CHAPTER 5

Previous Archaeological Investigations and Mid-Holocene Subsistence Practices at the South Yale Site (DjRi 7)

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Introduction and Background

The South Yale site (DjRi 7) is situated on the east bank of the Fraser River opposite the small historic gold-rush era town of Yale, B.C., and immediately south of the very southern end of the most rugged section of the Fraser Canyon (Figures 1 to 3). It is a very large site, measuring about 4.0 km N-S by 1.0 km E-W at its widest point, and it occupies a series of prominent stepped terraces created by early Holocene riverine down-cutting. The site is quite unique in that it contains an extinct "hanging" channel of the Fraser River passing through it that was created around 8000 years BP. The geomorphological history of the site is complex and interesting (Chapter 4), and relevant to this chapter are both sides of the extinct river channel, a large cluster of boulders situated on "South Yale Ridge" (a.k.a. South Yale block-field), and the extensive upper early Holocene river terraces to the southeast.

The site lies within the Coastal Western Hemlock biogeoclimatic zone (Meidinger and Pojar 1991). Common coniferous trees on valley bottoms and sides include western hemlock, western redcedar, Sitka spruce and Douglas fir. Deciduous trees in low-lying and riparian areas include northern black cottonwood, Sitka willow, and red alder. The South Yale locality also contains isolated stands and small copses of Garry oak *(Quercus garryana)*, which is found mostly on the southern Coast (Lea 2006), but isolated communities are known for in the Fraser Valley, and the South Yale site is one of them. Understories typically include red huckleberry, thimbleberry, salmonberry, twinflower, bunchberry, gooseberry and Saskatoon berry; all are present in moderate to high abundance at South Yale.

The site is located within the traditional territory of Yale First Nation, who are Halq'eméylem-speaking Coast Salish people whose pre-contact period lifeways were shared with other Stó:lō ("people of the river") groups to the south. During the pre-contact period, salmon were the primary source of protein exploited, taken using still and dip nets. Salmon were prepared for storage using wind and/or smoke to dry prepared sides. A wide variety of plants were harvested and used as food, textiles and medicines (Chapters 11 and 28). Primary sources of ethnographic and archaeological information for Stó:lō groups are provided in Boas (1894), Duff (1952), Harris (1994), Hill-Tout (1903), Lerman (1952), Maude (1978), Schaepe (1998), Smith (1950) and Wells (1987).

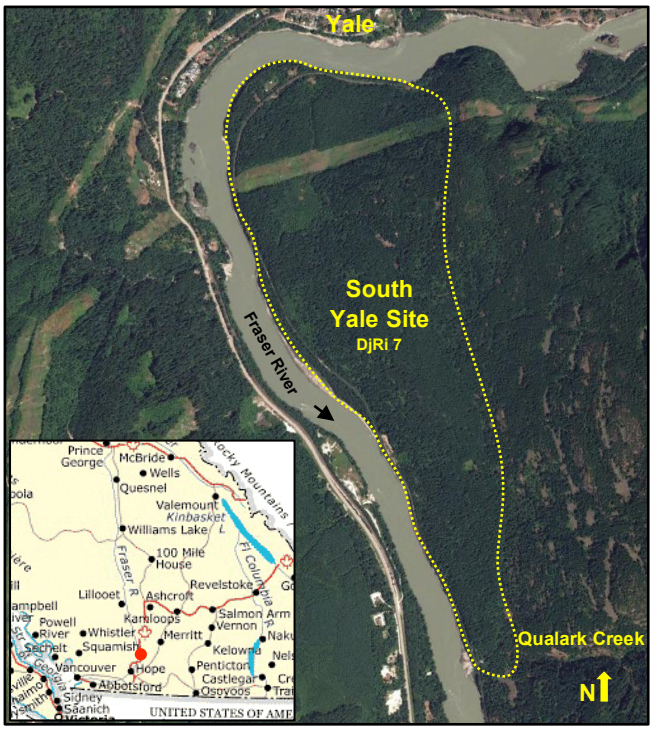

Figure 1. The South Yale Site (DjRi 7) in the Lower Fraser Canyon south of the small town of Yale, B.C. Google Earth Image 2016.

In 1808, Simon Fraser's expedition down the Fraser River brought him to what is now the town of Yale, and in 1846 the Hudson Bay Trading Company established "Fort Yale" at the same location (Paterson 1985). The discovery of a large deposit of gold at Hill's Bar in 1858 resulted in an influx of gold prospectors to the Fraser Canyon region. Hill's Bar is located in the western aspect of the South Yale site (Figure 3), and it produced more gold than any other locality on the Fraser River, with approximately $2,000,000 estimated to have been recovered by 1875 (Lyons 1950:45).

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Figure 2. A view of the northern half of the South Yale Site (center) looking northeast toward Yale (left).

During the 1860s, the Land and Fleming Sawmill Company moved their operations from Yale to the south side of the Fraser River, and began selective logging of the South Yale site. A wild-fire swept through the northern aspect of the South Yale site in 1868, resulting in loss of most of the remaining marketable timber (Bruce Mason, Pers. Comm. 2008). Railroad construction and related buildings and residential settlement occurred on the lower terraces at the northern edge of the site in the late 1800s, and some houses are still occupied today. BC Hydro installed a large power transmission line through the north half of the site in the mid-1970s. Exploratory placer mining activities were resumed in the Hills Bar locality in the 1970s, and several large machine-excavated test holes were dug to access underlying gravel deposits. Despite these past developments and land-altering activities, most of the South Yale site remains intact.

This chapter provides a summary of past archaeological investigations conducted in the South Yale site, and presents and discusses several lines of evidence that allow a preliminary reconstruction of prevalent subsistence activities and other related behaviours that transpired there during the mid-Holocene (7000 to 3000 years BP).

