Chapter 11

Results of the Keatley Creek Archaeological Project Lithic Source Study

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Introduction and Background

The procurement and use of lithic materials for tools constitutes an important aspect of the prehistoric economy of Keatley Creek residents. The procurement and use of distinctive lithic materials from different sources by identifiable subgroups within the Keatley Creek community can also provide important information about social and economic organization within the community, as demonstrated by Bakewell (Vol. I, Chap. 16). Thus, it is important to document, to the extent possible, the main sources of lithic materials used by the past residents of Keatley Creek. The goal of this chapter is to document these lithic sources to the extent possible given the financial resources available.

During a two week period in July of 1988, and a three week period in June and July of 1989, a small reconnaissance survey project was conducted to identify and record prehistorically exploited lithic material sources in the Mid-Fraser River region of southwestern British Columbia. Specific areas examined include the Lillooet locality, Fountain Valley, Botanie Valley, the Pavilion locality, the Marble Canyon locality, Maiden Creek Valley, Upper Hat Creek Valley and the north side of Carpenter Lake (Figs. 1, 2, 4, 7, 10, 12, 16, and 17). This project was undertaken as a research component of the Fraser River Investigation of Corporate Group Archaeology Project. The primary objectives of the 1988 lithic source study were: 1) to locate local lithic sources by following leads provided by local informants and other researchers, as well as from information in publications and reports, and by surveying selected geologic deposits deemed to have potential for containing flakable cryptocrystalline silicates and/or high quality basaltic rocks; 2) to secure a representative sample of lithic materials from each of the identified sources so that their general character and any variability could be subsequently documented; and 3) to briefly compare the main lithic material types recovered from the Keatley Creek site with those identified during the lithic source identification study to determine if any of the source types were represented there.

Study Area

The study area examined during the 1988 and 1989 field seasons includes much of the Mid-Fraser River region of southwestern British Columbia. The Maiden Creek area and Upper Hat Creek Valley are intermediate to the Mid-Fraser River and Thompson River regions (Figs. 1, 7, and 12) and were used historically by both the Shuswap and Thompson peoples. About 30 judgementally selected specific locales of varying size deemed to have moderate or high potential for bearing flakable lithic materials were intensively examined during this study (Figs. 1, 2, 4, 7, 10, 12, 16, and 17). A geological reference for the Braelorne/Goldbridge area that Ed Bakewell had during his visit indicated that cherty deposits are present along the north side of Carpenter Lake (Fig. 1) and this area was also examined in 1989. However, the "cherts" found in these metamorphosed deposits on the north side of Carpenter Lake are of very poor quality, and are unsuited for flaking purposes. Given the geological context of the area, it is highly doubtful that a source of flakable quality materials exists there.

Local surficial and bedrock geology in the Mid-Fraser River region is comprised of a number of separate geologic "groups." There are two main groups that are of interest to this study, the "Cache Creek Group" and "Kamloops Group." The Cache Creek Group is represented primarily in the vicinity of Marble Canyon, which lies east of the Keatley Creek site. Duffel and McTaggart (1951:15–24) document that:

> The Cache Creek Group consists of a thick assemblage of cherts, argillites, minor agglomerates and tuffs, and their metamorphic derivatives, exposed along Thompson River and the Cariboo Highway from Martel to Cache Creek and north to Clinton. It also includes the massive, recrystallized limestones typcially exposed in the Marble Canyon and Pavillion Mountains, and known as Marble Canyon formation. This limestone, forming a distinct subdivision that may be mapped separately, contains minor intercalations of chert, argillite, and greenstone.

The other geologic group of interest to this study is the "Kamloops group." The Kamloops Group was initially described by Dawson (1896), and has been redefined several times since (see Drysdale 1914; Duffel and McTaggart 1951; Campbell and Tripper 1971; Ewing 1981). It consists primarily of Tertiary age basalts and sediments.

Tertiary age volcanics and sediments are found in several locations along the Fraser River from Lytton northward to the mouth of the Chilcotin River on valley sides and upland areas, and also in some of the mid-altitude and upland areas from Pavilion to Kamloops on the north side of the Thompson River. Tertiary volcanics and sediments are obvious by their conspicuous bright coloration, which include true and mixed shades of yellow, orange, red, purple, brown, green, and occasionally medium grey and even light blue. Tertiary sediments often stand out in sharp contrast against adjacent deposits or bedrock. Most are thick vertically but are often isolated or relatively localized. They appear to represent deposits that escaped removal or erosion by glacial and/or fluvial activity. In some of these sediments, chalcedonies and cherts have formed in cavities and bubbles within the sediments, and/or have replaced organic matter (i.e., petrified wood). They may also contain secondarily deposited pebbles and cobbles of similar materials that eroded out of associated Tertiary lava flows. The quality of basaltic rocks found within Tertiary volcanics varies from highly glassy to vesicular and granular columnar forms. The basaltic formations assigned to this group are most prominent on the north side of the Thompson River between Cache Creek and Kamloops, however, there are also several major areas northeast of Pavilion in the Maiden Creek area. While recent petrographic analyses have indicated that the black vitreous material commonly used for making stone tools prehistorically is probably a very fine grained trachydacite (Vol. I, Chap. 16), this material has traditionally been referred to as "vitreous basalt" by regional archaeologists. For ease of comprehension, I will continue to refer to these materials in this paper as "basalts" or "vitreous basalts."

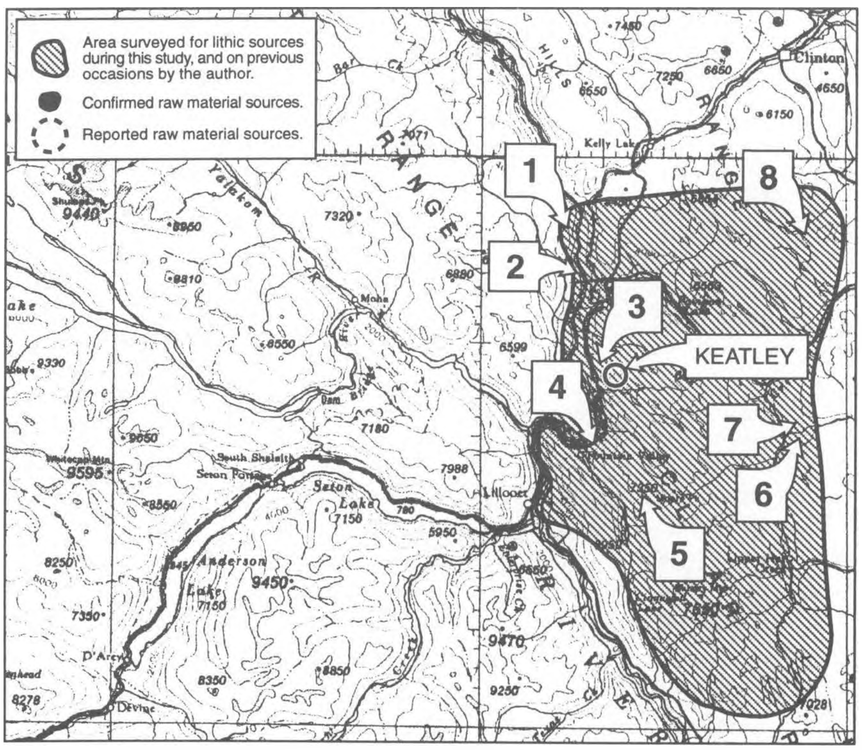

Figure 1. The general areas examined for lithic sources in the Mid-Fraser River region, and location of the eight sources discussed in this report. 1) Moran Chalcedony source; 2) Blue Ridge Ranch Chalcedony source; 3) Glen Fraser Silicate source; 4) Fountain White-Pink Speckled Chalcedony source; 5) Rusty Creek Red Chert source; 6) Upper Hat Creek Silicate source; 7) Upper Hat Creek basalt source; and 8) Maiden Creek basalt and Silicate source.

