MARGINAL NOTES

INTRODUCTION

The Dawson Range is located to the north of Donjek River in the Tom Creek map area. Tors are common along the unglaciated ridges and summits which range in elevation from 760 to 1500 m above sea level. Uplands are covered by weathered bedrock and/or loess-enriched colluvium modified by periglacial processes such as cryoturbation, cryoplanation and solifluction. Slopes are generally covered in mantles of colluvium that grade into thick loess-enriched aprons along lower slopes and valley bottoms (Fig. 1). The lower Donjek River dissects the map area and flows west to its confluence with the White River at approximately 450 m above sea level. The broad braided floodplains of the Donjek and White rivers are the source of most of the eolian or wind-blown silt and fine sand (loess) deposited throughout the map area and further to the north and east. Thick eolian blankets form benches along many valley bottoms in the map area (Fig. 2).

Bedrock outcrops are common along the north banks of the Donjek River in the vicinity of Harzburgite Peak (Fig. 3). Surface lineaments north of this peak may be associated with a local thrust fault (Murphy et al., 2007). A northeast-trending normal fault extending up Tom Creek (Murphy et al., 2007) may also be associated with local copper-gold mineralization (Bennett et al., 2010).

GLACIAL HISTORY

Most of the map area was unglaciated during the Pleistocene, however lobes from at least three Pleistocene ice sheets originating in the St. Elias Mountains extended north down the White River valley and terminated near the mouth of Donjek River. Evidence of these glaciations at this location is described in further detail by Turner et al. (2012, in prep).

The oldest and most extensive glaciation 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). The Reid ice lobe extended down the White River valley and terminated at the confluence with Donjek River. Lateral moraines from this (Reid) glaciation are found along the flanks of some hills east of the White River and south of the Donjek River.

The early Wisconsin Gladstone glaciation reached its maximum extent by 55 000 years ago (Ward et al., 2007). A Gladstone ice lobe also extended down the White River valley but was less extensive than the Reid lobe and terminated 4 kilometres south of the Donjek River. Terminal and recessional moraines are found in the map area along the eastern banks of the White River.

The late Wisconsin McConnell glaciation reached its maximum approximately 15 000 years ago in southwest Yukon (Bond & Lipovsky, 2009) and was even less extensive than the Gladstone glaciation. The lobe of McConnell ice extending down the White River valley terminated near the extreme southwest corner of the map area, where relatively fresh looking ground moraines are present.

PERMAFROST

Permafrost is widespread but discontinuous in the map area. Permafrost distribution and character (depth, thickness and ice content) vary widely with local scale variations in both macro and micro-topography, surface cover and soil texture. It is likely absent on steep south-facing slopes with bedrock outcrop and thin, coarse-grained colluvial veneers. It is most prevalent on north-facing slopes and in valley bottoms where thick fine-grained colluvial aprons (interbedded loess, colluvium and peat) and organic veneers are located. Ice-rich permafrost is most commonly found in valley bottoms (Fig. 4) and zones of groundwater convergence. Clearing or disturbance of organic cover in these areas may lead to rapid thaw and terrain destabilization.

Several landforms that indicate the presence of permafrost were found in the map area, including cryoplanation terraces, solifluction lobes, active-layer detachment slides, open system pingos, thermokarst ponds, palsas and ice-wedge polygons (Fig. 5).

HEAVY MINERAL SAMPLING

Pan sampling was undertaken in the headwaters of a small tributary to the Donjek River, south of Mt. Mclennan.

Site Number	Location (UTM Zone 7, NAD 83)	Type	Results
10JB010	576171 E, 6949109 N	Pan (2 kg)	no gold; magnetite-rich heavy minerals
10JB012	576794 E, 6948242 N	pan (x2)	no gold; magnetite-rich heavy minerals
10JB013	575473 E, 6948287 N	pan (x2)	no gold; magnetite-rich heavy minerals
10JB014	575873 E, 6947135 N	pan (x2)	1 colour/4 flakes

DATA SOURCES

This surficial geology map was interpreted from high resolution digital stereo imagery (2.5 m panchromatic CartoSat-1 satellite data captured in 2007) and hard copy 1:40 000 scale aerial photographs flown in 1987 and 1989.* Selective field checking was performed in July 2010.

