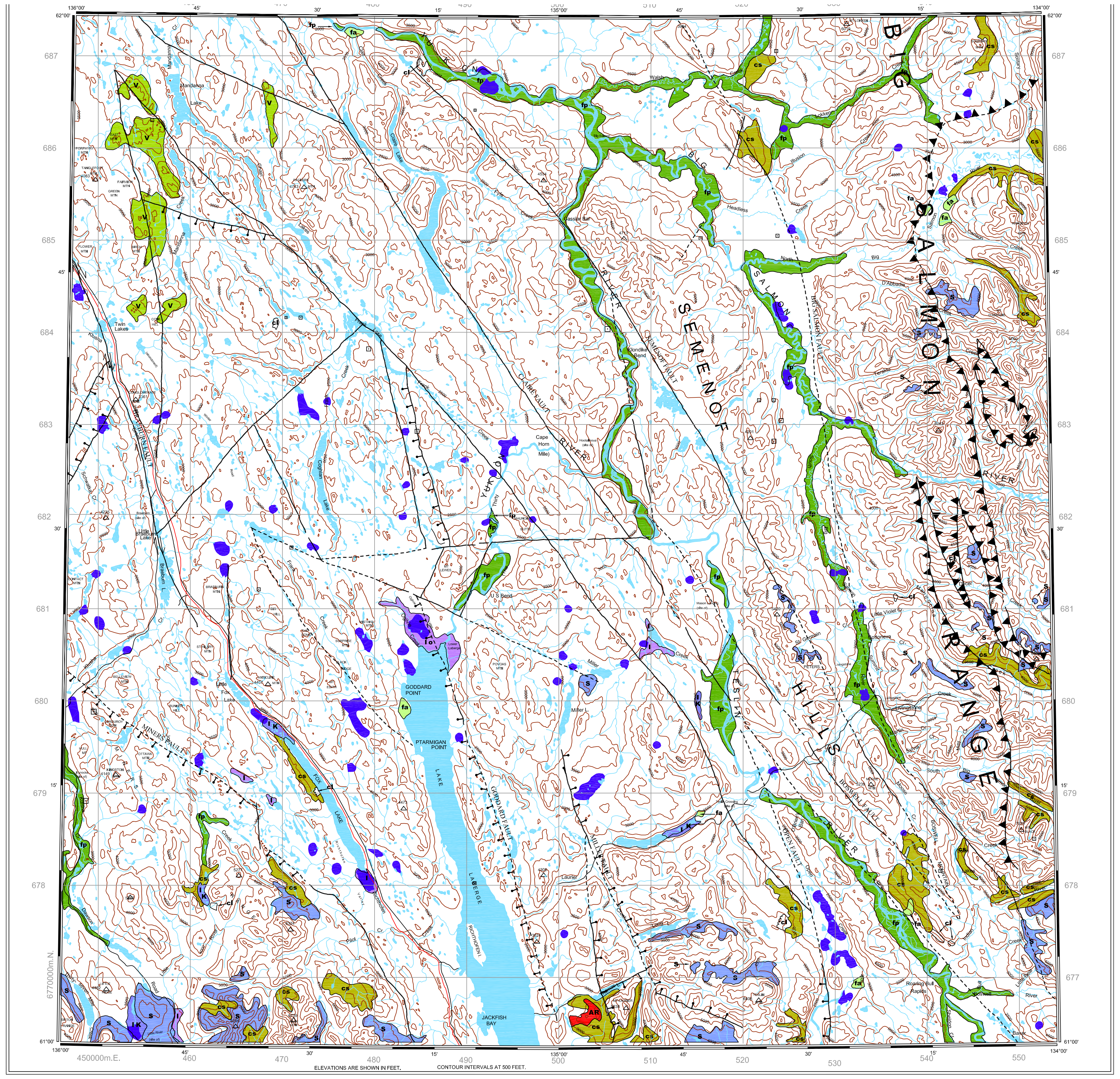

TEN THOUSAND METRE UNIVERSAL TRANSVERSE MERCATOR GRID NAD 83 ZONE 8

NOTE: THIS MAP HAS BEEN PRODUCED BY THE COMPILATION OF DATA FROM VARIOUS SOURCES. IT IS NOT TO BE USED TO DEFINE LEGAL BOUNDARIES.