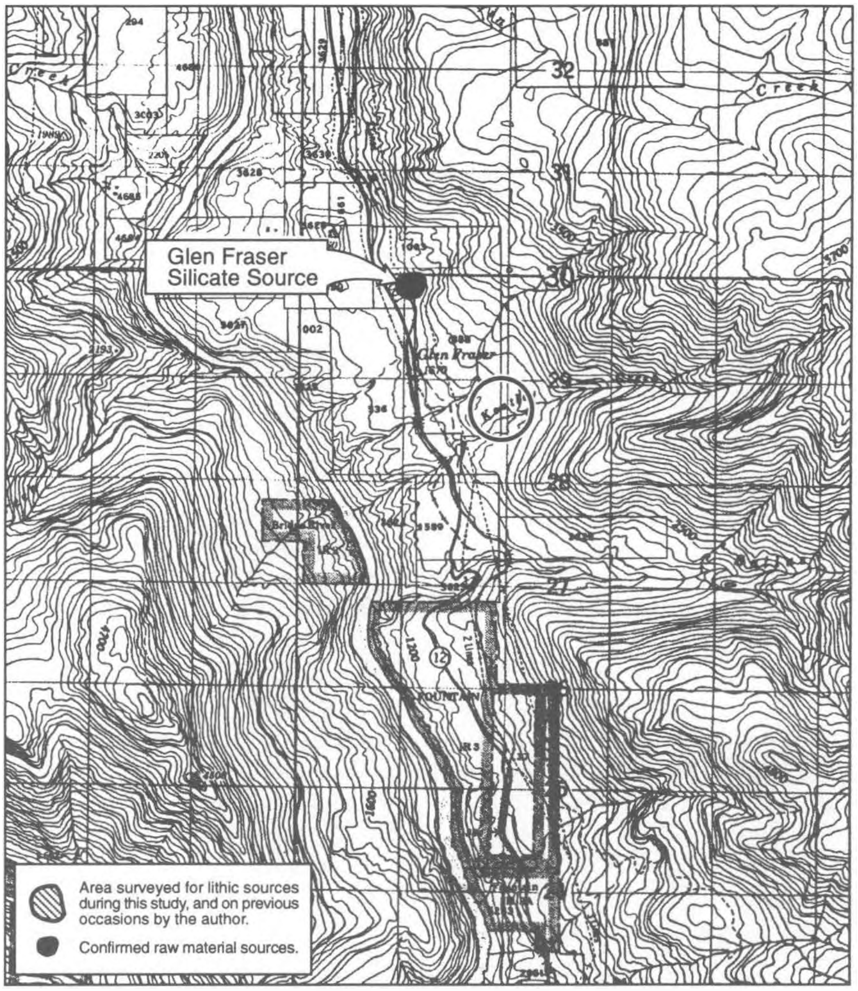

Figure 2. Location of the Keatley Creek site (circled), the Glen Fraser Silicate source, areas inspected in proximity to the Keatley Creek site, and master map legend.

Although most of the basaltic rocks are represented by lava flows, secondarily deposited pebbles and cobbles of flakable material up to about 50 cm in diameter have been found in great numbers in exposed glacial till and glacio-fluvial deposits near the town of Cache Creek. Unfortunately, a bedrock source for this material has yet to be identified (Richards 1987 and 1988). This basaltic source has been well known for many years, as reflected in local place names like "Arrowstone Hills" and "Arrowstone Creek." Although the Cache Creek basalt source is referred to several times in this report, details concerning it are not presented here. The reader is referred to Richards (1987, 1988) for further information. Occasionally small nodules, veins, or "pockets" of chert and chalcedony formed by crystalization of dissolved silica can be found in large air cavities formed in vesicular basalt lava flows. These high quality nodules are usually translucent white chalcedony (i.e., clear agate), although sometimes mineral impurities have imparted various chromatic hues and shades of yellow, orange, red, green, brown, grey, grey-blue, black, and sometimes even blue and purple. Presumably, the color of some of these silicates was derived from the colors of the lavas and sediments in which they were formed. Color mottling, striations, and banding are also common for some of these silicate types, and sometimes the odd macrofossil inclusions can be detected with the unaided eye in some specimens.

Further details concerning the local geomorphology and late Quaternary history of the area are summarized in Ryder (1978).

Survey Methodology

The most successful method used to locate lithic sources involved following leads provided by local rock collectors, other researchers that have previously worked in the area, and local native elders. Rock collectors queried during the study included George Kirschenstein (Lytton), Ron Purvis (Lillooet), Mr. Bouvette (previously of Lillooet, now in Princeton), Cliff and Gail Proznick (Ashcroft), and Brian Parke (Parke Ranch, Upper Hat Creek). Information was also provided by Dr. Arn Stryd (Arcas Associates), Dr. Martin Magne (Archaeological Survey of Alberta), Dr. David Pokotylo (Department of Anthropology, UBC), and Diana Alexander (SFU). Native elder Desmond Peters (Pavilion Band) provided information about the Maiden Creek source, and related that there may also be a source of white chert(?) within Botanie Valley (see below).

Lithic quarries were also sought by initiating a judgemental ground surface survey in areas where exposed geologic deposits were deemed to possibly contain silicate pebbles and cobbles. Most of these locations are indicated in Figures 1, 2, 4, 7, 10, 12, 16, and 17. As indicated above, prime target areas included intact or secondarily deposited Tertiary age volcanic and sedimentary geologic units.

Once a source area was located, it was inspected to determine its extent, and the nature and abundance of available materials. Samples of materials available on the surface were also collected for later description and future reference. All source locations were plotted on 1:50,000 NTS maps, and black and white photos were taken at several source areas.

All specimens secured from these sources were catalogued using SFU Archaeology. department lithic source reference numbers (e.g., SFU-B.C. 6). Samples from all four identified sources are presently being stored in the Archaeology Department at SFU.

Study Results

Of the seven possible lithic raw material sources reported by local rock collectors, previous researchers, and local native elders, only four were located and recorded during this study. They include the Glen Fraser Silicate source, Blue Ridge Ranch Chalcedony source, Upper Hat Creek Silicate source, and the Maiden Creek basalt and Silicate source (Sections 4.1, 4.2, 4.4, and 4.8; Figs. 1, 2, 4, 7, and 12). The remaining three unlocated sources include a source of good quality petrified wood on Arrowstone Mountain; a possible source of good quality chert in the Rusty Creek area of Fountain Valley, and a possible source of white chert in the Upper Botanie Valley.

Four previously unreported quarries were discovered. They include: the Upper Hat Creek basalt source; Fountain White-Pink Speckled Chalcedony source; the Rusty Creek Red Chert source; and the Moran Chalcedony source (Figs. 1, 4, 7, and 10).

Glen Fraser Silicate Source (SFU lithic source B.C. 39)

The Glen Fraser Silicate source is located only about 1.5 km north of the Keatley Creek site immediately east of the B.C. Rail tracks (Figs. 1, 2, and 3). The main source is an eroding debris flow lobe situated about 100 m east of the tracks near the apex of an alluvial fan (Fig. 3). This source was previously documented by Stryd (1973:189), and was reported to the author in 1986 by Mr. Bouvette, who used to own a rock shop south of Lillooet.

The main source area contains angular and rounded pebbles and cobbles of cherts and chalcedonies of various colors and qualities. Most pieces range between about 3 and 15 cm in diameter, although some larger chunks are also present. The most common materials observed are purple, purplish-pink, blood red, orange-red, orange, and yellow cherts. Small pebbles or pieces of translucent, opaque white, and milky white chalcedonies are also present in low frequencies. Mottling of colors and variation in grades and texture are common, even on the same piece of stone. The

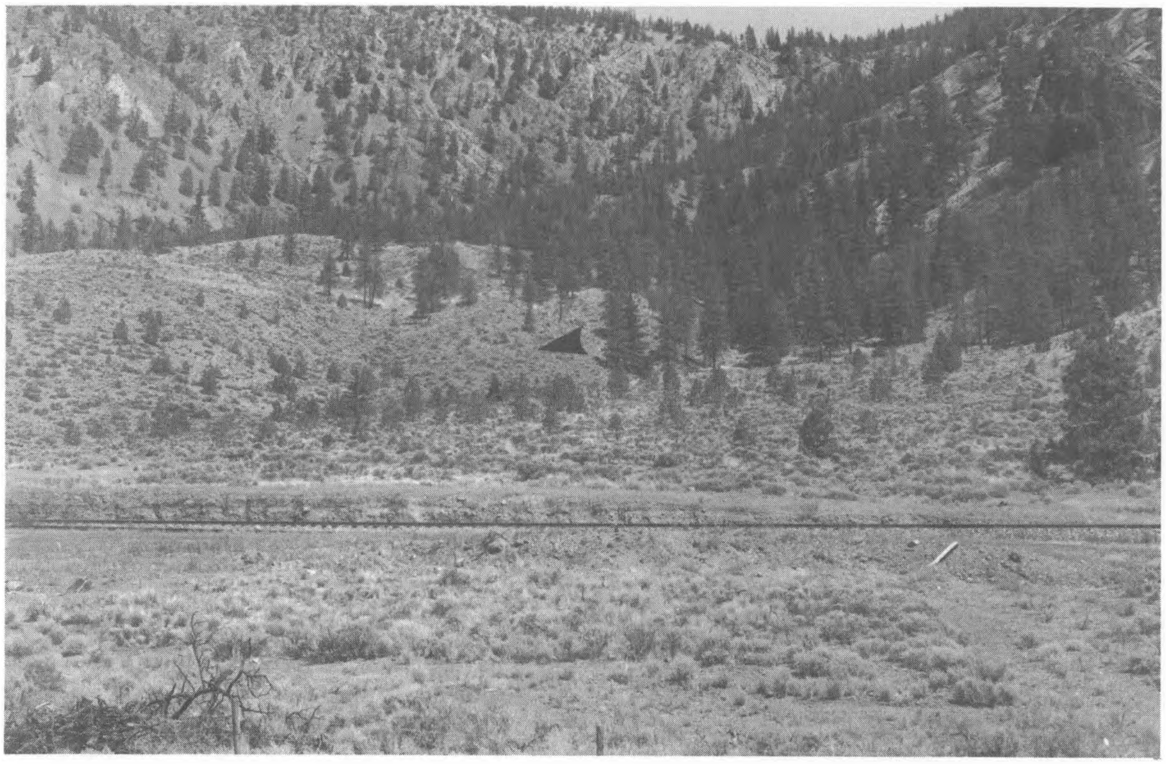

Figure 3. View of the Glen Fraser Silicate source, located about 1.5 km northwest of the Keatley Creek site, looking east. The arrow indicates the debris flow lobe where most materials are eroding out. The alluvial fan deposit between the main source and B.C. Rail tracks also contains a few pebbles and cobbles of similar fair to good quality materials.

cortex lacks patination on most pieces, but weathered surfaces have a frosted appearance.

