Chapter 17

Site Formation Processes at Keatley Creek

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Introduction

It is crucial to understand site formation processes before any interpretation of the archaeological record can be attempted. Traditionally, few investigators paid much attention to these factors except as implicit or *ad hoc* afterthoughts. However, Schiffer (1972, 1976, 1985, 1986, 1987) and others (especially Stevenson 1982; and Samuels 1991:196ff) have focussed attention on the critical role that site formation processes play in all archaeological interpretations and especially in reconstructing past economic or social behavior. In order to investigate economic behavior at Keatley Creek, it was necessary to establish what food parts, technological materials, and prestige items were brought to housepits; whether the remains associated with a housepit floor constituted remains of everything that was eaten or used in the house, or whether some portion of those remains had been discarded in other types of deposits such as roofs or rims or special refuse areas far removed from the housepit; whether boiling, pounding, or other processing had destroyed substantial portions of the remains; whether dogs or other scavengers had removed or consumed remains from meals; whether the remains had been burned; and what degree of decay had affected remains wherever they may have ended up.

In order to investigate social organization at Keatley Creek, it was similarly important to know whether artifact patterning in the living floor deposits was due to actual activities and social divisions of the principal residents; whether such patterning was due to transient campers who used the structures after they were abandoned; whether patterning was due to natural or fortuitous mixing of deposits from different origins or time periods; whether patterning was due to sweeping, cleanup or storage practices; and whether all objects of value had been removed in the course of an orderly abandonment or left in the housepit during the course of an emergency abandonment. It was also important to understand whether prestige items had long use-lives, breaking down gradually where they were used most, or whether they were removed from systemic contexts after relatively short periods of use via their inclusion as burial goods or other ritual offerings. Such questions can be extended to include many of the most important aspects of past societies. The full understanding of formation processes is a daunting task, but certainly one worth pursuing. The purpose of this chapter is to synthesize what we have learned about site formation processes at Keatley Creek and to resolve as many of the issues mentioned above as possible.

I have divided the analysis of site formation processes at Keatley Creek into two broad areas: first, general formation processes involved in the overall economy and the deposition of different types of sediments found associated with housepits throughout the site; and second, socioeconomic factors that account for specific artifact occurrences and artifact patterning within housepits or between housepits. Understanding and documenting the general factors constitutes the goal of this volume. The socioeconomic factors will be dealt with in Volume II.

The study of general site formation processes includes the study of the geological origins and nature of the soil matrix forming the bulk of most of the site. Thus, it is important to know the local surficial geology and soil formation history (Vol. I, Chaps. 5–7; also Stein 1987).

The study of what cultural materials were introduced (and why only those specific elements) together with what happened to them subsequently, also forms an integral part of site formation analysis. Much of the inspiration for this type of approach has come from the paleontological subdiscipline of taphonomy, the formation processes involved in the deposition and degradation of faunal remains. Botanical remains can be analyzed using the same basic framework (Miksicek 1987). The study of stone tools, however, requires considerably different kinds of approaches due to the long distances involved in transport and use as well as the selective modification of some stone materials for specific purposes involving design considerations. I have referred to the overall analysis of stone materials from this perspective as "tool formation processes" (Hayden 1990:89). These include factors influencing the design, raw material selection, and manufacture of stone tools; techniques used to resharpen stone tools; wear traces and residues on stone tools; and discard practices and environments. Bone, antler, and shell tools could be analyzed in a similar fashion.

Finally, and not least, in order to understand various kinds of deposits with their cultural contents, it is essential to understand the natural factors that have altered both sediments and artifacts since their incorporation into archaeological contexts. All of the above factors have been dealt with in this volume.

In his analysis of housepit formation processes in the Southwestern United States, Schiffer (1985) suggested that eight types of refuse might occur. Iannone (1990) modified Shiffer's list to reflect what I feel is a more useful set of factors for the housepits at Keatley Creek. These include:

1) Primary Refuse: This is refuse related to an intact occupation surface (e.g., housefloor) involving materials left at the spot where they were used or manufactured, whether tools or waste materials.
2) Secondary Refuse: This is refuse that has been cleaned up and removed from its primary use or manufacturing context and dumped elsewhere, usually in designated refuse areas.
3) De Facto Refuse: This involves refuse which was never fully or intentionally discarded but which was left in the actively used part of the occupation surface at the time of abandonment, whether intentionally or unintentionally. Such items include materials that were lost, materials that were placed in provisional discard locations but never removed, and materials that were too cumbersome or unimportant to remove at the time of abandonment.
4) Prior-Occupation Refuse: This is refuse from earlier occupations that may become mixed with refuse in occupation or discard areas.
5) Post-Abandonment Refuse: This is refuse which may represent either occupation of an abandoned pithouse floor by transients, children, or others, or dumping of refuse from other pithouses in abandoned pithouses.

As we will see, there are additional special cases of refuse deposits, including pit fill, and dumps on pithouse floors. There was also a possible ritual interment of dog skulls and bodies, as well as dog remains left on pithouse floors at the time of abandonment perhaps as part of a ritual.

Aside from the types of refuse associated with housepits, it is important to establish the nature of the abandonment (Stevenson 1982; Schlanger 1989). Schlanger makes a fundamental distinction between planned and unplanned abandonment of households (Fig. 1). In the latter case abandonment is usually due to fires, raids, or other catastrophes leading to the abandonment of virtually all household material items in their use, or systemic, contexts, often referred to as a "Pompeii" condition. Planned abandonment, on the other hand, results in the removal of some or all useful or valuable items from the household depending on such factors as the speed of abandonment, the permanent versus temporary nature of planned abandonment, as well as the distance of the move and the capacity of any transport aids used in moving. Under planned abandonment conditions, only items of inconsequential value are typically left behind. Abandoned households may subsequently be left open to scavenging activities on the part of others who may remove articles of use or interest, or abandoned households may be closed to scavenging activities due to burning and structural collapse, catastrophic burial or other similar factors. The remaining items in all cases constitute the material assemblages that archaeologists recover when the households are excavated. Fortunately, in the housepits at Keatley Creek that we selected for extensive excavation, it was relatively easy to determine refuse types and abandonment conditions and it was quite clear in all cases that little or nothing of value had been left behind.

The general model that has been found to be most useful for analyzing housepit deposits is one that

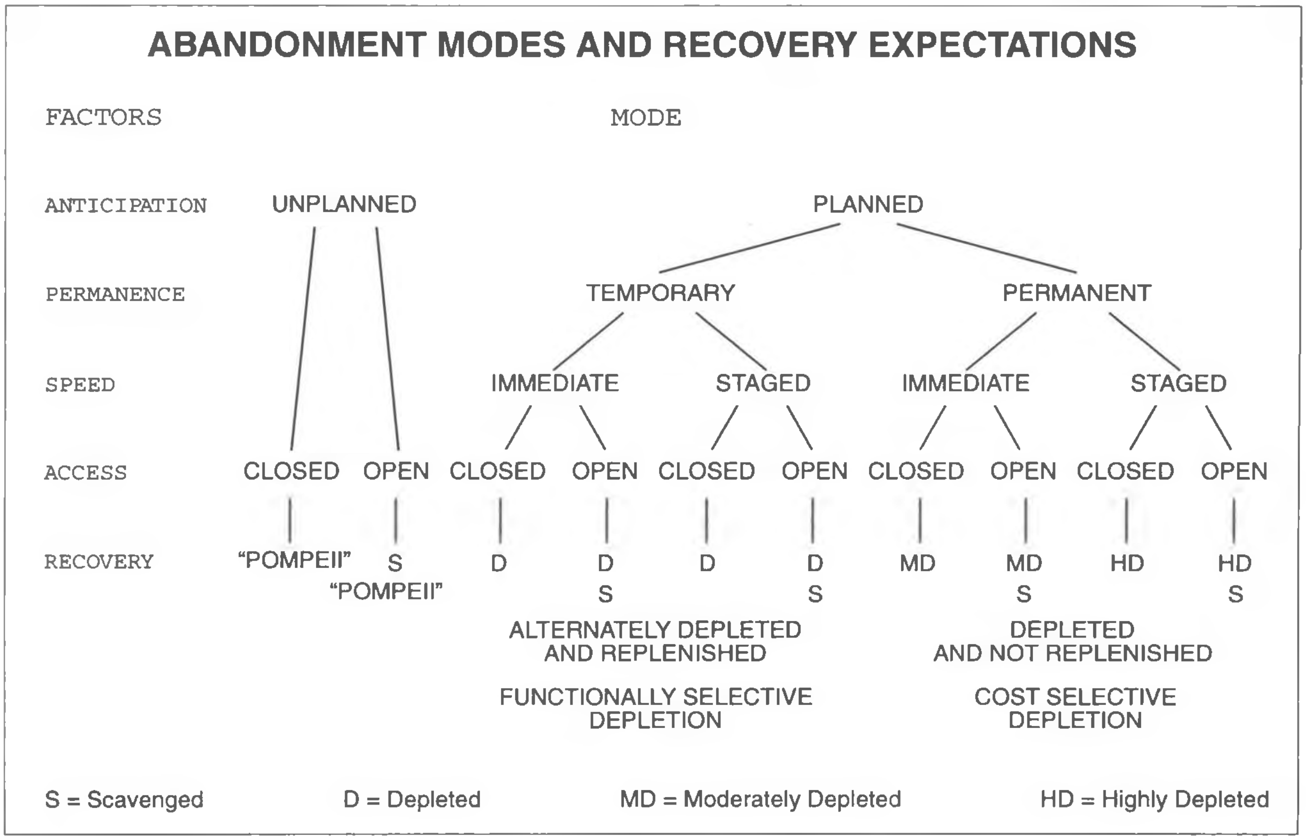
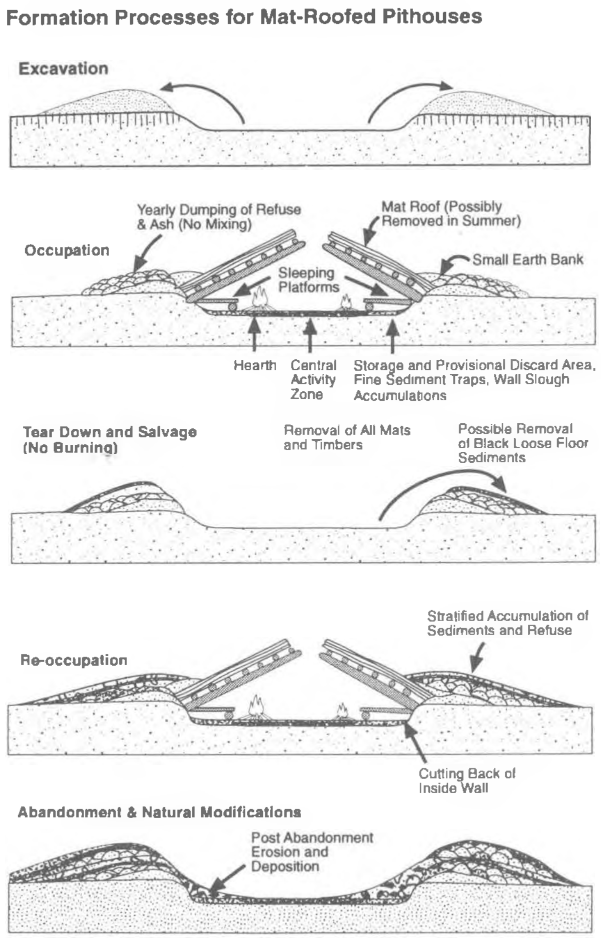


Figure 1. Factors affecting the type of abandonment of structures and their effects on materials left for possible archaeological recovery (adapted from Schlanger 1989: Fig. 3).

divides sediments into three basic categories (based on stratigraphic context, morphological characteristics, and artifact contents): living floor deposits, roof deposits, and rim midden deposits. Pit fill and dump deposits constitute special cases of floor sediments. The ethnography (Vol. II, Chap. 2) and archaeology both concur that at the outset an area was excavated into the ground and the resulting spoil was dumped around the perimeter of the circular depression that was to form the floor. Teit's (1895) unpublished account describes pithouse construction thus:

> Regarding your questions concerning the kekuli houses. The excavation was dug in the usual manner as digging graves etc. Of course none except easy soil to dig was chosen for the sites of kekuli houses, grave yards, etc. Another thing to be remembered all through is that in making a kekuli house mostly all the neighbors lent a hand, principally the women digging and the men doing the other work. The owner of the new house with the help of their relatives furnished the grub for all during the time the work was going on. Sometimes as high as twenty, thirty if even more people worked together to help people who were well liked, or who had plenty of grub so that kekuli houses have been known to be started in the morning and all finished by nightfall excepting the ladder. The tools were the common root-diggers for digging and breaking soil, straight sticks with a wide, flat and rather thin point for scraping etc. All stones found were simply thrown out, and all dirt or earth was put into large baskets, chiefly with the help of the hands and small baskets. The large baskets were then carried or lifted out and their contents dumped in close proximity to the outside circle to be handy for use on the roof. When covering the roof the dirt was loaded in baskets again and these emptied on the roof in the required places. The whole being leveled off with the help of the stick scrapers and the hands and feet.

Further details from this account are provided in the Appendix (see also Teit 1900:192–3). After the roof beams had been put in place and all the intervening spaces between joists had been covered by smaller poles, bark, mats, and conifer needles, soil from around the houses was piled onto the roof as insulation. Archaeological observations of the charred pole remains in HP 104 and ethnographic accounts (Kennedy and Bouchard 1977:Tape 1) indicated that at least some roof elements consisted of split poles and logs. As time passed, roof or support poles began to rot out or become so infested with insects (Kennedy



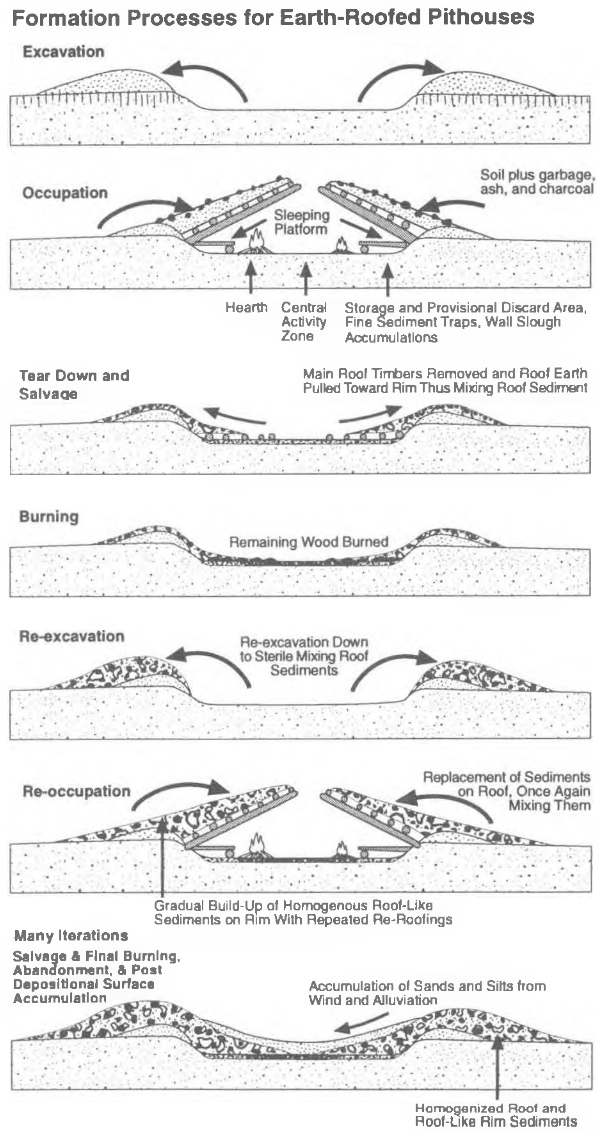


Figure 2. A schematic illustration of the formation of roof and rim deposits over several cycles of roof replacements. Important differences in formation processes and deposit characteristics depended on whether the roofs of structures were mat covered or earth covered. Rim deposits of mat covered structures retained the stratified features of the deposited refuse, whereas the moving and churning of dirt for roofs in earth-covered houses generally destroyed stratification of refuse deposits in the rim. Medium and large housepits display a progression from clearly stratified rim deposits in lower levels to homogenized, churned deposits in the upper levels indicating a change from mat-covered to earth-covered roofs probably around 1,500 years ago.

In each re-roofing cycle of earth-covered houses, refuse accumulated on the roof and on the rim during occupation. All this material was then piled on the rims while the old roof was being replaced, and much of the soil and refuse from the previous occupations was then thrown on top of the new roof or left churned up on the rims. In this way, increasing amounts of artifacts and debris mixed together and accumulated over time in the roof deposits and in the portion of the rim affected by re-roofing activities.

and Bouchard 1978:37) that the roof would have to be replaced. Insect infestations are also a reason frequently given for the intentional burning of structures in other culture areas (Posey 1976:52; McGuire and Schiffer 1983:291). It is highly unlikely that any structures we excavated were accidentally burned or were burned in raids considering the depleted nature of the assemblages and the resistance of pithouses to burning (Wilshusen 1986). While ridding houses of vermin may have been a beneficial aspect of the burning, burning the roofs may also have been an expedient way of dismantling rotting roofs in a hurry so that they could be replaced rapidly in the fall and before the onset of freezing weather in November. If this was the case, it can be anticipated that major posts or beams or other wooden furniture in good condition would have been salvaged before the burning, and that roof soil would have been pulled down from the peak of the roof in order to facilitate salvage efforts and burning. Once the roof had burned and the soil on the roof had collapsed down onto the floor, the sediments on the floor could either be smoothed out to form a new level floor, or they could be removed down to sterile deposits. A new roof would then be built and the sediments that had

Figure 3. An example of stratified rim deposits from HP 5. The dark, homogenized, "roof-like" rim deposits are clearly visible in the top 50 cm of this deposit, while bands of light colored till (thrown onto the rim from periodic excavation of pits or floor cleaning) alternate with darker refuse in the lower part of the rim deposit showing very clearly defined, and largely undisturbed lenses and strata. This shows that in the earlier history of the house, no extensive reworking of rim deposits took place such as appears to have occurred in later times when the "roof-like" rim was deposited.

