

**BONNET PLUME LAKE**  
YUKON TERRITORY  
106 B  
Scale 1:50,000  
CONTOUR INTERVAL 100 METRE Elevations in Metres above Mean Sea Level  
North American Datum 1983 Transverse Mercator Projection  
Universal Transverse Mercator Grid Zone 9

NOTE: THIS MAP WAS PRODUCED BY THE COMPILATION OF DATA FROM VARIOUS SOURCES. THE USER ASSUMES ALL RESPONSIBILITIES FOR THE ACCURACY OF THE DATA. THE YUKON GEOLOGY PROGRAM DOES NOT ACCEPT RESPONSIBILITY FOR ANY ERRORS, OMISSIONS OR DELAYS IN THE PRODUCTION OF THIS MAP.

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**GEOPROCESS FILE - SUMMARY REPORT**  
BONNET PLUME MAP AREA - NTS 106B

**INTRODUCTION**

The GEOPROCESS File is a compilation of information and knowledge on geological processes and terrain hazards, including mass movement processes, permafrost, flooding risks, faults, seismic activity and recent volcanism, etc. Please refer to the GEOPROCESS File User Guide for more in-depth information on how the maps were developed, which other GEOPROCESS File maps are available, how to utilize this inventory and how to interpret the legend. Special interest should be taken in the detailed description of the terrain hazard map units. Appendices in the User Guide include summary papers on the geological framework, permafrost distribution, and Quaternary geology in Yukon and a list of comprehensive GEOPROCESS File references.

This report includes a brief discussion of the scope and limitations of the GEOPROCESS File compilation maps followed by summaries of the bedrock geology, surficial geology and terrain hazards for the NTS map area, and a list of references.

**Geological Processes and Terrain Hazard Compilation Maps**

There are five mineral occurrences in the Yukon portion of the Bonnet Plume map area. The knowledge consists of bedrock, volcanic, hydrothermal, sedimentary, and zirconium and zirconium-bearing deposits.

**SURFICIAL GEOLOGY**

The Bonnet Plume Lake map area is within the limits of the McConnell glaciation. There is no published information on surficial geology or Quaternary geology in the area. General information on glacial history and permafrost is available in the User Guide of the Geoprocess File.

**PERMAFROST**

The Geological Survey of Canada's Pacific Geoscience Centre in Victoria provided the permafrost information.

**MASS MOVEMENT PROCESSES**

There is no mapped information or published information on mass movement hazards in this area. The following comments are based on landforms and hazards relationships identified on existing maps and/or general considerations for areas at these latitudes.

**Bedrock Geology Summaries**

Each 1:250 000 NTS map area is described according to morphogeological belts and terranes defined by Cosca et al. (1991) and Wheeler et al. (1991). Bedrock geology (including structure) and mineral occurrences are briefly described and taken largely from the referenced map. More detailed geological maps with additional contributions from Wheeler and McFelly (1991) and Yukon MNFILE (1993), a summary paper "A Geological Framework for Yukon" in Appendix A of the User Guide provides a framework and context for each of the bedrock summaries.

The level of knowledge and understanding of Yukon geology is constantly evolving with more detailed mapping and development of geological models. Names, ages and terrane affiliations of rock units on the most recent 1:250 000 geological maps may, in some cases, now be considered incorrect. This information contained within some of the bedrock geology summaries may be out of date. Although much of the information reflects the knowledge at the time that the source map was published, additional information has been inserted wherever possible to assist the user in integrating the information with current geological maps, concepts and understanding. The age ranges for similar packages of rocks may also vary between map areas since the actual rocks, or at least the constraints on their ages, may vary between map areas.

**Bedrock Geology**

The Bonnet Plume Lake map area is located within the Foreland Belt, the Yukon side of the map area, in the southwest corner of the map sheet, is dominated by the extremely rugged Hess and Selwyn Mountain ranges, and the Stewart and Bonnet Plume River drainages. The map area is underlain by 370 million year and older Highland Group quartzite, sandstone, quartzite, conglomerate, shales, phyllite and limestone that is overlain by Ordovician-Devonian rocks of the Selwyn Basin. The area within Yukon is characterized by northwest-trending faults.

