The Upper Hat Creek Valley is about equidistant from the Fraser, the Bonaparte, and the Thompson Rivers. However, there are no large prehistoric housepit sites on the Bonaparte or Thompson Rivers within easy access to the Upper Hat Creek Valley. Only the Fraser River has large sites like the Keatley Creek and the Bell sites, and the populations there must have been so much larger than communities along the other rivers that the Fraser Valley communities would have needed access to greater root gathering and hunting land. These large communities would also be able to forcibly dominate neighboring groups to the east if necessary. The fact that large roasting pits ceased to be built or used at almost the exact same time that the large communities along the Fraser River were abandoned strongly supports this interpretation.

Thus, we have extended the postulated boundaries of the prehistoric Keatley Creek community far into the Upper Hat Creek Valley. Like other high altitude valleys (e.g., Botanie Valley), the Upper Hat Creek valley may have been a summer rendez-vous and root collecting area for many surrounding bands, and presumably would have been richer in geophyte foods than has been the case since. The presence of a few housepits and some very large root roasting pits at the junction of Hat Creek Valley and Marble Canyon indicates that there were probably relatively abundant geophyte foods in this locality in the past since the fish resources here are negligible. These extended boundaries do not directly affect the nature of the resource models used in the present studies, except that they provide important support for the lithic procurement models advanced in Bakewell (Vol. I, Chap. 16) and for the previous models of resource use formulated by Alexander (1992).

Another important modification of the general resource base as presented in 1992 involves the species of salmon available. The research by Berry (Vol. II, Chap. 8) and Kew (1992) indicate that pink salmon were the most abundant species of salmon in the Fraser River around Lillooet prior to the Hell's Gate landslide of 1913, and prior to the abandonment of the large Classic Lillooet villages. Pink salmon are relatively small and have less fat than other salmon species. They are relatively weak swimmers and therefore they swim close to the shore. They are thus easier to catch and dry (often with the vertebral column left in the fillet). They are also very susceptible to having their migrations blocked by obstacles such as landslides. The heavy dependency on pink salmon documented at Keatley Creek indicates that the basic subsistence economy would have been very vulnerable to natural perturbations in salmon migrations.

Overview of Subsistence

On the basis of early ethnographies, our recent ethnoarchaeological studies (in Hayden 1992c), and archaeological material, a number of general conclusions can be advanced with relative confidence about the subsistence at Keatley Creek. The foremost conclusion is that the Lillooet subsistence system was an extremely simplified one with very few staples accounting for the overwhelming bulk of foods consumed. Salmon was the single most important staple in the region. No other resource is now, or ever seems to have been, abundant enough to support large communities and population densities that characterized either the ethnographic or the Classic Lillooet periods. The ungulate ranges around Keatley Creek are of poor quality. Even with the Keatley Creek traditional band range extended to include much of Upper Hat Creek, the average total annual deer harvest (assuming humans culled 10% and cougars culled 10%) was probably not much more than 35, with no moose, only eight elk, and about five sheep (Dave Low, personal communication). Such densities could be easily overhunted by a population the size of Keatley Creek, or even much smaller groups as demonstrated by the overhunting of Upper Hat Creek, the Nicola Valley, and Chilcotin areas in historic times (Greaves 1990:92; Teit 1900:230; 1909:462; Wyatt 1972:197, 201, 212). While ungulate bones are common in the Keatley Creek deposits, they are primarily small smashed fragments that could all be from very few animals. Moreover, it is doubtful that the animals that these bones represent were killed more than a few kilometers from the site, whereas most ungulates were hunted in the summer and fall, high in the mountains where their bones would have been left.

The mainstay of the salmon component was probably pink salmon, with the second largest component being sockeye salmon, and a relatively minor but important component comprised of spring salmon. The sockeye and especially the spring salmon would have been the species of choice for drying and trading, while pinks would have been used almost entirely for domestic consumption especially by poorer families. Although it is venturesome to estimate the exact proportions of these species in Keatley Creek subsistence due to the range of possible faunal assemblage formation factors (discussed in Vol. I, Chap. 17), if I were to hazard a guess, I would think that about 50–70% of all salmon might be composed of pinks, 20–40% of sockeye, and 10–20% of springs. It is worth emphasizing that there is strong evidence of episodic periods of starvation even in the very earliest years of contact (Kennedy and Bouchard 1992:319; Romanoff 1992b:481–3; Hayden 1992b:531; see also Mullan 1987:33–4 for accounts of starvation on the Columbia in 1811, 1825, 1826, and 1831). These accounts are important for our understanding of the dynamics of cultural changes and the identification of factors associated with increasing cultural complexity. On the basis of these data, the occurrence of food shortages at 10 or 20 year intervals does not seem to have been a critical factor (Hayden 1992b:531).

On the other hand, Drake-Terry (1989:24, 28, 47, 56, 72) has argued that fur trading activities led to the overexploitation of furbearers in the Fort Kamloops area by 1840, as well as gold mining resulting in overexploitation of game and fish in the Lillooet region by 1858. In addition, she argues that excessive salmon fishing at Fort Langley on the Lower Fraser River resulted in native starvation upriver from 1859–61. Without further documentation, it is difficult to assess these arguments. For instance, Codere (1950:28–9) maintains that even as late as 1880, commercial fishermen were only taking 61,000 cases of salmon out of British Columbia waters, and that even much greater harvesting in subsequent years did not have an adverse effect on Indian subsistence fishing. However, what is clear is that periods of starvation and fish failures did occur in a cyclic fashion decades before any significant impact of the European presence occurred.

There are few indications that highly productive geophyte patches would have been available to Keatley Creek residents, or that they brought back any substantial quantities of dried roots to the Keatley Creek winter base camp (Vol. I, Chaps. 9 and 17). There is evidence at Keatley Creek for the presence and use of a number of berries which are abundant throughout the region; however, their sparse remains do not indicate that they constituted a stored staple of major importance during the winter months. Climatic changes over the past 2,000 years do not appear to have been of great enough magnitude to have changed these assessments dramatically. On the basis of radioisotope analyses, it is probably realistic to view up to 70% of the overall diet as composed of salmon (Chisholm 1986; Lovell et al. 1986), with the vast majority of the non-salmon foods such as geophytes, berries, and ungulates being consumed during the spring, early summer and late fall. Impressionistically, it seems that dried salmon may have accounted for as much as 80–90% of all food consumed during the winter in housepit villages. The remainder would be composed of stored berries and geophytes together with very occasional dried meat and fresh animal kills.

Community Size

Community size is one of the most important cultural traits that is strongly influenced by the nature of the "extractable" resources of an area (i.e., those food resources that can be obtained with existing technology and other cultural constraints). In general, it can be argued that for subsistence-based societies, community size should be a function of local resources. Abundance and the spatial restriction of resources, as well as the need for cooperative labor to extract food at optimal rates (e.g., Beckerman 1983), are perhaps the most common and relevant resource characteristics of relevance. In the Mid Fraser Canyon, restricted numbers of water sources may have also constrained the number of sites that could be inhabited, although Keatley Creek is one of the smallest creeks of the entire Middle Fraser Canyon. It must also be acknowledged that other factors sometimes play important roles (Vol. II, Chap. 2), such as defense considerations (Keeley 1996), the desire to be close to trade routes (e.g., the effect of the fur trade on native settlement patterns and sizes), the cost of moving residences, and the availability of suitable community sites (see also E. Smith 1981). Of special relevance is Alexander's (Vol. II, Chap. 2) observation that larger settlements are needed to defend wealthier groups.

Community size, in turn, has an important effect on many other community characteristics such the need for hierarchical organization (G. Johnson 1982), the need for specialists (including types of political officials), and the ability to wage war. The settlement at Keatley Creek does not appear to have been defensive in nature although shear size is often a major deterrent of attacks. On the other hand, winter may not have been a time when raids generally took place due to the difficulty of traversing snow-bound mountain passes (Desmond Peters, Senior, personal communication). Although habitation sites may have been somewhat limited by water resources, there is little correlation between water flow and community size, and there are at least 184 recorded housepit sites between Lytton and Pavilion (Vol. I, Chap. 1, Fig 3). If water availability was the factor most influencing site size, we should find many more large sites at major creek locations such as Sallus Creek and far fewer small dispersed sites. Thus, by process of elimination, it would appear that the large size of the Keatley Creek village can best be understood in terms of abundant local resources and the generation of substantial wealth. Control over trade routes may have also played a role, although it is not evident why Keatley Creek should have had greater advantages in this respect than any other village in the area on the Fraser terraces.

The location of the Keatley Creek village makes most sense in terms of optimal proximity to wood, water, and primary fish procurement locations. Locations that provided some shelter from winds, and the size of the area suitable for occupation may have also played roles in site selection. However, when one observes the degree of adaptability of community residents to locations such as the Bell site, located high up on a steep mountain slope, it seems that there must have been many suitable physical sites for housepit villages.

Binford (1990:131) has suggested that sedentism is primarily related to storage and cold climate. Both these factors are relevant to understanding the existence of Keatley Creek since large amounts of fish were stored in order to survive the harshest months of the year. However, abundance of resources must also be taken into account, as examples such as the Calusa (who did not store food or endure seasonally frigid temperatures, being situated in Florida) and many horticultural communities demonstrate since these groups do not reside in cold climates and frequently did not use storage facilities. It is also interesting to view the major residential corporate groups of large settlements like Keatley Creek as simply extended aggregation phases of otherwise independent hunting and gathering bands that come together for socialization, marriages, alliances, and rituals during the winter, and then separated into independent local groups for the rest of the year (Wills and Windes 1989). As we have seen, the major corporate groups at Keatley Creek seem to have exploited distinctly separate ranges when they were not residing at Keatley Creek (Vol. I, Chap. 16).

Sources of Salmon at Keatley Creek

The overwhelming importance of salmon in the prehistoric diet of the residents at Keatley Creek is one of the more certain conclusions that have been established by our own research and the research of others. Ethnography, history, isotopic analysis, archaeology, and studies of regional extractable resources all concur in indicating that salmon was more important than all other foods combined. Given the strength of this conclusion, it might next be asked where the salmon procurement sites were for the largest, most populous community of the entire Classic Lillooet region. Other major sites such as the Bridge River site, the Bell site (as well as their corresponding modern communities), the McKay Creek settlements, and the Seton site are situated near prime fish procurement locations on the Fraser River—the Six Mile fishery and the Ten Mile fishery, a prime fishing location near McKay Creek recorded in Hayden 1992c, and the Seton River fishery, respectively. Moreover, Sam Mitchell (Bouchard and Kennedy 1973) stated that people in winter villages always lived near their fishing places. While the prehistoric residents of Keatley Creek may have procured some of their salmon from the fisheries associated with other village sites, the substantial prehistoric transportation costs lead one to expect the establishment of winter villages relatively close to productive fisheries. What important fisheries are close to Keatley Creek? Our ethnoarchaeological inventory of fisheries along the Fraser River (Kennedy and Bouchard 1992; Tyhurst 1992:363) indicated that there were no major fisheries between the Ten Mile rapids just below the Bell site and Skwish Creek, about 3 km upstream from Pavilion. Only at the mouth of Sallus Creek and at a rocky point about a kilometer above the "Camelsfoot constriction" are there minor rock outcrops that could be used for effective fishing of deep swimming salmon. Such locations are suitable for use by a few people, but are generally not very highly productive (Tyhurst 1992:357). With no obvious, highly productive sources in the immediate Keatley Creek vicinity to produce the vast amounts of salmon that must have been consumed at Keatley Creek, we are faced with a conundrum.

There are several possible answers to the paradox of where the salmon must have come from. I will not consider the possibilities that other resources were used by residents or that population estimates have been exaggerated by many times. There are no good data or other arguments to sustain such interpretations, whereas all the data except the identification of the salmon procurement sites, support the premise of a populous community at Keatley Creek relying heavily upon salmon. Assuming these interpretations are correct, the possible salmon sources include:

1) Trade with other groups established at the principal fisheries. This seems unlikely since Keatley Creek has no resources that the other sites would not also have.
2) Direct procurement of salmon at the other major fisheries, especially at the Six and Ten Mile fisheries. This also seems unlikely given the transport costs involved. Moreover, it raises questions about why settlements closer to these highly productive fisheries would not have been much larger.
3) The long stretches of gravel shorelines near Keatley Creek may have been unusually productive for

procuring pink salmon, although they are not suitable for procuring other types of salmon. This is a speculative possibility, but we have virtually no information on traditional fishing techniques for pink salmon since these runs were eliminated by the Hells Gate landslide of 1913. It seems possible that simple artificial brush or rock jetties along the gravel shores of the Fraser River might have been sufficient to create effective procurement sites for these weak swimming, shore-hugging fish. A simple dip net technology (in contrast to the longer, larger, and more complex dip nets used for sockeye and spring salmon) would be adequate to harvest pinks from these locations.

4) Substantial changes may have occurred over the last thousand years in the rock outcrops that intersect the Fraser River in the vicinity of Keatley Creek. In particular, the outcrops at the mouth of Sallus Creek may have collapsed or been eroded to less productive forms. In addition, the fresh-looking shear rock faces at the Camelsfoot constriction (Fig. 1) seem to indicate that substantial shearing, spalling, or collapse of this major rock formation has occurred sometime in the last millennium and may have altered some fishing sites. However, it must be admitted that this cliff face is so shear and tall, and the river constriction below it is so narrow, that it is difficult to imagine how this or nearby locations could have ever been used for fishing, or how the contours of the bedrock outcrops could ever have been much different.

Figure 1. An aerial view of the Fraser River at the Camelsfoot constriction near the Keatley Creek site. The sheer rock wall on the left is casting a sharp shadow.

5) Although the walls of the Camelsfoot constriction are shear, it is possible that artificial platforms could have been suspended along the rockfaces from anchors above and back from the rockfaces. These platforms could have enabled fishermen to obtain salmon in great abundance since all species of salmon would have been forced close against the canyon walls. The extremely narrow canyon would have provided ideal conditions for concentrating salmon in this fashion as well as immediately downstream where they would congregate while resting before the ascent through the canyon. The only problem would have been access. That Interior Salish Indians could have engineered such access is indicated in the accounts from Simon Fraser of crossing the precipitous cliff faces at Hell's Gate. Because of the importance of these observations for our potential understanding of fishing technology near Keatley Creek, I quote these passages at length:

> I have been for a long period among the Rocky Mountains, but have never seen any thing equal to this country, for I cannot find words to describe our situation at times. We had to pass where no human being should venture . . . steps which are formed like a ladder, or the shrouds of a ship, by poles hanging to one another and crossed at certain distances with twigs and withes, suspended from the top to the foot of precipices, and fastened at both ends to stones and trees, furnished a safe and convenient passage to the Natives—but we, who had not the advantages of their experience, were often in imminent danger. (Lamb 1960:96)

> The road was inconceivably bad. We had to pass many difficult rocks, defiles and precipices, through which there was a kind of beaten path used by the natives, and made passable by means of scaffolds, bridges and ladders so peculiarly constructed, that it required no small degree of necessity, dexterity and courage in strangers to undertake a passage through such intricacies of apparent danger as we had to encounter on this occasion. For instance we had to ascend precipices by means of ladders composed of two long poles placed upright and parallel with sticks crossways tied with twigs. Upon the end of these others were placed, and so on for any height. Add to this that the ladders were often so slack that

> the smallest breeze put them in motion—swinging them against the rocks—while the steps were so narrow and irregular leading from scaffold to scaffold, that they could scarcely be traced by the feet without the greatest care and circumspection; the most perilous was, when another rock projected over the one you were leaving. . . . The descents were still worse. . . . the Indians . . . thought nothing of these difficulties, but went up and down these wild places with the same agility as sailors do on board of a ship. (Lamb 1960:116–7)

It is also worth remembering that even at contact, the Indians had established a substantial rope bridge over Bridge River and over the Chilko River (Teit 1909:583), indicating that their rope technology could be quite sophisticated when the rewards justified the necessary investment of time and effort. Furthermore, suspended fishing platforms were popularly used elsewhere on the Plateau. In 1872, along the Fraser River Canyon, A.C. Anderson observed that "scoop nets are chiefly used, which are wrought from stages (scaffolds) suspended from the rocks bordering on rapid currents." (Kennedy and Bouchard 1992:284). Dawson (1989:55) saw similar "structures of poles" suspended from higher parts of banks used for fishing in 1875 between Yale and Lytton. Even in more recent years, Desmond Peters, Senior (personal communication) used similar scaffolds for fishing in the Lillooet region. At the Dalles, up until comparatively recent times, scaffolds were also used (Fig. 2). Without historical documentation, I had originally assumed that the suspended platforms at the Dalles were probably a recent development that occurred with the introduction of industrial technology. However, Simon Fraser's and Anderson's descriptions make it seem much more likely that the platforms at the Dalles had prehistoric origins, and that similar scaffolding might have been used at the Camelsfoot constriction by groups able to construct the necessary facilities to procure major quantities of sockeye and

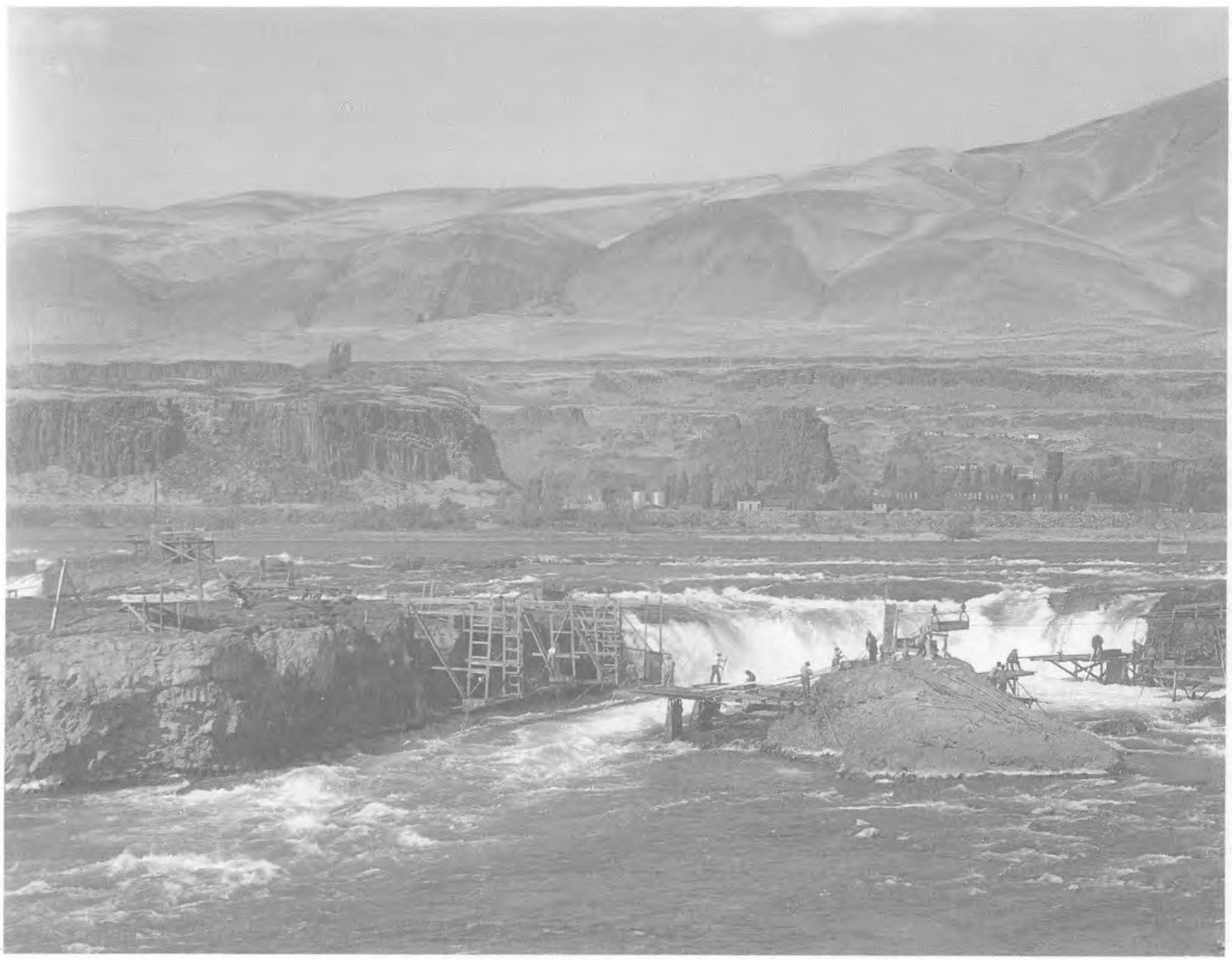

Figure 2. Platforms and scaffolds constructed at the Dalles in order to intensify procurement of salmon. Note in particular the scaffolds "hung" from the rock faces to the left of the main falls; similar scaffolds may have been used by residents of Keatley Creek at the Camelsfoot constriction. (Photo by David Cole, 1956).

spring salmon. Whether this technology would have been adequate to overcome the shear canyon walls at the Camelsfoot constriction remains to be determined.