THIS MAP IS ISSUED AS A PRELIMINARY GUIDE FOR WHICH THE DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT WILL ACCEPT NO RESPONSIBILITY FOR ANY ERRORS, INACCURACIES OR OMISSIONS WHATSOEVER.

EDITION 2: PRINT DATE: JULY 19, 1999

LAKE LABERGE

YUKON TERRITORY
105E

Scale

10 0 10 20 30 km
5 0 5 10 15 miles

CONTOUR INTERVAL 500 FEET Elevations in Feet above Mean Sea Level
North American Datum 1983 Transverse Mercator Projection
Universal Transvers Mercator Grid ZONE 8

138°	136°	134°	132°
63°	115-I CARMACKS	105L GLENLYON	105K TAY RIVER
62°	115H AISHIHIK LAKE	105E LABERGE	105F QUIET LAKE
61°	115A DEZADEASH	105D WHITEHORSE	105C TESLIN
60°			

Index to Adjoining Sheets.

Magnetic Declination 1989 varies from 29 ° 24' easterly at the centre of the west edge to 29° 47' easterly at the centre of the east edge. Mean annual change 11.9' westerly.

GEOPROCESS FILE - SUMMARY REPORT

LABERGE MAP AREA - NTS 105E

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 this NTS map area, and a list of references.

Geological Processes and Terrain Hazard Compilation Maps

The GEOPROCESS File map units were drafted on the 1:250 000 topographic base maps through interpretation from bedrock geology maps, surficial geology maps and in some cases terrain hazard maps at various scales. The compilation maps have a confidence level reflecting the original source material. All materials used to produce the maps are listed in the references on each map. A file containing the documentation used to construct these maps is available at the Indian and Northern Affairs library in Whitehorse, Yukon. Areas for which no surficial geology or terrain hazard information is published were left blank. Summary reports on surficial geology and terrain hazards for these map sheets were written by extrapolating the data from adjacent map sheets or smaller scale maps. Information from small scale (e.g. 1:1 000 000) maps was used for the summary reports, but not redrafted onto the 1:250 000 GEOPROCESS File maps.

The GEOPROCESS File compilation maps are intended as a first cut planning tool; the legend on the maps describes the general aspects of terrain hazards (also see below) and associated geological processes. **These maps should never replace individual site investigations for planning of site specific features, such as buildings, roads, pits, etc.**

Bedrock Geology Summaries

Each 1:250 000 NTS map area is described according to morphogeological belts and terranes defined by Gabrielse et al. (1991) and Wheeler et al. (1991). Bedrock geology (including structure) and mineral occurrences are briefly described and taken largely from the referenced, most recent 1:250 000 geological map with additional contributions from Wheeler and McFeely (1991), and Yukon MINFILE (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 affinities of rock units on the most recent 1:250 000 geological maps may, in some cases, now be considered incorrect. Thus 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 whenever possible to assist the user in merging 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 age, may vary between map area

BEDROCK GEOLOGY

The southern and western portion of the Laberge map area is in the Intermontane Belt, whereas the northeastern portion is in the Omineca Belt. The two belts are separated by the large northwest-trending, strike-slip Teslin Fault.