Table 1. Estimates of the number of re-roofing events for housepits based on the total number of artifacts incorporated in roof deposits in relation to the number of artifacts recovered from floors.*

HP	Number of Sampled Subsquares from Roof	Number of Subsquares in Excavated Roof	Portion of Roof Samples	Number of Flakes in Roof Sample	Estimated Number of Flakes in Excavated Roof	Number of Flakes in Excavated Floor	Estimated Number of Floors in Roof
3	37	269	0.14	1,693	12,309	2,292	5
7	47	640	0.07	2,738	37,283	5,424	6
12	24	96	0.25	442	1,768	672	2

* The figures for portion of roof samples should probably be lower and the estimated number of flakes in the roofs proportionately higher because none of these roofs was completely excavated. While this is also true of the floors the discrepancy between total area and excavated area is substantially greater in the roofs since roof deposits extend out over the rims. Consequently, the estimates for number of floors in each roof are more likely to be low than high. On the other hand, both chipped stone refuse thrown onto the roof during occupation and shorter use-life of the last floor due to forced abandonment would tend to inflate the estimates of floors in each roof. These various factors may well balance each other out thus resulting in a rough, but realistic approximation of the number of reroofing events *involving soil covered roofs*.

been thrown out of the collapsed building (as well as other surrounding soils) could be placed onto the new roof for insulation (Fig. 2). This process could be repeated *ad infinitum*. As a result, roof and rim deposits could be constantly recycled with materials from all time periods mixed up together in a random fashion. Further details of roofing events, including the length of time roofs probably lasted, will be discussed below under the heading of "Roofs."

While our archaeological results at Keatley Creek (Vol. III, Chaps. 4–6, 11) show that this scenario is actually what happened in many cases, there are several important exceptions. First, while the upper, and therefore latest, parts of rim deposits in the large housepits certainly conform to this scenario, the lower levels exhibit a very different configuration. Notably, the upper levels of the rims are mixed and homogeneous as if a rototiller had been used to work them. They resemble the roof deposits in this respect. In contrast, the lower levels, beginning sometime during the Plateau horizon on the basis of projectile point styles, exhibit relatively coherent stratification of brown organic materials, soil, charcoal, and sterile till lenses and layers (Fig. 3; Vol. III, Chaps. 4–6, 11). There is nothing in the lower deposits that resembles the gray mixed roof deposits. I cannot imagine how these strata could have retained their stratigraphic coherency if sediments were periodically being placed onto the roof from the rims and then put back on the rims only to be returned to the roofs. The only scenario in which rim strata could be coherently preserved without any addition of roof-like material is one in which there was little if any sediment placed on the roofs of pithouses during the Plateau and preceding Shuswap horizons. That this was probably the case is also supported by the relative amount of stone and bone remains in the roof deposits. If all the remains in the roof deposits were derived from materials on the floors at the time of abandonment, it would have taken only 5–6 reroofing events to accumulate all the remains in the roof deposits (Table 1). If we assume that roofs were replaced on an average of 10–20 years (see below), this represents only the last 120 years, at most, of the pithouse occupation, whereas the Plateau and Shuswap horizons extend over 1,000 years farther back in prehistory. Any artifacts thrown onto the roof as secondary refuse would only increase the estimated length of time such roof deposits had been in existence, as would any increase in the estimated length of time (and artifact accumulation) floors might have been used before reroofing events. If anything, such estimates therefore overestimate the time that soil covered roofs were in existence. Thus, it seems likely that earlier large pithouses did not have significant amounts of soil on their roofs, but probably were simply covered with multiple layers of mats that were likely held in place by external poles and/or lashings.

The other exception to the general roof sediment scenario that was outlined on the basis of ethnographic observations is the situation in which houses were not burned down but simply left to decay gradually. This would have provided opportunities for the post-abandonment use of the structures by transient hunters or other people, as well as the dumping of refuse from other housepits into the structure's floor—situations more or less precluded by the burning of the roofs. Several housepits exhibited patterns consistent with this scenario (HP's 47, 58, and 105, although the latter may be feasting refuse—see Vol. III, Chap. 11). With these general constructs in mind, a more detailed discussion of our investigations into site formation processes follows.

Results: Rims, Roofs, and Rooms

Parent Materials

Friele and Martin (Vol. I, Chaps. 5–6) describe the Keatley Creek site as situated on a glacial till terrace with an aeolian capping of loam generally varying from 10 to about 25 cm in depth. The till typically contains 20–50% gravel and pebbles and 0–5% cobbles. In very localized areas there appear to be amorphous loam deposits within the till, presumably resulting from water deposition within or under glaciers. Till deposits are not heavily weathered but can be somewhat consolidated and difficult to excavate. The surface aeolian deposits generally display some evidence of light soil formation processes and have less than 5% gravels and pebbles with few if any cobbles. Due to the strong winds in the Fraser Valley, aeolian deposits are still actively forming and eroding today.

Rims

There are two fundamentally different origins of rim deposits:

1) One major type of rim deposit results predominantly from the initial excavation of the housepit and the piling up of the resulting soil around the perimeter of the excavated area, thus forming a rim. Subsequent roof constructions also create rim deposits that can be distinguished from other types of rim deposits. Both roof-like and re-worked till-like components of rims can be considered as "construction" deposits.
2) The other major type of rim deposit that we encountered clearly accumulated over an extended period of time and is composed predominantly of dumped refuse from inside the structure, although lenses of till or floor soils were also present. These deposits are referred to as "refuse" rim deposits. Both construction and refuse components may be present in house rims.

Construction Rims

Rim deposits were much more complex than we had originally anticipated. In all the excavations undertaken, it was apparent that the lowest levels of the rim deposits represented soils and essentially sterile till that was removed from the center of the housepit during the initial excavation of the sunken house floor. These are the basal "construction" rim deposits.

Occasionally small traces of charcoal or other cultural materials may occur in these deposits, but they are usually sterile and difficult to distinguish from sterile till on the basis of color or composition, although they are usually less compact. In some cases (e.g., HP's 5 and 7) the soils which were excavated out of the center of the pithouses contain cultural remains from much earlier occupations, notably Lehman and Lochnore occupations with bladelets. In these cases, such soils were redeposited in a mixed fashion at the base of the rim, and may overlie *in situ* deposits from these earlier components.

Given the low artifact numbers recovered from the rims, roofs, and floors of most smaller housepits and the limited organic staining of these deposits, small structures appear to have been occupied for periods of about a generation or two (in total or for each distinctly separate occupation). For instance, Table 1 indicates that a maximum of two reroofing events took place at HP 12. Each event probably represents one generation. In these cases, little further modification of the rim deposits appears to have taken place aside from some organic staining and soil development near the surface. Having said this, it must be admitted that our investigation of this type of rim deposit is not extensive, being restricted to test trenches that sectioned housepit rims only to their crests. We have not explored rims of small housepits more extensively due to the paucity of materials and the incidental nature of these deposits to our basic research priorities. Nevertheless, tests from all small housepits constructed on relatively pristine surfaces display the same basic characteristics of extremely low artifactual densities in rim deposits (e.g., HP's 4, 9, 12, 47, 58, 90, 104, 106, 107, 108). The comparatively short occupation of these housepits is probably responsible for the apparent relative lack of accumulated cultural materials on the rims (although to be certain, rims would have to be tested around the perimeters of these structures). The general paucity of materials in the rims may be due to several factors, including: 1) relatively small amounts of refuse thrown out on the rims (either because of short occupations or low levels of refuse production related to smaller numbers of occupants or poorer economic standing; or use of the roof rather than the rim as a refuse area); and 2) initially unfavorable conditions for preservation of organic materials on rims, especially if small amounts were involved (see Vol. I, Chap. 9). Low levels of artifacts in the rim of HP 9 which had very rich faunal remains on the floor suggest that poor preservation probably played a major role in the limited occurrence of organic remains in rim deposits of small housepits.

Relatively sterile, unconsolidated, redeposited till material from the initial construction of large housepits were clearly evident at the base of the rim deposits in the north test trench of HP 7 (Stratum XIIId), while the base of the western rim (Stratum XVII) seems to consist primarily of redeposited and mixed soils containing Middle Prehistoric Period artifacts with bladelets. The initial creation of the floor for this large housepit seems to have been restricted to the creation of a level surface by cutting into a gentle slope at the base of a hillside. Thus, rim deposits from initial house construction excavations are rare or non-existent in the upslope sections of the rim (especially the east and south) due to undesirable work involved in throwing dirt uphill as opposed to downhill. Although investigated in much less detail, rim deposits in other early large housepits excavated into hillslopes (HP's 1 and 8) seem to follow this same pattern.

The occurrence of roof-like deposits in the upper part of the thick rim deposits of large housepits also constitutes a type of construction accumulation. However, it is difficult to fully understand the formation of these deposits without first examining the refuse components of the rims, a topic to which I now turn.

Refuse Rim Deposits

The rims of all the tested medium and larger housepits contain thick layers of partly decomposed organic materials (e.g., Stratum XIIIb-c in HP 7). These materials lie either directly on the original preconstruction soil surfaces, or overlie the initial construction rim accumulations which contain very little cultural material.

The refuse components of the rims exhibit occasional stratigraphic bands that extend over large areas as well as smaller thin lenses consisting of charcoal, reddened soil, plant materials, or other distinctive materials (Fig. 3). As already noted, these lenses and bands are important because they indicate that there was no apparent use of rim materials to cover roofs during the period when refuse rim deposits were being formed. Nor was there any indication of a long period when rim accumulation ceased. Prentiss' (Vol. I, Chap. 15) analysis of temporally diagnostic artifact types in the rim strata of HP 7 strongly supports the proposal that these strata are predominantly coherent depositional units, although some rodent disturbance has taken place. Similar coherency also characterizes the other housepits with thick refuse rim deposits (HP's 1, 3, 5).

It was abundantly clear during excavation that all refuse rim deposits were highly variable from lens to lens, band to band, and stratum to stratum. Some deposits were unusually rich in charcoal or ash, others were almost entirely composed of partly decayed botanical remains including still pliable conifer needles and bark, some had varying amounts of soil mixed in, and still others were bands of sterile yellow till that presumably were thrown out after new construction events, whether the digging of a new storage pit, or more likely, the deepening or expansion of the floor. Some flotation samples from the refuse rim deposits could not be "floated" because the entire sample was composed of organic remains and was buoyant, thereby precluding any separation of materials. Lepofsky's detailed analysis of botanical remains from these rim deposits documents the extreme variability involved (Vol. I, Chap. 9). Her analyses also clearly indicate that the rich botanical remains in the rims were largely materials cleaned off the floors inside the pithouses. The density of remains is far higher in the rims than the floors, species diversity is slightly higher in the rims, while multiple dumps are indicated by the presence of both charred and uncharred remains in localized lenses, the variability between samples, as well as in micro-fabric patterns (Vol. I, Chap. 7). Moreover, the charcoal in the rim has the same species characteristics as charcoal associated with inner hearths, indicating that hearth cleanings were probably dumped on the rims (Vol. I, Chap. 9). This is substantiated by the abundant occurrence of ash in Goldberg's microfabric analysis.

The source of the rich uncharred botanical remains was probably varied, including discarded bedding material (conifer needles and grasses) from the previous year, woodworking debris from inside the house (or from outside activities on the rims during mild weather), bark from making shaft tools or baskets or garments, waste materials from making reed mats, plant food remains from processing or consumption, worn out mats or bark garments, and other items. It is possible that the vast majority of organic material came from the cleaning out of the houses prior to occupation in the fall, since (as described ethnographically by Laforet and York 1981:121) combustible waste generated during the winter might have been used as fuel, but substantial quantities of refuse still could have been dumped on the rims throughout the winter occupations. The absence of any broken wooden tools or basket elements from the rim deposits may be due to the use of such items as fuel, although it is also possible that only birch bark containers were used instead of baskets until protohistoric times. A few of the birch bark fragments had been punched along one edge for sewing. Other cultural components of the refuse rim deposits include lithic materials and faunal materials. Prentiss' (Vol. I, Chap. 15) analysis of the lithics clearly shows that the overall proportion of stone tool types and debitage are the same for both the floor and the rim deposits and he concludes that the vast majority of lithic material in the rim deposits was simply material collected from the pithouse floor and discarded on the rim. Certainly, cleanup of the floor appears to be documented in the analysis of lithic, faunal and botanical remains (see below). The only indication of possible special use of the rim as a special lithic-using activity area is the very dense occurrence of lithics throughout the southwestern part of some rims, where afternoon sun would be warmest in the winter. The slightly elevated number of primary flakes in the rim deposits compared to floor deposits may also be due to some activities being carried out on the rims. Large cobbles and boulders occurred sporadically in the refuse rim, sometimes appearing to line the inner walls like spotty retaining walls (also observed at the Bell site—Eldridge 1971 field notes: EeRk4, HP 3). Boulders sometimes occurred higher in the deposits where they may have been associated with roof beam emplacements in pits dug into the refuse rim deposits. Ethnographic accounts describe large rocks being used to set rafters on (Kennedy and Bouchard 1977:Tape 2). It is also possible that they accumulated at the time of the formation of the refuse rims, and that they were used as weights for holding down roofing mats. In most cases, the resolution of stratigraphic details was too difficult to establish clear associations with these rocks.

Faunal remains, while comprising mostly unidentifiable fragmented mammal bone, nevertheless include an unusual number of large bones, and a slightly lower percent of burned bones than the floor (Vol. I, Chap. 10). Faunal remains are especially concentrated in the north, a pattern also reflected in roof deposits. Whether this was a preferred area for discarding unwanted bones and/or was actually used occasionally as a butchering area is difficult to determine. Refuse bones consisting of fragmented and burned pieces do seem to have been dumped on the rim in localized areas, and presumably constituted waste cleaned off the living floor inside. The concentrations in the north may be related to general refuse disposal of large angular waste materials such as fire-cracked rock which appears to have been preferentially discarded in the north part of the roof (Vol. I, Chap. 14).

The unusually good preservation of botanical remains may stem from a number of factors, including the deposition of large amounts of dry, relatively hydrophobic plant material in one place at one time, the inclusion of high amounts of ash which tend to produce hydrophobic environments (Vol. I, Chap. 6; Hayden and Cannon 1983), the inclusion of large amounts of conifer needles and fragmentary bark which might retard microbiological activity, and the domed shape of the rim which would tend to shed water rather than allow it to stand and soak into the ground. A detailed analysis of the precise reasons for the hydrophobic nature of these deposits would require more specialized analysis.

In sum, the refuse rim deposits appear to be largely composed of waste materials picked up from the inside of the housepit, especially old bedding, hearth cleanings, waste materials from woodworking and other activities producing plant wastes, food waste, and lithic waste. There is evidence for the selective discard of faunal elements in the north and chipped stone in the southwest parts of the rim, but it is also possible that these areas could have been used as special activity areas. The presence of such outside activity areas associated with houses can be expected due to poor lighting conditions inside the houses, or due to activities that generate large amounts of waste or messy wastes. The more acidic or open weathering and scavenging environment on the rim may have led to the depletion of some of the bone elements.

The above scenario is remarkable because it implies that except for a few special categories of objects, almost all of the materials discarded by the residents of each housepit over the thousands of years of occupation have been deposited around each structure and remain associated with each individual housepit. This permits a meaningful comparison of refuse associated with each housepit with other contemporaneous housepits, as well as the tracking of changes or continuity within a single housepit over time. As we have seen in the analysis of stone materials used by each housepit (Vol. I, Chap. 16), such analyses can have unexpected and important implications about the most fundamental aspects of socioeconomic organization. Given the large quantities involved in the refuse rim deposits and given the lack of any evidence for refuse disposal between housepits, it certainly appears that in most cases, we can identify *all* of the preserved garbage produced by the residents of given pithouses. Indeed, given low winter temperatures, it is understandable why refuse would be disposed of in the closest, most convenient location. The buildup of refuse on the rim may have also been an intentional undertaking meant to increase the height of the rim and the insulating characteristics of the house.

Unfortunately, there is also considerable evidence for bioturbation and some cultural turbation within the refuse rim deposits that obscures many of the details of separate strata and lenses. The rich organic matter provided excellent forage and litter material for rodents whose burrows are sometimes apparent in the rim and whose remains sometimes occur in various types of deposits. Burrowing insects would also have found the organic rich deposits fertile ground for their activities. Cultural disturbances include digging into the upper parts of these deposits in order to establish roof beam emplacements (difficult to recognize except for the large boulders and cobbles sometimes associated with these features), the digging of small cache pits in the base of the walls (e.g., for caching the nipple tipped stone maul—probably of Plateau Horizon age—found at the base of the rim deposits in HP 7), and the sloughing off of rim walls that were excavated too steeply. Sloughed off sediments could accumulate inside the housepits and cover objects like the nipple tipped maul which had been stored against the walls. Botanical and micromorphological analyses clearly indicate that agents of bioturbation were active, and they appear to have contributed to the difficulties we experienced in excavating these rim deposits. However, while the bioturbation of refuse rim deposits has blurred some of the patterning, bioturbation has clearly not destroyed major patterning in sediments, as demonstrated by the still visible lenses, bands, sub-strata, and the stratigraphic coherency of period-diagnostic artifact types.