In sum, there are enough plausible scenarios for the procurement of abundant amounts of salmon in the Keatley Creek vicinity for us to assume not only that it was possible, but that it actually occurred and supported the large populations at the Keatley Creek site. Although we have not been able to explore these possibilities (indeed it is conceivable that the evidence may even be beyond archaeological recovery due to spalling and landslides at key locations), they can be treated as hypotheses worth testing in the future.

Lillooet Resources and Cultural Adaptations

There are numerous potential relationships between resource characteristics and cultural adaptations. In this section, I will focus on several of the most important types of adaptations, namely: 1) the overall effect of resources on private ownership, competition, cooperation, and socioeconomic inequality; 2) conditions that give rise to large residential corporate groups; 3) conditions that promote large village sizes and regional trade. Other issues that have been previously addressed are the intensity and frequency of raiding in relationship to resource shortages (Cannon 1992) and the nature and importance of feasting (Hayden 1995).

As I have argued elsewhere, when considering human behavior as adapted to ecological or practical concerns, we are only making statements about *average* human motivations and decision making. We are not making any predictive or blanket statements about any one individual's behavior, much less all individuals' behavior. People exhibit far too great a range of idiosyncratic motivations for that to be possible. While diversity is the raw stuff of evolution, survival and coping with practical realities are nevertheless the keys to short term success. Natural selection has weighted the scales in favor of survival by ensuring that most people most of the time behave so as to ensure their own survival and success even though the promotion of diversity in some individual behaviors may be unpredictable and result in individual failures. In his Foundation trilogy, Isaac Asimov called this perplexing situation the "Theory of Psycho History." He astutely observed that while we can predict human behavior given enough mass (number of people), our generalizations can never be applied in a law-like fashion to individuals. And it is true.

Socioeconomic Adaptations at the Community Level

The reasons why complex hunter/gatherer communities develop from generalized hunter/gatherers is one of the most important theoretical questions archaeologists are now trying to resolve. With their competitive use of food and wealth, their pronounced socioeconomic inequalities, their intensive food procurement strategies, their prestige technologies, and their private ownership of procured food, wealth, and resource locations, complex hunter/gatherers are much more similar to horticultural communities than to more nomadic generalized hunter/gatherers (Testart 1982; Price and Brown 1985:16; Shnirelman 1992). This basic distinction between generalized and complex hunter/gatherers was recognized a century ago by Grosse (1896) but has been neglected until the last two decades in anthropology and archaeology.

While there are numerous attempts to account for the emergence of complex hunter/gatherers in the Northwest (see Ames [1994] and Matson and Coupland [1995] for recent reviews) the most critical question, in my opinion is whether conditions of stress or abundance lead to socioeconomic inequality and complexity. I have argued this issue at some length elsewhere (Hayden and Gargett 1990; Hayden 1992a, b; 1994; 1995; 1996). The gist of these arguments is that if complexity is based on the production of surpluses, then it must arise under conditions of abundance; this seems axiomatic. Moreover, private ownership of produce or resources will generally not be tolerated by any community of generalized hunter/gatherers at large when food shortages occur on a widespread and regular basis. It is only under normal conditions of abundance and adequate food provisioning for all families that most residents of a community will acknowledge the right of some or all people to establish proprietary claims on food that they have produced, as well as on resource locations, and on wealth. Ownership of resource locations is the key to understanding complexity according to Matson (1983; 1985; 1992:422; Matson and Coupland 1995:150–2) and others (Coupland 1988:36–9; Victor Shnirelman, personal communication; Burnard 1987) and is strongly implicated in the development of resource and technological intensification (Testart 1982; Tremaine 1997).

On the basis of a number of ethnographic examples from the Plateau and elsewhere, the general community acknowledgment of ownership seems to be conditional on everyone having enough to eat in normal times. When resource conditions deteriorate to the point that enough families experience significant food shortages, the acknowledgment of resource ownership is revoked by the community, and "owners" are obligated to share their resources with others in need (as documented below). This viewpoint is contested by researchers advocating that complexity develops as an adaptation to stress, population pressure, or the need for information management and quick responses to threats or environmental changes.

Studies on the Northwest Coast have demonstrated a strong relationship between salmon productivity and socioeconomic complexity (Donald and Mitchell 1975, Mitchell and Donald 1988:321). Other researchers in the area note that status differentiation and rank appear after archaeological indications of salmon abundance (Carlson 1993, 1996) and that potlatching only took place in times of surplus, *not* when people were starving (Codere 1950: 63). It was the increase in trade and wealth generated by the fur trade with Eurocanadian suppliers of Industrial goods that created the intense levels of potlatching noted both on the Coast and in the Interior in historic times (Codere 1950:94–5; Goldman 1940:339–346; Gibson 1988: 389). On the south Alaska coast, Maschner and Hoffman (1994) observe that there is no evidence of economic stress when ranking and corporate groups emerge and that large houses up to 500 square meters formed in the richest environments.

On the Plateau, Eugene Hunn (1990:214) expresses a similar notion when he observes that food surpluses are correlated with population, wealth, and political centralization. Indeed, the two most complex centers ethnographically observed were the Dalles on the Columbia Plateau and the Lillooet region on the British Columbia Plateau. Both locations were noted as the most productive salmon fisheries throughout the Interior drainages of their respective river systems. The quality of salmon in these locations was also optimal in terms of their fat content and nutritional value, thereby enhancing the exchange value of any surpluses (Romanoff 1992a:249; Kew 1992:186; Teit 1906:231–2). Such a coincidence seems far too pronounced to be fortuitous and strongly supports the surplus-driven models of complexity rather than the deficit-model of complexity. Similarly, in California, it is only communities with rich sea mammal rookeries, fishing, and oak groves that developed complex societies (Hildebrandt and Jones 1992:389). In contrast, social complexity is documented as emerging in other areas of the world where resource shortages were not important factors (Milisauskas and Kruk 1993:90).

Only Schalk (1981) and Matson (1985) have argued on reasonable empirical grounds that complexity is the result of temporal and spatial concentrations of resources rather than resource abundance. Schalk emphasizes the effects of temporal constraints, while Matson emphasizes the spatial constraints. From a broad comparative perspective, these arguments do not accord well with the data. The Calusa of Florida were among the most complex hunting and gathering cultures in the world, yet appear to have had year-round access to fresh resources with little or no temporal restrictions and no significant long-term storage (Widmer 1988:268). Among the early complex communities of coastal Chiapas, Blake (1993) suggests that food was constantly available with little seasonal variation in abundance. It is also relevant to note that the most complex communities in New Guinea which bordered on chiefdoms, had root resources readily available from gardens all year around.

Similarly, while perhaps not quite as complex as more northern groups, the Straits of Georgia and Fraser estuary Salish groups with much less need to store food than their Interior counterparts due to the more constant availability of salmon runs and other food resources, were very complex hunter/gatherers on a world scale. Moreover, as a group, the coastal communities were certainly more complex than communities farther upstream in the Interior where resource availability was much more temporally and spatially constrained due to the progressively lower numbers of salmon runs with increasing distance from the ocean (leading to a far greater reliance on storage) and the limited number of good fishing locations. The greater complexity of the coastal groups cannot therefore be understood in terms of the importance of storage or in terms of temporal constraints on resource availability (contra Schalk 1981 and Binford 1990). Rather, the progressive changes in complexity from the Coast to the Interior are much more intelligible in terms of the progressive reduction of salmon abundance as one proceeds upstream (see Kew 1992). Groups inhabiting the headwaters of the main rivers had the most pronounced temporal constraints on salmon procurement, but the least abundant surpluses, and the least complex societies of any of the transegalitarian communities to be discussed.

Thus, resource abundance seems to play a fundamental, critical role in the emergence of complex hunter/gatherer communities. However, secondary factors such as the need for constructing costly procurement facilities, or increasingly intensive labor requirements to process ever larger amounts of resources in ever shorter time periods as temporal availability of resources decreased, or other special labor requirements, also seem to act as second order factors affecting the degree and nature of complexity that emerges in communities.

While all regions of the Northwest Coast may have had approximately the same ability to produce food surpluses, perhaps the north coast groups did have greater cooperative labor organization requirements for exploiting owned resource locations. From the limited perspective of the Northwest Coast, Schalk may be right: greater social and political complexity probably developed in the north because of shorter availability of critical resources. However, to argue that resource abundance is not fundamental to all basic complexity on the Northwest Coast and elsewhere is unwarranted. Spatial restriction and reliability undoubtedly play a very significant similar role as well (per Matson 1985; 1992:422). The importance of restricted access to abundant resources is clearly illustrated by comparing the Lillooet region with other regions along the Fraser River or the Thompson River where the natural rock formations did not provide as good fishing locations, but where the scheduling of the fish runs was essentially the same (Romanoff 1992b:483). Where good fishing locations occurred that produced abundant, reliable surpluses of fish, high populations and complex cultures existed, as around Lillooet and the Farwell Canyon region at the confluence of the Chilko River. Simon Fraser was told by the Shuswap living upstream from the Lillooet that he "could not suffer from want" among the Fraser Lillooet (Lamb 1960:77–9). Where the fishing locations were less productive, as in the Chilcotin, and in the Nicola Valley, the populations were smaller and the cultures were less complex (Bussey and Alexander and 1992; Wyatt 1972:39,183–4). It is difficult to dismiss resource abundance and the ability to produce surpluses on a regular and reliable basis as a critical variable in explaining complexity, and I have no doubt that had the Lillooet communities been able to produce increasing amounts of surpluses that they would have developed still more complex communities.

Testart (1982), Binford (1990:131), Ingold (1983), and others have argued that food storage, or delayed consumption, was a critical element in the emergence of ownership, sedentism, and complexity, among other phenomena. While it seems clear that storage does have the effects attributed to it by Testart, I am not convinced that it is strictly necessary for complexity or the other phenomena to develop. Certainly, the extra effort required to process and store large amounts of food on a long-term basis would be a great incentive to view the stored produce as one's own private property and would create the *potential* for separating producers from their stored produce as Coupland (1988:215) has emphasized (see also Matson and Coupland 1995). Carlson (1993, 1996) similarly argues that stored food requires management, a redistribution system, and invites treatment of surpluses as capital, while Matson (1992:420) clearly relates storage to the establishment of the Northwest Coast pattern of status display. This is all probably true. However, as previous examples have shown, some of the most complex hunter/gatherers and horticultural groups in the world had little long term large scale storage. Ownership over stored produce would only be recognized by others if they, too, had an equal opportunity to obtain adequate food for themselves.

Thus, I would argue that while storage certainly facilitated and promoted ownership, hierarchies, sedentism, and investment, it probably played more of a secondary role in these developments (e.g., making it possible to sustain higher population densities in seasonal environments as well as maximizing use of resources) compared to the more fundamental role of absolute exploitable resource abundance. In fact, on the Coast, prestige technology precedes evidence for large scale storage by about 1,000 years (Carlson 1989, 1991, 1993, 1996; Matson 1992:423). The critical point is that food abundance must be convertible into wealth either via processing it into storable forms that have value in other seasons, or via direct exchange, or via direct support of non-food producing individuals. "Social storage," which I think is a misnomer, is only one of several strategies. Where real storage is used, houses of successful aggrandizers have more storage space on a per capita basis in order to support feasts, trade, and other strategies for converting surplus food into power and wealth (Lightfoot and Feinman 1982). Because of these uses, some storage by elites in the most complex transegalitarian and chiefdom communities can probably always be expected, even in non-seasonal environments.

From this perspective, I have argued that once individuals or families are permitted to accumulate and own food surpluses, ambitious aggrandizers begin to develop schemes to get other community members to produce surpluses, to surrender some control over those surpluses to the aggrandizers, and to use these surpluses to advance their own self-interest by concentrating more and more political, economic, and social power in their own hands (see Clark and Blake 1994:21; Hayden 1995). These aggrandizers use a variable mix of strategies based on the provocation of wars involving feasts (surpluses) for allies and death compensation payments; the sponsoring of reciprocal feasts for allies; the creation of competitive feasts based on investment and advertising; increasing the value of marriage payments and succeeding reciprocal exchanges; increasing the value of the children involved in marriages via expensive child maturation feasts; and by controlled regional exchange. I will elaborate these issues in the next section.

Resource Relationships to Residential Corporate Groups

Large Structures

Because of the disadvantages of living with large numbers of people in large structures, I have argued that considerable other practical advantages should be present to induce people to choose living in large residential corporate groups. The disadvantages are both social and physical. As the number of people residing in close proximity increases arithmetically, the number of possible conflicts increases geometrically. This situation would be particularly aggravated at the high resident densities recorded ethnographically for pithouses (Vol. II, Chap. 2, Table 1). In physical terms, it is clear that large structures require considerably more costly heating strategies to maintain at acceptable temperatures than smaller structures (Vol. II, Chap. 16). What advantages, therefore, could have existed to induce some of the residents at Keatley Creek to live in unusually large pithouses? This is a problem addressed by Lewis Henry Morgan over a century ago (1881).

One of the advantages might be defense. Raiding was certainly a part of life on the British Columbia Plateau (Cannon 1992); however, most prehistoric winter communities had no formal defenses. Desmond Peters, Senior (personal communication) has pointed out that raiding was not generally conducted in the winter when snow would have blocked mountain passes. Raiding was predominantly a summer and fall activity. Keeley (1996) also points out that large communities are the most immune to raids. Moreover, if defense were a primary reason for living in large residential corporate groups, it could be expected that the great majority of people in a community would do so. The fact that a large number of people lived in small or medium sized housepits at Keatley Creek and even more so elsewhere on the Plateau where warfare was more intense, indicates that defense was probably not a key factor in the emergence of large residences. The fact that these large structures occur in regions with exceptional salmon resources (the Lillooet and Farwell Canyon regions) seems far more pertinent.

The second obvious condition that could lead people to reside as large coresidential groups in large residences is for material benefits or gains (Morgan 1881; Hayden and Cannon 1982). In addition to theoretical considerations, both the ethnographic and the archaeological record provide critical support for the idea that the largest residences were founded on the control of the most lucrative salmon resources in the region. Theoretically, Cannon and I thought that under certain conditions where labor was the bottleneck to wealth, aggrandizing individuals might provide benefits to supporters for helping to exploit resources or undertake other profitable projects. In this scenario, aggrandizers need reliable labor to succeed, while corporate members hope to improve their normal standard of living by belonging to an aggrandizer's corporate support group. Members are thus attracted to corporate groups by advantages rather than driven to them by necessity. By implication, the wealthier a corporate group was, the larger their corporate group residence would be, and vice versa. This relationship has been documented by many researchers in specific instances from the Northwest and as a cross-cultural pattern (Netting 1982; Feinman and Neitzel 1984:75; Maugher 1991:133; Nastich 1954:23; Post and Commons 1938:39; Walters 1938:87; Jewitt 1974:49; MacKenzie 1962:220; Blake 1991:28–9; Jochelson 1908:69–72; Minc 1986:89; Beckerman 1983). As in other parts of the world, it seems that "large residences therefore became monuments to the authority of their leaders," (Huntington and Metcalf 1979:138).

In conjunction with the creation of large houses to display economic success and the size of the corporate labor force, it would have been necessary to garner much larger surpluses than other households in order to attract and bind kin and nonkin members to the residential corporate groups. While some of the surplus food could be exchanged or transformed and displayed as prestige items (Vol. II, Chap. 13), the vast bulk of food stores and surpluses would have to be stored for a number of months in order to be used for feasts or emergency stores. This would have required storage facilities, and there were a number of storage strategies used, including raised platform or pit caches at fishing sites, raised platform or pit caches near pithouses, pit caches inside pithouses, and storage in baskets or on rafter shelves in pithouses. Many of these storage facilities would have been easily visible and perhaps even decorated by wealthier families, especially the raised caches or the small roof-like coverings of outside cache pits. In other traditional cultures with which I am familiar, such as the Torajan communities in Sulawesi, Indonesia, food storage facilities are elaborately decorated and serve to display the wealth and success of households. Even if the Lillooet storage facilities were not decorated, their size and number must have been public knowledge and must have been used as a major criterion for assessing a household's assets and economic worth. Corporate members, prospective intermarrying families, exchange partners, allies, and feasting partners would all probably have keen notes on storage facilities in deciding where their best interests lay.

Aside from defense and self-benefit, I can think of no other plausible practical explanation for the large winter structures that existed at Keatley Creek and elsewhere on the Plateau. On the Coast, Drucker (1951:279–80) clearly states that lower ranking tenant or retainer families were attracted to the powerful and wealthy longhouses. The aggrandizer-attractor explanation has the very great advantage of providing an inherent hierarchical framework capable of resolving disputes, maintaining social harmony, group cooperation, and propagating itself. That is, because people are attracted to corporate membership in order to obtain things or services that they desire, and because the power to dispense goods or services is hierarchically structured within the group, members are strongly motivated to subdue social animosities within the group and to accept decisions made by controlling figures in the organization, just as in contemporary corporations. This explains how social harmony was achieved and why people sought and probably competed for membership in the residential corporate groups at Keatley Creek. The ownership of surplus producing resources as a basis for these corporate groups also explains the existence of hereditary "chiefs" (corporate administrators and titular owners) in the Northwest in what otherwise seem to be societies characterized by achieved status (i.e., Big Man, or ranked societies—see Schulting 1995:73; Teit 1906:254–5). This is discussed in more detail below.

Resource Intensification Structures

Before any excavation began, I suspected that the control of the major surplus staple, salmon, would be the economic basis for the establishment of these corporate groups, particularly since it was known that salmon was a valuable trade item produced in abundance in the Lillooet region (Hayden et al. 1985), an idea which was not particularly novel at the time, but which had never been tested. As Cannon (n.d.) stated it: "control over other resources like trapping grounds were not sufficiently important to provide the impetus for corporate group formation or maintenance. It seems more likely that ownership of trapping grounds [and other resources] was ancillary to the ownership of the salmon stations, and that existing corporate groups provided the framework for the ownership of any and all valuable resources."

Ethnographically, some continuity between Classic Lillooet and essentially modern resource exploitation practices might be expected. These elements can provide hints of past socioeconomic organization. One of the elements of most relevance is the private ownership of the most valuable fishing localities. While the largest, most productive fishing sites were owned in common by the entire community and ensured that everyone had access to sufficient salmon for their own subsistence purposes in normal years, there were also more than 25 owned fishing locations from Della Creek to Pavilion Creek (Kennedy and Bouchard 1992; Romanoff 1992a:242–7; Teit 1900:294; 1906:255; 1909:582). While sockeye salmon could be procured at the public sites, spring salmon were difficult to obtain there. In contrast, spring salmon were the predominant species obtained at the privately owned sites (Kennedy and Bouchard 1992; Romanoff 1992a:234; Alexander 1992:163), and it was dried spring salmon that were the most valued trade species (Teit 1906:232; Romanoff 1992a:242, 252), probably because its higher oil content was critical for supplying enough calories in the winter months to stay warm. The fact that spring salmon were far less numerous than sockeye salmon (Hayden 1992a), that spring salmon were much stronger swimmers that stayed in deeper water than any other species, and the fact that they required much more careful drying in order to prevent the oil from turning rancid, all undoubtedly added to the high value of dried spring salmon as a trade commodity. They were much harder to get and much harder to process. The fact that they stayed in deep water meant that only a very few natural rock outcrops which projected far into the river would be suitable for obtaining springs, and even then, artificial wood platforms or scaffolds had to be constructed out over the water in order to maximize chances of procuring them. Construction of platforms involved the procurement of long timber poles, strong ropes, and secure fittings. They required from one to three days simply to assemble (Alexander 1992:163; Romanoff 1992a:242). As noted previously, scaffolds were used at some locations along the Fraser River.

