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LITHIC TECHNOLOGY AND RISK: WINTER HOUSEHOLDS AT BRIDGE RIVER
VILLAGE

By

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B.A, University of Alabama at Birmingham, Birmingham, AL, 2008

Thesis

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for the degree of

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in Anthropology, Archaeology

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ABSTRACT

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Anthropology

Lithic Technology and Risk: Winter Households at Bridge River Village

Chairperson: Dr. Anna Marie Prentiss

The 2012 excavation of a single housepit (Housepit 54) at the Bridge River Village site (EeR14) offers the unique opportunity to look at lithic organization and technological strategies during the Fur Trade era in the Middle Fraser Canyon. The main goal of this research is to understand how the winter occupation of Housepit 54 may have affected the lithic technological strategies carried out at Bride River Village. As a winter pithouse, lithic raw material sources would be inaccessible during the three months of occupation. The hypothesis of this thesis is structured with a theory of risk framework in order to understand what strategies may have been implemented in order to minimize the risk of exhausting raw material over the winter. This thesis will also seek to explore the ethnographic record in relation to the archaeological record in order to extrapolate a model of lithic organization. The hypothesis proposes that certain strategies such as bipolar reduction and high production intensity would be applied in order to conserve raw material over the winter. Tools size, expedient reuse and longer use-lives are also factors anticipated from the hypothesis. These factors are highly testable variables that will provide a deeper understanding of lithic technological strategies, but also, will provide insight into the activities being carried out over the winter occupation at Bridge River Village during the Fur Trade era.

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CHAPTER 1

INTRODUCTION

Stone tools and their associated lithic debitage are often the most common artifacts recovered during archaeological excavation. The study of lithics can offer a great deal of insight into prior lifeways and cultures of prehistoric peoples, exposing subsistence patterns, tool strategies, and socioeconomical organization. Organic materials such as wood have poor preservation over time, but rocks are preserved extremely well, which makes lithics an important resource in archaeological examination. This research focuses on the lithic assemblage recovered from a semi-subterranean structure in the Bridge River Village. Located in the Middle Fraser Canyon in Southern British Columbia, Bridge River is one of several large winter village sites in the Mid Fraser occupied during approximately the same time periods ranging from approximately 1800 BP to the contact period (Hayden 1997; Prentiss et al. 2008). The Mid Fraser Canyon is a significant area of study for complex hunter-gatherers because it has a rich ethnographic record as well as well-preserved stratigraphic sequences that span at least 2000 years (Prentiss et al. 2011, 2008). The main goal of the project is to analyze the role lithic technology played in the adaptive strategies of winter pithouse occupation at Bridge River Village during the Fur Trade Era. As a winter occupation, Bridge River Village encountered harsh winter conditions that inhibited travel to raw material quarry sites. These raw materials, which would be used for tasks such as, hide scraping, woodworking and stone working, needed to be collected in the warmer months. As raw materials would have been difficult if not impossible to acquire, I hope to understand how the prehistoric peoples of the Bridge River Village employed various lithic technologies during long winters to solve the problem of limited

resource access and examine an archaeological assemblage formed from a limited resource, high-risk situation that was annually encountered, endured, and successfully managed.

RESEARCH QUESTIONS

The people of Bridge River practiced a seasonal round mobility strategy where they would occupy winter housepits during the coldest months of the year. One of the main questions I will address is how did winter occupation affect lithic strategies, since snow and ice would have limited access to lithic raw material. Stockpiling played an important role in maintaining enough raw material to last through the winter months. However, I argue that stockpiling did not provide an ever-abundant source, and instead, materials became inadequate over time. With this expectation, I hope to understand what strategies were applied to mitigate the risk of exhausting the limited raw materials over the winter months using a theory of risk framework. Every cultural system creates technology to offset risk and the possibility of loss. If technology helps to minimize risk, high cost situations should select solutions that minimize the probability of technological failure. Every act related to lithic artifacts, be it use or maintenance, results in the loss of material. Without access to raw material, the Bridge River people would have had to apply other strategies to cope with the decreasing abundance of material. I hypothesize that as a winter occupation, Housepit 54 had limited access to lithic raw material sources resulting in the application of conservation tactics such as bipolar reduction, intense retouch, and reuse of broken tools. From this hypothesis, I infer that smaller tools with longer use lives and a high level of reduction intensity would be present, along with more expedient tools with multiple uses. I hope to understand how the problem of limited resource access was solved using these various lithic strategies and what an assemblage from a high-risk situation might look like. A lack of raw material creates the risk of loss not only of food but also of not being able to complete the

various winter activities that are typically performed. The ultimate goal of this thesis is to understand the means by which the people of Bridge River achieved success and prosperity with the help of stone and understand how raw material availability determined technological strategies.

SIGNIFICANCE OF RESEARCH

This research contributes to the larger Bridge River project conducted by Dr. Anna Marie Prentiss in collaboration with the Bridge River Band in Lillooet, British Columbia. Bridge River is unique in stratigraphic preservation; the pithouses at the village were chronologically built on top of each other, preserving floors from the past *in situ*. This allows for highly accurate occupation sequencing, which in turn opens up many opportunities for research concerning environmental changes and cultural adaptations. The focus of this research is on lithic strategies, but also is concerned with native culture during the Fur Trade era. The occupation dates for Bridge River Village (which are divided into 4 periods) range from 1800 BP to the contact period. The last occupation period Bridge River 4 (BR4) extended into the Fur Trade era. The data for this project are extracted from the BR4 occupation of a singular household, Housepit 54 (HP54). Housepit 54 is estimated at having been occupied from around the 1850s or possibly earlier in the decades for approximately twenty years. This short time span is unique and allows for detailed comparison to the ethnographic record. In this project, I extrapolate a model from the ethnographic record in order to test the historic strategies discussed by Teit (1900, 1906, 1909). I also rely on previous research in the region (Hayden et al. 1996) to further understand the technological strategies in the Mid Fraser Region. This project contributes not only to the larger project at Bridge River, but also offers insight into the affects of raw material availability on lithic strategies and risk analysis.

THESIS OUTLINE

This paper is presented in seven Chapters. Following the Introduction (Chapter One), I outline my theoretical perspective in Chapter Two, which consists of the theory of risk analysis, which falls under the greater umbrella of Human Behavioral Ecology. I discuss the theory of risk in the following three sub-sections of Chapter Four: subsistence and risk, lithics and risk, and design theory. The Site Background (Chapter Three) discusses the location, environment and prehistory of the Mid Fraser Canyon and provides a cultural chronology of the region. It also reviews Bridge River Village's periods of occupation and the previous research carried out at the project site. Chapter Four focuses on the seasonal round of the Lillooet peoples and is concerned with the details of pithouse economies and strategies, specifically focusing on what activities were carried out during winter pithouse occupation. There are also sub-sections on raw material availability and lithic strategies pertinent to the project area. The main goal of Chapter Four is to incorporate the Bridge River lithic economy through a cultural context using ethnographic description and previous research in the region. Chapter Five consists of field and laboratory methodologies, and outlines my hypothesis, expectations, and the methods used to test them. The results of my analysis and the corresponding discussion of those results comprise Chapter Six. Finally, Chapter Seven presents the conclusions of my research.

CHAPTER 2

THE THEORY OF RISK

The majority of Darwinian Evolutionary research in anthropology and archaeology has focused on the ways in which artifacts or behaviors can increase fitness in a certain context and then evaluates the effects of changes on those conditions (Bamforth and Bleed 1997). For this research, I examine what coping strategies were applied in the manufacture of stone tools to help minimize risk. In order to understand risk it is important to define it. In common everyday usage, “risk” often refers to perilous or unpredictable situations; however, once the idea was co-opted into anthropology and archaeology the concept of risk was applied to fit different perspectives and interests (Bamforth and Bleed 1997). At times the concept of risk would be used synonymously with predictability or reliability (Bamforth and Bleed 1997), but risk has widely been defined as the probability of failure or loss (Keene 1981). Oftentimes, hunter-gatherer studies approach risk from a human behavioral ecology (HBE) or optimal foraging perspective, which focuses on the possible failure of the individual (Ames 2006). One of the main tenants of HBE is that if behavior exhibits an adaptive design, we can begin to produce hypotheses about the past and form expectations. HBE is often thought of in relation to subsistence; however, the ideas and theories behind it can be applied to a vast array of archaeological problems. When relating it to intensification, one will often look at diet breadth and prey choice within optimal foraging theory (OFT). The diet breadth model predicts that the top-choice prey will be chosen over a less profitable prey choice (Bird and O’Connell 2006; Broughton 1994; Broughton et al 2010; Janetski 1997; Winterhalder and Smith 2000). The assumption here is that foragers have a goal behind their actions, which is to choose the best option with the most net yield in a given environment. This model can also be applied to field

processing, such as whether or not resources (raw material, harvested game or foodstuffs) will be processed in the field for more efficient transport (Winterhalder and Smith 2000). If resources are not encountered randomly but in “patches,” the choice then becomes whether or not to enter a patch and how long to stay (Bird and O’Connell 2006). If the high-ranked resource declines or becomes less accessible, lower ranked items will be included in diet, so inclusion of lower-ranked resources is reliant not on their own abundance but instead on the lack high-ranked prey (Byers and Broughton 2004; Broughton 1994; Janetski 1997; Munro 2009).

These concepts can be applied to lithic raw material transport and tool kit strategies that were employed in the Mid-Fraser Canyon. A great deal of the literature dealing with risk relies and builds on HBE and the Optimal Foraging Theory. The same assumption that people will make the most logical choices when faced with a problem is found in risk sensitive models. Most anthropological discussions of risk have focused on social as opposed to technological responses to risk, i.e. sharing and exchange versus storage (Bamforth and Bleed 1997). For my research, I am focusing on the technological responses to risk. I am interested in the effects of winter conditions limiting access to raw materials and how the Bridge River people coped with these conditions through specific technological considerations. I define risk as unpredictable variation in the outcome of a behavior with fitness or utility consequences (Elston and Brantingham 2010; Winterhalder et al. 1999). This definition does not limit me to the issue of subsistence and allows me to further explore the issue of risk when applied to lithic technological strategies.

RISK AND SUBSISTENCE STUDIES

The majority of discussions concerning risk in archaeology have focused on subsistence (the risk of failing to acquire food). Neo Darwinism predicts that organisms adapt to avoid

dietary shortfalls by minimizing risk as much as possible (Winterhalder et al. 1999). Wiessner (1982) states the first component of risk, i.e. the probability to acquire dietary requirements, is faced every time a resource is encountered (Torrence 2001). Early attention to the problem of risk addressed predictability of resource distribution, so studies of dietary risk often examine the fluctuation of food resources and consider the way foraging decisions vary in response to these fluctuations (Bamforth and Bleed 1997). Like most optimal foraging models, analysis of “risk-sensitive models” assumes that organisms make decisions in logical and rational ways.

Bamforth and Bleed (1997) state that an analysis of risk-sensitive foraging suggests:

An organism should act in ways that reduce the variance in foraging yields when resources are abundant relative to that organism's needs (that is, they should be "risk-averse") and should act in ways that increase variance when resources are scarce (that is, they should be "risk-prone"). (113)

Most of these studies address the means by which people mitigate the possibility of shortfalls in their food supply emphasize social relationships, such as sharing resources or exchange (Burch & Correll 1972, Gould 1991, Lee 1976, Smith & Boyd 1990). Some other means of minimizing the risk of loss are sharing and passing on knowledge of resource distributions, mobility, storage, and relying on predictable plant foods. While my research is informed by risk sensitive foraging studies, my main focus is not on subsistence but on lithic strategies in response to limited material availability.

RISK AND LITHIC STRATEGIES

The study of risk minimizing strategies in lithic technology really began with Torrence’s (1989) discussion of risk as a determining factor for patterns in tool production. Torrence (1989) notes that human beings use technology to manipulate their environment to satisfy needs, and it is always possible for something to go wrong. Technological strategies should be linked to risk

by their ability to reduce failure in the face of high failure costs (Bamforth and Bleed 1997). These consequences can be analyzed by modeling the probability of outcomes for each behavior and their value as utility (Elston and Brantingham 2010). Bamforth and Bleed (1997) built on Torrence's work and through time more empirical methods of testing the effects of risk have developed (Bleed 2002; Elston and Brantingham 2010; Winterhalder et al. 1999). Most of the literature on lithic technology assumes the central problem that lithic technologies are trying to solve is ensuring tools are available and useful when people need them and that they vary under different conditions in which people live (Bamforth and Bleed 1997). Maintaining access to raw materials is paramount in any lithic strategy for the manufacture or replacement of tools. Without them activities requiring tools will fail. As discussed in the previous chapter, during the winter some hunting does occur as well as hide scraping and production of tools for the spring. The risk of food shortage during the winter is minimized by storage of dried salmon and meats; however, a long winter can stress those resources. Winter hunting then becomes an important aspect of acquiring resources; having a lack of raw material creates the risk of loss not only of food but also of not being able to complete the various winter activities that are typically performed (e.g. hide work, clothes production, etc). So what technological strategies are applied to help mitigate the problem of resource availability?

Nelson (1991:61) states, "Rather than assuming that people achieve optimal solutions, I prefer to view optimizing as an important aspect of adaptation." By taking this view, one can model constraints and propose optimal technological solutions (Nelson 1991). The ultimate goal is to understand the means by which the people of Bridge River achieved success and prosperity with the help of stone. Lithic technological strategy is just one means of minimizing risk, and I hope to understand how raw material availability determined technological strategies such as

use-life and increased retouch. Many have approached answering these questions from an artifact design perspective (Bamforth and Bleed 1997; Elston and Brantingham 2010; Torrence 1989; 2001).

DESIGN THEORY

Another theoretical perspective that has emphasizes how constraints (material availability, time, transport, etc) affect tool formation processes is design theory. While design theory does not explicitly assess the affects of risk, it is closely related. The main goal of design theory is to understand how and why tools are produced to solve problems (Hayden et al. 1996; Horsfall 1987). In the past, the variables that have been measured to understand the selection of tool design and organization in the face of risk/constraints were reliability, maintainability, versatility, flexibility, and curation.

Reliability and maintainability are typically viewed as the most important factors for understanding variability in lithic technology when applying design theory (Torrence 2001). Hayden et al.'s (1996) research states that reliability is the most central concept to their analysis since it relates to high-risk conditions and has material design implications. Bleed (1986) laid out several characterizations of reliable and maintainable tool systems:

Table 2.1. Characteristics of Reliable and Maintainable Systems from Bleed 1986.

Reliable Systems:

1. Overdesigned components (parts made stronger than they minimally need to be)
2. Understressed (system used at less than full capacity)
3. Parallel subsystems and components (redundant and standby)
4. Carefully fitted parts and generally good craftsmanship
5. Generalized repair kit including basic raw materials (to affect any repair)
6. Maintained and used at different times
7. Maintained and made by specialist

Maintainable Systems:

1. Generally light and portable
 2. Subsystems arranged in series (each part has one unique function)
 3. Specialized repair kit that includes ready-to-use extra components
 4. Modular design
 5. Design for partial function
 6. Repair and maintenance occur during use
 7. User maintained
 8. Overall easily repaired-"serviceable"
-

Reliable technology is made to always work when it is needed (Nelson 1991; Torrence 2001).

Another feature of reliable tools is that they are generally complex and diverse; as a result, reliability is costly due to the time and skill needed to produce reliable tools (Torrence 2001).

Bleed (1986) argues that reliable tools do not necessarily mean specialization; however, Hayden et al. (1996) comment that the careful craftsmanship and skill found with reliable tools should require a specialized tool kit. Torrence (2001:83) states: "To cope with the demands of manufacturing a reliable tool-kit, specialist technicians...may also be necessary." Since reliable tools are strong and well constructed, it seems plausible that it would be a desired characteristic when raw material amounts are low.

Maintainability is a response to the need for continuous or unpredictable use (Torrence 2001). Unlike reliability, manufacture and repair are continuous. Tools or parts are replaced before they have the chance to wear, but creating maintainable tools would be less conservative with material than creating reliable tools. Nelson (1991) divided maintainability into two categories: versatility and flexibility. Flexible designs are those that change form for different functions by reworking or recycling (Torrence 2001). Versatility does not require change in form to carry out multiple tasks, i.e. multi-purpose tools (Hayden et al 1996; Torrence 2001). The term versatility was first proposed by Shott (1986) in which he defined the concept by the

number of Employable Units (used or retouched edge) on a tool. Hayden et al (1996) argued that versatility and flexibility are poor descriptors; therefore, for their design considerations, they used the “more established and descriptive term: ‘multifunctionality’” (13). The fact that these terms are somewhat interchangeable shows some weakness in the concepts and their material design implications. This is further demonstrated by the last factor in design considerations: curation.

Curation is a term that has received a great deal of contention in recent years. This is partly due to its origins and vague definition. Binford first introduced the term in 1973 as a response to critics of the “functional argument” (Shott 1996). Binford originally referred to curation as the transport of tools between sites, but since then it has taken on numerous meanings. Curation is generally understood as “a strategy of caring for tools and toolkits that can include advanced manufacture, transport, reshaping, and caching or storage” (Nelson 1991:62). However, it is also used interchangeably with use-life, manufacture in anticipation of use, recycling, and efficiency (Shott 1996). With all of these possible meanings of “curation” a problem arises in its ambiguity. “Curation” can fit into most tool kit strategies. Nelson (1991) even argues that curation solves the problem of acquiring mobile resources and time stresses, such as resources available for only short periods of time. This would be a fitting concept for my research; however, the vagueness of the definition does not allow for a direct measure of tool “curation.” Some have proposed abandoning the term in lieu of the other factors outlined previously (maintainability, reliability, etc) (Hayden et al 1996). Unfortunately, all of these variables suffer from vagueness with few ways to directly measure their presence or absence. Hayden et al (1996) admit that some of the concepts outlined in design theory, such as maintainability, are difficult to deal with because most chipped stone involve some maintenance

and replacement. They argue that maintainability has been used as a catch-all (Hayden et al. 1996). While these terms have limitations it cannot be denied that some of the ideas behind the concepts are important, such as multiple function tools characterizing tools in which material access is a constraint (Hayden et al. 1996). Because of the issues inherent in these terms (reliability, maintainability, curation etc.), I am abandoning them. However, I hope to maintain some the concepts using more measurable factors interpolated from the ethnographic record and literature on the effects of limited material access.

CHAPTER 3

REGIONAL AND SITE BACKGROUND

There are a number of geographical regions within the Canadian Plateau. For this research, I focus on the Middle Fraser Canyon in Southern British Columbia. It contains the Bridge River site as well as a number of other large winter village sites including Keatley Creek, Bell, Seton Lake, McKay Creek, and Kelly Lake (See Fig. 3.1). The Mid Fraser Region follows the Fraser River Canyon and stretches roughly from Cache Creek to the township of Lytton at the mouth of the South Thompson River. The Mid Fraser climate is semi-arid area (Prentiss and Kuijt 2012). The arid nature of the region is due to the “rain-shadow” created by the mountainous coastal range. The “rain-shadow” occurs when moist weather conditions produced in the Pacific Ocean are slowed by the coastal range, which pushes the moisture up, cools it, and releases it as rain or snow. This phenomena results in dry warm summers and bitterly cold winters. The extreme temperatures in the region can reach lows of -52°C in winter and summer highs of 42°C (Goodale et al. 2008; Hayden 1997). Average temperatures at Bridge River are around -6°C in the winter and 32°C during summers (Goodale et al. 2008; Hayden 1997).

The region is mountainous with deep and narrow valleys. There is a great natural diversity ranging from boreal subarctic zones of central British Columbia to basin and range province in the south. The area also supports the Interior Douglas Fir Bioclimatic Zone that is dominated by the presence of Douglas Fir, sagebrush, and various bunch grasses (Prentiss and Kuijt 2012). The people of the region mainly rely on anadromous salmon, deer, and root crops as subsistence items (Walker 1998).