Given these caveats, there appears to have been very little basic economic change throughout the Plateau and early Kamloops Horizons. Although monitoring changes over time was not one of the main goals of our research program, it is nevertheless clear from Prentiss' analysis of lithic tools in rim deposits (Vol. I, Chap. 15), that very little change occurred throughout the depositional sequence of the rims other than the change from atlatl to bow and arrow hunting technologies. Unfortunately, sampling for botanical remains was very limited from rim deposits and faunal remains were relatively infrequent in the deep sections of rims that we excavated. Therefore, little can be said about any possible faunal or botanical changes in household economies over time, although there is nothing to indicate that these aspects of the economy changed in any fundamental way either.

Roof-like Rim

In all of the housepits with thick refuse rim deposits, there is a relatively sharp break or truncation of these deposits within 50 cm of the surface of the rim. In all cases, the upper stratum is composed of much more homogeneous ashy gray soil that is indistinguishable in the field from the roof deposits overlying the floor and forming a continuous deposit with the upper stratum of the rim (Fig. 3). It is clear that if such thick roof-like deposits had existed during the period when layers of refuse were accumulating on the rims, the roof-like deposits would have been very apparent within the layers of refuse. Yet there is essentially no indication that anything like these deposits ever existed in the lower strata. That the roof-like rim deposits are not simply weathered upper horizons of refuse rim deposits is indicated by the clear demarcation between the refuse and roof-like deposits and by the lack of any evidence of lenses of charcoal or other more weather-resistant materials found among the layers of refuse but not in the roof-like rim deposits.

Rather, the roof-like rim deposits of the larger housepits appear to have been churned and homogenized. As implied by Teit, these deposits may have originally covered the roofs and were removed from roofs and placed on the rims during reroofing events, becoming constantly mixed. Presumably, some of the upper levels of the refuse rim deposits became incorporated into this matrix as a result of using materials from the rim area to put onto the roof (Teit 1895). And presumably, despite the homogenizing effects of recycling sediments used to cover roofs in this fashion, people still continued to discard organic and other wastes on the rims. However, with these wastes being churned up every 10–20 years due to reroofing, such wastes would be much more susceptible to decomposition. That this is relatively close to an accurate interpretation of events is indicated by botanical remains. Lepofsky (Vol. I, Chap. 9) in particular shows that the density and preservation of botanical remains of the roof-like rim deposits is almost exactly intermediate between refuse rim deposits and typical roof deposits. Although Kusmer (Vol. I, Chap. 10) does not break down faunal remains according to sub-strata in the rim, it seems very likely that faunal remains, and particularly fish remains, would follow the same pattern except that the more acidic environment of the refuse rim deposits might reduce bone preservation.

In sum, it is most reasonable at this point to view the roof-like rim deposits as representing material that has been repeatedly recycled onto and off of the roof, leaving some residue on the rim either due to excess material, slumpage of soil down the roof over time, or the actual pulling down of roof soil from the roof on to the rim in order to facilitate burning of the wood roof frame and minimize the amount of haulage of dirt off the floor for subsequent reroofing. Whether the roof-like rim deposits were originally obtained from sterile till used on the roof, or whether they were at least partially obtained by using refuse rim deposits to put onto the roof cannot be determined at this point.

As previously noted, on the basis of stratigraphy and artifact densities, the massive placement of sediment on the roofs appears to have been a relatively late development. There is no indication of such use of sediment throughout most of the Plateau horizon refuse deposits, and in fact, most of the projectile points in the roof-like rim deposits are Kamloops with a minor proportion of Plateau points (Vol. I, Chaps. 3 and 15). Although Stryd's data from the Bell site have not been quantified, he, too, had the impression that earth covered roofs were not generally used before the Kamloops horizon in the Lillooet region (personal communication).

Roofs

Ethnographic Observations

Teit (1900:192–4) observed a number of abandoned pithouses and published illustrations and photographs displaying their construction, which are relatively well known and cited. Additional information has been compiled by Alexander (Vol. II, Chap. 2). For the immediate purposes of understanding the formation processes of roof deposits, it is sufficient to note that a log framework was overlain by smaller poles which constituted the roof surface. It is evident from Teit's (1900) illustrations and photographs that the main support beams of the roof were set into the ground near the top of the rim deposits. This coincides with the position of features recorded in the upper eastern wall of HP 7 (Vol. III, Chap. 5). Bark of various tree species was placed over the poles (per Laforet and York 1981:118; Bouchard and Kennedy 1977:63; Kennedy and Bouchard 1977:Tape 1, 1987:260) and we have recorded *Pinus* and *Populus* bark remains over roof beams archaeologically in HP's 7, 47, and 58. A layer of conifer needles, and/or grass was then placed on the bark and these have also been recovered in some less burned archaeological deposits (e.g., HP 12). It is possible that grass or mats might have been used as substitutes for bark or conifer needles. Whether the conifer needles functioned as insulation, or to keep the structural elements dry and away from contact with soil, or to inhibit dirt from filtering into the house interior (e.g., G. Wilson 1934:412; Kennedy and Bouchard 1987:260; Surtees 1975) is unclear. It appears that the same technology was transferred to the construction of native log cabins, as well as other features of residences such as the use of storage pits. Leonard Sampson, an older resident of the Bridge River Band told me that he grew up in such a log cabin. According to him, there was 6 in (15 cm) of pine needles placed on the roof before adding soil. While this may be an exaggeration, it is clear that ideally, a thick layer of conifer needles would be placed on the roofs; and these must have burned readily when roofs were burned. I observed this same construction technique in a partially collapsed cabin on the Pavilion reserve, used by Desmond Peters' grandmother (Fig. 4). In this case, as in most sod roofed cabins, shakes had been used to fill in spaces between joists and cross poles.

One other aspect of roof construction that is important for understanding formation processes of all deposits associated with pithouse occupation is the length of time that roofs would last before they had to be replaced. This interval basically determines how long floors could be used before they were scraped down to sterile and removed during reroofing events. In turn, this interval also set the number of years that

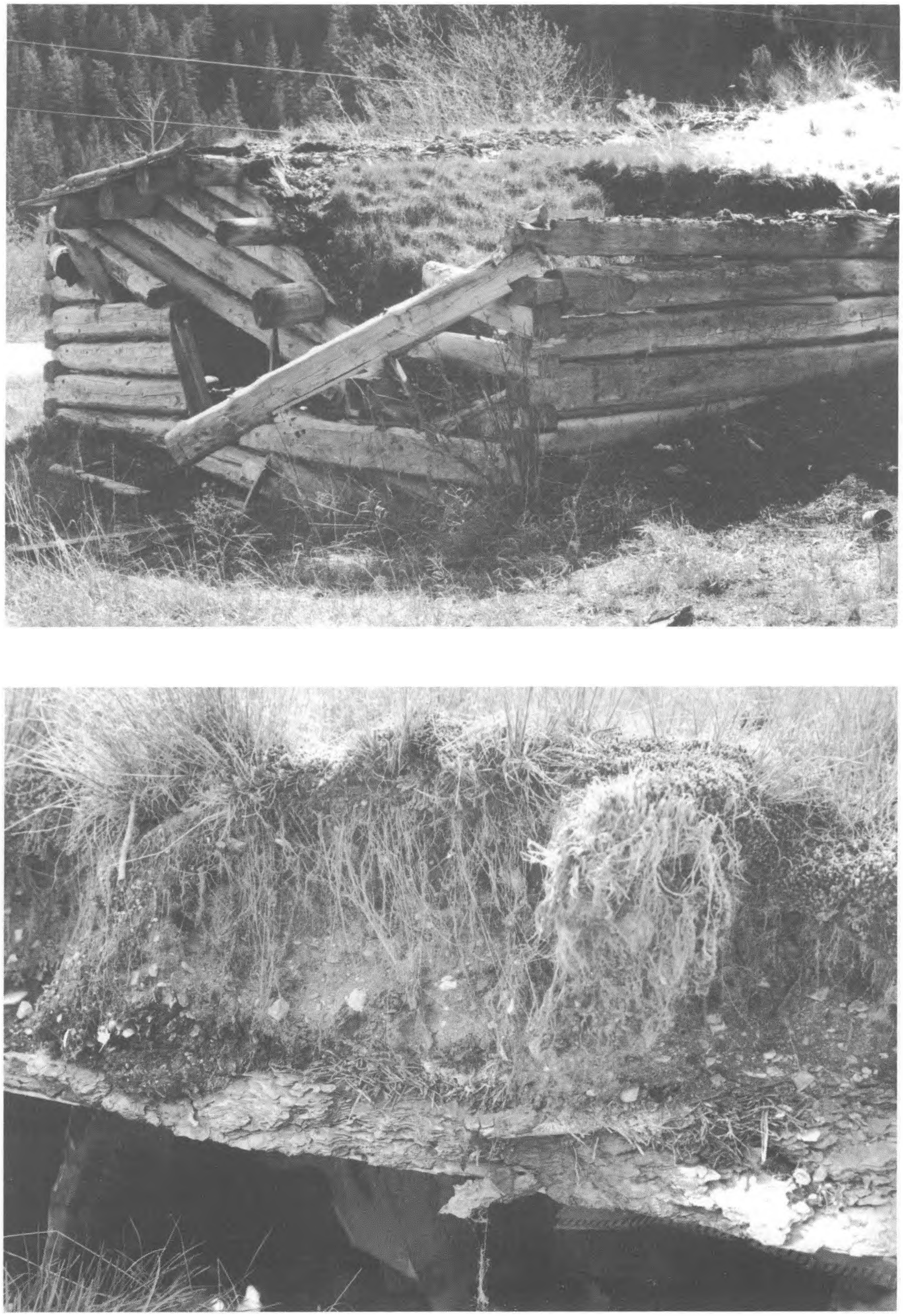


Figure 4. **The collapsing roof of a traditional "sod" roof log cabin on the Pavilion reserve. This structure is reported to be over 80 years old and has only recently begun to decay because it was abandoned and unheated in the winter. Roof construction techniques are probably very similar to those used to roof pithouses. Note the use of pine needles and pine bark slabs at the base of the earth covering in the detail photo. Wood shakes have probably replaced poles as construction material used between the roof cross beams and the pine bark.**

refuse could accumulate on the floor and how frequently materials left in or on the floor sediments would be removed to be added to the roof deposits—which as we have seen can be useful in estimating the amount of time roofs had been covered with soil (Table 1). Thus, it is of some consequence to determine such intervals fairly accurately.

Unfortunately, there is no simple solution. None of the traditional ethnographers comment on this topic. Leonard Sampson thought that sod roofs of log cabins would last about 75 years. He noted that the first parts of the cabin to decay were the logs in contact with the ground. Sod roofs together with the wall supports of log cabins that are clearly over 100 years old (e.g., Desmond Peters' grandmother's cabin, cabins in the historic village of Bridge River, and root cellars associated with the Pavilion General Store) are still partially intact, and according to informants were still functioning or being lived in up until the 1950's. Only when they were abandoned did they begin to decay due to the absence of heat keeping moisture away from needles and wood. This implies that the structural supports and sod roofing would probably remain in serviceable condition for about 50–60 years or more. Interestingly, these structures never seem to have been intentionally burned by their occupants to get rid of vermin or for any other reasons.

On the other hand, untreated fence posts made of pine in similar environments generally last only a fraction of this time, typically about 5 years (McGuire and Schiffer 1983:291). Even our survey stakes were frequently insect riddled and decayed after a few years. There are several wood related factors that affect the rate of decay. These include the wood type, the diameter of the wood (Wainwright 1971:224), and the presence or absence of bark. Pine decays the most rapidly, yet Lepofsky's (Vol. I, Chap. 9) analysis of wood remains from major interior postholes indicates that pine was being used for the principal structural supports of the pithouses. This fully corroborates Teit's (see Appendix) observation that pine was used for the major support posts and joists, "as it was soft wood to cut." He also states that all logs and poles used in the roof were peeled. Evidence from structures like the root cellars at the Pavilion General Store, indicate that even untreated wood in contact with the ground may last much longer than the brief 5 year periods noted for fence posts, perhaps in large part due to the roof acting as protection from moisture. In the Southwestern United States with a similar environment, archaeological evidence also indicates that juniper log roofs of housepit structures were replaced about every 20 years (McGuire and Schiffer 1983:291; Allen Kane, personal communication). G. Wilson (1934:372) reports that Hidatsa earthlodges ordinarily lasted from 7–10 years, with posts rotting out at the base first. Similarly, experimental housepits such as the one built by Roscoe Wilmeth at Anaheim Lake, have generally not lasted more than about 10–20 years before serious collapse began. Condrashoff (1972; 1980:5), too, reports that the roofs of British Columbian housepits lasted about 10–20 years, based on information from Isaac Willard who was born in a pithouse near Kamloops.

Given all the above factors, a relatively conservative estimate of 20 years seems reasonable for roof replacement at Keatley Creek. Coincidentally, this exactly coincides with Alexander's independent estimate (Vol. II, Chap. 2). There is, nevertheless, a slight chance that roofs may have lasted up to 50 or even 60 years. That insect activity did affect roof beams was clearly revealed by several carbonized beams in HP 7 where the interior portions consisted entirely of insect debris. I suspect that the considerably longer use-lives that seem to characterize sod roofed log cabins are due to the use of harder, more rot resistant logs such as douglas fir, the use of much larger diameter logs, and the systematic use of stoves for heating. All of these changes were probably made cost-effective by the introduction of metal cutting tools and stoves. As argued in subsequent sections, fires were probably only used in pithouses for special occasions.

Archaeological Observations

In comparison to rim deposits, roof deposits appear exceptionally homogeneous in the field. They are generally derived from till deposits and display the characteristic high gravel and pebble content (33% on average—Vol. I, Chap. 6) of the local till, although one housepit is aberrant. Organic staining varies from housepit to housepit, as does artifact density, according to intensity of occupation. In the most intensively occupied housepits, the roof is characteristically dark gray brown. In the less intensively occupied housepits, the roof deposits are much browner.

There are some important exceptions to the generalization that roof deposits are homogeneous. Occasional concentrations of large charcoal segments and fire-reddened pockets sometimes occur in the middle of roof deposits. These may in part represent beams and other plant material that remained partially upright as the rest of the roof collapsed around them when burned, or they may represent other processes that we do not fully understand as yet. There are also some localized concentrations of bone or artifactual materials that seem atypical of most roof deposits. These may represent basketloads of refuse thrown onto the roof shortly before abandonment that had not lost all their coherency during collapse or been exposed on the surface long enough to decompose. Other concentrations of bones and artifacts occurred close to the surface and were associated with hearths dug into the top of the collapsed roof deposits. These were so distinctive that they could easily be recognized as transient camp remains of hunters who had used collapsed, abandoned housepit depressions for camps (see summaries of HP's 7, 9, and 90 in Vol. III).

In some areas of the roof of HP 7, especially the west, the texture of the roof sediments changed in unusual ways. This area contained alternating bands of the usual coarse roof gravels but also contained bands of much finer loams typical of surface aeolian deposits in the area. Oral accounts collected by Steven Romanoff indicate that special efforts were occasionally made to obtain fine river or anthill sediments for the final layer of roofing material in order to reduce water penetration (cited by Stryd 1971 field notes:232). Nancy Condrashoff Romaine (personal communication) was told by a Shuswap man who was born in a pithouse that dirt from anthills was placed on roofs to keep snakes away from the houses. Kennedy and Bouchard (1977:Tape 1; 1978:37) provide further documentation of these practices. The finer materials in the west sectors of the HP 7 roof may have been intentionally added to the roof by residents of the house residing in that sector, or simply been inadvertently added by those throwing roofing soil onto the roof from the most convenient sources which happened to be nearby aeolian deposits. Given the general high status nature of the domestic groups in the west half of HP 7 and the desirability of using fine sediments for roofing, I suspect that the addition of the fine silts was intentional.

The coherency of the different textural bands indicates that large sections of the roof may have collapsed as entire units rather than burning through as localized hotspots with roof materials funneling through the holes to the floor. This observation supports the notion that the larger structural elements may have been scavenged from the house prior to burning. Furthermore, except in HP 104 and 106, we found no *in situ* stubs of burned posts or joists where they would have abutted the rims. Experiments that we conducted in which wood beams were partially buried in the sides of large campfires demonstrated that burning stops only a few centimeters from the ground surface. Thus, if any major support posts or joists had been left in the house prior to burning, we would have expected to find their charred stubs. Except for HP 104 and 106, we found none, and we infer that all of the principal structural elements were removed prior to burning in most houses.

There are a number of accounts of pithouses being disassembled prior to collapse in order to salvage usable wooden structural members. For instance, the Hidatsa removed timbers that were still usable (Wilson 1934:372), as did the Pueblo Indians (see Vol. I, Chap. 2). In an analysis of Anasazi pithouses, Glennie 1983:129) proposed that primary, secondary, and tertiary beams would have been difficult to obtain, especially since they had to be straight and thick. Because of the potential depletion of wood sources especially near large, regularly occupied sites, it would be worth retaining larger beams during reroofing events or even at the abandonment of a pithouse. The degree of beam salvaging should be dependent upon the size of the population in a community, the rate of reroofing or house replacement, and the rate of natural forest renewal, which in semi-arid environments such as Lillooet would be low. Thus, expecting considerable salvaging of major roof elements prior to burning the roofs of pithouses at Keatley Creek is a reasonable premise that is consistent with general ethnographic observations and archaeological evidence.