The investment of effort in the creation of these unusual facilities may have been one of the principal arguments for their privileged use by their builders and their descendants. Fishing at such locations would have only become productive by dint of the time and effort that certain individuals put into making them productive. These individuals would not be depriving anyone else of their usual food resources, but would be opening up a new source of fish through their own efforts. Such individuals could be seen as having a natural right to privileged access, or "ownership," of these locations, especially once the principle of ownership over produce had been established (see Hayden 1992b), although even these claims might only be recognized when others perceived some benefit for themselves (Romanoff 1992b:494). The benefits that non-owners of fishing platforms might derive from the establishment of these facilities would include:

1) the ability to use the improved or developed facilities after the owner had finished (even if there was

a fee); this arrangement was common (see Vol. II, Chap. 17; Hayden 1994)

2) the advantage of increased protection that larger and more powerful groups provided for all community and corporate group members (disappearances in the mountains were frequent and worrisome—Teit 1906:240; compare also Burch 1975:226 and Keeley 1996);

3) the increased variety of options for survival in times of famine that rich neighbors provided, including possibilities of working for food, borrowing food, and begging for food, even if the giving of food always entailed becoming indebted and was rarely if ever completely gratis (Nastich 1954:24; Teit 1909:705–6, 731; Sproat 1987:112–3);

4) the availability of increased wealth and exchange goods in the community that surplus producing groups would bring; non-owners could obtain some of these items through industrious work and affiliation with owner groups;

5) the increased availability of desirable mates within a community that surplus production would bring especially in non-owners could obtain backing from owners to acquire mates.

Only when there was general starvation in exceptionally bad years might recognition of privileged use or ownership of these sites and their produce be retracted (Hayden 1995; Sproat 1987:112–3; Hudson, n.d.:5).

Because it was so critical to obtain and store large numbers of salmon for survival through the winter, and because salmon were only available in abundance for a short period of the year at very restricted locations, access to labor during times of salmon availability determined the magnitude of surpluses that could be produced. While individual runs of salmon might be spread out over a week or more, the extraordinarily productive peaks of these runs generally lasted for only a day or two each (Hayden 1992a, b). These were the times when it was essential to run the productive fishing localities around the clock and to have enough people processing salmon to prevent any from being wasted. Even strong fishermen needed to rest after about 30 minutes of fishing at peak periods although they could catch up to 300 per day (Alexander 1992:163–4; Kennedy and Bouchard 1992: 300–1). Although these cases are exceptional, Desmond Peters, Senior (personal communication) describes how he once caught 25 sockeye and a spring salmon in only three sweeps of his net, while other accounts mention 12–15 fish caught with one sweep of a net (Kennedy and Bouchard 1992:283), and 10–11 salmon caught in one sweep (Franklin Ledoux: personal communication). Thus, having a number of brothers or other kin or corporate members who could share in the exploitation of a lucrative fishing location maximized the benefits that could be obtained from the investments in platforms and the advantages of promoting claims of ownership.

Corporate Group Laborers and Owners

Salmon processing personnel constituted the most serious bottleneck in this system of production. As noted above, hundreds of salmon could be caught by a single person during peak periods whereas only about 30–60 could be processed by a single woman in one day (Romanoff 1992a:235; 1992b:482). Their are several accounts of fish going to waste because the women processing salmon could not keep up with the rate of catch (Kennedy and Bouchard 1992:300–1). My experiments with stone tools indicate that butchering time would probably be at least doubled prehistorically creating even more of a bottleneck. Traditionally, butchering and drying was exclusively done by women (Kennedy and Bouchard 1992; Romanoff 1992a). Stryd (1971), Romanoff (1992b:479) and Kennedy and Bouchard (1992:301) suggest that the pronounced degree of polygamy as well as the holding of slaves noted ethnographically for wealthy Lillooet men probably was in part due to the need for many people to process the abundant salmon that the wealthy obtained from their owned fishing locations (see also Hunn 1990:205, 225). This seems like a sound inference, and again indicates how social structure adapts to resource characteristics although in a more general context and for other reasons related to resource abundance, polygamy is very common among successful aggrandizers in most transegalitarian communities (White 1990; Lightfoot and Feinman 1982:67; Schulting 1995:74; Hayden 1995).

The other expectable outcome of high labor requirements for the exploitation of fishing sites would be the formation of corporate groups whose male and female members cooperated to derive the maximum possible benefit from owned fishing locations, and who shared in those benefits according to their position in the hierarchy, extending from slave, to common worker, to low ranking kin, to siblings of the owner, to the titular head who inherited the actual ownership rights. Access to corporate wealth accumulated over the generations would be a great attraction of belonging to corporate groups although the highest ranking elite administrators probably exercised control over precisely how inherited corporate wealth was used. An associated problem with the formation of such groups, however, is how to minimize labor maintenance costs during low-production periods of the year when great amounts of labor are not needed (see Fei and Chang 1945).

If salmon production was the basis for the formation of these corporate groups, one might expect all individuals who had participated in the procurement and production of salmon to stay together for the period that the stored salmon lasted, that is, to participate as a group in the benefits that their intensive group production generated. Excessive maintenance costs of the entire group throughout the rest of the year could be avoided by disaggregating into smaller independent socioeconomic groups once the bulk of the stored salmon had been consumed, invested, or disbursed by the spring. This, in effect, would account for the ethnographically observed behavior of closely related families (or archaeological residential corporate groups) staying together as a socioeconomic unit immediately after the main salmon procurement season, co-managing the large amounts of stored salmon within (and perhaps outside) corporate pithouse structures, sharing much (but evidently not all) of the salmon between members (Romanoff 1992a:247). This phase was followed by a dispersal into smaller independent socioeconomic groups in the spring when stored salmon had been exhausted. The now largely forgotten Lillooet term, "pel'uΣem," or "one family, one people, one bunch living together" (Romanoff 1971:6) seems to refer to something like this kind of corporate residential group that lived together in one house and presumably it was this coresidential group that shared rights over certain owned fishing localities (Romanoff 1971:54; Teit 1900:192; 1906:255). Desmond Peters Senior translated pel'uΣem as "one person, or whole face, or a clan," adding that each had its own crest (coyote, bear, or other), and its own watchman responsible to the chief for maintaining order.

Among the Canyon Shuswap, who lived in a salmon surplus producing region very similar to Lillooet, crest groups owned fishing sites, land, houses, trading privileges, crests, as well as collecting fees for the use of their bridges (Teit 1909:582–3). The crest groups were related hereditary families that either lived together in villages separate from other villages, or lived in houses or groups of houses within the same village, therefore meeting in every respect the definition of a residential corporate group (Hayden and Cannon 1982). At Keatley Creek there must have been at least 5–6 quite large pel'uΣem and many other more moderate sized ones in contrast to the one or two that characterized later villages (Teit 1906:252–3). The formation of pronounced hierarchical corporate groups under these circumstances parallels the increased hierarchical nature of the more northerly Coastal societies that Schalk (1981:69ff) describes. However, in contradistinction to his interpretations, it is clear in the Lillooet region that without *abundant* surpluses at the peaks, the constrained availability of salmon runs would not have resulted in particularly complex, hierarchical, or sophisticated cultures.

Ownership of spring salmon fishing sites and house sites around Lillooet was inherited and kept within certain families (Romanoff 1992a:242–7; 1992b:491; Kennedy and Bouchard 1992:308; Teit 1900:294; 1906:255; 1909:582–3). The same was true at the Dalles, on the Columbia River (Schulting 1995:59–60):

> Fishing stations were highly prized and passed by inheritance into the possession of a group of relatives in each generation. It was assumed by the informants that these were descendants of the original discoverer of the site. No one else was allowed to fish at a particular station without permission of its owners. Six to ten related old men might own a station in common at which their families fished. Any one among them might preempt the best place at the station temporarily. Each station had its overseer who was usually a chief or head man. (Spier and Sapir 1930:175, see also Curtis 1911:95)

At The Dalles, salmon was clearly the primary source of wealth and the key factor behind the intensification of resource procurement as well as the unusual social complexity of this region. With an analogous salmon procurement situation on the Fraser River, it seems likely that a similar cooperative and "corporate" arrangement existed aboriginally in the Lillooet region. Romanoff (1992a:247) clearly states that the Lillooet owners of fishing locations had the best supply of salmon and that the number of wealthy families was limited by the number of productive fishing sites. Teit (1900:250), too, states that fishing platforms were the most productive fishing sites. All sons inherited rights to these named sites and the sons generally lived together (Romanoff 1992a:244; Teit 1906:255). Nastich (1954:23) adds that wealthy families were multi-family units, implying that residential corporate groups were based on the ownership of productive salmon sites and their resulting wealth. It is undoubtedly those families that had inherited some claim to co-ownership of household resources (including the use and management of fishing sites) which constituted the "elite" or nobility of the house and the community. As the number of families with such claims to a single site could be numerous (up to 10 at The Dalles), it is not surprising that one half to two thirds of a household or a community might be considered as elites, as Teit (1909:576) reports. Such widespread recognition of privileges (whether based on heredity or arranged labor or both) may have been a necessary concession of aggrandizers in the early developments of hierarchical societies with privately owned resources producing benefits primarily for a restricted class of people. That is, in order to defend their claims of privilege against egalitarian demands of the majority of a community, aggrandizers would initially have had to enlist the support of a large proportion of the community by making them co-beneficiaries of the privileges. This topic is more completely discussed with ethnographic examples in Vol. II, Chap. 1 and Hayden (1997:115). These observations help explain the high proportion of elite domestic areas in HP 7. Of course, the most active aggrandizers, the chiefs, would have benefited the most.

As the economic power of corporate groups increased, elites and their supporters undoubtedly managed to extend their claims of ownership to other resources that were highly localized and profitable for trade (e.g., eagle eyries, deer fences, hunting grounds), ultimately including, in the most developed transegalitarian societies, exclusive trading rights, ownership over all land, and fees for the use of bridges, or even fees for transiting through claimed territories (e.g., Teit 1909: 576, 582–3; Boas 1891:638; Dawson 1892:14; Romanoff 1992b:502; Alexander 1992:143–4; Hudson 1994; Dickason 1984; Wheeler 1990; Tyhurst 1992:399; Spier and Sapir 1930:225; Schulting 1995:53; Walker 1982:110; Marshall 1992:212–3; Ferguson 1984:286–7, 304, 314). Through advantages of wealth and the restrictions that the wealthy and politically powerful could impose on others, commoners were prevented from acquiring valuable prestige items (Jewitt 1974:60). Similar attempts were usually made to control the ideological basis of the community through ploys such as ownership of house or clan crests; ownership of masks, myths, songs, or other ritual paraphernalia; restricting secret society membership, or ritual roles to elites (Kamenskii 1985:86); and limiting powerful vision quests or other initiations to elite children (Schulting 1995:50–2; Ray 1942:235). However, as previously mentioned, when claims over resources could not be enforced or when severe food shortages occurred, all claims were always open to renegotiation and the wealthy were forced to share food and other privileges, however, not without resentment and disparagement (e.g., Romanoff 1992a: 247–8). Together with the observations already made for the Canyon Shuswap, these patterns of hereditary ownership of surplus and wealth producing fishing sites by related families forming large residential corporate groups appear to be the most plausible model for understanding the basic nature of the social and economic organization of the large structures at Keatley Creek.

The ethnographic and theoretical scenario described above is strongly supported by the archaeological remains that have been recovered from small, medium, and large sized housepits at Keatley Creek. In the poorer small housepits, and even in the medium sized housepit that we excavated, pink salmon constituted the overwhelming, if not exclusive, species of salmon present (Vol. II, Chap. 8). Only in the large housepits do significant numbers of sockeye and spring salmon remains occur. Despite the many different factors that could affect the preservation of salmon bones in housepits (Vol. I, Chap. 10 and 17), the archaeological remains strongly indicate that significant differences did exist between residents living in different sized pithouses in terms of their ability to procure the more difficult-to-obtain and valuable species of salmon.

Differences between the residents of different sized housepits in their procurement of varying amounts of salmon are also indicated archaeologically by the much larger storage capacity per person in the large housepits as revealed by pit volume per floor area (Vol. II, Chap. 1). People in large houses had much larger storage capacity than residents of smaller houses. It is also evident that the development of hearths is much more pronounced in the larger housepits, and that densities of artifacts are much higher, although this last observation could be explained in part on the basis of differences in the number of years the last occupation floors were used in the various housepits. Nevertheless, the substantial increases in ungulate bone densities in large housepits is so pronounced and overall faunal diversity is so much higher that it seems to correspond to patterns in other, complex communities where deer remains are concentrated in high status households and overall faunal remains are more diverse in high status houses (Cleland 1965; Bogan 1983; Jackson and Scott 1992). The difference in hearth reddening is too pronounced and consistent to be satisfactorily accounted for by differences in lengths of occupation of the living floors. The lack of any evidence for occupation other than in the winter at Keatley Creek is yet another indication of the congruence between the ethnographic/theoretical model and the archaeological model, as is the apparent hierarchical internal arrangement of domestic units within the larger housepits (Vol. II, Chap. 1).

Finally, as in the ethnographic examples previously cited, the archaeological analysis of the distinctive types of cherts used by residents in each of the major housepits at Keatley Creek (Vol. I, Chap. 16) provides compelling evidence that the residents formed an enduring corporate group with economic privileges extending beyond the simple ownership of the best salmon fishing locations, and certain house sites. Exploitation rights seem to have extended to specific mountain resource areas used by the constituent families of a residential corporate group in the spring, summer, and fall, as well. This implies ownership not only of the chert sources, but also of geophyte food patches and probably hunting areas. In fact, Dawson (1892:14) states that in former times Shuswap families owned hereditary hunting grounds. Archaeologically, ownership of resource areas in other transegalitarian communities in the Northwest has been demonstrated for coastal cmmunities such as Ozette (Huelsbeck 1994:91; Wesson 1988:196–8;1994). Moreover, archaeological results from Keatley Creek indicate that large corporate groups retained their identity, their rights to resource locations, and ownership over their winter house locations over many centuries and possibly as long as 1,300 years (Hayden et al. 1996). I would submit that only corporate groups which were powerful and large and exerted control over unusually lucrative resources could have maintained this kind of continuity over such long periods.

Some of these archaeological inferences are supported by ethnographic observations. For instance, house sites were generally owned and inherited by corporate residents or their titular heads (Teit 1900:294; 1909:582–3; Romanoff 1992b:491). As previously documented, salmon fishing locations were owned and inherited (a proposition expressed earlier for the prehistoric Lillooet communities by Stryd 1973:102). Other evidence points to some differences between ethnographic and prehistoric socioeconomic organization, such as the sheer size of the prehistoric residential corporate groups, the degree of hierarchical ranking within them, and the apparent extension of privileged access or ownership to specific mountain resource locations. These archaeological indicators suggest that some factor was responsible for greater degrees of resource control (including control over mountain hunting grounds) and of surplus production at Keatley Creek than were typical of ethnographic times. One possibility might be that elaborate rope and scaffold technology was required to exploit the potentially productive fisheries at the Camelsfoot constriction, and that considerable wealth, labor, and/or managerial organization was necessary to underwrite the construction of these kinds of facilities. Presumably, only the larger, more powerful corporate groups would have been able to support such undertakings. Landslides over the last 1,000 years may have subsequently altered the rock formations at the Camelsfoot constriction so as to render them much more difficult to use for any kind of salmon fishing.

In sum, theoretical considerations, actual evaluations of the resources available, ethnographic observations, and archaeological data, all point to the same basic conclusion: the formation of large residential corporate groups was a major socioeconomic development that depended upon the ownership of highly lucrative salmon fishing locations although the prehistoric manifestations of these corporate groups seem to have been larger and perhaps more powerful than those recorded historically. Salmon was used for the group's subsistence needs, and surpluses were used on a regular basis to generate wealth and social hierarchies. Exactly how surpluses were used for these purposes is the topic of the following section. At this point, it is worth iterating that the basic conclusion concerning the factors responsible for the development of large residential corporate groups is one of the soundest, most certain results that the FRICGA project has achieved. Its support by multiple lines of investigation make it particularly robust.

The Uses of Surpluses to Create Complexity

The following discussion is somewhat less certain than the previous on, given the current debates about the mechanisms by which socioeconomic complexity emerges in traditional societies. Nevertheless, in order to understand more about the socioeconomic organization within pithouses at Keatley Creek it was necessary to grapple with models and questions of mechanisms responsible for complexity. I did this over a number of years by examining a range of transegalitarian ethnographies that illustrated how strategies used by ambitious aggrandizers changed as levels of surplus production changed (Hayden 1995). The mst complete set of data was derived from the New Guinea Highlands which range from very poor resource areas with very low surpluses and low population densities in the east (generally thought to have been hunter/gatherers until recently) to highly productive communities in the west with long histories of food production surpluses, high population densities, and competitive feasting. The western societies with competitive feasts have often been compared ith Northwest Coast potlatching communities (e.g., Mauss 1924), while the poorer eastern New Guinea communities might be compared to the poorer hunter/gatherers on the Plateau such as those in the Chilcotin. I undertook the comparative ethnographic study specifically so that I could situate the Keatley Creek prehistoric community along a developmental continuum related to surplus production in order to understand what kinds of strategies and socioeconomic organizational principles were probably being used by aggrandizers at Keatley Creek. The result is somewhat provisional and tentative; however, I have found it to be a useful tool and I summarize the results here as a step in the ongoing process of interpretation.

My overall comparative results are summarized in Figures 3 and 4 and Table 1. For ease of reference, I have divided up the continuum into three rough stages representing increasing levels of surplus production and major changes in aggrandizer strategies that accompany these increases. I have changed the labels that others have used to refer to similar stages of complexity, largely because of a shift in theoretical perspective, but also because of differences in the defining criteria used for these stages. The stages I use are: *Despots* (roughly equivalent to the "Great Men" of New Guinea), *Reciprocators* (roughly equivalent to "Head Men" or "Leaders" in New Guinea), and *Entrepreneurs* (roughly equivalent to the most complex "Big Men" in New Guinea). The following capsule summaries are derived from a much more lengthy treatment (Hayden 1995) which should be consulted for more complete details.

While the forms of social and economic organization to be discussed seem to be the most common at given levels of surplus production, it is worth emphasizing that they are not apparently the only developmental sequences that emerged. For instance, complexity appears to have developed in the Near East with no significant levels of violence occurring until well after the emergence of complex communities. Many of the concepts about aggrandizers that proved most useful were articulated by Marvin Harris over a number of decades. He emphasized that aggrandizers (Big Men) were important agents in the intensification of production, in redistributing goods via trade or feasting, and in the waging of war for self-interests. D'Altroy (1994) has documented many of the same characteristics to be discussed below in South American tribal communities.

