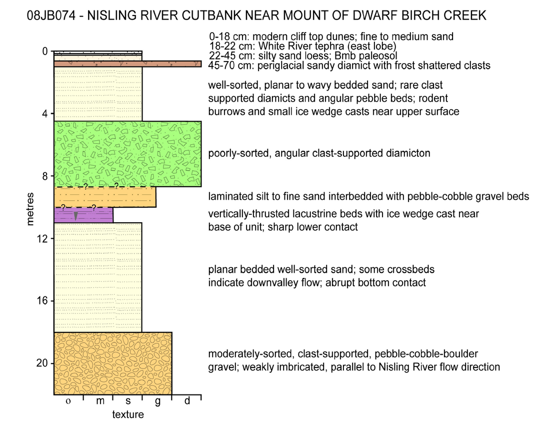


MARGINAL NOTES

INTRODUCTION

The Rhyolite Creek map area is on the northeastern side of the Nisling Range. Summits and ridges in this part of the Nisling Range are between 1400 m and 1800 m a.s.l. (Fig. 1). Much of the upland surface is treeless and is covered with weathered bedrock colluvium (Fig. 1). Upland surficial deposits are affected by active periglacial processes such as cryoturbation, nivation and solifluction. The range is dissected by the Nisling River valley and three of its larger tributaries, Rhyolite, Dwarf Birch and Tyrrell creeks. The walls of these steep-sided valleys are covered by a colluvial veneer, which transitions into a colluvial apron at the valley bottom (Figs. 1 and 2). The flat-lying valley bottoms contain meandering streams and discontinuous fluvial and glaciofluvial terraces.

GLACIAL HISTORY

The terminae of three Pleistocene ice sheets originating from the St. Elias Mountains are located in the map area. The leading edge of the St. Elias ice sheet would have resembled a system of valley glaciers advancing to the northeast through the Nisling Range. The oldest advance predates marine isotope stage (MIS) 4 (50ka BP to 80ka BP) and may correlate with the MIS 6 (130ka BP to 230ka BP) Reid glaciation documented for the Selwyn Lobe (Ward et al., 2008).

Landforms from the Reid glaciation are best preserved within the Nisling River valley where three valley glaciers converged and terminated. Meltwater channels and colluviated moraine slopes are visible on the southwest side of the Nisling River valley (Fig. 3). Only sporadic evidence of this glaciation remains within the valleys of Rhyolite, Dwarf Birch and Tyrrell creeks.

The early Wisconsin Gladstone glaciation reached its maximum extent by 50,000 years ago (Ward et al., 2007). The Gladstone valley glaciers followed a similar path as the Reid glaciers into the Nisling Range, however they were less extensive and did not reach the Nisling River. Discontinuous glaciofluvial terraces of Gladstone age are present in Rhyolite, Dwarf Birch and Tyrrell creeks. The terminal moraine in Tyrrell Creek is well preserved whereas glaciofluvial erosion has removed it in other valleys of the map area (Fig. 4). Local alpine glaciers developed on the upland immediately north of Dwarf Birch Creek.

Most of the map area was unglaciated during the Late Wisconsin McConnell glaciation. Terminal moraines from this time are present in both Rhyolite and Dwarf Birch creeks near the western margin of the map area. The McConnell terminal moraine in Tyrrell Creek is found further south in the Talbot Creek map sheet. Glaciofluvial plains and terraces are found in the main valleys of the map sheet and extend into the Nisling River valley (Fig. 5).

PERMAFROST

Most of the map area is underlain by permafrost. The nature of the ice within the sediments is generally a function of drainage. Periglacial features dominate the upland surfaces and massive ice may accumulate within depressions or small valleys filled with colluvial blankets. In the valley bottoms, the distribution of near surface permafrost is obvious from the vegetation. The ice-rich colluvial aprons that flank the floodplains have stunted black spruce, whereas the floodplain and terraces are covered with White spruce forests (Fig. 6).