Once the major support elements had been removed, the remaining lower parts of the roof may have either remained standing, being held in place like a fragile upside down basket rim by mutual pressure of the lighter roofing poles against each other, or the remaining lower roof may have collapsed immediately onto the floor as joists were removed. In this last instance, considerable air space would undoubtedly be left between the horizontal roof poles lying on the floor, allowing for considerable burning resulting in the pattern of burned beams observed archaeologically (Vol. III, Chap. 6:Fig. 3). Overall, this last scenario seems most realistic. On the Coast, Samuels (1991:203) reports comparable removal of roof supports from abandoned houses. Indications that useable major structural beams were removed from the roofs prior to burning are important for interpreting dates obtained from housepit roof beams. As with the Southwestern United States housepits (Bullard 1962; Wilshusen 1986:248), the main beams at Keatley Creek seem to have been removed upon abandonment and were recycled. Those beams not directly in contact with earth may have been in use for several generations, or more in some cases, before finally decaying beyond use or being burned. Thus, carbonized roof beams laying on occupation floors may have been procured over a period of a hundred years or more prior to that occupation, but may all have been in use during the occupation of the floor. Thus, there may be a significant spread of dates from a given occupation floor if the larger roof beams are used for dating.

Although very few roof samples were examined for botanical remains due to our research focus on the floor deposits for the purposes of the project, it is nevertheless obvious that there is considerable variability in botanical remains across the roof of HP 7 (Vol. I, Chap. 9) especially in charred conifer needles and seeds. This variability was unexpected, but may be due to a number of factors including: disposal of hearth cleanings containing charred materials in preferential locations on the roof; activity areas on the rim or against the base of the roof that left botanical remains; differences in the completeness of burning or in burning environments around the roof involving conifer needles and/or grass materials used in roof construction; and the differential growth of plants on the roof with their subsequent carbonization during the burning of the roof.

Roof Activity Areas

On the basis of his previous experience in excavating housepits, Mike Rousseau suggested that parts of the roof might have been used for special activity areas. This also made sense in terms of our supposition that lighting would be poor inside housepits and that outside areas would be used during mild sunny winter days for activities requiring good lighting or large areas. Thus, there was some reason to expect that there might be patterning in the roof deposits representing activities that took place on or near the base of the roofs while the houses were occupied. Certainly, the concentration of fragmented faunal remains in northern and eastern roof deposits (Vol. II, Chap. 7) mimic the concentrations of fire-cracked rock concentrations in *all* extensively excavated intact housepit roofs (HP's 3, 7, 12). This indicates that there were at least preferential areas of the roofs where these materials were discarded. In the case of the concentrations of unusual identifiable bone elements and unusually low proportions of unburned bone near the northeast and east edge of the HP 7 roof, these may result from butchering activities that took place on the coolest side of the house. In contrast, lithic concentrations on the southwest edge of the roof of HP 3 may indicate activities were conducted at the base of the roof in order to take advantage of the warmth in that sector (Vol. I, Chap. 14). The distinctiveness of the lithic assemblage in that area and the concentration of unidentifiable fragmented bone in the same localized area makes this appear especially likely.

Assuming that there was no earth covering for the roof during the formation of the refuse deposits in the middle zone of the HP 7 rim and that debris from outside activities in the southwest would be left on the rim instead of on the base of the roof at pre-Kamloops houses with no dirt roofs, the concentration of lithic remains in the southwest Kamloops period roof deposits may be the late period analog of the concentration of lithic debris in the west rim deposits of earlier structures. Similarly, the possible butchering concentrations of bone in the northeast edge of the roof may be the analog of similar bone concentrations in the north part of the rim that we sampled, while the concentrations of bone in the east could simply represent one component of the disposal of hard refuse (including fire-cracked rock), as documented in the roof. Fresh bone left on the roof or rim was probably heavily scavenged by household or vagrant dogs.

In interpreting patterns of artifact concentrations in certain sectors or quadrants of roofs, it should also be borne in mind that reroofing events would mix materials left in the floor deposits with those of the roof. Everything else being equal, economy of effort would dictate that on average, floor deposits would be thrown up on the rim (and subsequently onto the roof), at the closest rim location to the area of the floor being cleaned. In this manner, if there was an unusually dense concentration of bone in one sector of the house, and if the pattern was stable over several reroofing events, such a concentration could be expected to be reflected in the roof deposits covering that sector of the floor, although they would not necessarily be expected to concentrate at the periphery of the roof deposits. Some of the concentrations in the roof deposits analyzed may in fact be due to this factor, in particular the bone concentrations in the southeast quadrant of HP 7.

Based on ethnographic observations among the Maya (Hayden and Cannon 1984), it also seemed possible that long, thin items such as bone tool blanks, some bone tools, ornaments, large primary flakes, or arrow foreshafts, might be stored in the inner roof, wedged between roofing poles just above the sleeping or working locations for domestic groups. Similar storage behavior (but using walls) has been reported for traditional Northwest Coastal houses (Maugher 1991:116). While such items are normally infrequent and are only abandoned because they have little value or are forgotten, we suspected that there might be some patterning of these types of items in the lowest levels of the roof deposits, especially if large sections of the roof collapsed as units. Thus we tried to ensure that the bottom 5 cm of the roof deposits were always identified. That artifacts were stored on the inside of the roof in HP 3 is indicated by an unusual concentration of bone artifacts in the bottom roof levels, including two barbed bone points, two awls, and four incised or polished pieces of bone, whereas only two other bone artifacts were found throughout the rest of the roof deposits.

Aside from the few likely special activity areas on roof surfaces that have been mentioned, most of the differences in the faunal assemblages associated with the roof versus floor deposits can be explained by differential preservation and/or removal of hearth (including burned bones) or other refuse from the floor area and subsequent discard onto the roof. Roof materials from all analyzed housepits display very similar faunal characteristics. As a rule, fish bone is rare in comparison to the floors, probably due to less favorable preservation conditions in the roof deposits, which also explains the substantially greater proportion of weathered bones in roof deposits compared to floor deposits. Burned bone can be much more frequent in the roof deposits than in floor deposits, which may reflect either the high proportion of burned bone in post-abandonment hunters camps or the removal of burned bones with hearth remains from the floors and their dumping on the roofs. Similarly, the total lack of uncarbonized botanical remains (except for occasional pieces of birch bark) and the very low values of carbonized needles and wood compared to rim deposits may reflect more adverse preservational environment of the roofs compared to other types of deposits.

Again, aside from the southwest sectors of the edge of the roofs which may be special lithic using activity areas, the lithic assemblage from the roofs bear striking resemblances to the lithic assemblages from the floors in almost all characteristics: flake sizes, raw materials, flake types, artifact types, wear state, and amount of cortex (Vol. I, Chap. 14). The only consistent differences of any magnitude are the slightly greater proportions of flakes on the roof produced by hard hammer percussion as well as flakes with more cortex, with greater weathering, and more fragmentation. Some categories in HP 12 with small sample sizes provide a few exceptions. However, the main differences are all understandable in terms of different weathering environments and the preferential discard of the least useful reduction products. The consistently greater occurrence of 1–2 cm flakes in the roofs compared to the floors, and a higher percentage of larger flakes on the floor may be due to the clean-up of small debris from the floor and discard onto the roof. In contrast, flakes smaller than 1 cm are more common on the floor indicating that hand picking up of refuse rather than sweeping may have been the most widely used technique for cleaning up, although floor mats used for sitting or serving could have been swept off on a regular basis. The overall similarity between the roof and floor deposits implies either that the vast majority of the lithics in the roofs were materials cleaned up off the floor and dumped on the roof during occupation, and/or that the materials in the roof were largely derived from the incorporation of floor deposits in the roof deposits during reroofing episodes (Fig. 2).

In sum, the cultural material in the roof deposits appears to derive largely from the discard of refuse from the occupation floor, but also undoubtedly includes a great deal of material originally deposited in the floor matrix. As the roof was repeatedly replaced and all loose floor deposits were removed from above the sterile till, the floor matrix and contents were added to the dirt roof covering. Localized activity areas also occur on the periphery of the larger roofs.

Collapse Events

The nature of the roof collapse may have important consequences for the patterning of any primary, secondary, or de facto refuse left on the surface of the roof. The major factors of importance are whether the roof was burned or left to decay by natural processes, and whether the roof collapsed in coherent large sections or whether dirt gradually filtered through multiple holes throughout the roof. Much more needs to be known about the conditions and processes involved, however, at this point it appears that if roofs were left to decay slowly through natural processes, localized areas between main support beams were more likely to rot resulting in the gradual funneling of roof sediments onto the floor. This would mix artifacts laying on the roof surface with prior occupation refuse in the body of the roof sediments. The same processes can be observed occurring today with collapsing sod roofs on early log cabins in the area (Fig. 4), and are also evident in early photographs of partially collapsed housepit roofs (Teit 1900:Plate XV). So far, there is only one clear example in the 26 housepits tested at Keatley Creek of a roof having decayed naturally (HP 9); most if not all the others appear to have been intentionally burned.

Burning roofs could result in a similar pattern of localized holes and filtered collapse due to the more rapid burning of smaller wood elements between the main roof beams. However, removal of the largest structural beams before burning might weaken the roof to such an extent that burning could result in the massive collapse of large sections of roof, or as argued in the discussion of roof deposits, sections of the roofs may have collapsed before burning. In this case, any refuse patterning on the surface or inside of the roof might be retained to a much greater degree and artifact dips might frequently be relatively horizontal, although the pulling down of roof soil from the center of the roof towards the edges in order to remove structural beams and posts could obscure some of this patterning. Subsequent to the collapse, slumping and colluvial movement of roof materials toward the bottom of the house depression would rework the uppermost collapsed roof deposits even further.

As noted above, there are a number of indications that roofs at Keatley Creek were weakened before burning by the removal of main structural beams and posts and that some segments of the roofs collapsed as coherent units. The occurrence of large carbonized roof beams laying directly on the floor of the houses instead of mixed with the body of the roof deposits or laying on top of the roof deposits also indicates that large sections of the roof collapsed directly onto the floor rather than burning through in localized spots through which roof sediments could fall onto the floor and cover it before the beams collapsed. The relative lack of any roof deposits in the central areas of the housepits together with Kusmer's (Vol. I, Chap. 10) observation from the HP 7 roof that bones from the peripheral areas of the roof were primarily found below the uppermost 10 cm of roof also strongly indicate that roof soil was pulled down from the center of the roof toward the edges prior to burning.

In some of the excavations, attempts were made to recognize "filtered roof collapse." These were thought to contain fewer coarse clasts due to the greater ease with which finer materials could pass through the initial decay or burn holes in the roofs. While a number of excavators felt that they could detect a vertical gradation in the occurrence of coarse clasts within the roof corresponding to this model, I had difficulty in perceiving such a change given the local variability in large clast occurrence and the general small size of the vast majority of clasts. The "filtered collapse" deposits identified in HP 3 even had the lowest proportion of flakes under 1 cm of all deposit types, which is contrary to what one might expect with filtering effects. I suspect that holes in the roof would tend to break through in large enough sections during burning or natural decay so that size filtering effects would be negligible. The issue certainly requires further experimental work and detailed texture analysis of soils in order to be clarified. However, it is evident from the very low percentage of fish (1%) and elevated percentage of weathered bone (8%) in the filtered collapse that these deposits were derived from the roof rather than any interior sediments.

One other factor affecting variability in roof deposits is the completeness of burning that took place. This obviously would affect factors such as the preservation of roof beams, conifer needles and bark used in roofing, and any botanical remains (cultural or natural) associated with the roof surface. The patterns of carbonized beams (which are well preserved in some housepits (e.g., HP 3) or portions of housepits, but only intermittently present in others) and the localized preservation of bark or conifer needles in association with roof beams (e.g., HP 12) indicates that there was substantial variability in carbonization versus complete oxidation of wood during house burning.

After the collapse of the roof into the center of the housepit, roof deposits would be loose and poorly consolidated, especially given the low clay content in the parent material. Thus, considerable downslope movement could be anticipated, depending on the depth and slope on the inside of the pits. Slopes vary from less than 10 degrees to over 30 degrees.

In sum, roof deposits, like the other major types of deposits associated with housepits, have proved to be considerably more complex than we assumed before taking a detailed look at the variability and processes involved. Subjectively, it is easy to focus on the homogenous field appearance of most roof deposits and ignore some of the important variability, especially if roof materials are not obviously central to one's main research objectives. Yet, the broad patterns involved in the formation of roof deposits seem clear enough to inspire confidence in our interpretations, including the use of roofs as refuse disposal areas as well as special activity areas, and the manner of their construction and collapse.

Despite these factors, it is still puzzling as to why larger housepits throughout most of the Plateau and Shuswap occupations do not seem to have used significant amounts of soil to cover the roofs. Excavation of smaller Plateau period housepits (e.g., HP's 4, 9, 90, 107) seem to indicate that some earth was used as part of the roof. It might be suggested that during the Plateau and earlier periods mats were primarily used to cover these structures during the winter and that such mats would quickly rot out if left covered with earth for the entire year and therefore had to be removed after every seasonal occupation. For smaller housepits, it would be a relatively small task to cover such mats at the bottom or even relatively completely with earth and to remove this earth after every occupation, much as earth banked winter mat lodges continued to be made in historic times (Alexander 1992: Plate 3.3). However, for larger houses it may have involved an excessive amount of time and labor to cover any significant part of the roof with earth every year and to remove it after every occupation. This may be the reason why roofs of large Plateau period houses involved negligible use of dirt. Instead, mats may have been secured on the roof by the use of poles attached to the mats on the outside. Access through the smokehole could have been achieved via an outside ladder (Condrashoff 1972). Given this arrangement, almost all refuse would presumably have been thrown on the rims in order to avoid damaging mats, and of course outside activities would be conducted on the rims rather than on the roofs.

The above model assumes that the dirt roof covering of later period roofs was left as is after collapse, or was totally removed in order to construct a new roof and then used as part of the new roof soil covering.

Although most of the housepits that we excavated or tested did conform to this sequence of events, there were a few occasions where subsequent occupations did not clean out all roof and floor soils down to sterile till, but rather simply removed some of the collapsed roof deposits and leveled out the remaining material to create a new living surface above the older buried one (e.g., HP 9 and probably 110). Partially collapsed structures might also be repaired and fallen roof material smoothed out for temporary or single season use, as appears to have happened during the natural decay of the Stratum VI roof in HP 9.

The strong similarity between the lithic assemblages of roofs and floors (Vol. I, Chap. 14) and between floors and rims (Vol. I, Chap. 15) strongly indicate that no basic economic changes took place from the time that the rim and roof deposits accumulated and the time that the floor deposits accumulated. Faunal and botanical differences between roof versus rim and floor deposits can be entirely accounted for in terms of the differential preservation conditions that typify these different types of deposits, and in terms of differential discard behavior that characterized different types of deposits.

Surface Deposits

Typically, all relatively deep housepits at Keatley Creek have a deposit of fine, dark gray-brown loam containing about 5–20% gravels and pebbles in the top 5–15 cm. This stratum is quite distinct from the roof deposits (which contain much higher gravel and pebble volumes) in most cases, although in other cases there is a much more gradual transition between the two deposits. The higher gravel and pebble content in these surface deposits within housepits indicates that they are not simply aeolian accumulations similar to the aeolian loams that occur at the surface of the till elsewhere. While there may be some, perhaps considerable, aeolian enrichment of silts and sands, especially due to the dead air spaces and lower air velocities within housepit depressions, it also seems probable that much of the fine fraction of the surface deposits (as well as their coarser fraction) is derived from the water transport of silts and sands from the uppermost collapsed roof soils down toward the base of the housepit depressions. This is further indicated by the progressive thinning of these surface loam deposits as one moves up the inside slope of the housepit to the rim (Fig. 2). The collapsed form of a housepit constitutes a closed depression which naturally tends to concentrate and retain rainwater at the bottom. This appears to favor the development of grass vegetation at the bottom of many housepits, and it is probable that some of the rich dark color and high organic content of the surface loams in housepit depressions is due to soil formation processes associated with these richer grass microenvironments.

Most post-housepit occupations of the site by transient hunters occur within the surface loam deposits and are concentrated toward the center of the housepit depressions where there is the most flat area and least wind. These occupations are generally easy to recognize on the basis of the occurrence of hearths within the surface loams, as well as localized scatters of distinctive lithics (endscrapers and cherts) or historical artifacts (metal knife blades, arrowheads, axes, bottle fragments, leather scraps, pipes), or distinctive faunal remains. Sometimes pits, hearths, or occupations occurring shortly after the roof collapse extend into the uppermost roof deposits as well but are generally easily distinguished from housepit occupation activities.

Deposits Outside Housepits

Before turning to formation processes of floor deposits, it is worth mentioning that some activities do appear to have taken place away from housepits, resulting in some bias in housepit refuse in terms of the overall representation of activities performed at the site. These activities can be classified into three basic categories: refuse disposal, special activity areas, and communal activities.

One of the most common comments concerning archaeological reconstructions of housepit socio-economic organization is that much of the refuse may have been removed from the housepit and dumped elsewhere, or that the patterning on the floors could simply represent refuse thrown into abandoned housepits. The dumping of refuse in abandoned housepits will be addressed in the next section. We investigated the possible disposal of refuse away from housepits by undertaking a transect sample across the site between housepits and by the excavation of small depressions that were the most obvious potential facilities for refuse disposal. The transect excavations (Vol. I, Chap. 6) revealed essentially nothing but natural deposits containing no or very rare cultural material. Investigation of 13 small cultural depressions selected to sample all parts of the site and all sizes of smaller depressions revealed no concentrations of refuse such as would be expected from refuse dumping (Vol. III, Chap. 12). Some of these depressions constituted abandoned storage pits that had been filled with what excavators termed "refuse," however, in all cases this was predominantly composed of soil with low densities of artifacts that was indistinguishable from general roof fill. There were no dense concentrations of faunal remains, fire-cracked rocks, or botanical remains as one would expect from a basket load of refuse collected from elsewhere and dumped in a pit. Rather the pit fills appeared to have been obtained from nearby housepit roof or other associated deposits. Except for a few clear instances at the site (e.g., HP's 47, 58, Vol. III, Chap. 11), there is no evidence for the disposal of pithouse refuse away from the immediate pithouse that generated it. One area which remains to be investigated as a refuse dumping location is the creekbed of Keatley Creek.