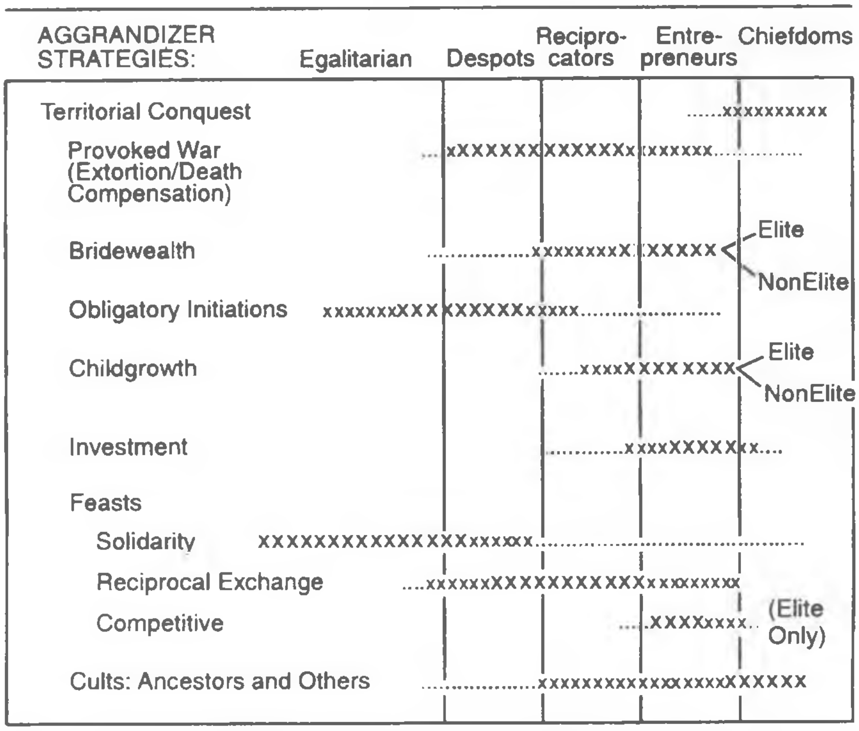

Figure 3. Proposed major strategies used by transegalitarian aggrandizers and changes in strategies with increases in surplus levels.

Table 1. Archaeological Consequences of Transegalitarian Aggrandizer Strategies

Strategies	Archaeological Manifestations
Provoked war	Fortifications Trauma and violent deaths Armor
Bridewealth	Surplus-based reidential corporate groups Rich female burials Female cult figurines
Child growth	Rich child burials
Investment exchange	Regional exchange High volume of prestige goods Craft specialization
Ancestor and other cults	Shrines and public ritual architecture Burial shrines
Reciprocal and competitive feasts	Feasting-related facilities and structures Domesticates Prestige food vessels

Despot Communities

When the ability of most families to produce surpluses is marginal and unreliable, ambitious aggrandizers have considerable difficulty convincing anyone to agree to contractual debts or promissory obligations to provide surpluses for future events. Individuals are simply unwilling to take the risk of having to default on contractual debts or having to give up valued possessions as a result of defaulting. Under these circumstances, aggrandizers who want to foster surplus production by others in the community, in order to control and benefit from community surpluses, must adopt strategies that compel other community members to participate. The two strategies that most consistently appear are community defense and community rituals. By taking advantage of, or even by provoking or concocting real or imagined threats to community safety, aggrandizers can motivate every family in a community to participate in actions that are apparently in their own self-interest. By linking adequate defense to the acquisition of good allies, and by linking the acquisition of good allies to reciprocal feasting and gift-giving, ambitious Despots can essentially extort surpluses from families ostensibly for the safety of the community. The more lavish the feasting and gifts, the better the quality and reliability of the allies.

As MacDonald and Cove (1987:vii) have noted, trade and warfare co-evolved prehistorically on the Northwest Coast. It should come as no surprise to find

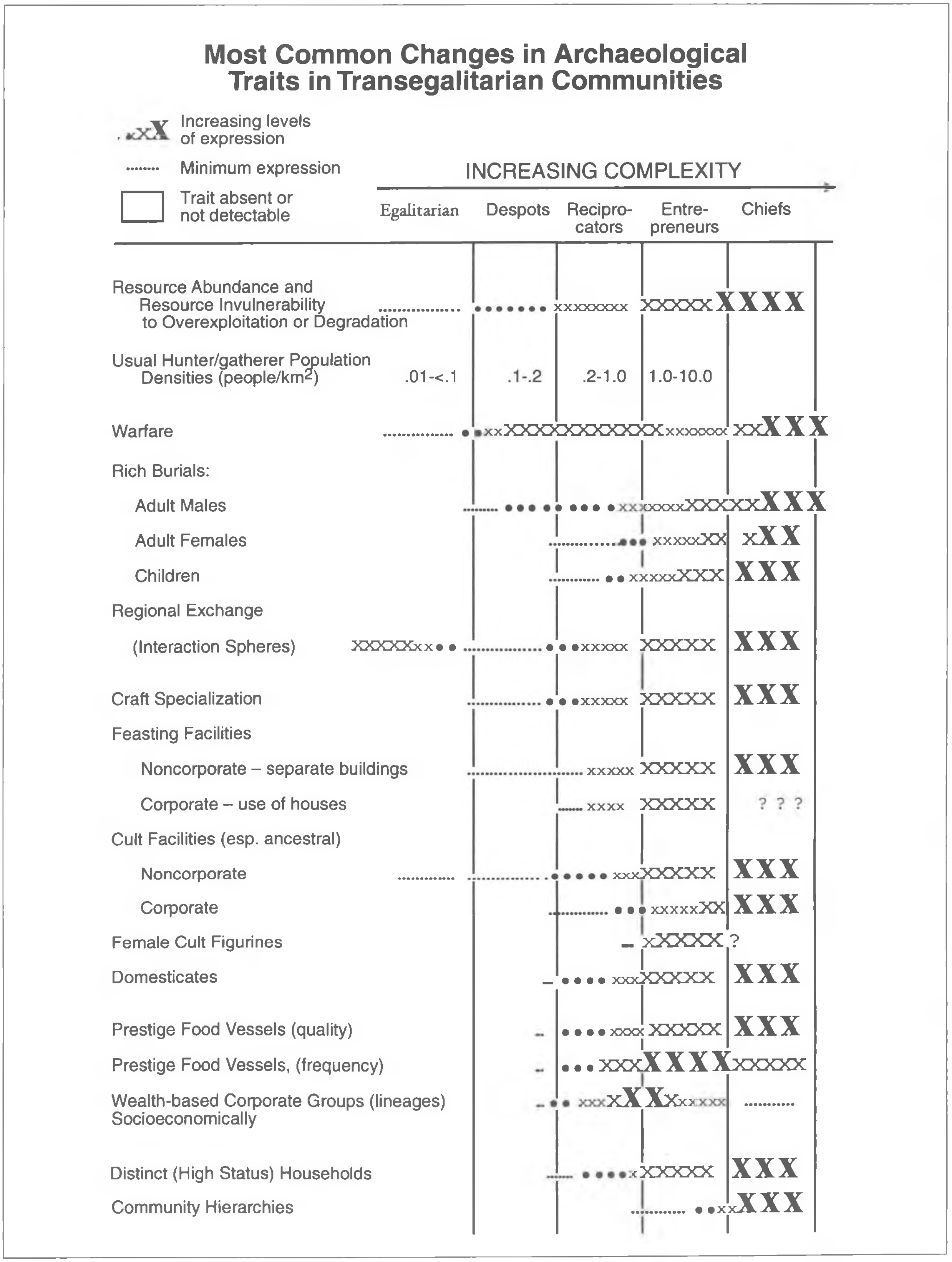

Figure 4. Comparisons of material and other cultural trait trends proposed for egalitarian to chiefdom societies.

that aggrandizers are the ones that often provoke wars as well as arrange feasts for allies. Similarly, when it is in their interests to establish peace, it is the aggrandizers that are involved in the peace negotiations, and who suggest establishing peace by means of feasts and death compensation payments to both enemies and allies for their losses. Such payments, of course, require the production of substantial surpluses that would be handled by aggrandizers on behalf of the community. Similar manipulation of wars by leaders for their own benefit has been documented among tribal groups in South America by D'Altroy (1994).

Cult festivals occurring every few years also begin to appear in Despot societies. These are supposedly held for community fertility or to deal with other crises in community affairs. Each family pledges to provide a significant amount of surplus and/or ritual paraphernalia for the festival. It is again the aggrandizer who orchestrates the use of these surpluses and wealth, and who, one presumes, benefits most from them, perhaps using the justification of having done all the organizational work and having incurred various necessary costs.

Archaeological indicators of Despot societies include unusually high incidences of violent deaths and other indications of frequent warfare; very limited evidence of surplus production or storage; relatively low population densities (ca. 0.1–0.5/km^2 for complex hunter/gatherers); small community sizes (50–200 people); rare prestige items or regional exchange items; limited evidence for pronounced socioeconomic inequality in housing or grave goods; low status for women and children (reflected in grave goods); and limited or even no evidence for special feasting/ritual structures, food preparation vessels, or serving paraphernalia.

While Despot societies may not constitute a universal step in the evolution of transegalitarian societies (levels of violence seem to be unusually low in the Levant until the Bronze Age), they are extremely common. Despot types of societies are known from the eastern Papua New Guinea highlands, the Amazon basin, the earliest complex cultures of the California and Northwest Coast, plus the European and Nubian Mesolithic. Given the proximity of the Northwest Plateau to the Northwest Coast as well as the ethnographic occurrences of Despot societies on the Plateau where Dawson (1892:25) observed that warfare was constant and that the most northern Shuswap groups were the most warlike. Traditional stories of warrior despots also came from the Shuswap area (Teit 1909:557–9, 561–3) with noted warriors becoming "chiefs" (Teit 1909:696, 731). Pretexts also existed for maintaining climates of hostility, such as the practice of killing an enemy or stranger after the natural death of a father, brother, or son (Teit 1900:335; 1909:594). Among these groups and similar groups noted for warfare such as the Nicola, Cree, Sekani, Chilcotin, and Tutchone (Teit 1909:470–1, 540, 550; Wyatt 1972:183–4), feasts were rare and limited in variety, potlatching was unknown (Teit 1909:569, 574), and wealth was rare. There was no system of nobility, clans, special societies, or crests (Teit 1909:570). Mobility was much higher than other Plateau groups, and although there were some surpluses and wealth, all resources were communally owned (Teit 1909:572). This closely follows the New Guinea pattern of emergent complexity where surpluses were least abundant or reliable (see Hayden 1995), and forms a clear pattern on the Plateau as surpluses decrease in magnitude toward the headwaters of the major river systems (see Bussey and Alexander 1992). Conversely, as surpluses progressively increase as one descends these river systems so does complexity, feasting, and exchange. Thus, it seems likely that early complex cultures on the Plateau were also of the Despot variety. However, not enough archaeology or burial information is available from the relevant (early Shuswap) horizon to affirm this with any certainty.

Reciprocator Communities

Surpluses are considerably more abundant and reliable in Reciprocator types of communities, at least to the extent that household heads feel confident that if they accept surpluses from others, they will be able to pay back the loan in the future on at least equal terms. Household heads are therefore willing to enter into reciprocal contractual loan agreements and promissorial agreements of support. This, in turn, fuels the holding of reciprocal feasts on a larger scale. Such reciprocal feasts are used by Reciprocator aggrandizers to boost surplus production, to create a system of contractual debts, as well as to control or manage the surpluses and wealth involved in feasting. As a result, prestige and regional exchange items become more common; some special feasting structures begin to appear together with specialized feasting paraphernalia (special serving bowls, food processing vessels, and cooking facilities); and special labor intensive feasting foods are introduced. These new strategies for concentrating wealth and power in the hands of aggrandizers are *added to* Despot strategies; they do not replace Despot strategies.

Readers of ethnographies often get the impression that influence in communities comes simply from giving wealth away with no return expected and no obligations incurred. However, there are enough people with short memories of favors done, to make this scenario a highly unlikely means of acquiring either social status or political influence. As Helms (1994:56) notes for Central American chiefdoms, people wanted to acquire gold without having to obey the distributors. People are rarely motivated to be faithful to benefactors unless there is a clear prior agreement or unless they know that they are likely to obtain future disbursements in exchange for support. The classic ethnographic portrayal of status and influence accruing to people simply because they give away their wealth is misleading at best. In order to acquire influence by giving away wealth, there must be a system in place which involves the recognition of obligations at some level (e.g., the creation of debts) on the part of the receivers, although it is also clear that some gift giving at feasts is for purely advertisement purposes to attract good personnel, or for social bonding or other purposes, and that in these cases, no return is expected (compare D'Altroy 1994). As Kamenskii (1985:48) and other ethnographers have observed:

> In theory gifts are voluntary, but in fact they are given and repaid under obligation . . . Prestations which are in theory voluntary, disinterested and spontaneous, but are in fact obligatory and interested, . . . The form usually taken is that of the gift generously offered; but the accompanying behavior is formal pretence and social deception, while the transaction itself is based on obligation and economic self-interest. (Mauss 1924:1, 73)

All households participating in this feasting and loan system can be expected to own special ritual/feasting paraphernalia such as special bowls, pipes, or other items associated with the conduct of feasting and the establishment of contractual agreements. Many Reciprocators also adopt a new strategy of investing their surpluses in their marriage partners and their children. Reciprocators use wealth to obtain more marriage partners as well as more productive marriage partners who in turn will assist them in producing more surplus food or prestige items. Reciprocators begin to pay for costly maturation ceremonies or training for their children so that upon marriage, larger marriage payments will be made to the aggrandizive parents or so they can marry into wealthy and powerful families. Warfare and community cults continue to be important strategies that are used to promote the production and surrender of surpluses, but warfare declines in its predominance as more effective strategies come into play.

Archaeologically, Reciprocator communities can be identified by their larger communities; higher population densities (ca. 0.5–2.0/km^2 for hunter/gatherers); increased evidence of food storage or rich resources; construction of initial feasting/ritual structures; the greater occurrence of prestige items, regional exchange items, feasting paraphernalia or facilities; the occurrence of labor intensive foods in low proportions to overall subsistence staples, possibly including the first domesticates; intensification in subsistence production; increased socioeconomic differentiation in burials and perhaps housing; and occasional high value of women and children due to their enhanced marriage value as reflected in burial goods. In addition to the New Guinea examples, Reciprocator communities probably include the majority of the ethnographically known Plateau groups such as nearly all of the Thompson Indians and many of the Shuswap communities. Teit (1900:267, 270) commented that raids and warfare were very frequent before the fur trade and that men were always armed and ready for attack, even while eating. Moreover, high prices were required to settle killings (Teit 1898:65). Slavery, which is uncommon in Reciprocator communities, may have only become common for most groups as a result of population losses from European introduced diseases and the need to maintain adequate numbers of productive adults (Mitchell and Donald 1985:31). On the other hand, acquiring wives by raiding and abduction is common among Reciprocator communities and is also a common theme in Salish myths and stories (Teit 1898, 1912a, b, 1917).

Among most Plateau groups, the criteria for "chiefs" was essentially identical to characteristics of Head Men in New Guinea (Modjeska 1982): wealth, giving feasts, liberality, good oratory abilities, charisma, and good abilities in warfare (Teit 1900:289; 1906:255). Such criteria do not even change in many more advanced chiefdom societies such as the Maori of New Zealand (Urry 1993:21,23,63). In both areas, one of the most important functions of "chiefs" and Head Men was as peace negotiators (Bouchard and Kennedy 1985:62), a position they probably maneuvered themselves into and used to further their own self interests. They used peace making as compelling reasons for obtaining materials for feasts (Teit 1909:659,664). As in New Guinea, there was a wider diversity of feasts than among Despot communities (Teit 1900:296–8), concurrent with increases in food resource abundance and population density as one descended the river systems. As in New Guinea Reciprocator communities, women in Northwest Reciprocator communities had little voice in councils or matters of importance (Teit 1900:290). While the Despot strategies may not have been used universally, as communities became more complex, it seems far more likely that most, if not all, trans-egalitarian communities throughout the world adopted the most common Reciprocator strategies during the course of their evolution into increasingly complex societies.

Entrepreneur Communities

The potential for producing surplus resources in Entrepreneur communities is so great compared to previous levels of organization that household heads apparently felt relatively confident that they could return the initial amount borrowed from someone plus an agreed upon increment, or interest payment, for the use of those resources. This is one of the hallmarks of Entrepreneur strategies, i.e., the use of surpluses for investment loans which brought in more than was loaned out. Typically the major constraint on production is labor and the willingness to produce surpluses. Once again, aggrandizers could appeal to the self-interest of other community members to increase their own wealth and power by producing as much surplus as possible and loaning out this surplus (to Entrepreneurs or others). The result was the classic potlatch and moka systems described in the ethnographies and often compared to each other by ethnologists (e.g., Mauss 1924).

These feasting and exchange systems involved far larger amounts of surplus than previous ones. In fact, surplus often became so cumbersome that it had to be converted into prestige items. Prestige products proliferated together with craft specialization and regional exchange. Marriage became one of the principal avenues of establishing ongoing investment exchange relationships, and investing in children became a major means of increasing the quantity of goods exchanged at marriage. The value of children could be augmented by a long series of costly maturation ceremonies or training, extending from birth, to naming, to tattooing, to piercing, to initiations, to first hunts, to puberty—all calculated to be a means of investing surplus wealth for later exchanges. Marriage and ultimately funeral payments were simply extensions of this same logic and marriages were frequently contracted by family heads, even for infants or preadolescent children (McIlwraith 1948:384; Swanton 1975:50; Boelscher 1989:117; Emmons and de Laguna 1991:267). As Swanton (1975:68) noted for Northwest Coast Entrepreneur societies: "Property counted for more in making these matches than any other consideration." And McIlwraith (1948:423) states that "Marriage ceremonies resemble more of business transactions." As a result, women's and children's statuses were frequently much higher than in other transegalitarian community types. As the value and status of women in wealthy and powerful families increased due to their value in marriage exchanges, labor and fertility becomes of such concern that special female fertility cults emerge (that even barred women members in some cases!). Women could even hold potlatches of their own and possibly assume the position of "chief" in special circumstances (see below).

Warfare, while not eliminated completely, tended to interfere with investments and exchange, and therefore decreased significantly in importance. In the Plateau ethnographies, warfare is always least frequent in communities that were central to exchange and where feasting was most frequent and diverse such as among the Lillooet, the Canyon Shuswap, The Dalles Wishram, and the Kettle Falls Okanagan (Teit 1906:236; 1909:470–1, 535, 541, 556; Cannon 1992; Schulting 1995:59, 65). Teit (1909:541) even states that war was not important for the Canyon Shuswap "because peace . . . was requisite for their valuable trading interests." As in New Guinea, blood feuds (which persisted in the Interior even after European influences eliminated tribal warfare—Teit 1900:270) were common, and were ended by gifts, marriages, feasts, and wealth exchanges (Teit 1906:236, 247, 255; 1909:659, 664). The Entrepreneur aggrandizers who brokered these transactions (including "chiefs," and Big Men) had the same suite of characteristics as their Reciprocator confreres (wealth, apparent generosity, oratory, charisma) and undoubtedly used these characteristics to insinuate themselves into important positions of power such as peace negotiators, where they could increase their own influence, power, and wealth.

By transegalitarian standards, extreme socioeconomic inequality characterizes Entrepreneur communities, whether in the form of indebted servants to Entrepreneurs, slaves, or control over trade. Slavery is surprisingly common among Entrepreneur communities, occurring among Northwestern Alaskan, Northwest Coast, Northwest Plateau, Ainu, and Calusa communities (Donald 1997; Hayden 1995; Marquardt 1991:70). Despite considerable variation in sizes, communities remain largely independent and do not exhibit the full chiefdom constellation of traits involving true monumental architecture, control by one community over another, or site hierarchies. Although, as in the case of Keatley Creek, bimodal site size distributions do seem to occur for as yet undetermined reasons and modest monuments do occur in some areas.