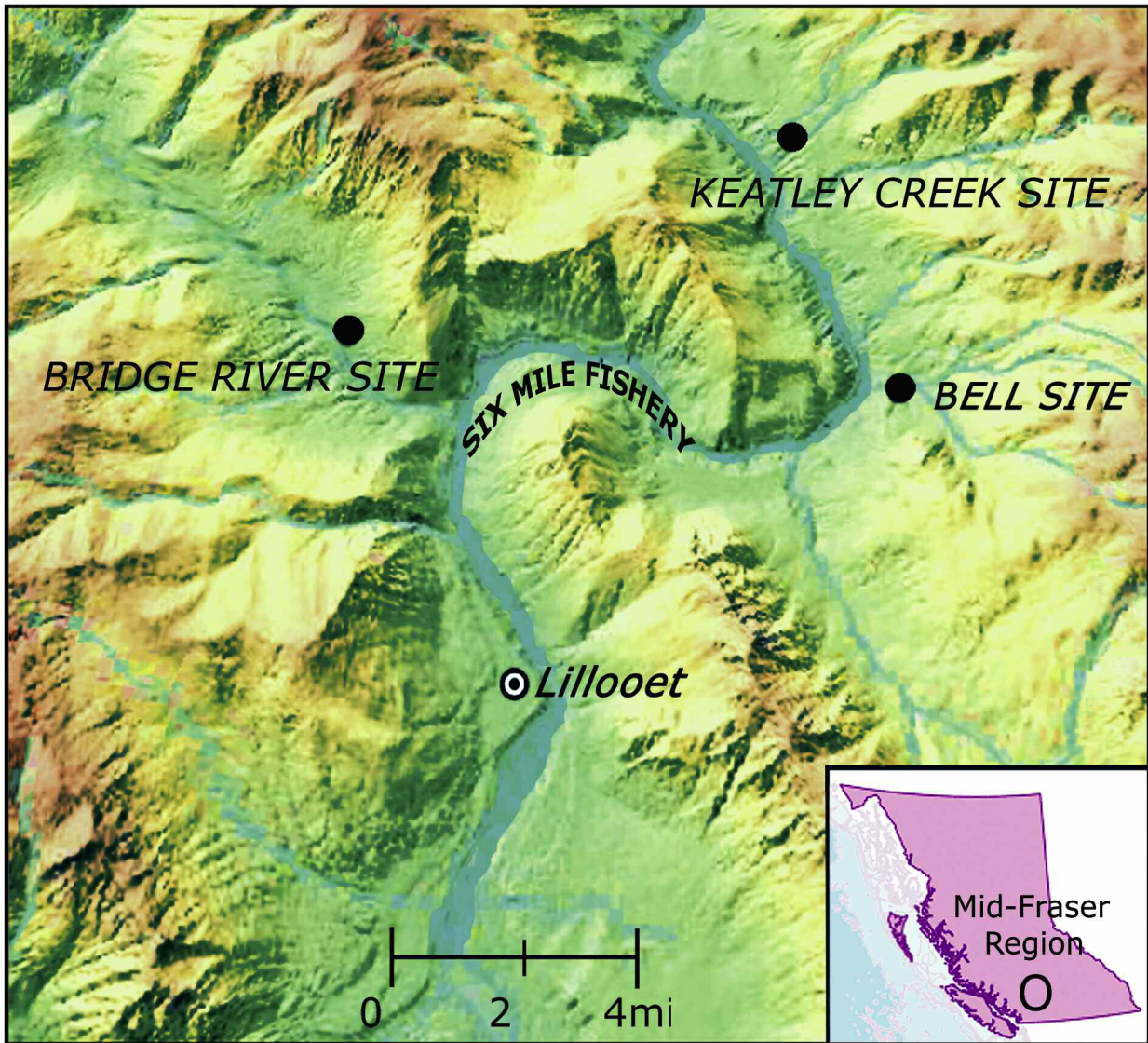


Figure 3.1. Middle Fraser Region with Bridge River, Keatley Creek, and Bell Site shown. (Made by Wanzenried 2010)

Linguistically, the most common language spoken in the region is Interior Salish; however, the culture area also contains Sahaptian, Kutenai, Chinook, and Athapaskan speaking peoples. Ethnographically identified and also contemporary groups include the Upper or Fraser River Lillooet (*Stl'atl'imx*) and the Shuswap (*Secwepemc*). The Thompson or *Nlakapamux* also used the Middle Fraser area.

CULTURAL CHRONOLOGY

This section focuses on the cultural context of the southern British Columbia Plateau. I will rely heavily on the culture history outlined by Styrd and Rousseau (1996) as well as Richards and Rousseau (1987), Rousseau (2004), and Prentiss and Kuijt (2012). I will also rely on ethnographic data that will focus on the seasonal round and winter pithouse economies. In 1996, Styrd and Rousseau established three time periods for the region: Early (11,000-7,500 B.P.), Middle (7,500-3,500 B.P.) and Late (3,500-200 B.P.). Within the late period is Richard and Rousseau's (1987) Plateau Pithouse tradition. This is the phase I am most concerned with as it represents the first major introduction of semi-subterranean pithouses that eventually evolved into the large pithouse communities. Late in this period (1200 -1250 B.P) socioeconomic inequality emerges (Prentiss et al. 2007, 2008, 2011). However, others argue that inequality emerged earlier at 2600 B.P. (Hayden 1997, 2000; Hayden and Ryder 1991). Though the timelines may vary, the emergence of trade, salmon intensification, differential access to food, and ownership of resources begins during the Plateau Pithouse Tradition (PPT). The PPT is divided into three horizons (Shuswap, Plateau, and Kamloops), which I will discuss further below.

Shuswap Horizon (3,500 BP-2,400 BP)

The Shuswap Horizon is the earliest period of the Plateau Pithouse Tradition and represents the first major appearance of pithouse communities in the Mid-Fraser Region (Prentiss et al. 2009). There is an emergence of the collector-based strategy with more food storage and regular winter residency. During this period, pithouses were smaller with an average size of 10.7 m in diameter (Richards and Rousseau 1987). The houses had side entrances with usually a

single central hearth that indicates residents lived in single egalitarian units (Prentiss et al. 2005). Houses also tended not to have middens or rim areas, but there were internal storage areas as well as cooking pits. During the Shuswap period groups exploited a variety of subsistence items including: deer, elk, black bear, sheep, muskrat, beaver, snowshoe hare, red fox birds, fresh water mussels, trout and salmon, and trumpeter swans (Richards and Rousseau 1987).

These cultural changes coincided with cool and wet Neoglacial conditions that increased the abundance of salmon and expanded forest growth (Chatters 1998). The expansion of forest landscapes maximized biological carrying capacity while limiting grasslands. Rousseau (2004) observed the Shuswap period as a time of abundance that allowed small catchment area for collecting and foraging. There is evidence that salmon became a more important resource during this time period. However, salmon did not become the main dietary resource until the Plateau Horizon.

The lithic assemblage associated with the Shuswap Horizon was less complex in workmanship, composition, and technological sophistication as compared to the later horizons of the Plateau Pithouse tradition (Richards and Rousseau 1987). The raw material was also of a lesser quality. Nearly all of the lithic organization during the Shuswap period was based around production of flaked stone tools from small to medium cores (Prentiss et al 2005). Hayden et al. (1996) argue that at Keatley Creek small cores were shaped at quarries and transported to the villages in the autumn months. Once the village was occupied in the winter, these cores were used to create expedient and long-term use tools. When the core materials started to run short, a bipolar core strategy was implemented in order to maximize the utility of the already exhausted cores (Hayden et al 1996; Prentiss et al 2000, 2005). Projectile points at this time had a wide range of morphology, but they were generally stemmed points with contracting or expanding

stems. Some note their similarity to Oxbow and McKean-Hanna-Duncan complex atlatl dart points, suggesting contact with Plains groups (Richards and Rousseau 1987; Rousseau 2004). There is an increase in bone and antler technologies, evident in recovered leister tips, harpoons, bone awls, and needles. Other lithic tools associated with this horizon include: key-shaped unifaces and bifaces, unformed unifacial and bifacial tools, microblades, and cores. Lithic technology requiring more hours to produce, such as groundstone, formal scrapers, and artwork, was rare during the Shuswap horizon which demonstrates a more expedient organization. The stone artifacts were predominantly made from local materials such as basalt (dacite), chert, quartzite, jaspers, and chalcedonys (Clarke 2006; Richards and Rousseau 1987).

Finally, during the Shuswap Horizon evidence of trade emerged. The appearance of dentalium shells from the coast and Shuswap projectile points resembling those of the Locarno Beach Phase indicate that contact likely existed between the two regions.

Plateau Horizon (2,400-1,200 BP)

During the Plateau Horizon there is a climatic shift from cool, moist conditions to warmer and drier conditions that are still present today. Pithouses during this period tended to be smaller than those in the previous Shuswap Horizon. While the pithouses themselves may have been smaller, later in this time period, the “Big Pithouse Village” pattern emerges (Lenert 2001). There is an emergence of large winter villages, some with over 100 pithouses, that exhibited a high degree of labor organization and status differentiation (Prentiss et al. 2005). During this phase the intensification of salmon fishing also occurred. Individuals were relying heavily on salmon and supplemented their diets with roots and big and small game. Stable carbon isotope analysis of human bone from this time suggests 60% of all dietary protein had marine origins

(Pokotylo and Froese 1983; and Richards and Rousseau 1987).

Status inequality begins after 1300 BP (Prentiss et al. 2005, 2007). Ownership of hunting and quarry territories emerge and multi-family corporate groups appear (Hayden 1997). There is also evidence that the Plateau Interaction Sphere (PIS) occurs during this Horizon (Hayden and Schulting 1997). The PIS is a trans-Rocky Mountain exchange network involving the Plateau, the Northern Plains, the Eastern Kootenay, and Rocky Mountain Regions. It is represented archaeologically by the presence of nephrite, argillite, top of the world chert, Dentalium and Olivella shells (Prentiss et al. 2009). These artifacts represent prestige goods and demonstrate elites beginning to establish wealth as well as the need to maintain access to important high-quality materials.

The winter village core-flake organization, similar to that found during the Shuswap period, was still present, but groundstone frequency declined and more fine-grained materials from a wider geographic range were used for tool manufacture (Prentiss et al 2005). Though the ground stone technology declined in the period, the slate industry found in Bridge River begins at this time. The lithic technology of this horizon shares similarities with the Northern Plains and Northwest Coast. The bow and arrow technology began around 1,800 BP in the Mid Fraser Region, and the projectile points began to be more sophisticated with corner notched bases and “well-controlled pressure flaking” (Richards and Rousseau 1987). Larger points were used throughout the period and it was only after 1800 BP that smaller arrow points were utilized (Richards and Rousseau 1987). As chipped unifacial and bifacial tools became more common during this time, the use of key-shaped scrapers also increased (Rousseau 2004). There is also evidence for the presence of more antler and bone tools than in previous periods.

The population of the Mid Fraser region reaches its peak during the Plateau Horizon by

1200 BP. Bridge River (BR) is occupied during the latter half of the phase from 1800 BP-1100 BP (BR2 and BR3 periods). The population increase stresses local resource leading to the intensification of fish and roots. This stress on resources is one possible cause for the abandonment that occurs during the Kamloops Horizon.

Kamloops Horizon (1,200-200 BP)

The Kamloops Horizon is the last prehistoric period in the Mid-Fraser Region. The subsistence and settlement strategy remained unchanged from previous horizons with the winter pithouse village occupation and heavy reliance on salmon, and most pithouses had an average diameter of 8.66 m, but they could range from 5 to 22 meters in size.

The lithic strategies of this time maintained the traditional winter village technology and reduction strategies such as bipolar cores. Kamloops side-notched projectile points, which are small and triangular with narrow side-notches with straight, convex, or concave basal margins, emerge and are the most prevalent during this period (Rousseau 2004). Later in the horizon multi-notch points are found, but they are very rare. Bifacial reduction is abundant and there is an increased focus on ground stone tools as well as some anthropomorphic forms (Richards and Rousseau 1987). Individuals were heavily reliant on bow and arrow technology and fine pressure flaking is evident on small, precise projectile points (Richards and Rousseau 1987). There is also more high-grade raw material and nonlocal materials. The slate industry reaches its height during this horizon. The emphasis on ground stone and high quality materials such as nephrite during this period indicates some craft specialization as well as trade. Some of the non-lithic artifacts found during this time are birch bark baskets and woven blankets. There is also an increase in bone and antler artifacts that were often highly decorated with geometric shapes.

There is also a decrease in the frequency of food resources and a notable decline in population density (Rousseau 2004). The Mid Fraser population collapsed some time between 800 BP and 1000 BP. There is a great deal of debate behind the cause for the population decline and eventual abandonment of many of the pithouse villages in the region. Rousseau (2004) presents three hypotheses: over exploitation of resources during Plateau horizon, long-term changes in salmon ecology and habitat, and epidemic disease. Hayden and Ryder (1991) argue that the Texas Creek landslide dammed the Fraser River and hindered salmon runs between 1200 B.P. and 1000 B.P., causing the abandonment of the Mid-Fraser Region. Kuijt (2001) argues that the landslide event predates 4200 B.P., so it could not have effected the populations of Lillooet. Prentiss et al. (2007) argue that climate change and a reduction of salmon access resulted in expanded terrestrial resource use, which in turn, depressed local resources. Few subsistence options exist in the vicinity of the Bridge River site other than salmon, meaning a reduction in salmon access would greatly affect subsistence at the village (Cail 2011). The Kamloops Horizon ends with the arrival of Euro-Americans in the region around 200 BP.

Fur Trade Era (1808 to Present)

The history of Europeans in British Columbia (BC) has its roots in the fur trade. James Cook (among others) participated in an exploratory voyage to BC in 1778. When the journals he kept on his journeys were published in 1784, the news of the abundance of the desirable sea otter pelts spread. Thereafter, traders began to rapidly move in to the region. Alexander Mackenzie was the first European to pass through the Mid Fraser region in 1793 where he met the Shuswap people (Carlson 2000). Other explorers of the interior included Simon Fraser and David Thompson. Fraser passed through the Lillooet area in 1808. Fraser noted in his journal entries

that European trade goods had made it into the Mid-Fraser before Mackenzie's and Fraser's journeys. He traveled south along the Fraser River, and passed the confluence of the Thompson River, which he named after fellow explorer David Thompson. Thompson worked for the North West Company and built a house east of the Shuswap region where he traded with native people from 1807 to 1811. In 1821, the Hudson Bay's Company took over the North West Company and established a permanent trading post the northeast confluence of the North and South Thompson Rivers (Carlson 2000). This represented the first permanent trading post in the region.

In the late 19th century Franz Boas and others working for his Jesup Expedition came to the Mid-Fraser to document indigenous cultures; however, the trade network had already significantly changed cultural practices. It is important to note that the indigenous populations were not passive victims to the Europeans, but active participants in exchanging trade goods and changing economic conditions (Lutz 1992). That is not to say there were not adverse affects to European contact. The indigenous population was severely impacted by new diseases that were introduced such as small pox, tuberculosis, and venereal disease. The Caribou Gold Rush of 1858, which occurred in the Lillooet area, further stressed indigenous and European relationships as more outsiders began to come in and settle. A military fort was constructed as a result of the gold rush to "assert control over the region" (Carlson 2010:40), and in 1863, a small pox epidemic in Lillooet killed approximately 170 people depleting the local population (Kennedy and Bouchard 1978).

In the early 20th century, James Teit recorded some of the best ethnographic work in the Mid-Fraser region. Teit lived in the area for many years and spoke the dialects fluently; as a result, many regard him as the prominent ethnographer of the Lillooet, Shuswap, and Thompson

(Prentiss et al 2008; Rohner 1966; Wickwire 1993, 1998). Other researchers in the Mid-Fraser were G.M. Dawson (1891), and Charles Hill-Tout (1907). Teit's ethnographies are viewed as a little more well-rounded since he included information about most aspects of indigenous life including some women's activities. Other researchers often focused on one or two smaller subjects such as oral traditions, burial, or geology in the region (Wanzenried 2010). Although, ethnographic descriptions in general have their limitations. Early accounts often idealized descriptions and ignored aspects of daily life (Alexander 2000). Even the "well-rounded" ethnographies of Teit (1900, 1906, 1909), were edited by Franz Boas indicating that a certain picture of indigenous life was being painted. Regardless, these ethnographers were able to document a pivotal time in Mid-Fraser region that has given greater insight into community organization, subsistence, trade, and pithouse construction.

BRIDGE RIVER VILLAGE

The indigenous people of the Bridge River area are the St'át'imc (Upper Lillooet Indians) and are considered part of the Interior Salish (Kennedy and Bouchard 1990). The Canadian government defines the Upper Lillooet as six bands: Shalalth, Pavilion, Fountain, Bridge River, Lillooet Seton Lake, and Cayoosh Creek (Prentiss and Kuijt 2012). The Bridge River Band is the group currently residing in the project area.

Bridge River is located approximately 5km upstream from the confluence of the Fraser and Bridge Rivers and consists of approximately 80 large housepit depressions. Initial archaeological investigations at Bridge River started in 1974 with Arnold Stryd. Stryd contended that Bridge River was occupied at the same time as the nearby Keatley Creek site. Bridge River was then seen as a means to independently test the conclusions drawn from the

Keatley Creek site about occupation dates and cultural lifeways in the region. In 2003 and 2004, the University of Montana under the direction of Dr. Anna Marie Prentiss began a long-term research project in collaboration with the Bridge River Band. The primary goal of the 2003 and 2004 field seasons was to determine changes in village size by dating housepit floors leading to the extensive investigation/dating of as many housepits and features as possible. After taking a total of 90 radiocarbon samples from 2003 and 2004 (currently approximately 105 total samples) from housepit and hearth features, the following periods of occupation were established: Bridge River (BR) 1 started at approximately 1800 BP and had steady growth until 1600 BP. BR2 began in 1600 BP and continued until 1300 BP. Around 1250 BP to 1200 BP, during BR3, the village reached its peak size and was subsequently abandoned around 1000 BP. The population size may have as much as tripled during BR3 (Prentiss et al. 2012). Reoccupation during BR4 began around about 400 BP, but overall a dozen houses have been dated into the final pre-colonial and early colonial periods from 500 to 200 years ago (Prentiss and Kuijt 2012). These dates showed that Bridge River was occupied approximately 200 years prior to Keatley Creek and abandoned 300 years earlier (Prentiss et al. 2003, 2008).

The village is thought to have had seven occupied pithouses during BR1, and radiocarbon dates show seventeen pithouses during BR2 (See Fig. 2.2). BR3 was the most populated period at Bridge River with twenty-nine occupied houses (Prentiss et al. 2008). During the final occupation (BR4), when Bridge River was reoccupied after abandonment, approximately fourteen occupied housepits were found. Dating the houses allowed for a better understanding of pithouse arrangements throughout the different occupation periods (See Fig. 3.2), which can provide insight into changing social conditions and practices (Prentiss and Kuijt 2012). During

the early occupation of the site, there appears to be little or no obvious organized settlement pattern.

