Chapter 5

The Evolution of Landforms at Keatley Creek, near Lillooet, British Columbia

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Introduction

The objectives of this chapter are to describe the basic geological context of the Keatley Creek site and to outline the evolution of landforms at the site. Understanding the nature of the geological matrix and processes at archaeological sites is fundamental in documenting and understanding site formation processes. This chapter involves 1) a brief description of the regional setting and bedrock geology; 2) a review of the local Quaternary history, providing a conceptual model for the formation of the main landforms at the site; and 3) an airphoto analysis and field examination, providing insight into post-glacial processes that have modified the main landforms and which may have affected the prehistoric inhabitants or contributed to the post-depositional modification of archaeological features.

Physiography

At Keatley Creek, the Fraser River forms the boundary between the Camelsfoot Ranges to the northwest and the Clear Range to the southeast. These ranges constitute the southwestern edge of the Fraser Plateau, a subdivision of the Interior Plateau (Holland 1976). This is rugged country, with steep slopes rising from about 250 m elevation along the deeply incised Fraser River, to summit elevations in excess of 2,250 m in the Camelsfoot and Clear Ranges.

Bedrock Geology

The main bedrock mass underlying the Clear Range consists of fine grained sedimentary rocks (argillite) and intercalated chert, including smaller outcrops of limestone and volcanic rock (basalt and tuff). These rocks are middle to late Triassic in age and are part of the Cache Creek Group. This marine assemblage is intruded into by younger, plutonic rocks (granodiorite, diorite) of Jurrassic age put into place during the formation of the Coast Mountains (Monger and McMillan 1984).

Quaternary sediments underlie the study site and fill the Fraser Valley to an elevation of about 350 m. However, bedrock directly underlies the steep hillsides to the east of the site. On the slopes on the south side of Keatley Creek are outcrops of dioritic rock; on the north side of the creek are volcaniclastic rocks (tuffs) containing minor basalt and andesite flows (Monger and McMillan 1984).

Late-Quaternary History

Surficial materials and landforms in the study area are the product of Quaternary glaciation with minor post-glacial modification (Ryder 1976). Thick glacial drift has filled the Fraser Valley to depths between 250–350 m. These sediments, consisting of sequences of glaciofluvial, glaciolacustrine and till materials, represent Early Wisconsinan and the Late Wisconsinan, Fraser Glaciations (Huntley and Broster 1994).

During the onset of the Fraser Glaciation (29,000–20,000 years BP), montane glaciers in the Camelsfoot Range to the west built up and began to advance downvalley. In front of the ice, glaciofluvial outwash sediments filled the lower reaches of montane valleys and prograded into the Fraser Valley. Eventually, large outwash fans, debris flow fans, and then tributary ice, blocked southerly drainage of the Fraser River, forming an extensive proglacial lake. This feature, extending from the study area, as far north as Williams Lake, has been called Glacial Lake Camelsfoot (Huntley and Broster 1994). As climate continued to deteriorate, tributary glaciers coalesced in the main valleys and eventually spilled onto Plateau areas to the east. During the climax stage (19,000–13,500 years BP), montane glaciation gave way to true piedmont glaciation, with the direction of ice flow controlled by the rheology of an extensive ice dome rather than by topography. In south central British Columbia, the location of the ice divide was situated almost directly over the northern Camelsfoot Range. Following the climax stage, climate rapidly ameliorated, and deglaciation began. In montane areas, ice thinned, exposing summits and ridges, while valley glaciers gradually retreated into the headwater areas. In the Interior, the piedmont dome stagnated, becoming widely disintegrated, locally blocking drainage, and causing the formation of large postglacial lakes. Deglaciation was largely complete by 11,000 years BP (Ryder et al. 1991).

During and immediately following deglaciation, valley fill materials were rapidly incised, leaving broad drift terraces along the Fraser River. At the mouths of steep tributary basins, large debris flow fans developed (Ryder 1971). Gradually, as sediment supplies declined, these alluvial fans became incised, leaving the landscape much as we see it today. Holocene processes consist of minor fluvial reworking of drift materials, minor debris flow activity, and aeolian reworking of fines scoured from terrace scarp faces (Ryder 1976).

Site Description and Formation Processes

Air photo interpretation (approximate scale 1:14,000) has been used to map the terrain features at the Keatley Creek site. Interpretations based on this analysis have been augmented with experience gained from excavation and field examinations in the vicinity of the site. The following discussion refers to specific landforms depicted in Figure 1.

In the vicinity of the Keatley Creek archaeological site, the Fraser River, graded to about the 250 m elevation, is incised to a depth of 330 m below the valley fill terraces. The valley fill surface meets the bedrock hillslope at about the 640 m elevation. Above the terrace surface, bedrock-controlled slopes climb steeply into the Clear Range. The Glen Fraser and Keatley Creeks flow from small, steep-sided basins which drain the west side of the Clear Range. These creeks are intermittant and ephemeral, partially drying up during the summer months.