When flaked, there is a tendency for most of these materials to shatter along planes of weakness that result in irregular fracturing. Most of the materials observed at the main source area are generally considered to be poor to fair quality for flaking and tool manufacture, but some small (i.e., 2–10 cm in diameter) pieces are quite isotropic and flake relatively well.

In addition to the main quarry area, small (2–10 cm) chunks of the same materials with a higher proportion of translucent, white, and sometimes puple and pink cherts and chacedonies are also present in low frequencies on, and buried within, the alluvial fan deposits to the immediate southwest (Fig. 3). Numerous small and randomly distributed prehistoric lithic reduction station sites containing vitreous basalt and a high incidence of these "exotic" silicates are scattered over the alluvial fan deposits. These sites were not recorded during this study.

About 500 m north of the main source area, occasional small platey pieces of translucent chalcedony and calcite nodules are eroding from Tertiary sedimentary beds at the southern base of a bluff. The chalcedony from this source is considered to have poor to fair flakability, as it contains numerous flaws, and thus potential for production of tools on large flake blanks is seriously hindered.

Initially, it seemed that the suite of lithic materials collected from this source was very rarely represented in the assemblage of materials secured from the Keatley Creek site (Spafford, personal communication 1988). However, because the main quarry source is known to rock collectors as a "jasper" source, it is possible that much of the better quality surficially evident materials were recently depleted prior to being inspected during this study. It is possible that better quality materials are buried within the debris flow lobe representing the main quarry source. However, I feel that this could only be demonstrated by excavating into the debris flow lobe comprising the main source area.

Blue Ridge Ranch Chalcedony Source (SFU-B.C. 40)

The Blue Ridge Ranch translucent chalcedony or "agate" source is located 11 km (linear distance) northwest of the Keatley Creek site on the west side of the Fraser River on property owned by Blue Ridge Ranch (Figs. 1, 4, 5, and 6). It was initially reported by Mr. George Kirschenstein of Lytton, and is accessed by

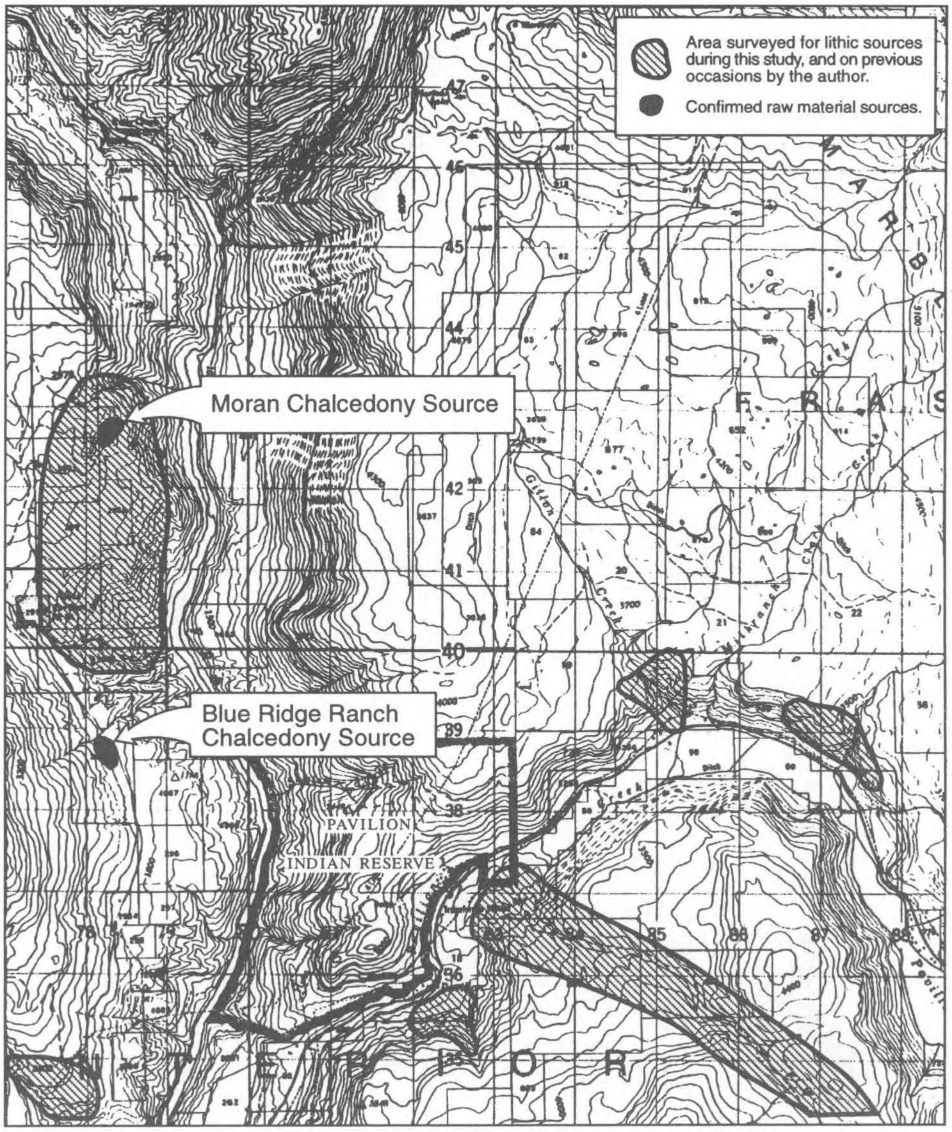

Figure 4. Location of the Blue Ridge Ranch Calcedony source, and the Moran Chalcedony source, and specific areas examined for lithic sources in the Pavilion locality.

Slok Creek Road, which begins at the confluence of the Fraser and Bridge Rivers. Ranch owner Mr. Clint Heichman was contacted by mail in 1988 to request that he plot the reported quarry source location on a 1:50,000 NTS map (Fig. 4), and if possible, to provide a small sample of lithic types represented there. I thank Mr. Heichman for his swift response, and the information and samples he provided. In 1989 I visited the quarry location and collected a larger sample of materials and inspected the geological context of the source.

At this source, thousands of small pebbles and nodules of calcite and chalcedony are eroding out of the fairly loose clayey silt which appears to be an isolated pocket of Tertiary age marine sediments (Figs. 5 and 6). However, most of the nodules within the sediments are only about 1 cm in diameter, and range between about .5–5.0 cm in diameter. An extraordinarily large cobble Mr. Kirschenstein collected from this source is about 30 cm long by 10 cm wide, and Mr. Heichman also confirmed that other fairly large cobbles have been found at this source.

Most of the nodules are either round, football-shaped, or egg-shaped. The larger ones (i.e., 2–5 cm in diameter) lend themselves very well to bipolar reduction. Some nodules contain surficially evident spherical inclusions which may be fossiliferous. A large proportion of the nodules have a distinctive "pock-marked" textural appearance, and many also have a dull, thick, earthy-looking grey-brown or orange-brown cortex over much of their surface.

The groundmass of most of the chalcedony is generally opaque white, although some have a yellowish, bluish, or blue-grey tinge. The quality of the chalcedony grades from poor to excellent. For most specimens the groundmass appears to be relatively isotropic, although internal flaws are present in some pieces. The sample flake from a large cobble from this source provided by Mr. Kirschenstein appears to contain a high frequency of dendritic fossilized inclusions of an unknown nature.

In general, flakability appears to be fair to excellent, however, the small average size of the pebbles would have certainly restricted the size of flake blanks that could have been obtained from them. This general suite of translucent chalcedonies cannot be visually distinguished from similar chalcedonies that are commonly found throughout most of the Mid-Fraser and Thompson River regions in glacio-fluvial outwash deposits.

It is important to consider that although this source, and the Moran Chalcedony source, are fairly close to the Keatley Creek site (Fig. 1), they lie on opposite sides of the Fraser River. The river would have almost certainly acted as an effective geographic barrier to the movement of materials across it, and it may be that these sources were only rarely (if ever) exploited or accessed by the inhabitants of Keatley Creek village.

