# CHAPTER 3

# The Significance of Linear Grooves at Petroglyph Site DjRi-31 near Yale, B.C.


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### Introduction and Background

This chapter presents and discusses the significance of linear grooves in bedrock at petroglyph site DjRi-31, located on the west bank of the Fraser River near Yale, B.C. (Figures 1 and 2). Although knowledge of these grooves has long been maintained through First Nation oral tradition and documented in the journal of explorer Simon Fraser, archaeological interest in them has been minor, and explanations regarding their purpose have been cursory at best. Unlike most petroglyph sites where designs were intentionally produced, the grooves at site DjRi-31 differ as they are most likely the result of intense tool-use associated with a set of specific subsistence behaviours, and it is important to consider their functional context. I posit that stone grooves present at site DjRi-31 are directly associated with salmon procurement and processing industries. The following presents a description of the grooves, their specific geographic location, and general ecological context. A brief overview of past ethno-historic and archaeological interpretations is also provided. I argue that these grooves are hard physical evidence for edge maintenance of ground stone knives that were once heavily relied upon for intensive and efficient salmon processing in the lower Fraser Canyon.


**Figure 1. Google Earth image showing general location of site DjRi-31 on the Fraser River near Yale, B.C.**

### Site Location and Description

Site DjRi-31 is a small (*ca.* 20 m N-S by 20 m E-W) pre-contact period "petroglyph" site located at the southern extent of the Fraser Canyon, approximately 1.2 km upriver of the historic town of Yale, B.C. (Figures 1 to 3). The cluster of v-shaped grooves are situated on a flat meta-sedimentary rock outcrop below the old Trans-Canada Highway route, approximately 10 metres above the current average level of the Fraser River (Figure 2). This deep and narrow section of river is immediately downstream of a jagged rock island known as "Lady Franklin Rock". This island was named after Sir John Franklin's widow who travelled up the Fraser River in an attempt to locate the ill-fated expedition party (Lyons 1950:50). The river is constrained in this location and, as a result, its flow is fast and turbulent with several back-eddies that provide ideal salmon fisheries.

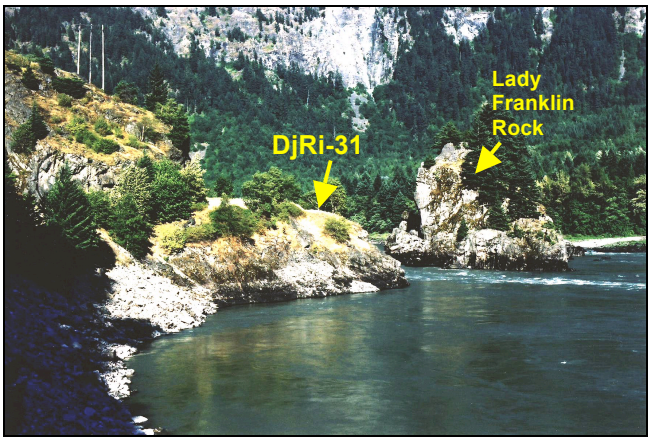


**Figure 2. View of bedrock outcrop and site DjRi-31 on the Fraser River, looking east.**

Also known as *The'xelis,* the site is one of many prominent salmon fishing stations in the lower Fraser Canyon where dip net fishing and wind-drying occurs on an annual basis. This method of salmon fishing and processing has been well documented in early historic times and at present (Figure 3). Since site DjRi-31 was probably used as a seasonal fishing station for countless generations before European contact, it is highly likely that lithic artifacts and other cultural materials are contained within the surrounding soil deposits.


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**Figure 3. An early post-contact period photo of salmon drying racks at site DjRi-31, looking west. Image 358 courtesy of the Royal BC Museum and Archives.**

Of interest are 36 linear grooves that are incised into a flat platform-like meta-sedimentary bedrock outcrop measuring approximately 1 m by 1 m (Figures 2 and 4). On average, grooves are approximately 10 cm long and 1 cm deep, while the largest groove measures 24 cm long. All grooves are clearly anthropogenic, and not the result of geological processes such as glacial or fluvial abrasion. The majority are oriented perpendicular to the river (E-W), and six of them appear to have been purposely incised into two quartzite veins (Figure 4).