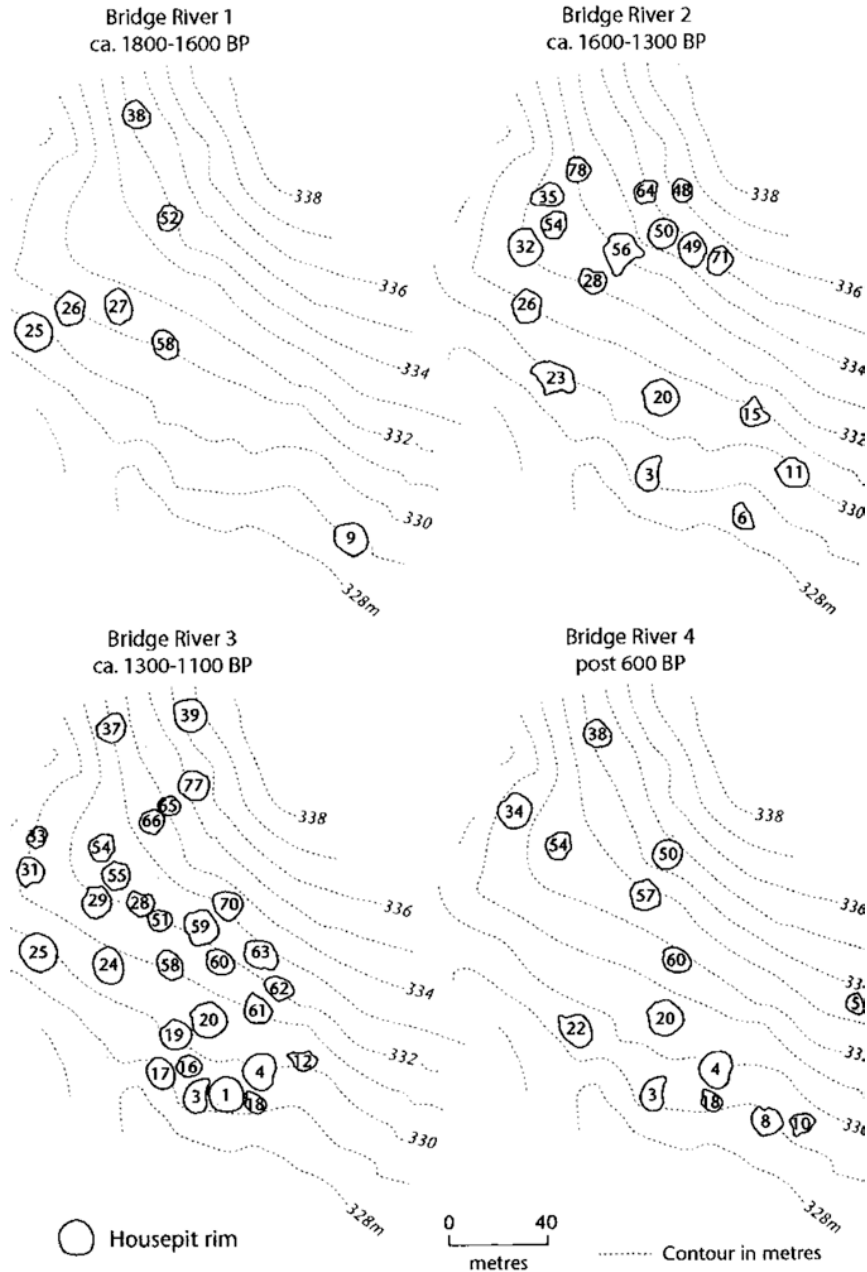


Figure 3.2. Map of housepit distributions at Bridge River site, plotted by occupation period. (from Prentiss and Kuijt 2012)

During BR2, the majority of the houses are concentrated on the north end of the site with only a few houses located in the southern end. The houses in the southern end were occupied earlier in BR2 than the northern end (Prentiss et al. 2008). By BR3, two distinct neighborhoods emerged in the north and south sides of the site. The housepit arrangements seem to be in arc-like patterns opening to the east, possibly surrounding central communal areas (Prentiss et al. 2008). The northern group during BR 3 seems to have two parallel arcs while the southern end has only one. This distinct arrangement pattern likely demonstrates the development of a complex sociopolitical organization by BR 3 (Prentiss et al. 2008). Finally, once the site was reoccupied during BR4 there is no discernable pattern to house arrangement other than a roughly linear pattern north to south (Prentiss and Kuijt 2012). It does seem that the largest roasting pit features are on the northern end of the site and smaller ones in the south, which mirrors the earlier periods.

The Bridge River village is located near the 6-Mile Rapids, which could have been selected due to its access to salmon runs in the region (Prentiss et al 2008). This is significant because unlike other sites nearby such as Keatley Creek, Bridge River may have been more reliant on salmon since other resources like roots and ungulates may have been less accessible (Prentiss et al. 2008). This would suggest that hindered access to salmon would affect the population significantly. The archaeological record shows that the salmon population did fluctuate in the region with the decline most likely happening between BR2 and BR3 (Prentiss et al. 2007, 2008, 2011). Not only does the salmon population appear to decrease, but also ungulates begin to appear in the archaeological record in larger numbers with evidence of more field processing (Prentiss et al. 2007, 2011). This suggests that more extensive hunting may have been undertaken for game as salmonid resources declined.

Prentiss et al. (2007, 2008) contend that climate change played a major role in the cultural developments of Bridge River. They suggest that Bridge River and the surrounding area were first occupied during a dry period that lasted from 2200 BP to 1600 BP. When cool moist conditions emerged after 1600 BP, the salmon population flourished allowing significant population growth (Prentiss et al. 2011). When the Medieval Warm Period arose around 1200 BP, the reemergence of a drier, warmer climate caused a decline in the salmon population creating resource stress for the Bridge River population. Hayden and Matthews (2009) argue that no significant climatic events occurred during these time periods; however, changes have been noted in the surrounding and distant regions by various studies (Prentiss et al. 2011). In order to predict large-scale changes on fish populations due to environmental shifts, one must assume that warmer air and sea temperatures produce regional changes of the same type (Butler and Chatters 1992). If the salmon population did decline as a result of the Medieval Warm Period during the peak occupation period at Bridge River, this would have had significant effects on behavior. Without as much access to salmon, people would have been forced to look to other resources in the area (such as big game and edible roots) to supplement their diets. Increased reliance on these alternative resources might depress them locally and require exploitation of larger areas (Prentiss et al. 2011). Evidence shows a transition from more on-site whole carcass butchering to limb transport, which shows that hunters may have been required to expand their hunting zones (Prentiss et al 2007, 2011).

From BR2 to BR3 there is evidence of increased social inequality as more prestige items begin to emerge in the archaeological record as well as an increase in house sizes. Ethnographic context (Teit 1906) tells us that families in the area inherited social status, and we can assume that household control of resources played a major role in acquiring and maintaining wealth

(Prentiss, et al. 2007). During this time there may have been a growing population of “poor” that had to subjugate themselves to the elite in order to have protection and access to certain food items since elites owned critical fishing rocks and hunting locations (Morice 1893; Prentiss, et al. 2007). If these data are correct, you would expect a correlation between the presences of highly sought over food resources and prestige items (Prentiss, et al. 2011). As resources became more commodified and elites gained control over prime hunting and fishing locations, some of the “poorer” individuals may have been forced to seek out resources in other areas. While this period represented a time of growth, it was also on the brink of collapse (Prentiss et al. 2012). As mentioned previously, climate likely affected the salmon population causing individuals to rely more on alternative food resources such as ungulates and possibly geophyte or root populations depressing local resources (Kuijt 2001; Kuijt and Prentiss 2004). This combination of economic factors may have been enough to cause local households to drop their investment in the social experiment underway in the large villages and return to more egalitarian and mobile lifestyles (Prentiss et al. 2012). While the region was never completely abandoned, semi-sedentary housepit villages did not resume until around ca. 500 cal. B.P. Houses in the reoccupied villages were no longer organized in rings as at Bridge River prior to 1000 cal. B.P. The Bridge River village now featured nearly random distributions of around seven to ten simultaneously occupied houses. Houses were organized around a single central hearth with individual kitchen, sleeping, tool making and perhaps, ritual areas positioned across the floors (Prentiss et al. 2012).

These issues of cultural evolution and the development of socioeconomic inequality were emphasized during the second stage of the Bridge River project during the 2008 and 2009 field seasons. Excavations from 2008 targeted activity areas from BR3 and included housepits of

varying size that had a BR3 component: HP 20, 24, and 54. Excavations in 2009 continued the research started in 2008; however, instead of only focusing on only BR3, the excavations focused on houses that could provide data from BR1-3. As a result, excavations from HPs 11, 16, and 25 were also included (see Fig. 3.3).

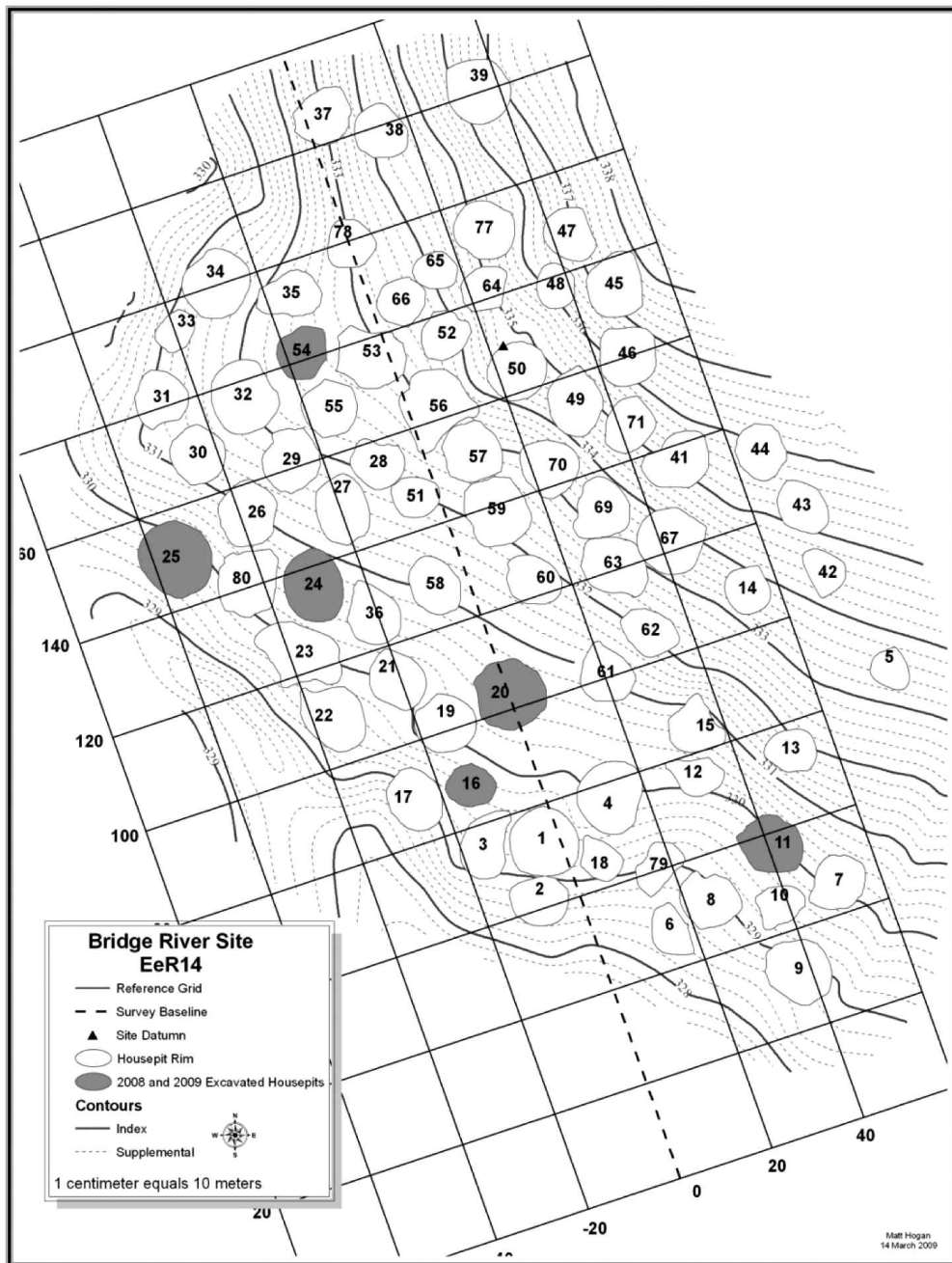


Figure 3.2. Bridge River site with the 2008 and 2009 excavated housepits in gray.

Housepit 54

Housepit 54 is a medium sized house that is approximately 13 meters in diameter. It has highly complex stratigraphy with at least 15 superimposed floors and 7 roofs (see Fig. 3.4). A number of cultural strata were identified during the 2012 excavations (Table 3.1).

Table 3.1. Cultural Strata at Housepit 54 as identified in 2012.

Stratum	Cultural Affiliation
I	Surface
II	BR4 Floor
V	BR4 Roof
XIV	BR4 Midden
XVI	BR3 Bench/Rim
Va	Final BR3 Roof
Ila	Final BR3 Floor

While HP54 features components from BR 2 and 3 phases as well as BR 4, during the 2012 excavation only BR3 (Strata XVI, Va, and Ila) and BR4 (Strata I, II, V, and XIV) phases were identified. BR 4 only had one very thin floor present and in some areas of the house it was completely worn away, but a large midden was found during excavation in the BR 4 floor in the southwest region of the house. From data acquired in 2008, it was established that HP 54 had some of the largest cache pits, although it contained lower counts of fire-cracked rock (Prentiss, et al 2009). HP 54 also had the highest count of projectile points and slate tools. Due to its highly complex *in situ* stratigraphy, which represent three different occupation periods, HP 54 was chosen for the next phase of excavations for the Bridge River Project. Excavations began in 2012 and provided the data for this project.

CHAPTER 3

SEASONALITY AND LITHIC TECHNOLOGICAL STRATEGIES

Robert Kelly (1983) distinguishes between mobility strategy and season round by noting that a seasonal round refers to the geographic movement of people, while mobility strategy refers to the decision making process behind group movement (Prentiss 2000). From this perspective, the mobility strategy of the Middle Fraser was organized as seasonably sedentary in winter villages (Prentiss 2000). In this chapter I will rely mainly on Teit's (1900, 1906, 1909) and Alexander's (2000) ethnographic descriptions and analysis of winter villages in the Mid Fraser Canyon to further explore the tactics used to reduce risk of winter shortages, including storage, organization of resource collection, and seasonal mobility patterns. I will also explore in greater detail lithic raw material availability and lithic technological strategies carried out during winter occupation at Bridge River by examining previous research carried out in the region.

WINTER HOUSEHOLD ECONOMY

Pithouses were used primarily in during the winter months from late November or Early December to February or late March (see Fig. 4.1) depending on the severity of the weather (Dawson 1892; Hill-Tout 1907; Teit 1900, 1906, 1909). While some argue that pithouses were only used during the winter (Green 1972), some accounts state they were sometimes occupied during the summer to escape the heat and the very old may have even stayed in the pithouses throughout the whole summer (Kennedy and Bouchard 1978; Teit 1898). Because children spent a great deal of time with their grandparents, they may have also occupied the pithouses during summer months (Nastich 1954).

First Moon, or ^ʔnu'lxten (“going-in time or place”). — People go into their winter houses. The weather gets cold.

Second Moon, or Tca'uamuxs tceñ'ken. — Winter solstice. Sun turns.

Third Moon, or Stexwauzi'ken (“middle of ridge or back”). — Called “middle month.” Coldest weather of winter. Ice sometimes on the rivers.

Fourth Moon, or ^ʔnu'tskaten (“coming-out time or place”). — People come out of their winter houses.

Fifth Moon, or ^ʔskwelkwa'l (“green”). — The moon before the leaves come, or ^ʔskaptsō'l (“real spring or chinook wind”). The grass grows, and the weather ceases to be cold. Some people fish and hunt.

Sixth Moon, or ^ʔsla'kōlkwallt (“leaves green”). — Leaves come out on the bushes and trees.

Seventh Moon, or Kwo'ltus ^ʔsku'klep (“when strawberries are ripe”). — People fish small fish and the first salmon.

Eighth Moon, or Kwōlixtcu't (“ripen self”). — Service berries and most other berries ripen.

Ninth Moon, or Spantsk (“summer”). — Warmest month. People pick berries.

Tenth Moon, or laq a ^ʔstsō'qaza (“the salmon come”). — Salmon run in great numbers, and people fish.

Eleventh Moon, or ^ʔstsē'peq (“boiling”). — People boil salmon and make oil.

Rest of Year, or llwē'lsten (“fall” or “autumn”). — People hunt and trap game.

Figure 4.1. List of the moons and the principle occupations during each month 1st Moon (Nov) - 12th Moon (Oct). (From Teit 1906)

Alexander (1992) also speculated that the villages might have been visited periodically during the summer in order to store dried food and other material collected on trips. The winter houses were often built in the valleys of the principal rivers, with easy access to water, and were inhabited by family groups that would likely scatter during the summer months during the hunting and fishing seasons (Teit 1900). The houses could hold fifteen to thirty people and as a result stayed very warm during the winter since the houses were insulated. This meant that less wood was required to heat the houses (Teit 1928). Throughout the warmer seasons the people of the Mid Fraser lived in more temporary summer lodges, which consisted of a round or square

framework of poles covered with mats or bark (Teit 1900). During the spring, people dispersed across the landscape and hunted and foraged according to the availability of seasonal resources.

In the spring, families sought out plant foods to collect and process for the winter (Alexander 1992). Other spring resources included trout and the early runs of Chinook salmon. Salmon was the most important industry for Bridge River and occupied a much higher position than in other interior tribes (Teit 1906). In addition to the Chinook run, the August run of sockeye occurred during a period of low water when mass harvesting could take place. During August, thousands of sockeye were harvested, processed and dried. Dried salmon can be stored for over a year, which made it a significant resource during the winter months. According to Kew (1992) and Hayden (1992), each individual would need to harvest and dry at least 300 salmon to survive the winter. Following the late summer spawning, people once again dispersed into the mountains to hunt deer and other ungulates. Other animals were also hunted for meat such as bear, beaver, and hare. By December dried salmon, roots, and deer have been stored at the pithouses and families will rely on their stored goods til spring.

Preparation for the winter months involved stockpiling calorically high, seasonally abundant resources. Fauna from the 2012 excavations at Housepit 54 showed that the majority of the fauna present represented more high utility elements such as vertebrae and ribs of salmon and very few low utility elements such as fish heads (See Williams 2013). This demonstrates that offsite processing and storage at the pithouses was likely occurring. Most of the food was temporarily stored at the procurement camps and then brought to the pithouses when there was more spare time (Teit 1906). Three storage types could be found in the Mid Fraser Canyon: elevated wooden caches, underground cache pits, and wooden storage platforms within the houses (Alexander 2000; Teit 1900, 1906, 1909). Elevated caches usually consisted of a wooden

box with a roof built on a pole platform with four supports, but they could also be expediently built in trees (Teit 1900, 1906, 1909). This style of cache generally was used to store dried fish with each box being able to hold several hundred fish (Alexander 1992; Teit 1900).

Underground caches were built as pits covered with bark or poles, pine needles or grass, and then soil (Teit 1900). Dried fish and baskets of roots and berries were wrapped in birch bark in order to help prevent moisture damage and roots (Teit 1900). Food caches built near the houses were used to store food over the winter and were accessed as needed. Internal cache pits were also used, though the exterior pits were more common. The storage platforms, or shelves, were constructed at the angle between the roof and the wall of the pithouse (Alexander 2000). Food on the shelves was intended to be used rather quickly, and each shelf usually contained different items (Teit 1909). General storage of family items could be found under bed platforms, under the ladder entry, or hanging things from posts and beams within the house. Tools were likely stored within the house during the winter. Teit (1989) discusses how tools were cached in other seasons when all the people of a house were leaving: “They buried some of the valuable tools they did not want to take along. Especially things made of stone.” This provides some insight into tool caching, however, these ethnographies do not offer a great deal of insight into how lithic raw materials were acquired.

The selection and transport of lithic raw materials was potentially based around similar foraging principles as food resources that would provide Mid-Fraser foragers a resource base to draw on throughout winter. The storing of lithic raw material would have played an important role in order to maintain enough raw material to last through the winter. Many researchers have previously put less emphasis on the storage of lithic raw material and focused more on the importance of food storage. Binford (1979) contends that lithic acquisition would have been

secondary to food recovery and that storing lithics was embedded in other activities. Others agree, citing efficient time management as being a key adaptation in high-risk environment (Gamble 1986; Torrence 1983). Alternatively, Bamforth (1986) argues that transporting tools has its separate costs that must be considered. It seems likely that a combination of planned and opportunistic responses both play a role in raw material stockpiling. Regardless, lithics played a significant role during winter “down time” (Binford 1979; Bleed 1986) when lithic tool use was oriented toward producing more complex tools, clothes, and shelter (Alexander 2000; Prentiss 2000). Because lithic raw material was not accessible at this time due to ice and snow, some form of stockpiling had to take place in order to carry out the tasks carried out through the winter occupation.