The valley fill terrace surface has two main levels: the upper terrace extends from the hillside at 640 m elevation to a scarp at about 585 m elevation, about 500 m west of the hillside. The lower terrace is a gently sloping feature with a scarp at 485 m elevation overlooking the Fraser River below. The upper terrace surface is flat to undulating, and is underlain by about 10–15 m of Fraser Glaciation till overlying advance glaciolacustrine silts. This sequence is exposed in the upper terrace scarp and in the steep gully sidewalls of Glen Fraser Creek. The base of the lacustrine materials was not seen. The lower terrace is underlain by coalescing, immediate postglacial, debris flow fans which have issued from Glen Fraser, Keatley, and Sallus Creeks (Ryder 1976). Older drift materials are exposed in the steep scarps that descend directly to the Fraser River. Transverse to the orientation of the Fraser River terrace scarps, are deep gullies incised by Glen Fraser, Keatley, and Sallus Creeks. Aeolian silts and sands, varying in thickness from .10–0.5 m, have capped the surface of the drift terrace.

The housepit site is situated on the upper terrace, on the height of land between the Keatley and Glen Fraser gullies. The main concentration of housepits is located in a southernly sloping swale. Given its sloping, channel-like form defined by scarps to the east and west, this swale was probably carved by a transient, ice-lateral meltwater channel. The location of the housepits on the floor of the channel feature, a relatively sheltered position, would have offered some protection from the strong, cold winds that blow down the Fraser Valley during the winter.

The lower bedrock slopes, just above the drift terrace, are blanketted with 2–4 m of till. This till blanket gradually thins upslope over a distance of 50–75 m Upper slopes consist of a mixture of thin rubbly colluvium, thin till, and exposed bedrock. Post-glacial hillslope processes, including slope wash and small debris flow activity, have gullied the till blanket and redeposited the material in small fans which spread out over the inner 50–100 m of the upper terrace. The stratigraphy in HP 106 suggests that these processes were active into the late Holocene, during the period of housepit occupation. HP 106 was originally excavated into till or colluvial material, and then abandonned for some time allowing 10–15 cm of well sorted aeolian silt and sand to accumulate on the rim. Overlying the aeolian material is 20 cm of poorly sorted sediment containing an angular volcanic clast about 25 cm in diameter. The angular clast is clearly derived from the nearby hillslope, thus the layer may represent a thin debris flow layer.

The large hummocky feature that occupies the mouth of Glen Fraser basin (Fig. 1) truncates the head of the creek gully. This feature is interpreted as a large slump, probably of early to mid-Holocene age, although possibly later. Presently, Glen Fraser Creek flows to the north side of this feature, along a relatively shallow gully, before entering the main gully at the toe of the deposit. The creek arises from a spring near the apex of the deposit. Examination of this area revealed recent sediment trim lines 50 cm high on Douglas fir tree trunks and a number of small, fresh debris lobes indicating active debris flow activity issuing from the Glen Fraser basin. These debris flows have the potential to divert Glen Fraser Creek to the south, towards the housepit site. Topographic and stratigraphic evidence suggests that diversion has happened in the past. The southern tributary gully to the main Glen Fraser gully was probably carved when the creek flowed along the south side of the main lobe. The fine sediment which has filled HP 119, and adjacent pits in the west corner of the site, represents fluvially transported materials that have washed down from the south side of the Glen Fraser lobe. The roof materials of HP 119 contained a Kamloops point preform indicating that the infilling took place in the last 1,200 years BP (Vol. III, Chap. 10.21).