Figure 1. A view to the south up a tributary to Dwarf Birch Creek. This is a typical landscape in the map area with sparse tree cover on the uplands, colluvial slopes, and abundant fluvial and glaciofluvial deposits in the valley bottoms.

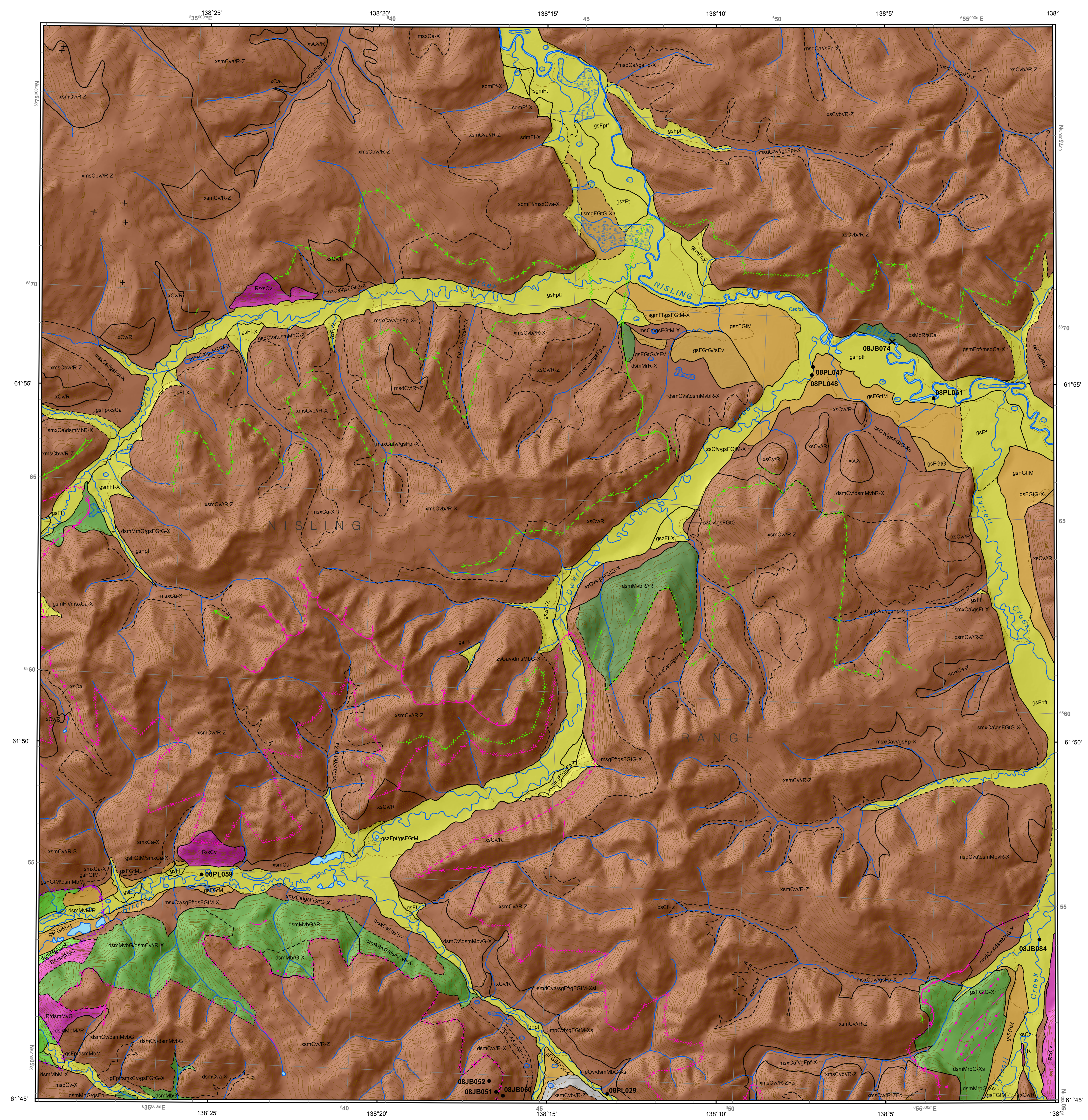
Figure 2. A view to the southwest up Dwarf Birch Creek. The slopes are mantled by colluvial deposits that extend into the valley bottom where they form colluvial aprons. The colluvial apron is visible on the left hand side of the floodplain (see arrow).