Teit and other ethnographers offer detailed descriptions of the tasks carried out during the winter, which required stone tools. Teit’s ethnographies (1900, 1906, 1909) indicate a focus on hide-working and wood-working using chisels, scrapers, knives and arrow smoothers for wood-working and knives and scrapers for working hides. Desire for certain European goods during the Fur Trade Era, such as cloth, iron, beads, and even horses, could have driven up production of hides on a scale higher than in previous time periods. It is assumed much of the lithic production during the winter was oriented towards these activities; however, a variety of other tasks were carried out during the winter, many of which were designated by gender. Some of the women’s duties included preparing skins, mats, baskets, sacks, bags, clothing and moccasins; and looking after children (Teit 1900). Men would have manufactured tools and weapons, tanned skins, and gone hunting. Butchering and de-hairing hides occurred outside the pithouse on most occasions, although on special feasting occasions butchering may have occurred in the house (Teit 1909). Hunting deer and elk also occurred during the winter months,

but ungulates were not as plentiful as they were during the fall rutting season. The winter hunt demonstrates once more that maintaining access to raw materials is paramount in any lithic strategy, so replacement tools can be made if necessary.

LITHICS: RAW MATERIALS AND STRATEGIES

In this section, I will discuss the various material types and availability, as well as, the technological strategies implemented at Bridge River Village. Forty-eight material types have been identified at the Bridge River site (See Appendix C), but only 37 of these 48 were identified during my analysis of the Fur Trade Strata (I, II, V, and XIV). There are multiple raw material sources near Bridge River (See Fig. 4.2) including: Glen Fraser Silicate Source, Blue Ridge Ranch Chalcedony, Upper Hat Creek Basalt Source, Upper Hat Creek Silicate Source, Moraine Chalcedony Source, Fountain White-Pink Speckled Chert Source, Rusty Creek Red Chert Source, and the Maiden Creek basalt and Silicate Source (Rousseau 2000).

Obsidian is one of the few material types that cannot be found within the region. The closest obsidian source is 200km from the Bridge River site (Prentiss et al. 2009). Hat Creek jasper and pisolite are two other non-local material that can be found within the assemblage. The majority of the raw materials come from the Coastal Belt, which is a mountain range to the North and West of the Fraser River that extends from Vancouver to Alaska (Mathews and Monger 2005). This formation is mostly composed of basalt and granite, but also contains diorite, quartz, greenstone, mica, shale, sandstone, chert, and serprentinite (Mathews and Monger 2005).

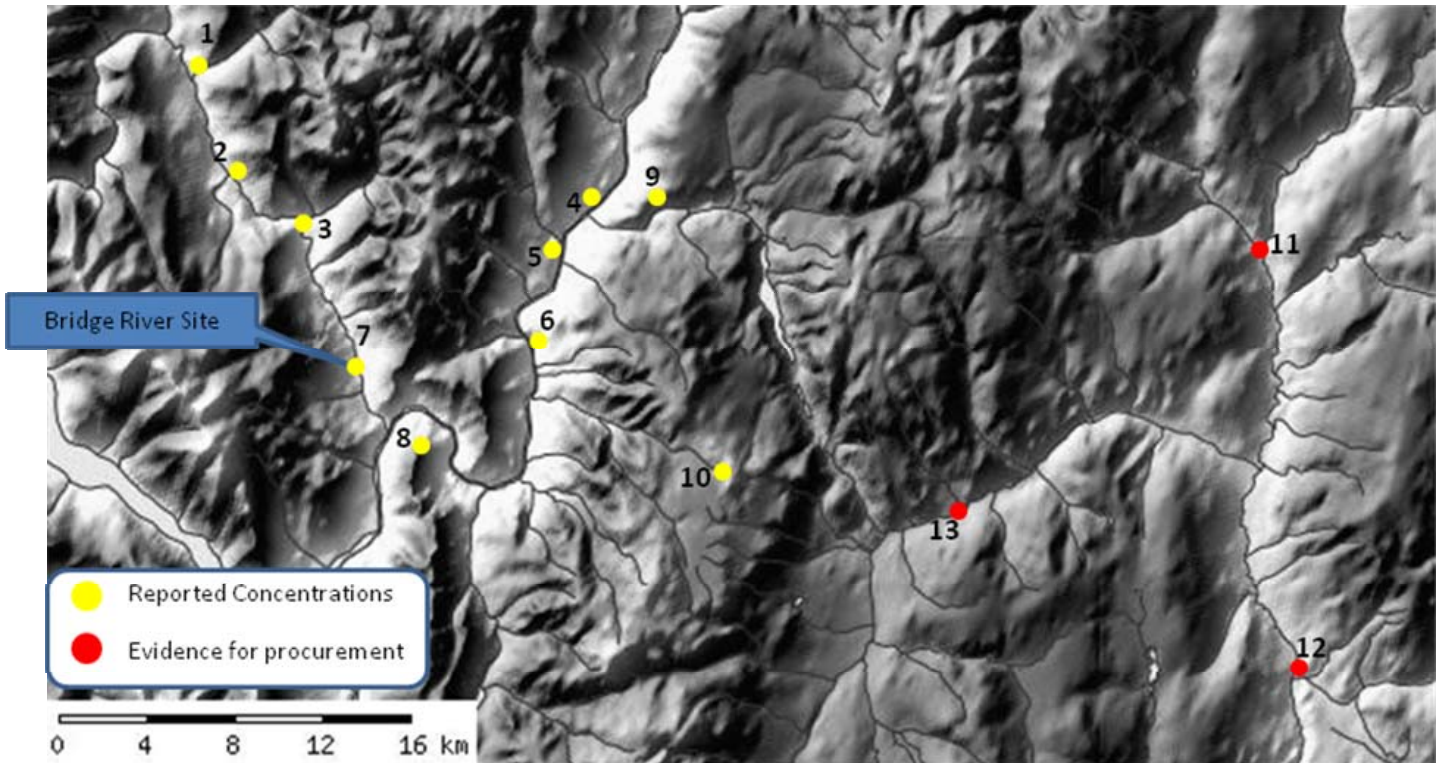


Figure 4.2. (1) Confluence of the Bridge and Yalakom/Yalakom River Moraine Chert deposits; (2) Camoo chert, chalcedony, and dacite deposits (3) Applespring chert and dacite deposits (4) Moran chalcedony outcrop; (5) Blue Ridge Chalcedony outcrop (6) Glen Fraser silicate outcrop (7) Bridge River Arbor chert, chalcedony, and dacite deposits (8) Fountain Ridge Pisolite deposit (9) Pavilion Mountain chert outcrops (10) Cornwall chert outcrop (11) Maiden Creek dacite and silicate source (12) Cache Creek Dacite source (13) Upper Hat Creek dacite and silicate source (<http://atlas.nrcan.gc.ca>). [From Wazenried 2010]

Basalt falls into the volcanic rock category. Probably the most ubiquitous basalt material found in the Mid Fraser is dacite, which is vitreous, fine-grained, and good for making flaked stone tools (Austin 2007; Rousseau 2000). According to Bakewell (2000) and Hayden et al. (1996), 70-90% of excavated lithic materials were made from fine-grained basalt at Keatley Creek. The same can be said at the Bridge River site (81% Dacite). Obsidian is another material that would fall under the volcanic category; however, in comparison to dacite, it makes up a very small percentage (.9%) of the lithic materials at Bridge River. The obsidian found in the Mid Fraser as stated previously is a significant distance from the Bridge River site and may come from

multiple sources such as Anahim Lake (Hayden 2000). Obsidian was desired for its excellent cutting ability (Galm 1994) and, due to its inaccessibility, was a marker for social inequality and an indicator for trade relationships.

Metamorphic rocks, which can vary greatly in their mineral context, can be hard or soft. Some of the metamorphic rock types are slate, quartzite, and phyllite (Austin 2007). Of these rocks, slate, is probably the most important material in relation to Bridge River due to its role in the ground slate industry that developed at Bridge River through time (Prentiss, et al 2004, 2005). The slate materials were located directly in or around the Bridge River site (Clarke 2006). Slate was the second most represented raw material. It made up 9% of the assemblage, which shows that it also played an important role in household activities during the fur trade era.

Another local resource that was used for lithic tools was chert, which is a type of fine-grained quartz (Austin 2007). There are many varieties of chert surrounding the Bridge River area. Chert is quite variable and can be a multitude of different colors: black green, red, white, and chalcedony (which is normally a translucent pale white)[Folk 1974]. Chert can also vary in quality, and low quality chert would sometimes be heat-treated in order to make it into a more superior material.

As mentioned previously obsidian was a prestige material due to its distance from the site and ability to make finer tools (Hayden 1998, 2000). Two other non-local raw materials can be found in the Bridge River archaeological record: pisolite and jasper. Pisolite is found only in the Fountain Valley, and jasper is found in the Hat Creek Valley. A more local material is nephrite; a type of jade that is usually found as cobbles and boulders in the Bridge River area (Austin 2007). Nephrite was often used to make tools such as adzes. Steatite was another nearby raw material; it is a fairly soft rock and is often found in association with nephrite (Austin 2007).

Because of its softness, it was an excellent carving material, and it also had high heat resistance, which made it good for making smoking pipes (Austin 2007). Interestingly, the introduction of iron during the Fur Trade Era seemingly had little effect on the proportions of lithic raw materials used at Bridge River. While some metal objects and trade beads were identified in the 2012 assemblage, only two metal tools were found. Research through time at Bridge River and Keatley Creek consistently show that dacite and other stone raw materials remains ubiquitous through time with little indication of a reliance on iron tools.

Other than during the winter months, lithic raw materials are accessible nearly year round. The means collecting them could occur at the convenience of the Bridge River people during foraging. Many researchers have argued (Andrefsky 1994; Kelly 1988; MacDonald 2008; Nelson 1991; Parry and Kelly 1987) that in largely sedentary situations where travel is constrained and raw material is abundant, tool production should rely on expedient tools with less retouch, and scarce raw material sources should result in more formally curated tools with a high level of retouch. Previous research in the Mid Fraser region supported this hypothesis (Wanzenried 2010), arguing that stockpiling raw material at Bridge River leaves an abundant source to draw upon during the winter, which is why such a high number of expedient tools exist. I argue that evidence shows that stockpiling does not provide an ever-abundant resource and instead becomes inadequate over time. This is shown through the implementing of a bipolar technique and serial expediency (Prentiss 2000).

Following Goodyear (1993), I argue that the presence of bipolar reduction strategies demonstrates a means for extending tool use-life during winter occupation at Bridge River. Bipolar reduction involves using a stone hammer and anvil and striking the “parent piece” (which can vary from thick flakes, exhausted cores, broken bifaces to small pebbles) repeatedly

for the derivation of flakes (Goodyear 1993:6). Battering and crushing will be present on the platform struck and to a lesser extent on the opposing end from the anvil. Bipolar reduction is a technique that has long been recognized as a means to conserve raw material when access to a material source is limited (Goodyear 1989, 1993; Hayden 1980; Kelly 1988; Prentiss 2000).

Goodyear (1993:12-13) states:

The bipolar reduction of biface fragments, core remnants, fluted points and scrapers...would literally signal the last possible effort to squeeze usable flakes from a nearly exhausted toolkit. Where no other comparable raw material is nearby, such a practice of intensive recycling is an effective and rational means of dealing with a tool replacement problem.

When a resource becomes too small or a tool has broken there are few ways to extract useable material from it. Bipolar reduction is one effective strategy to deal with an exhausted tool. The high number of bipolar cores and flakes found at Bridge River demonstrate a need to extend the use-life of the tools. This shows that stockpiling raw material did not leave an abundant source to draw upon throughout the winter, but instead one that became more limited as winter passed. This is also indicated by more intensive resharpening of tools and reuse of discarded tools for a new purpose. Such an assemblage would contain a range of heavily retouched and broken tools and would appear to represent primarily expedient tool use (Prentiss 2000). The actual formation of such an assemblage may be far more complex with some tools being used expediently on multiple occasions, or “serial expedient use” (Prentiss 2000: 215). Teit (1900, 1906, 1909) describes multiple types of specialized flake stone tools indicating that a method of serial expediency could be likely. In order to have continuous use of lithic materials over the three month winter period, serial expediency and curated use of specialized flake tools as well as a reliance on bipolar reduction strategies were required. Previous research at Keatley Creek gives further insight into the lithic strategies in the Mid Fraser Canyon.

PREVIOUS RESEARCH: DESIGN THEORY AT KEATLEY CREEK

In 1996, Hayden, et al. looked at lithic strategies and design criteria at the neighboring site of Keatley Creek. Their goal was to assess acquisition, manufacture and manipulation of stone resources. They evaluated the basic strategies employed and the role that constraints played in the design considerations of tools. They applied design theory (as discussed in Chapter 2) to help explain tool morphology and assemblage organization. The design considerations that they discussed are reliability, maintainability, versatility, flexibility, and curation. Another factor that design theory emphasizes is various constraints such as portability, time constraints, material availability, production costs, etc. These are concepts that are very similar to the theories of risk analysis. Constraints are essentially factors of risk.

In order to examine the constraints and design considerations that Hayden et al (1996) discussed, they explored the lithic assemblage of Keatley Creek. They chose single examples from the six major lithic strategies applied at Keatley Creek to illustrate their approach. The six strategies they examined were: expedient block core, biface, portable long-use, quarried bipolar, scavenged bipolar, and ground stone cutting. In the expedient block core strategy cores are kept at the site, and flakes are removed and modified as needed (Hayden et al 1996). The flakes are usually discarded after an immediate task is completed “unless large, still usable flakes are involved” (Hayden et al 1996:16). The bifacial strategy is one used in a high mobility situation with constraints on the amount of material that can be transported on trips. Initial reduction is done at the quarry to cut down on weight and transport costs. Portable long-use is a strategy that is also used in highly mobile contexts where specialized tools that will last as long as possible are carried. As a result, one can avoid the need to carry excess stone weight (Hayden et al 1996). Quarried bipolar strategy is described as being oriented to needing large spall tools, which can be

left at the site or discarded after use (Hayden et al 1996). Hayden et al. discussed the scavenged bipolar strategy briefly, but due to the original research design, they were unable to provide detailed analysis of this strategy. As discussed in previous section, this is an important strategy at Bridge River. The strategy is one in which tools and flakes, as well as bifaces and block cores, are recycled by intentional breakage and bipolar reduction to create new flakes (Hayden et al 1996). The final strategy discussed in their analysis is ground stone cutting. This strategy is used “under conditions of high-volume processing involving cutting tools and/or to display control of wealth and power” (Hayden et al 1996:33).

After analysis, the authors found that the assemblage at Keatley Creek was dominated by the expedient block core strategy. They suggest that this shows that stone was used in a very economic fashion since there would have been considerable constraints on raw material availability due to the nature of winter village lifestyle. Many of the factors they discussed are similar to the expectations of my analysis such as: small tool and core sizes, high rate of breakage and re-use of edges formed by breaks, multiple edge use, recycling of broken bifaces and exhausted cores through bipolar reduction (Hayden et al 1996). They found the second most common strategy was the use of bifacial reduction flakes. Again, the authors state that this strategy also makes sense under conditions where raw material is scarce.

The conclusions that Hayden et al. (1996) reach are in many ways similar to my research expectations; however, there are some differences. I focus more on the bipolar reduction strategy, and other strategies that are present at Bridge River not represented at Keatley Creek. For example, the ground slate industry is very common at Bridge River though not at Keatley Creek. Hayden et al’s (1996) research is a good comparative study that, in conjunction with my research, allows for a better understanding of the lithic assemblages in the Mid Fraser as a whole.

This research also gives the opportunity to see the differences between two neighboring sites in the region.

CHAPTER 5

METHODOLOGY

Excavations of the Fur Trade Era occupation of Housepit 54 at Bridge River, conducted during the 2012 field season, recovered 11,907 lithic artifacts from Strata I, V, II and XIV. Of this sample, debitage amounted to 10,505 artifacts, while tools and cores comprised the remaining 1,402 artifacts. Tools and cores were classified into 170 types that were identified according to and modified from precedent SFU-Keatley Creek (EeR17) and Bridge River lithic typologies (Hayden et al. 1996, 2000; Prentiss et al. 2003, 2005, 2009, 2010; Appendix B). This large sample was obtained with attention to artifact distributions within Blocks A-G.

Field Methods

Excavations were organized by a superimposed grid system consisting of six blocks, identified as A-H (see Appendix A). Each block contained 16 1x1 m squares. The squares were further sub-divided into four quads each. However, the squares were only excavated in quads when a floor, bench or midden feature was encountered. Surface and roof sediments were not excavated in quads. The blocks were separated by 50 cm wide balks left in place to permit trans-housepit profile mapping and to preserve a sample of archaeological materials for future investigations (see Appendix A). Excavations were conducted relying upon a combination of cultural and arbitrary levels. Arbitrary levels were excavated when cultural strata were too thick for a single level. Stratum I was limited to a single 10 cm level.

Strata V, and XVI were excavated in 10 cm levels. Strata II and XIV were excavated in 5 cm levels. Excavators point provenience mapped all cultural items (artifacts and bones) greater in maximum diameter than 3 cm and other items including charcoal fragments and fire-cracked

rock (FCR) greater than 5 cm. Excavated material was screened through a 1/8-inch screen and all cultural items were collected by provenience. The data for my analysis comes from the BR 4 floor (Stratum II) including the midden data (Stratum XIV), the roof (Stratum V), and the surface (Stratum I) deposits. Bridge River 3 strata (XVI, Va, and IIa) were not included, since my research focus is only on the fur trade era during BR4. The following tables (Tables 5.1-5.4) give a break down of the artifacts recovered from each respective strata:

Table 5.1. Stratum I lithic artifacts.

Block	Flakes	Scraper	Biface	Used Flake	Kamloops Point	Other	Stone Bead	Ornament	Spindle Whorl	Core
A	265	10	0	2	1	16	0	0	0	8
B	510	14	2	2	2	13	0	0	0	2
C	273	10	0	0	0	16	0	0	0	3
D	425	12	1	0	3	34	1	0	0	12
E	84	0	0	0	4	5	0	0	0	2
F	95	2	0	0	2	4	0	0	0	4
G	16	2	0	0	0	4	0	0	0	1
H	68	1	0	0	0	4	0	0	0	1

Table 5.2. Stratum V lithic artifacts.

Block	Flakes	Scraper	Biface	Used Flake	Kamloops Point	Other	Stone Bead	Ornament	Spindle Whorl	Core
A	1814	69	15	21	17	75	4	0	0	45
B	1741	54	2	4	8	76	4	1	0	30
C	1403	82	13	16	10	108	1	3	0	33
D	2104	56	5	16	8	100	0	0	0	51
E	134	19	1	0	1	5	0	0	0	4
F	35	7	0	0	1	10	1	0	0	6
G	0	4	0	0	0	5	0	0	0	1
H	2	5	0	0	1	6	1	0	0	3

Table 5.3. Stratum XIV lithic artifacts.

Block	Flakes	Scraper	Biface	Used Flake	Kamloops Point	Other	Stone Bead	Ornament	Spindle Whorl	Core
A	352	8	2	2	4	18	0	1 figurine	2	8
B	36	3	0	0	0	2	0	0	0	2
C	47	0	0	0	0	0	0	0	0	0

Table 5.4. Stratum II lithic artifacts.