*National Air Photo Library photographs A27481 (1989): 21-30, 60-68, 115-123 & 154-162 and A27176 (1987): 68-75.

Figure 1. Typical colluvial blanket diamicton on north facing slope consisting of retransported loess, angular coarse fragments and organic material (10PL041). Permafrost table visible above shovel blade.

Figure 2. Thick valley bottom loess accumulation in bench near mouth of Tom Creek (10JB041).

Figure 3. View to the west looking down Donjek River valley, with southern flanks of Harzburgite Peak on the right.

Figure 4. Ground ice exposed in cutbank at mouth of tributary to Donjek River (10PL045). Massive ice is 4 m thick.

Figure 5. View to west of ice wedge polygons near the mouth of Klotassin River. Donjek River visible in background.

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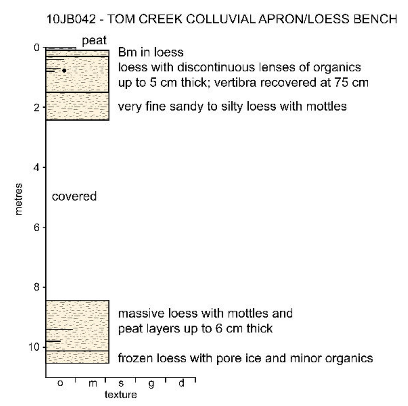
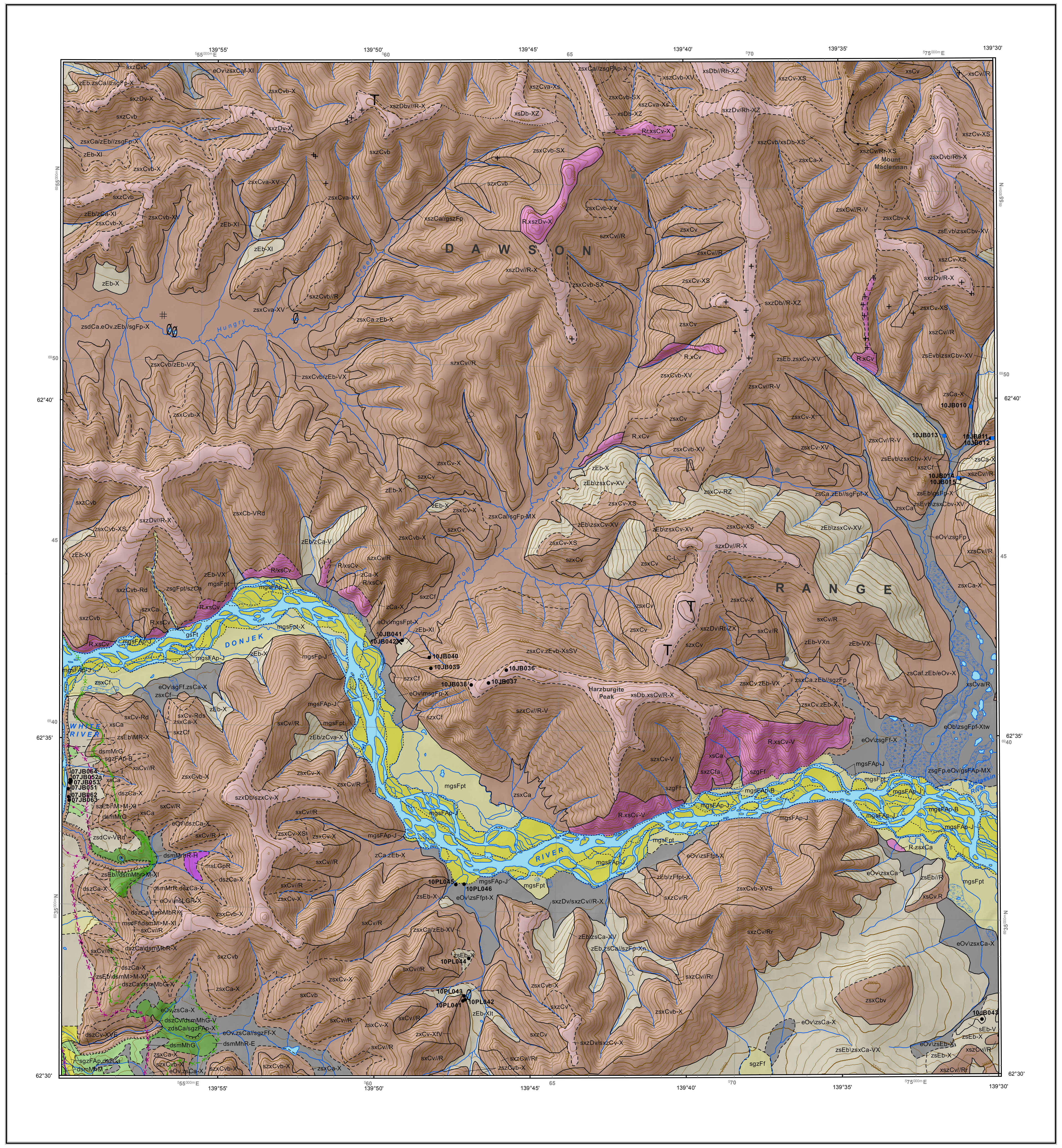