Summary of Previous Archaeological Investigations

Since the 1950s there have been many archaeological investigations undertaken in the lower Fraser Canyon, including those conducted at the South Yale Site (DjRi 7), Esilao Village (DjRi 5), and the Milliken Site (DjRi 3), which have contributed greatly to our initial understanding of the complex culture history in the region, and revealed evidence for local human occupation of the Yale and Milliken localities extending back at least 9000 years BP (Mitchell 1965; Mitchell and Pokotylo 1996). Antiquus (2008), Haley (1996) and Hoffman (2001) provide accounts of past archaeological work undertaken at South Yale, and a general summary is presented below.

1960s – Early 1970s Investigations

The South Yale site was first investigated in the early 1960s, and work extended into the early 1970s by Charles Borden (1968a,b), Don Mitchell (1965) and Moira Irvine (1973). These initial "pioneering" investigations were the largest ever conducted on the site, and resulted in recovery of thousands of lithic artifacts from excavations conducted in selected locations on five separate terrace levels (Figure 3). However, these results are only minimally summarized and discussed in Mitchell (1965) and Haley (1996). In 1963, Charles Borden and Don Mitchell conducted excavations at the north end of the site to: (1) determine if cobble tools found on the surface are representative of the entire assemblage; (2) to explore the nature and depth of cultural deposits; and (3) to seek, identify, and investigate areas with high artifact concentrations (Borden 1968b:55; Mitchell 1965:1). These excavations recovered artifacts that were interpreted to represent primary reliance on a rudimentary "early" period cobble-core/flake technology.

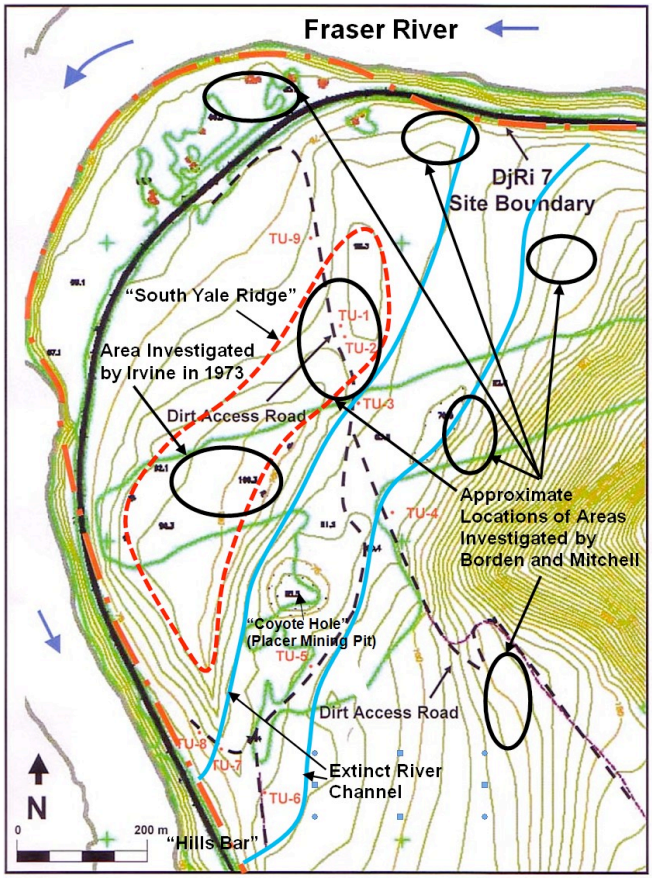

Figure 3. Map of northwestern aspect of the South Yale site (DjRi 7) showing approximate location of specific areas subjected to detailed archaeological excavations in the 1960s and early 1970s, and in 2003 (TUs 1 to 7). Base map provided courtesy of Coast Mountain Geological Ltd. with information added from maps produced by Haley (1996), Irvine (1973), and Mitchell (1965).

Despite the enormous amount of fieldwork and recovery of a very large body of archaeological data from the South Yale site prior to 1973, there are no formal detailed reports that present a comprehensive account of the investigations conducted by Borden or Mitchell. Mitchell's (1965) article provides only a very basic summary description of excavation results conducted in 1963. His sketch map only show approximate locations of the 1963 excavation units (Antiquus 2008:23), and our archival search at the Museum of Anthropology at UBC failed to locate any additional unit placement maps or field notes. Excavations began in 1963, and eventually a total of 16 test pits measuring 10 feet by 5 feet wide were dug during the 1960s (Mitchell 1965:5). Another 87 six by six- foot units were excavated by Borden in 1970 (Irvine 1973:4).

Figure 4. One of several large boulder shelters occupied at South Yale during the mid-Holocene. Borden and Mitchell conducted excavations here, and beside several other nearby boulders in the 1960s and early 1970s.

Very productive and interesting results were obtained from excavation units placed beneath and beside several very large boulders located in a dense cluster situated on what was called the "South Yale Ridge" lying on the west side of the extinct river channel (Figures 3, 4 and 8) (Chapter 4). Many of these early excavation units were not backfilled, and remain clearly visible today along with their respective back-dirt piles. Unfortunately, detailed results of these excavations have not been reported, although Haley (1996:58) indicates that stratigraphy is well-defined, cultural material densities are medium to high, and artifact types include cores, cobble "choppers", large spall tools, microblades, formed bifaces, projectile points, unifaces, flake tools, hammerstones, ground slate, an ochre nodule, and calcined bone. Several radio-carbon age determinations and presence of a well-represented microblade technology indicate multiple occupations between 6000 and 3000 BP (Haley 1996:59).

It is clear that these boulders, with or without protective overhangs, were the focus of intensive human activity during this time, and recovered artifact types are consistent with those found at large seasonal field camps and/or food processing locations. Areas immediately surrounding these large boulders were occupied and used on a regular basis; people being drawn to them for protection from the wind, rain and sun, and perhaps because it was easy to construct a simple temporary lean-to-like dwelling structures up against them. There is currently no direct archaeological evidence for the existence of these latter temporary "boulder dwellings", but logic suggests that it would have been regarded as a practical and quickly executed solution for ensured comfort and convenience when spending a few weeks in one location. We hypothesize that rooves for these suspected shelters were hastily constructed with prepared (stripped) poles laid close to each other against the boulder and then covered with bark, tree branches and moss to provide privacy and added protection from the elements.