Block	Flakes	Scraper	Biface	Used Flake	Kamlo ops Point	Other	Stone Bead	Ornam ent	Spindle Whorl	Core
A	92	2	1	0	0	11	0	0	0	4
B	553	9	2	1	1	6	2	0	0	0
C	108	3	1	1	0	4	0	0	0	3
D	205	3	3	0	1	14	0	1	0	3
E	13	2	0	0	0	0	0	0	0	1

Laboratory Methods

Debitage were sorted by raw material type, thermal alteration, size, completeness-related types, cortex, technological type, and when applicable, fracture initiation. A total of 48 raw material types were identified during analysis. Thermal alteration was marked as present or absent. Lithics that had flake scars that were smooth or soapy in texture compared to older surfaces that had grainier and duller texture were likely heat-treated (Whittaker 1994). Another defining characteristic of heat-treated lithics is color. Lithics that had a greasy luster and/or a pink to reddish color were likely to have been heat-treated (Crabtree and Butler 1964:1; Purdy and Brooks 1971:322). Debitage and tools were also separated into five size categories: extra small (<.64 sq cm), small (.64 to 4 sq cm), medium (4 to 16 sq cm), large (16 to 64 sq cm), and extra large (>64 sq cm) (Prentiss et al. 1998, 2001, 2009, 2010). Completeness of debitage was defined and sorted using a modified Sullivan and Rozen typology (MSRT) (Prentiss 1998; Sullivan and Rozen 1985) [see Fig. 5.1]. This MSRT typology initially sorted debitage by size. Following the size designation, it was determined if a single interior surface (ventral face) was present or absent. If debitage did not have a single interior surface it was defined as Nonorientable. The next step was to determine if the debitage had a point of applied force, or platform. If no platform was present, the debitage was defined as a Medial/Distal Fragment. If a platform was present the flake was either Proximal or Complete. A Complete flake has intact

margins while a Proximal flake does not. Finally, if a flake is sheared longitudinally, it was defined as a Split flake. These determinations are useful in identifying reduction techniques and intensity.

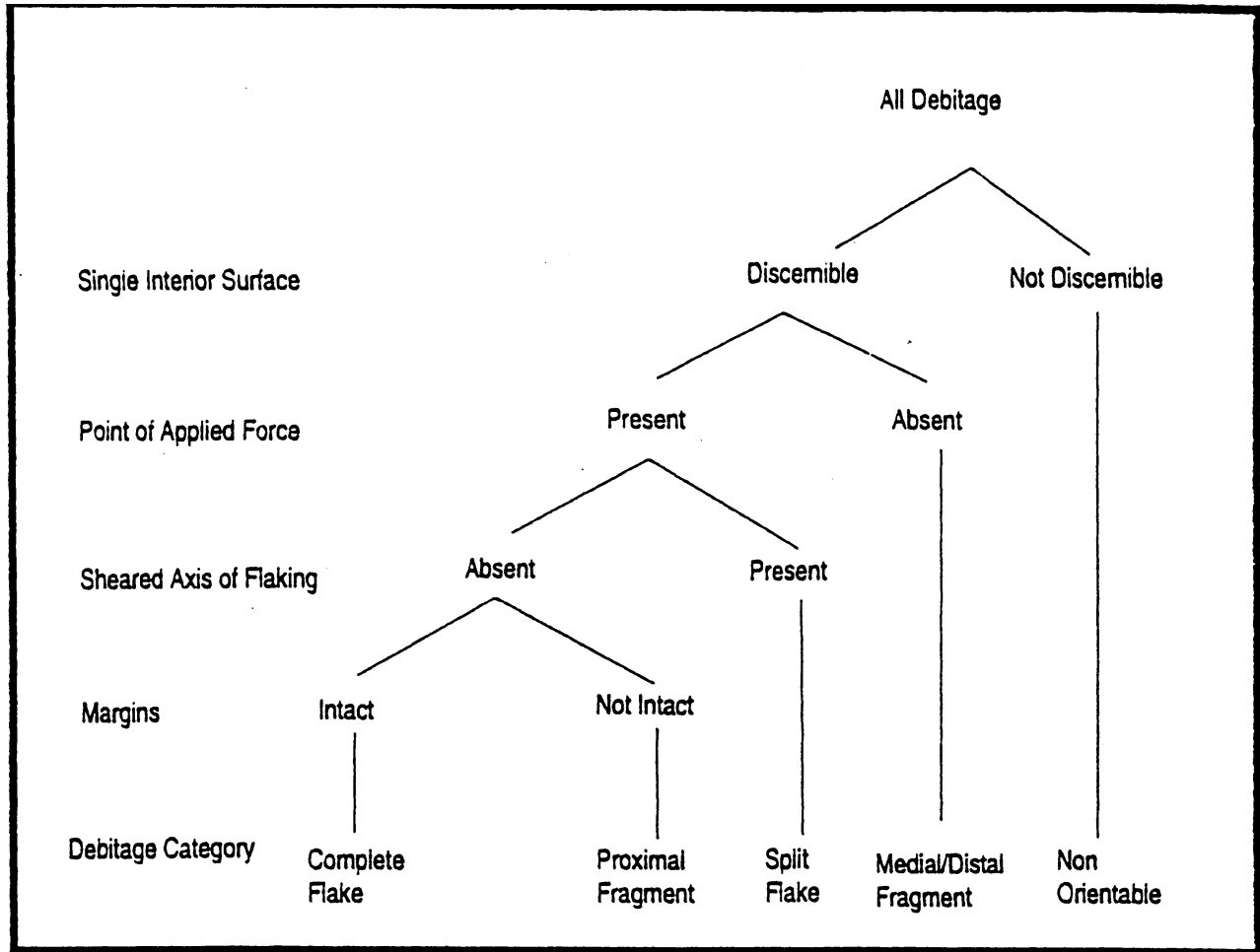


Figure 5.1. Hierarchical attribute of Sullivan and Rozen (1985) used to define debitage.

Any debitage that was sorted as a Complete Flake, Proximal Flake, or Split Flake, was analyzed to determine its fracture initiation. Three fracture initiation categories were designated: Cone, Wedge or Bend. Cone initiations are typically associated with hard hammer percussion, while Bend initiations are typically associated with soft hammer percussion. Wedge initiations typically result from bipolar lithic reduction (Cotterell and Kamminga 1987). The cortex cover

on the dorsal face was measured to establish stage of reduction on the scale of Primary (99-100% cortex), Secondary (1-98% cortex), or Tertiary (0% cortex). Finally, technological origin for individual platform bearing flakes was identified, including early stage reduction (thick flake with high dorsal platform angle and limited platform faceting), biface thinning (medium and larger flake with small faceted platform, thin and broad form, and low dorsal platform angle), retouch (small or extra-small flake typically with medium to low dorsal platform angle), notching (small to extra-small oval flake with distinct raised platform), bipolar (wedge initiated, compression-controlled propagation, and often crushing on ends), core rejuvenation (flake with attributes of dorsal platform from core removed to facilitate further flaking), and blade (flake with length at least double width, high dorsal platform angle, and lateral symmetry).

Tools recovered were sorted using a wide range of characteristics. The size of tools was determined using sliding calipers. All tools were drawn in plan view and profile, and when necessary, some tools such as projectile points were drawn showing multiple faces and margins (e.g. proximal and distal profiles). Macroscopic and microscopic techniques were employed to identify use-wear and retouch characteristics. Microscopic techniques utilized Motic SMZ-168-BP; .75x – 50x zoom microscopes. Use wear analysis defined such things as polish, striations, rounding, crushing, etc. Measurements were taken to determine edge angle using Wards Contact Goniometer. Each distinct working edge was termed an employable unit or EU (Knudson 1983). Edge retouch characteristics were recorded including retouch face (normal, inverse, bifacial), retouch invasiveness (abrupt, semi- abrupt, invasive), and retouch form (scalar, step, hinge). The Bridge River lithic tool typology was applied to all lithic artifacts recovered in 2012. Several new tool types were added to this typology during the lithic analysis (see Appendix B for a complete list of all tool types including new tool types added for the lithic artifacts recovered in

2012). The typological classification provides a quick reference for tool morpho-functional types and is not intended to replace more focused attribute based approaches to analysis.

Statistical Methods

Statistical analysis was performed using SPSS® Version 21.0. Most basic statistical analysis, such as percentages of tool types, was done in Microsoft Excel. The comparison of a set of nominal categories (such as Flake Type and MSRT) between two samples was approached using Chi-Square (χ^2) tests. A Chi-square test is based on whether or not 2 or more samples were drawn from a common population and, therefore, is a good test for assessing associations between different categories. For evaluating the difference in means between two samples, I applied the two-sample T-test. T-tests examine two variables independently to assess if the observed difference between the samples is a result of sampling or if there is a statistically significant difference between the two means. For three or more samples, the technique applied is analysis of variance, or (ANOVA). Similar to two-sample T-tests, ANOVA examines the difference of means and answers the significance question: How likely is it that these populations were produced from the same parent population, or in other words, have the same mean? This is beneficial for evaluating such things as the relationship between tool type and mean tool size. Statistical significance was set at $p < .05$; however, in most cases a significance value of $p < .001$ was seen as more meaningful than $p < .05$.

HYPOTHESIS AND EXPECTATIONS

In this subsection, I will revisit my hypothesis and discuss how I measure my research expectations. The main goal of this research is to analyze the role lithic technology played in the adaptive strategies of winter pithouse occupation at the Bridge River Village by assessing the

tactics of major tool reduction as well as reduction intensity. I extrapolate a model from the ethnographic record in order to test the historic strategies discussed by Teit (1900, 1906, 1909) and other ethnographers of the region. As discussed in previous sections, during the winter “down time” (Prentiss 2000:214), there was a focus on woodworking, hide working, and tool production of more complex tools, clothing, and shelter (Prentiss 2000). The raw materials, which would be used for these tasks, were collected in the warmer months when snow and ice did not inhibit travel and the materials were accessible. Given this strategy of collecting in warmer months, the people most likely stockpiled what they collected and in the winter (when they were in the village) they would produce tools to prepare for the spring hunting and gathering (Hayden et al 1996; Prentiss 2000). Maintaining access to raw materials is paramount to any lithic strategy, so replacement tools can be made if necessary (Bamforth and Bleed 1997). Without access to raw material, the Bridge River people would have had to apply other strategies to help cope with the lack of material resources. I hope to understand how the problem of limited resource access was solved using various lithic technologies and what an assemblage from a high-risk situation like this might look like. In order to better understand my methodology, it is beneficial to reexamine my hypothesis and test expectations.

Hypothesis

As a winter occupation, HP 54 had limited access to lithic raw material sources resulting in the application of conservation tactics such as bipolar reduction, intense retouch, and reuse of broken tools.

Expectations and Measures for Hypothesis

One of the factors expected from my hypothesis is that limited raw materials would cause

more late stage production, smaller tool sizes, and high reduction intensity. To infer production stage, flake sizes, stages of reduction, and flake types were analyzed. Non-diagnostic Medial/Distal flakes were not included in the statistical analysis of the relationship between type, size, or reduction stage, since they do not offer definitive information for these categories. Another measure of reduction intensity and raw material use is size variation. Tool and flake sizes can reveal use-life history. I would expect tools produced from an abundant raw material source to be discarded earlier with larger masses and decreased use-wear, and tools from a limited source to be maintained/used for extended periods of time and smaller in size. Statistical testing was applied to test the significance of size in relation to different tool types and curation types. The percent of bipolar cores is also important in understanding rates of raw material use. I hypothesize that bipolar artifacts represent a method of extending the utility of a toolkit, which is important in solving the issue of raw material availability. Although employed in a wide range of settlement conditions, bipolar reduction is most often applied under specific lithic resource circumstances, including raw material scarcity and/or raw material size constraints (Kuijt et al. 1995). Raw material scarcity would require intensive reduction of available material and size limitations would result in difficulties reducing nodules using a method other than bipolar reduction. One issue that arose from the early discussion of bipolar reduction was the confusion between bipolar cores and *piece esquillees*. Hayden (1980) states that in an early study by George MacDonald (1968), MacDonald describes the morphology of a bipolar core as a *piece esquillee*. This issue has long been sorted out; while *piece esquillees* and bipolar cores both have crushing on opposite ends, *piece esquillees* are used as wedges to split material such as bone or wood. Bipolar reduction serves as a means to remove more useable flakes by resting a core on an anvil and striking it with a hammer (Crabtree 1972) [see Fig. 5.2]. Therefore, a *piece*

esquillees does not show flake scars indicative of flake removal nor are they blocky as bipolar cores tend to be (Hayden 1980). I also examine the debitage patterning in order to investigate tool and core reduction with a specific focus on further documenting the evidence of bipolar reduction.



Figure 5.2. Bipolar reduction on an anvil.

To further explore my expectations, eight tool classes are identified: Biface, Uniface, Projectile Point, Core, Groundstone, Ornament and Multiuse Tool. By breaking down each category, it can be determined which tools and core types were most represented. This method also allows the measurement of the number of expedient tools versus formal tools. Formal tools encompass a large variety of tools typically that have undergone additional effort in production (Andrefsky 1994). Torrence (1983) attributes the characteristics of advance preparation, anticipated use, and transportability to formal tools. These tools have generally been linked with populations practicing more mobile settlement strategies and having short-term site occupations (Andrefsky 1994). Tools that I define as formal in this study include bifaces, projectile points, groundstone, and ornaments (see Appendix D for complete list of formal and expedient tool

categories). Expedient, or informal, tools are generally defined as unstandardized or casual in form (Andrefsky 1994). These tools are believed to have been manufactured, used, and discarded over a relatively short time period and are usually expected in situations with abundant resources (Andrefsky 1994; Kelly 1988). Given these definitions, it would seem that more formal tools should be present at Bridge River; however, I hypothesize that more expedient tools would be present as a result of serial reuse. Hayden et al.'s (1996) research showed that expedient knives made up a large percentage of the assemblage at Keatley Creek, and I anticipate the same at Bridge River Village. Similarly, I expect a higher percentage of tools to have multiple functions and show evidence of recycling. Resharpening and reuse of previously discarded tools can indicate this. I argue that, instead of using and discarding expedient tools, the people of Bridge River used expedient tools on multiple occasions (or serial expedient use)(Prentiss 2000). On initial inspection this can be difficult to detect, so in order to test this expectation, I measure the number of Employable Units and their associated variation. In 2012, there were a total of 1,402 tools recovered from the Bridge River 4 deposits; however, on flake tools with multiple functions, each EU was treated as its own tool. This means that a tool with two functionally different EUs (i.e. one with scraper wear and one with knife wear) would count separately as two tools: one scraper and one knife (this method was not applied during statistical analysis; instead, these tools were included in the "Multiuse" category). After applying this methodology, the total number of tools equaled 1,451. Looking at different use-wear on each EU allows for a more precise measure of technological tool types. Hayden et al (1996) state:

We feel that in order to separate tools used for single types of tasks from those used for a diverse array of tasks, it is essential to use more precise measure than the number of employable units per tool. These could include different types of retouch on the same tool...or different types of use wear. (13)

Since this method was only practical for flake tools, I did not apply it to bifaces, projectile

points, slate scrapers or ground stone. Any of these four tool types that had multiple functions were included in the Multiuse tool category. A final measure for the presence of recycling and serial reuse was to calculate how many tools were noticeably reused/recycled after a break as well as repurposed after initial use. As stated previously bipolar core and *piece esquillees* were both also indicative of material conservation and were included in the counts for recycled tools. These methods were employed to gain insight into the lithic technological strategies applied at Bridge River and were used successfully to produce the results in the following chapter.

CHAPTER 6

ANALYSIS OF THE LITHIC ASSEMBLAGE

This chapter will examine the lithic technological strategies applied at Bridge River Village. The analysis will evaluate if raw material conservation strategies were being applied during winter occupation to help cope with the risk of exhausting raw material. My hypothesis will be tested against my research expectations to further understand the lithic technology used during the Fur Trade era. This chapter is broken down into two sections: debitage data and tool data.

DEBITAGE DATA

In the previous chapter, I argue that limited raw materials would result in a higher frequency of late stage reduction and reduction intensity. Debitage can reveal a great deal about production stage. In 1985, Sullivan and Rozen published an “interpretation free” method of debitage analysis based on a hierarchical key of flake completeness (See Fig. 5.1). When it was originally published, this methodology was met with criticism concerning the lack of empirical experiments (Amick and Mauldin 1989; Ensor and Roemer 1989; Prentiss and Romanski 1989; Prentiss 1998); however, with more experimentation over time it has been shown that the simplicity and replicability of this method makes it a useful classification (Bradbury and Carr 1995; Prentiss 1998, 2000). Most of the experiments sought to evaluate the effects of assemblage variability such as raw material type, trampling, and size. The Sullivan-Rozen Typology (SRT) has been used as a means to establish the effects of core reduction versus tool reduction. Core reduction is assumed to produce more complete, split, and nonorientable fragments, while tool production results in higher quantities of proximal and medial/distal

fragments (Sullivan 1987; Sullivan and Rozen 1985, 1989). Many of the experimental work that followed the original SRT tests found that most diagnostic categories for identifying different reduction stages were proximal and nonorientable fragments not complete and medial/distal flakes as Sullivan and Rozen had argued (Bradbury and Carr 1995; Kuijt et al. 1995; Morrow 1997; Prentiss 1993; Prentiss and Kuijt 1988:9; Prentiss and Romanski 1989). In Prentiss' 1998 experiment to test the validity and reliability of the SRT, she found that the resulting data for core versus tool reduction are often homogenized. She argues that these data patterns may be more suited for recognizing more precisely defined activities instead of the more ambiguous "tool" versus "core" data (Prentiss 1998). Prentiss' later research (2001) suggests that the ambiguity problems may be a result of applying the typology without taking size variability into consideration. By adding a series of size classes (see size classes in Methods Chapter), she found that this effectively brought the typology from 5 to 20 flake types. In her examination of the modified SRT, or MSRT, Prentiss found that core and tool reduction did indeed produce distinct debitage distributions. Core reduction assemblages tended to have more numerous large complete, proximal and split flakes as well as medium medial/distal and small nonorientable fragments. Tool reduction proved to produce more small medial/distal and proximal fragments with very few nonorientable fragments. Similarly, Austin (1999) successfully uses the SRT to distinguish between patterned tool reduction and reduction of cores. He found that he achieved reliable results using a two-group separation between patterned tools and core reduction assemblages. When a third category was added to the data (bipolar core reduction) the SRT proved to be even more successful in discriminating between groups with 95% of the assemblages correctly assigned to the appropriate group (Austin 1999).

In my analysis of the debitage from HP 54, I rely on the MSRT and analyze the SRT in

conjunction with size classes. The majority of the flakes recovered during excavation were Medial/Distal (see Table 6.1).

Table 6.1. The Number and Percentage of Debitage in Each MSRT Category.

Modified Sullivan and Rozen Typology (MSRT)					
	Complete	Medial/Distal	Proximal	Non-Orientable	Split
Amount	174	7962	2116	122	130
Percentage	2%	76%	20%	1%	1%

The next most represented category was Proximal, and a high number of small proximal flakes can be indicative of tool reduction and edge modification of prepared cores (Prentiss 1998, 2001). The least represented type is nonorientable, which demonstrates a lack of core reduction. A Chi Square test comparing size to MSRT and revealed a significant association between flake size and flake type, $\chi(16) = 143.6$, $p = .000$, $\alpha = .05$. However, this data output had a high number of cells (48%) have counts less than 10, which means one of the assumptions of chi-square may have been violated, and thus, the results may not be meaningful. In order to rectify this issue, I reran the chi-square test after combining the Medium, Large, and Extra Large Size categories. I also deleted the nonorientable category as it only represented a total of 7 flakes that were diagnostic. The Chi Square test comparing size and MSRT again revealed a significant association between flake size and flake type, $\chi(6) = 99.3$, $p = .000$, $\alpha = .05$. No cells were present with values less than 10, and the Crosstabulation (Table 6.2) showed proximal flakes represented 49% of the Small size category followed by 21% of the proximal flakes in the Extra Small size category showing that tool production was likely the activity of focus during the winter not core reduction.

Table 6.2. Crosstabulation of MSRT and Size Category.