The striations appear to be the result of a rigorous back-and-forth (alternating) use-action with a material of slightly lesser or equivalent hardness. The larger grooves incised into quartz veins, however, were probably abraded by a much harder stone like quartzite. The grooves appear to fall into two categories: (1) short (4-10 cm long) and shallow (n=>24); and (2) long (10-20 cm long) and deep (n=6). This difference may indicate that two different tool types were being sharpened. The shallow shorter ones may have been incised by sharpening local shales and slate knives (cutting tools for filleting salmon), while deeper larger grooves were worn by quartzite spall tools (choppers for beheading salmon) (Figure 5). There is also the possibility that metal knives were sharpened on the rocks at this location during the proto-historic period and later. Further archaeological investigation of the surrounding soil deposits would likely result in the recovery of associated cutting tools, choppers, abraders, and salmon bones or fragments of them.

**Historical Accounts of Site DjRi-31**

The grooves were first recorded over 200 years ago in a journal entry relating to Simon Fraser's 1808 pioneer expedition down the Fraser River. He writes, "At the bad rock [Lady Franklin Rock], a little distance above the village, where the rapids terminate, the natives informed us that white people like us came there from below; and they shewed [sic] us indented marks which the white people made upon the rocks, but which, by the by, seemed to us to be natural marks." (Lamb 1960:120). Fraser's journal entry is interesting because his informant tells him that the markings were made by "white people like [them]" who arrived previously. In this case, the informant may be referencing contact made by Captain Narvaez in 1791 or by Captains Valdez, Galiano, and Vancouver the following year (Armitage 2001:25). Neither of these voyages, however, extended any distance up the Fraser River. It is

**Figure 4. Linear grooves incised in bedrock at site DjRi-31, looking northwest.**

interesting that Fraser assessed the stone grooves to be the result of natural processes rather than by human intent. In a monograph of the Fraser River, Lyons indicates that, "The Indians have no knowledge of the origin of these grooves but, bearing out the evident antiquity, tell a legend handed down over the years." (Lyons 1950:50-51). According to his informant, a battle occurred at this location when an invading medicine man from a distant tribe was confronted by their local medicine man. When the intruder was thrown into the canyon, he clawed grooves into the stone while falling to his defeat. Lyons concludes by surmising that the grooves were the result of sharpening stone projectile points used to foil unwanted intruders to the area.

In 1950, ethnographer Wilson Duff was shown the grooves at site DjRi-31 and objectively describes them in his field notes (Duff 1950). Duff suggests that the "sawing of nephrite" probably produced these grooves and that similar grooves existed further up in the nearby mountains. The proposed association with nephrite or serpentine adze/celt blade sharpening and maintenance is a reasonable one since the Hope-Yale locality is a known source of these stone tools (Fladmark 1982:131; Chapter 27).

Sawing of nephrite cobbles, however, may have occurred anywhere, and these grooves are not directly associated with that early stage of adze/celt production. Furthermore, the considerable hardness of nephrite could quickly wear grooves into softer metasedimentary rock, especially since sharpening adze blades requires such persistent abrasion.

In 1972, George Ferguson officially registered the site with the Archaeology Branch as a petroglyph (Ferguson 1973). Doris Lundy (1977:55), in her summary review of B.C. petroglyph sites, states that, "the marks [at DjRi-31] appear to have been made during tool-sharpening activities". She posits that "v-shaped" grooves are generally the result of stone tool production and/or edge maintenance rather than petroglyph designs that are more commonly exhibit "u-shaped" grooves. This observation is probably based on the principal that it is much easier to wear a u-shaped groove for the purpose of design than abrade a V-shape by carefully altering edge pressure and angle.

