MARGINAL NOTES

INTRODUCTION

The topography in this largely unglaciated portion of the northern Dawson Range is characterized by broad ridges, convex slopes and v-shaped valleys (Fig. 1). The western flanks of the Mount Cockfield massif are located along the eastern edge of the map area, while Stevenson Ridge separates Dip and Duke creeks to the north from Kotaszin River and Colorado Creek to the south. Ridges and summits range in elevation from 1000 to 1800 m above sea level. Upland surfaces consist largely of loess-enriched weathered bedrock (Fig. 2) and colluvium modified by periglacial processes such as cryoturbation and solifluction. Bedrock outcrop and tors are commonly found along alpine ridges, and less commonly in valley bottoms where spurs intersect high order valley bottoms. Slopes are generally covered in mantles of colluvium that grade into thick loess-enriched aprons along lower slopes and valley bottoms. First and second order streams are confined to narrow valleys with largely locally derived floodplain sediment. Higher order streams such as Dip Creek, Colorado Creek and Klotassin River meander through wide valley bottoms filled with more distally derived sediment (colluvium and retransported loess). The broad braided floodplains of the Donjek and White rivers to the southwest are the source of most of the eolian or wind-blown silt and fine sand (loess) deposited throughout the map area.

Isolated alpine glaciers existed on Mount Cockfield during the Pleistocene. At least one of these glaciers extended west into the headwaters of a Victor Creek tributary during the Reid glaciation. The only other evidence of glaciation in the map area is found in the headwaters of Canadian Creek, immediately northwest of Patton Hill, where remnants of early Pleistocene cirques exist.

PERMAFROST

Permafrost is widespread but discontinuous in the map area (Bond & Lipovsky, 2011). Several landforms that indicate the presence of permafrost were found in the map area, including solifluction lobes, aufes, open system pingos (Fig. 3) and thermokarst ponds (Fig. 4). 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 commonly absent on rocky south-facing (27-70%) 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 and zones of groundwater convergence (Fig 5). Clearing or disturbance of organic cover in these areas may lead to rapid thaw and terrain destabilization.

HEAVY MINERAL SAMPLING

Preliminary heavy mineral sampling was undertaken in Casino, Canadian, Rude and Colorado creeks.

Site Number	Location (UTM Zone 7, NAD 83)	Type	Results
10JB035	620907 E, 6951534 N	pan (x2)	4 colours
10PL023	612327 E, 6953362 N	pan (x2)	4 colours + 1 wire gold ($1.81/yd @ $1000/oz)
10PL024	621503 E, 6939541 N	pan	no gold
10PL027	622945 E, 6939751 N	pan	no gold
10PL028	623005 E, 6939705 N	pan	no gold
10PL031	621904 E, 6939632 N	pan	no gold
10PL035	615928 E, 6948100 N	pan	no gold
10RG001	612327 E, 6953362 N	sluice (75 gallons)	14 colours ($0.49/yd @ $1000/oz)
10JB057	609920 E, 6959105 N	sluice (50 gallons)	149 fine colours ($1.24/yd @ $1000/oz), abundant magnetite

DATA SOURCES

This surficial geology map was interpreted from high resolution digital stereo imagery (1:40 000 scale aerial photographs flown in 1998*). Selective field checking was performed in July 2010.

*National Air Photo Library photographs A27481 (1989): 6-15, 73-82, 100-109, 168-176 and A27517 (1989): 57-65.

Figure 1.View to the west of Rude Creek placer mine (10JB034) with Dip Creek in the background.

Figure 2. Frost-shattered weathered bedrock exposure approximately 1 m thick above *in situ* fractured bedrock (below dashed line) on the summit of Patton Hill (10JB023).

Figure 3. Collapsed open system pingo (with green thaw pond) in headwaters of tributary to Dip Creek (10PL039). Aufeis (icing) exposed in creek on left side of photo (10PL038).

Figure 4. Thermokarst thaw pond (10PL040) formed in a loess blanket located in Dip Creek valley.

Figure 5. Ice-rich permafrost in silty colluvial veneer on upper slopes of Casino property (10PL014).