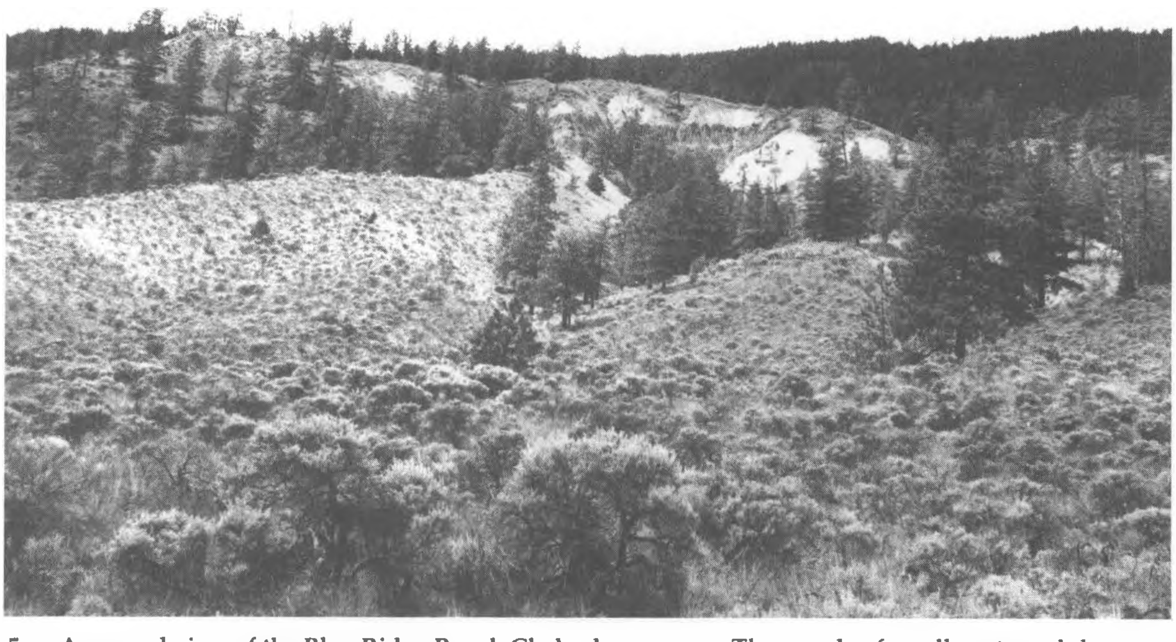

Figure 5. A general view of the Blue Ridge Ranch Chalcedony source. Thousands of small agate nodules are eroding from the sediments in the upper half of the photo. Looking west from Slok Creek Road.

Figure 6. Closeup view of eroding sedimentary deposits at the Blue Ridge Ranch Chalcedony source containing a high density of small chalcedony and calcite nodules. Looking south.

Upper Hat Creek Basalt Source (SFU-B.C. 41)

This lithic source is located about 1 km north of the intersection of Upper Hat Creek Road and Medicine Creek (Figs. 1, 7, and 8). Thousands of glassy to fine grained basalt pebbles are eroding out onto a steep talus slope occupying the southern and western sides of the northern end of a prominent ridge (Fig. 8). This basalt source was not previously identified during archaeological investigations conducted in the Upper Hat Creek Valley in the late 1970's (Pokotylo, personal communication 1988).

In 1989, Ed Bakewell examined the source and concluded that it is a steeply uplifted section of an eroding Tertiary(?) age fluvial deposit comprised primarily of sedimentary beds bearing moderate to high densities of small secondarily deposited basalt nodules. The relatively vertical disposition of the beds containing these nodules accounts for several localized areas where moderate to high densities of small pebbles appear to be "streaming" down the talus slope.

When compared to basalts from other nearby abundant sources (i.e., Cache Creek and Maiden Creek), the Upper Hat Creek basalt pebbles differ conspicuously by their smaller average size. Most range between about 2–4 cm in diameter, although a few cobbles up

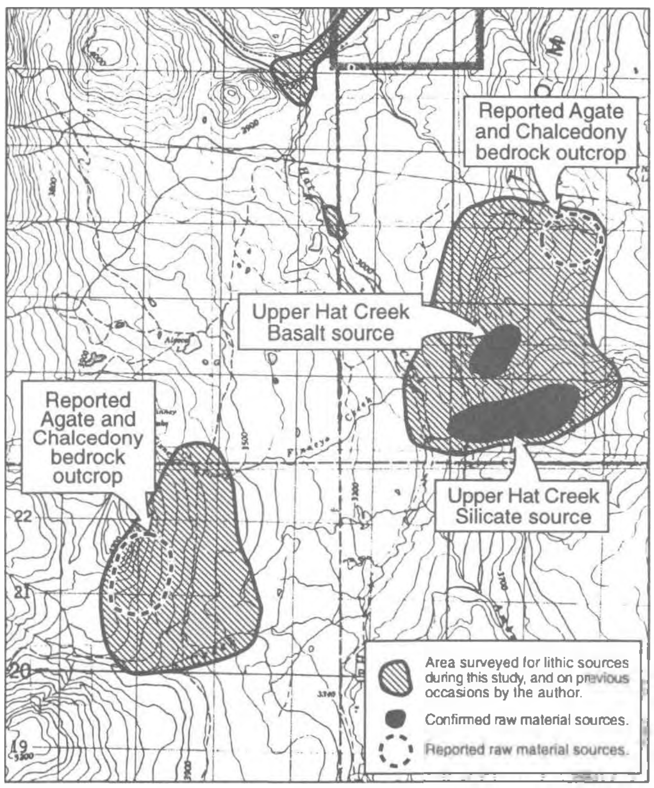

Figure 7. Location of the Upper Hat Creek basalt source and the Upper Hat Creek Silicate source near Medicine Creek, and reported chert and chalcedony bedrock outcrops and areas examined during the study.

to about 10 cm diameter were also found. Isolated basalt pebbles and cobbles can also be found in very low frequencies on the surface or in stream and roadcut exposures within a 1 km area surrounding the main source area. On average, these isolated pebbles and cobbles tend to be larger than those represented at the main source, and their character usually has greater visual similarity with the Cache Creek basalts.

Most of the Upper Hat Creek basalt pebbles can be visually distinguished from those found in the vicinity of Cache Creek and Maiden Creek in that the Upper Hat Creek basalts bear a very distinctive patina. It is light to medium grey and has a somewhat dull grey metallic luster, as if the pebbles had been coated with graphite or lead. Cache Creek and Maiden Creek basalts have patinas that are typically either white or light grey, and almost always have a dull or "chalky" luster. A high percentage of the pebbles (ca. 80%) from the Upper Hat Creek source are somewhat elongate discoidal or eliptical in form, and they have a smoothed weathered appearance. The internal consistencies and textures of these pebbles are visually indistinguishable from most of the other basalts represented in the adjacent Cache Creek source deposits.

When flaked, there is a tendency for the pebbles to split easily along longitudinal planes, and as a consequence, they lend themselves very well to bipolar flaking to produce small flakes. Their smaller average size would obviously have restricted the size of the flakes and tools produced from them. Indeed, Dr. David Pokotylo and I have noted a high incidence of small bipolar reduction sites in the immediate vicinity of the main source area. The basalt pebbles may have also been selected for microblade cores because of their small size, discoidal and eliptical forms, and platey flaking tendency, but this remains to be verified.

Cortex-bearing surfaces on basalt flakes recovered in the excavations at Keatley Creek lack the distinctive metallic luster observed on the Upper Hat Creek basalts. Therefore, I conclude that regular exploitation of this source by the inhabitants of the Keatley Creek site may have been quite rare, as there are several other nearby sources (i.e., Maiden Creek and Cache Creek) where significantly larger basalt cobbles of comparable quality are readily available. It may be possible to verify whether this material was being used by the inhabitants of Keatley creek using X-Ray florescence analysis.

Upper Hat Creek Silicate Source (SFU-B.C. 6)

The Upper Hat Creek Valley has long been known as a major source of chert and chalcedony by rock collectors and archaeologists. Pebbles, cobbles and boulders of yellow, brown, orange, red, purple, green, and black chert and chalcedonies have been found in glacial till contexts as float throughout much of the Upper Hat Creek Valley area. The most abudant types

Figure 8. A general view of the Medicine Creek locality in Upper Hat Creek Valley indicating the location of 1) the Upper Hat Creek basalt source and 2) the Upper Hat Creek Silicate source. Looking north.

Figure 9. A view of the Moran Chalcedony source in the West Fountain locality. Tabular chunks and nodules of chalcedony and clacite are eroding out of the bedrock outcrop in the upper-center of the photo. Looking northwest.

are yellow, light yellow-brown, and medium brown. Mottling is common, and some chunks bear red, green, and sometimes light grey patchy inclusions. Other lithic types, although rarer, include translucent chalcedony and various grades of grey or brown petrified (i.e., "opalized") wood (Cliff and Gail Proznick, personal communication 1989).

The area that has reportedly yielded the greatest concentrations of materials encompasses the lower portions of Medicine Creek valley and its immediately adjacent areas (Figs. 7 and 8). Here, most of the material has been found within, and beside the creek east of the cattleguard for about 1 km, and on the ridge to the immediate south (Fig. 7). Most pieces of these materials range between about 3 and 20 cm in diameter, but occasionally boulders up to about 1 m in diameter of yellowish brown cherts and chalcedony have been recovered. Several such boulders are owned by Cliff and Gail Proznick (Ashcroft).

Surficial examination of the lower Medicine Creek drainage area suggests that there is presently very little evidence to indicate that a major lithic source does indeed exist in this location. Because this source has been known to rock collectors and exploited by them for over 50 years, it has been depleted to the point where very little exists on the present surface either as outcrop or float pebbles. Dr. David Pokotylo informed me that during one weekend he observed about 15 vehicles belonging to rock collectors parked there. Nevertheless, for a patient and keen eye, some good-quality materials can still occasionally be found in the creek bed along some sections of Medicine Creek, and in several recently disturbed areas on the ridge to the south.