Borden initially suggested that some artifacts recovered from upper terraces at the site belonged to a technologically simple "Pasika Complex", that he surmised to date from 12,000 to 10,000 BP (Borden 1968a,b). Assemblages typically include very technologically "crude" artifacts, the majority of which are unifacial and bifacial "cobble choppers", and large simple flakes struck from them (Borden 1968a:12; Kidd 1968:220). However, subsequent radio-carbon dates from excavated contexts suggest that this putatively early assemblage actually only dates from 6000 to 3000 years BP, which is temporally consistent with similar dated assemblages found elsewhere in the Pacific Northwest (Haley 1996). Haley (1987, 1996) also points out that cobble choppers and large flakes are also directly associated with other recent and technologically sophisticated artifact types (i.e., microblades, leaf-shaped and stemmed points, unifaces, ground stone items), and that the former were the result of a simple and expedient solution for producing simple cutting and chopping implements that were used to satisfy a variety of basic and routine subsistence-related needs. While it is quite possible that pre-6000 BP occupations do indeed exist at this site, they remain to be conclusively identified and adequately dated by ^{14}C radiometric assay and/or geologic context.

In 1973 Moira Irvine (1973) conducted salvage excavations within and beside the proposed footprints of two transmission line towers within the BC Hydro ROW (Figures 5 and 6). Since previous excavations conducted beside boulders on the nearby South Yale Ridge by Borden and Mitchell were found to be quite productive, a similar cluster of seven large boulders were subjected to a brief excavation program. Low to medium densities of cultural materials were recovered, including discoidal pebble cores, "core tools", cortex spall tools, formed unifaces (scrapers), large unmodified flake tools, a ground slate knife, and low quantities of lithic waste. Of note are a large thick "crude" leaf-shaped biface that appears to be a large knife, and a medium-sized contracting stem projectile point or knife that is formally consistent with forms dated between 5000 and 2400 years BP. Not surprisingly, Rock VII, which has an overhang, yielded the greatest density of cultural materials, and Irvine notes that this boulder shelter has a large fallen slab that may have once been part of the overhang/roof, and she suspects that intact cultural deposits are buried below it.

Figure 5. Four of seven large boulders that were the focus of Irvine's (1973) excavations within the BC Hydro Transmission Line ROW impact zone. The flags mark corners of the 1973 excavation units.

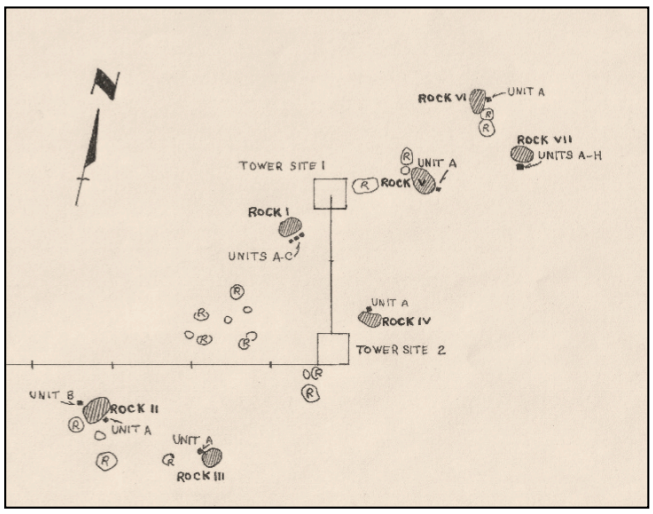

Figure 6. Map showing locations of Boulder Shelters I to VII located adjacent to transmission line towers excavated by M. Irvine in 1973. Reproduced by Mike Will from Irvine's sketch map.

2003 Investigations

From June to August of 2003, Mike Rousseau and Mike Will of Antiquus Archaeological Consultants Ltd. (2008) directed an impact assessment (AIA) study for a main access road ROW intended serve a proposed large-scale gravel quarry extraction project involving the entire South Yale Site. This proposed road followed the existing single-track road extending N-S through the center of the site. During the two month project, most of the site was visually explored many times over, providing intimate knowledge of its terraces, boulder clusters, and habitable localities along the extinct river channel and upper eastern terraces. For a number of reasons, the proposed gravel extraction project was abandoned shortly after the fieldwork was completed.

One of the 2003 primary objectives was to make an attempt to relocate specific locations within the site that had been previously subjected to detailed archaeological subsurface investigations during the 1960s and 1970s by Borden and Mitchell. Overviews provided by Haley (1996) and Hoffman (2001) have maps showing only the general location of these earlier investigated areas (Figure 3). Using this basic information as a guide, we revisited these various locations and attempted to identify individual excavation units. Units placed within the boulder cluster on "South Yale Ridge" were easily found, as most of them still remain open. While we were successful in identifying a few units in other areas of the site that were not backfilled, or only partially backfilled, it was eventually evident that many backfilled units have since been obscured by erosion, vegetation growth and littermat accumulation over the last three decades. To complicate matters further, there are a number of large square and rectangular holes measuring about 2 to 5 meters across that were dug in several places on the site that do indeed resemble eroded excavation blocks, but many could also relate to post-1970s placer mining "test-hole" activities.

A visit to the Museum of Anthropology at UBC resulted in locating a few vague field notes, and a large rough sketch map prepared by Don Mitchell in 1963 showing the location of 16 "Test Pits" placed along the northern aspect of the site (Antiquus 2008:23). A subsequent but unsuccessful effort was made to find some of these excavation units. It became clear that relocating and mapping Borden and Mitchell's pre-1973 excavation units would be a daunting task requiring more time and information than we had available, and thus we were forced to abandon this objective. The exact location of these early excavation units may be forever lost with the recent passing of Don Mitchell.

We easily identified all seven of the boulders (Rocks I to VII) excavated by Irvine (1973). Each boulder was cleared of surrounding vegetation, previous excavation units were flagged, photos were taken (Figure 5), and we also reproduced Irvine's original sketch map (Figure 6). Subsequent impacts to the ground adjacent to these boulders has been minimal, and intact cultural deposits still remain associated with them.