**Mineral Deposits and Occurrences**

In map area 106B (Vernon and Hughes, 1966), there is permafrost thickness in excess of 120 m (400 ft) in addition to solifluction lobes, patterned ground, peat bogs and pingos, as well as large surfaces covered by patterned ground. Similar features are likely found in map sheet 106B.

**Flooding and Other Risks**

The lowerment terraces of the major rivers are likely subject to flooding. Some sections of the braided channels are probably unstable. In addition to the flooding risk, the steep portions of alluvial fans are also exposed to the additional possibility of mud flow and debris flow associated with rapid increases in discharge. Alluvial and colluvial fans are usually susceptible to channel migrations and erosion.

**Seismicity**

There are 16 recorded seismic events in the map area. The events range in magnitude from 2.0 to 4.999, or less.

**Permafrost**

There is no detailed mapped information or published information in this area. The following comments are mostly based on adjoining maps to the south and general considerations for areas at these latitudes. This area lies within Yukon's Extensive Discontinuous Permafrost Zone (50-90% of land underlain

**Permafrost**

by permafrost (Hegribottom, 1995; Hegribottom and Rastburn, 1992), with low to moderate ice content in morainal and colluvial deposits above valley floors, low to moderate ice content in alluvial and fluvial deposits and moderate to high ice content in fine-grained glaciolacustrine deposits and in fine-grained alluvial fans and terraces above stream level. Permafrost is assumed to be absent or thin in under-south-facing, well-drained slopes. The zone of Continuous Permafrost (95-100%; Hegribottom, 1995) occurs in the central and northeastern parts of the map area, mostly within Northwest Territories, with the boundary between the two permafrost zones running close to the Yukon/Northwest Territories border. Mean annual ground temperatures range from -2 to -5 degrees Celsius.

**Active and Inactive Rock Glaciers**

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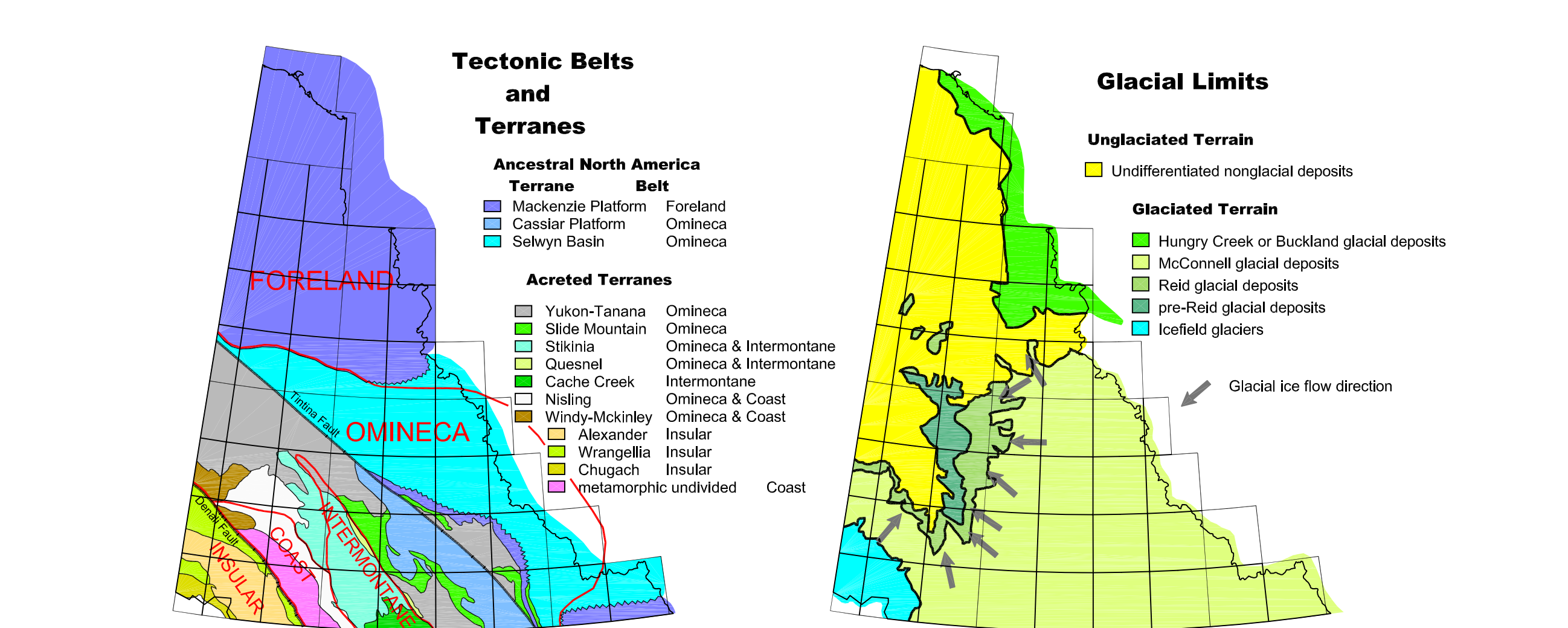
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**LEGEND**