The rocks in the Intermontane Belt are part of Quesnel and Stikinia Terranes, both interpreted as Mesozoic volcanic arc terranes. Quesnel Terrane (Tatchun Belt of Tempelman-Kluit, 1984) rocks are composed of 220 million year old volcanic breccia, augite porphyry basalt and chlorite amphibolite schist. Stikine Terrane consists of similar rocks and includes a thick sequence of folded sedimentary strata. The sedimentary rocks are 220 to 160 million years old and are dominated by Lewes River Group greywacke, limestone and shale; Laberge Group shale, greywacke, conglomerate and arkose; and Nordenskiold Formation dacite tuff.

The Omineca Belt is underlain by metamorphosed sedimentary and igneous rocks of the Teslin Suture Zone, Yukon Cataclastic Terrane and the Seminof Hills block. These rocks are equated with the Kootenay Terrane or Yukon-Tanana Terrane, but may include some parts of the Slide Mountain Terrane. The rocks include 290-250 million year old granite gneiss ("Selwyn Gneiss"); 350-250 million year old Anvil Allochthon amphibolite, greenstone, serpentinized dunite, and augen amphibole gneiss; Nisutlin Allochthon muscovite-quartz schist and marble; 320-300 million year old Seminof Formation basalt; and one billion to 300 million year old Boswell Formation phyllite, greywacke, chert, conglomerate, limestone and gabbro.

The eastern and northeastern-most portions of the map area are underlain by Cassiar Terrane rocks (Omineca Crystalline Belt in Tempelman-Kluit 1984) which consist of 570-400 million year old Askin Group dolomite, Nasina Formation graphitic siltstone and Kechika Group phyllite. This package overlies pre-650 million year old Ketza Group marble, schist and granodiorite gneiss.

Several exposures of 140 to 60 million year old Tantalus Formation chert pebble conglomerate, siltstone and gritty sandstone occur on the western and eastern margins of Stikine Terrane. Mount Nansen Group volcanic rocks (approximately 110 million years old) near Packers Mountain consist mainly of dacite and rhyolite, whereas the volcanic rocks in the Teslin Mountain area are mainly andesite, greenstone and volcanic breccia. Several scattered occurrences of 80 million year old Open Creek volcanic rocks consist of columnar-jointed dacite flows and flow breccia in the eastern part of the area. Extensive flows of 70 million year old Carmacks Group hornblende feldspar porphyry, augite andesite and feldspar porphyry andesite flows occur in the southwestern part of the map area, as well as part of a large hornblende syenite intrusion.

Suites of 215 and 186 million year old granitic rocks form small plutons throughout the map area. Numerous small plutons are associated with the aforementioned volcanic units.

Mineral Deposits and Occurrences

Although there are 60 mineral occurrences in the Laberge map area, only 27 of them host known mineralization. Most of the occurrences are limited to small copper skarns or copper-gold veins in Stikine Terrane rocks. None of the mineral occurrences have any defined tonnages; however, the Loon occurrence, a gold-silver-copper vein, has received recent exploration attention. The Loon occurrence and similar veins are near the Livingstone Creek placer camp which has produced placer gold for most of this century. Although the region has been glaciated, it is thought that the east-trending creek valleys and their pre-glacial placers were not ravaged by the northerly advance of the glaciers. At least seven small deposits of coal, associated with Tantalus Formation conglomerate, are also known in the Laberge map area.

SURFICIAL GEOLOGY

The main source of information for the Laberge map area is a surficial geology map by Klassen and Morison (1987).

The surface deposits of the Laberge map area are associated with the most recent Cordilleran ice sheet, the McConnell glaciers, believed to have covered south and central Yukon between 26,500 and 10,000 years ago. Most of the area was covered by the Cassiar lobe which flowed towards the northwest from the Cassiar Mountains. Streamlined morainal deposits (drumlins) indicating a northwesterly ice flow direction are abundant west and north of Lake Laberge.