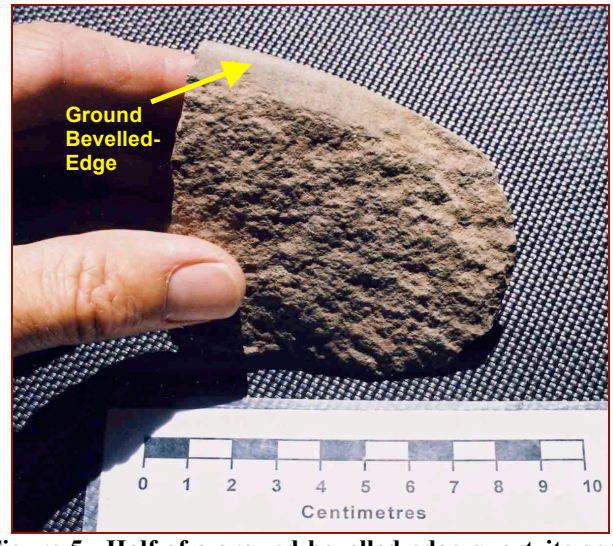


**Figure 5. Half of a ground bevelled-edge quartzite spall tool/knife recovered from the beach in Yale. Large stone cutting tools like this may have been sharpened in bedrock grooves at the site.**

**Variation in Traditional Oral Narratives**

While Fraser's informant indicated that previous white explorers had incised the grooves, and Lyons provides only a vague summary of his informant's oral narrative, more detailed and comprehensive ethnographic accounts exist. The site is locally known as "Th'exelis" by both the Sto:lo and Nlaka'pamux peoples, and slight variations in the narrative occur. The Sto:lo version indicates that Th'exelis was the location of a supernatural battle between the creator Xa:ls and a medicine man rival named Kwiyaxtel. The stone grooves are said to be the result of Xa:ls scratching the ground where he sat in anticipation of fighting Kwiyaxtel (Mohs 1976:92). This version is similar to the narrative told to C.P. Lyons in 1950.

Teit describes a fascinating variation told by the Nlaka'pamux people in which, Xa:ls observed boys suspending each other upside-down to catch salmon by hand. Sympathizing with their struggle, Xa:ls sat on the rock to think of a solution and, with each subsequent scratch he made into the rock, he gained a bit of knowledge leading to the development of dip net fishing, which he then passed on to the people (Teit 1912: 227). This second narrative provides the strongest link between First Nations cosmology and a functional perspective relating to subsistence behaviour.

**Discussion**

Since there is little doubt that these markings have an anthropogenic origin, we are left to conclusively determine and discuss what type of archaeological behaviour they were initially associated with. The word *petroglyph* is commonly used to describe anthropogenic rock designs (i.e., lines, grooves, pits, polish, etc.) that often relate to spiritually significant locations and/or events such as initiation ritual, territorial boundary markers, gaming, and record keeping. While some of the above-mentioned attributes may have been erroneously assigned sometime after the grooves were first produced, from a design perspective, their formation and configuration were probably not intentional. The apparent disorganization among the grooves (i.e., variations in size, depth, spatial arrangement, alignment, etc.) indicates that intentional design elements are absent. In addition, edge angles are relatively high and the quartz veins that were chosen are much more difficult to incise than the "u-shaped" linear grooves found in many rock artist-inspired petroglyphs. The abundance, concentration and depth of the grooves at site DjRi-31 are more consistent with repetitive instances of abrasion for the purpose of producing and maintaining edge-ground stone tools that experience a high rate of use-wear in a confined activity area. It is well-known that site DjRi-31 was (and still is) a major salmon processing location and it is reasonable to assume that ground stone tools were heavily relied upon to behead, fillet, and score salmon caught by dip nets.

The Fraser Canyon and upper Fraser Valley contains numerous highly productive salmon fisheries that have played a major role in both pre-contact period and ethnographically documented broad-spectrum delayed-return subsistence economies (Graesch 2007). The site is situated where a natural constriction forces salmon to swim along the canyon walls and in swirling back-eddies as they fight their way against the river's powerful flow (Figure 2). Today, family-owned fishing platforms are constructed in such prime locations where a surplus amount of salmon can be harvested by long-handled dip-nets and dried on racks (Carlson 2001). The majority of dip-netting occurs in late July and early August when salmon return to inland spawning beds. Once caught, they are transported to nearby processing locations to be cleaned, beheaded, filleted, and scored on a wooden plank, then splayed to wind-dry on racks (Ray 1938, Suttles 1951, Morin 2004). This phase of the processing operation is perhaps the most critical and labour-intensive, as it requires a versatile tool kit and high level of co-ordinated labour to keep pace with the quantity of salmon being harvested during run peaks. Threat of spoilage, run duration, and changes in weather are key factors that contribute to the urgency for rapid processing and a high degree of tool efficiency.