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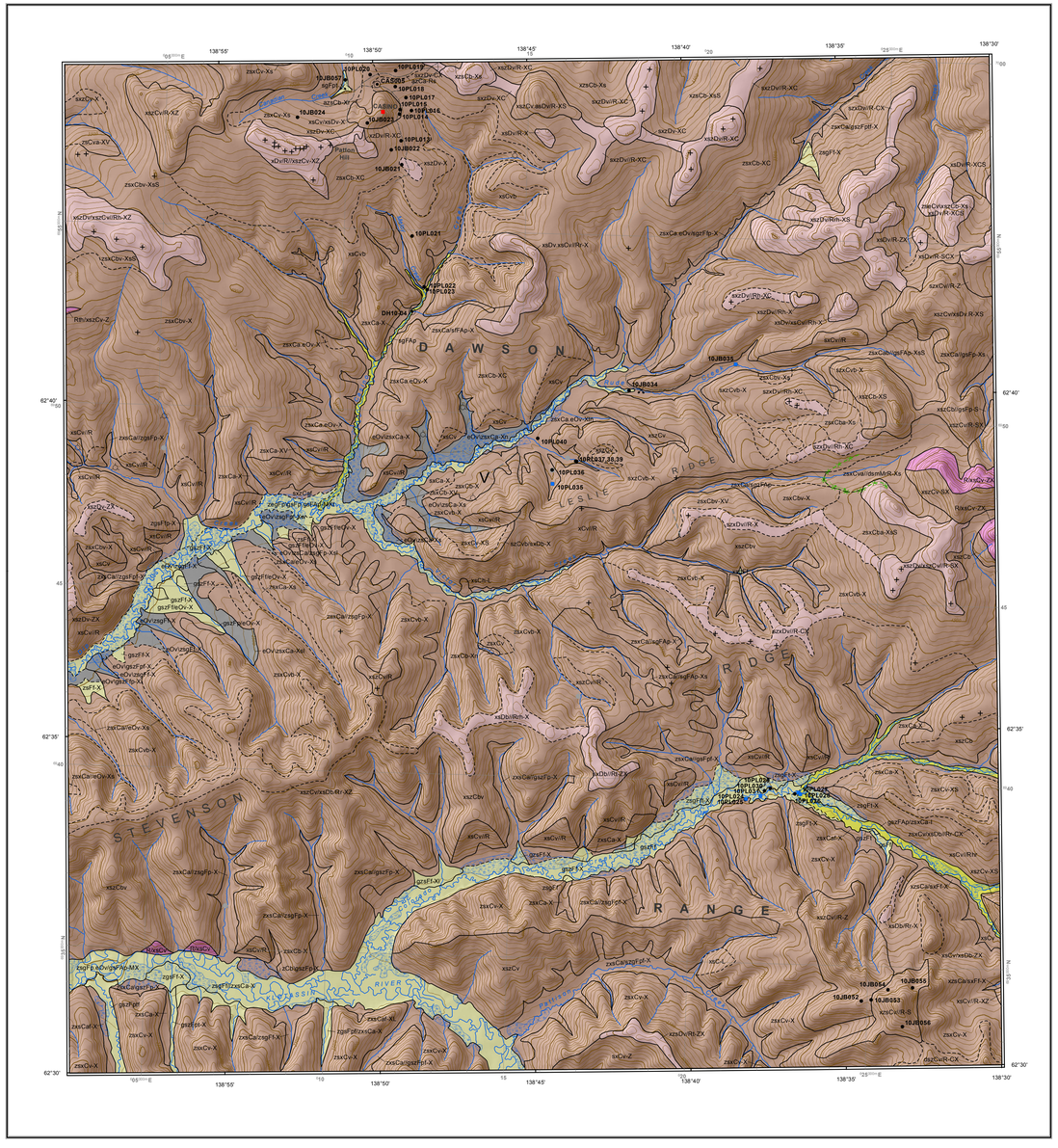
Howes, D.E. and Kenk, E., 1997. Terrain classification system for British Columbia, Version 2. B.C. Ministry of Environment and B.C. Ministry of Crown Lands, Victoria, B.C.



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

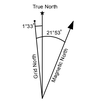
FIVE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 7

CONTOUR INTERVAL 100 FEET
Elevations in feet above Mean Sea Level

SURFICIAL GEOLOGY
COLORADO CREEK
YUKON 115J/10

SCALE 1:50 000

0 1 2 3 4 5
kilometres



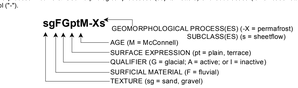
Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION NOVEMBER 2011
FOR CENTRE OF MAP

115J/14 COFFEE CREEK (DSC open file 4344)	115J/15 BRITANNIA CREEK (DSC open file 4345)	115J/16 CRIPPLE CREEK (DSC open file 4346)
115J/11 DOYLE CREEK open file 2012-3	115J/10 COLORADO CREEK open file 2012-2 MAP LOCATION	115J/09 SELWYN RIVER open file 2012-1
115J/06	115J/07 MOUNT PATTISON	115J/08 APEX MOUNTAIN

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 accommodate 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 ("-").



Due to scale limitations, up to 4 terrain units may be included in a single map unit label (e.g. sgFGptM.dsmMbMIxsDvIzxLGpM-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 "x" 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 — 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 comprising 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 more locally derived than in higher order streams. Active fluvial (FA) materials are subject to regular flooding.

F^ — 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^ — LATE WISCONSIN - MCCONNELL (M)
No McConnell glaciofluvial deposits are found in the map area.

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

M^ — 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^ — LATE WISCONSIN - MCCONNELL (M)
No McConnell morainal sediments are found in the map area.

M^ — EARLY WISCONSIN - GLADSTONE (G)
No Gladstone morainal sediments are found in the map area.

M^ — ILLINOIAN - REID (R)
No Reid morainal sediments are found in the map area.

LG — 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. No glaciolacustrine sediments are exposed in the map area.

R — PRE-QUATERNARY
Bedrock: In general, 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 Dip Creek may be associated with extension and local copper-gold mineralization (Bennett et al., 2010). Much of the map area is underlain by the mid-Cretaceous Dawson Range batholith granodiorite (Whitehorse suite), which was intruded by Late Cretaceous plutons (Prospector Mountain suite)(Gordey and Makepeace, 2003). Stevenson Ridge is primarily composed of Paleozoic quartzite and schist of the Yukon-Tanana terrane.

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, plains). 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. 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 geomorphological 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; (i) 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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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 2012-2

Surficial Geology of Colorado Creek (NTS 115J/10) Yukon (1:50 000 scale)

by

Jeffrey D. Bond and Panya S. Lipovsky