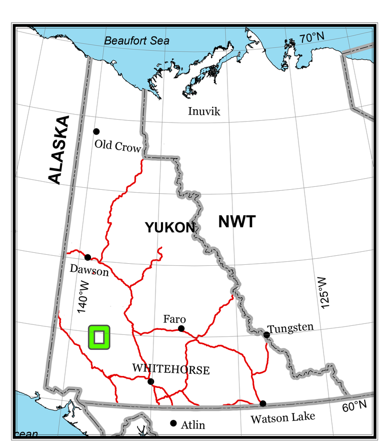
Figure 3. A view to the north from the mouth of Dwarf Birch Creek. The Nisling River valley is visible in the background. Reid meltwater channels bisect the ridges at the confluence of these two valleys (see arrow).

Figure 4. A view to the west of the Gladstone glacial limit in Tyrrell Creek. A terminal moraine and a series of well-developed recessional moraines mark the glacial limit (see arrows).

Figure 5. An aerial view of a McConnell glaciofluvial terrace in Tyrrell Creek. Note the channel scars from the former braided river.

Figure 6. The sharp contact (see dashed line) between the colluvial apron (thin active layer) and the fluvial plain (thick active layer) of Dwarf Birch Creek is well illustrated in this photograph.





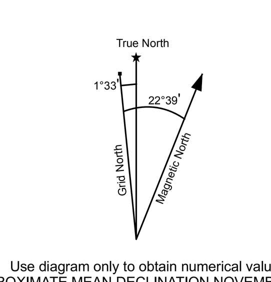
1:50 000-scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

FIVE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 7

CONTOUR INTERVAL 100 FEET
Elevations in feet above Mean Sea Level

SURFICIAL GEOLOGY
RHYOLITE CREEK
YUKON 115G/16

SCALE 1:50 000
0 1 2 3 4 5
kilometres

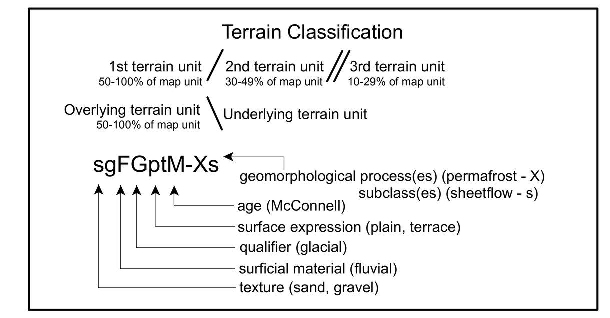


Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION NOVEMBER 2009
FOR CENTRE OF MAP

115J/02 ONION CREEK	115J/01 KLAZA RIVER	115I/04 FALSE TEETH CREEK
115G/15 KIYERA LAKE open file 2009-46	115G/16 RHYOLITE CREEK open file 2009-47 MAP LOCATION	115H/13 SCHIST CREEK
115G/10 SERPENTHEAD LAKE	115G/09 TALBOT CREEK open file 2009-48	115H/12 ALBERT CREEK

SURFICIAL GEOLOGY MAP

This surficial geology map was classified using the Terrain Classification System for British Columbia (Howes and Kenk, 1997), with modification to meet standards set by the Yukon Geological Survey. For example, we have added permafrost process subclasses to further account for the breadth of permafrost features on the landscape. In addition, we have added an age classification to the glacial deposits to distinguish different Pleistocene glaciations. Linework for the map was produced from interpretations of 1:40 000-scale aerial photos (1987). Subsequent field checking of the map area was completed in the summers of 2007 and 2008.