During the 2003 AIA inspection, a total of 410 shovel tests were dug within and immediately alongside the existing single-track dirt access road. A total of 129 tests (31%) were positive, and collectively yielded 142 artifacts and 200 lithic waste flakes. Noteworthy artifacts collected during the shovel testing program included a projectile point, 32 cores and core fragments, hammerstones, utilized flakes, retouched flakes, milling stones, and several bifaces (Figure 7).

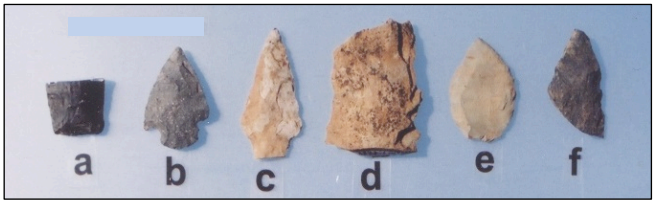

Figure 7. Formed bifaces recovered in 2003.

Upon completion of the 2003 shovel testing program, road segments determined to have medium or high artifact densities were examined in greater detail by digging nine test excavation units (TUs) (Figure 3). Some units coincided with positive shovel tests that yielded significant medium density cultural deposits, whereas others were placed in locations where cultural materials were surficially evident. Eight units measured 2 m^2 were dug; and Test Unit 5 was a trench measuring 4 x 1 m. Detailed results of these excavations are presented in Antiquus (2008). Results for four units (TUs 1, 2, 5 and 6) are summarized below, since they provided the best and densest information relating to mid-Holocene lithic tool production and subsistence practices.

TU1 was a 2 m^2 square excavation unit located on the east side of the existing access road on the west bank of the extinct river channel within the area occupied by the cluster of large boulders on "South Yale Ridge" excavated by Borden and Mitchell in the 1960s and early 1970s (Figure 8). A total of 22 lithic artifacts and 43 lithic waste flakes were recovered, including utilized flakes, eight microblades (or portions thereof); two microblade cores; six flake-core fragments, and a hammerstone. The presence of microblades and cores in this part of the site is consistent with previous excavations, and indicates occupations predating 3500 years BP, since after this time, solid evidence for common use of microblade technology is conspicuously absent in excavated and dated components throughout the Pacific Northwest.

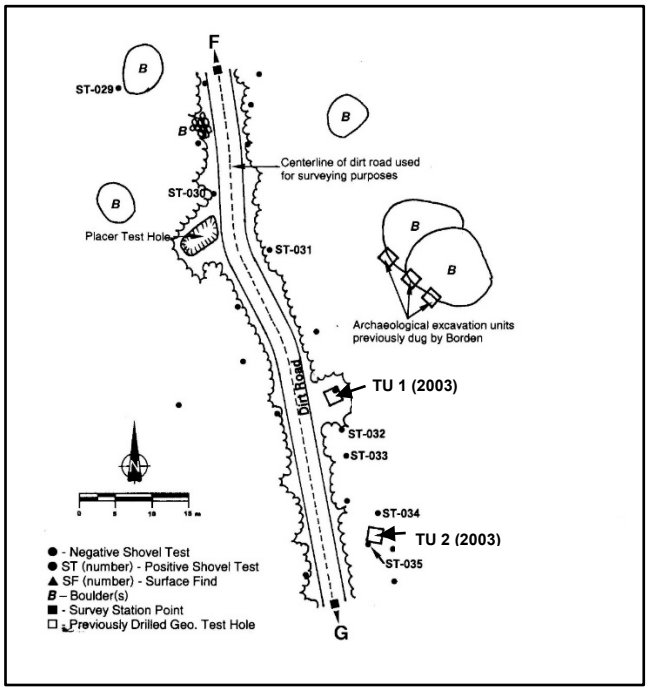

Figure 8. Map showing location of excavations conducted under a prominent boulder overhang by Borden in the 1960s, and two nearby 2m^2 units TU 1 and TU 2 dug in 2003.

TU2 was a 2 m^2 square excavation unit also located in the "South Yale Ridge" boulder cluster a few meters east of the existing access road and about 25 meters south of TU 1 near the north edge of the extinct river channel bank (Figures 8 and 9). Excavation indicated the presence of medium and high density cultural materials. While not visible on the surface before excavation, several large angular boulders were encountered and exposed in this unit, and their peripheries yielded high density cultural deposits. It appears that these boulders were once used as seats, or as small table-like surfaces while performing routine daily tasks. We recovered 35 lithic artifacts and 56 lithic waste flakes. Artifacts include 19 flake-cores and core fragments, three microblades, three presumed schistose "saws", two perforators, and numerous utilized flakes. Of particular interest is a small well-worn milling stone that bears what appears to be the image of a small dart etched into its dorsal (top) surface (Figure 16). The significance of this incised image is unknown, but since advanced wear-patterns on this

Figure 9. Post-excavation view of TU 2 showing exposed large boulders near the extinct river channel. Several artifacts, including a well-worn milling stone, were recovered from this unit directly associated with the peripheries of the flat-surface boulders.

Figure 10. A pre-excavation view of a small boulder shelter excavated in 2003. Flags mark placement of excavation unit TU 5.

Figure 11. A cross-section view of a small circular shallow saucer-shaped pit feature encountered in TU 6 containing hundreds of small rounded pebbles at the interface between the early Holocene sandy silts and mid-Holocene aeolian silts. This feature is provisionally interpreted to be the remains of an acorn leaching/steaming pit.

item attest to a very long use-history, it may be a personal mark to indicate ownership, or perhaps less likely, a preferred direction of use.

When considered collectively with Borden and Mitchell's earlier general excavation results, areas sampled by TUs 1 and 2 clearly indicate that a great amount of important and intact archaeological information relating to mid-Holocene occupations still remains beside and between the boulders on "South Yale Ridge". Future archaeological investigations conducted in this section of the site should also make an effort to include a detailed analysis and presentation of the data secured during the earlier 1960 and early 1970s excavations.