1:50 000 scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

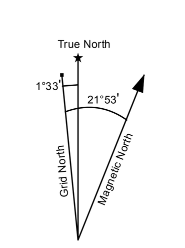
FIVE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 7

CONTOUR INTERVAL 100 FEET
Elevations in feet above Mean Sea Level

SURFICIAL GEOLOGY
TOM CREEK
YUKON 115J/12

SCALE 1:50 000

0 1 2 3 4 5 kilometres



Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION NOVEMBER 2011
FOR CENTRE OF MAP

115K/16 KATRINA CREEK	115J/13 HOME CREEK open file 2012-5	115J/14 COFFEE CREEK GSC open file 4344
115K/09 CALEDONIA CREEK	115J/12 TOM CREEK open file 2012-4 MAP LOCATION	115J/11 DOYLE CREEK open file 2012-3
115K/08 SNAG CREEK	115J/05 WELLESLEY LAKE	115J/06

TERRAIN CLASSIFICATION SYSTEM

This surficial geology map was classified using the Terrain Classification System for British Columbia (Howes and Kenk, 1997), with minor modification to meet standards set by the Yukon Geological Survey. For example, we have added some permafrost process subclasses to accomodate the wider variety of permafrost features found in Yukon. We have also added an age classification to distinguish materials deposited during different Pleistocene glaciations.

A sample map unit label is shown below to illustrate the terrain classification system. Surficial materials form the core of the polygon map unit labels and are symbolized with a single upper case letter. Lower case textures are written to the left of the surficial material, and lower case surface expressions are written to the right. An upper case activity qualifier (A = active; I = inactive) may be shown immediately following the surficial material designator. The glacial qualifier "G" may alternatively be written immediately following the surficial material to indicate glacially modified materials. Age is indicated by a capital letter that follows the surface expression but precedes the process modifiers. Geomorphological processes (capital letters) and subclasses (lower case letters) always follow a dash symbol ("-").

sgFGptM-Xs

GEOMORPHOLOGICAL PROCESS(ES) (-X = permafrost)
SUBCLASS(ES) (s = sheetflow)
AGE (M = McConnell)
SURFACE EXPRESSION (pt = plain, terrace)
QUALIFIER (G = glacial; A = active; or I = inactive)
SURFICIAL MATERIAL (F = fluvial)
TEXTURE (sg = sand, gravel)

COMPOSITE SYMBOL DELIMITERS:

Due to scale limitations, up to 4 terrain units may be included in a single map unit label (e.g. sgFGptM.dsmMbM/xsCv\zcLGpM-XsV). Each component is separated by a delimiter that indicates relative proportions between the components (".", "/", "//") or a stratigraphic relationship "\").

"." - terrain units on either side of the symbol are of approximately equal proportion
"/" - terrain unit(s) before the symbol is more extensive than the one(s) following
"//" - terrain unit(s) before the symbol is considerably more extensive than the one(s) following
"\" - terrain unit(s) before the "\" symbol stratigraphically overlies the one(s) following

1st terrain unit (>50% of map unit) / 2nd terrain unit (30-49% of map unit) // 3rd terrain unit (10-29% of map unit) \ Underlying terrain unit

SURFICIAL MATERIALS

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. 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 generally unmapped. Organic material in the map area commonly consists of peat with fibric to mesic decomposition.