The serious depletion of materials from this source area by rock collectors in the last few years clearly indicates that it is quite possible to exhaust a relatively abundant source if it is well known. I suggest that this has important implications for prehistoric situations—especially during periods of peak population—when the Upper Hat Creek lithic resources would have been very heavily exploited. This may have been especially true during the Lochnore phase (ca. 5,000 to 3,500 BP) and the Plateau horizon (ca. 2,400 to 1,200 BP), when it seems that utilization of the Upper Hat Creek Valley area was most intense (Pokotylo and Froese 1983; Richards and Rousseau 1987; Stryd and Rousseau 1988).

Inspection of several areas in the uppermost reaches of Upper Hat Creek Valley indicate that flakable materials appear to be rare south of MacDonald Creek. This was also confirmed by rock collectors Cliff and Gail Proznick (Ashcroft) and Brian Parke (Upper Hat Creek) who have collected rocks in the area for a number of years.

Lithic raw material types from Upper Hat Creek sources appear to be well represented in the lithic assemblages recovered from housepits at the Keatley Creek site. Some of the tranluscent chalcedony and petrified wood recovered from this site may have also been derived from Upper Hat Creek Valley. However, it is important to point out that some of the chalcedonies and cherts from Upper Hat Creek Valley are visually identical to many of those found in the Maiden Creek source area which lies about 20 km to the north. Because of this very close visual similarity between certain lithic types from these two source areas, assignation of archaeological specimens to one specific source might be erroneous. This would be especially true for prehistoric peoples using the the Lower Hat Creek area which lies between these two abundant source areas, and for groups occupying the Pavilion and Fountain localities.

In 1988, Dr. Martin Magne (Archaeological Survey of Alberta) indicated the location of two possible bedrock sources of chert and "agate" in the Upper Hat Creek valley around Finney and Anderson Creek that he observed from the air (helicopter). The first is situated about 3 km northeast of the confluence of Medicine and Hat creeks. The other is located on the north side of Anderson Creek about 3 km west of its confluence with Hat Creek (Fig. 7). Inspection of these locations during this study failed to identify any outcrops of siliceous materials, however, brightly colored red and orange outcrops of volcanics exist in these locations and these may have been visually mistaken for chert source areas from the air.

Moran Chalcedony Source (SFU-B.C. 42)

The Moran Chalcedony source is located exactly 7.5 km (linear distance) NNW of Pavilion on the west side of the Fraser River opposite the abandoned trainstop called Moran (Figs. 1, 4, and 9). Tablular chunks and nodules of calcite and translucent chalcedony can be found in moderate abundance on the talus slope leading down from an isolated orange-red outcrop of eroding Tertiary volcanics and compacted or conglomerized sediments (Fig. 9). The material can also be seen in the bedrock outcrop and its related hoodoo-like formations.

The calcite and chalcedony appear to have formed in pockets, interstices, bubbles, and viens within both the basalts and sediments. Most chunks and pieces indicate that it was formed in cracks and crevices, thereby giving them a platey or tabular appearance. On many pieces where they interfaced with the bedrock, pock-marking or rippling is a prominent feature, as is the presence of a relatively thick light yellow, light yellow-green, or light green patina. Generally the pieces tend to be small (about 1–4 cm in diameter), but some bigger pieces up to about 8 cm diameter can also be found.

The internal groundmass is usually fairly hard, and either translucent white (i.e., pure colloidal silica), or sometimes pale yellow-white or pale grey-blue. Most of the specimens indicate some degree of flawing, notably where crystal growth plane fronts intersect. There is also a tendency for this material to shear more easily in a manner perpendicular to the planar axis of the chunks, hence producing the characteristic "tabular" appearance. This material has generally poor flakability because of its hardness, small average nodule size, and groundmass flawing and bedding planes. There was no evidence for prehistoric lithic reduction activities noted at this source.

The lithic assemblages recovered from the housepits tested at the Keatley Creek site contain small percentages of translucent chalcedonies resembling those observed at this source. However, positive identification of chalcedony obtained from this source would be difficult on the basis of visual criteria alone, as identical materials are also available as float pebbles in glacio-fluvial and fluvial deposits throughout the valley bottoms and sides in the Mid-Fraser River and Thompson River regions. Nevertheless, the distinctive outer surface texture, unique patination, and tabular tendencies of Moran Chalcedony may make future identification possible at some sites. Because this source, and the Blue Ridge Ranch Chalcedony source, lie on the opposite side of the Fraser River from the Keatley Creek site, I think it is very unlikely that they would have served as a primary focus for lithic material acquisition for the inhabitants of Keatley Creek.

Fountain White-Pink Speckled Chert Source (SFU-B.C. 43)

There is a distinctive white-pink speckled chert that sometimes constitutes a significant percentage of the exotic material lithic assemblage samples recovered from housepits tested at Keatley Creek. According to Bakewell's analysis (Vol. I, Chap. 16), this is technically a "pisolite." The color of this material is somewhat variable with most hues grading between pale yellow, white, and pink, and sometimes pastel shades of light purple and light grey. The texture of a fresh surface on most of the varieties ranges from dull to waxy, although some flakes can have a glassy luster. There is no apparent rigid correspondence between color and texture, although the white and yellowish hues sometimes tend to have a dull luster and greater incidence of flawing. The pink materials tend to be better quality, but also suffer from some flawing.

The most distinctive feature of this raw material is the presence of numerous small white or pale grey spherical inclusions about .5 mm in diameter in the groundmass that petrologist Ed Bakewell thinks may be fossiliferous (Vol. I, Chap. 16). Some flakes clearly indicate having been thermally altered. Thermal alteration of the material also changes its color.

The absence of any weathered surfaces on the archaeological examples of this material type indicate that it is a tabular chert that was probably formed in a metamorphosed sedimentary context, or perhaps within large cracks and fissures in bedrock. Initially it was thought that the source of this distinctive speckled material lay somewhere in upper Rusty Creek Valley to the south, but a source for it was not discovered in this location during a subsequent inspection despite several days of searching. Another attempt to locate the source of this distinctive material involved examining several lithic scatter sites in Fountain Valley, and inspecting a large collection of artifacts owned by Mr. Bert Lehman who lives at the south end of the valley. From these data, it was surmised that the source probably lay somewhere in proximity to the northern end of Fountain valley where it joins with the Fraser River. This was determined by the presence and sometimes high incidence of this material at sites in this area, its common use at both the nearby Bell site (Stryd 1973) and Keatley Creek site, and the almost total lack of this material in Mr. Lehman's artifact collection.

Through diligent searching, an area containing cobbles that bear this distinctive white-pink speckled

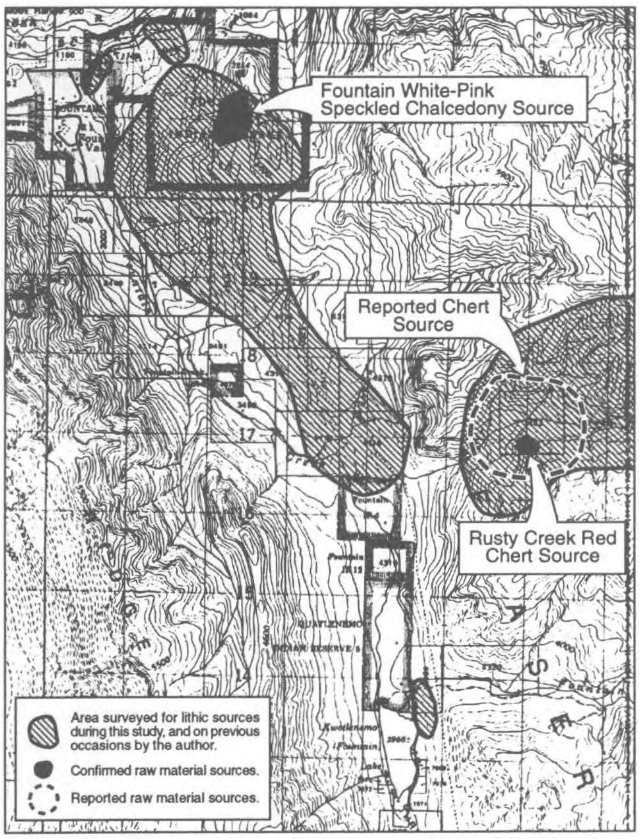

Figure 10. Location of the Fountain White-Pink Speckled Chalcedony source, the Rusty Creek Chert source, and areas inspected for lithic sources in the Fountain Valley.

material was identified on Fountain Indian Reserve 1A about 2 km east of the village of Fountain (Fig. 10). It lies only about 8 km south of Keatley Creek, hence local accessibility to this source for the inhabitants of Keatley Creek (and other local sites for that matter) is considered very high. Small chunks, tabular pebbles, and cobbles of poor quality white chert containing sections and viens of the distinctive yellow and pink speckled material described above are eroding out of a steep slope on what appears to possibly be a thick Tertiary age sediment near the apex of a promient ridge. The source area has been subjected to some erosion, and several small springs emerge from the base of the sediment unit. Several multicolored Tertiary age basalts and sediments lie immediately north of the source area, however, previous examination of the bases of these deposits suggest that they do not contain other sources of flakable stone.