The testing of small depressions did lead to the identification of a number of special activity areas. Many of these were interpreted as roasting pits for cooking meat (EHPE [Extra Housepit Excavation] 2 and 12) or plant materials (EHPE 1 and 2, just north of HP 7). One larger structure (EHPE 20) was so charcoal rich and devoid of other cultural remains, except FCR, that it must have been a root roasting pit or perhaps even a feature used for producing charcoal. Other small cultural depressions appear to have been small structures possibly used for secluding women during menstruation, or as residences of very poor individuals or families. The amount of cultural material associated with these small depressions was generally very limited, but distinctive in terms of faunal remains, amount of charcoal, and some lithic materials. The scarcity of these specialized activity areas and the low numbers of artifacts involved indicates that they probably have not created a major distortion in our modeling of the activities that occurred inside the housepits. There are also a number of storage pits that occur between or far from housepits, especially on the terraces to the east and south of the site core. Several structures may have been used for special community structures. They are discussed in Volume II, Chapter 1.

In sum, the immediate deposits associated with most housepits (roof, rim and floor) appear to contain the vast majority, if not all, of the refuse that was generated by daily activities of the residents of each housepit. There is very limited evidence for refuse dumping away from housepits or in other abandoned housepits. Only occasional activities appear to have taken place away from housepits or in specialized community structures.

Floors

Identification and General Characteristics

Floor deposits were considerably more complex than originally anticipated. If we are going to reconstruct socioeconomic organization within housepits with any degree of detail and confidence, it is necessary to be able to distinguish floor deposits from roof and till deposits in the field with relative confidence and to determine whether any mixing with non-floor deposits has taken place. Distinguishing floor deposits from sterile till, and even middle prehistoric components (4,800–7,000 BP), posed no problem given the striking difference in color between the yellow till/early components and the blackish floor deposits. Careful attention to the problem of distinguishing floor deposits during the test trenching of housepits in 1986 led to the fairly confident subjective identification of floor deposits versus roof deposits in several housepits (HP's 1, 3, 7, 12). These impressions were reinforced during subsequent more extensive excavations in these housepits.

Before excavations began, we proposed on the basis of the literature (e.g., Schiffer 1976, 1985, 1986) as well as on the basis of postulated theoretical and common sense grounds that living floor deposits might exhibit some or all of the following characteristics:

Sediments

1) If the roof acted as a filter that permitted fine sediments to sift into the house but blocked coarser materials, or if the interior acted as a trap for aeolian particles, or if silt and clay-rich sediments were brought into the houses by people, the floor deposits might be enriched in fine sands, silts, and clays in comparison to roof or till deposits. We therefore examined the textures of these deposits. In most cases, the floor deposits were about 10% richer in sands, silts, and clays (Vol. I, Chap. 6).
2) Floor deposits were expected to be more compact than roof deposits, especially since collapse of the roof should have disaggregated any compaction in the roof soils. We used bulk density tests in an attempt to measure compaction, however, variability in pebble and cobble content appear to have overwhelmed any differences due to compaction. Gravels and pebbles in the soils rendered the use of penetrometers ineffective. Despite our inability to monitor compactness in a precise way, we nevertheless collected subjective impressions of excavators in a relatively systematic fashion (see below). These data clearly indicate that floor deposits were generally distinctly more compact than roof deposits (Vol. I, Chap. 8).
3) Chemical residues from food processing and consumption were expected to vary in a structured and patterned fashion across the floor. Concentrations of chemical elements in floor deposits should therefore reflect activity areas identified on the basis of other indicators such as hearths and faunal remains. Phosphorous, nitrogen, calcium, strontium, and magnesium were the most obviously relevant elements. Analysis of these elements does in fact reveal strong concentrations of these elements where they would be expected (Vol. II, Chap. 6).

Table 2. Distribution of Artifact Orientations by Strata Type

	Floor		Roof		Surface	
	No.	% of Floor	No.	% of Roof	No.	% of Surface
Horizontal						
HP 1	33	75	130	62	38	66
HP 3	24	92	27	34	—	—
HP 4	31	72	31	55	65	63
HP 7	22	96	74	74	22	81
$\Sigma/\bar{M}$	*110*	*81*	*262*	*58*	*125*	*66*
Slanted						
HP 1	10	23	72	34	18	31
HP 3	2	8	47	59	—	—
HP 4	11	26	23	41	31	30
HP 7	1	4	26	26	4	15
$\Sigma/\bar{M}$	*24*	*18*	*178*	*39*	*53*	*28*
Vertical						
HP 1	1	2	7	3	2	3
HP 3	—	0	5	6	—	—
HP 4	1	2	2	4	7	7
HP 7	—	0	—	0	1	4
$\Sigma/\bar{M}$	*2*	*1*	*14*	*3*	*10*	*5*
Total	136	100	454	100	188	100

Fauna Remains

1) Due to the rapid covering of floor deposits by collapsing roofs, and given the churned and exposed nature of roof soils, we expected that bone preservation would be best in the floors and poorest in the roof deposits, especially of small delicate elements (Schiffer 1986). Deposition of fresh faunal remains on roofs would also expose them to scavenging by dogs or other animals since dogs generally appear to have been kept outside and not inside houses (there is minimal evidence for canid gnawing or digestion of bones in floor deposits and ethnographic accounts refer to dogs outside houses—Teit 1912a:250, 256, 307; 1912b:325; 1917:46). This expectation was strongly supported by excavation data. Deposits identified in the field as living floors contained far more fish bone and unweathered bone than roof deposits: 56% fish in the floors versus 5–10% in the roofs, and 0–4% weathered bone in the floors versus 20–30% in the roofs (Vol. I, Chap. 10).

2) Bone remains, as well as lithic artifacts and botanical remains, were expected to exhibit spatial patterning in floor deposits corresponding to activity or storage areas, whereas such patterning should be largely absent in roof deposits (except a few possible activity areas on the periphery of the roof and general disposal areas on the roof for refuse). Concentrations of bone near hearths and large bone artifacts or refuse near the floor perimeter were the types of patterns expected to occur in floor deposits (Hayden and Cannon 1983; Hayden 1982). Results from botany, fauna and stone artifacts amply confirm these expectations (Vol. II, Chaps. 4, 7, 11; Spafford 1991).

3) Mesodebitage (1–10 mm) from bone and stone processing activities were also expected to be primarily associated with obvious activity areas on the floor (Schiffer 1987:267–9). The concentrations of bone and stone debitage evident in the floor deposits clearly support this expectation (Vol. II, Chap. 9).

4) Due to the thin and horizontal nature of floor deposits, all relatively large bones and flakes found in floor deposits were expected to exhibit little or no dip, that is, little deviation from a horizontal plane; whereas due to the mixing of deposits thrown onto the roof, dip angles of larger objects were expected to be much more variable (Schiffer 1986). While all observations did not conform to expectations, over 80% of the artifacts recorded from floor deposits were horizonal, whereas only 58% of the objects from the roof exhibited horizontal orientations (Table 2).

Botanical Remains

1) Aside from the patterning in floor deposits mentioned above, lower densities of botanical

remains might be expected to occur in the roof as a result of the open weathering environment and repeated churning of roof sediments during reroofing episodes. These trends were not apparent in Lepofsky's analysis (Vol. I, Chap. 9), perhaps due to continuous discard of organic remains on the roofs or to a greater resistance to weathering than anticipated.

2) Charcoal might also be more rounded in floor contexts than in roof contexts due to scuffing and treadage on the floor. This was not apparent in subsequent analyses, perhaps because so much of the material thrown out on the roof was derived from the floor deposits or due to mixing of earlier floor deposits in with roof soils during reroofing events.

Stone Materials

1) Aside from the patterning in floor deposits already mentioned above, more worn out and broken tools were expected to occur in roof deposits than in floor deposits (Schiffer 1986). The previous discussion on roof formation processes has already established that there are some differences conforming to these expectations, but that these differences are not pronounced (Vol. I, Chap. 14). This is probably because most of the materials left on the floors were objects of little value or objects ready for discard.
2) Because of the difficulty of picking up very small debitage for discard, proportionally more small debitage may occur in floor deposits unless sweeping and removal of floor sediments was common (Schiffer 1987:267–9). As mentioned in the discussion of roof formation processes, flakes under 1 cm in size were more common in floor deposits (Vol. I, Chap. 14), although mixing of floor and roof deposits during reroofing events must have also tended to homogenize such differences over time.
3) Weathering was expected to be more pronounced in roof deposits than floor deposits (Schiffer 1986). Probably due to the much greater resistance to weathering of stone materials, only slight differences in this direction were observed (Vol. I, Chap. 14).

Testing Expectations

Archaeological observations were gathered to test the above expectations. These data empirically documented the distinctive living floor origin of the deposits that excavators had subjectively identified as living floors in the field on the basis of color, texture, and compactness. These subjective field criteria sometimes varied across the floors, but locally could exhibit striking differences in color, texture, and compactness compared to roof deposits (Vol. I, Chap. 8). Other localized areas exhibited more subtle differences that made the distinction between roof and floor more a matter of intuition than observation. Nevertheless, even in situations that were difficult to interpret, the unanticipated occurrence of carbonized roofbeams or charcoal flecks at the contact between field-identified floor and roof deposits sometimes confirmed the accuracy of these identifications. On the whole, excavators felt that they could distinguish floor deposits from roof deposits in the field with relative confidence. Where there was doubt, we assumed that the 3 cm above sterile till represented floor deposits, although with hindsight it seems possible that a minimum of floor deposits were present in some localized parts of the floor and that roof deposits were almost in direct contact with the sterile till. The occurrence of carbonized roof beams and charcoal flakes at the presumed contact of floor and roof deposits over large parts of the floors greatly enhanced our confidence in field identifications of floor deposits (Fig. 5). Similarly, occasional large flat artifacts such as spall scrapers, plank segments, and bones lying horizontally on this contact also strengthened confidence in our field interpretations.

Thus, on the basis of field indications and on the basis of laboratory analyses, there was a relatively high degree of confidence that floor deposits had generally been accurately identified in the housepits that we chose for extensive excavation.

Sediment Composition

In general, floor deposits had high gravel contents and pebble contents (15–35%) with a dark gray brown color similar to the roof. Floor deposits usually ranged from 3–5 cm thick. An initial working assumption was that floor deposits would be a relatively homogeneous type of hopefully distinctive sediment. As mentioned previously, some of this sediment was assumed to have been introduced from external sources. After textural analyses and fortuitous marked variations in the till composition underlying single floors, it became evident that most of the sediment forming floor deposits was actually derived from the scuffing, loosening, and subsequent mixing of the uppermost till deposits as people carried out activities on the fresh till surfaces after the initial excavation of the housepit or after cleaning out loose sediments for reroofing. Textural analysis showed that the gravel and pebble content of the floor deposits is essentially similar to till and roof deposits with about a 10% enrichment of fine sands and silts in floor deposits for most housepits (Vol. I, Chap. 6)—a difference detected by excavators in the field. While some of the enrichment in sands and silts may have come from finer elements filtering through the roof as people or dogs walked upon it (a phenomenon I observed inside modern pithouse reconstructions), it is doubtful that many of the coarser elements would have penetrated the bark, pine needles, and poles at the base of the roof. It seems far more likely that larger materials would be derived from scuffage of the underlying till materials. This was also the subjective impression of several excavators who noted that charcoal had discolored the bottom centimeter or so of the floor deposits while artifacts predominantly occurred in the upper parts of the floor deposits. Similarly, charcoal stained earth sometimes occurred partially, but not completely, under pebbles and cobbles that were still firmly embedded in the till matrix. Furthermore, in the south central part of the floor in HP 7, the underlying till was locally composed of fine yellow loam instead of the usual gravel and pebble rich matrix. In this loamy till area, the floor deposits also had a very loamy composition and were very easy to distinguish from the overlying roof deposits which were much more gravel and pebble rich. Elsewhere in the house floor where the underlying till had a typically high percent of gravels and pebbles, the floor deposits of HP 7 contained much more gravel and pebble material, similar to the underlying till deposits. Thus, there are a number of indications that the matrix of the floor deposits was derived primarily from the underlying till, with some possible enrichment of fine fractions from material filtering in through the roof or perhaps blowing in through the entrance/smoke holes. Loose till material may have also been added to the floor from the excavation of new storage pits or other features.

On the other hand, if the fresh till forming the floor surface after each reroofing event was eventually scuffed up to a depth of about 3 cm (the median thickness of floor deposits) and removed during the next reroofing event, this would result in the removal of about 1 m over the course of a millennium. None of the large postholes, hearths, or storage pits indicate that their original depth had been truncated by anything approaching this figure. All of the bell shaped pits still retain their bell shaped profiles and all are approximately the same depth (90–110 cm). I suspect that the reason for this lies with the proposal made earlier that earth covered roofs on larger houses were a relatively recent phenomenon, and that prior to their adoption, there would have been no need to periodically shovel out collapsed roof sediments, nor for that matter loose floor deposits.

Mixing Disturbance

One of the most common questions asked about the floor deposits is how it is possible to determine whether the assemblages on the floors represent "pure" assemblages from the last occupation (i.e., from the period between the last reroofing event and the collapse of the last roof, which may represent a period of a few years to as many as 30 or more) or whether the floors contain mixed assemblages from prior occupations as well as the last occupation. Presumably, artifacts falling onto the floor from roof deposits or mixed into the floor by bioturbation, cryoturbation, or other mass-turbation processes would be responsible for such mixing. There are a number of types of data that can be used to evaluate the extent of any possible mixing. First, as discussed in the opening of this section, the distinctiveness of the deposits in terms of color, texture, compactness, the undisturbed occurrence of carbonized roof beams, and the differential occurrence of organic remains or weathering all attest to strata that have remained coherent on a large scale.

Second, indications of bioturbation can also be used. While rodent burrows were sometimes detected or suspected in the refuse rim deposits, they were comparatively rare in the actual floor deposits, perhaps in part due to the difficulty of burrowing in the consolidated till under the floors. In fact, the only indications of bioturbation that occurred in the floor deposits were the dark plugs of earth that filled cicada larvae burrows (about 1 cm in diameter) in the sterile till, and indications in microfabric sections that insects had passed through parts of the floor deposits (Vol. I, Chap. 7). The cicada burrows were rare in the gravel rich till, probably because of difficulty in burrowing in gravels, but they were relatively numerous in the looser roof deposits and where the till was composed of loams. Even here, however, the density of burrows was never so great that there was any trouble at all distinguishing the contact of the floor from the sterile till. Since the dark soil that filled the burrows left an indelible mark that lasted for thousands of years, it must be assumed that the soil record of these burrows represented virtually all the significant bioturbation that had occurred since the housepit was built. While these burrows may have affected the vertical distribution of occasional artifacts less than 1 cm in size, they cannot be expected to have affected a large proportion of the assemblages in any other size category. On the other hand, these kinds of vertical openings in the earth may have been a source of introducing very small modern seeds such as Chenopodium seeds into deep roof and floor assemblages.

A third type of data that can be used to assess mixing of assemblages is the relative degree of easily understood patterning in floor assemblages. While there is never any *a priori* guarantee that the occupants of any house left their refuse in a sensible patterned fashion when they abandoned their sites, the occurrence of clear and sensible patterning in living floor deposits cannot be accounted for on the basis of natural mixing processes. Thus, the systematic clustering of fire-cracked rock, seeds, mammal bone fragments, debitage, tools, and phosphorous levels in proximity to hearths in HP 7 (Vol. II, Chaps. 4, 6, 7, 11), the clustering of conifer needles together with large bones and stone artifacts along the walls (Vol. II, Chaps. 4, 7, 11; Spafford 1991:103–4), and the occurrence of fish bones clustered in specific areas all make a great deal of sense in terms of an unmixed, undisturbed occupation floor, and seem impossible to account for in terms of natural processes. Even more compelling is the occurrence of areas where almost nothing is found on the floor, such as the south central sector in HP 7. If mixing had been significant, these occurrences would be very difficult to account for. The occurrence of large and numerous items (at Keatley Creek, large flakes, large faunal elements, segments of articulated salmon backbones, and re-used scrapers) near structure walls has been documented for ethnographic households in the Maya Highlands as a common means of storage or provisional discard of the largest objects in the least heavily used areas (often under beds or in corners—Hayden and Cannon 1983). Catastrophically buried houses exhibiting "Pompeii"-like refuse characteristics such as those at Ozette also display the same pattern as observed at Keatley Creek (Samuels 1991:240ff).

In all the ethnographic and archaeologically "intact" cases, the patterning of artifacts on the floor is never crisp, but is relatively blurry. This can be expected wherever there were densely packed populations who constantly displaced objects and dust as they walked from one area to another within structures. In fact, the comparable degree of clarity in the artifact patterning between housepit floors at Keatley Creek and at Ozette make it possible to say that there was no significant mixing or turbation of artifacts over 1 cm in size in the floor deposits. This led Samuels (1991:262, 268) to argue that there had been no significant movement of artifacts from area to area within the Ozette houses. Thus, the occurrence of artifacts in specific floor areas was a result of their use or storage in those areas. The same conclusion seems warranted for the housepits we excavated at Keatley Creek. On the basis of a careful analysis of debitage, Prentiss (Vol. I, Chap. 13; 1993:517) arrived at a similar conclusion. Nor does sweeping appear to have been used in cleanup activities (based on the size fractions of debitage discarded on roofs) or at least sweeping does not seem to have significantly affected artifact distributions. Given the powdery, dry, silty condition of the floors, sweeping would probably have created uncomfortable dust levels in houses unless it was simply used to clean off mats used for sitting or serving food. The analysis of mesodebitage (1–10 mm) from flotation of heavy fractions would be expected to reveal effects of sweeping or other sediment displacements. However, there is no dramatic deviation from the patterns apparent in studying the spatial distribution of the larger size artifacts (Vol. II, Chap. 9).