The Quaternary deposits are dominantly composed of morainal sediments; either moraine or mixed colluvial and morainal veneers are present at high elevations. The lower to mid-elevations are covered by either streamlined or incised moraine deposits, or moraine blankets. Bedrock outcrops are common at elevations greater than 1200 m. Till, or more correctly diamicton of glacial origin, is an unsorted mixture of coarse material ranging in size from pebble to boulder, with a matrix of clay, silt and sand. The general composition of the till matrix in the adjoining map to the south (Whitehorse NTS map 105 D) indicates a wide range of content of sand (50 to 70%) and silt (20 to 35%), and usually lower clay content (5 to 20%). This low clay content is reflected by the low plasticity of the matrix. Morainal deposits can usually provide a stable base, if there is no permafrost present. Isolated lenses of permafrost may be present on north facing slopes and at high elevations, where thick organic deposits are present over the Quaternary sediments.

The Yukon, Teslin, South and North Big Salmon rivers, and the Klusha and Mandanna Creek valley floors are commonly benched and covered by glaciofluvial sand and gravel. The glaciofluvial sand and gravel have variable thickness and composition, are usually stable surfaces, however may contain undesirable lithologies (weak) for their potential use as aggregate. Silt and fine sand caps up to 2 m thick are commonly found over the low relief glaciofluvial gravelly deposits. In addition to the glaciofluvial gravel, the largest river floors contain alluvial deposits. The composition of these deposits can vary rapidly over short distances and depth and may also range from well to very poorly drained.

Small glaciolacustrine deposits are found north of Lake Laberge, and north and south of Fox Lake. These fine-grained sediments may contain large bodies of segregated ice (permafrost) and thermokarst subsidence may occur if the surface of these deposits is disturbed.

The White River tephra (1,200 years B.P.) is found close to the surface of most landforms in this area, except on active landforms such as landslides, alluvial terraces and fans, colluviating slopes, etc.

TERRAIN HAZARDS

Slope failures in steep bedrock represent the highest risk hazard in the area. This hazard is restricted to the south central map area. Flooding of major flood plains of the lowest terraces of the major rivers is common.

Seismicity

There are 15 recorded seismic events within the map area. All of the recorded events are 4.0 to 4.999 or less in magnitude.

Mass Movement Processes

A few small earth flows or landslides were mapped in the Big Salmon Range, but no large slumps or slides were identified. Snow avalanches could occur on steep bedrock slopes and can entrain large volumes of boulders and debris. Development of any kind in close proximity to steep escarpments, ridges, cirques and arrêtes prone to these hazards should be discouraged. Map units labelled cs refer to colluvium covered slopes which may be active.

Permafrost

This area lies within the discontinuous permafrost zone (Brown, 1967). Permafrost distribution is expected to be sporadic (Heginbottom and Radburn, 1992). Permafrost indicated by solifluction lobes and stripes and sorted stone polygons is locally present at high elevations in colluvial and morainal deposits.

Ice content is nil to low in most active landforms and in coarse, well-drained sediments, such as glaciofluvial and fluvial sand and gravel. Low to moderate ice content is possible in morainal and colluvial deposits, where small ice lenses, veins and crystals may be present. Ice content would be highest in fine-grained clayey and silty sediments such as alluvial terraces, glaciolacustrine sediments and the lower part of alluvial and colluvial fans. Permafrost is more likely to be present in these landforms if they are covered by thick mosses or organic soils.

Thermokarst collapse and thaw slides are possible hazards in fine-grained glaciolacustrine and fluvial sediments around Fox Lake and Lake Laberge.

Flooding and Other Risks

Floods related to ice-jams, snow melt and summer rainstorms are possible hazards in lower reaches of most streams in the area. For example, ice jams are common on the lower reaches of the Yukon River below Lake Laberge (Underwood McLellan Ltd., 1983). The steep portions of alluvial fans, in addition to the flooding risk, are also exposed to the additional possibility of mud and debris flows associated with a rapid increase in discharge.

NOTE: A new digital compilation of Yukon Geology is now available by Steve Gordey and Andrew Makepeace (GSC Open File D3826 and/or DIAND Open File 1999-1(D)), and more recent MINFILE updates should also be verified (Yukon MINFILE, 2001).