LEGEND TERRAIN HAZARDS		ASSOCIATED RISK LEVELS/COMMENTS		LEGEND GEOLOGICAL PROCESSES		INFERRED HAZARDS	
MAP SYMBOL	DESCRIPTION	RISK LEVEL	COMMENTS	MAP SYMBOL	DESCRIPTION	RISK LEVEL	COMMENTS
[A]	Mass Movement Processes	High		[df]	Talus fan or apron, moderate to steep slope, coarse angular bedrock fragments, sources are often areas of rapidly downsloping bedrock.	High	Rock fall and debris flow common on active fans, steep slopes generally unstable to traffic.
[B]	Snow Avalanched.	Low to Intermediate		[ci]	Landslide, moderate slope, varies from large blocks of bedrock to finer material.	Intermediate	Landslides generally are recurrent in susceptible areas and may become active if disturbed.
[C]	Extremely slow to moderate rates of failure in soil and bedrock, including soil creep, rock creep, earthflow, soil or rock slump, slides or rock slides.	High		[ca]	Colluvium covered slope, gentle to moderate slope, underlain by unsorted rubble, soil/cracks and other periglacial features common.	Low	Areas of fine textured materials and gentle slopes at high elevations, where there is ground ice will be susceptible to high solifluction rates and thermokarst if disturbed.
[D]	Moderate to extremely rapid rates of failure in soil and bedrock (1.5 m to >5 m), including rock slump, debris slides, rock slides, debris flow, debris torrent, debris avalanche, rockfall, rock avalanches.	High		[fa]	Alluvial fan, active.	Low	Subject to shifts in channel and bar positions, occasionally subject to flooding.
[E]	Arctic, Alpine and Periglacial Processes	Low		[fb]	Floodplain.	Low to Intermediate	Subject to shift in channel and bar positions, occasionally subject to flooding.
[F]	Permafrost present.	Low		[fc]	Glacier ice.	Intermediate to High	Crevasses.
[G]	Thermokarst present.	Low		[fd]	Mountain ice caps.	Low to Intermediate	Avalanches, ice and rock falls, and crevasses.
[H]	Soliflucted.	Low to Intermediate		[fe]	Off glacier.	Intermediate to High	Avalanches, ice and rock falls.
[I]	Grouped, cryoturbated, soliflucted, riveted.	Low to Intermediate		[ff]	Lacustrine or glaciolacustrine sediments.	Low	Slit and dry, usually susceptible to frost heaving and, if permafrost present, to thermokarsting when disturbed.
[J]	Fluvial Processes	Intermediate to High		[fg]	Ice at depth make surface susceptible to thermokarst, unstable slopes.	High	Thick organic matter is often underlain by permafrost. Disturbance of permafrost may cause poor drainage and thermokarsting.
[K]	Braided, unstable channels, risk of flooding.	Intermediate to High		[fh]	Organic.	High	Thick organic matter is often underlain by permafrost. Disturbance of permafrost may cause poor drainage and thermokarsting.
[L]	Fluvial erosion, deposition and low risk of flooding.	Low to Intermediate		[fi]	Fault	High	Defined, approximate, assumed, extrapolated beneath overburden.
[M]	Anastomosing.	Intermediate to High		[fj]	Fault	High	Solid circle indicates downthrown side. Arrows indicate relative movement.
[N]	Flooded regularly.	Intermediate to High		[fk]	Fault	High	Solid circle indicates downthrown side. Arrows indicate relative movement.
[O]	Miscellaneous Erosion Processes	Intermediate to High		[fl]	Thrust Fault (beeh indicates upthrust side)	High	Arrows indicate relative movement.
[P]	Karst.	Intermediate		[fm]	Airphoto Lineament	High	No known recent volcanism in map area 106B. Olivine basalt.
[Q]	Piping.	Intermediate to High		[fn]	Roads	High	
[R]	Outlet.	Low to Intermediate		[fo]	Streams	High	
[S]	Observation of frozen soil or ground ice.	High		[fp]	Marsh	High	
[T]	Rapid mass movements (debris torrent) with known point source. Limits of runoff not implied by symbol.	High		[fq]		High	
[U]	Slow mass movement (earth flow) with landslide, escarpment source. Limits of landslide runoff not implied by symbol.	Intermediate to High		[fr]		High	
[V]	On Site Symbols			[fs]		High	
[W]	Unit boundary (defined, approximate).			[ft]		High	
[X]	Erosional escarpment.	High		[fu]		High	
[Y]	Landslide escarpment.	High		[fv]		High	
[Z]	Landslide (includes source and runoff areas).	High		[fw]		High	
[aa]	Perp.	High		[fx]		High	
[ab]	Rock glacier.	High		[fy]		High	
[ac]	Spring or saline seep.	Low		[fz]		High	
[ad]	Observation of frozen soil or ground ice.	High		[ga]		High	
[ae]	Rapid mass movements (debris torrent) with known point source. Limits of runoff not implied by symbol.	High		[gb]		High	
[af]	Slow mass movement (earth flow) with landslide, escarpment source. Limits of landslide runoff not implied by symbol.	Intermediate to High		[gc]		High	