SURFICIAL MATERIAL

Surficial materials are non-lithified, unconsolidated sediments. They are produced by weathering, sediment deposition, biological accumulation, human and volcanic activity. In general, surficial materials are of relatively young geological age and they constitute the parent material of most (pedological) soils. On the map, surficial materials form the core of the polygon label. They are symbolized with a single upper case letter, with texture written to the left, and surface expression or glacial qualifier to the right. The glacial qualifier "G" was used to describe glacially modified materials. If actual activity state is different than the assumed activity state (indicated in brackets next to the surficial material name below), a qualifier A (active) or I (inactive) must be used as a superscript following the surficial material designator. Note that a single polygon will be coloured only by the dominant surficial material, but other materials may exist in that unit.

HOLOCENE

O — Organic: Organic deposits are accumulations of vegetative matter thicker than 1 m. They are commonly found in floodplains, areas of near-surface permafrost such as north-facing slopes, and locations where there is poor drainage. Thin veneers of organic material are widespread and often unmapped.

V — Volcanic: Volcanic tephra deposits found in the map area are from the 1140-year-old White River eruption. Primary tephra deposition across the map area was between 10 cm and 20cm and consisted of a grain size of medium-sand. Local resedimentation of the tephra into lake basins, onto fluvial fans or into cirque basins can result in accumulations exceeding 20 cm.

E — Eolian: Material that was transported and directly deposited by wind. The dominant eolian sediment in the map area is loess. A thin veneer of loess (10-20 cm) was deposited over the landscape during the last glaciation. On stable sites, the loess is intact, whereas at cryoturbated or colluviated areas, the loess is reworked into the soil profile. Since loess deposits represent only a thin veneer, they were not mapped; however, loess it is a widespread material in the map area.

C — Colluvium: Material that was transported and directly deposited by down-slope, gravity-driven processes such as creep, landslides and snow avalanches. Due to the active periglacial processes that have occurred in the map area, colluvium is widespread across the upland surfaces. The texture and composition of colluvium vary more than any other material in the map area, depending on the parent material, and the mechanism and distance transported. For example, materials derived from till will likely resemble the in situ till, however they may contain slope-parallel resedimentation structures. Comparatively, colluvium derived from physically weathered bedrock will be an angular, poorly sorted diamict and will likely contain less matrix. Some materials formed by rapid processes, such as rock falls, debris flows and avalanches, are deposited within tens of seconds and are typically found on steep to moderate slopes. Conversely, slower processes occur on gentle slopes and are commonly associated with permafrost, solifluction and creep. Colluvium in the map area is commonly derived from weathered bedrock and till, resulting in a silt-rich diamicton with angular, local bedrock and sub-rounded erratic clasts. Beyond the glacial limits and in alpine settings, colluvium is dominantly derived from weathered bedrock fragments and loess.

F — Fluvial: Fluvial materials are transported and deposited by modern streams and rivers. They typically consist of stratified sand and gravel that is well sorted and contains sub-angular to rounded clasts. These deposits result in floodplain, terrace and fan surface expressions within the map area. Due to scale limitations, fluvial deposits in most of the smaller valleys are not mapped.

L — Lacustrine: Sediment that has been deposited into a modern lake. Includes biologically produced material such as marl and gyttja. Lacustrine deposits are only mapped where a lake has drained exposing the lake bottom material.

Glaciofluvial: Glaciofluvial materials have been deposited directly by glacial meltwater. These deposits can form above, in, below, or adjacent to a glacier. They are deposited in meltwater channels, eskers, plains, terraces, kames and deltas. Glaciofluvial deposits consist of moderately to well-sorted, rounded, stratified sand and gravel, but can vary locally depending on transport distance. Near surface ground ice is generally absent in glaciofluvial deposits unless there is a poorly drained underlying unit present.

FG — LATE WISCONSIN - MCCONNELL (M)
McConnell glaciofluvial plains and terraces are present in Dwarf Birch Creek, Tyrrell Creek and Nisling River valleys.

FG — EARLY WISCONSIN - GLADSTONE (G)
Gladstone glaciofluvial deposits are present in Dwarf Birch Creek, Tyrrell Creek and Nisling River valleys.