Ethnographically, Entrepreneur communities include the western highland groups of Papua New Guinea, and virtually all the Northwest Coast communities. Archaeologically, these groups can be recognized by high population densities (2–10/km² for hunter/gatherers); larger settlements; evidence of rich resources and stored surpluses; a somewhat lower incidence of warfare; increased regional exchange and prestige item production; specialized feasting structures, paraphernalia, facilities, and foods; pronounced socioeconomic inequalities in burial goods and housing; and occasional high status of women and children reflected in burial goods. Some of the more complex historic Plateau communities such as those at The Dalles, those around Lillooet, and the Canyon Shuswap were probably Entrepreneur types of societies. All of these groups had social classes with hereditary nobles and slaves. Corporate groups owned resource sites producing substantial amounts of surplus and wealth, which were used in reciprocal and competitive feasts. Child growth and maturation feasts were highly developed together with great emphasis on wealth exchange particularly in the context of marriage payments. Polygyny and specialized training featured prominently among all these elites together with privileged claims to supernatural power. Finally, warfare was notable by its reduced importance. Whether Keatley Creek was an Entrepreneur community prehistorically will be discussed next.

However, first, it should be recognized that communities organized into residential corporate groups exhibit slightly different characteristics in terms of the above developments from communities organized on the basis of independent nuclear family households. With residential corporate groups, most feasting occurs within the corporate residential structure so that there is no need to construct special edifices within the community for such gatherings. On the other hand, some cult related structures might be expected to occur such as those recorded on the Coast (Walker 1982:121), but probably on a small scale. Moreover, I suspect that hierarchical social stratification and power may be more pronounced within residential corporate groups than in communities with largely independent nuclear households. This may entail consequences for relative production of prestige items, socioeconomic differences, and sometimes even corporate monumental architecture. With these considerations in mind, it is now possible to examine Keatley Creek and other settlements of the Classic Lillooet culture in order to determine what evidence is present for the various strategies mentioned above and depicted in Figures 3 and 4.

Conclusions: The Transegalitarian Position of Keatley Creek

Stryd (1973:90) and Sanger (1971:255) both suggested that there was greater socioeconomic stratification in the large prehistoric Classic Lillooet and other Plateau communities than existed in the region during the ethnographic period. Such suggestions have never been assessed in a systematic fashion and are worth re-examining at this point.

Although ethnographies and accounts of fur traders from the early historic period mention large fortified settlements in the Lillooet region (Lamb 1960:80–82; Teit 1906:235–6, 239), there is little prehistoric evidence of warfare. No fortified winter settlements have been reported, and no large summer or fall fishing sites have been excavated. It is predominantly the summer fishing sites which may have been most vulnerable to attack since it is at these locations that the greatest concentration of surplus food and prestige items was to be found. No overall assessment of levels of violence can be made given the few prehistoric burials that have been recovered from the Lillooet region and the lack of information on skeletal trauma from excavated burials elsewhere on the Plateau (see Schulting 1995). Rick Schulting (personal communication) estimates that the few existing observations of violent trauma entail only about 5% of the relevant collections, although no systematic study of violent trauma has ever been undertaken.

In fact, the fortifications recorded by Teit and Simon Fraser may have been the result of the prior introduction of European industrial trade goods, horses, and firearms which, in the earliest phases of contact, seem to have markedly increased competition, violence, and complexity among other Interior groups (Goldman 1940:334–7; Bishop 1987; MacDonald and Cove 1987:ix; MacDonald 1989:18; LeGros 1985; Gibson 1988). On the other hand, as already noted in the discussion of Entrepreneur communities, the Fraser River Lillooet and the Canyon Shuswap were clearly disinclined to war, as was also true of the other major salmon surplus producing communities on the Plateau. As in the case of New Guinea Entrepreneur societies, this certainly must have only been a relative assessment since stories of raids and warfare are hardly lacking for the Lillooet groups. Elsewhere on the Plateau, as would be expected of Reciprocator and Despot communities, it is clear that warfare was much more prevalent despite Ray's views on the peaceful nature of Plateau society (see Cannon 1992; Kent 1980; Suttles 1981; Bouchard and Kennedy 1985:34, 58–61).

The tendency to avoid conflict, together with the fact that the Lillooet region produced the greatest amounts of surplus salmon for trade of any Interior fisheries in British Columbia, makes it seem unlikely that the Keatley Creek community was organized according to Despot principles and strategies. Even the fur traders at Fort Kamloops traveled to Lillooet to procure most of the dried salmon that they required to last through the winter (Kennedy and Bouchard 1992:319) each fort on the Fraser River required 25,000 salmon according to Drake-Terry (1989:26). In fact, traders from Yakima in Washington State came to Lillooet apparently for the same purpose as well as to exchange prestige items (H. Smith 1910:144), while Lillooet and other Plateau elite made the "10 night" trek to the coast to trade and to obtain wives (Lamb

1960:79; Nastich 1954:20; Kennedy and Bouchard 1992:319; Schulting 1995:53). They even drew maps for Simon Fraser of the route between Lillooet and the Coast. The Upper Lillooet and the Canyon Shuswap were the greatest traders (Teit 1909:535, 536). The Lillooet salmon was abundant; it had an optimal fat content since it was not too close to the sea nor too far up the drainage where exhausted salmon often became like cardboard; and the salmon at Lillooet was dried under optimal conditions due to the hot winds of the region. The Lillooet region was also situated on the principal communication corridor with the Coast (via Seton and Anderson Lakes, and thence down the Lillooet River to Harrison Lake and the Fraser River tidal zone—Nastich 1954:15, 20; Teit 1909:536). All these factors must have made the prehistoric Lillooet communities powerful and wealthy and highly desirable as exchange partners for other elites.

In addition to the regular production of large surpluses and the relative disinclination to violence, Keatley Creek and other Classic Lillooet communities display considerable capacity for the storage of food in large subterranean caches, and additional storage can be assumed to have existed both in pithouse rafters and as exterior above-ground caches (Alexander 1992; 129–32; Vol. II, Chap. 2). Population densities and community sizes were correspondingly high, with 1,200 to 1,500 people residing at Keatley Creek and a population density of 2–3 people per square km (Vol. II, Chap. 2).

There is considerable evidence for regional exchange in the form of dentalium and other shells from the coast (330 km to the west), moose antler from Prince George (460 km to the north), obsidian from Anaheim Lake (430 km to the northwest—Stryd 1973:46), and Fraser River nephrite recovered archaeologically from the Rocky Mountains and the Columbia Plateau (Darwent 1998). These items constitute prestige goods which Lightfoot and Feinman (1982:67) argue reflect the development of leadership. Trachydacite from the Keatley Creek/Cache Creek region has also been identified in some abundance in the North Cascades park in Washington State, while two pieces of greenish agate at Keatley Creek probably came from Idaho or the Hosamine chert source in the Ross Lake region of Washington State (Ed Bakewell, personal communication). The list of trade goods ethnographically brokered on the Plateau is extensive (Teit 1900, 1906, 1909), and exchange of prestige goods was carried out predominantly, if not exclusively by elites who attempted to monopolize exchange activities whenever possible. They were successful predominantly in regions that produced large surpluses such as The Dalles, Lillooet, and Farwell Canyon (the Canyon Shuswap—Teit 1909:535, 576, 582; Spier and Sapir 1930:225; Schulting 1995:53).

These exchange activities created a unified elite social fabric across the Plateau (Hayden and Schulting 1997) with a common trading and elite interaction languages such as Chinook and possibly the "high" languages of the elites. Desmond Peters Senior told me that only chiefs like Sam Mitchell and Baptiste Richie knew the Lillooet high language. This language was spoken among the chiefs and was used in important addresses. Hudson (1994) reports a similar high language among the Okanagan, and one also was used among the elites on the Coast (Berman 1994:504–5). One of the functions of the chief's mouthpiece reported by Ray (1942:229), may have been to translate speeches made by chiefs in high languages to event spectators. Elite high languages appear to be increasingly common features among chiefdoms and early state levels of organization. Chinook was spoken best by the Lillooet who were renowned for their trading activities and the multilingual abilities of their traders (Drake-Terry 1989:42; Teit 1906:202, 231–2). Wood (1980) has referred to this integrated network as the Pacific-Plateau trading system, and Rick Schulting and I have called it the Plateau Interaction Sphere (Hayden and Schulting, 1997).

Salmon played a special role in this exchange system because it was so critical for the survival of many of the groups without access to prime fishing locations (Cannon 1992). As already noted, the Lillooet region produced the highest quality dried salmon in British Columbia, and Lillooet producers obtained the highest exchange rates (Teit 1906:232). While Lillooet was clearly the primary salmon producer on the British Columbia Plateau, it appears to have been far surpassed by salmon production of its homology at The Dalles, on the Columbia River. The Six-Mile fishery (The Fountain) at Lillooet produced 40,000 salmon in good years before the serious disruptions of 1913 (Romanoff 1992a:246; Kennedy and Bouchard 1992:300–1, 315). In contrast, Lewis and Clark saw 10,000 pounds of stored dried salmon at The Dalles in 1805 (Spier and Sapir 1930:178–9), while Hunn's (1990:133) graphs indicate catch rates of 100,000 pounds per day at The Dalles in historic times, which seems scarcely credible. However, accounts of the first commercial fish wheels established at The Dalles in the 1890's tell of how the cost of one $80,000 mechanism was recovered in a single day of operation (David Cole, personal communication). In short, by all accounts, The Dalles was producing salmon surpluses on a far grander scale than can be imagined for the Lillooet region, and as might be expected, the ethnographic and archaeological evidence portrays considerably richer, more complex cultural developments at The Dalles—an archaeological loci that has been systematically looted by art collectors for generations (Schulting 1995).

Just as English is the world trade language of today because the United States is the foremost trading power, it is certainly no coincidence that the pan-Plateau trading language was Chinook, the indigenous language of The Dalles region. Prehistorically, salmon production in the Lillooet region was almost certainly substantially greater than that recorded by Euro-Canadians in the early 1900's. Not only had placer mining, competitive salmon canneries, deforestation, damming, and other industrial activities adversely affected the Fraser River salmon runs by the turn of the century (Hayden 1992a; Drake-Terry 1989:47, 56, 72; D.S. Mitchell 1925), but prehistorically residents of Keatley Creek relied to a significant degree on pink salmon which are almost unknown historically in the region. Thus, prehistoric salmon production must have been considerably greater at Lillooet than the historical records indicate, although total production was undoubtedly still far below production at The Dalles.

The unusually labor intensive manufacture of nephrite adzes in the Lillooet region is not only an indication of prestige good manufacturing, but may be an indication of indentured or slave labor in the region. Slaves were reported ethnographically (see below) and occurred in even greater numbers at The Dalles (Spier and Sapir 1930:22). Other prestige goods recovered at Keatley Creek include antler digging stick handles, incised bone plaques or pendants, bone buttons, dentalium and other coastal shells, raptor and loon wing elements, bear claw elements, stone pendants and eccentrics, soapstone pipes, rolled copper beads and sheets, graphite, serpentine sculpture, sculpted mauls, mica fragments (see also Stryd 1973:404; Teit 1909:650), and other items (Vol. II, Chap. 13). See Stryd (1973) for comparable materials excavated from the neighboring contemporaneous Bell site including quartz crystals, pectin shell rattles, bone and stone sculptures, and other items.

There are clear status and wealth inequalities in the Keatley Creek and other Classic Lillooet communities. There are major differences between small, poor houses and large houses in storage capacity, prestige items, overall intensities of economic activities, the intensity of firewood use, and the hierarchical arrangements of domestic groups (Vol. II, Chap. 1). Storage capacity and household size are both related to developing inequality in transegalitarian societies according to Lightfoot and Feinman (1982:66–7) who observe similar developments in pithouses of the American Southwest. Although we encountered no human remains at the Keatley Creek site, elsewhere in the Lillooet region and at analogous locations on the Plateau, there are substantial differences between burials in terms of the value of grave inclusions indicating substantial development of inequality (Schulting 1995; Pokotylo et al. 1987; Stryd 1973; Sanger 1968). Moreover, children were sometimes buried with unusual amounts of wealth (e.g., the child buried with several sculptures and 246 dentalium shells inside a housepit at the Bell site—Stryd 1973:426).

At other major centers on the Plateau, women were buried with the same basic range of prestige grave goods as men (Schulting 1995), and there are indications of female cults such as "She Who Watches" at The Dalles. The comparatively high status of women evident in the archaeological record is paralleled in the ethnographic accounts of the major salmon surplus producing centers. As is consistent with the increased importance of marriage exchanges among Reciprocator and especially Entrepreneur communities (Hayden 1995; Teit 1906:240), noble women had almost the same status as men (Teit 1909:576, 578), participating in dance societies and even holding potlatches and becoming "chiefs" under special circumstances (Teit 1906:255). The bilateral descent of the Lillooet (Teit 1906:252) also makes sense in terms of using marriage as a primary means of exchanging wealth.

Despite these observations, as in the most complex New Guinea societies (Modjeska 1982) women were rarely on a full par with men within any given rank. Women did not generally occupy the most important positions of power and did not generally play prominent roles in public life. For instance, on the Coast, although women were not generally abused and might control considerable trade and might have high status as individuals, no notice was generally paid to them and they were often betrothed by the age of seven or eight. Women often were in servile conditions, working while men lounged or participated in feasting or public events (Sproat 1987:49, 68, 83; Walker 1982:47, 84; Jewitt 1974:55,109; Kamenskii 1985:30, 34). One woman who refused to have sex with her husband even had part of her nose bitten off (Jewitt 1974:109). In the Lillooet region, women ate last of all the adults in feasts (Romanoff 1992b:477) and ethnographers (Teit 1898:75, 80; 1912a:279, 361; 1912b:298, 307, 320, 328, 336, 338, 344, 356, 366; Boas 1898:3) frequently refer to chiefs or parents or brothers "*giving*" daughters to special men as wives or receiving women for wives as great presents in regional oral histories. The idea of women being given husbands in this fashion seems to have been unheard of. As a counterpoint, a man could lose his wife and children by using them as stakes in gambling (Teit 1912a:375; 1912b:338–9). According to Ray (1942:229), women were never chiefs anywhere on the Northwest Plateau except among the Lillooet and even then only under exceptional circumstances. Women, in general, did not fare well in work, either. Among the Shuswap, Simon Fraser observed that "women are much accustomed to laborious work" while the men did not carry anything heavy (Lamb 1960:140–1). Teit

(1917:37) recorded similar behavior among the Thompson. Thus, all in all, women's status was not particularly high, although under special circumstances elite women could sometimes assume roles as important as men.

Relatively small and presumably rather exclusive cult structures may exist at Keatley Creek on the upper terraces in the eastern part of the site. This must still be verified. Evidence for feasting includes rather large food preparation areas such as the roasting area near HP 7 (EHPE 2), the roasting features near the presumed cult structures (EHPE 12), and a large roasting structure near the creek itself (EHPE 20). Outside food preparation areas for feasts seem to be quite common occurrences in transegalitarian communities (e.g., Blake 1991:38–40, 44). Inside the large housepits such as HP 7, central areas are cleared of most ordinary debris and often have fine silt flooring which may have been natural but incorporated as important features in choosing pithouse locations and orientations. Grant Keddie (personal communication) recorded an oral account of large housepits being used for dancing and feasting and fine silts being brought in to spread on the floors for these purposes. Pithouse like structures in other culture areas generally have a portion of the floor reserved for "sacred" purposes (e.g., Bowers 1965; Wilson 1934), and generally, sacred areas are opposite household entrances (Vol. II, Chap. 1).

A number of faunal remains also indicate the existence of ritual dances presumably performed in pithouses in the context of feasts, much like the potlatch ritual dances of the Coast. These faunal remains include wingbones of raptors, extremities of bears, bones of furbearers, and antlers that have been sawn and tapered as if to fit into a headdress although they could have been hafted for practical purposes as well. Ethnographically, groups used parts of ancestral totemic animals or power animals in dances, including bear claws and deer antlers (Teit 1906:257; 1909:578). While special serving vessels and other paraphernalia for feasting probably existed, they appear to have been constructed of perishable materials like basketry, leaving little material record. Feasting was very important for ethnographic elites. As Teit (1906:258) observed:

> Potlatches were given by one individual to another or by the chief of one clan to another. In the latter case, the chief represented his clan, and the potlatch was equivalent to one given by all the members of one clan to all the members of another. Some of these potlatches were great affairs; and clans tried to outdo one another by the quantity and value of their presents, thus showing to all the country that they were the most powerful, wealthy, and energetic . . . In most cases the guests were expected at some future day to return presents equal in value to those given to them, or even of greater worth.

In addition to displaying the power and success of a group, lavish and costly feasts were also used for child births and subsequent maturation celebrations, for marriages (accompanied by major reciprocal wealth exchanges), for making peace and acquiring allies, and for funerals (Teit 1906:236, 247, 258–60, 267; 1909:583–4, 659, 664). As already noted, these uses of feasts are very similar to the feasting strategies found among Reciprocator and Entrepreneur societies of New Guinea and used by ambitious individuals to acquire political and economic power (Hayden 1995).

Finally, there are domesticated dogs at Keatley Creek. These may or may not have been used for feasting, but they are undoubtedly associated with the display of status and prestige. It is difficult to account for the curation of the dog skulls recovered from HP 7 (Vol. II, Chap. 10) unless they were being kept and displayed as testimonies of important past rituals or feasts, just as horns of cattle or the jawbones of sacrificed pigs are hung up on walls as displays of wealth and good fortune in China (Song 1964 cited in Kim 1994:121) and Thailand (Hayden field notes). At Keatley Creek, dogs may not have been eaten at feasts, but were clearly dismembered at impressive events similar to the rituals recorded by Teit (1909:579) and secret Tolache cult rituals of southern California (Salls 1990). The value of dogs is indicated by the fact that they were one of the items inherited by sons (Teit 1900:294) and sacrificed at funerals. I have even seen one fur trade journal account of the spiteful killing of a dog between two Indian families resulting in a full conflict and massacre.

In historic times, the horse seems to have taken over many of the roles of native dogs, being used for status display, bearing burdens, and sacrifice at funerals (Teit 1909:734; Vol. II, Chap. 10). Rich chiefs owned up to 1,000 horses (Teit 1909:734; 1930:262) and prehistoric wealthy families undoubtedly owned numerous dogs. A similar role was also filled by slaves ethnographically (Teit 1906:232–3; 1909:576; Nastich 1954:23, 46–7), with the dog dance society (Teit 1909:579) even bearing remarkable similarities to the cannibal society dances of the Coast. Like dogs and horses, slaves were sometimes killed at the funeral of their owners, sometimes by being buried alive with them (Teit 1906:270)!

The existence of slavery is so widespread in the Northwest and is recorded from such early historic contexts that it seems highly likely that it had a prehistoric origin and was not simply the result of contact with Europeans, although it may well have achieved a more widespread distribution, new levels of intensity, and new productive functions due to the depletion of populations by epidemics, the need for labor, and intensified wealth competition (Mitchell and Donald 1985:31). Yet, the archaeological evidence for slavery is elusive at best. As previously noted, the development of nephrite celts may be one of the most visible expressions of slavery. Jewitt (1974:65) states that slaves performed all hard and menial work, and given a rate of cutting nephrite using non-industrial technology of only one millimeter per hour (Darwent 1998; Chapman 1891:498–9; Hansford 1950:79; M. Johnson 1975), making these celts would have certainly constituted hard and menial work. In addition, there are several occurrences of burials lacking grave goods in housepits immediately prior to abandonment or between two occupations (e.g., Housepit 1 at O'Sullivan Reservoir, Washington, and the Pine Mountain site at Lochnore-Nesikep, B.C.—Daugherty 1952; Sanger 1966). These may be similar to the apparent deposition of dog remains on floors of houses at Keatley Creek just prior to their abandonment (Vol. II, Chap. 10) or to the dog sacrifice rituals at Wildcat Canyon (Dumond and Minor 1983).

Evidence of human sacrifice (which generally involves slaves) appears in the Nicola Valley where H. Smith (1900) reported decapitation-like cut marks on a burial, and from a housepit dated to 1,100 BP near Chief Joseph dam where a human skull was recovered from a pit in the center of the floor. Schulting (1995:134, 144) suggests that other burials at Fountain and Adams Lake appear to have been slaves that accompanied their owners to the grave. If slavery was present prehistorically elsewhere on the Plateau, it certainly should have also been present at Keatley Creek, and I think that it probably was. There are no direct ethnographic accounts of the household duties of slaves on the Plateau, but if they were similar to slave chores on the Coast, they would have included fishing and food preparation (Vol. II, Chap. 1). Oral traditions of the Thompson groups indicate that servants performed the hard work like getting firewood and water, cooking, dressing skins, and carrying loads or delivering gifts (Teit 1912a:242, 384).