TU 5 was a trench measuring 4 m N-S x 1 m E-W located on the south-east side of a small boulder shelter overhang on the south side of the extinct river channel (Figure 10). This boulder has a small low overhang, and excavations revealed it was occupied several times over the last few thousand years as a "residential focus" that may have related to a short-term seasonal field camp. Again, it is possible that a simply constructed temporary dwelling may have once existed there. A total of 40 artifacts and 130 waste flakes were recovered. Noteworthy items include several flake-cores and core fragments, utilized flakes, sling or boiling stones, hammerstones, unifacial scrapers, the basal portion of a stemmed bifacial knife or projectile point not commonly found in the biface sequence during the last 3000 years (Carlson 2008; McLaren and Steffen 2008), and a corner-notched projectile point that resembles those found in many components dating between 2400 and 1000 BP throughout the Pacific Northwest. Three small mammal bone fragments were also recovered; which is considered a rarity due to ambient acidic soils and relatively high precipitation. The recovered projectile points and faunal remains indicate that the occupants were engaged in at least some hunting-related activities. This boulder, and many others like it on the valley floor associated with well-used trails, were surely commonly occupied overnight during local hunting forays, or while travelling between large field camps and/or permanent settlements established along the valley bottom.

TU 6 was a 2 m^2 square excavation unit yielding a total of 31 lithic artifacts, including 20 utilized flakes, cores and core fragments, a non-diagnostic leaf-shaped chert biface and some lithic waste flakes. Of interest and importance to this chapter is an enigmatic, small, circular (1.0 m diameter), saucer-shaped lens of pebble-gravel encountered

Figure 12. Flake-cores, cobble "choppers" and core fragments recovered from South Yale in 2003. Note high formal and technical variability.

in the south wall of the unit at about 50 cm BS (Figure 11). We were initially puzzled as to its origin and purpose, and an obvious function could not be confidently inferred. However, we now suspect that it may be the remains of an acorn leaching/ steaming pit that is discussed further below.

Mid-Holocene Subsistence Activities at South Yale

Use of Cobble Cores/Choppers, Cores and Large Flakes

Researchers in the Pacific Northwest have long pondered and hypothesized on the age and functional significance of unifacial and bifacial "cobble tools", "cobble choppers", "cobble cores" and the many large flakes struck from them. These artifacts are very common and ubiquitously distributed throughout most of the South Yale site on all terrace levels, and this is also true for many other mid-Holocene sites in the Lower Fraser Canyon sub-region. There have been attempts to classify them into formal and technological categories and define reduction sequences and strategies (Haley 1996:52-54) (Chapter 11), but these efforts have proven to be of little interpretive or insightful value with regard to conclusively determining specific function(s) or other interrelated subsistence behaviours.

It is curious that nobody has attempted to rigorously address the purpose(s) or behaviours associated with the production and use of this very simple, highly flexible, and efficient lithic technology. It creates two useful products: **(1)** the large and medium-size flakes struck from cobbles that can be used unmodified as very effective hand-held cutting, scraping and shaving tools, and can be easily formed into unifacial scrapers and occasionally bifaces; and **(2)** the cobble/pebble core that was also used as a wood-chopping tool, and perhaps occasionally as a digging implement, or to sever heads from salmon. Past researchers have focused primarily on the attributes and reduction sequences pertaining to the cobble cores/choppers rather than the very useful flakes derived from them. It is apparent that many cobble cores have reduction edge angles that are far too obtuse to have functioned as effective chopping or hacking tools, and many cobbles were reduced to the point of exhaustion, resulting in "tortoise-shaped" or discoidal cores. Many other less-interesting multidirectional core forms were also commonly produced from blocky angular clasts at South Yale and elsewhere, but many researchers choose to ignore these more mundane forms (Figure 12).

It is our opinion that the high density widespread presence of cobble/core/tools, other core forms, and large flakes at the South Yale site relates directly and primarily to harvesting (chopping down), de-limbing, bark-stripping, and modifying small straight-trunked saplings and trees. We posit that the most common behavioural scenario involving their use is as follows. Circular and ovate elliptical (mesially-flattened) cobbles ranging from 15 to 30 cm in maximum dimension and 5 to 10 cm thick made of flakable toolstone (siliceous metasediments, andesite, quartzite, etc.) were selected from cobble/gravel bars and shores along the edge of the extant and extinct river channels located at or near field camps and salmon fisheries. Although elliptical cobbles were preferred, other similar-size clast forms were also used as cores if their lithic materials were deemed flakable. Hammerstones for reducing these cores were also gathered. These intended cobble cores and hammerstones were carried to locations supporting small straight-trunk saplings and trees, which surely existed throughout many parts of the South Yale site. Several large sequentially-struck "decortication" flakes and flake blanks were removed from edges of the cobbles in a variety of ways to create unifacially flaked "core tools" or "cobble choppers" (Figure 12a-n) with moderately acute edge angles that were well-suited for chopping/hacking down 10 to 15 cm diameter saplings at their base. The rounded natural contour of the cobble opposite the flaked edge allowed a firm, comfortable and safe grasp of the cobble tool during reduction and use as a chopping tool. Several saplings could be felled in this

manner over a relatively short period of time, and dulled "chopper" edges were retouched and/or expanded as needed to restore penetration efficiency. Choppers were also used to hack off larger limbs. Once the desired number of saplings were cut down and de-limbed, the initially struck decortication flakes and new flake blanks derived from the "chopper-cores" (which at this point had served their pole-harvesting purpose) were used unmodified to strip-shave bark from the sapling trunks, remove small branches, and finish the poles. Once the desired number of saplings were cut and initially processed, the cobble chopper/cores, used flake tools, waste flakes and hammerstones were most always abandoned at pole harvesting locations, with the processed poles and some larger branches being dragged to their intended use-locations at salmon fishing stations and field camps. It is the ultimate disposable lithic technology that lends itself well to pole production and woodworking, since elliptical cobbles of suitable lithic materials were very common locally, and numerous expendable, sharp, functionally flexible, and highly efficient flake tools were very easily and quickly produced. This same set of activities was repeated up and down the Fraser River for thousands of years, especially between 5000 and 3000 years BP.