FG — ILLINOIAN - REID (R)
Reid glaciofluvial deposits are present above and beyond the Gladstone limit and in the Nisling River valley.

Morainal: Morainal materials are diamicts deposited by either primary glacial processes such as lodgement, deformation and melt-out, or secondary glacial processes caused by gravity and water. Therefore, this term applies to all types of till including flow tills, which are not directly deposited by glacial ice. Ablation tills tend to have a hummocky or rolling surface morphology with a sandy matrix comprising 30-40% of the material. Lodgement tills have an even surface morphology with a silty sand matrix comprising 40-60% of the material. Due to the uneven topography of the map area, tills are often colluviated. Permafrost is generally widespread within morainal deposits.

M — LATE WISCONSIN - MCCONNELL (M)
Ablation moraine associated with the McConnell limit are found in Dwarf Birch Creek in the southwest corner of the map area.

M — EARLY WISCONSIN - GLADSTONE (G)
Both ablation and lodgement tills are found in Rhyolite, Dwarf Birch and Tyrrell creeks. Abundant colluviated moraine is also found in these valleys.

M — ILLINOIAN - REID (R)
Reid morainal deposits were mapped in Rhyolite, Dwarf Birch and Tyrrell creeks and in the Nisling River. Moraine of this age is mostly colluviated and much of its surface expression has been reduced by colluviation or periglacial weathering.

Glaciolacustrine: Glaciolacustrine materials were deposited in a lake that formed on, in, under or beside a glacier. Glaciolacustrine sediments consist of stratified sand, silt and clay. Ice-rich permafrost and thermokarst erosion is widespread in these deposits. Their poor drainage and high in-situ moisture content can result in massive ice lenses.

LG — LATE WISCONSIN - MCCONNELL (M)
Glaciolacustrine sediments of this age were not documented in the map area.

LG — EARLY WISCONSIN - GLADSTONE (G)
Glaciolacustrine sediments of this age were not documented in the map area.

LG — ILLINOIAN - REID (R)
Glaciolacustrine sediments of this age were not documented in the map area.

R — PRE-QUATERNARY
Bedrock: Rocks in the Kluane Lake area are composed of three metamorphic assemblages, mid- and Late Cretaceous to Eocene granitoids and Upper Cretaceous to Eocene volcanic rocks. Late Cretaceous to Eocene Ruby Range batholith, the largest pluton in the area. Metamorphic rocks to the northwest belong to Yukon-Tanana terrane and the structurally overlie Windy-McKinley terrane. Yukon-Tanana terrane consists of two assemblages: quartzose psammite, pelite, marble and amphibolite of the Proterozoic to Lower Paleozoic Snowcap assemblage, and carbonaceous phyllite and quartzite and lesser felsic and mafic metavolcanic rocks of the mid-Paleozoic to Late Permian Finlayson assemblage. Foliated granitic rocks occur in both assemblages. Windy-McKinley terrane also comprises two assemblages: the schist-gabbro subdivision and the Harzburgite Peak-Eikland Mountain ophiolite. The former assemblage is lithologically and stratigraphically similar to Yukon-Tanana terrane, differing only in the presence of voluminous bodies of Triassic metagabbro. The Harzburgite Peak-Eikland Mountain ophiolite in Kluane Lake area consists primarily of harzburgite, with lesser amounts of gabbro, dunite and plagiogranite. The third metamorphic assemblage, the Kluane schist, is southwest of the Ruby Range batholith. Kluane schist consists primarily of highly deformed, variably carbonaceous, porphyroblastic biotite schist and rare bodies of gabbro and harzburgite (Murphy et al., 2009).