E — Eolian: Sediment transported and deposited by wind. The dominant eolian sediment in the map area is loess, which is predominantly silty in texture with a smaller fraction of fine sand. Loess veneers and blankets were deposited over the landscape during glacial periods. On stable sites, the loess is intact, whereas in cryoturbated or colluviated areas, the loess is reworked into the soil profile and its presence is indicated by the "z" textural symbol. Resedimented loess is a major component of colluvial aprons in the area. Ice-rich permafrost is common within low-lying eolian sediments.

C — Colluvium: Material transported and deposited by down-slope, gravity-driven processes such as creep, solifluction, landslides and snow avalanches. Colluvium is the most dominant surficial material in the northern Dawson Range as most of the area escaped Pleistocene glaciation. It commonly has a stratified structure with a highly variable texture and composition controlled by the parent material, transport mechanism and travel distance. Colluvium on uplands and slopes in the northern Dawson Range is generally derived from weathered bedrock and loess, resulting in a silt-rich diamicton containing angular, local bedrock clasts. On steeper slopes colluvium is generally coarser grained, as it has been deposited by rapid mass wasting processes such as rock fall, debris flows and avalanches. Slower processes such as sheetwash, solifluction and creep occur on gentler slopes and produce finer-grained colluvium. Colluvial aprons found on lower slopes are commonly ice-rich and are primarily composed of resedimented loess and peat.

F, FA — Fluvial: Sediments transported and deposited by modern streams and rivers, found in floodplains, fans and terraces. Fluvial deposits typically consist of well-sorted stratified sand and gravel that is comprised of sub-angular to rounded clasts. In the unglaciated regions of the northern Dawson Range, low order streams are confined to very narrow V-shaped valleys and their fluvial deposits are generally not mapped due to scale limitations; their sediments, however, are more coarse-grained and locally derived than in higher order streams. Active fluvial (FA) materials are subject to regular flooding.

Glaciofluvial: Sediments transported and deposited by glacial meltwater above, in, below, or adjacent to a glacier. Glaciofluvial materials are deposited in meltwater channels, eskers, plains, terraces, kames and deltas. Sediments consist of moderately to well-sorted, rounded, stratified sand and gravel, although the nature and texture may 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^M — LATE WISCONSIN - MCCONNELL (M)
No McConnell glaciofluvial deposits are exposed in the map area.

FG^R — ILLINOIAN - REID (R)
No Reid glaciofluvial deposits are exposed in the map area.

Morainal: Morainal (till) materials are diamicts deposited by either: primary glacial processes such as lodgement, deformation and melt-out (ablation); 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 are relatively coarse grained and tend to have a hummocky or rolling surface expression; lodgement tills typically have a finer-grained matrix with fewer clasts and a smoother surface expression. Tills are generally colluviated when found on slopes. Permafrost is widespread within morainal deposits. As most of the northern Dawson Range is unglaciated, morainal sediments are rare in the region. Even in upland areas that show evidence of alpine glaciation, no morainal sediments remain as they have likely been buried in colluvium and/or modified by intense periglacial and colluvial processes.

M^M — LATE WISCONSIN - MCCONNELL (M)
McConnell morainal sediments are found in the extreme southwest corner of the map area.

M^G — EARLY WISCONSIN - GLADSTONE (G)
Gladstone morainal sediments are found on the eastern banks of White River, south of Donjek River.

M^R — ILLINOIAN - REID (R)
Reid morainal sediments are found along the eastern side of White River, south of Donjek River.

Glaciolacustrine: Stratified sand, silt and clay deposited in a lake that formed on, in, under or beside a glacier; may contain dropstones (ice-rafted clasts). Ice-rich permafrost and thermokarst erosion is widespread in these deposits as they are generally poorly drained with high *in situ* moisture contents that promote the growth of massive ice lenses. Glaciolacustrine sediments are rarely exposed in the region.