Although large pieces of this very distinctive chert were not found in the identified source area, numerous smaller pieces of white chert were found that contain thin viens and small sections of this very distinctive white-pink speckled chert. It may be that there is a large isolated vien of the archaeologically observed high quality homogenous material somewhere in the immediate area, however, we did not locate one during this study. The apparent paucity of this material at the identified source location may also be due to almost total source depletion in prehistoric times as a result of heavy exploitation, or perhaps the main lode area has been buried by recent colluvial activity. Evidence for prehistoric lithic reduction activities were not observed at the source location identified in this study. Further intensive inspection of this area might reveal another highly localized and high density source of this distinctive material.

Rusty Creek Red Chert Source (SFU-B.C. 44)

Dr. Arn Stryd and local Lillooet resident Gary Taylor indicate that there is a reported chert source located within and/or adjacent to Lot 3453 in the upper reaches of Rusty Creek Valley, a tribuary of Fountain Valley (Fig. 10). Unfortunately, neither informant knows the exact location of this chert source, or the nature of the material supposedly found there. The current owners of Lot 3453, Reid and Cindy Frederick, have a site in their garden that has yielded hundreds of flakes of Fountain White-Pink Speckled Chert. Reid Frederick reports that some of the chunks and pieces are fairly large. Consequently, I concluded that there must be a source of this distinctive speckled chert in the immediate area, and in 1989 the upper reaches of Rusty Creek drainage area were extensively examined during a four-day search

Figure 11. A view of the Rusty Creek Red Chert source (arrow). Looking south. There may be another source of flakable stone in the area, however, it was not identified during this study.

for a source of this, and other, flakable materials. The area examined included the valley bottoms and sides of Rusty Creek and its tributaries (Fig. 10), and extended eastward to include the alpine meadow areas in the upper reaches of Gibbs Creek and immediately south of Chipuin Mountain (not shown on figure maps).

Although a source of the white-pink chert was not found within the upper Rusty Creek drainage area, a source of poor to fair quality, orange-red chert was identifed in the southern section of Lot 3453 (Figs. 10 and 11). It is eroding out of a large metamorphosed basalt bedrock face of unknown geologic age comprising the apex of a steep prominence on the south side of the valley (Fig. 11). The chert has formed in interstices and cracks within the basalt flow, and occurs in dendritic and large angular blocky chunks up to about 30 cm in diameter.

In general, the flaking quality of the material is significantly affected by microfractures and flaws, although small pieces with highly siliceous groundmass lend themselves well to being flaked. No evidence for quarrying activities were observed at the source. That this material would have been used on any regular basis by local prehistoric populations seems unlikely because it is difficult to access and the stone has comparatively inferior flaking qualities. Moreover, it does not appear at any of the archaeological sites inspected in the immediate area.

It should be noted that Dave Johnstone and I found that the cliff faces at the top of the angular ridge in the upper-centre of Figure 11 could not be accessed safely from the valley bottom due to steep talus slopes and precipitous terrain. It remains to be inspected, and there may be a more accessible route down to the base of these cliff faces somewhere along the top of the ridge; a moderate (2.5 km) hike from the main road to the west. As reported, there may still be another highly localized source of flakable silicates in the upper Rusty Creek, or perhaps in the Frantzen Creek drainage area to the immediate south. This potential for additional sources is inferred for these areas because of the sedimentary nature of the local bedrock, the presence of basalt flows and intermediary compressed and foliated sediments, and the confirmed presence of at least one chert source.

The Rusty Creek Red Chert source may in fact be the one referred to by Stryd (1973), however, this does not seem likely. Mr. Bouvette may know the location of another better-quality silicate source in the immediate area.* Another possibility is that the reported "chert" source in upper Rusty Creek is actually the disturbed site in the Frederick's garden that has yielded a very high incidence and density of Fountain White-Pink Chert. There used to be an old homestead on the north side of the creek about 150 m south of Frederick's log house that may have initially used this

* Mr. Bouvette can be contacted at Bouvette's Rock and Gem Shop, Princeton, B.C.

garden plot, thus exposing the site and resulting in it being mistaken for a natural chert source.

Maiden Creek Basalt and Silicate Source (SFU-B.C. 45)

The Maiden Creek source area lies within Kamloops Group Tertiary volcanics and sediments. It is situated in the upper reaches of Maiden Creek and its adjacent mid-altitude areas to the south just northwest of Bonaparte IR No. 2 (Figs. 12–15). Pavilion Band elders have related that they traditionally used a source of basalt from the Maiden Creek area (Alexander, personal communication 1989), which can be accessed via Pavilion Creek or from Pavilion Mountain. Elders have also indicated that they hunted, and still hunt in this area, and it is possible that hunting and quarrying were synchronous activities in prehistoric times.

Walking distance along the easiest direct route from the Keatley Creek site to the uppermost drainage area of Maiden Creek is only about 25 km (Figs. 1 and 12). During the 1987 and 1988 field seasons, I had the opportunity to view the Pavilion Creek and Upper Maiden Creek drainage areas, and see no reason why human movement might have been seriously hampered through the pass connecting these areas, other than, perhaps, the marshy area southeast of Pavilion Mountain summit.

Duffel and McTaggart (1951:18) also mention that dark grey to green and sometimes black, fine-grained cherts can be found around this general area. I think it is possible they may have mistakenly identified the flakable basalts in this area as being chert. Also, Richard Brolly (Arcas Associates) related that he noted an unusually high density of basalt and exotic materials at several sites in the Maiden Creek area during a previous impact assessment survey.

In 1989, a judgmental survey was initiated over a large area encompassing the north and south side of Maiden Creek (Fig. 12). A large and fairly abundant source of flakable stone was found which encompasses an estimated 20 square km. These materials are represented in two separate geological contexts. The first lies in the bottom of the creek valley within and around the southwestern corner of lot 143 (Lill) and it continues southwest on either side of the creek for about another 500 m (Fig. 12). Here, small and large basalt cobbles are found in moderate to high densities in glacio-fluvial and fluvial deposits. The access road passes over the creek at this location, and there are several areas of extensive disturbance within these deposits relating to fairly recent gravel quarrying, and road and hydro line construction activities.

Here, several unusually large (15–25 cm in diameter) and many smaller (5–15 cm in diameter) cobbles of glassy and fine to medium grained basalt were found on and beside roads, in the gravel quarry, along the creek bed and banks, and in the fluvial deposits exposed within the hydro line right-of-way (ROW). About 95% of the flakable material here is basalt, although I also found several pieces of relatively poor quality yellowish chert and a large cobble of translucent grey-blue chalcedony.

There are also some basalt and silicate materials lying in the very upper reaches of Maiden Creek, however, I noted in several large disturbed areas that there was a general decrease in the abundance and average size (about 5 cm in diameter) of basalt cobbles, and only the rare small piece of silicate. There was abundant evidence for aboriginal lithic reduction activity immediately along and beside the creek where the apparent greatest density of large basalt cobbles was identified (Figs. 12 and 13). Sites were significantly more spotty further up the creek toward Pavilion summit, and most of these were small core reduction stations. It is not known whether any of these sites have been previously recorded, and they were not recorded during this study. The northwestern extent of this

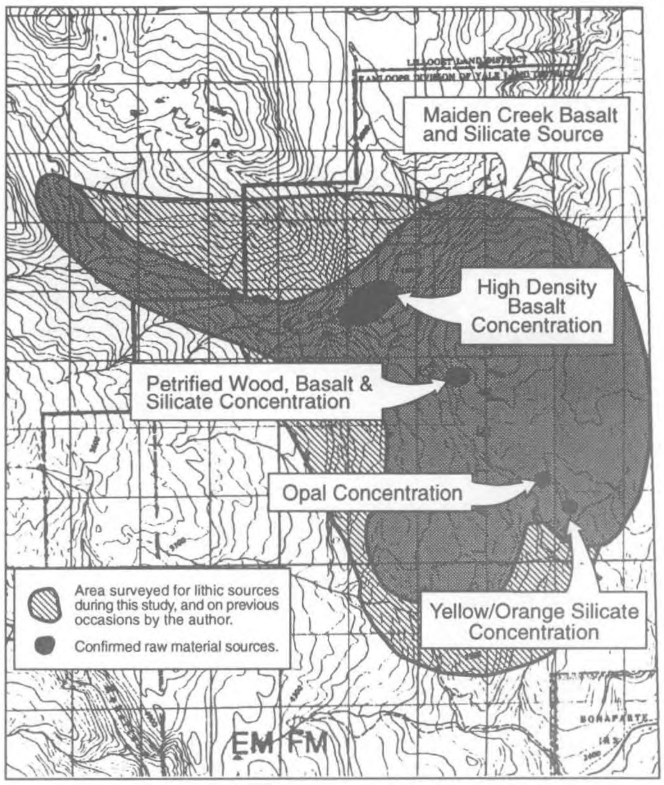

Figure 12. Location of the Maiden Creek basalt and Silicate source, and areas examined during the study. Specific material type clusterings noted during the study are also indicated.

source in upper Maiden Creek Valley could not be determined due to the lack of access and subsurface exposures. I suspect it probably extends to the base of Pavilion mountain where the Marble Canyon Formation interfaces with the Tertiary age volcanics.