Thus, in sum, there is only weak evidence for warfare or cults as an aggrandizive strategy for promoting the production of surpluses and using some of these surpluses to enhance aggrandizers' wealth and power at Keatley Creek. There is good ethnographic and archaeological evidence for regional trade and the production of substantial amounts of prestige goods that would be consistent with a very evolved Reciprocator or early form of Entrepreneur organization. Population densities, storage capacities, available resource levels, and abilities to produce surpluses all support this evaluation.

Complexity can also be inferred from a number of types of settlement data. Size distributions of houses within settlements can be used to measure inequality using Lorenz curves and Gini coefficients (Vol. I, Chap. 1). The same techniques can be used to measure inequalities in burials (Schulting 1995), and inequalities in the size distributions of sites within a region (Vol. I, Chap. 1). In the case of the Plateau in general, and the Lillooet region and the Keatley Creek site in particular, all of these indices point to social and economic organizations that were far from egalitarian. However, applications of these techniques is still extremely new, and without a broader comparative body of similar observations from a range of egalitarian to complex societies, it is difficult to use these measures as indicators of specific forms of socio-economic complexity. Even in the case of pronounced inequalities in settlement sizes (considered to be an important indicator of chiefdoms and complexity by G. Johnson (1973), Wright (1977), and others, unusually large settlements sometimes occur around successful Big Men (Entrepreneurs) with no real power hierarchy of one settlement over another (Lightfoot and Feinman 1982:67). However, the unusually large site of Keatley Creek persisted over too many centuries to have resulted merely from ephemeral charismatic characteristics of successful leaders. Much more fundamental economic factors must have been involved. Aside from differential settlement sizes, we have no evidence for actual political site hierarchies or even evidence for unified political control within a single large settlement; and therefore we have no unequivocal evidence for true chiefdoms.

Settlement size does provide a strong indication of transegalitarian complexity, while population density provides a weaker, but still useful indicator as well. Naroll (1956:690, 699), Carneiro (1967), Blau (1977:162–3, 182, 241), Johnson (1982), Ames (1985), Clark and Parry (1990:309), and Hassan (1981:181) have all documented the empirical relation between the size of the largest settlement of a polity and the number of formal social organizations, the number of occupational specialists, and the need for administrative and enforcement officials (Fig. 5; see also Hayden 1997:48). On the basis of the relationships that they have documented, about 10–20 types of occupational specialists including 5–10 craft specialists probably existed at Keatley Creek during its peak population of 1,200–1,500, among which were probably house administrators, heralds, police, warriors, runners, fishermen, hunters, slaves, carvers, nephrite workers, shamans, traders, basket makers, herbalists, and leather workers (Hayden 1997:48; Romanoff 1992b). There were probably also 5–10 types of social organizations, including residential corporate groups, nuclear families, trade partnerships, secret societies, dance societies, and village councils. Some scholars have suggested that these increases in complexity stem from the limited capacity of humans to form numbers of relationships and recognize appropriate roles beyond a few hundred individuals (Forge 1972; Blau 1977:132), the need for information processing specialists above certain population sizes (scalar stress—Kosse 1990), and increased power related to increases in group size (Blau 1977:241). Whatever the reason, these models are consistent on a larger scale with what is known on the Plateau ethnographically, and they strongly support our basic inferences about the social and economic organization of the region prehistorically.

The relatively high status of women and children as reflected by prehistoric grave goods in the Lillooet region implies that marriage payments, child growth payments, and exchange were all important features of the large houses in the Keatley Creek community. The magnitude of the socioeconomic inequalities observed within and between housepits plus the occurrence of domesticated dogs also points to an elaborate Reciprocator or simple form of Entrepreneur organization. One of the most critical factors in differentiating these two organizational forms is whether profit driven investment was a feature of feasting and other relationships. This is a difficult problem to resolve at this stage. Ethnographically, "potlatches" to outdo rivals in producing and distributing wealth clearly occurred and were especially common among the Canyon Shuswap (Teit 1906:258; 1909:535, 583). Keatley Creek was far larger than any ethnographic community, and we could reasonably expect commensurately more and more intensive feasting in the large Classic Lillooet communities. I think it is very likely that at least low level Entrepreneurs succeeded in instituting profit driven investments and competitive feasts in these communities. However, I cannot demonstrate this unequivocally.

Was Keatley Creek more complex than the ethnographic Upper Lillooet and Canyon Shuswap? Given the effects of European trade, horses, firearms, and diseases (Campbell 1990:17–21), this is difficult to answer, especially since there is little consensus by researchers on the magnitude or direction of effects from each of these factors or their overall impact. Bishop (1987), MacDonald and Cove (1987:ix), Gibson (1988), Fitzhugh (1985:37, 188–9) and Goldman (1940) all argue that European trade substantially augmented the preexisting political centralization, conflict, class distinctions, and the general complexity of native communities, including those in the British Columbia Interior. Campbell (1990) argues that epidemics and more equal access to trade goods by all community members acted to reduce inequalities (as in New Guinea—see Feil 1987:95, 117–120). Empirically, Schulting (1995) finds little difference in burial inequality on the Plateau from prehistoric to proto or early historic times. However, the opening and closing of trade routes clearly had major effects on local socioeconomic complexity and inequality elsewhere in the world whether the context was prehistoric or historic (Vogel 1990; Cabrero 1991; Ramenofsky).

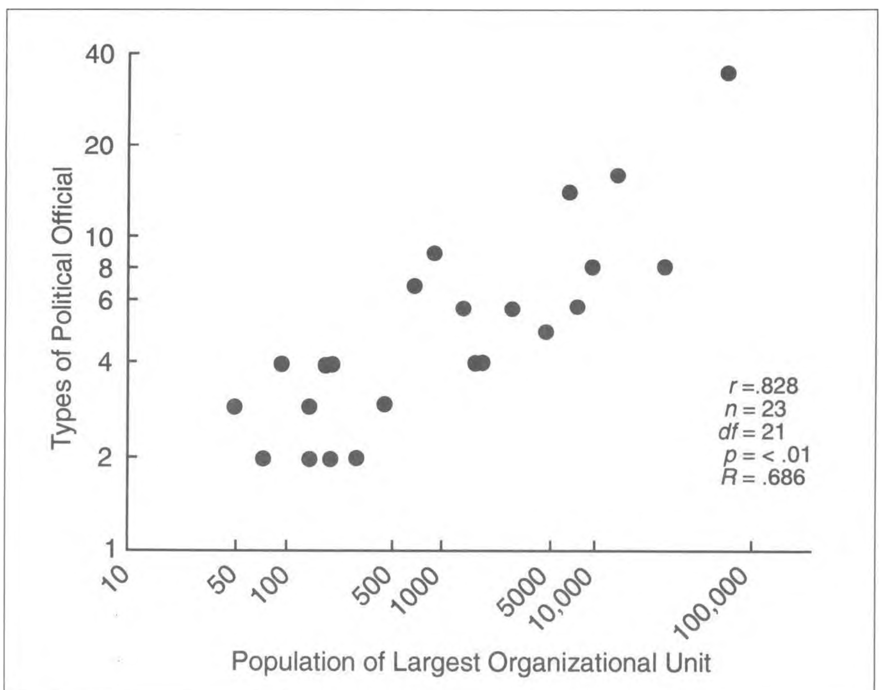

Figure 5. The relation between population size of polities and the number of types of political officials in the polity (from Johnson 1982:390). Given this relationship, Keatley Creek should have had 5–10 types of political officials.

Overall, I think it is relatively safe to conclude that the prehistoric Keatley Creek polity was at least as complex as the most complex ethnographic Lillooet and Canyon Shuswap communities and resembled them in many basic organizational characteristics. It is also possible that the Classic Lillooet cultures with greater abundance and surpluses of salmon were even more competitive in their feasting, approaching some of the more complex *prehistoric* coastal groups in this respect where potlatching was much less frequent and intensive than recorded for the fur trade period (McIlwraith 1948: 243; Goldman 1940:345; Codere 1950:94–5). At this point, there is no reason to believe that any Interior groups were organized into true chiefdoms with authoritative political heads of entire settlements, multi-settlement political hierarchies, and active campaigns of territorial conquest. The most powerful figures at Keatley Creek seem to have been heads of independent corporate groups that resided together in the same community.

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Chapter 18

Social Organization and Life at Keatley Creek: A Reconstruction

Brian Hayden

Introduction

It is possible to embellish the basic conclusions that have been established thus far with yet other observations from archaeological, historical, ethnographic, and ethnological work to create a more complete picture of how the Tl'atl'lh (Keatley Creek) community was organized and what life was like for its residents. Because this community was situated in a transition area between the Shuswap and Lillooet ethnographic groups, I will draw most heavily on both of these traditions. Observations from similarly complex groups on the Coast will also be used at times to provide insights into social and economic organization since the overall level of complexity was probably similar, the basic organization into residential corporate groups was similar, and since there was clearly considerable contact in terms of trade and marriage between the Coast and the Interior. The goal of this section is to flesh out what life may have been like, from my point of view, using these sources as guides. Indications of the sources used for these reconstructions are included wherever possible. Other details are derived from my own conceptions of how these communities operated. As is consistent with the original aim of the FRICGA project, most attention will focus on the large residential corporate groups.

Seasonal Resource Acquisition

The time is late summer in the year AD 800, about 50 years before the catastrophic collapse of the salmon runs and the nearly total abandonment of the community. At the height of the hot season, the terraces were rich with saskatoon berries, goose berries, soapberries, and blackcaps (Turner 1992:423). Women and children collected large quantities and dried them for the winter. Toward the end of the Berry Moon (late July) before the edges of the Great River became black with salmon, all the members of the great ancestral houses, the pel'uΣem, were down at the river repairing fishing platforms, scaffolds, and drying racks, and repainting the crest poles and rocks that displayed their ownership of the sites (Teit 1906:255; 1909:576; Kan 1989:85). During the Salmon Moon (August), at the peaks of the salmon runs, all the men took turns in the fishing; all the women helped in the butchering and drying; and all the children that were old enough helped in carrying the fish from the men to the women or in dumping fish wastes into ravines, or helped in whatever way they could. Everyone was involved except those women in their lunar period and the elite girls in their isolation periods[1] (Owens and Hayden 1997; Alexander 1992:136). The peaks of the runs were exhausting for everyone, with men fishing throughout

1. The longer the elite girls stayed in seclusion and the less physical work that they did, the more valuable they were in marriage exchanges (Oberg 1973:33). The highest ranking girls stayed in seclusion for four years or more (Teit 1906:265).

the night in order to take in as much of the most productive part of the run as possible (Bouchard and Kennedy 1990:253) and women and children trying to keep up with the processing.

During the peaks of the runs of sockeye and spring salmon, many of the independent poor families had helped the great families fish and process salmon at the platforms and scaffolds owned by the great houses. The poorer families did not own any platforms or scaffolds or fishing sites of their own, so were paid for their help in salmon. The poor were also permitted to salvage (for a share of the product) any salmon which the great houses could not process themselves. The poor could use the fishing sites (again for a share), but only after all members of the great houses had obtained what they wanted (Teit 1909:582–3; Romanoff 1992a: 244; 1992b:493; Kennedy and Bouchard 1992:308; Schulting 1995:59; MacDonald 1987:6; Swanton 1909:71; Curtis 1915:28).

At the fisheries each family dried hundreds of sockeye and spring salmon, either for winter consumption or trade. Spring salmon were the richest nutritionally and the most valued fish for trading. These oily spring salmon were carefully sliced into long thin slab fillets, then scored every finger width and smoke dried to prevent decay. Dried backbones were tied into bundles for emergency soups. Scraps were given to the dogs (Desmond Peters, Senior, personal communication) or boiled up into thick broths from which the precious oil was skimmed off and put into salmon skin bottles (Romanoff 1992a; Kennedy and Bouchard 1992).

When the processing of the salmon was complete, the women and dogs carried the dried salmon up the towering river gorge and across some 3,000 paces of terrace to the great houses. There the salmon was kept in baskets in deep earth pits inside and outside the houses where they were best preserved (Teit 1909:495; Lamb 1960:140; Romanoff 1992b:488). The least valuable backbones were always placed on skins and straw at the bottom to prevent dampness from affecting the most valuable dried salmon (Spier and Sapir 1930:179; Romanoff 1971:40). The remaining roots and berries that had been gathered in the summer were also placed in these pits or stored in baskets under sleeping platforms. Each family had its own storage pit or shared a part of a pit with others in the house depending on the amount to be stored and the rank of the families involved (Teit 1917:45; Kennedy and Bouchard 1975:45). Since outside storage pits froze up in the winter and were inaccessible, additional salmon storage was either located in sheds on elevated platforms down by the river where it was less cold and would be accessible throughout the winter, (Boas 1891:635; Romanoff 1992a; Kennedy and Bouchard 1992; Bouchard and Kennedy 1990:253,278–80; Alexander 1992:131) or in pits close to the houses that were not covered with earth but only by poles (Teit 1898:109,150fn; 1900:199; 1906:223). Food for more immediate use was hung from the rafters or placed in baskets in the great house (Vol. II, Chap. 2). Supplies left down by the river were relatively safe after everyone entered their pithouses since the mountain passes leading to enemy territories were generally blocked by snow within a moon or two (Desmond Peters, Senior, personal communication).

Between the peaks of the major runs, men entertained the many traders that traveled from one fishery to another trying to exchange dentalium shells, nephrite, copper, buckskin, furs, pipes, beads, ochre, feathers, slaves, and other prestige commodities for the tasty dried salmon of the region. People who did not stop to trade were charged transit fees for carrying wealth across the land of the pel'uΣem (Vol. II, Chap. 17). Evenings were spent with visiting traders playing lahal, dancing, singing, and sometimes arranging marriages (Teit 1900:167,259; 1906:231–2; 1909:536,616; Lamb 1960:120–1; Romanoff 1992a). Children amused themselves by burning off berry patches and brush at night (Teit 1900:230; Turner 1992:413) providing spectacular sights like fireworks visible for miles. If there were no interesting social events, adults spent time making mats, baskets, snowshoes or other items (Alexander 1992:161).

The sockeye and spring salmon runs were unusually abundant this season, the greatest of the four years in the sockeye cycle, and the nobles of the great houses were reassured that the winter would be comfortable and enjoyable with the possibility of hosting major feasts. After a few weeks, as the main runs of the valued sockeye and spring salmon subsided, the elite hunters of the great houses realized that they would soon have to travel to the alpine areas if they wanted to obtain as much deer meat as possible before the snows arrived. They craved deer meat as superior food, as a respite from eternal salmon, and as an essential valuable food for holding feasts of renown and profit (Romanoff 1992b). Deer skins, so valuable for their warmth in winter, were in their prime condition now, and the deer meat was richest in fat at this time of year. Without deer skins, it might be necessary to use the embarrassing sagebrush bark capes and blankets of the poor.

The elite hunters therefore left the fisheries under the care of the elderly house nobles who were unable to make the arduous trip into the mountains, who stayed by the river to direct the commoners of the house and the slaves in the fishing, drying, and storage of the most abundant, but less desirable salmon runs—those of the dry tasting pink salmon (Garfield 1966:29). With the arrival of the pink salmon, every family could construct a cobble or brush jetty along the gravel banks of the river and obtain almost enough fish to last them for the winter. However, the pinks were not as nutritious, or tasty, or valuable for trade as the other species (Kennedy and Bouchard 1992:275). Pink salmon were often dried with the backbone still attached to the split fish, and towards the end of the season, they were even freeze dried.

Staying by the river for the runs of pink salmon, however, meant that the poorer families could not participate in the fall hunt in the alpine meadows; they therefore had little opportunity to accumulate dried deer meat for feasting. The poor never hunted by themselves, but always tried to accompany the elite professional hunters if they could afford to (Steven Romanoff, personal communication). Even then, they were not always given a share of the kill to take back (Teit 1912b:360). Generally, the poor stayed at the river until the end of the pink runs and then packed a good quantity of their dried fish to the winter village.

The elite hunters and their families made the difficult trek to the tops of the high mountains and the valley beyond to hunt and dry deer meat during the Hunt Moon (October) and to gather pine nuts, moss, and huckleberries (Turner 1992:423). The women, slaves, and dogs carried almost all the household possessions and supplies on these trips (Teit 1917:37; Lamb 1960:140–1). They camped under the subalpine trees, and the women worked hard to tan as many skins and dry as much meat as they could when not out gathering. If there were too many hides to tan before leaving, they would be dried and brought back to work into fine buckskin in the great houses. Each great house had its own deer fences in its traditional hunting area (Dawson 1892:14; Romanoff 1992b; Teit 1909), and while there, the men picked up as much good quality tool stone as they could carry back to the winter village (Vol. I, Chap. 16; Vol. II, Chap. 17).

Preparations for Winter Hardships and Celebrations

Like some tribal Europeans, the year began for the Tl'atl'lh community with the notable increases in darkness and cold. Everyone returned to the winter villages during the Enter Winter Houses Moon (November). The elite hunting families returned from the high mountains ladened with dried deer meat, dried fleshed deer skins or furs, tool stone, and any roots that had been cached during the previous summer. Daughters in their seclusion periods and women in their moon periods followed the main group. Hunters gave portions of their kills, especially the rich deer fat, to the Firstman of the pel'uΣem (Teit 1912b:363; Oberg 1973:30; Arima 1983:70; Boas 1921:1337). The remaining families from the fishing locations along the river returned with the last of their bundles of dried fish to store at the village. Families went far to bring back firewood for the winter which they stacked mostly outside the houses but also brought some inside to put on ledges or under sleeping platforms[2] (Condrashoff 1972; Teit 1917:26; 1912a:222; Barrett 1975:39).

Perhaps it was at this time too, when the dead were honored just as the contemporary bands have a special cemetery day. Important wealthy families also held *sxwayxwey* mortuary feasts in the region in front of the carvings and crests of their ancestors, some even reburying bones in new wrappings and with new wealth[3] (Ostopkowicz 1992; Teit 1900:330; 1906:259,270; 1909:576,593).

Before the funeral rituals, houses were cleaned out. All old grass and fir bough bedding, along with sweepings and unusable rock or stone or bone were carried up the steep notched log ladder and thrown on the outside edge of the house roof. Mats were unrolled from their storage places and placed on the floor between the hearths and the sleeping platforms, as well as on the walls (Teit 1900:188; Post and Commons 1938:40). New grasses and boughs were brought in and placed between the rush mats and the poles of the knee high sleeping benches which extended out from all the house walls (Teit 1900:199; 1906:215; 1909:676; Bouchard and Kennedy 1973, 1977:63; 1985:35). The roof was checked for any necessary repairs. Valuables stored in pits inside the house (Teit, n.d.) were taken out for use and display. The carved tops of the log ladders and the large carved interior posts representing the ancestral animals of the great houses (Teit 1900:194; 1906:204,213; 1909:492,576) were repainted to reflect the crests of each pel'uΣem: bear, beaver, coyote, dog, deer, eagle, owl, hawk, raven, cougar, wolf, serpent, frog, or toad. The same designs were woven into mats hung along the walls and between domestic areas within the great

2. Even on the coast, John Jewitt (1974:96) had to travel 3 miles (5 km) from a major village in order to obtain firewood. The high population concentration at Keatley Creek and the scant forest cover must have made firewood there even more difficult to obtain.
3. The grave goods, grave sculptures of deceased family heads, secondary interments, and honoring of elite ancestors is characteristic of Entrepreneur societies and chiefdoms in many parts of the world (Hayden 1995) and make sense as part of ritual strategies for validating inheritance of resource and/or managerial rights as well as for claiming supernatural superiority of one's immediate ancestors, a superiority which is passed on to the living sponsor of the funeral feasts. This is probably also why burials in general are so important for most native communities in the Northwest.

houses (Teit, n.d.; Condrashoff 1980), especially those around the house chief. Hide or mat flaps over the side and top entrances (Teit 1898:23,28; 1912b:369; 1917:72, 86) were also repainted, repaired, and secured, with log ladders from roof to floor inside and out of the house. Hammocks were set up for babies, and lines were strung for drying clothes (Teit 1900:199; 1906:206).