LG — ILLINOIAN - REID (R)
Reid glaciolacustrine sediments are found in gully exposures along the eastern banks of the White River, south of Donjek River (Turner et al., 2012, in prep).

R — PRE-QUATERNARY
Bedrock: The bedrock geology of the northern Dawson Range consists of Paleozoic metamorphic rocks of the Yukon-Tanana terrane intruded by Cretaceous and early Cenozoic plutons (Bennett et al., 2010). Regionally, the Cretaceous intrusions are associated with major strike-slip faults that may extend into the Dawson Range, imposing a primary northwest-trending structural trend in the region. Second-order, northeast-trending structures extending up Tom Creek and Doyle Creek (Murphy et al., 2007) may be associated with extension and local copper-gold mineralization (Bennett et al., 2010). The northern part of the map area is underlain by the mid-Cretaceous Dawson Range batholith granodiorite (Whitehorse suite). Cretaceous mafic volcanics and late Paleozoic ultramafics (harzburgite) are found near Harzburgite Peak and south of the Donjek River (Murphy et al., 2007).

D — Weathered bedrock: bedrock decomposed or disintegrated in situ by processes of chemical and/or mechanical weathering such as freeze-thaw. Weathered bedrock is common in the uplands of the northern Dawson Range, especially along ridge tops and near tors. The material texture is coarse grained and sandy where derived from plutonic bedrock, although a silty component may be present due to incorporation of loess by cryoturbation.

SYMBOLS

GEOLOGICAL BOUNDARIES:
defined
approximate
assumed

AGE OF GLACIAL FEATURES:
McConnell (M) - late Wisconsin
Gladstone (G) - early Wisconsin
Reid (R) - Illinoian
Pre-Reid (>R) - early to middle Pleistocene

GLACIAL FEATURES:
moraine ridge
meltwater channel
cirque
arete

GLACIAL LIMITS:
defined
approximate
assumed

OTHER LINEAR FEATURES:
escarpment
lineation (fault, joint, tension crack)
sand dunes
strandline

TOPOGRAPHIC FEATURES:
contours
streams
trails
wetlands

GROUND OBSERVATION SITES:
(labelled with site number, e.g. 10JB004)
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; uncollapsed, collapsed
tor
drumlin (coloured by glacial age)
cryoplanation terrace
kettle
landslide, active layer detachment
palsa
thermokarst pond
placer mine
Yukon mineral occurrence

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. Texture is indicated by up to three lower case letters, placed immediately before the surficial material designator, listed in order of decreasing abundance.

Specific clastic textures
a - blocks: angular particles >256 mm in size
b - boulders: rounded particles >256 mm in size
k - cobbles: rounded particles >64 - 256 mm in size
p - pebbles: rounded particles >2 - 64 mm in size
s - sand: particles between >0.0625 - 2 mm in size
z - silt: particles 2 μm - 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: general 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; longtitudinal 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. Up to three upper case letters may be used to indicate processes. These are listed in order of decreasing importance and placed after the surface expression symbol, following a dash (-) symbol.

Subclasses are 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 two subclasses can be associated with 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

B - braiding channel: active floodplain consists of many diverging and converging channels separated by unvegetated bars

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

J - anastamosing channel: a channel zone where channels diverge and converge around many islands. The islands are vegetated and have surfaces that are far above mean maximum discharge levels

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; (d) debris flow; (g) rock creep; (s) debris slide; (u) slump in surficial material

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; (f) thaw flow slides; (l) segregated ice; (n) pingo; (t) thermokarst subsidence; (r) patterned ground; (s) sheetwash; (w) ice-wedge polygons

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

SURFICIAL MATERIAL AGE

GLACIATION	TIME PERIOD	APPROXIMATE GLACIAL MAXIMUM	MARINE ISOTOPE STAGE
M - McConnell	late Wisconsin	15 000 years ago	2
G - Gladstone	early Wisconsin	55 000 years ago	4
R - Reid	Illinoian	130 000 years ago	6
>R - Pre-Reid	early to Middle Pleistocene	2.6 million to 200 000 years ago	8-102

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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 2012-4

Surficial Geology of Tom Creek (NTS 115J/12) Yukon (1:50 000 scale)

by

Panya S. Lipovsky and Jeffrey D. Bond