The second geologic context identified to contain cobbles of flakable stone in the Maiden Creek area is the mid-altitude rolling upland area lying southeast of the main valley bottom basalt source (Figs. 12, 14, and 15). Almost all of the materials were recovered from glacial drift and till deposits which blanket the area. The till appears to be comprised primarily of reworked Tertiary volcanics and sediments which were eroded by glaciation and essentially "smeared" over the source area between elevations of about 3,000 and 4,000 feet asl.

The entire hydro transmission line ROW was surveyed within the identified source area (Figs. 13–15), as were numerous logging roads. This mid-altitude context also contains basalts identical to those found in the creek bottom to the immediate north, but the cobbles are notably less frequent, smaller (about 5–15 cm diameter), and comprise about 50% of the sample of flakable stone recovered during the survey. About 30% of the cobbles in the collected sample are chalcedony or chert, 10% are "opal," and the remaining 10% are petrified wood. These materials are described below.

Although isolated cobbles of exotic silicates are randomly distributed throughout the area, most silicates tend to cluster according to specific type, although some types were noted to occur together (Fig. 12). Some of the exotic silicate materials resemble those found in Upper Hat Creek valley, and in a few cases there is virtually no visual difference. The basalts appear to have been scattered randomly throughout most of the source area, but they are less abundant in its southern portion. Slightly greater densities of both basalts and silicates were noted in areas where cobbles and boulders of angular and rounded vessicular basalt, and a distinctive grey-brown-red marbled rhyolite were also very common.

Evidence for prehistoric quarrying and reduction activities, characterized by small core reduction stations, were observed along the transmission line ROW. This indicates that this source was known and exploited in prehistoric times, however, the intensity to which this happened is difficult to measure at this point in time.

General Description of Maiden Creek Basalt

The basalt cobbles from the Maiden Creek source are variable in shape, with many being either discoidal, eliptical, trapezoidal, or most often, polyhedral with large facet-like features. They also have a distinctive thick white or light grey patina, and in this regard they differ with Cache Creek basalts which typically have a thin white or whitish blue hue to their cortex. The Maiden Creek basalts also differ markedly with those

Figure 13. A view of the area noted to have a high density of large basalt cobbles in the bottom of Maiden Creek Valley (center photo). Looking north.

from the Upper Hat Creek basalt pebbles which are typically quite small and have a very distinctive dull silvery-grey patina.

Many of the Maiden Creek basalt cobbles, notably the larger ones, also have a very distinctive rough "corrogated" texture that always appears on a flat face. It seems that this corrugation corresponds with the lamellar flow planes within the groundmass. This potential diagnostic trait is also usually associated with the most heavily patinated sections of cobbles. Many cobbles also bear patches of calcium carbonate (caliche) adhering to their cortical surfaces.

In general, the groundmass of the sample of Maiden Creek basalts examined in this study is typically either jet black or very dark grey-black with no visually apparent mottling or striae. Some (20%) of the cobbles are quite glassy, but most are fine-grained (50%) and the rest are medium grained. When flaked, the material behaves in a manner similar to that of Cache Creek basalt which has a tendency to favor the direction of the platey flow planes of the groundmass. However, the Maiden Creek basalts also have a greater tendency to produce hinge and perverse fractures than Cache Creek basalts.

There is a large lithic scatter site associated with the high density basalt source in the valley bottom, indicating that it was well known and regularly frequented during prehistoric times. Most of the flaked materials suggest primarily core reduction and large flake blank production. An identical site type pattern is indicated for the Cache Creek source area.

It is likely, and probable that at least some of the basalt found in assemblages from Keatley Creek originates from the Maiden Creek source area. This might be testable through comparison of relative element abundance signatures (i.e., "fingerprints") for samples from the site with those from Maiden Creek using the X-Ray Florescence method (James, personal communication 1989).

Descriptions of Maiden Creek Silicate Types

Chalcedony. Many of the Maiden Creek chalcedonies closely resemble types found in Upper Hat Creek valley, which lies about 20 km to the south. The most common varieties are either semi-translucent yellow, yellow orange, orange, or orange brown. Weathered or slightly patinated cortical surfaces have a dull or frosted appearance, whereas fresh surfaces usually have pearly or waxy lusters. Cobbles varying between about 5 and 15 cm in diameter were found. A few pebbles and cobbles of translucent grey or grey-blue chalcedony were also recovered, one of which was about 25 cm in diameter. In general, the flakability of the chalcedonies are considered to be fair, being hindered slightly by its hardness, numerous inclusions and flaws, tendency for fracturing perversely, and relatively small core size. They resemble some of the chalcedonies represented in the sample assemblages recovered from several

Figure 14. A general view of the area noted to have the greatest density of both basalts and silicates at the Maiden Creek source. Maiden Creek is in the center of the photo, and Pavilion Mountain lies in the far distance. Looking north.

housepits at Keatley Creek, but a positive identification is not possible on visual criteria alone.

Cherts. The cherts from the Maiden Creek source are generally the same hues as described for chalcedonies (above), with yellow and yellow-brown being most common. The average cobble size ranges between about 5 and 10 cm in diameter. Some cobbles contain both chalcedony and chert. Weathered or patinated cortical surfaces tend to be dull or frosted, and fresh surfaces have a waxy texture. Some types have a strong visual affinity with cherts found in Upper Hat Creek; suggesting a probable common geologic origin for the basalt and silicate-bearing deposits represented in both these areas. Again I think that it would be almost impossible to separate some of the cherts common to either of these source areas relying on visual criteria alone.

In general, the flakability of the Maiden Creek cherts is considered to be poor to fair. As with the chalcedonies from this source, they are affected by some flawing and irregular fracture tendencies. Their visual characteristics clearly lie within the range of variation expressed by chert types recovered from the Keatley Creek site, and consequently some of them may originate from this source.

Opal. At least one localized source of a material commonly referred to as "opal" was also encountered. The material is represented in a variety of colors and grades of quality; many of which can be present and highly variable on the same piece of stone. Most pieces are either predominantly pale yellow, light yellow, light green, light green-brown, or pale yellow brown, although some small pieces are bright orange and/or blood red. It has a characteristic semi-opaque translucency and a waxy appearance, and it tends to break up naturally into blocky or tabluar chunks about 2–10 cm in diameter. Weathered surfaces have a dull or frosted appearance. There may be other localized sources for this material elsewhere in the source area, but these remain to be identified.

This material is quite brittle, and when flaked, is sometimes unpredictable because of extensive internal flawing. Perhaps this flawing could be partially rectified by thermal alteration, however, this was not attempted on samples during this study. I do not recall having recognized any of this distinctive "opal" material in assemblages from Keatley Creek. Nevertheless, a subsequent examination may reveal low frequencies at the site.

Petrified Wood. Several fairly large chunks of petrified (opalized) wood were found along the transmission line ROW immediately southeast of a pond (Fig. 12). One piece was about 50 cm in diameter and weighed about 50 kg, although most of the larger chunks in the collected sample were only about 10–20 cm in diameter. The rest were signifiantly smaller pieces, varying

Figure 15. A view of the southern extent of the Maiden Creek Basalt and Silicate source along the transmission line right-of-way. Several large cobbles of yellow and yellow-brown chalcedony and chert were found in the area lying in front of the transmission line standard. Looking north.

between about 2 and 10 cm in diameter. Isolated smaller bits of petrified wood were also found scattered throughout many parts of the source area.

The petrified wood from this source is generally opaque white, light grey, light brown, medium brown, or dark brown in color (or a mixture of these), but some pieces contain small sections which are fairly translucent and even slightly irridescent—much like true opal. Weathered surfaces are heavily patinated, and fresh surfaces are either waxy, pearly, or dull in texture. On large pieces, the annual rings of the wood are clearly visible, and they indicate having been formed from branches and trunks of fairly large trees.

Flakability is considered to be generally poor because of the tendency for most pieces to shatter and fracture into elongate chunks and blocky flakes. This is probably due to only partial replacement of the wood by silicates, and/or because the material has a tendency to shear more easily along the lamellar structure of the wood. For these reasons it was probably not a very popular lithic material in prehistoric times.

The petrified wood from Maiden Creek resembles that sometimes found in Upper Hat Creek (Cliff Proznick, personal communication 1989), and a direct geologic relationship between these two areas is again inferred. A few small flakes of petrified wood have been found in assemblages from Keatley Creek which may have originated from either of these two source areas.

Miscellaneous Float Pebble Lithic Types

Randomly dispersed float pebbles of chert and chalcedony are found throughout most of the Canadian Plateau within glacial drift, till, and outwash deposits on valley sides and bottoms. For those with a trained eye, it is not uncommon to find at least one or two cobbles of "exotic" silicate materials ranging from 3–7 cm in diameter during a typical day of surveying or casual hiking. Over the years, several cobbles of high quality siliceous materials have been found incorporated in the extensive outwash deposits flanking the Fraser River in proximity to the Keatley Creek site. Pebbles and cobbles of fine-grained and medium-grained quartzites are also very common in hues ranging between white, yellow, brown, and grey. The latter are quite well represented at the Keatley Creek site. Indeed, it is suspected that many of the low frequency lithic types represented in lithic assemblages from the Keatley Creek site were probably collected from these contexts during the course of subsistence-related activities.