NOTE: Where areas have more than one identified process or hazard, the colour of the encompassing polygon is assigned based on a hierarchical scheme relating to the severity of the hazard. The relative order of severity is: Terrain Hazards (Mass Movement Processes then Fluvial Processes then Arctic, Alpine and Periglacial Processes) followed by Geological Processes.



**Tectonic Belts and Terranes**  
Ancestral North America Belt  
Mackenzie Platform  
Selwyn Basin  
Foreland  
Omineca  
Acroterranes  
Yukon-Tanana  
Sibley Mountain  
Stikinia  
Quasnoy  
Cochise Creek  
Niding  
Windy-McKibbey  
Alexander  
Wopmayella  
Chugach  
Mesozoic  
Unmetamorphic undifferentiated

**Glacial Limits**  
Unglaciated Terrain  
Undifferentiated nonglacial deposits  
Glaciated Terrain  
Hungry Creek or Buckland glacial deposits  
McConnell glacial deposits  
Raid glacial deposits  
pre-Raid glacial deposits  
Icefield glaciers  
Glacial ice flow direction

**Distribution of Recent Soils**  
Soils  
B1 Eutric Brunisol  
B2 Dystric Brunisol  
C1 Turbic Cryosol  
C2 Stalic Cryosol  
C3 Organic Cryosol  
R Rockland  
I Ice Field  
Soil Boundary

**Permafrost**  
Continuous  
Widespread  
Scattered  
Alpine

**Location Map**

Exploration and Geological Services Division  
Yukon Region  
Indian and Northern Affairs Canada

**Yukon GEOPROCESS File**

**Geological Processes and Terrain Hazards of Bonnet Plume Lake 106B**

by Mougout, C.M. and Walton, L.A.

Copies of this map may be obtained from Geoscience and Information Services, c/o Whitehorse Mining Recorder, Indian and Northern Affairs Canada, Room 102, 300 Main Street, Whitehorse, Yukon Y1A 2B5 (867) 867-3268; FAX: (867) 867-3267

Recommended citation: Mougout, C.M. and Walton, L.A., 1996. Yukon GEOPROCESS File (2002). Geological Processes and Terrain Hazards of Bonnet Plume Lake, 106B. Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada, 1:250 000 scale.