In pre-contact period times, intensification and exploitation of riverine resources resulted in the development of a specialized toolkit. Morin identifies ground slate knives, chert bifaces, hafted microflakes, cobble spalls, and ground mussel shell knives as key components of the tool kit used for processing salmon caught for wind drying. Morin's (2004:287-309) experimental analysis revealed that hafted ground slate knives were most useful for filleting and flesh-scoring and, although they required frequent edge maintenance (re-sharpening), the knives had a very long use lives compared to those produced from flaked stone. Once the blade material was worn and expended, it was removed from its wooden haft and replaced by another. Borden (1968:19) observed that, during the ethno-historic period, "…older women use a steel knife with a wooden back, a close facsimile of the old ground-slate knives."

Another advantage of edge ground tools is the capacity for the achieving various edge characteristics by varying the angle and pressure of edge abrasion (sharpening). For instance, an edge that is abraded on both sides at oblique angles would, in theory, produce a less sharp but more durable knife. Conversely, an edge abraded to produce a higher angle on only one side would be somewhat sharper, but more fragile. Crowe-Swords identifies six edge types among the ground slate knives recovered from the Carruthers site (DhRp-11) in the Pitt Polder (1974:99). His edge typology involved combinations of bevelled, curved, and flat margins. These specific tool shapes and edge profiles would result in a variety of tool types optimized for performing specific tasks such as cutting tubers and other plant matter, chopping fish heads, filleting or scoring fish, and some stages of avian and mammalian butchery. Also contributing to the popularity of edge ground tools was an abundance of suitable locally available raw material including slate/shale, quartzite, nephrite, shell, etc. Chipped-stone artifacts made from fine-grained silicate materials

such as dacite, chert, chalcedony, agate, and opal are relatively rare in the Fraser Valley region and therefore, it was necessary to take advantage of coarser materials from local sources.

Regular use of abrasive slabs or "abraders" was integral to the use-life of all edge ground tools such as slate knives and points, mussel shell, adze blades, and quartzite "spall knives" (Figure 5). Although the linear grooves at DjRi-31 were worn into a metasedimentary bedrock exposure, the vast majority of abraders identified in the Fraser Valley and Gulf of Georgia regions are portable and therefore more ergonomic and easily sourced from nearby creek beds and rock outcrops. Abraders are ubiquitous in the Hope-Yale locality and are commonly composed of micaceous and garnetiferous schists, sandstone, and silts (Von Krogh 1974:150). The fishing platform, with its hard gritty metasediment bedrock and quartzite veins, is well suited for edge sharpening and was clearly exploited in pre-contact period times and potentially even later by sharpening steel knives in the narrower grooves (Figure 4).

A technological transition towards ground stone technology seems to correspond with an overall increase in geomorphological stabilization that happened approximately 5,000 years ago during the mid-Holocene. At this time, interior lake levels stabilized and their outflows became much steadier. This enabled major fish-bearing drainages like the Fraser River to establish regular salmon runs and promote a shift towards riverine subsistence patterns. The period between 5000 and 4500 BP is widely considered to be an important turning point in subsistence and settlement patterns in the Gulf of Georgia region (Ames et al. 2010:51; Moss et al. 2007), and intensified use of ground stone technology in the lower Fraser Canyon probably occurred sometime after 4500 years BP. Before this period, large unifacial cobble choppers, spall tools, discoidal scrapers, leaf-shaped knives, and projectile points dominated lithic assemblages at sites in proximity to DjRi-31 such as the Lady Franklin Site (DjRi-22), Hills Bar Site (DjRi-24) and Milliken Site (DjRi-3) (Borden 1983, 1960; Kidd 1968:220, 229).

The nearby Milliken Site contains one of the oldest lithic components in the region with a radiocarbon date of 9050 years BP (Borden 1975). The large, unifacial cobble tools and leaf-shaped bifaces present at the Milliken site belong to the Old Cordilleran Culture (ca. 9000 to 5500 years BP) and it is thought that this tool-kit represents a focus on hunting with modifications to accommodate locally abundant resources like salmon (Martindale 1999:18). Since micro-blades, pecked or ground stone tools, abraders and stone sculpture are absent from most Old Cordilleran assemblages (Fladmark 1982:107), it is likely that the stone grooves at site DjRi-31 were probably produced sometime after 5500 BP.