MSRT * Size Crosstabulation

		Size			Total	
		Xsmall	Small	Medium to Large		
MSRT	Complete	Count	63	69	42	174
		Expected Count	43.3	104.6	26.1	174.0
		% of Total	2.4%	2.6%	1.6%	6.6%
	Proximal	Count	553	1290	268	2111
		Expected Count	525.3	1269.0	316.7	2111.0
		% of Total	21.1%	49.2%	10.2%	80.6%
	Split	Count	23	78	23	124
		Expected Count	30.9	74.5	18.6	124.0
		% of Total	0.9%	3.0%	0.9%	4.7%
	Medial/Distal	Count	13	138	60	211
		Expected Count	52.5	126.8	31.7	211.0
		% of Total	0.5%	5.3%	2.3%	8.1%
Total	Count	652	1575	393	2620	
	Expected Count	652.0	1575.0	393.0	2620.0	
	% of Total	24.9%	60.1%	15.0%	100.0%	

The MSRT approach can also be used to further explore how debitage reflects evidence of bipolar reduction. Kuijt et al. (1995) conducted an experiment to further understand bipolar reduction using the Sullivan and Rozen Typology by reducing dacite following the ethnographic observations of Teit (1900). They found that in general a bipolar reduction assemblage is characterized by a high frequency of non-orientable and medial/distal fragments, as well as a low percentage of complete and proximal flakes. While there is a high number of medial/distal flakes and a low percentage of complete, the low number of non-orientable flakes in conjunction with the high percentage of proximal flakes does not match this model. Additionally, it has been established that medial/distal flakes can be produced under a number of circumstances and, therefore, less diagnostic. This would again support that tool reduction, rather than core

reduction, was the most prevalent activity occurring during the winter down time; however, there is still a substantial amount of evidence that bipolar reduction was occurring, which will be explored later in the Tool Data section. While MSRT can give us insight into the type of reduction occurring at a site, it cannot reveal much about reduction stage (Austin 1999), so to further explore reduction stage I examine cortex percentages, size, and technological flake type.

In the analysis of debitage, one of the most common typological approaches uses the primary/secondary/tertiary (PST) categories to correlate reduction stage (White 1963). Primary flakes are removed during the first stages of reduction, secondary during further core reduction, and tertiary during late stages of tool and core reduction (Bradbury and Carr 1995). The percentage of cortex is a major criterion in determining PST types. Although assessing the amount of cortex present as a means to define reduction stage has been done for decades, there are some criticisms of its application (Ahler 1989b; Ingbar et al. 1989; Sullivan and Rozen 1985). Some of these criticisms include: inconsistencies in recording the amount of cortex cover, unstandardized means of defining the proportion of cortex for flake type, flake types only being reliable on complete flakes (Bradbury and Carr 1995). The biggest issue is the inconsistency in defining how much cortex is present for each PST category, which makes it difficult to compare one analysis to another. I argue the significant difference in the amount of tertiary versus secondary/primary flakes in the data recovered from HP 54 makes these criticisms moot (See Table 6.3). Even with secondary and primary types combined versus tertiary, there is a large difference in the amount of flake types in the assemblage. Combined Primary and Secondary flakes only represent 4% of the assemblage while Tertiary flakes represent 96%.

Table 6.3. The Number and Percentage of Debitage in Each Cortex Category.

Reduction Stages (Cortex %)			
	Primary	Secondary	Tertiary
Amount	22	403	10,079
Percentage	.2%	3.8%	96%

As another measure, I separated complete flakes from the rest of the data to reduce the possibility of ambiguous results with fragmented flakes (See Table 6.4). When just looking at Complete flakes, there was still a significant difference in Primary/Secondary flakes (11.5%) compared to Tertiary flakes (88.5%). This shows that it is likely that a large percentage ofdebitage was produced during late stages of reduction, however, it should be noted that this could also occur from the transport of decorticated cores to the housepit.

Table 6.4. The Number and Percentage of Complete Flakes in Each Cortex Category.

Reduction Stages (Cortex %)			
	Primary	Secondary	Tertiary
Amount	1	19	154
Percentage	.5%	11%	88.5%

Size is another factor that has long been important in lithic analysis. It is generally believed that the size of the flake is directly related to the size of the objective piece (Andrefsky 2005). This means that thedebitage size decreases as the artifact nears completion, so the smaller the tool generally the smaller the flake removed from it. This does not mean larger flakes are always removed before smaller flakes, but generally, flake sizes during removal will follow a general pattern of decreasing size (Andrefsky 2005). Following Prentiss' 2001 MSRT size categories, I separateddebitage into size ranges (extra small (<.64 sq cm), small (.64 to 4 sq cm), medium (4 to 16 sq cm), large (16 to 64 sq cm), and extra large (>64 sq cm). In the

assemblage recovered from HP54 approximately 90% of the debitage fell into the small and extra small size ranges (see Table 6.5). The medium size range represented 9% of the assemblage while the large and extra large categories represented less than 1% of the debitage. Again, this demonstrates that mostly late stage reduction was occurring during the winter occupation of housepit 54 in the Bridge River Village. It also demonstrates that many of the tools being produced were likely smaller in size, which will be discussed further in the next section.

Table 6.5. The Number and Percentage of Debitage in Each Size Category.

Debitage Sizes					
	XLRG (>64 cm ²)	LRG (16-64 cm ²)	MED (4-16 cm ²)	SM (.64-4 cm ²)	XSM (<.64 cm ²)
Amount	5	43	936	6506	3014
Percentage	.04%	.4%	9%	62%	29%

Finally, the last step in the debitage analysis is to separate the artifacts into their respective technological classifications. For this study seven technological types were identified: Early Stage Reduction Flake, Bifacial Thinning Flake, Bipolar Flake, Retouch Flake, 'R' Billet Flake, Core Rejuvenation Flake, and Notch Flake. Medial/Distal Flakes could not be typed and were not included in the technological analysis of the assemblage. The most represented technological category is the retouch flake followed by the bipolar flake (see Table 6.6).

Table 6.6. The Number and Percentage of Identifiable Technological Types in Debitage

Technological Types							
	Early Stage	Thinning Flake	Bipolar Flake	Retouch Flake	'R' Billet Flake	Core Rejuvenation Flake	Notch Flake
Amount	107	139	269	2056	42	11	3
Percentage	4%	6%	10%	78%	1.5%	.4%	.1%

The high amount of retouch flakes indicates late stage reduction was likely occurring. The low number of early stage flakes indicates the off-site core reduction may have been a part of the technological strategy at Bridge River. The presence of bipolar flakes would also seem to demonstrate that the main core strategy applied was that of bipolar core reduction, which would have provided the most efficient use of materials present, especially if the cores and flake blanks had been produced off-site. However, it has been noted that bipolar flakes are not necessarily always connected to a bipolar reduction strategy (Ahler 1989a; Barham 1987; Magne 1985). Bipolar flakes can also be produced from hard hammer edge reduction, but bipolar flakes are generally produced “sporadically and in small numbers in a variety of non-bipolar flaking operations” (Ahler 1989a:211).

In general, thedebitage data support the hypothesis that late stage production of tools was occurring at Bridge River during the winter occupation. While some of the results are more ambiguous, these data give a preliminary understanding of the kind of reduction occurring the site, which was intensive tool production and a reliance on bipolar reduction to conserve raw material with limited freehand core reduction as demonstrated by only 107 early stage reduction flakes. This will be further explored by analyzing the tool data in the next section.

TOOL DATA

Teit's ethnographic descriptions indicate the primary focus of winter villages in the Mid Fraser Canyon was on wood and hide-working, using tools such as knives and scrapers. The lithic technological strategies applied to successfully carry out these tasks would have been impacted by the need to conserve raw materials so immediate tools needs and future needs could be met. The focus on producing and maintaining tools, clothing, and hides should be reflected in the tools found during the 2012 excavation of HP54. Conservation of raw material, to combat material shortages that would occur over the three months of winter occupation, should be reflected in the data by the presence of flake tools (for serial use) and bipolar reduction techniques. Table 6.7 and Figure 6.1 break down the tool types present in the assemblage. Unifacial (28%) and groundstone (27%) tools made up the majority of the assemblage followed by cores (16%) and bifacial tools (12%). Within the unifacial and groundstone categories, 46% were scrapers and 13% were knives, which means of the most represented tool categories, approximately 60% were scrapers and knives.

Table 6.7. Number and percentage of tool types in each typological category.

Morpho-Functional Tool Types								
	Bifacial	Unifacial	Groundstone	Projectile Points	Cores	Ornamental	Multifunctional	Other
Amount	172	413	391	165	235	31	41	3
Percentage	12%	28%	27%	11%	16%	2%	3%	1%

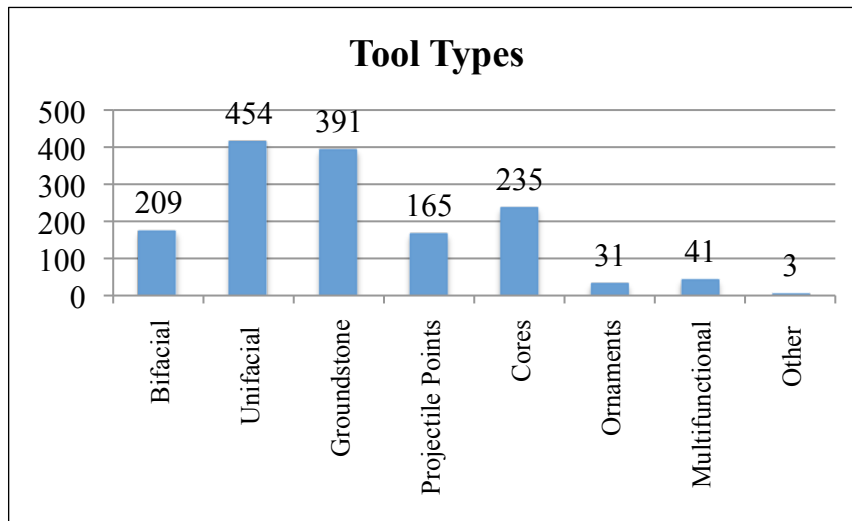


Figure 6.1. Column graph of tool types.

These tool types likely indicate a high frequency of hide processing, which supports the ethnographic descriptions of Teit. The most represented tool is the slate scraper. A total of 209 slate scrapers are present, which represents 14% of the whole assemblage, again showing a focus on hide-work.

Cores made up 16% of the assemblage. It is important to note that of the cores present, approximately 91% were bipolar reduced (see Table 6.8 and Fig. 6.2). Once a raw material loses its mass to a certain point, there is no other means of obtaining flakes except by hitting it with a hammerstone on an anvil. The only exception being microblade cores, which are not present in the assemblage. When the size of a tool kit becomes constrained and raw material sources are unavailable, the bipolar reduction strategy is implemented.

Table 6.8. Number and percentage of core types in tool assemblage.

Core Types				
	Bipolar Core	Unidirectional Core	Multidirectional Core	Small Flake Core
Amount	213	5	14	1
Percentage	91.4%	2%	6%	.6%

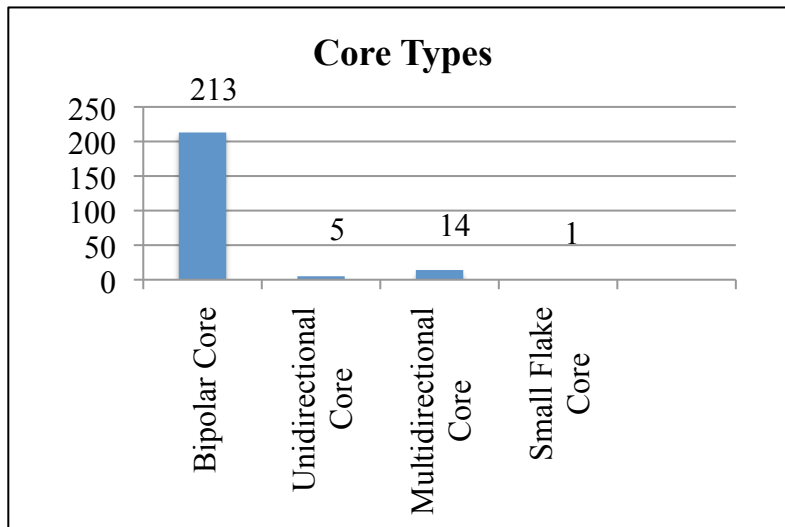


Figure 6.2. Column graph of core types.

The high number of bipolar cores shows that the need to conserve and recycle raw materials was present in the pithouse. Bipolar cores can often be underrepresented in an assemblage making it difficult to determine if the strategy was carried out (Kuijt et al. 1995), so observing such a high percentage of bipolar cores is significant in showing that this method of reduction was dominant at the Bridge River Village. With low supplies of raw material, the practice of intensive recycling through bipolar reduction is an effective and rational means of dealing with a tool replacement problem (Goodyear 1989). A variety of ethnographic studies indicate that the bipolar technique can produce flakes of suitable size for use as tools (Goodyear 1993; Hayden 1980; Stafford 1981). It has been suggested that even tools as small as 2cm could be hafted (Goodyear 1993). Because of the small nature of bipolar cores, the size of the tools produced from reduction would likely also be small. This is supported by the data recovered from Housepit 54.

Size variation is a useful measure for comparative raw material use and tool retouch. It can generally be expected that tools discarded earlier in their use-lives would have larger masses, and

tools with longer and higher reduction would be smaller. Due to the raw material scarcity during the winter months, I expect tools to have longer use-lives and, thus, be smaller in mass. The tool sizes from the HP54 assemblage had a noticeable trend. Nearly 80% of the tools fell into the small and medium size categories (See Table 6.9 and Fig. 6.3). Large tools represented 18% of the assemblage while extra small and large made up only 4% total.

Table 6.9. Number and percentage of tools in each size category.

Tool Sizes					
	XLRG (>64 cm ²)	LRG (16-64 cm ²)	MED (4-16 cm ²)	SM (.64-4 cm ²)	XSM (<.64 cm ²)
Amount	39	244	529	557	18
Percentage	3%	18%	38%	40%	1%

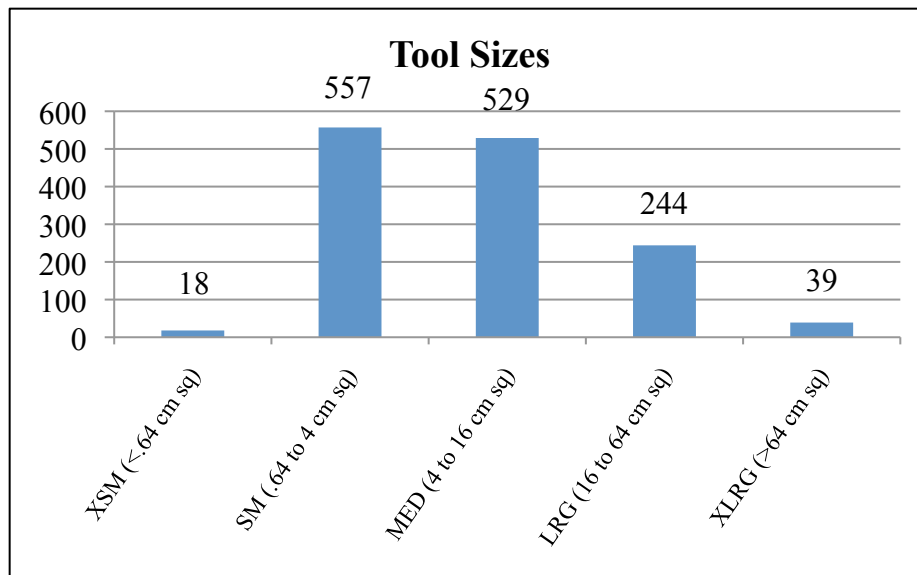


Figure 6.3. Column graph of tool sizes.

I had expected a more noticeable separation from small to medium sizes, since each of these size categories were represented almost equally I further sorted the classes (See Table 6.10). Looking

at the trend in tool sizes after the small and medium categories are broken down from .64-16 cm² it is clear that the majority of tools range from .64-6 cm² (See Fig. 6.4) This shows that the larger tool sizes in the “Medium” category are the least represented, and the highest percentage of tools range from 2-4 cm².

Table 6.10. The number and percentage of tools within the small (.64-4 cm²) and medium (4-16cm²) tool size categories.

Breakdown of the Small and Medium Tool Size Categories								
	.64-2 cm ²	2-4 cm ²	4-6 cm ²	6-8 cm ²	8-10 cm ²	10-12 cm ²	12-14 cm ²	14-16 cm ²
Amount	199	358	207	136	80	42	40	24
Percentage	18%	33%	19%	13%	7%	4%	4%	2%

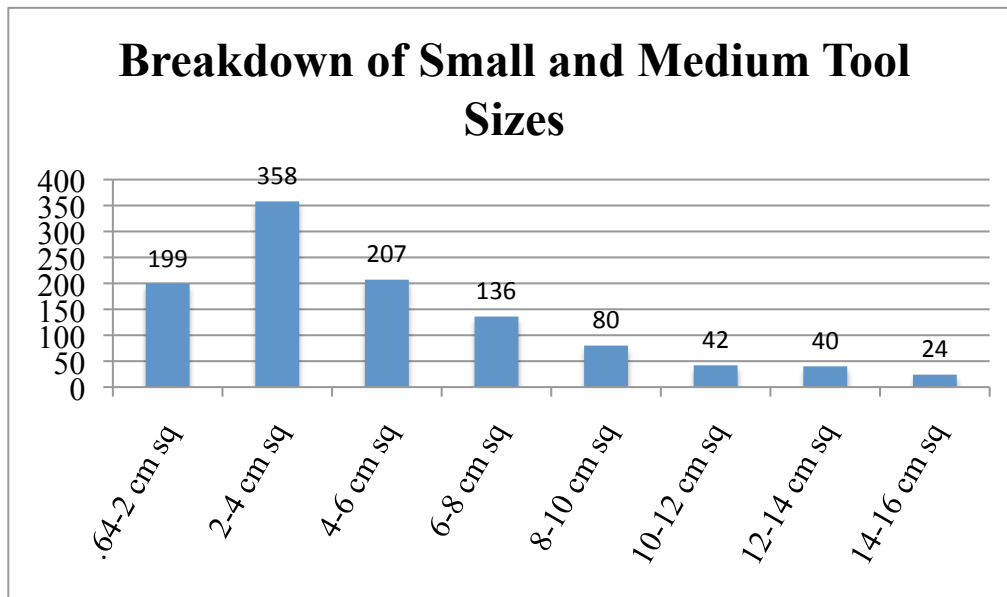


Figure 6.4. Column graph of tools in the small and medium size categories.

To further explore tool size, statistical analysis was run in order to assess the relationship between tool type versus tool size. Two different statistical tests were run: One-way Analysis of Variance (ANOVA) and a Two Sample T-Test (see all statistical Output in Appendix E). The

ANOVA is a useful test; it can compare each variable (tool type) and show if their mean size is significantly different. The one-way between subjects analysis of variance revealed a reliable effect of tool type on size, $F(5, 1349) = 56.2$, $p = .000$, $MS_{error} = 453$, $\alpha = .05$. A Tukey post-hoc test revealed that the mean size of groundstone was statistically significantly larger (27.6 ± 30.8) than all other tool categories, which all have a mean size less than 10cm^2 (See Fig. 6.5 and Table 6.11). The Tukey post-hoc test also revealed that projectile points (2.35 ± 1.5) were significantly smaller when compared to unifaces (9.1 ± 16.5). There were no statistically significant differences between cores, unifacial, multifunctional, or bifacial tools. Due to the substantial difference of groundstone from all other tool categories, the one-way ANOVA was run again excluding groundstone from the data.