Pole and branch harvesting and processing was necessary to supply structural elements for construction of salmon drying racks, scaffolding and platforms at fishing stations, net poles, above-ground caches, digging sticks, stakes, weaponry components, roof elements for pithouses, and for the suspected temporary dwellings constructed against boulders. Given that intensive local salmon fishing is a 5000 year-long tradition in the Lower Fraser Canyon, it comes as no surprise that cobble choppers/cores and large flakes struck from them are so abundant and widely distributed over the entire South Yale site. Thus, their common presence throughout most of the site – including uninhabitable slopes – is not indicative of an enormous camp or residential settlement, rather, they are simply the accumulated amalgam of thousands of years of discarding expendable/disposable cobble cores and their flakes in locations were saplings suitable for pole production once grew, which was pretty much everywhere.

Use of Edge-Ground Cobbles

Edge-ground cobbles are a unique artifact class that has been consistently ignored by researchers despite their common recovery from many mid-Holocene components at sites close to the Fraser River. The typical example is an ovoid discoidal cobble about 15 to 20 cm in diameter that has one or two relatively straight or near-straight lateral margins that have been ground dead-flat, or occasionally slightly convex (Figures 13 and 14), using a longitudinal "sawing" motion while holding the cobble vertically on its latitudinal axis. While dense (heavy) ovate discoidal cobbles were preferred, occasionally, some edge-ground cobbles were made from angular or amorphous clasts that could be easily held in the hand (Figure13b-d), and had at least one elongate faceted edge that could be used.

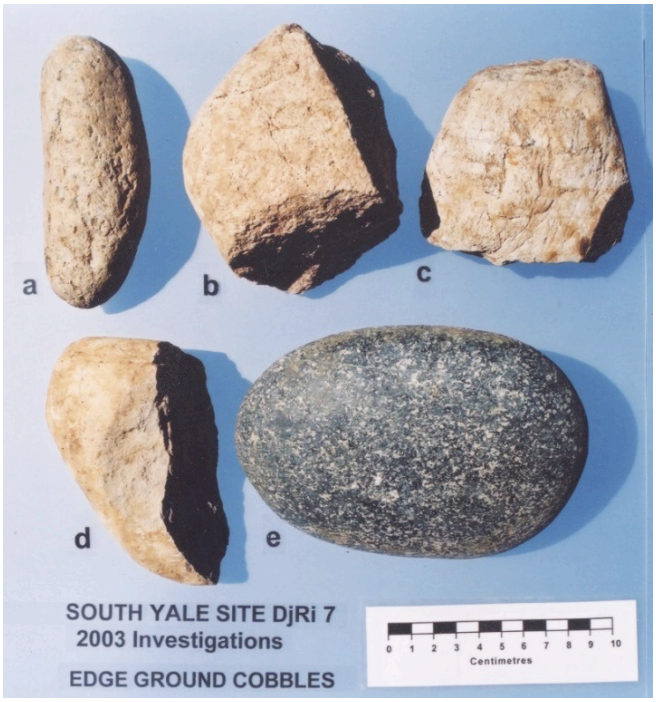

Figure 13. Edge-ground cobbles recovered in 2003.

Figure 14. A "classic" well-used edge-ground cobble with moderate edge grinding along all lateral margins. These tools are common at riverine fisheries and salmon processing camps. They were most probably used to pound and grind dried salmon sides into a fibrous "flour" for later storage and consumption.

While it is clear that these fairly common tools were used to grind/mill, and perhaps pound and pulverize something, it is not immediately clear as to what that was. It is also uncertain as to whether the ground edges are the direct result of long-term use, or if they were intentionally created by abrasion against harder rocks to produce desired edge-facets first, and were then put to their intended use. Use-wear striations and smoothing clearly indicates a back-and-forth motion, and contact with hard surfaces (e.g., an underlying rock) during use is also suspected.

Since these distinctive and puzzling tools are often recovered from sites at or near salmon fisheries, it can be inferred with a modicum of certainty that a significant functional relationship exists between these items and

salmon processing. Wind-dried salmon is often fairly hard, and in this state it can be further processed by breaking up, shredding and milling dried flesh into a fibrous mass to ensure complete drying, to easily mix it with other dried foods, and to store it for later consumption. We suspect that most edge-ground cobbles were used for this task, but this remains to be adequately demonstrated by experimental replication and use, and/or by residue analyses. The latter approach would be the best way to test this suspicion, since salmon oils would have surely seeped well into porous facets of well-used specimens, and may remain today. If it is indeed eventually shown that edge-ground cobbles were primarily used as dried salmon flesh-shredders, this important activity could be directly and assuredly inferred for sites where they are found. That they may reflect an intensive effort to pulverize large quantities dried salmon into a fibrous "flour" for storage and winter consumption from 5000 to 3000 BP should be viewed as significant, since subsequent to that, dried salmon sides were simply stored whole in underground cache-pits within and near winter villages, and as a result, common use of edge-ground cobbles appears to have become obsolete. It could be logically argued that edge-ground cobbles may have been used primarily to process dried plant foods (e.g., nuts and berries) since they are formally and functionally capable of doing that, but we think this would have been regarded as a secondary function of these tools.