The technological shift towards greater use of ground stone tools (i.e., thin slate knives, slate projectile points, nephrite adze blades, etc.) occurred during the later stages of the Charles Culture/Phase (5500 to 3500 years BP) (Matson and Coupland 1995; Fladmark 1982:110; Borden 1975). The lower lithic component at the nearby Esilao Village Site (DjRi-5) was used define the Eayem variant of the Charles Phase where side notched projectile point, thin slate knives, abraders and decorative objects were identified (Borden 1975). This period is also characterized by a region-wide shift towards broad-spectrum subsistence practices in the Lower Fraser and Gulf of Georgia regions. Although overall intensification of local resources increased during the Charles Phase, it is argued that salmon were still caught for immediate consumption and were a reliable food source for only about one third of the year (Martindale 1999:39). While this was the case for the lower Fraser River region as a whole, it is possible that some small-scale procurement and storage methods (i.e., dip net and wind drying) were practised in the lower Fraser Canyon between 5500 and 3500 years BP.

I contend that the linear stone grooves at site DjRi-31 were most likely produced sometime during the Locarno Beach Phase (*ca.* 3500 to 2500 years BP) when significant developments towards to the ethnographically documented Northwest Coast cultural pattern occurred. Throughout the region, we see increased use of abraders, ground slate points and knives, hand mauls, nephrite adze blades, and prestige items (Fladmark 1982:114). This technological shift seems also to coincide with an overall increase in sedentism and the emergence of family-owned resource gathering locations, which became prevalent as storage technologies allowed for a surplus amount of food and a delayed-return subsistence economy (Graesch 2007). Furthermore, due to the limited distribution of prime fish processing locations in the lower Canyon, it would have been beneficial for families or groups to establish ownership over such locations. At DjRi-31, it is also possible that the use of the bedrock platform as an abrader served as a marker to reaffirm family ownership of that specific location.

**Conclusions and Future Research Considerations**

Although it is not my intention to explore the socio-economic implications of salmon exploitation and storage, I believe it is necessary to examine possible functional explanations for linear groove petroglyph sites like DjRi-31. Historic documentation of these particular grooves demonstrates a long-standing awareness of their existence and an ongoing interest in assigning a meaningful account of their origin and purpose. Cosmological events described in the First Nation oral narratives are important to consider, especially since the Nlaka'pamux version directly attributes the marks to the emergence of the dip-net fishing industry. It is still unclear as to whether or not the First Nation informants who recounted these narratives had knowledge of the role this site had in pre-contact period stone tool sharpening, but I suspect they did. It is my opinion than the grooves were produced over the course of many generations as a result of abrasion associated with the production and maintenance of edge-ground stone tools. Furthermore, they were most likely incised sometime after the beginning of the

Locarno Beach Phase around 3500 years BP when ground stone technology, improved fishing (dip-netting) and storage methods, delayed-consumption subsistence economies, and increased sedentism became widely practised in the region.

Stone groove sites similar to DjRi-31 are most likely present at other salmon fisheries in the Fraser Canyon and an effort should be made to identify them during future archaeological investigations. It would be interesting to determine how far up the canyon this edge-ground toolkit extends and whether or not they should be considered an expedient tool type as opposed to more formal ground stone types found in the Gulf of Georgia region. Furthermore, excavations in surrounding soil deposits should be conducted at this site (and ones like it) since datable materials could provide a more confident inference on their age. It is possible that elements of this "crude" edge-ground toolkit were overlooked during earlier archaeological excavations in the Lower Canyon sub-region, and that a more comprehensive analysis of material type, tool edge and groove metrics might confirm the associations proposed in this chapter.

It is expected that future subsurface testing or excavations at DjRi-31 would yield: (1) slate/shale knives and cutting tools or fragments; (2) quartzite spall tools with bevelled edge grinding; (3) portable abraders or fragments; (4) expedient chipped-stone/flake tools; (5) probable salmon remains; and (6) possible associated pre-contact period charcoal. Finally, I suggest that linear groove sites like DjRi-31 warrant a separate categorical descriptor instead of being lumped with "petroglyphs" since they are not the result of an artistic endeavour, rather they are the by-product of a functional one.