SYMBOLS

GEOLOGICAL BOUNDARIES:
defined
approximate
assumed

AGE OF GLACIAL FEATURES:
McConnell (M) - late Wisconsin
Gladstone (G) - early Wisconsin
Reid (R) - Illinoian
unspecified age

GLACIAL FEATURES:
moraine ridge
meltwater channel
cirque
esker
glacial lake shoreline

GLACIAL LIMITS:
defined
approximate
assumed

GROUND OBSERVATION SITES:
(labelled with site number, e.g. 08JB004)
field station
stratigraphic section

radiocarbon sample
cosmogenic sample
heavy mineral sample

erratic, unspecified age
erratic, Gladstone
erratic, Reid
no erratics found

OTHER SURFACE FEATURES:
open system pingo
tor
drumlin (coloured by glacial age)

TOPOGRAPHIC FEATURES:
contours
streams
trails
wetlands

TEXTURE

Texture refers to the size, shape and sorting of particles in clastic sediments, and the proportion and degree of decomposition of plant fibre in organic sediments.

Specific clastic textures
a - blocks: angular particles >256 mm in size
b - boulders: rounded particles >256 mm in size
k - cobbles: rounded particles between 64 and 256 mm in size
p - pebbles: rounded particles between 2 and 64 mm in size
s - sand: particles between 0.0625 and 2 mm in size
z - silt: particles between 2 μm and 0.0625 mm in size
c - clay: particles <2 μm in size

Common clastic textural groupings
d - mixed fragments: a mixture of rounded and angular particles >2 mm in size
x - angular fragments: a mixture of angular fragments >2 mm in size (i.e., a mixture of blocks and rubble)
g - gravel: a mixture of two or more size ranges of rounded particles >2 mm in size (e.g., a mixture of boulders, cobbles and pebbles); may include interstitial sand
r - rubble: angular particles between 2 and 256 mm; may include interstitial sand
m - mud: a mixture of silt and clay; may also contain a minor fraction of fine sand
y - shells: a sediment consisting dominantly of shells and/or shell fragments

Organic terms
o - organic: unclassified organic materials
e - fibric: the least decomposed of all organic materials; it contains amounts of well-preserved fibre (40% or more) that can be identified as to botanical origin upon rubbing
u - mesic: organic material at a stage of decomposition intermediate between fibric and humic
h - humic - organic material at an advanced stage of decomposition; it has the lowest amount of fibre, the highest bulk density, and the lowest saturated water-holding capacity of the organic materials; fibres that remain after rubbing constitute less than 10% of the volume of the material

SURFACE EXPRESSION

Surface expression refers to the form (assemblage of slopes) and pattern of forms expressed by a surficial material at the land surface. This three-dimensional shape of the material is equivalent to 'landform' used in a non-genetic sense (e.g., ridges, plain). Surface expression symbols also describe the manner in which unconsolidated surficial materials relate to the underlying substrate (e.g., veneer). Surface expression is indicated by up to three lower case letters, placed immediately following the surficial material designator, listed in order of decreasing extent.

a - apron: a wedge-like slope-toe complex of laterally coalescent colluvial fans and blankets. Longitudinal slopes are generally less than 15° (26%) from apex to toe with flat or gently convex/concave profiles

b - blanket: a layer of unconsolidated material thick enough (>1 m) to mask minor irregularities of the surface of the underlying material, but still conforms to the general underlying topography; outcrops of the underlying unit are rare

c - cone: a cone or sector of a cone, mostly steeper than 15° (26%); longitudinal profile is smooth and straight, or slightly concave/convex; typically applied to talus cones

f - fan: sector of a cone with a slope gradient less than 15° (26%) from apex to toe; longitudinal profile is smooth and straight, or slightly concave/convex

h - hummock: steep sided hillock(s) and hollow(s) with multidirectional slopes dominantly between 15-35° (26-70%) if composed of unconsolidated materials, whereas bedrock slopes may be steeper; local relief >1 m; in plan, an assemblage of non-linear, generally chaotic forms that are rounded or irregular in cross-profile; commonly applied to knob-and-kettle glaciofluvial terrain

l - delta: landform created at the mouth of a river or stream where it flows into a body of water; gently sloping surfaces between 0-3° (0-5%), and moderate to steeply sloping fronts between 16-35° (27-70%); glaciofluvial deltas in the map area are typically coarse-grained with steep sides and gently inclined kettled or channeled surfaces