Every generation, it was necessary to replace the decaying roof of the great houses, a major undertaking requiring considerable expenditure (Teit 1900:192). It was necessary to accumulate the logs, mats, poles, bark and requisite wealth payments over a number of years in order to accomplish this job. As on the Coast, many helpers had to be paid and a major group feast had to be given for all participants and other nobles of great houses. But this did not have to be done this year. Girls and women in seclusion went off about 15 paces from the great houses to set up and repair their tiny seclusion houses, only 3–5 paces across (Post and Commons 1938:41; Teit 1900:198,326–7; 1906:263; 1909:495). When the weather was very cold, or when girls or women were sick, the women in seclusion might be lodged in the loft area or in special corners of the great house (Teit 1912a:361).

This was the period when raids were most likely to occur from enemy groups, although it was generally the smaller houses that were most vulnerable. By this time, all surrounding and distant groups could assess quite accurately whether they had enough salmon and other stores to last the winter without major shortages. If they were seriously short, it would be necessary to make up the shortfall either by trading or raiding before snows blocked the mountain passes (Cannon 1992:510). Sometimes this happened toward the end of the fishing season, consequently, many groups put up fortifications around their summer or fall shade shelters (Lamb 1960:82). The Lillooet were rich in food and surpluses. They preferred to trade and exchange rather than go to war, and they were known for preferring peace. They were therefore frequently raided, especially whenever they were traveling in small groups in the mountains (Teit 1906:240; 1912b:331). Small groups were always more vulnerable (compare Burch 1975:226), and one of the most important advantages commoners obtained from their affiliation with great houses was protection.

Feasting Forms and Functions

Feasts to Promote Alliances

Socially-bonding feasting took place after entering the great ancestral houses in the fall to celebrate and give thanks to everyone who had helped obtain the salmon for the year, to thank honored guests for their support, and to thank the ancestors of the elite owners of the fishing locations for having established the fishing locations (and the great houses) and made them productive (Spier and Sapir 1930:175). Prior to such feasts, the elite men and women indulged in sacred sweatbaths down by the creek (Teit 1900:198; 1906:267; Post and Commons 1938:42; Commons 1938:193). Taking these sweatbaths required considerable amounts of wood to build the fires and heat the rocks, but they felt both pleasurable and empowered participants with new knowledge, strength, and magic (Teit 1912b:345,348).

The largest ancestral feasts of the fall and winter served to impress specially invited guests with the richness and success of the great house and instill in them the desire to become affiliated with the house either by contributing productive labor, goods, investments, or marriageable partners which would benefit the guests, as well as the great house. Thus, members of the great house always made a special effort to serve the most sumptuous foods, in beautifully painted bark trays, wood plates, or coiled baskets, spread on finely woven and decorated serving mats (Lamb 1960:84; Teit 1900:200; 1909:482–3). Rich and tasty pounded salmon mixed with oil and berries were served with smoked dried deer meat and rich deer fat. Thick soups of fish and lily roots were eaten with wooden or sheep horn spoons. As always, water—the only drink ever consumed—was brought from the creek in bark buckets and served in bark cups. These feasts were rewards for those who were members of the great houses, and enticements to others to become part of the social and economic web of the great houses. Only about 40% of the families in the village could afford to give such feasts (Romanoff 1992b:477).

During the fall ancestral and harvest celebrations, like all feasts, the house Firstman, or house chief, presided from his fur covered platform along the south wall with the most sacred crest mats and roof support posts around him. He was dressed in fine fringed white buckskin tailored clothes ornamented with rich furs from ancestral totemic animals—coyote, wolf, lynx, bear, or beaver. He also wore exotic feathers, dentalium shells, incised bone plaques, and copper rolled beads or sheets (Teit 1900:218; 1906:257). He wore much of the inherited wealth of the great house, wealth amassed by previous generations and handed down to him, wealth to which he had also contributed. The copper jewelry represented his spiritual connection to the sun and stars as well as his wealth (Teit 1912b:343–4; 1917:44). He sat proudly on goat hair blankets, displaying his facial tattoos, his ear and nose ornaments, and his impressive feather and fur headdress. His lavishly dressed wives were at either side together with his children, pet foxes, hawks, dogs, and almost naked slaves (Teit 1906:218,220–1,250; Post 1938:34).

When he received high ranking nobles of the great house or guest nobles of power at these feasts, he would carefully withdraw his tubular pipe from one of the decorated hide pouches hanging by the wall and share sacred smoke[4] with them thereby binding their social and economic relationships (Teit 1900:350; 1906:250; 1930:154,165; Spier and Sapir 1930:269; Vol. II, Chap. 13).

Fires burned in front of all the elite domestic areas on the western half of the house. The central area before the Firstman was the foremost dance and speech area, a sacred area chosen because of the soft loam that occurred naturally in the ground at this spot, which made it more comfortable to dance upon. Small children climbed up on the walls in the east where archaeologists later found their footholds. The children crouched under the eaves to watch the performances by firelight, sweat glistening in the packed and overheated house (Teit 1909:669).

Throughout the night, drums thundered, rattles droned, flutes and whistles pierced the air, songs rose and fell, and elaborate costumes of the spirit realms came to life—costumes and masks worn by dancers and made with parts of totemic ancestors or individual power animals (Teit 1900:354–7; 1906:253,257,290; 1909:576–8; 1912a:353; 1912b:361–2,367–8; Veniaminov 1982:22–3; Anatolii 1982:57). These masks, too, were prestige items of great value inherited from the house ancestors. At times, the entire house seemed to pulse and vibrate like a living entity (which it, in fact, was), and spectators sometimes fell into ecstatic states of rapture or were transported into spirit realms. During the speeches to the ancestors, speeches for the performances, speeches for serving food brought in from the outside ovens, and speeches for the distribution of gifts, the Firstman and his nobles often spoke in the special language of their ancestors with spokesmen interpreting the speeches for the general assembly (Walters 1938:98; Goldman 1940:355–7; Ray 1939:23–4; 1942:229; Hudson 1994). Firstmen never spoke directly to people in public. The ancestors were always addressed in a special language that ordinary people could only half understand, but which was used by the elites whenever undertaking anything involving spirit power, including trade, marriage, and negotiations among themselves (Hudson 1994). In fact, transegalitarian elites everywhere always seem to claim to have special or exclusive supernatural powers (Goldman 1975:5 cited by Kan 1989:81; Drucker 1965:167; Hayden 1995).

Other feasts, such as the largest, most impressive feasts between the great houses, required years of careful investments, exchanges, trade, and preparations. The Firstman of the house had to convince his elite relatives that they would benefit from such lavish and costly feasts, or at least that they had a strong chance of benefiting from it (Rosman and Rubel 1971:27). Nothing was ever certain, even when other people had accepted the Firstman's initial gift of wealth indicating their agreement to support an upcoming feast (Kamenskii 1985:44) and even after they had made firm promises with the traditional binding rituals involving sacred pipes and oaths, they sometimes failed to provide what they promised. The chief's success relied to a great deal on his ability to convince others that he knew how to choose reliable people to conduct transactions with. This was his "prestige" and it was critical for wealth transactions. His relatives and supporters could absorb occasional and minor miscalculations, but the Firstman knew that if these happened too frequently or were of too much consequence, it could spell ruin for himself and his kin. They might even force him to retire in disgrace and force him to assume all the outstanding debts that he had convinced them to invest in. In order to maintain confidence and support, the Firstman paid off whatever bad debts or promises that he could with the hope that future transactions would again bring him greater wealth and increased power.

Marriage Feasts

Holding feasts to secure military allies, to end wars, to arrange marriages accompanied by wealth exchanges, and to out-compete rival great houses were some of the easiest pretexts to use in order to obtain contributions from the other families of the great house (Teit 1898:54; 1900:322–3; 1906:267; 1909:611,659,664; 1912a:261,270; 1917:30–1,73; Boas 1898:3). Often two or more of these purposes were combined in hosting a single great feast. Wealth exchanges associated with marriages were especially secure types of investments. By paying a large purchase price of salmon, dried deer meat, and prestige valuables for a boy or a girl with proper training from another elite family, the entire great house would benefit by being favored in the future with external trade relationships that brought wealth, with invitations to future feasts hosted by other elite groups, by the ability to use the other group's fishing stations and hunting grounds, by the ability to borrow food and prestige goods for feasting or investments, and by obtaining allies. Such lavish events were also important in advertising the success of the great house. Finally, properly trained incoming elite spouses could also play a productive role in facilitating all of these matters and in hosting rituals, transactions, and feasts of the great house. Thus, the Firstman of the house had to consult all the leading families for such

4. Smoke was not from tobacco, as tobacco was unknown to the community.

marriages and could argue forcefully for substantial payment contributions from everyone in the great house since desirable marriages benefited everyone in the house (Sproat 1987:80–1) although the largest portion of the marriage feast was usually paid for by the spouse's family.

Maturation and Marriage Feasts

Similarly, it was relatively easy to obtain some contributions for feasts that would mark the progress of great house children through various stages of birth, maturation, and training (Teit 1900:291,309,321; 1906:260). The greater the training and special recognition of the children, the greater the payments would be upon their marriage. In this way, other powerful and wealthy great houses could be lured into marriage, and political or wealth exchange alliances. Once again, it was normal that the child's family would make the greatest contributions to these costs, but the Firstman of the house tried to emphasize the needs of the pel'uΣem and benefits to the house as a whole. By encouraging everyone to contribute as much as they could at shorter intervals, he could increase the total surplus being invested by the great house, he could increase the brokerage benefits to himself, and he could more easily justify demands for contributions from other families which would be made when the children were married. Wealthy families always tried to marry their children into other wealthy families (Teit 1900:325; Hayden 1995; Schulting 1995:73) and the greatest amount of wealth in marriages could usually be gotten from other elite families in other villages (Rosman and Rubel 1971:13,144; Sproat 1987:72). It was also a matter of honor and a sign of success to be able to provide at least some marriage payments and maturation feasts or training for all children of the great house, even the poorest common children. But the largest, most expensive, impressive, most lucrative feasts, training, and marriage payments were reserved for elite children and were graduated according to their own internal ranks and family wealth (Kan 1989:87–8,91; Owens and Hayden 1997). Marriage feasts involving substantial wealth exchanges required at least a year of financial and other preparations (Nastich 1954:59–60).

Marriage payments, together with the training and grooming of children for high marriages, were ways of transforming the surpluses of normal years into stored wealth and power. As Hunn (1990:223) noted for groups on the Columbia Plateau, gifts were necessary for people to function in society, but they were also a source of conflict. The food that was not needed was given away at feasts and invested in children or marriage partners or traded for prestige objects used for these same purposes, with the promise of future return in kind or other wealth. These were mechanisms of using excess food, food that would otherwise simply decay and be lost over time.

Reciprocal Feasts

Some of the feasts that ensued between intermarrying great houses were simply reciprocal with no attempt to gain excessive profits (Teit 1900:296–9; Boas 1898:3). These feasts were held in order to retain the other great houses (either those at Keatley Creek or those in the other regional communities) as allies in warfare, in financial matters, in politics, and in marriage. Once again, the Firstman of the house could appeal to the common interest of everyone in the great house to contribute to these occasional feasts, but the lowest ranking, common families and slaves always bore the brunt of the work required (Burch 1975:231). These feasts were, in fact, necessary for the continued functioning of the great house and its success. Being without allies in warfare could lead to destruction; being without wealthy marriage relations led to poverty and incompetent management; being without allies that could loan food or wealth when they were needed could lead to starvation and missed investment or other opportunities of great importance. Attracting only lazy moochers as co-members of the great houses would mean proportionately more work for everyone else and could lead to impoverishment (Nastich 1954:84).

Reciprocal feasts, too, were ways of transforming and storing food. Surpluses could be used to feed guests with the promise that the hosts would be guests at some future date usually within the following year (Teit 1900:299). Common foods such as salmon were used to underwrite the production of more socially important foods and items such as hunted deer meat and exotic shells, which were also given at feasts, with similar returns expected in the future. While the Firstman of the house could appeal to the necessity of maintaining the alliances with other great houses in order to obtain contributions and support for feasts, he also benefited directly from them as the spokesman, chief ritualist, and titular administrative head of the great house. He could certainly argue that in order to conduct his duties for the house, he required many things, including appropriate ritual regalia, prestige foods to offer the other administrative heads of great houses, fine clothes, properly trained wives, slaves, appropriate gifts to give (which of course involved receiving items of similar worth in return).

Like marriage payments, the value of feast gifts and honors were always determined by the estimated ability of the recipients to return as much or more than they received (Burch 1955:257). Gratitude was rarely expressed by receivers of the gifts since it was generally recognized that self-interest motivated all these transactions (Sproat 1987:112–3). Under these pretexts, the pel'uΣem Firstmen and to lesser extents depending on their rank, the other elite families, could benefit enormously from the holding of reciprocal feasts. It seems that everyone in the great houses thought that they were benefiting to some extent, from the holding of these feasts, as long as they did not stretch their own food reserves too far.

All feasts, funerals, marriages, and maturation ceremonies involved people from other houses who were invited in order to witness the events taking place and to be able to convey these events to the rest of the community at large. Thus, at all these events, the prestige, the power, the success, and the potential benefits of the great house were on display for all to take note of. Since these great houses depended for their success on the quantity and the quality of members that they could attract, as well as the quantity and quality of occasional helpers and allies, these displays had a strong tendency to become competitive, with each house attempting to put on as lavish and impressive a display as possible according to their abilities and recent fortunes in subsistence and financing (see Teit 1900:289,298–9; 1906:255). While there might rarely be enough surpluses for the great houses to actually compete with each other to the point of demanding increases from each other at every feast, they clearly tried to outshine each other whenever conditions were favorable enough (Teit 1906:258; 1909:583). Winners in these battles might not get all of their investments back, but the resulting renown and fame was the best advertising that could ever be wished for in terms of attracting the most desirable alliances and the most capable, productive members for the great house.

The absolute limit on the salmon supply, the absolute limits on the access to that supply, and the dramatic cyclical fluctuations in the salmon supply, all probably created conditions under which increases (interest payments) on loans and gifts from one feast to the next could not be sustained on a regular, reliable basis. Substantially increased returns on gifts and loans was probably only possible on an occasional basis and was seized upon by individual great houses opportunistically to achieve temporary renown or dominance within the community. The very large mandatory investment and feasting increments that characterized some of the Coastal groups may have largely been the product of disease-related nineteenth century population losses coupled with the introduction of European trade goods, and may not have been typical of the prehistoric situation at all (Codere 1950:61,63,70,94–5; Goldman 1940:345). Certainly in the Lillooet region, it would seem to make most sense to view investment and feasting as being largely reciprocal in nature with any increments in repayments being used on an opportunistic and fluctuating basis in order to gain temporary dominance in the region. As on the coast and in other Entrepreneur societies, the largest competitive feasts might require up to 8–10 years of investing and preparation, whereas validating new Firstmen only required preparations of about a year, similar to important funerals and marriages.

In addition to the many feasting obligations and opportunities, there were also many individual investments. With his elite connexions in allied great houses and other communities, the Firstman of the house could borrow considerable sums of salmon, deer meat, deer fat, and prestige items. He would borrow these goods when they were needed for feasts or marriages or other events in order to increase the values involved and the amount of wealth that would eventually come back in return, or to enhance the image of the great house for the public. Sometimes the Firstman would have to repay these costs largely from his own production in the following years, but whenever he could, he tried to obtain contributions from other families in the great house, particularly if the event could be portrayed as being for their own benefit. When not needed, he always tried to place any extra food or wealth with other families as loan investments and to create the maximum number of debts as possible (Gregory 1982:19,197). Most of the elite families in the great house also had connexions with other great houses or individuals from which they often borrowed supplies for feasts to increase the worth of their child's maturation ceremonies, marriages, or for other purposes.

In order to undertake all these ventures, items of value were required, and many of these could only be obtained from other elites via exchange, or by traveling to the sources of these items and trading directly for them. While going directly to sources (such as to the Coast for dentalium shells) may have been the most profitable way to obtain prestige valuables, it was also the most dangerous and risky. Because of these dangers, great spiritual power was required together with much spiritual training and preparation. Many traders painted their power spirits on the rocks above the long lakes before beginning their journey to the Coast.

Although feasts were critical for retaining power (Jewitt 1974:112–3), keeping track of all of the costs of feasts, marriages, obligations to allies, loans, debts, training, equipment and formal dress, ritual needs, interpersonal conflicts, trading expeditions, and the thousand and one details of running the great house, often gave the Firstman of the house headaches. He was all too aware, as his parents never ceased to remind him, that it was easy to fall from a high position and that it was very difficult to rise from a low position

(Barnett 1955:248). Maintaining the wealth and status of the family and the great ancestral house required constant vigilance, self discipline, a great deal of administrative work, and especially good marriages and training. Marriage to a commoner could ruin an entire family's fortunes (Nastich 1954:24–5,58); but marriage to a rich family could lead to access to other fishing resources and open up helpful exchange relationships for acquiring prestige valuables.

Moreover, the Firstman had to please the people of the Great House that he depended upon almost all the time, and they never liked a Firstman who acted in an openly greedy or selfish fashion. While most Firstmen tried to advance themselves as much as possible, they always had to appear magnanimous, friendly, and helpful (Teit 1900: 366). Outwardly, they maintained a commitment to egalitarian principles, while in reality they held considerable hierarchical power and wealth. Many Firstmen continuously strove to enhance their privileged position (Donald 1985:241; Hayden 1995). The Firstman tried to put on a show of being especially generous at his installment feast in order to obtain enthusiastic support from as many people as possible. He received a great deal of help from his supporters for this, and used much of the wealth they loaned or gave to him to establish his first official exchanges as house chief.

From then on, he had to keep careful track of how frequently and how large the feasts were given so that winter supplies did not run out too soon. If he miscalculated, if he could not provide adequate benefits or returns on loans to his supporters, the families of the great house would simply refuse to give any more and would begin to grumble with discontentment, become aggressive, and might even move to another house or remove him from his administrative position, especially if they felt that he had misused surpluses or could not repay loans that they had made to him (Sproat 1987:81; Jewitt 1974:112–3; Kenyon 1977; Arima 1983: 70). Because his role was to organize all the economic and social aspects of the great house, and because he claimed special spiritual powers, he could be blamed when almost anything went wrong, especially investments. But the rewards were too enticing to abdicate his position. The thrill of organizing an impressive feast, the riches that he obtained for his personal use, the power that he held, his slaves, his wives, his comfort, were all too important to him. The large feasts and all the organizing were especially addicting. The intense competition, the social adulation, the sense of power and achievement, the spectacular displays all combined to make these some of the most exhilarating experiences a person could ever know (Polly Wiessner, personal communication).

All the principal players in these events shared these experiences, but the Firstman's were the most intense. He did everything he could to push everyone in the great house to produce or borrow as much as they could for feasting, wealth exchanges, and child maturation ceremonies. Industriousness, prestige, success, and respect were the leitmotifs of all his harangues and speeches (Romanoff 1992b:498). Sometimes he was too insistent and created resentment. All of these feasts and alliances demanded a great deal of organizing and work, and haranguing. Like other powerful Firstmen on the Plateau, in order to distance himself from bothersome or nuisance claims, and to seem more impressive on important occasions the Firstman often used a commoner individual as his "speaker" and would not talk directly to those who came to bother him for small favors or early return payments or other complaints (Ray 1939:23–4; 1942:229; Goldman 1940:356; Walters 1938:98).