There are two types of evidence that point to possible mixing of assemblages, either due to items falling from the roof or incomplete cleaning out of earlier floor deposits. These indicators consist of varying dates on charcoal from floor deposits, and varying styles of projectile points found on the floors. I have dealt with the problem of dates from any given occupation floor spanning several centuries in discussing roof formation processes (above) and the dating of the site (Vol. I, Chap. 2).

I am convinced that the occasional (sometimes up to 25%) occurrence of Plateau horizon points in Kamloops horizon floor deposits, shows that, as in the Great Basin, atlatl technology persisted for several centuries after the introduction of the bow and arrow. There is no reason why this could not have also occurred on the British Columbia Plateau. Stryd (1973:49) found similar mixed point styles on some of the floors at the Bell site. Since Kamloops points are clearly arrow points and Plateau points are clearly atlatl points, perhaps they should be expected to coexist for several hundred years after the introduction of the bow and arrow, with the older technology being used especially by poorer families or for specialized types of game. Such situations clearly occur on the Coast. At the Tualdad Altu site, Jim Chatters (1989:176–7) documented the division of a house into two halves with the apparently privileged half having, among other things, exclusive use of harpoon technology, while the poorer half used bows and arrows. Similarly, at the Meier site, the house excavated by Ken Ames exhibited a division into privileged and poorer halves with the new technological introductions (iron blades) associated with the privileged end of the house (Ames, personal communication).

The last occupations at Keatley Creek represent a comparable period of technological change, that is, the first century or two of the adoption of bows and arrow points. As in the Coastal examples just cited, the large house (HP 7) that we excavated is divided into privileged and poor halves. The occurrence of the more archaic atlatl (Plateau style) points in the poorer half of HP 7 is twice that of the privileged half (Spafford 1991:134). However, another complicating factor on the Plateau is the fact that older projectile points found on the ground were sometimes recycled by Plateau Indians (Teit 1900:241, 338; 1909:519, 539, 645; Smith 1899:126–7, 137), and this may also account for the occurrence of some Plateau points on Kamloops floors. If one were to postulate that these points fell through the roof, it would be necessary to envisage truly enormous quantities and sizes of materials streaming down onto the floors during occupation. There is no reason to suspect this. Nor do the relatively thin floor deposits bear any indication that prior loose floor materials were not almost all removed during reroofing episodes. The few clearly identifiable earlier occupation deposits were all quite compact.

Thus, the two types of data (dating and mixed point styles) that do not superficially conform to expectations concerning the purity of assemblages can be relatively easily accounted for. Variable dates from roof beams can be accounted for by the scavenging and recycling of structural timbers. Mixed point styles can be accounted for by scavenging and recycling of earlier points and/or by the co-existence of new bow and arrow technology with older atlatl technology for a few centuries.

On the basis of distinctive floor deposit characteristics, artifact patterning, and evidence of bioturbation, it seems abundantly clear that mixing of deposits did not significantly affect the large-scale, overall patterning of artifacts in the floor deposits, although small scale insect activity obviously has been responsible for the introduction of small broadcast seeds and some vertical introductions or displacements of small cultural materials.

Variations Across Floors

Variations across floors in the composition of the soil matrix was an unanticipated element that complicated, but also enriched, our formation process models. Socioeconomic factors may have had important roles in the creation of the variability of soils within housepit floors, and they are therefore dealt with here where appropriate.

During the first season of excavation in 1986, it became apparent that instead of a homogeneous deposit that could be referred to as "floor," there were considerable differences in the sediment characteristics of floor deposits within a single housepit. Attempting to describe and explain this variability proved to be very challenging. Given the large areas involved, it was clearly impractical to obtain detailed textural analyses across the floors. Recording Munsell colors was equally futile given variations in moisture of excavated sediments and the very coarse grained color distinctions that the Munsell color codes provide. Compaction tests were equally difficult to implement given the high gravel and pebble content. Therefore, rather than engage in expensive, time-consuming objective analyses, we gradually evolved a set of subjective observations to be recorded by excavators. Assuming that the roof deposits were much more homogeneous than the floor deposits, excavators were simply asked to record whether floor deposits seemed finer/coarser, lighter/darker, looser/more compact than the overlying roof deposits. This was admittedly a crude measure of variability in floor deposits which evolved imperfectly over a number of seasons, but it was hoped that results would reveal the most general patterns present in floor soil variability, as well as provide some indication as to whether more intensive investigation of this variability was warranted.

With only occasional exceptions, all excavators in all housepits reported that floor deposits which could be easily distinguished from roof deposits were more compact (Vol. I, Chap. 8). The domestic sleeping areas (between the walls and the main hearths in HP 7) tended to be the easiest to define and were the most obviously compact, while the central areas of the housepit where one would expect most foot traffic tended to be less distinctive in terms of compactness. Interestingly, the only very clear instances of floor deposits that were less compact than the roof occurred in very localized patches immediately adjacent to the walls.

Variation in texture (Vol. I, Chap. 8) exhibits interesting patterning. In HP 12, floor sediments that are finer than roof sediments occur in the north (around the hearth) and east near the walls. In HP 3, finer floor sediments also occur near the walls, but in the west and east sectors. In HP 7, finer floor sediments also occur primarily near the entire perimeter of the walls. Unfortunately, the central portions of both HP's 3 and 7 were excavated in the early phases of development in this recording system. As a result, much of the data from the central areas of these housepits is either missing or of such a general nature that conclusions about the patterning involved cannot be advanced with very high levels of confidence. As an independent, quantifiable means of verifying the subjective impressions, we weighed the coarse heavy fraction (larger than 1 mm) from the floor flotation samples and plotted the weights There may be a number of factors affecting these measurements including the removal of larger pebbles in some samples by excavators, some variation in the actual amounts floated (1 liter plus or minus 200 g.), and underlying variations in the gravel content of the parent till material. The precision of this type of data collection can certainly be improved in the future.

Nevertheless, in HP's 3 and 12, it is clear that the densest gravel concentrations occur in the central area of the floor. This may be due to the heavier foot traffic and scuffage in this area and the settling out of the dusty fine fractions in peripheral zones. Such processes may explain why the floor sediments of HP 3 had an anomalous higher gravel content than roof sediments

(Vol. I, Chap. 6), since the floor samples from HP 3 were largely taken from the central part of the floor where gravels tend to concentrate. Housepit 7 displays more variation, but the unusually low values of gravels and pebbles are almost all in the peripheral zone. Thus, both subjective evaluations and limited quantitative measurements indicate that finer, more compact sediments tend to concentrate in peripheral areas where low traffic and protected sleeping areas most probably occurred. Whether bedding material was placed directly on mats laying on the floor, or whether beds were usually elevated on wood benches made of logs, poles, and/or planks around the entire floor circumference as described by Lillooet elders (Kennedy and Bouchard 1977:Tape 1) cannot be determined with confidence, although plank segments have been recovered from both HP's 3 and 7 and it seems likely that they would have been used to make bedding and storage platforms. The occurrence of large flakes, large faunal elements, and articulated salmon vertebrae near walls strongly indicate that these floor areas were low intensity activity zones used for storage and/or provisional discard and little else as described in Lillooet oral accounts of eating on sleeping platforms and storage under them (Kennedy and Bouchard 1977:Tapes 1 and 2). Areas under such platforms would have been protected from foot traffic and would have tended to concentrate finer sediments which could compact more easily. This may also explain, in part, the tendency for floor deposits to be somewhat thicker near some walls, although other factors such as wall sloughing may also be involved.

In addition to these areas of finer floor texture, there was a broad area of finely textured floor in HP 7 roughly corresponding to squares A, B, E, and F, and to the central part of Spafford's Inner Zone (Vol. II, Chap. 11) where very few artifacts occur. The underlying till in this area, which also extends partially into some surrounding squares, is very fine yellow brown loam. Initially, it seemed possible that this material had been brought into the house for use as flooring, similar to ethnographic accounts of fine loam being spread on the floors of the larger houses for dancing (G. Keddie, personal communication—see Vol. II, Chap. 1). Upon investigating the depth of the loam deposit in HP 7 and the nature of its contact with the more gravelly till, it seemed more likely that the fine loam in HP 7 was a natural occurrence. Even if this loam is a natural deposit, its occurrence in an area which may have been used as a high status ritual and dancing area in HP 7 (Vol. II, Chap. 1) makes it seem likely that the occupants of HP 7 focused on this natural occurrence of loam to organize their use of space as well as the overall construction and the orientation of the pithouse. Similar loam deposits are associated with the floor of HP 1, but in this case whether these are naturally occurring or imported into the house must be determined by future excavations.

Color is much more variable from housepit to housepit. In HP 12, with two localized exceptions, the floor deposits are almost uniformly darker than roof deposits. This is probably due to the limited number of times the roof would have been replaced (Table 1) and the limited amount of refuse that would have been mixed into the roof soil in comparison to the much more intensive accumulation of charcoal and organic wastes in the thin floor sediments during the same period. In contrast, the periphery of floor in HP 3 was generally lighter than the roof deposits. Data was unfortunately lacking for the central parts of the house floor. The same is true of HP 7 (Vol. I, Chap. 8). The overall lighter color of floor deposits in these housepits may be due to the much longer period during which ash and other organics were thrown onto the roofs, the much larger volume of material discarded onto the roofs, the relatively protected nature of peripheral floor areas (under benches or mats), and possibly to a relatively shorter formation period for the floor deposits, especially in HP 3. If reroofing and floor cleaning had taken place only one or a few years prior to abandonment of the housepit, then only a limited amount of organic staining of the yellow till parent material would have taken place. Thus, the floor deposits would appear relatively light in comparison to roof deposits that had become stained over a number of centuries. Localized areas of unusually dark soil could be logically expected to occur in the immediate vicinity of hearths. This clearly seemed to be the case in HP 9 (Vol. III, Chap. 7), and may have also been the case in HP 7.

The fact that the subsquares near the fire-reddened area of HP 12 and those around most of the fire-reddened areas of HP 7 (at least where observations exist) are lighter than the roof, probably indicates that fires were very infrequent in smaller housepits and that probably only one or two hearths were used on a regular basis in the larger housepits with the rest being used on special occasions. This is another important aspect of the formation processes for floor deposits. In fact, there are numerous other indicators that hearths were not generally used (see Hayden et al. 1996 for details). These include the fact that no white ash or charcoal deposits were associated with most fire-reddened areas; there was an absence of charcoal concentrations in flotation samples taken near some hearths (Vol. II, Chap. 4), the existence of highly trampled debitage around and over fire-reddened areas (Vol. I, Chap. 13), and field observations that floor deposits overrode fire-reddened areas. The very extensive size and shape of some hearths also made it apparent that these hearths were expanded for special activities such as feasting or jerking deer meat. Moreover, smaller housepits generally had very superficially fire-reddened till deposits, and appear to have been used very infrequently. Oral accounts too, indicated that fires were used infrequently and that dried foods were eaten without cooking (Kennedy and Bouchard 1977:Tapes 1 and 2). That all the fire-reddened locations in HP 7 were active hearths, at least episodically, is clearly indicated by the concentrations of fire-cracked rock, debitage, artifacts, bone debris, and anvils that cluster around the fire-reddened areas. However, all other indicators seem to imply that these hearths were not used on a regular basis, and that when not in use, the areas occupied by hearths were simply used like any other part of the floor for foot traffic or other activities. Such episodic use of special purpose hearths is recorded by Hill-Tout (1978:58) for warmth during particularly cold periods in pithouses, and by Barrett (1975:39) for baking bread inside Pomo houses. These infrequently used hearths reverted back to normal floor use once their special functions were ended. Prentiss (1993:493) also detected considerable evidence of trampling in lithic debitage overlying firereddened areas, indicating that these zones were being used as ordinary floor surfaces.

Thus, morphological and color variations in floor deposits provisionally seem to correspond to four different types of depositional environments: 1) low traffic areas near walls or under benches where stored materials and fine fractions were enriched by air borne dust or wall tricklings; 2) activity areas near hearths where greases and charcoal were concentrated; 3) high activity or traffic areas toward house centers where coarse fractions were enriched; and 4) special ritual or other specially avoided areas. A fifth type of deposit consisting of dumped sediments can be added to this list and will be discussed in a following section.

Chemical Variations

In addition to sampling floor deposits to monitor botanical and mesodebitage variability, we also used portions of the same samples for analyzing chemical variability across the floors, reasoning that major activity areas might leave floor sediments enriched in certain elements such as phosphorous, nitrogen, calcium, and magnesium from plant or animal waste materials. While the patterning is certainly not as coherent as the clusters of debitage or fauna, it is nevertheless clearly present and corresponds to the peripheral versus central areas and to hearth locations, with the highest concentrations typically occurring between the hearths and the walls in the large houses (Vol. II, Chap. 6). Given the controversy about whether total or available phosphorous is the most meaningful to measure, we measured both values for a sample of our samples over a wide range and found the two to be almost perfectly correlated. Phosphorous and calcium are perhaps the two most likely elements that would be expected to concentrate around food preparation and/or consumption areas. The fact that they do exhibit higher values in these areas adds confidence to many interpretations advanced in the socioeconomic interpretations, such as the use of two hearths on a regular basis in HP 3 (one in the north and one in the south), and the division of the interior of HP 7 into numerous independent domestic groups. In HP's 9 and 12, phosphorous and calcium concentrate very strongly around the hearths and associated food preparation areas. The concentrations associated with single hearths and food preparation areas emphasize the communal nature of the socioeconomic organization in these housepits. Nitrogen and magnesium (not illustrated) display roughly similar patterning, although many of the peaks of these elements seem to be slightly displaced or more broadly spread out than was the case with phosphorous and calcium. It is difficult to know exactly what to attribute the concentrations of nitrogen and magnesium to.

More detailed investigation of plant, animal, and soil chemistry are required to unravel the full meaning of these distributions. However, three meanings are clear: first, the overall patterns certainly seem to confirm other indications of activity and social patterning on the floors. Second, although some bioturbation has clearly occurred in the floor deposits, it has not obliterated or even dramatically affected the basic chemical patterning in the floor deposits. Third, all the elements show an overall increase in value from the smallest housepit (HP 12) to the larger housepits. On the basis of other archaeological indicators, it was suggested that HP 12 had a shorter overall occupation and probably much reduced economic activities in comparison to larger housepits. The lower concentrations of waste-related elements not only support these interpretations, but also strongly indicate that the concentrations of these elements is due to cultural factors rather than natural variations in the till or in the soils above the buried housepit floors. That the results are not simply a function of differential soil development according to the thickness of overlying roof deposits is clearly demonstrated by the distributions in HP's 3 and 12 where the phosphorous concentrations are strongly related to the one or two hearth locations, but display no relation to the roof deposit contours. Soil pH exhibited broad variations that could not be related to other types of socioeconomic patterning.

Finally, the conditions of abandonment and accessibility after abandonment had major impacts on the nature of the artifactual content associated with living floor deposits. The situation concerning HP's 3, 7, 9, and 12 seems fairly clearcut in this respect. All artifactual indicators point to a planned abandonment with the systematic removal of everything that was of value from the housepit floor prior to burning the roof. The only whole tools left behind were large, heavy items difficult to carry (anvils, sandstone abraders, spall tools). The only objects of value left behind seem to have been lost (one small sculpture and a copper tubular bead in HP 7; a graphite crayon in HP 3), or cached and forgotten about (one pestle cached in a pit in the base of the wall in HP 7). All the storage pits had been filled in; there is no evidence of wooden tools or furniture left on the floors; the main structural elements of the roof had been removed; and there was no evidence of killing or violence. In fact, there are no human remains at all. The skull of an aged dog was left near the center of the floor in HP 7, while the headless body of a young dog was left near the center of the floor in HP 3. These appear to have been intentional acts performed at or around the time of abandonment. It is always possible that these were random acts by individuals without ritual intentions; however, the very clear contact with the floors, the short time that appears to have elapsed between abandonment and burning, the obvious important curation and burial of dog skulls in some storage pits of HP 7, and the central location of the skull in an area with little else around it all indicate a more probable intentional and meaningful deposition of these remains. Moreover, the occurrence of dog remains in similar special contexts in three separate housepits (HP's 3, 7, and 110) seems unlikely to occur by coincidence. Dog remains were also left in a similar fashion on the floor of a housepit at Monte Creek (Wilson 1992).

Everything speaks of a planned, intentional departure from the housepits, either with the intention never to return, or to return at a later date in order to rebuild the burned superstructures. Nor does it appear that these structures were open for access after abandonment. There is absolutely no indication that anything was dumped into these structures through their smoke holes. There are no identifiable dump deposits or anomalous concentrations of refuse near the centers of the floors, such as do occur in HP 58; and there is no evidence of encampments on the floors that do not conform to the overall organization of other features and artifact concentrations on the floors.

Housepit 9 is exceptional in that it was not burned down during any of its occupations and in the occurrence of numerous pieces of antler that may have had considerable value including a digging stick handle and a very long split and shaped bark peeler. Whether these items had become damaged or were considered of no further use, or whether they indicate that the house was abandoned in an unplanned fashion (e.g., due to death prior to a planned return) is difficult to tell. The main storage pit also seems to have been left partially open. It also appears that the housepit was left open to use in its partially decayed state of collapse and that a small group occupied it after partial collapse; however, no other extraneous or post-abandonment dumped refuse is evident in examining the distributions of artifacts across the floor. This is the only probable case of post-abandonment reoccupation of a partially collapsed structure that we encountered during our excavations at Keatley Creek.