Use of Milling Stones

During the 2003 investigations, we noted milling stones and hammerstones in small cobble piles left beside open excavation units associated with large boulders that were dug in the 1960s and early 1970s. These tools had obviously been overlooked by early excavators and were not collected. Granted, these simple stone tool forms often bear little visible evidence for intentional modification or use unless they are given very close scrutiny. With this past recognition bias in mind, we were vigilant for milling stones during our 2003 excavations, and succeeded in recovering a fair number of them (Antiquus 2008) (Figure 15). Their currently observed distribution at the site suggests that they are common along, and within 50 metres back from, the extinct river channel banks, and throughout the area occupied by the boulder cluster on "South Yale Ridge". The majority of South Yale milling stones are fist-sized cobbles that conform well to fingers and palm when grasped. The average form is "bun" or "biscuit"-like for use in one hand, but some larger elongate examples may have been used with both hands in a "*mano"*-like manner. Clear evidence for surface abrasion, parallel striations, smoothing and polishing are evident on a few South Yale specimens, attesting to long periods of use. Seeking and selecting river-rounded stones well-suited for effective milling may have involved spending a bit of time on the river gravel bars, since candidates had to be the right size and overall shape,

Figure 15. Milling stones recovered from the South Yale site in 2003.

fit comfortably in the hand so they could be used for extended periods, and the milling surface(s) had to be relatively flat or slightly convex. Once a "good" one was found, it was probably valued by its owner, and used over long periods. Unlike cobble core/choppers and their resulting flakes, milling stones were not regarded as an expedient or "disposable" technology. Some may have been intentionally left in conspicuous locations (e.g., on the edges and tops of boulders and big rock slabs) at the end of each seasonal field-camp occupation so they could be readily found and used again during successive annual visits.

In most archaeological contexts, the common presence of milling stones is usually considered indicative of processing of fair to large quantities of foods to be stored and later consumed over the winter and/or during lean times. Logic suggests the usual suspects such as seeds, nuts, dried berries or dried fish. Milling stones are very common at sites in the Great Basin and northern California where they were involved in processing large quantities of grass seeds, pine nuts and acorns (Jones 2008). Fitzgerald and Jones (1999) note that many lithic assemblages contained at sites where milling stones are found often lack or contain only a few well-made projectile points. It seems that this same proportional pattern also exists at South Yale, where projectile points are found in very low numbers compared to most other artifact types.

Figure 16. Two views of a well-used milling stone recovered in association with large flat boulders. It fits very well in the right hand, and its base/bottom (top image) is worn smooth and is highly polished, and has a dark stain that may be an organic residue. A small arrow-like figure is incised on the dorsal surface (lower image), perhaps as a personal mark of ownership, since it is perfectly suited for milling/grinding and would have been valued.

At South Yale, the artifact types associated with the extinct river channel and "South Yale Ridge" boulder cluster are most consistent with those associated with assemblages generated by salmon fishing and plant gathering and processing activities. Hunting seems to have been merely a secondary incidental pursuit. If it is assumed that most males were generally preoccupied with fishing and hunting activities, then it remains that the primary users of milling stones (and edge ground cobbles) may have been women and children (see Jones 2008:139). The big question remains: What exactly was being processed by milling stones at South Yale?

Garry Oak Ecosystems and First Nations Acorn Processing

Garry oak *(Quercus garryana)* is an acorn-bearing deciduous tree that thrives best in "Mediterranean–like" climates, and are very sensitive to local ground disturbance and invasive Douglas-fir forest encroachment. Typical healthy Garry oak ecological communities include blue camas, white Easter lily, chocolate lily, snowberry, and a variety of grasses and mosses. Soils and climatic conditions are well-suited for supporting Garry oak trees at South Yale, and it was probably one of the dominant tree species found there during the pre-contact period. They were probably most prolific during the early and mid-Holocene (8000 to 5000 years BP) when local climate was warmer and drier than it is today (Erickson 1993). Clear-cut timber harvesting and burning of much of the site in the late 1800s allowed Douglas fir and cedars to invade and dominate. Nevertheless, many isolated stands and small clusters of healthy Garry oak trees still thrive on the site within or near natural and artificial clearings.

Garry oak forests were routinely subjected to controlled and/or "prescribed" burning to manage plant harvesting areas (Lepofsky 2008:138). Pringle (2008) also mentions that acorns were harvested and processed by Northwest Coast peoples, but it seems that this topic has received little research attention by B.C. archaeologists. In their raw state, acorns naturally contain tannic acid which is difficult for humans to consume, but "leaching" removes the acid and renders them edible. It has been determined that acorn leaching through boiling can remove the tannic acid from 9% to 0.19% (1987 Bainbridge).

The Sunken Village site (35MU4) located on the Columbia River in Portland yielded data to support intensive acorn leaching by placing large numbers of them in submerged basketry along the riverbanks and in "leaching-pits" (Croes et al. 2008; Bogan 2006; Mathews 2007). Other methods of leaching tannic acid from acorns include boiling, steaming, or smoking for long periods (Turner and Bell 1971). Croes (1995) relates that after completion of the acorn leaching process, "handstones" (milling stones) were used to process acorns into flour that could be stored for long periods and consumed when needed. Acorn flour was used among Northwest Coast groups to make cakes (Croes 1995), and Californian groups used milled acorns as a substitute for "corn meal", which was used in soups and stews, baked or dried into cakes, and as a coffee-like beverage (Bainbridge 1987).

Given an assumption that these oaks were common on the South Yale locality pre-contact period landscape – especially during the warmer mid-Holocene – their acorns would surely not have been ignored, since they were an easily harvested and abundant source of storable carbohydrate and plant fat. We suspect that acorns were gathered and processed in large quantities along with lesser amounts of other plant foods, and they were processed into "nut-flour" using milling stones.

Evidence for Acorn and Berry Processing at South Yale

There is no definitive "smoking gun" that allow us to confidently infer that acorn processing occurred at South Yale (e.g., burnt acorn husks in good archaeological context and/or positive identification results using residue analysis), but there are some indirect lines of evidence that are consistent with intentional leaching, drying and milling to produce acorn "nut-flour". That Garry oak were common in this locality during most of the post-contact period is a good assumptive start, but the obvious preponderance of milling stones in several excavated areas is most telling. Also, the unique, small, circular saucer-shaped pit containing a layer of pebbles encountered in TU 6 during the 2003 excavations may be the remains of an acorn leaching pit feature (Figure 11). We offer that the bottoms of small shallow hand-dug pits like this were lined with a thin layer of clay and/or large leaves, filled with acorns, some water was added, and then the pit contents were boiled/steamed by introducing several hundred fire-heated "boiling stones" (pebbles). Leaching in this manner could be carried out in any flat location with a nearby source of water, and where the fine aeolian silts are hydrophobic, which along with a thin clay or organic liner, helped to ensure that the water did not seep into the underlying ground. Moreover, it was curious that we recovered several isolated so-called "boiling/sling stones" during the 2003 excavations, and some of these may have been scattered boiling/steaming stones once used in the acorn leaching process. Submerged basket leaching may have also occurred along the edge of the river, but any direct archaeological evidence for this practice can be assumed non-existent.