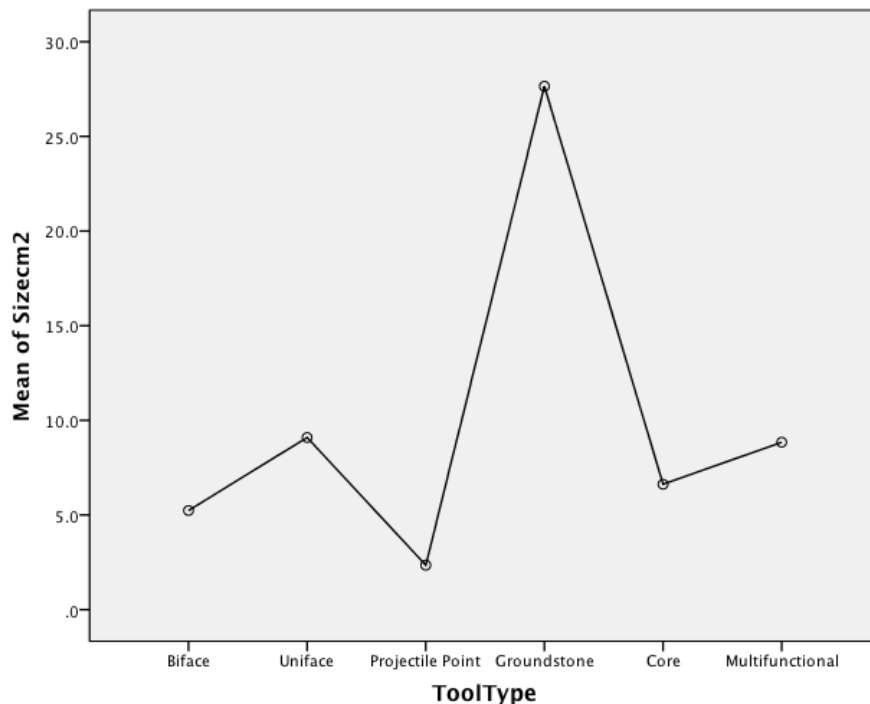


Figure 6.5. Mean plots of tool type in relation to tool size.

Table 6.11. Multiple Comparisons of Tool Type Means with Significant (>.05) Values Highlighted

Multiple Comparisons

Dependent Variable: Sizecm2

Tukey HSD

(I) ToolType	(J) ToolType	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Biface	Uniface	-3.8576	2.0229	.398	-9.631	1.915
	Projectile Point	2.8866	2.3404	.820	-3.792	9.566
	Groundstone	-22.4103	1.9617	.000	-28.009	-16.812
	Core	-1.3876	2.1605	.988	-7.553	4.778
	Multifunctional	-3.6066	2.8086	.794	-11.622	4.409
Uniface	Biface	3.8576	2.0229	.398	-1.915	9.631
	Projectile Point	6.7443	2.0513	.013	.890	12.598
	Groundstone	-18.5526	1.6059	.000	-23.136	-13.970
	Core	2.4701	1.8435	.763	-2.791	7.731
	Multifunctional	.2511	2.5727	1.000	-7.091	7.593
Projectile Point	Biface	-2.8866	2.3404	.820	-9.566	3.792
	Uniface	-6.7443	2.0513	.013	-12.598	-.890
	Groundstone	-25.2969	1.9910	.000	-30.979	-19.615
	Core	-4.2742	2.1871	.370	-10.516	1.967
	Multifunctional	-6.4932	2.8291	.197	-14.567	1.581
Groundstone	Biface	22.4103	1.9617	.000	16.812	28.009
	Uniface	18.5526	1.6059	.000	13.970	23.136
	Projectile Point	25.2969	1.9910	.000	19.615	30.979
	Core	21.0227	1.7761	.000	15.954	26.091
	Multifunctional	18.8037	2.5249	.000	11.598	26.009
Core	Biface	1.3876	2.1605	.988	-4.778	7.553
	Uniface	-2.4701	1.8435	.763	-7.731	2.791
	Projectile Point	4.2742	2.1871	.370	-1.967	10.516
	Groundstone	-21.0227	1.7761	.000	-26.091	-15.954
	Multifunctional	-2.2190	2.6822	.963	-9.874	5.436
Multifunctional	Biface	3.6066	2.8086	.794	-4.409	11.622
	Uniface	-.2511	2.5727	1.000	-7.593	7.091
	Projectile Point	6.4932	2.8291	.197	-1.581	14.567
	Groundstone	-18.8037	2.5249	.000	-26.009	-11.598
	Core	2.2190	2.6822	.963	-5.436	9.874

When groundstone was removed from the multiple comparisons, the one-way between subjects analysis of variance again revealed a reliable effect of tool type on size, $F(4, 962) = 5.62$, $p = .000$, $MS_{error} = 251.8$, $\alpha = .05$. A Tukey post-hoc test again revealed there was no significant difference between cores, unifacial, multifunctional, and bifacial tools; however, projectile points (2.35 ± 1.5) were found to be significantly different from unifacial tools (9.1 ± 16.5) as well as multifunctional tools (8.8 ± 9.5) once groundstone was removed from the data (See Fig. 6.6 and Table 6.12). Another interesting statistic revealed during the Tukey post-hoc test was that unifacial tools and multifunctional tools had no difference between groups with $p = 1.000$, $\alpha = .05$. Besides examining the difference of mean size between tool types, I was also interested in exploring the relationship between size and tool curation (expedient v. formal).

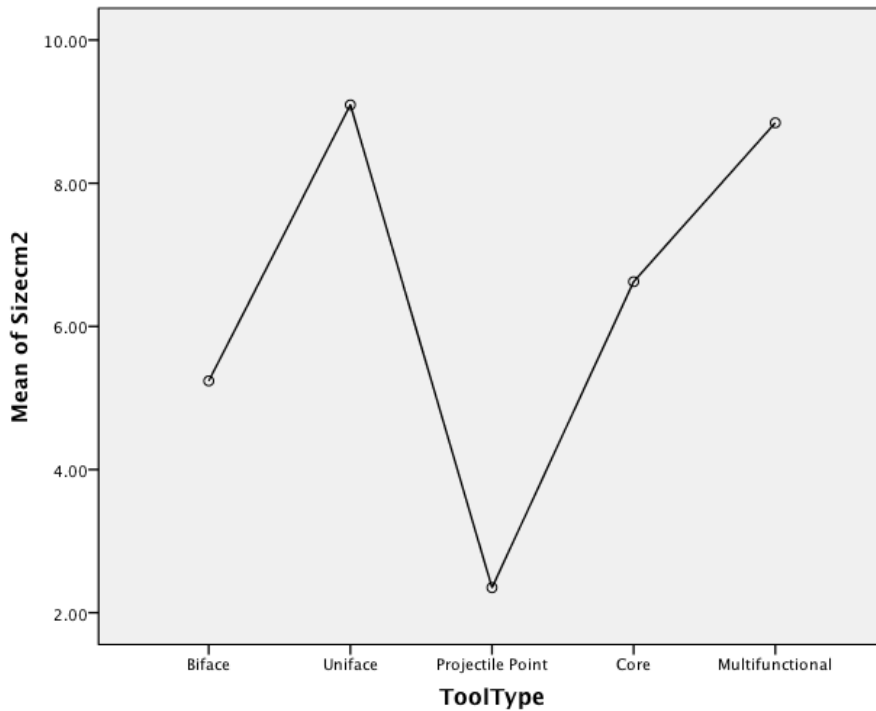


Figure 6.6. Mean Plot of Tool Types in Relation to Tool Size without Groundstone.

Table 6.12. Multiple Comparisons of Tool Type Means with Significant (>.05) Values Highlighted without Groundstone

Multiple Comparisons

Dependent Variable: Sizecm2

Tukey HSD

(I) ToolType	(J) ToolType	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Biface	Uniface	-3.85763	1.50799	.079	-7.9789	.2636
	Projectile Point	2.88664	1.74466	.463	-1.8814	7.6547
	Core	-1.38757	1.61058	.911	-5.7892	3.0141
Uniface	Multifunctional	-3.60656	2.09370	.420	-9.3285	2.1154
	Biface	3.85763	1.50799	.079	-.2636	7.9789
	Projectile Point	6.74428	1.52919	.000	2.5651	10.9235
	Core	2.47006	1.37424	.376	-1.2857	6.2258
Projectile Point	Multifunctional	.25107	1.91785	1.000	-4.9903	5.4925
	Biface	-2.88664	1.74466	.463	-7.6547	1.8814
	Uniface	-6.74428	1.52919	.000	-10.9235	-2.5651
	Core	-4.27421	1.63044	.067	-8.7301	.1817
Core	Multifunctional	-6.49320	2.10901	.018	-12.2570	-.7294
	Biface	1.38757	1.61058	.911	-3.0141	5.7892
	Uniface	-2.47006	1.37424	.376	-6.2258	1.2857
	Projectile Point	4.27421	1.63044	.067	-.1817	8.7301
Multifunctional	Multifunctional	-2.21899	1.99952	.801	-7.6836	3.2456
	Biface	3.60656	2.09370	.420	-2.1154	9.3285
	Uniface	-.25107	1.91785	1.000	-5.4925	4.9903
	Projectile Point	6.49320	2.10901	.018	.7294	12.2570
	Core	2.21899	1.99952	.801	-3.2456	7.6836

As discussed in the previous chapter, I hypothesize that more expedient tools would be present in the HP54 assemblage. It has often been argued that a winter pithouse environment would be more conducive to the formal curation of tools that are more reliable over time. I argue, however, that the reuse of expedient tools was the main strategy implemented at Bridge River. The data revealed an almost even split between expedient and formal tools (see Table

6.13). A total of 737 expedient tools were present and 720 formal tools.

Table 6.13. Number and Percentage of Expedient and Formal Tools.

Tool Curation		
	Expedient	Formal
Amount*	737	720
Percentage	51%	49%

*Data does not include Ornaments

This does not follow the expectation of a heavy reliance on expedient tools, and instead, it may show that the people of Housepit 54 relied heavily on the Groundstone industry (which accounted for approximately 391 of the formal tools – most of them being slate scrapers). As mentioned previously in this section, slate scrapers represent 14% of the assemblage. While ground slate tools were classified in this study as formal tools, they may well have been used in a more expedient manner given the fact that most had very limited to no evidence for actual grinding and polishing on tool faces or margins. If this is the case then the lithic tool assemblage is truly dominated by situational need tools. Informal testing at the Bridge River site carried out in 2013 showed that a slate scaper could be created in less than a minute and show similar use-wear as that found in the 2012 assemblage after 700 to 1000 strokes on a hide. While more experimentation is needed, these initial findings show that slate scrapers may be more ambiguous in regards to formal or expedient use. If slate scrapers are removed from the data due to their ambiguous nature, the number of formal tools drops to 511. This would result in 59% of the assemblage being expedient and 41% formal. While this is still only a twenty percent difference between expedient and formal tools present, it shows that expedient tools may have been more represented than initially observed.

With the expectation of expedient tools dominating the assemblage, I also anticipated the size of expedient tools to be significantly smaller than formal tools. Although expedient tools

did not make up a large portion of the assemblage, a two-sample T-test found that expedient mean tool sizes (7.7 ± 18.6) were statistically significantly smaller than formal tool mean sizes (17.7 ± 26.3), $t = 8.1$, $p = .000$, $\alpha = .05$. This demonstrates that expedient tools did tend to be smaller in size than formal tools; however, projectile points, which are classified as formal tools, represented the tool type with the smallest tool mean size. Groundstone again likely affected the significant size difference between expedient and formal tools. If slate scrapers are deleted (again due to their ambiguous nature), the T-test still shows expedient tools (7.7 ± 18.6) to be significantly smaller than formal tools (13.1 ± 27), $t = 3.9$, $p = .000$, $\alpha = .05$. The results discussed here indicate that the formation process of all these tools may be more complex than anticipated. Some tools, be they formal or expedient, may have also undergone serial expedient use.

Serial expediency involves a tool undergoing use in multiple occasions, which should manifest in the archaeological record as higher frequencies of retouched tools and lower frequencies of discarded unbroken, usable tools (Bamforth 1986). The final expectation for this research is that raw material shortages would result in frequent recycled and multiuse tools. Overall, 386 tools were found to show evidence of recycling or multiuse making up 28% of the assemblage (see Table 6.14).

Table 6.14. The Number and Percentage of Multifunctional Tools and Recycled Tools

Multiuse and Recycled Tools			
	Multiuse	Recycled/Reused*	Total
Amount	66	320	386
Percentage	5%	23%	28%

*This count includes all bipolar cores and *piece esquillees*

While the number of multiuse tools (5%) was not as high as expected, the frequency of tools that

showed recycling (23%) demonstrates that some strategy of raw material conservation was being implemented. Additionally, other tools may have been reworked but unfortunately were not identifiable. Table 6.15 gives a detailed list of each tool that showed distinct evidence of reuse or recycling.

Table 6.15. List of Tools that Show Evidence of Reuse and/or Recycling

Tool Type	Use-Wear	Retouch	Description
Bipolar Core	N/A	N/A	A total of 213 bipolar cores are present in the assemblage
Bipolar Core	N/A	N/A	21 tools were bipolar reduced after their initial use
<i>Piece Esquillees</i>	N/A	N/A	A total of 70 <i>piece esquillees</i> are present in the assemblage
Unifacial Knife	Rounding, polish	Semi-Abrupt Step/Scalar	Unifacial knife that broke and then utilized as a small piecer
Biface	None	Semi-Abrupt Scalar	Biface was further reduced after a break
Double Scraper	Bright polish, rounding, perpendicular striations	Abrupt Scalar	One of the EUs broke and was resharpened on the break
Single Scraper	Rounding/bright polish	None	<i>Piece Esquillees</i> broke and the break was then used as a scraper
Used Truncation	Bright polish, rounding, perpendicular striations	None	Likely planed hard material such as bone; used truncation after biface snapped
Unifacial Knife	None	Semi-Abrupt to Invasive Scalar	Unifacial knife with hafting element that has bifacial retouch on haft; proximal end was broken before use
Pendant Fragment	Drilling/incised	None	Broken tubular pipe incised to create tie off for pendant
Adze Fragment	Rounding polish	None	Tip of adze fragment used as borer
Small Piercer	Rounding, striations, perpendicular chipping	Semi-Abrupt Step/Hinge	Piercer made from distal tip of a biface
Drill	Polish, rounding on tip	Abrupt Scalar	Drill made on point that was resharpened after possible break to create bifacial side-notched drill
Biface	Rounding, oblique chipping, with crushing and perpendicular striations	Semi-Abrupt Scalar	Steep retouch truncation on a snapped biface
Biface	Perpendicular and Parallel Striations	Invasive Scalar	A point perform that was used as a bifacial scraper and knife
Bifacial Knife	Crushing, polish, parallel striations	Invasive Scalar	Retouched into bifacial knife after use as a scraper
Biface	Crushing	Semi-Abrupt Scalar	Attempt to rejuvenate biface after a snap but failed
Bifacial Borer	Rounding	Abrupt Scalar	Borer that was made from a reduced Kamloops point
Slate Scraper	Rounding, perpendicular striations	None	Most of the use wear present is on a break

DISCUSSION

The analysis of the HP54 lithic assemblage suggests that some risk minimizing techniques may have been implemented to help conserve raw material. It was hypothesized that limited raw material access would result in more late stage tool reduction. This was supported by the data. The analysis of the lithic debitage showed consistent evidence of late stage tool production, with small retouch flakes dominating the assemblage and tertiary flakes representing 96% of the assemblage. I also expected a high number of bipolar cores. Overall there were a total of 233 cores in the assemblage, and of the cores present 213 were bipolar, supporting the hypothesis that a bipolar reduction strategy was implemented. This suggests that the people had to extract as much as possible from the materials within the house. Twenty-one tools also were also bipolar reduced after their initial use, further demonstrating a strategy of bipolar reduction from seemingly exhausted materials.

Another expectation was that the assemblage would be dominated by 'Small' tool sizes. The majority of tools are under 4 cm², although a substantial portion of tools also fell into the 'Medium' category. However, further examination showed that the highest percentage of tools in the medium size category were smaller than 6cm². The trend of tool sizes supports the hypothesis of high reduction intensity leading to smaller tools. Finally, there was a high number of reused/recycled tools. While the assemblage had a lower frequency of multiuse tools than hypothesized, there seems to be a trend of serial reuse present as represented by the high reduction intensity and the lack of discarded useable tools. I had anticipated the assemblage to be dominated by expedient tools, and with the inclusion of slate tools, the count of formal and expedient tools was nearly equal. However, there is also evidence that some of the more formalized slate scrapers may have been used in an expedient manner because most had very

limited to no evidence for actual grinding and polishing on tool faces or margins. Informal testing also demonstrated that slate tools could be created easily and their application of use not very extensive. While this does not definitively show that slate tools were more likely to be used expediently during winter occupation, it does imply that the slate assemblage is not clearly formal; therefore, expedient tools may indeed dominate the assemblage. It is clear, however, that the people who occupied HP54 during the winter months were carrying out raw material conservation methods, such as bipolar reduction, and focusing on tool production as evident by high reduction intensity.

CHAPTER 7

CONCLUSIONS

The research presented in this thesis was approached with the hope of further understanding the affects of risk and raw material availability on technological strategies. I believe this study shows that the risk of loss (be it loss of raw material or the ability to hunt) does affect how people approach lithic technology. By defining testable variables to assess the lithic strategies carried out at Bridge River Village, I was able to identify evidence of techniques applied to extend the use-life of tools, such as bipolar reduction and the recycling of broken tools. Looking at specific indicators of resource conservation, instead of trying to identify vague characteristics such as reliability and maintainability, allows for a more conclusive understanding of the assemblage and what technological techniques were being applied. This is not to say that there are not some vagaries within this research design. For one, the presence of more late stage reduction and high reduction intensity can be present in many different cultural systems and do not necessarily indicate resource conservation. However, in conjunction with my other expectations, the presence of late stage reduction and high reduction intensity further supports the ethnographic prediction that during the winter months, the Bridge River peoples would focus on tool production. Some of the formal tools such as bifaces and end scrapers were likely produced for use during the spring and summer months, and the high frequency of projectile points (165) also demonstrates that winter hunting was occurring reminiscent of the ethnographic descriptions by Teit (1900, 1906, 1909). The production of flake tools during the winter downtime would aid in winter food preparation, hide-working, and allow them to “gear up” for anticipated spring activities. The focus on tool production and the presence of conservation techniques, such as bipolar reduction and tool reuse, demonstrate that stockpiling of raw

materials likely did occur as it was described ethnographically. Finally, the high frequency of slate tools indicates a heavy focus on hide working, which is again predicted by the ethnographic record. Slate scrapers dominated the assemblage and were primarily chipped into form with only a few including grinding and marginal sawing. This implies a level of hide processing exceeding evidence in earlier deposits at Housepit 54 and elsewhere at Bridge River Village. This may imply a focus on hide work increased during the Fur Trade era, perhaps to meet the demands of trade.

The lithic analysis of the Housepit 54 floor assemblage suggests that some risk-minimizing techniques were implemented as a result of limited resource access. There was a heavy reliance on bipolar reduction as well as high reduction intensity, which suggests a need to extract as much from the raw materials as possible. The assemblage proved to have a significant number of tools smaller than 6cm^2 , demonstrating a need to extend the use of a tool for as long as possible. Projectile points had the smallest mean size in the assemblage; however, their small size likely reflects the style of point most common during this era (Kamloops), which tends to be smaller in size and thus may not indicate a need to conserve raw material. The small size of cores and expedient tools, however, does seem to indicate that some conservation was occurring. Tool production activities generated a wide range of tool forms that almost equally represent expedient and formal curation. While this did not follow my original expectation that expedient tools would dominate the assemblage, it does not necessarily disprove expedient use as the dominant strategy applied. There is some evidence that slate scrapers may have been used expediently, evident by the lack of marginal sawing and grinding. If slate scrapers are removed from the formal tool count as a result of their ambiguity, the frequency of expedient tools increases by 20%. This highlights the difficulty behind identifying a tool as expedient or formal.