Making and Maintaining a Great House

The great houses were owned and run by closely related families that could all trace their descent (by straight or crooked geneologies) back to the original founder of the great house—a very powerful ancestor (Teit 1906:257; Spier and Sapir 1930:175). All the families of the great house were supposed to be closely related, but there were always some rumors of geneological irregularities from the past. Commoners, too, were all supposed to be related to the founding ancestor, only more distantly. In fact, the kinship link between the commoner families and the elite owners was often more fictitious than real (Hayden 1995; Allen and Richardson 1971:49; Deetz 1968:47); but it was a convenient and comforting fiction, and everyone seemed content to pretend that it was true for the strength of the group.

As on the coast (Jewitt 1974:65), about half the families of the great houses were wealthy elite families with varying claims to the resources, prestige goods, privileges, and running of the house affairs (Teit 1909:576; Romanoff 1992b:477). They formed the council of the great ancestral house (Teit 1906:257); and they occupied the south and west sectors of the house which were farthest from any seepage and also were warmed a bit more by the winter sun than the other sectors. They were also in deeper shadows during the day which gave a greater sense of security. Although only a few slaves were owned by the Firstman or other high ranking families, these were mainly women, and slept in the same houses as their owners either at the edge of their owners' domestic areas or in the least desirable part of the house (Teit 1912b:318,320; 1930:277).

The great houses needed hard working noble descendants as well as productive common workers and slaves in order to be successful (Nastich 1954:23). The work of the elites was often organizational and administrative or required specialized training, whereas the work that commoners and slaves performed was primarily that of producing food staples.

The nobles measured their lucre primarily in terms of the value of their food, their skins and furs, their buckskin clothes, ritual costumes and masks, quillwork, elk teeth, copper, blankets, feathers, coastal shells, worked nephrite, canoes, large nets, elaborate baskets, wives, slaves, and the size of their house (Teit 1898:54,75; 1900:261; 1912a:261,270,328; 1917:30–1,73,88; Nastich 1954:51; Romanoff 1992b:478–9; Mitchell and Donald 1988:321; Duff 1952:80,91; Minc 1986:89). Much wealth had been accumulated by the earlier generations of the great house, and these valuable inherited stores were supposed to be used to benefit the current members. The labor required to obtain large quantities of dried deer fat and meat for feasts might be compared to the considerable labor necessary to raise fattened pigs or cattle in transegalitarian societies elsewhere in the world. The Firstman controlled the vast majority and the best of all the wealth items, as well as holding title to the great house's fishing sites, weirs, hunting grounds, masks, and crests. However, many of the prestige valuables and all of the economic resources were viewed by the other nobles of the house as only being provided to the Firstmen in trust for the group as a whole. They were viewed much more as property belonging to the office, rather than property belonging to the office-holder. They were materials used in trust for the pel'uΣem as a whole (Teit 1906:253,255–6; Oberg 1973:62; Walker 1982:60; Stott 1975:11; Garfield 1966:14,22–3,26–7; Boas 1921:1345; 1966:35; Jewitt 1974:11; Kan 1989:82–3,91). Because other members felt the Firstman represented their interests, and perhaps their family, an insult to the Firstman of the house was an insult to the entire pel'uΣem (Sproat 1987:81). Therefore hitting Firstmen was punishable by death or severe reprisals (Jewitt 1974:44–5). As on the Coast, Firstmen of the most powerful great houses did little menial work in order to show how well-off and successful the pel'uΣem was (Oberg 1993:25,89; Swanton 1975:50; Barnett 1955:180; see also Marquardt 1991:171,173).

The nobles also told stories of tragic results when common people tried to undertake projects beyond their power or spiritual training (Teit 1898:41)—thinly veiled admonitions to commoners and moral lessons for elite children. In the beliefs of the nobles, even an impure or improperly trained wife could cause her husband's loss of power and success. Thus, children in successful noble families were trained over many years and underwent painful exercises that common children would never want to endure and perhaps, some people thought, could not endure. Some boys were said to train in the mountains for four years to acquire their spiritual power and knowledge (Teit 1912b:362,365). Similar practices were taken to the extreme among the distant Mayan nobles of Central America, where the nobles pierced their hands, tongues, and phalluses in order to contact their ancestors (Schele and Friedel 1990). Among the Lillooet nobles, training was not as excruciating, but nevertheless involved exhausting fasting, running, abstinence, whipping, cutting, and burning. These training ordeals could last up to 10 years (Teit 1900:310; 1906:262,263,265; 1909:588–90; Nastich 1954:51–9,81–4).

The children of the elite families received the most training, the most lavish (and costly) maturation ceremonies, underwent the longest seclusions, acquired the greatest number and the most powerful spirit guardians (Schulting 1995:50–4,73; Goldman 1940:360–6), and obtained the most desirable marriage partners associated with the most powerful and wealthy families in the other great houses (Teit 1900:325; 1906:260–5; Kan 1989:87–8,91; Owens and Hayden 1997). As in many other cultures with chiefs or Entrepreneur Big Men (e.g., Helms 1994:58; Berman 1994:504–5), only the elite knew the secret language used to address the spirits, used in trading prestige valuables, used in making peace, and used in all important transactions or negotiations with other elites; and only the elites knew the full sacred and myth cycles of the pel'uΣem (Kan 1989:91). All these abilities required long and costly training if not handed down within the family. But the hardworking common members of the great houses also received assurances of obtaining mates and some reasonable role in community or great house affairs if the pel'uΣem was successful.

The long, elaborate, costly, and "hard" training of noble children certainly had its practical side in some cases, but it served above all to separate the successful noble resource-owning families from the non-nobles and the impoverished noble families, maintaining these differences over generations. The training of the noble children also served to justify the greater power, privileges, and wealth of the nobles since success and wealth were argued to be the result of this training (Nastich 1954:81–4); and their training served to support noble claims of special access to superior spiritual power (Teit 1900:318; Nastich 1954:58–9,81; Drucker 1965:167; Schulting 1995:50–4,73).

When an elite child died before he or she could be married, it was a great loss for the entire great house. They would display their loss, as well as the greatness of the house, for everyone in the village to see during the funeral of the child by burying the body with wealth and ritual and fanfare. The greater the investment in the child, the more lavish was its funeral. In fact, all funerals of important members, and all marriages were used to advertise the greatness of the houses for all to see. Much dried deer meat, other special food, and many small gifts were given away at these events to all who attended without any expectation of return (Teit 1900:334–5). As with marriages, it usually took a year or more to acquire enough smoked deer meat through hunting and exchange to hold a funeral for an important member of the pel'uΣem (Teit 1900:334; Nastich 1954:58–60,67; Romanoff 1992b:475). Much food was consumed by the participants, but these events were also often used to set up subsequent contractual exchanges of surplus and wealth between great houses by giving special gifts.

The more wives that could be obtained by the co-residents of a house, and the more hard-working and skilled the members were that joined, the more productive and wealthy such houses would become (Lightfoot and Feinman 1982:67). The great houses needed agile strong men to man the fishing stations, efficient hard working women to fillet and dry as many fish as possible, expert hunters who could provide quantities of deer meat and especially deer fat and hides, and good warriors. Without good workers, the inherited resources of the great houses would be useless (Drucker 1951: 273). The great houses also needed highly skilled men and women as administrators: individuals who knew how to host feasts, how to invest and exchange wealth, how to address other elites, how to respectfully negotiate loans or marriages, how to speak effectively, and how to maintain the craft production and the wealth of the great house. It was not easy or inexpensive to find such well-trained individuals. Those that had the training and the qualities were highly sought after and marriage payments were often very high.

In addition to all of these basic costs, the desirability of belonging to a specific great house was often judged on its ability to put on impressive ceremonial and ritual displays, just as ritual displays were used in the coastal potlatches to display wealth, success, and power, even though on ordinary days the elites might not be dressed much more lavishly than any other person (Marshall 1992:206–7; Walker 1982:51). Thus, the members of each great house, and especially the elite members, made or obtained highly decorated impressive dancing and ritual costumes, drums, rituals, songs, dances, and membership in cults. "Prestige," and "status" became elite euphemisms for advertising their success in this competition for good people.

One of the great houses at Keatley Creek even held a spectacular wolf ceremony in which cult members worked themselves into a wild frenzy and killed two dogs with their bare hands (Vol. II, Chap. 10). Another house was renowned for antlered dancers that performed remarkable imitations of deer copulating (Teit 1909:578). Each house tried to involve as many dancers and performers as possible with full costumes and coordinated dances. Supporting impressive shamans, too, was a sign of prestige, even though they lived in separate dwellings at a distance from the great ancestral houses to which they belonged (Nastich 1954:52; Kamenskii 1985:86). Adding to the splendor of the feasts and dances were specially trained and dressed hunters and warriors with armor coats of wood and leather or birch bark, armed with killing clubs of wood, antler, or bone (Lamb 1960:80; Teit 1898:67–8,75–6; 1906:234; 1912a:244,270,340; 1912b:319).

Training and supporting all of these individuals required additional surpluses and wealth. With all the real and imagined competition, conflicts, stakes, and high emotions, great houses needed community "watchers" to ensure peace within the pel'uΣem, within the village, and at the feasts (Nastich 1954:30). They reported directly to the Firstman and he not infrequently used them in order to obtain cooperation from others and "respect" for his wishes.

The most difficult task of the Firstman of the house was to decide how to budget the salmon reserves and other wealth of the great ancestral house. This involved not only deciding how to use the surplus that he, his three wives, and his two slaves produced, but it also involved trying to determine how he could obtain contributions from his siblings, uncles, aunts, and cousin co-elite owners and from the commoner members of the great house. He knew that appealing to their own interests was one of the best ways of obtaining support, but he could also appeal to them for support for the good of the great house—a more indirect but sometimes effective means of appealing to their self-interest and obtaining some of their surplus. Thus, everyone contributed something to the feast that honored the great house ancestors because everyone realized that these feasts were important for attracting productive families and marriage partners.

As on the coast, the Firstman of the house always had to be careful to consult with the other families that were close to inheriting the administrative position of the great house (Dawson 1880:119), for they had almost as much claim on the position as he had. Thus, he was ever wary to defend his position and justify it both in deed and in heritage. Like the house chiefs on the coast (Sproat 1987:80–1; Rosman and Rubel 1971:36,39), he spoke for everyone in the great house; he held the greatest influence of anyone in the great house; but he was always in the debt of his house confreres and could never function without them.

A Firstman's relationship with others was always full of potential conflicts. He always wanted more surpluses from the elite and common members of the great houses. They always wanted more benefits from the Firstman and the higher elites. Although everyone contributed some of their productive efforts to the glorification and aggrandizement of a few key people in the house, everyone benefited in some way from their relationship with each other (Mitchell and Donald 1988:332). Even the lowest ranking kin and commoners obtained benefits of protection and food, but worked much harder and received less in return than the high ranking families (Burch 1975:226,231). Because commoners had few options, house owners often took advantage of them. Refugees from wars or other destitute families often did not fare much better than slaves. Unaffiliated families that did not store enough food in the fall had to beg at the entrances of the great houses in order to survive and were reviled as lazy moochers. Although the nobles exacted services and other debts from these people for the food that they received, the service was often of poor quality and repayment of debts was unreliable at best (Teit 1900:297,366; 1909:705–6,731; Nastich 1954:24,84; Romanoff 1971:62).

Some of the most coveted advantages that commoners obtained by being members of the great houses were the chief's ability to provide their children with marriage partners and training considerably above what would otherwise be possible. From the elite viewpoint, only lazy and incompetent people were poor; if people were poor, it was their own fault and no respectable noble would even consider marriage with such people (Nastich 1954:24,84). The Firstman carefully calculated the relative benefits that he could provide to the commoner families that supported him, and he used this power to exact compliance and surpluses for other projects of the great house. Marriages between the elites of great houses were much more in the nature of economic contracts between the great houses than they were romantic alliances between lovers. Both intensive training and betrothing children at young ages to other successful elite families were used to maintain the high status, privileges, and wealth of the children. Betrothed children who married with great wealth exchanges between families could never divorce, although commoners who married without much exchange of wealth could divorce relatively easily (Nastich 1954:31,58,62,83–4). Only low-ranking independent households without much wealth or prestige engaged in such frivolities.

The poor independent households of the community built their houses small so that the heat would be retained better. Like poorer common members and slaves of the great houses, they were scantily clad in only sage bark capes, blankets, and fish skin shoes, or items made from other types of bark or from vagrant dogs' hides (Teit 1900:206,217; 1906:218). These less fortunate members of the community huddled in clusters during the winter. The coldest part of the winter often felt like hibernating. No one wanted to take the special foods to the women's seclusion hut or even go outside to excrete (Teit 1909:614,630). On the very coldest nights in the great and small houses, fires were lit and hot soups were prepared, but fires often created more misery with their smoke than they created comfort with their heat (Teit 1912b:363).

Mid-Winter Activities

Between the great feasts, little of interest happened. Leading members of the house always painted their faces and greeted the Day-dawn with prayers as well as praying to the sun, the mountains rising up behind the village, and the Old Man (Teit 1900:344; 1909:511–2). Elite children went through their daily outdoor running, bathing, or other endurance training exercises (Nastich 1954:51; Teit 1906:262–5). The coldest days and nights were spent with other members of the family huddled for warmth under heavy, comfortable fur blankets or capes on the sleeping platforms (Bouchard and Kennedy 1973; 1985:35).

When the sun shined and the air warmed up enough, members of the great houses became more active. They went outside to work on crafts against the sunny part of the roof, or to work hides on the shady side of the roof. Men spent time sitting on their sleeping platforms making and sharpening stone tools and manufacturing most of the necessary bone and wood objects used by members of the great house (Vol. II, Chap. 2; Teit 1900:182,297; Turner 1992:425,433). They decoratively carved or ochred their arrow shafts, made bone or stone jewelry and skin garments (Teit 1898:38; 1917:23; Vol. II, Chap. 3). Some objects like antler arrow-head flakers, were endowed with remarkable magic powers (e.g., Teit 1917:4,17,19,20). Women spent time in the communal center of the house or in their own domestic area working on baskets, mats, hides, clothing and other crafts (Teit 1900:182,185; Alexander 1992:138). Sometimes men also worked in these areas working on their spears, arrows, or bows with stone tools. Anything that created a mess or required a lot of space was carried out in the central part of the house floor or outside.

In the warmer winter days, children went outside and played in competitive games such as racing, shooting arrows, and in a ball game like lacrosse (Teit 1898:32,116,253; 1900:280; 1912a:262). The elite hunters would also venture out onto the lower slopes of the mountains to see if they could find deer and bring back fresh meat. They and other wealthy families were the only ones with the warm buckskin clothes, bows and arrows, and snowshoes needed to travel in the winter for hunting, or for ice-fishing, or for retrieving salmon stored in the elevated sheds by the river (Bouchard and Kennedy 1990:253) or even for obtaining firewood (Romanoff 1971:6; 1992a:224,253; 1992b:472,478–9; Nastich 1954:24). Common members of the great houses and people in poorer houses had to go around and borrow buckskin clothes to get firewood or other things, and they had to give a portion of whatever food or wood they procured to the owners of the clothes.

The elite hunters were lucky if they could find one or two deer during the entire winter. Often they returned with only some firewood. When the hunters were successful, everyone ate their fill, and the women put the thinly sliced remainder on wooden racks over the elite hunters' long hearths to be dried for future feasting (Vol. II, Chap. 1, Fig. 6; Teit 1900:234). It was then hung for further drying or rolled up in grass and put on the pole shelves that stretched around the inside of the house (Vol. II, Chap. 2, Teit 1909:672,688; 1912b:367). The bones were sometimes given to slaves or poorer residents or dogs, but whichever people got them almost always smashed the bones up for marrow and used the pieces in soups in order to extract every last bit of fat from the inside of the bone (Teit 1898:29; 1909:672,675; 1912b:324).

Between the times of huddling, hibernating, and craftwork, there were an ongoing series of small and large feasts and dances, particularly in the great houses which were more able to host such affairs because they were rich and powerful. The Firstmen of these houses acted as ceremonial leaders (Nastich 1954:26; Teit 1906:224,284; 1909:669; Cline 1938:146). There was at least one dance and feast per month in the village, and many more (and more elaborate ones) at the Winter Solstice. The arrival of the Solstice was determined by observing alignments of the rising sun with trees or mountains from special sighting rocks (Teit 1900:239; 1909:604,610). At all the feasts, many hours of fun were often spent gambling with the lahal bone game (Teit 1900:275). Sometimes families would return late at night when the cold winter winds rattled tree branches in the creek or the trees made creaking noises that frightened children and conjured up images of baleful spirits that might capture children and eat them.

The elite domestic groups of the great houses seemed to be always coming and going, hosting or being hosted in small, more private, feasts and negotiations between themselves and their elite allies (Teit 1900:275). They were always arranging affairs at these small dinner feasts: loaning or borrowing dried salmon or deer meat for transactions or larger feasts; exchanging the exotic shells from the coast for other goods or favors; arranging marriages; paying for insults, injuries, or deaths caused by members of their own great house (Teit 1906:236; Nastich 1954:28); or paying allies to mount revenge parties (Nastich 1954:41,44). They also had to arrange for tattooing or piercings done with sharply pointed bones (Nastich 1954:64) at children's namings, puberty ceremonies, first fishing or hunting or berry picking ceremonies, or vision quests. They arranged for the spiritual and physical training for noble children's future roles as hunters, warriors, shamans, fishers, runners, gamblers, or administrators (Teit 1900:354; Romanoff 1992b:474).

Spring

By the spring, after the Winter Solstice Moon (December), and the Coldest Weather Moon (January), and the Chinook Winds Moon (February), and after a number of feasts and maturation ceremonies had passed, the residents of the great houses and the independent small houses emerged during the Grass Grows Moon (March) to go out and gather the shoots of cow-parsnip, fireweed, balsamroot, and berries, together with onions, some lilies, and the inner bark of pine trees (Turner 1992:416). When people began to leave, they dispersed into small groups of families that went into the mountains. Everyone in the pel'uΣem agreed to meet again in the late summer at the fishing locations owned by the great house. Some old and very young people often stayed in the village to watch over affairs (Bouchard and Kennedy 1990:277; Walters 1938:87; Teit 1898:52). But if everyone left, they hid some salmon and deer meat surpluses in pits at Keatley Creek together with some of their more bulky, heavy, and valued possessions—those that were too cumbersome to carry into the mountains (Teit 1898:66; n.d.).

Over the next months, people would stop by at the winter pithouses to store other materials and ensure that everything was in order. And they looked forward to the fishing and hunting that would come again in the late summer and the fall. For the time being, the Old One had been benevolent and kindly and the great house had prospered. Everyone had experienced some exhilarating dances, ceremonies, and feasts. They looked forward to the generous and exotic gifts that they would receive from other great houses in feasts and in marriages in the coming year. The land was rich, and the people of the great houses were content and proud of their achievements over the past year. But now, supplies were low and they moved into the hills in search of fresh food.

Epilog

The Keatley Creek community thrived for several thousand years. Then it was affected by natural disasters that undermined the very foundation of its society. Faced with an almost total decimation of salmon runs due to landslides (Hayden and Ryder 1991), faced with the specter of starvation, people pulled the valuable main supports from their houses, burned their dwellings before leaving them for an unknown length of time, and left Keatley Creek. They sought shelter and help with elite allies in other communities along the Great River to the south, or even farther afield. Only many generations later would people again begin to populate the Lillooet region, coming perhaps from the Secwepemc country to the north and east, and from the Lillooet country to the west. It took centuries to re-establish the salmon runs and to re-establish the pel'uΣem. The great ancestral houses were never again quite as powerful or as strong as they had been in the past. New Firstmen of renown and power emerged. They began to re-establish the greatness of the Classic Lillooet communities such as Keatley Creek and Bridge River, Seton Lake, and the Bell site, but on a smaller scale. They commanded the respect of visiting Indian traders as well as the new white-skinned traders. And their feasts and marriages and child maturation ceremonies were among the most impressive on the British Columbia Plateau.

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