m - rolling: elongate hillock(s); slopes dominantly between 3-15° (5-26%); local relief >1 m; in plan, an assemblage of parallel or sub-parallel linear forms with subdued relief (commonly applied to bedrock ridges and fluted or streamlined till plains)

p - plain: a level or very gently sloping, unidirectional (planar) surface with slopes 0-3° (0-5%); relief of local surface irregularities generally <1 m; applied to (glacio)fluvial floodplains, organic deposits, lacustrine deposits and till plains

r - ridge: elongate hillock(s) with slopes dominantly 15-35° (26-70%) if composed of unconsolidated materials; bedrock slopes may be steeper; local relief is >1 m; in plan, an assemblage of parallel or sub-parallel linear forms; commonly applied to drumlinized till plains, eskers, morainal ridges, crevasse fillings and ridged bedrock

t - terrace: a single or assemblage of step-like forms where each step-like form consists of a scarp face and a horizontal or gently inclined surface above it; applied to fluvial and lacustrine terraces and stepped bedrock topography

v - veneer: a layer of unconsolidated materials too thin to mask the minor irregularities of the surface of the underlying material; 10 cm - 1m thick; commonly applied to eolian/loess veneers and colluvial veneers

GEOMORPHOLOGICAL PROCESSES

Geomorphological processes are natural mechanisms of weathering, erosion and deposition that result in the modification of the surficial materials and landforms at the earth's surface. Unless a qualifier (A (active) or I (inactive)) is used, all processes are assumed to be active, except for deglacial processes. Process is indicated by up to three upper case letters, listed in order of decreasing importance, placed after the surface expression symbol, and separated from the surface expression by a dash (-).

Subclasses can be used to provide more specific information about a general geomorophological process, and are represented by lower case letter(s) placed after the related process designator. Up to three subclasses can be attached to each process. Process subclasses used on this map are defined with the related process below.

EROSIONAL PROCESSES

V - gully erosion: running water, mass movement and/or snow avalanching, resulting in the formation of parallel and sub-parallel long, narrow ravines

FLUVIAL PROCESSES

I - irregularly sinuous channel: a clearly defined main channel displaying irregular turns and bends without repetition of similar features; backchannels may be common, and minor side channels and a few bars and islands may be present, but regular and irregular meanders are absent

M - meandering channel: a clearly defined channel characterized by a regular and repeated pattern of bends with relatively uniform amplitude and wave length

MASS MOVEMENT PROCESSES

F - slow mass movements: slow downslope movement of masses of cohesive or non-cohesive surficial material and/or bedrock by creeping, flowing or sliding

L - mass movement with an unspecified rate

R - rapid mass movements: rapid downslope movement by falling, rolling, sliding or flowing of dry, moist or saturated debris derived from surficial material and/or bedrock

Subclasses: (b) rockfall; (g) rock creep

PERIGLACIAL PROCESSES

C - cryoturbation: movement of surficial materials by heaving and/or churning due to frost action (repeated freezing and thawing)

S - solifluction: slow gravitational downslope movement of saturated non-frozen overburden across a frozen or otherwise impermeable substrate

X - permafrost processes: processes controlled by the presence of permafrost, and permafrost aggradation or degradation

Z - general periglacial processes: solifluction, cryoturbation and nivation, possibly occuring in a single polygon

Subclasses: (e) thermokarst erosion; (l) segregated ice; (n) pingo; (t) thermokarst subsidence; (r) patterned ground; (s) sheetwash

DEGLACIAL PROCESSES

E - channeled by meltwater: erosion and channel formation by meltwater alongside, beneath, or in front of a glacier

H - kettled: depressions in surficial materials resulting from the melting of buried glacier ice

T - ice contact: landforms that developed in contact with glacier ice such as kames

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RECOMMENDED CITATION

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Any revisions or additional geological information known to the user would be welcomed by the Yukon Geological Survey.

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Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon

Open File 2009-47

Surficial Geology of Rhyolite Creek (NTS 115G/16) Yukon (1:50 000 scale)

by

Jeffrey D. Bond and Panya S. Lipovsky