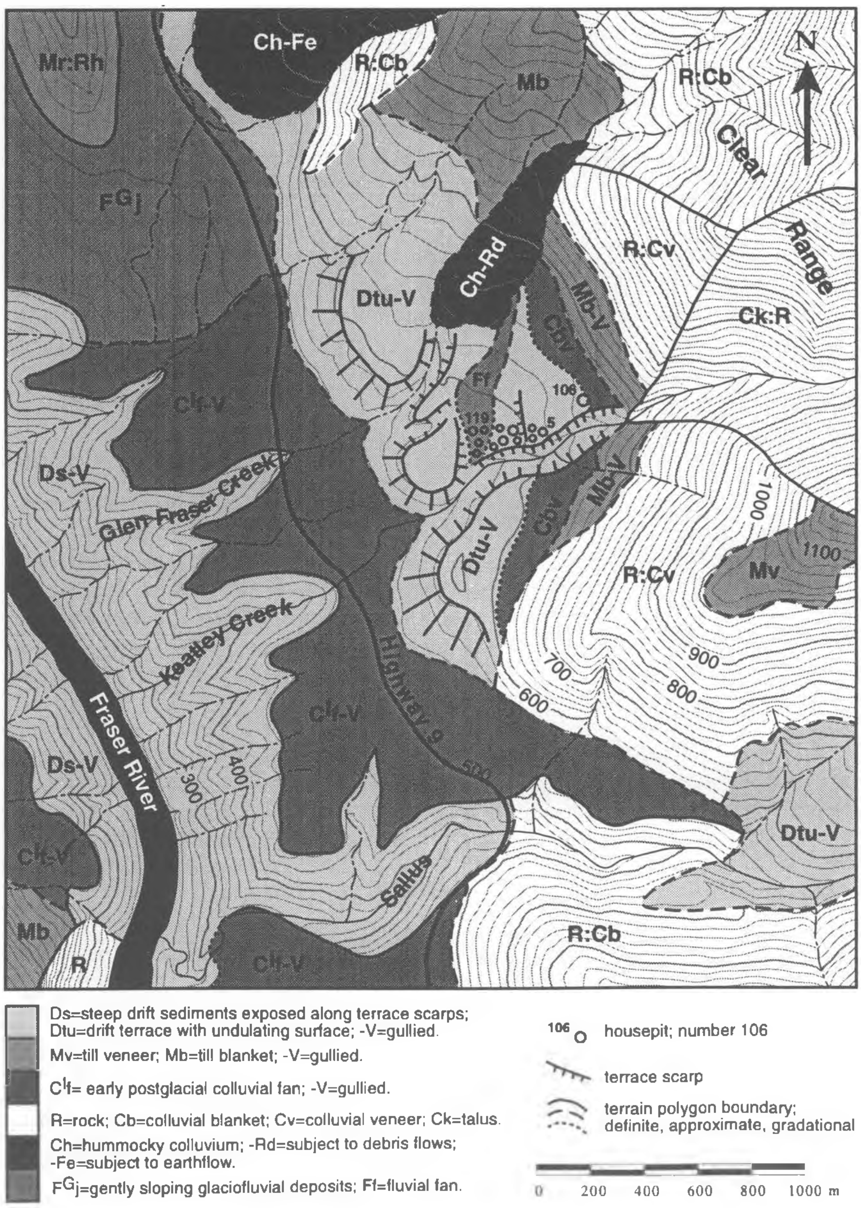

Figure 1. Terrain map for the Keatley Creek housepit site (EeR1-7) and surrounding area. [Source: Modified after Ryder (1976). Topographic base from TRIM; 20 m contour interval.]

Where Keatley Creek crosses the upper terrace near the main housepit site, its channel is about 10–15 m deep and has a broad bottom about 35 m wide. The floor of the draw has a slightly lobate topography, with relief on the order of 2 m, and is wet and swampy in places. Recent, sandy sediments blanket the draw floor and overlie silty glaciolacustrine materials. It is the presence of these underlying impermeable silts which explains the perched water table along the draw bottom, providing a nearby water source for the local inhabitants.

A dissected fan-shaped feature occupies the north and south side of the draw, near the mouth of the bedrock canyon and extends as far down as Housepit 5. This feature would have filled the draw at one time, but has since been largely removed by erosion. This fan terrace represents an early post-glacial debris flow deposit, which Keatley Creek has subsequently dissected.

The recent sandy sediments on the draw floor indicate the ongoing recurrence of small floods and/ or debris flows affecting the channel. The bedrock canyon from which Keatley Creek flows is wooded and choked with talus from the steep valley sides. Thus, recent debris flows are not originating from the headwaters of Keatley Creek. Small debris flows could originate from the gullied till slopes at the back of the site, and from small draw sidewall slumps. These materials have then been reworked by Keatley Creek.

Conclusions

The terraced landforms that exist at Keatley Creek and underly the housepit site are the product of glacial and immediate post-glacial processes. Post-glacial processes include minor slope-wash and debris flow activity from the steep slopes and drainage basins east of the site. These processes have formed colluvial fans along the inside edge of the valley fill terrace. A large slump and ongoing debris flow activity issuing from the Glen Fraser basin has led to the periodic diversion of that creek. At times during the Holocene, Glen Fraser Creek seems to have followed a southern channel around the slump deposit. During these times, the housepits in the vicinity of HP 119 would have been susceptible to flooding and sediment infilling. The broad creek bed of Keatley Creek south of the main housepit site contains fresh sediment lobes derived from minor sediment flood activity. The high water table in this reach probably results from groundwater perching on the impermeable glaciolacustrine materials that underly the gully.

By the time the first peoples arrived at the site, sometime in the early Holocene, the landscape probably appeared much as it does today. The site must have been an attractive locality because it offered some shelter from cold winter winds that blow down the Fraser Valley, and it has a small, but reliable source of water in Keatley Creek that is easily accessible from the village site. Flooding due to periodic diversions of Glen Fraser Creek may have led to temporary abandonment of some housepits in the west corner of the site.

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