References: Laberge Map Area - NTS 105E

To be thorough, check the references for adjacent NTS map sheets and the General Reference List (See User Guide).

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* References used in compiling this map

LEGEND

LEGEND TERRAIN HAZARDS

MAP SYMBOL	TERRAIN HAZARDS	ASSOCIATED RISK LEVELS, COMMENTS
	Mass Movement Processes	
A	Snow Avalanched.	high
F	Extremely slow to moderate rates of failure in soil and bedrock, including soil creep, rock creep, earthflow, soil or rock slump, debris or rock slide.	low to intermediate
R	Moderate to extremely rapid rates of failure in soil and bedrock (1.5 m/d to >3 m/s), including rock slump, debris slide, rock slide, debris flow, debris torrent, debris avalanche, rockfall, rock avalanche.	high
	Arctic, Alpine and Periglacial Processes	
X	Permafrost present.	low
K	Thermokarst present.	low
S	Solifluction.	low to intermediate
Z	Grouped, cryoturbated, solifluction, nivated.	low to intermediate
	Fluvial Processes	
B	Braided, unstable channels, risk of flooding.	intermediate to high
E	Fluvial erosion, deposition and low risk of flooding.	low to intermediate
J	Anastomosing.	intermediate to high
U	Flooded regularly.	intermediate to high
	Miscellaneous Erosion Processes	
T	Karst.	intermediate
P	Piping.	intermediate to high
V	Gullied.	low to intermediate
	On Site Symbols	Risk Level
∼	Unit boundary (defined, approximate).	
⌒	Erosional escarpment.	high
⌒	Landslide escarpment.	high
▩	Landslide (includes source and runout areas).	high
☮	Pingo.	high
⬢	Rock glacier.	high
* ⊠	Spring or saline seep.	low
▽ ▽	Observation of frozen soil or ground ice.	low
Ⓣ	Rapid mass movements (debris torrent) with known point source. Limits of runout not implied by symbol.	high
Ⓔ	Slow mass movement (earth flow) with landslide, escarpment source. Limits of landslide runout not implied by symbol.	intermediate to high

LEGEND SEISMIC EVENTS

SYMBOL	MAGNITUDE REPRESENTED	SYMBOL	MAGNITUDE REPRESENTED
⊡	<2.0	⊡	4.0 to 4.999
⊡	2.0 to 2.999	⊡	5.0 to 5.999
⊡	3.0 to 3.999	⊡	>6.0

LEGEND GEOLOGICAL PROCESSES

MAP SYMBOL	DESCRIPTION	INFERRED HAZARDS
cf	Talus fan or apron, moderate to steep slope, coarse angular bedrock fragments, sources are often areas of rapidly disintegrating bedrock.	Rock fall and debris flows common on active fans, steep slopes generally unstable to traffic.
cl	Landslide, moderate slope, varies from large blocks of bedrock to finer material.	Landslides generally are recurrent in susceptible areas and may be become active if disturbed.
cs	Colluvium covered slope, gentle to moderate slope, underlain by unsorted rubble, solifluction and other periglacial features common.	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.
fa	Alluvial fan, active.	Subject to shifts in channel and bar positions, occasionally subject to flooding.
fp	Floodplain.	Subject to shift in channel and bar positions, occasionally subject to flooding.
ice	Glacier ice.	Crevasses.
im	Mountain ice caps.	Avalanches, ice and rock falls, and crevasses.
is	Cliff glacier.	Avalanches, ice and rock falls.
l	Lacustrine or glaciolacustrine sediments.	Silt and clay, usually susceptible to frost heaving and, if permafrost present, to thermokarsting when disturbed.
m/i	Rock glacier, debris covered glacier.	Ice at depth make surface susceptible to thermokarst, unstable slopes.
o	Organic.	Thick organic matter is often underlain by permafrost. Disturbance of permafrost may cause poor drainage and thermokarsting.