In sum, floor deposits could usually be distinguished from overlying roof deposits relatively easily in the field. A broad series of analyses confirm the distinctiveness of these deposits and strongly support their identification as living floor deposits. While some small-scale mixing and turbation clearly occurred, it does not appear to have affected the basic artifactual, chemical, and pedological patterns created by the last occupants in the floor deposits. As will be seen in Volume II, the basic organization of activities on this floor seem to have remained remarkably stable throughout the last occupation and even over a much longer period of time as indicated by posthole patterns and locations of large storage pits. Similarities in the lithic assemblages of floors and rims (Vol. I, Chap. 15) also indicate that no other major economic changes occurred throughout the duration of occupation of the housepit except for the change from atlatl to bow and arrow technology. Most housepits were abandoned in a planned fashion with all objects of value and usable timber being removed. Since most structures were burned upon abandonment, they were effectively closed to post-abandonment scavenging or re-use of the living floor areas, although much later some groups camped on some of the collapsed surfaces.

Dumps and Pits

While the occurrence of large storage pits had important implications for the interpretation of socioeconomic organization within the houses, it was not until excavations were well underway that we appreciated the very important role that pits might also play in understanding floor formation processes. In almost all cases, it was abundantly clear that the large storage pits had been intentionally filled in over a very short period of time since there were no clear lenses of different types of materials and the fill of the pit interiors was unusually soft as occurs from single filling events. Bones from the same animal that occur in the top and bottom parts of the fill of a single pit (as in pit P-4 of HP 7) also indicate that pits were filled very rapidly.

At this point, it is difficult to tell whether large storage pits would have been used on a yearly basis (being emptied of earth, filled with dried food, gradually emptied, and refilled with earth every year), or whether their use might be much more occasional, only occurring in years when salmon harvests were exceptionally abundant, as might occur every four years with sockeye salmon (Kew 1992). Nor is it clear why some large storage pits occurred inside houses while others occurred outside, and still other stored foods were recorded ethnographically as being cached on elevated pole platforms. It does appear, however, that large interior storage pits were associated with richer, more powerful members of the housepits (Vol. II, Chap. 1). Nor is it clear whether all large pits were contemporaneously used, although their locations conform to a single pattern indicating that they were probably dug and used penecontemporaneously. While some of the pits were clearly capped by floor deposits, some even being covered by concentrations of fire-cracked rocks and fire-reddened earth, it is not easy to know whether the floor deposits had been laid down a month or a year or a decade or a century before abandonment of the house. Similarly, the occurrence of a Plateau point in the fill of a large storage pit in HP's 3 and 7 cannot be used to conclusively date the last use episode since Plateau points also occur relatively frequently in the floor deposits. Dating the large storage pits at Keatley Creek remains a problem but the dog remains at the bottom of one of the large storage pits of HP 7 were dated to 2,160 BP, well into the Plateau Horizon.

However, in terms of formation processes, the real problem presented by large storage pits exceeding a cubic meter in volume is what people did with the earth fill when they excavated the pits for storing food, and where the earth came from when they wanted to fill in the pits again. These are not trivial questions considering that six such pits might have all been in use at one time in large housepits based on the floorplan of HP 7. To have taken all the pit fill out and thrown it on the roof only to haul it down again to refill pits seems like an excessive amount of work if there were other easier alternatives. One possible alternative would have been to have areas within the housepits where dirt from the pits could be temporarily banked until the pit was ready to fill in again. These areas would have to be little used zones of the house, such as spaces underneath sleeping benches or sectors of the house not occupied by domestic groups. It is possible that the great thickness of earth on the floor of the northeast sector of HP 7 may represent such a pit fill storage area, however, field indications make it seem more likely that this earth was derived from a partial roof collapse during occupation. Combinations of these strategies may have also been used, such as the dumping of excavated dirt on the roof, but the filling in of pits with scrapings from the surrounding floor.

From the archaeological remains, two inferences are relatively apparent. First, it is clear that pits were filled in with dark floor-like material from inside the house, whether from stored dirt banks or scraped from the floor. Some scraping from the floor seems to have taken place given the occasional inclusion of thin lenses of sterile yellow till in the fill deposits. The most probable origin of such yellow till would be scrapings from the floors after the dark floor deposits had been removed. In addition to the overall resemblance of pit fill to floor deposits, the very high percentage of fish bone (64%) resembles the floor deposits (56%) rather than the roof deposits (10%), although some of these clearly came from the bottom of the pits where remains of stored fish were concentrated (Vol. I, Chap. 10). Mammal bone in three pits was also most similar to bone in floor deposits. It was also clear that during filling events other unwanted items were thrown into these pits, including debitage, large (and perhaps other) pieces of bone, anvil stones, and fire-cracked rock.

The second inference concerning pits is that relatively clear instances of dumped deposits occurred at the edge of some housepit walls (HP's 7, 9, 90), although the clearest instances of these dumps contain considerable charcoal or ash and almost no artifactual or faunal material. These deposits were noted during excavation, while microfabric analysis by Goldberg clearly identified dumped deposits, some with high concentrations of grass phytoliths and hearth materials, in peripheral floor areas. We treated these dump deposits as special cases of floor deposits. The conclusion that can be derived from these observations is that there were strategies for the management of excess earth inside housepit structures. Whether the amounts involved were derived only from medium or smaller sized pits and/or hearths, or whether such strategies could have accommodated soil removed from the larger pits as well, is difficult to answer. The fill from one large pit would cover a 100 square meter floor such as HP 7, with 1 cm of pit fill; conversely, it would take 1 cm of floor deposit from the entire floor area to fill in one large storage pit. The simultaneous filling in of 3–5 large storage pits in HP 7 could have removed virtually all the accumulated floor deposits.

It is possible that a large part of the soil emptied out of large pits was simply spread over the floor. If this was done frequently, it would obviously have a randomizing effect on the distributional patterns of artifacts and faunal materials in the floor deposits. There are several indications that the large storage pits were not emptied very frequently, and certainly do not seem to have had much use during the years (or centuries) preceding housepit abandonments. In the first place, patterning on all the floors is very strongly developed and clearly centers around hearths. This artifact patterning makes sense in terms of the use of space and bedding areas around those hearths (Vol. II, Chaps. 4, 7, 11) rather than in terms of pit fill spread over floors. Secondly, floor deposits, including hearth development, clearly overrode many storage pits. Thirdly, in other cases, there were indications that the storage pits had not been used for some time, such as the recovery of a Plateau point from the fill of one pit in HP's 3 and 7, and the occurrence of an interred dog and remains of 8 other dogs overlain by layers of birch bark and wood planks about half way down in the two pits in the northwest sector of HP 7 (dated to 2,160 BP). Finally, it can be noted that virtually all the large storage pits had been clearly filled in well prior to house abandonment, certainly long enough to permit the regeneration of typical thicknesses of floor deposits over the entire floor (assuming that floor scrapings were used to fill in the large pits). Thus, no impact might be expected to occur on artifact patterning on the floors from emptying pit fill and spreading it over the floor. Nevertheless, it is not clear whether all pits may have been dug and used during the Plateau (or even Shuswap) horizon and perhaps had gone out of use by Kamloops times, or whether only a few (or all) of these pits may have continued to be used sporadically throughout the entire occupation of the housepit.

Thus, there are still many intriguing questions concerning the use of these pits, the dirt management strategies for the earth used to fill in the pits, and the effects of these management strategies on living floor deposits. Answering these questions will require considerable effort, but because of the overwhelming impact pit fill can have on floor assemblages, they are important to deal with if researchers want to ask questions about socioeconomic organization within housepits. At this juncture, it is fortunate that such factors did not appear to have played a major role in the formation of floor deposits prior to the last abandonment of housepits we investigated.

One other type of deposit which merits attention, and which can be confused with dumps near the walls, are slump deposits (alluded to ethnographically by Laforet and York 1981:121). There are a number of indications that these types of deposits regularly occurred in some housepits. When houses were reroofed and cleaned out, or when they were enlarged, the floors sometimes were extended at the base of the walls so that they formed very steep wall angles (e.g., Fig. HP's 5 and 7). Where the walls were cut too steeply into loose rim refuse or other loose rim deposits, they would eventually become relatively unstable and parts of these rim deposits could be expected to slough off onto the floor. The large cobbles or boulders sometimes set into the wall deposits appear to be meant to stabilize these walls to some degree. At the Bell site, Eldridge (1971, EeRk4, HP 3 field notes) recorded a much clearer example of a stone retaining wall on the inside of a floor. The unusually clear distinction between floor and roof deposits often became blurred at the juncture of the floor and the wall. At these juncture locations in larger houses, floor sediments often became loose, more brownish, and graded into rim and roof deposits. This situation may well be due to the very protected depositional environments of these areas, but also seems to have been due to gradual or even mass sloughing off of refuse rim deposits along the wall.

In addition to these unique and specialized types of deposits, we have not investigated in detail other minor types of deposits such as post hole fills or fill units within pits, or special types of feature fill such as the broad shallow rock filled pits in HP 9 and 90 (Vol. III, Chaps. 7, 10). These were originally very puzzling features but seem to be related to occurrences of wet areas (due to seepage), the use of wet objects (such as water buckets), or the use of interior earth ovens. We did not always recognize the significance of these features in the field and missed some important opportunities for investigating these features in more detail. Some "pebble fields" also occur on the floors inside houses on the Coast at Ozette (Samuels 1991:187). Other types of pit fills related to the caching of valuables are discussed below in the context of lithic artifact formation processes.

Other Deposit Types

In the preceding pages, I have dealt with the most important types of deposits and formation processes in the housepits that were extensively excavated. In part, these housepits were specifically chosen for excavation because of the relative clarity of their deposits as determined from initial test trenches. Other housepits were rejected for excavation partially because of the complex or uninterpretable nature of the deposits revealed in test trenches (see for example HP's 2, 47, 58, 101, 104, and 109). Some of these deposits were very deep and ashy light gray with unusually dense artifact or faunal material, while some were simply very deep deposits with little cultural material. Others were confused lenses of materials or were broad thick ash deposits covering the entire floor, or were black, heavily charcoal stained deposits with little or no artifactual material or fauna. To deal with the formation processes of these more unique deposits would require many specialized studies and a great deal of effort. This is all work for future researchers. We have sought to initially establish a firm basis for understanding the most widespread and "simplest" types of deposits at the site. Once this has been successfully achieved, researchers should be in a much better position to deal with questions involving the more unusual and difficult to understand types of deposits. Certainly, simply dealing with rims, roofs, and floor deposits has been a challenging undertaking in itself, while the field identification of floor deposits has repeatedly required all the attention and observational resources that excavators could bring to the endeavor. By engaging excavators in questions of interpreting strata and modeling formation processes during the excavation, the undertaking becomes an intriguing intellectual adventure for everyone in the field.

Formation Processes of Cultural Materials

While frequent reference has been made to faunal and lithic materials in the preceding discussions, a complete understanding of the formation processes of site deposits must also include specific kinds of cultural remains together with explanations of how they came to be deposited (Prentiss 1993). In this section, I will briefly review some of the major factors which have formed the cultural assemblages present in the deposits that have been discussed.

Lithics

A wide range of lithic materials were obtained from different sources for use at Keatley Creek. For the present purposes, lithic raw materials can be grouped into 4 general classes: locally available materials, materials from Hat Creek and Pavilion Mountain quarries, trade materials, and prestige materials.

Quartzites were obtained locally for making adzes or spall scrapers used in hide working. Other local materials included anvil stones made from granite boulders, and boiling stones made from a variety of local cobbles found in the till and creek beds.

Mountain sources of vitreous trachydacite and chert were used for most other cutting and scraping tasks. These materials were obtained from the Upper Hat Creek Valley, Maiden Creek, or the headwaters of Rusty Creek (in Fountain Valley) (Vol. I, Chaps. 11, 16), probably during fall hunting and gathering trips into the mountains. Bakewell (Vol. I, Chap. 16) has shown that the large residential corporate groups at Keatley Creek used separate source areas from each other to obtain most of their raw materials. Specially shaped flake blanks, roughed out bifaces, and cores of raw material were carried back to the Keatley Creek winter village. However, due to the need to transport gear and as much food to the village for winter as possible, amounts of raw material that could be transported in the form of cores was probably very limited. Cores were stored and used at the winter village to produce expedient tools (e.g., expedient knives, general scrapers, notches, utilized flakes) for tasks as they arose. Even very small flakes were often used and retouched, while larger ones were frequently broken intentionally and recycled. These factors reflect the scarcity of raw material at the site. Because trachydacite wears down more rapidly, it was largely used for expedient tools with short expected use-lives, while the longer-lasting cherts were used preferentially for tools meant to be used for longer lasting activities, more intensive processing, or in highly mobile situations such as on hunting trips (e.g., endscrapers, drills, key-shaped scrapers). Projectile points may have been kept in storage for long periods, but their actual use-life was very short, and they were thus usually made of trachydacite. Because of the short use-lives of the expedient tools, they are by far the most numerous elements in the lithic assemblage at the winter village. Bifaces may have been developed primarily for use in highly mobile contexts, such as hunting trips, but it is clear that they were stored and used and resharpened at the winter villages as well. It is worth noting that, contrary to Binford's (1972:189; 1973:242, 249–60) expectations, there were essentially no "curated" tools at the winter villages that were not also used there. Binford argued that curated items used at specialized procurement sites should be brought back to main camps of collectors where they would be repaired and would constitute significant parts of base camp assemblages. Yet, despite the fact that although the overwhelming staple of the Classic Lillooet people was fish, there are only one or two tools out of thousands that can be related to fishing at Keatley Creek—a slightly barbed bone point and a possible net needle as well as a net needle and two ground slate knife fragments from the Bell site (Vol. III, Chap. 2; Stryd 1973:67, 372, 385). This is the more remarkable since Teit (1906:204) reports that slate fishing knives were common among all groups of the region.

In all, several different strategies are represented by the Keatley materials. The debitage left on (and discarded from) the floors of housepits predominantly reflects both the expedient production of tools and the resharpening of bifaces and making of projectile points (Vol. I, Chap. 13; Vol. II, Chap. 11).

Trade materials have not been intensively investigated due to the low frequencies of these materials and the difficulty of identifying specific sources. Nevertheless, Bakewell (cited in Mierendorf, in press) has identified the Hat Creek/Cache Creek vitreous trachydacite used in the Lillooet area as also present in archaeological sites in the North Cascades National Park in Washington State. He also feels that some examples of North Cascades Hozomeen chert are present in the Keatley Creek assemblages. In addition, optical identification of unusual green chert and white chert with rusty speckles indicates that flakes of these materials at Keatley Creek probably come from Walhachin (B.C.) and Monty Creek respectively, near Kamloops (Vol. I, Chap. 11), indicating either trade with or travel to these areas by members of the Keatley Creek community.

We suspect some other examples of rare materials may come from the west side of the Fraser River, while obsidian probably is derived from more distant sources. Obsidian from the neighboring Bell site was sourced by Arnoud Stryd indicating several unknown sources, but most samples were identified as originating from Tsitsutl Peak near Anahim Lake (Stryd 1973:46, 125). Assuming that much of the obsidian at Keatley Creek is from this same source, it is difficult to know how these trade materials fit into the overall lithic formation processes at the site. They do not appear to have been treated in any particularly distinctive fashion, and may therefore represent incidental acquisitions associated with other activities. Certainly, they indicate either exchange with, or travel to, these distant locations (or both) by individuals in the Classic Lillooet communities. Sandstone used for abrading stones may also have been obtained via trade since no known local sources for these stones has been located. As with faunal remains such as shells, the actual number of items representing regional trade is quite limited, a situation that also characterizes Coastal assemblages (Mitchell and Donald 1988:339).

Prestige materials are generally locally available (e.g., nephrite, copper, soapstone, marble, or other ground stone), but involve investments of time and energy in their procurement or manufacture that far exceed utilitarian requirements, and often no utilitarian function is apparent. These materials were used to produce high status ground stone celts, copper ornaments, stone sculptures, sculpted mauls, and delicate stone pipes. Occurrences of ochre, mica, and ground graphite can also be classified as prestige materials. Ochre occurs as a powder in the mountains to the east of the site, while no source for graphite is known. As might be expected, prestige materials were highly curated and rare to begin with. They are even more rare in the archaeological habitation deposits. Rarity of prestige items in habitation sites may be a relatively common phenomenon among transegalitarian and chiefdom societies (e.g., Cunliffe 1986:151), although there are some cases where items of lesser value that occur in moderately high frequencies can be associated with high status living areas (Chatters 1989; Ken Ames, personal communication). But fundamentally, the main depositional context for prestige items in most transegalitarian and chiefdom societies appears to be burials. This may be even more pronounced among groups with a highly mobile component in their seasonal round since possession of wealth would have also entailed requirements for the means to carry it around (wives, children, slaves, dogs) or to store it securely. People that could potentially inherit wealth would not necessarily have the means to maintain it.

Some items were certainly stored in pits in housepits while the occupants went on seasonal hunting and gathering trips into the mountains. Teit (n.d.) wrote that:

> If all the people of one house were going off on a trip, they buried some of [sic] valuable tools they did not want to take along. Especially things made of stone.

In moderate size pits at Keatley Creek, we have found a sculpted maul, a palette, antler billets, bone flakers, anvils, and a copper bead all apparently cached and never retrieved.

Fauna

There are four basic sources of faunal remains at the Keatley Creek winter village site: animals or fish brought in from expeditions to procure food; small game from the immediate site environment used for meat; prestige or display fauna; and bones introduced for use as tools.