The complex formation processes of these tools, with some being used expediently on multiple occasions, create a difficult task in correctly qualifying a tool as expedient or formal.

Previous research (Hayden et al 1996) has shown that expedient tools dominated the lithic assemblages in the Mid Fraser Canyon. Some have argued that expediency refers to minimized technological effort where time and place of use are highly predictable (Bleed 1986; Nelson 1991; Parry and Kelly 1987). This would seem to suggest that expediency would be present in conditions of sufficient time and materials. Parry and Kelly (1987) argue that the stockpiling or caching of raw materials would allow for constant availability of resources. I believe this research demonstrates that stockpiling does not provide a consistent source of raw materials. As the winter occupation continued, resources become more exhausted and conservation techniques were necessary to prevent a complete loss of inventory. Instead of a strategy only applied during times of plenty, expedient reuse was another means to extend the use of tools. Hayden et al.'s (1996) findings support this argument. Their research produced similar evidence of conservation techniques such as: small sizes of expedient tools and cores, high rates of breakage and reuse, multiple edge use, and bipolar reduction. However, in their research at Keatley Creek, Hayden, et al. (1996) largely ignore the bipolar core strategy and, instead, argue that the expedient block core strategy was the dominant strategy and provided the most efficient use of raw materials. They state that bipolar reduction produces a great deal of shatter and small flakes that would be wasteful of core material. The block, or multidirectional, core strategy involves removing flakes as needed, which are usually discarded after the immediate task is completed (Hayden et al 1996). My research shows that bipolar cores made up 91% of the core types present at Bridge River, while multidirectional cores only represent 6% of the assemblage. These results demonstrate the high importance of bipolar reduction in the

technological strategy applied at Bridge River. The low number of early stage reduction flakes also proves that very little freehand core reduction was taking place. This research does not focus on transportation costs or strategies and, therefore, offers less insight into how raw material was transported to the pithouse; however, it does show that once winter occupation began little early stage reduction was occurring and bipolar reduction was the dominant strategy implemented.

This research provides a greater level of understanding of how winter occupation in the Mid Fraser Canyon affected lithic strategies as well as enhances our understanding of the Fur Trade Era. For one, the Fur Trade might have had a more drastic affect on the lithic organization at Bridge River than previously expected, evident by the marked increase in slate scrapers. A comparative assemblage from earlier occupation periods would be extremely beneficial to this research, allowing for a more detailed analysis of how the Fur Trade affected lithic technology through time. It would also allow for more comparative data in relation to tool size, reuse and curation. The tool sizes demonstrated high production intensity was occurring during the winter downtime. Once the resources that had been stockpiled during the warmer months became depleted, bipolar reduction and serial reuse of tools was implemented in order to mitigate the loss of usable raw material. These conservation techniques enabled the people of Bridge River to successfully carry out winter activities and prepare for the spring hunt and trade seasons.

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APPENDIX A

Excavation Grid and Profile Balks

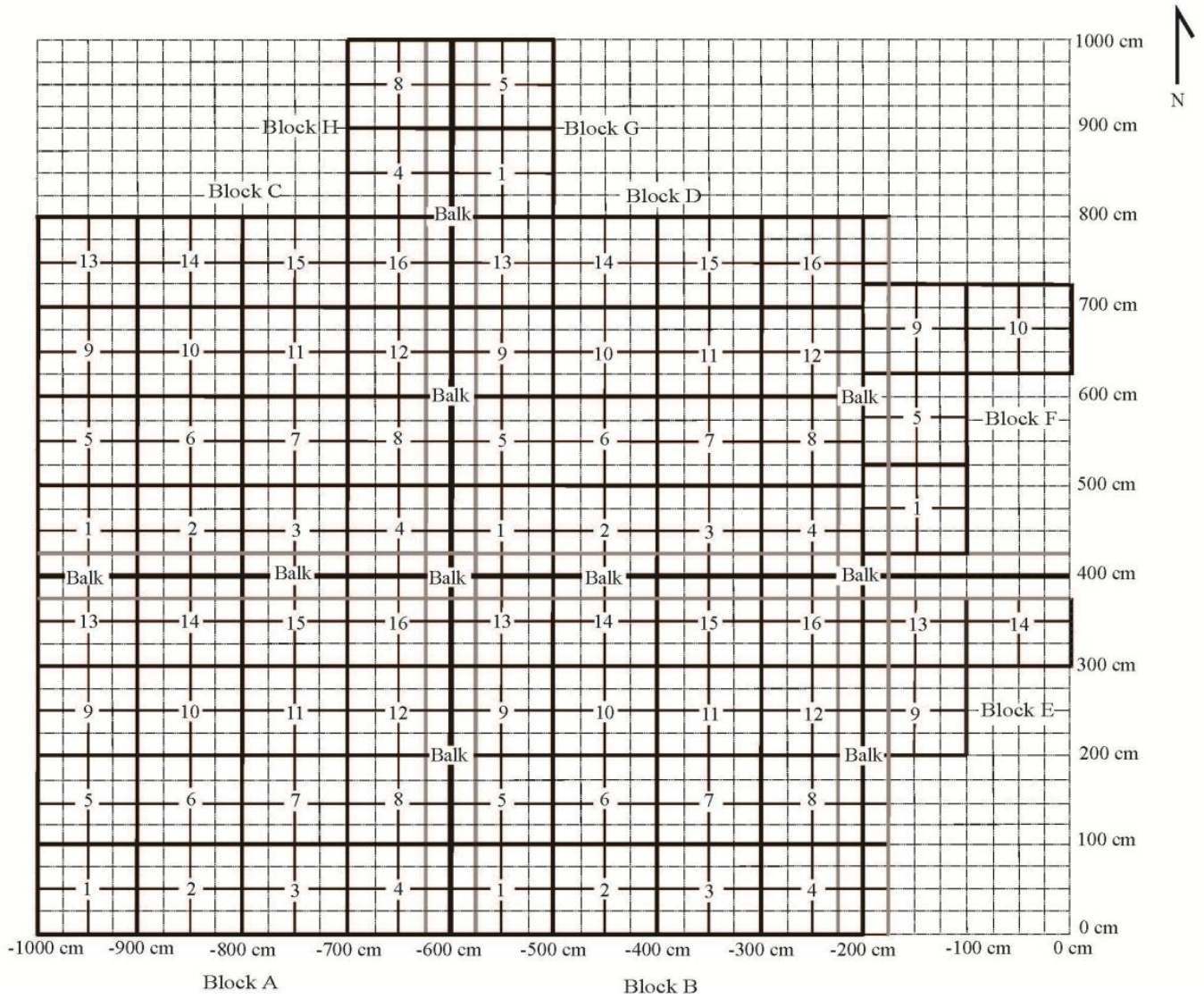


Photo of HP54 Excavation Grid and Soil Profile Balks



APPENDIX B

Lithic Artifact Typology

Unifacially Retouched Artifacts

- 1 miscellaneous
- 50 Unifacial blade tool
- 71 Used flake on a break
- 88 Dufour bladelet
- 143 Scraper retouch flake
- 148 Flake with polish sheen
- 150 Single scraper
- 151 Unifacial perforator
- 152 Unifacial borer/drill
- 153 Small piercer
- 154 notch
- 156 Alternate scraper
- 157 Miscellaneous uniface
- 158 Key shaped uniface
- 159 Unifacial knife
- 160 Unifacial denticulate
- 162 End scraper
- 163 Inverse scraper
- 164 Double scraper
- 165 Convergent scraper
- 180 Used flake
- 183 Spall tool
- 184 Retouched spall tool
- 188 Retouched backed tool
- 232 Stemmed scraper
- 255 Abruptly retouched truncation on a
flake
- 279 Hafted unifacial knife w/some
bifacial chipping on haft

Bifacial artifacts

- 2 Miscellaneous biface
- 4 Biface retouch flake with use-wear
- 6 Biface fragment
- 130 Bifacial knife
- 131 Stage 4 biface
- 132 Bifacial perforator
- 133 Bifacial borer/drill
- 135 Distal tip of a biface
- 139 Fan tailed biface

- 140 Knife-like biface
- 141 Scraper-like biface
- 145 Piece esquillees
- 192 Stage 2 biface
- 193 Stage 3 biface
- 225 Tang knife
- 240 Chipped wedge tool on angular slate
or shale
- 258 Hafted knife on a spall
- 262 Side notched bifacial drill
- 286 Steep retouched truncation on a
biface
- 291 Bifaical knife retouch flake
- 299 Key-shaped biface

Points

- 19 Late plateau point
- 35 Point tip
- 36 Point fragment
- 99 Misc. point
- 101 Lochnore point
- 102 Lehman point
- 109 Side-notch point no base
- 110 Kamloops side-notched point
concave base
- 111 Kamloops side-notched point
straight base
- 112 Kamloops side- notched point
convex base
- 113 Kamloops multi-notched point
- 114 Kamloops stemmed
- 115 Plateau corner-notched point
concave base
- 116 Plateau corner-notched straight base
- 117 Plateau corner-notched point convex
base
- 118 Plateau corner-notched point no base
- 119 Plateau basally-notched point
straight base
- 120 Shuswap base
- 121 shuswap contracted stem slight
shoulders
- 122 shuswap contracted stem
pronounced shoulders
- 123 shuswap parallel stem slight
shoulders

- 124 shuswap parallel stem pronounced shoulders
- 125 Shuswap corner removed concave base
- 126 Shuswap corner-removed eared
- 127 Shuswap stemmed single basal notch
- 128 Shuswap shallow side-notched straight basal margin
- 129 Shuswap shallow side-notched concave basal margin
- 134 Preform
- 136 Plateau preform
- 137 Kamloops preform
- 229 Shuswap 10: stem/eared with concave base
- 231 Ground/sawed slate projectile point
- 236 Limestone or marble projectile point
- 237 El khiam style point: side notched point on a triangular blade-like flake
- 244 Small triangular point
- 245 Large straight to concave base side-notch point
- 251 Slate side-notched point with a straight base
- 254 Large square stemmed dart point
- 256 Kamloops split base corner notched
- 285 Unifacial point preform
- 289 Lame a crete
- 292 Notched flake w/distal impact fracture
- 295 Plateau corner-notched point w/base missing

Groundstone

- 185 Wedge-shaped bifacial adze
- 190 hammerstone
- 200 Misc. groundstone
- 201 abrador
- 202 Sandstone saw
- 203 Ground slate
- 204 Steatite tubular pipe
- 205 Abrader/saw
- 206 Anvil stone
- 207 Abraded cobble or block
- 208 Abraded cobble spall

- 209 Ornamental ground nephrite
- 211 Groundstone mortar
- 218 celt
- 219 Groundstone maul
- 220 Ground slate piercer/borer with
chipped edges
- 222 Slate scraper
- 226 Sawed gouge
- 228 Groundstone adze on a natural break
- 230 Slate knife
- 233 Nephrite adze
- 234 Burnishing/polishing stone
- 235 metate
- 238 Groundstone spike
- 239 Small stone bowl
- 241 Sawed adze
- 242 Ochre grinding stone
- 246 Slate knife with bored hole
- 250 Ground nephrite scraper
- 257 Ground slate adze, without
cutting/sawing
- 259 Groundstone cube
- 260 mano
- 261 Groundstone effigy
- 263 Ground slate chopper
- 264 Adze perform
- 265 Shallow ground slate bowl
- 266 Sawed scraper on an igneous spall
- 267 Miscellaneous groundstone base,
possible effigy or bowl
- 268 Nephrite adze core
- 276 Hafted slate with blunt edge and
parallel striations, most likely mate
scraper
- 277 Incised slate
- 278 Slate knife retouch flake
- 280 Chipped slate
- 281 Sawed slate
- 282 Slate chopper
- 283 Steatite tubular pipe manufacture
reject
- 284 Chipped adze
- 293 Ground nephrite adze preform
- 294 Chipped stone chopper
- 296 Nephrite polished scraper
- 297 Scraper on a flake derived from a

handmaul
298 Polished steatite fragment

Ornaments

210 ochre
212 Mica ornament
214 Stone bead
215 Stone pendant or eccentric
216 Ground or sculpted ornament
217 Copper artifact
243 Sawed/sliced bead
252 Copper bead
253 Copper pendant
287 Spindle whorl preform
288 Spindle whorl
290 Ornament/pendant blank

Other

213 Misc. metal artifact
223 Burin spall tool
224 burin
227 Sawed stone disk
247 Misc. drilled artifact
248 Misc. sawed stone
249 Painted stone tool
269 Glass beads
270 Misc. glass
271 Window glass
272 Iron projectile point
273 Other historic period beads
274 Horseshoe
275 nail

Cores

146 Bipolar core
147 Microblade
149 Microblade core
182 Core rejuvenation flake
186 Multidirectional core
187 Small flake core
189 Unidirectional core
221 Slate core

Size

XSM	Extra small	1 cm square
SM	Small	4 cm square
M	medium	16 cm square
L	Large	64 cm square
XL	Extra large	Greater than 64 cm square

SRT

N/O	Nonorientable
M/D	Medial-distal
S	Split
P	Proximal
C	complete

Cortex

T	Tertiary
S	Secondary
P	Primary

Flake types

ESR	Early stage reduction
TF	Thinning flake
RBF	R billet flake
RF	Retouch flake
BF	Bipolar flake
NF	Notching flake
B	Blade
CRF	Core rejuvenation flake

Retouch

0	Invasive
1	Semi-abrupt
2	Abrupt
3	Scalar
4	Step
5	Hinge

Use-wear

0a	Polish
0b	Rounding
1a	Perpendicular striations

- 1b Parallel striations
- 1c Oblique striations
- 2a Scalar/step chipping
- 2b Oblique/perpendicular chipping
- 3a Crushing
- 3b Grinding
- 3c Blunting
- 4 Sawing
- 5 Gouging/boring
- 6 Notched
- 7a Drilled
- 7b Incised
- 8 Pecked
- 9 Battering

APPENDIX C
Lithic Raw Materials

Material

- 1 Dacite*
- 2 Slate*
- 3 Silicified shale*
- 4 Coarse dacite*
- 5 Obsidian*
- 6 Pisolite *
- 7 Coarse basalt*
- 8 Nephrite*
- 9 Copper*
- 10 Ortho-quartzite*
- 11 Basalt*
- 12 Steatite/soapstone*
- 13 Chert (green)*
- 14 Chert*
- 15 Jasper*
- 16 Jasper (hat creek)*
- 17 Chalcedony*
- 18 Chalcedony (yellow)*
- 19 Igneous intrusive*
- 20 Granite/diorite*
- 21 White marble
- 22 Green siltstone
- 23 Sandstone*
- 24 Graphite
- 25 Conglomerate*
- 26 Andesite*
- 27 Vesicular basalt
- 28 Phylolite
- 29 Limestone
- 30 Mica- black
- 31 Porphyry
- 32 Silicified wood*
- 34 Schist*
- 35 Misc.*
- 36 Serpentinite/serpentine*
- 37 Gray vitric tuff
- 38 Gypsum
- 39 Mudstone
- 40 Galena
- 41 Quartz crystal*
- 42 Metal/iron
- 43 Glass

- 44 Quartzite*
- 45 Other greenstone metamorphics*
- 46 Rhyolite*
- 47 Metamorphosed*
- 48 Gneiss*

*Raw Material Types Represented in 2012 Lithic Analysis of HP54 Strata I, II, V, & XIV

APPENDIX D
Formal and Expedient Tools

Tool Type	Expedient	Formal
Unifacial blade tool	X	
Used flake on a break	X	
Dufour bladelet		X
Scraper retouch flake	X	
Flake with polish sheen	X	
Single scraper	X	
Unifacial perforator	X	
Unifacial borer/drill		X
Small piercer	X	
notch	X	
Alternate scraper	X	
Miscellaneous uniface	X	
Key shaped uniface		X
Unifacial knife	X	
Unifacial denticulate	X	
End scraper		X
Inverse scraper	X	
Double scraper	X	
Convergent scraper	X	
Used flake	X	
Spall tool	X	
Retouched spall tool	X	
Retouched backed tool	X	
Stemmed scraper		X
Abruptly retouched truncation on a flake	X	
Hafted unifacial knife w/some bifacial chipping on haft	X	
Biface retouch flake with use-wear		X
Biface fragment	X	
Bifacial knife	X	
Stage 4 biface		X
Bifacial perforator	X	
Bifacial borer/drill		X
Distal tip of a biface		X
Fan tailed biface		X
Knife-like biface		X
Scraper-like biface		X
Piece esquillees	X	
Stage 2 biface		X
Stage 3 biface		X
Tang knife		X

Chipped wedge tool on angular slate or shale		X
Hafted knife on a spall	X	
Side notched bifacial drill		X
Steep retouched truncation on a biface		X
Bifaical knife retouch flake	X	
Key-shaped biface		X
Late plateau point		X
Point tip		X
Point fragment		X
Misc. point		X
Lochnore point		X
Lehman point		X
Side-notch point no base		X
Kamloops side-notched point concave base		X
Kamloops side-notched point straight base		X
Kamloops side- notched point convex base		X
Kamloops multi-notched point		X
Kamloops stemmed		X
Plateau corner-notched point concave base		X
Plateau corner-notched straight base		X
Plateau corner-notched point convex base		X
Plateau corner-notched point no base		X
Plateau basally-notched point straight base		X
Shuswap base		X
shuswap contracted stem slight shoulders		X
shuswap contracted stem pronounced shoulders		X
shuswap parallel stem slight shoulders		X
shuswap parallel stem pronounced shoulders		X
Shuswap corner removed concave base		X
Shuswap corner-removed eared		X
Shuswap stemmed single basal notch		X
Shuswap shallow side-notched straight basal margin		X
Shuswap shallow side-notched concave basal margin		X
Preform		X

Plateau preform		X
Kamloops preform		X
Shuswap 10: stem/eared with concave base		X
Ground/sawed slate projectile point		X
Limestone or marble projectile point		X
El khiam style point: side notched point on a triangular blade-like flake		X
Small triangular point		X
Large straight to concave base side-notch point		X
Slate side-notched point with a straight base		X
Large square stemmed dart point		X
Kamloops split base corner notched		X
Unifacial point preform		X
Lame a crete		X
Notched flake w/distal impact fracture		X
Plateau corner-notched point w/base missing		X
Spindle whorl preform		X
Spindle whorl		X
Iron projectile point		X
Other historic period beads		X
Bipolar core	X	
Core rejuvenation flake	X	
Multidirectional core	X	
Small flake core	X	
Unidirectional core	X	
Wedge-shaped bifacial adze		X
hammerstone		X
Misc. groundstone		X
abrador		X
Sandstone saw		X
Ground slate		X
Steatite tubular pipe		X
Abrader/saw		X
Anvil stone		X
Abraded cobble or block		X
Abraded cobble spall		X
Ornamental ground nephrite		X
Groundstone mortar		X
celt		X
Groundstone maul		X
Ground slate piercer/borer with chipped edges		X
Slate scraper	X	X
Sawed gouge		X
Groundstone adze on a natural break		X
Slate knife	106	X

Nephrite adze	X
Burnishing/polishing stone	X
metate	X
Groundstone spike	X
Small stone bowl	X
Sawed adze	X
Ochre grinding stone	X
Slate knife with bored hole	X
Ground nephrite scraper	X
Ground slate adze, without cutting/sawing	X
Groundstone cube	X
mano	X
Groundstone effigy	X
Ground slate chopper	X
Adze perform	X
Shallow ground slate bowl	X
Sawed scraper on an igneous spall	X
Miscellaneous groundstone base, possible effigy or bowl	X
Nephrite adze core	X
Hafted slate with blunt edge and parallel striations, most likely mate scraper	X
Incised slate	X
Slate knife retouch flake	X
Chipped slate	X
Sawed slate	X
Slate chopper	X
Steatite tubular pipe manufacture reject	X
Chipped adze	X
Ground nephrite adze preform	X
Chipped stone chopper	X
Nephrite polished scraper	X
Scraper on a flake derived from a handmaul	X
Polished steatite fragment	X