LEGEND FAULTS

Fault defined, approximate, assumed, extrapolated beneath overburden	——— - - - - ------- -·-·-·-
Fault Solid circle indicates downthrown side Arrows indicate relative movement	⫫ ⇄
Thrust Fault (teeth indicate upthrust side)	▲ ▲ ▲ ▲ ▲ ▲
Airphoto Lineament	—⧻—

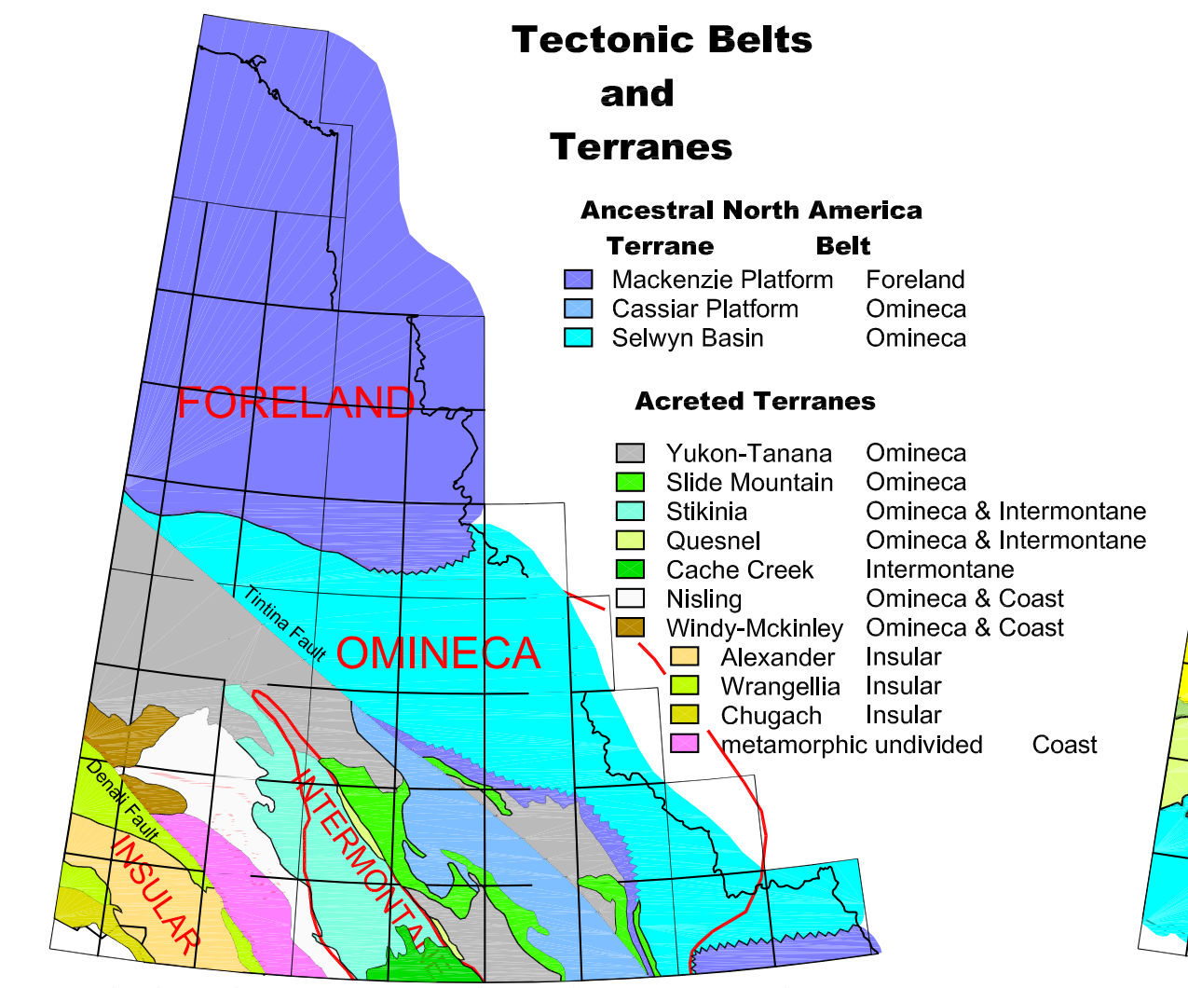