Intensive gathering of acorns, and leaching and processing them into "nut-flour" at South Yale stands out as a unique and relatively uncommon activity when compared to other documented primary subsistence tasks practiced by Stó:lō people and other British Columbia Coastal groups. We posit that this acorn harvesting tradition, which probably began around 5000 years ago, coincides with the beginnings of intensive salmon exploitation and the early adoption of more semi-sedentary lifeways, and it may have been more common and widespread than previously assumed.

Acorns aside, there is also a very wide variety of wild berries and of edible roots present throughout the site today. The most common are Oregon grape, salal berry, huckle-berry, salmonberry, thimbleberry, and bog cranberry, and these are all truly prolific. During the mid-Holocene when drier warmer conditions prevailed, this locality may also have supported dense Saskatoon berry communities such as those found north of Boston Bar today. These same floral foods were also likely available in abundance in the past, and many kinds of berries may have been dried, milled and formed into cakes for storage and delayed consumption.

It may eventually be shown that processing of acorns and other dried plants with milling stones may have begun adjacent to the extinct river channel and on "South Yale Ridge" as early as 8000 years ago, and that this tradition continued up to the abandonment of these parts of the site around 3000 years ago. One could also effectively argue that milling stones could have been used to pulverize and shred dry salmon, but we contend that edge-ground cobbles are much better-suited for that purpose.

Summary and Future Investigations

The vast South Yale site is truly one of the most intensively occupied and interesting pre-contact period sites in B.C., and its various settlement and activity foci still contain an enormous wealth of important archaeological information spanning back to 6000 BP. Small occupations dating several millennia earlier may also exist on the upper eastern terraces. While it is often assumed that salmon fishing and drying for storage were the most important and common subsistence activities that transpired at the site, there is no current direct archaeological evidence (salmon bone) to support this. Recovery of low numbers of projectile points indicates that local hunting was of minor importance. Detailed excavations clearly show that the South Yale site contains many hundreds of discrete and amalgamated activity areas containing low to very high density lithic scatters. There can be little doubt that millions of lithic artifacts remain in their primary depositional contexts at this site.

Although it is pure speculation at this juncture, we think it quite likely that simple hastily constructed lean-to like structures were often built against some of the many boulders located on "South Yale Ridge" and on either side of the extinct river channel. We posit that these temporary shelters were occupied for extended periods during late Spring to early Fall while people were gathering local plant foods and engaging in nearby salmon fishing. Some of these "boulder-dwellings" may predate the initial appearance of pithouses around 5000/4500 years ago (Chapters 9 and 25). Future detailed investigations conducted under and adjacent to these boulders should be mindful of structural remains indicators such as small post holes, obvious dwelling floor zones, evidence for intentional digging of shallow foundation depressions, etc.

We need to accurately determine when the Fraser River flowed through the extinct channel. Friele (Chapter 4) suggests that it may have formed and was active as early as 8000 BP, but it is not known exactly when the river abandoned this channel and shifted its course northward and flowed on the north and west sides of "South Yale Ridge". Given the current archaeological evidence, it is possible that at least some flowing water was present in the channel as a small stream between 6000 and 3000 BP, and perhaps it was big enough to allow small groups of people to regularly use this part of the site for establishing annual seasonal field camps. Eventually it may be shown that the extinct river channel was only fully active for a few hundred years sometime between 8000 and 7000 years BP. Regardless, it is abundantly clear that people continued to regularly revisit "South Yale Ridge" and other habitable areas and boulders along its dry channel banks for several millennia afterward.

Although we suspect that it will continue to be a challenging task, it is recommended that future investigations at South Yale should again attempt to generate detailed maps showing precise locations of excavation units that were dug in the 1960s and early 1970s. Also, we need to properly analyze and report the large quantity of data that was secured during these investigations.

Residue analysis of functional edges and surfaces of cobble core/choppers, edge-ground cobbles, and milling stones should be attempted to determine exactly what foods were being processed by these distinctive and well-represented mid-Holocene tools. Replication and experimental use of these implements could also provide some important insights about their functional efficiency while performing certain subsistence tasks.

Past efforts to accurately date and reconstruct the occupational history of the South Yale Site have been greatly hindered by poor preservation of charcoal and faunal remains, which are usually only found in ambiguous scattered trace quantities. AMS ^{14}C dating of small organic samples is now commonplace, and could be used to date very small previously collected samples, and those recovered during future investigations. Sediments under some of the larger boulder overhangs should still contain datable cultural materials, since these deposits are significantly drier and a bit less acidic, thus organics incorporated in them have been less susceptible to decay. A large series of ^{14}C dates is greatly needed, and this should be a future research priority at the site.

There are no current plans for development of the South Yale site, but this could change in the near future. It contains a fair amount of marketable timber, extensive construction-grade gravel deposits, and some suspect that a significant quantity of gold still remains beneath the extinct river channel. Although rail access exists, the greatest impediment to realizing the large-scale exploitation of these lucrative resources has been the lack of any direct vehicle access linking the nearby highway to the site. Fortunately, this poor access has also prevented the site from being substantially impacted by development and vandalism in the past. Eventually, a bridge spanning the Fraser River, or a new access road on the east side of the river will be constructed, and interest in exploiting the rich resources will be renewed. When this happens, it is a certainty that extensive detailed archaeological investigations will be required to mitigate and manage ensuing land-altering impacts, thereby providing future opportunities to further reveal and explore the lengthy and interesting occupational history of this site.

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