Salmon, deer, and mountain sheep constitute the major sources of meat for the Keatley Creek community, as well as ethnographic communities in the area (Vol. I, Chap. 10; Alexander 1992). The drying of sockeye and spring salmon fillets for winter consumption separates most of the meat of the fish from the bone. If only these dried fillets were brought to the site, fish bone would be extremely rare or completely absent. However, fish bone tends to be abundant in most deposits. This means either that the backbones and fins (with their not-inconsequential amounts of meat adhering to them) were also dried and stored for winter food (as documented ethnographically, i.e., Romanoff 1992; Kennedy and Bouchard 1992), or that late species of fish such as pink salmon were being dried whole without removing the backbones or fins. Whichever was the case, it is clear that large amounts of fish bone, including some head elements, were being brought to the site as part of the winter supplies of dried fish (Vol. I, Chap. 10).

Deer meat and mountain sheep were similarly deboned and dried when obtained far from winter village sites. Deer are presently more abundant than sheep and the taste of deer meat is preferred. The same situation appears to have characterized the past environments and peoples (Alexander 1992). However, when deer were killed within a few kilometers (four miles according to Lillooet elders—Kennedy and Bouchard 1977:Tape 2) of the winter village, it appears that the entire animal or large parts of it were brought back to the site for butchering. Bones with high marrow or grease content were systematically smashed for use in soups resulting in very high proportions of the faunal assemblage made up of unidentifiable mammal bone fragments and only occasional whole or identifiable bones.

Local hare and grouse bones also occur and were undoubtedly hunted opportunistically around the site during winter occupations. However, due to the high human population at the site, and the low natural population of these species in the vicinity, it is not surprising that remains from these animals are relatively rare in the faunal assemblages at the site.

All scrap food bones were probably cleaned up and discarded on the roof and rim together with other hard refuse such as fire-cracked rock. It seems highly likely that household or vagrant dogs would have heavily scavenged the bones discarded on the roof, especially the unburned bones, thereby reducing the survivability of discarded bone and leading to under-representation of bone material from the houses. Presumably any bone consumed by dogs would be excreted at various locations away from the immediate house structure. As previously noted, there are a number of ethnographic accounts that indicate dogs were usually kept outside rather than inside houses.

There are very clear examples of bones being introduced into the faunal assemblage at Keatley Creek for prestige or display purposes. These include bones of furbearers (lynx, fox, fisher), cervids (moose antler, and probably most of the elk antler at the site), ritually important animals (grizzly bear), birds (especially wing bones of loon, hawk, eagle), and shellfish (dentalium, whelk, rock scallop, marine mussel). I would also argue that domesticated dogs (Vol. II, Chap. 10) were bred and maintained primarily as prestige or display animals much in the same fashion that slaves were used to display prestige and economic power. Many worked, decorated pieces of mammal bone were probably also introduced into the site from mountain sources, although some could have equally well been manufactured from local deer kills or obtained via exchange.

Some elements of the faunal assemblage have also clearly been introduced from afar in order to fulfill technological needs. This is particularly evident in the case of the numerous beaver teeth found at the site given the very rare occurrence of other bone elements of beavers. The worked deer scapulae and antler objects may have also been brought in from mountain kills to be used as special tools (Vol. I, Chap. 10; Vol. III, Chap. 2), especially the antler billets, digging stick handle, and bark peeler. The more common bone awls and pins may have originated in the mountains as well. Mussel shells were most likely brought to Keatley Creek from Seton Lake where Nancy Turner (personal communication) has observed them. No other sources are reported in the region. Teit (1898:56; 1912a:338; 1912b:300; also Gould 1917:108) makes numerous references to shells being used for carrying coals for making fires.

As mentioned in the discussion of lithic curation, with one or two exceptions, there are essentially no bone tools associated with fishing at either the Keatley Creek or Bell sites (see Stryd 1973:67).

Finally, there are animal remains that largely entered the archaeological deposits by accident. These include small rodents that may have died naturally or been killed by residents.

Plants

There are six major sources of plant remains at the Keatley Creek winter village: construction materials, technological materials (including firewood), dried stored foods, local fresh foods, medicinal plants, and fortuitously introduced plant materials (Vol. I, Chap. 9).

Construction materials by far account for the greatest amount of preserved plant material at the site, involving main support posts of pine, roof beams of pine and fir, conifer needles, and deciduous or conifer bark used as roof covering. In many cases roofs were burned, but some of these materials were preserved due to collapse of the earth covered roof. In other cases, the roof was left to decay and little is left except a few cases of post mould in post holes.

Plant remains from technological activities constitutes the next largest category of remains. These concentrate in the refuse rims and in the floor deposits. They consist primarily of wood used for fuel (mainly Douglas-fir, pine, and Populus), scraps of birch and pine bark (much birch bark was used as "torches"—Kennedy and Bouchard 1977:Tape 2—and some birch bark was clearly sewn and probably represents containers), remains of wooden planks used for sleeping benches or as scaffold storage areas, sedges and reeds possibly for mats, sagebrush (bark was used for clothing), conifer needles and probably grasses used for bedding around the edge of the floors. The large masses of unidentifiable organic material in the rims may contain decayed bark, reeds, and shavings, however this cannot be ascertained at present.

Remains of basketry are particularly interesting. With one protohistoric exception in HP 104, at both Keatley Creek and the Bell site (Stryd 1973), the only remains of baskets recovered were birch bark fragments rather than the coiled baskets that were well known from the region in historical times. Assuming that preservation has not biased the admittedly small sample of basket remains, it would appear that most or all of the baskets in the Classic Lillooet settlements were birch bark. In fact, even ethnographically, Teit (1900:87; 1906:205–7; 1909:477) states that coiled baskets were rare for all Interior Salish groups and absent for the Shuswap and Upper Thompson. Even on the Coast, they were adopted relatively late (Hoover 1989:9; Bernick 1987; 1989:8). Post (1938:32) observed that the Southern Okanagan preferred coiled baskets for boiling since they lasted longer than birch bark baskets. Coiled baskets were always set in pits near hearths (Post and Commons 1938:63). No pits suitable for such purposes have been observed near hearths at Keatley Creek. Thus, on the basis of basket remains, ethnography, and pits, it seems that coiled baskets were lacking in the Classic Lillooet communities, or, if present, occurred only in low numbers and may have served as labor-intensive, exotic elite prestige items obtained through exchange. The popularity of coiled baskets in historic times was most likely the result of industrial markets and the native need for relatively high value crafts that could be exchanged for industrial goods (Hoover 1989).

Remains from stored plant foods are very scarce, probably due to limited quantities of these foods stored for winter use, as well as the lack of the need to prepare dried foods in or around a fire. Most dried food, including fish may have been eaten without being cooked during the winter (see Hayden et al. 1996; Kennedy and Bouchard 1977:Tape 2). Fires in pithouses may have created severe smoke problems (e.g., Teit 1912b:363) and firewood may have become depleted within easy walking distance of the site. Even on the Coast, John Jewitt (1974:96) had to go three miles to procure firewood. Most root foods also preserve poorly unless heavily charred. The few seeds of rose hips, cherry fruits, Saskatoon berries, and other berries that were carbonized probably fell into the edge of the fires by accident. While they do support the ethnographic accounts of using these foods during the winter (Turner 1992, Alexander 1992), they do not necessarily attest to a very important role in the winter diets. This is also a conclusion that emerges from close examination of the ethnographies.

Evidence for the use of local fresh plants is limited to a few rare occurrences of cactus, pine nuts, and kinnickinick. It is likely that little fresh plant food was available at the site during winter occupations.

Archaeologically recovered items that could have been used medicinally are limited to juniper, waterleaf, and kinnickinnick (used in smoking). Residue analysis from the inside of pipe fragments has not confirmed the use of tobacco at the site. Given the rare use of these plants and the limited quantities usually involved as well as the accidental circumstances usually required for their preservation, it is not surprising that smoking plants should be very rare elements in the macro-botanical assemblage at Keatley Creek.

Fortuitously introduced plant remains (aside from uncarbonized materials) include relatively frequent occurrences of chenopodium seeds, which presumably were collected by accident together with the large amounts of grass used in bedding, and other weed seeds such as *Silene* which may have been introduced by the same mechanism. Stone-seed plant (*Lithospermum*) seeds and many cactus seeds appear to have been introduced into various deposits by rodents. The sedge, *Carex*, may have been accidentally introduced with tule leaves.

Feces

One of the most abundant types of waste that must have been produced at the site consists of human and canid feces. Given the important amount of subsistence remains that must have been contained in all the feces produced at the site, it is worthwhile addressing the question of what became of them. The only feces that we recovered were fairly clearly canid feces associated with the dog inhumations in the large storage pits of HP 7. These appear to have been preserved due to the unusually rapid burial of the dogs, which, it would appear were thrown into the pits together with their entrails.

It is probable that all defecation took place away from the pithouses as related in a number of traditional stories recorded by Teit (1909:614, 630) and Kennedy and Bouchard (1977:Tape 2). Long distances seem unlikely given the cold weather, and the fact that even to get firewood, residents of pithouses had to borrow skin clothes from several families to protect them from the cold (Romanoff 1992:224). It is far more likely that defecation took place in the immediate environs of the pithouse, possibly on the roof or rim, or not far away.

Dogs and other scavengers probably consumed most of the human feces left outside. This is a pattern which is well known to traditional peoples whether in Europe, Africa, Australia, or Mesoamerica. Dogs might then defecate relatively farther away from the pithouses.

In addition, microfabric analysis (Vol. I, Chap. 7), indicates that any feces which were left on the surface of pithouses were quickly broken down by insect and other decay processes, leaving only small fragments of dung in the housepit deposits. Any partially digested bone or plant material in feces would probably undergo complete decay in these types of environments.

Summary

The documentation and understanding of even the simplest deposits at the Keatley Creek site has been considerably more complex than initially anticipated. Nevertheless, in part due to serendipitous practices and perhaps historical events such as the widespread simultaneous abandonment of all major settlements in the Lillooet region (Hayden and Ryder 1991), the archaeological record at Keatley Creek can be understood in terms that are useful for examining the socioeconomic organization within the community. There are clearly very significant differences between housepits both in general formation processes and in artifact formation processes. There are also strong organizational socioeconomic forces at work creating artifact and soil patterning on the living floors of pithouses. These patterns have been preserved due to the conditions of abandonment and the practice of burning the roof structures at the time of abandonment.

Overall, despite some bioturbation, the sites in the Lillooet region provide relatively ideal archaeological conditions for investigating prehistoric socioeconomic organization. Households are separate and the refuse that they generated has remained almost entirely associated directly with them in their rim, roof, and floor deposits. Deep accumulations of refuse on the rims have remained largely stratified enabling archaeologists to monitor changes over time. Abandonment conditions have preserved the patterns of activities and the organization that tended to take place in the same areas. Great stability is indicated over long periods of time not only in the internal organization of space, but also in the social identity and economic rights of specific corporate groups living in specific structures. However, without a clear understanding of the formation processes responsible for each type of deposit and each type of archaeological material, it would not be possible to engage in any meaningful reconstruction or explanation of these patterns. Although the exposition of observations and analyses dealing with site formation processes is generally less spectacular or sensationalistic than the presentation of results about socioeconomic organization, site formation processes constitute the very foundation for these other interpretations without which any reconstruction would crumble. It is very satisfying therefore, after all the analyses have been completed, to find that initial field impressions have been found to be justified and that there are solid foundations to the patterning that we had provisionally related to socioeconomic factors.

In addition to the stability in socioeconomic organization in some pithouses, it would also appear that great stability characterizes the faunal and botanical subsistence patterns over time from the beginning of the Plateau Horizon (or earlier) to ethnographic times (see chapters in Hayden 1992). This stability can probably also be extended to the approximate range of land use including ownership of prime fishing locations along the Fraser River and the controlled use of hunting areas and root collecting areas in the Clear Range mountains. In order to integrate all of these aspects, we will now take a closer look at the details of socioeconomic patterning evident in the floor deposits and housepits at Keatley Creek (Vol. II). These are some of the most exciting empirical and theoretical glimpses of prehistoric organization that we had hoped to obtain at the beginning of the project, particularly since they occur at one of the critical developmental phases of cultural evolution: complex hunting and gathering societies.

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Appendix: The Kekuli House

Further excerpts from a letter from James Teit to Franz Boas at the American Museum of Natural History—1895

According to my information the circle was often measured in the following way. A long bark rope was taken and knotted at say 20, 30 or 40 ft. from one of its ends or whatever length was intended to be the diameter of the hut. Another rope was taken and knotted at exactly the same length as the first. The ends of these ropes was then taken by four men and held in the position of sketch 1 immediately over the place selected for the site of the hut. These men tried to stand as much as possible at right angles and equidistant from each other. Sometimes these two ropes were previously folded up with the two ends together, the bight [?] consequently being the centre of the rope was knotted. When stretched out were the two knots came together was the centre of the circle or if without knots in the middle of the ropes, where the two ropes crossed one another was the center and accordingly marked with a stone or a small stake. Where each of the men stood was also marked likewise as A in sketch 2 and the butt ends of the four beams were placed at those places. Between the four marks a man scratched the surface of the ground with a stick in the form of a quarter circle as B in sketch 2. If after the hole was dug it was seen that it was not perfectly circular every place in its circumference, the diggers remedied this by digging a little more out here and there as they thought it required to make the circumference as uniform as possible. I think these somewhat hasty and not very concise remarks will be made clear by the enclosed rough sketches 1 and 2. Regarding the logs they were all measured with the bark ropes knotted as the required length. The "tEku/mEtin" were thus measured and cut the length which experience had taught them would be about right for a hole of a certain diameter. Sometimes however it happened that they were cut a little too short (taking into account the required elevation) for the size of the excavation. In such cases, the roof would when finished be rather flat and low, or if the beams happened to be cut a little too long the roof consequently was toward the opposite extreme, a little too steep and high. But they generally managed to get it about what they thought was the proper elevation. All the sticks used both great and small were peeled, excepting in the case sometimes of the thin poles of dry or dead when cut were not peeled as the bark had dried on and they would not rot, and moreover was hard to peel. These long thin poles etc. were done up in bundles and carried on the backs of men and women (with the ordinary packing lines) to the site of the building. Green timber was generally used for the other logs, especially yellow pine if obtainable within convenient distance was used for the tEku/mEtEn and ska/tsamin as it was soft wood to cut. These large logs after being peeled were simply drawn over the ground to the building site by no other means than a stout bark rope and plenty of men. The tEku/mEtin all those I have seen in kekuli houses have been round, in their natural shape without being squared, but the Indians admit this was the common way but they say that sometimes also the tEku/mEtEn were squared or more frequently squared only on the outside and sides (3 sides). These timbers were cut or chopped in the usual way by means of horn of stone "wana/u" struck with hammer (tul/kist) generally of stone but sometimes of wood the peeling and squaring (if any) and all notching and sometimes the chopping of the poles was done with stone adzes having a short crooked handle. The ska/tsamin was the first stick put in, the butt end of which was sunk some 15 inches in the ground and tamped [?] with sticks and the dirt [?] so that it stood in position perfectly solid as seen in A sketch 3. The upper extremity of the ska/tsamin was notched as B sketch 3. The tEku/mEtEn was next place in position as in sketch 4 with its butt end sunk in the ground some 2 feet and a little above its centre resting in the notch B of the sketch 3. They were at their junction securely fastened with withes of willow similar to B sketch 4. The other ska/tsamin and tEku/mEtEn were then placed in their respective positions in like manner to the above description. The "tsamani" or "tsamanis" braces of the tEku/mEtEn were usually simply lashed on somewhat like sketch 5[A]. Those I have seen were thus fixed, but I have also heard they were sometimes notched probably in the manner of B sketch 5. In every case however they were securely fastened with willows at their junction with the beam and their butt ends slightly sunk in the ground. The ntlukamanktEn of horizontal poles were put on generally about 1 foot apart from one another although sometimes they were put as much as 2 feet or over apart and sometimes as close to one another as 8 or 10 inches. An idea of how they were put on will be got from sketch 6. Their ends were lashed to the beams with willows in every case. From those marked (3) in the sketch the remaining ntlukamanktEn (or those from (3) upwards) were generally (although not always) laid in exactly the same manner as in your sketch of the Shuswap one, that is, the ends were laid one on the top of the other and resting on the beams. They were also generally lashed. In at least two kekuli houses which I have seen the kitctcintEn were not hooked with one another not yet notched. The others I have seen I don't remember how were they fixed. The Indians say that some times they were notched but as a rule they were not being simply fixed as sketch 7 and very strongly lashed to one another and to the end of the beams. The sticks used for them were generally a good deal thicker than the ntlukamanktEn sticks, and were invariably peeled and sometime squared. In cases where they were fixed, and those who have seen them so fixed and not at hand tonight for me to ask. My wife says she thinks there were two or three different ways in vogue of fixing the tulctcintEn but she says after looking at sketch 7 that that was the way she had generally seen them placed. The T'skae/lx or outside poles were placed on the manner of sketch 8 the tops may be more plainly seen as in B sketch 7. The whole was thickly covered with the dry pine needles or dry grass. The T'skae/lx were not fastened in any way only simply laid on. The ladder was not slanting like Father Morice sketch but was like that in your sketch almost perpendicular and sometimes stuck out the hole some 5 or 6 feet. It rested in one corner of the entrance as sketch 9 and was sometimes lashed here with a rope or willows. In many if not most cases (but not in all cases) the lower end was slightly sunk in the ground. In the back of this log or ladder a groove was made to run its entire length for a hand hold. The groove was 2 or 3 inches in depth and about the width of an adze blade with which tool [?] is was usually made. Sometimes but rarely the groove was made in the side. You will see by the above information which I have given you as minutely as possible that the ktetcitEn took only a secondary place in holding the tekumatin in position the main stay being really [?] the skatsamin. I think you will now thoroughly understand the construction of the average NkamtcinEamux kekuli house. I know the Cawaxamux ones were the same and according to what the Indians say the other parts of the tribe, the Eastern and Southern Shushwaps and Okanagons built exactly the same way. I am not sure of the Utammke but I think theirs were almost if not exactly the same also.