Additional Reported/Potential Sources

Two other reported sources remain to be identified and recorded, and a sample of materials collected. These include the Arrowstone Mountain petrified wood source and the Botanie Valley white chert source.

Arrowstone Mountain Petrified Wood Source

Cliff and Gail Proznick of Ashcroft indicated that another source of petrified wood exists somewhere on Arrowstone Mountain, which lies several kilometers north of Cache Creek on the east side of the Bonaparte River valley. Samples of the material provided by Mr. Proznick are creamy-white, tan, or whitish-brown, and the annual rings of the wood are fairly thick and well-defined. It is highly opalized, has a very waxy luster, and is considered to have better flakability than the samples of petrified wood from either Upper Hat Creek or Maiden Creek source areas.

Unfortunately the Proznicks could not point out the exact location on a 1:5000 NTS map, and I did not have the opportunity later to rendezvous with them. This reported source is a fair walking distance from Keatley Creek, and there are closer and more abundant sources (i.e., Upper Hat Creek and Maiden Creek) of petrified wood and other better quality silicates. Also, Mr. Proznick indicated that the wood from this source tends to be rare, although the odd large log or sections of logs of exceptional quality wood have been found. The exact location of this source, and inspection of the area for other potentially flakable stone should be conducted during any further lithic source studies initiated in the area.

Botanie Valley White Chert Source

Pavilion Band elder Desmond Peters indicated that there may be a source of white chert somewhere within Botanie Valley, which lies between Lytton and Upper Hat Creek Valley. Desmond remarked that Mr. Nathan Spinks (Lytton) may know the location of this source, but Mr. Spinks was not available to be interviewed. Bob MacNevin and I surveyed several areas in the upper part of Botanie Valley for lithic sources, and we also inspected several sites in the area for the presence of white chert flakes. No such material was found in any of the sites we examined. An attempt should be made to contact Mr. Spinks during a subsequent lithic source study in the area.

Miscellaneous Unspecified Sources

Duffel and McTaggart (1951:18) also indicate that blue-grey to white, oval-shaped chert nodules between 5 and 15 cm thick and about 30 cm long can be found embedded in the limestone in some locations within the Marble Canyon Formation. Several localities in Marble canyon were inspected for flakable chert deposits with the assistance of Ed Bakewell during the 1989 field season. The poor quality observed "cherty" materials associated with the limestone formations in marble canyon are clearly not suitable for flaking. Indeed, given the nature of the geology (i.e., fossiliferous limestone) and results of our inspections, it seems unlikely that the Marble Canyon Formation possesses any significant source of flakable materials.

The suite of basalts from the Keatley Creek site contains a distinctive variety characterized by a very dark grey groundmass with very thin black parallel lines/planes passing through it. In 1988 I suspected that this material might be found in the Maiden Creek drainage area, however, the sample of basalts taken from this source in 1989 do not contain this distinctive basalt variety. This type is not commonly represented at the Cache Creek basalt source, although the groundmass of some cobbles come close in color, and it may be that the occasional cobble from this area is in fact medium or light grey.

"Whalachin Green" chalcedony, a very distinctive lithic type available in the vicinities of the community of Whalachin, and at the confluence of Tranquille River and Watching Creek northwest of Kamloops, is represented in very low frequencies at Keatley Creek. This suggests that the acquisition radius for most lithic raw materials probably rarely exceeded this distance in Late Prehistoric times. Exchange of this material may have been most intense during the Plateau horizon and early Kamloops horizon, when lithic material exchange seems to have been most common throughout the Canadian Plateau (Richards and Rousseau 1987).

Conclusions and Recommendations

The 1988 and 1989 lithic source identification program initiated by the Fraser River Investigation of Corporate Group Archaeological Project attempted to locate lithic raw materials sources that may have been exploited by the prehistoric inhabitants of the Keatley Creek site (EeRl 7) and also by people occupying the Mid-Fraser River region in general. A total of eight lithic sources were identified and recorded. Of these, it appears that only four source locations would probably have been frequented by prehistoric inhabitants of the area. These include the Fountain White-Pink Speckled Chert source; the Upper Hat Creek Basalt source; the Upper Hat Creek Silicate source; and the Maiden Creek Basalt and Silicate source. I suspect that the Glen Fraser Silicate source, the Blue Ridge Ranch Chalcedony source, and the Moran Agate source were probably only rarely exploited. The Rusty Creek Red Chert source is quite hard to access, very localized, and has only mediocre quality material, and for these reasons I suspect that it may never have been exploited.

The information gathered during this lithic source study permit several important observations to be advanced. The first of these is that a suspected source for the very distinctive white-pink speckled chert common in Keatley Creek lithic assemblages has finally been identified near the confluence of Fountain Creek and the Fraser River. This indicates that this "exotic" material was likely not involved in a long-range lithic exhange system as was previously speculated.

Second, it was determined that an abundant source of good and fair quality basalt and silicates is available in the nearby Maiden Creek area. There is a relatively high degree of visual similarity between some of the silicates from the Maiden Creek source and Upper Hat Creek Valley, and for this reason I strongly suspect that the two have a very similar geologic relationship and/or origin. This fact is important to consider when conducting the analysis of lithic material types for the Keatley Creek site, because some of the material types relegated to Upper Hat Creek may have actually been derived from the Maiden Creek area (and vice versa). This distinction may be of importance for attempting to reconstruct site catchment areas, or other aspects of the cultural system related to subsistence and settlement patterns.

Third, given the relative abundance and sometimes fairly widespread distribution of some of the lithic materials found at several of the sources identified and examined during this study, I conclude that any attempt to control or restrict access to specific lithic sources by certain individuals or groups during prehistoric times in the Mid-Fraser and Thompson River regions would have been a very difficult, if not impossible task. I submit that anybody could have simply walked through these source areas and collect materials exposed on hillsides (particularly south-facing) or along small creek channels and washout gulleys. This would be particularly true of the Upper Hat Creek, Maiden Creek, and Cache Creek area sources. Moreover, most of the abundant sources are also located in mid-altitude contexts, which were generally uninhabited or sparsely inhabited, and were frequented primarily during the spring, summer, and early fall for hunting and plant gathering purposes. Lithic raw material procurement at these sources was probably embedded into these activities. Therefore, it may be that differences in relative proportions of various material types represented at some sites in the Mid-Fraser River region may be related to knowledge about certain lithic source locations, exploitation rates and exhaustion of materials, and seasonal subsistence and settlement patterns.

Recent research involving X-Ray Florescence of various types of basalts and other silicates from different sources conducted by Malcolm James (Dept. of Arch. SFU) suggests that there appear to be some significant differences in the relative amounts of certain elements in samples of basalts obtained from Cache Creek, Upper Hat Creek, and Maiden Creek sources. Thus, elemental "signatures" unique to each source can be discerned, and these might be potentially useful for "fingerprinting" archaeological basalt specimens from sites in the Mid-Fraser and Thompson River regions in order to determine their source of origin.

The preliminary data obtained by the X-Ray Florescence method suggest that typical Cache Creek and Hat Creek basalts are similar in elemental composition, however, Niobium (Nb) and Yttrium (Y) are absent in Hat Creek samples, and only about 30 to 50% of the Cache Creek samples contain them. On the other hand, the Maiden Creek samples contain slightly more of both of these elements. Strontium (Sr) is more abundant in the Upper Hat Creek samples than in the Cache Creek samples, and Maiden Creek basalt contains significantly larger amounts of this element compared to the other two sources. Rubidium (Rb) is more common in the Cache Creek samples than in the Hat Creek ones, and the Maiden Creek basalt has only about one-tenth the Rb observed for these other two sources.

Any future research involving the identification and recording of lithic sources in the Mid-Fraser and Thompson River regions should attempt to undertake the following recommendations:

1) Visit the Arrowstone Mountain petrified wood source located northeast of Cache Creek to determine its exact location, relative abundance and quality of material, and to inspect the area for other flakable lithic raw material types. Cliff and Gail Proznick of Ashcroft know the exact source of this material.
2) Contact Mr. Nathan Spinks (Lytton) and attempt to determine the location of a reported white chert source within the Botanie Valley.
3) Examine the cliff bases along the ridge on the south side of upper Rusty Creek (Fig. 11). As reported, there may still be another highly localized source of flakable silicates in the upper Rusty Creek drainage area, or perhaps in the Frantzen Creek drainage area to the immediate north.
4) There might also be sources of flakable lithic materials within some of the Tertiary age deposits situated on the eastern wall of the Fraser River canyon between Pavilion and Kelley Lake. This would require walking the B.C. Rail ROW and abandoned mining access roads.
5) Examine the two prominent hills lying immediately southwest of the confluence of Maiden Creek and Bonaparte river between about 3000 and 4,000 feet asl (Fig. 12) to determine if the Maiden Creek Basalt and Silicate source extends into this area as well.
6) Examine selected areas within the Kamloops Group formation on the north side of the Thompson River from Cache Creek to Kamloops for additional sources.
7) Examine selected areas with Tertiary age volcanics and sediments along the Thompson River from Cache Creek to Lytton. At least one potential source is known in this area (Shaw Springs Chalcedony source), and others may exist.

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