LEGEND QUATERNARY VOLCANISM

No known recent volcanism in map area 105E

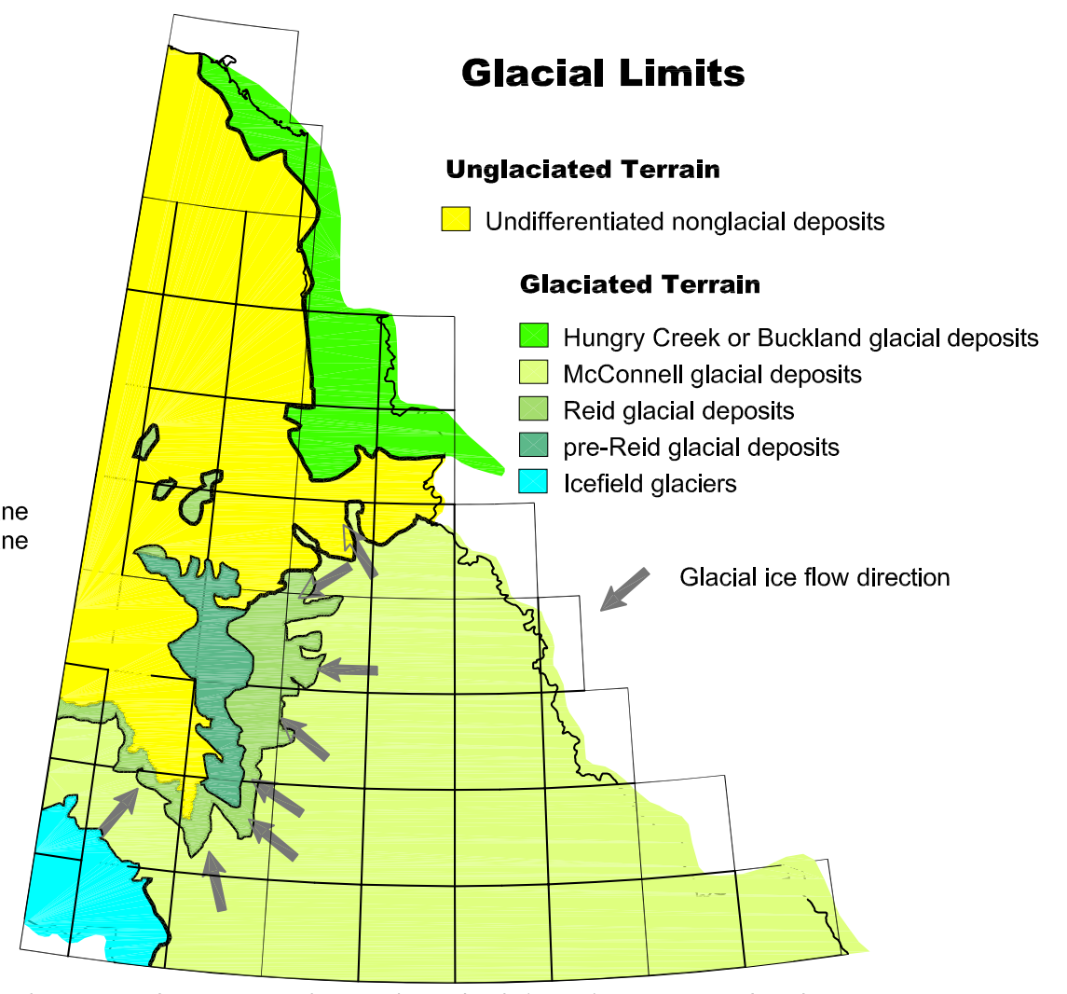
OTHER FEATURES

Roads	— —	Lakes	🟦
Streams	∿	Marsh	🟪

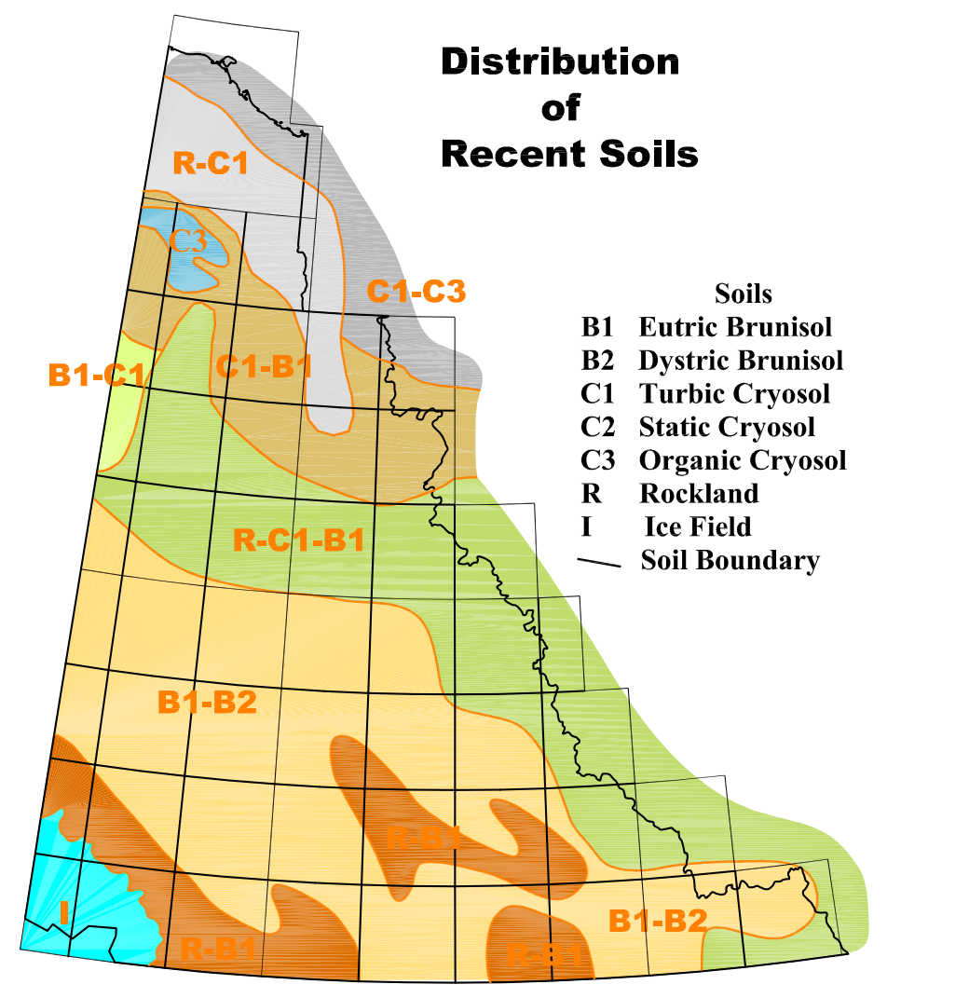
NOTE: Where areas have more than one identified process or hazard, the colour of the encompassing polygon is assigned based on a hierarchical scheme relating to the severity of the hazard. The relative order of severity is: Terrain Hazards (Mass Movement Processes then Fluvial Processes then Arctic,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



After: Gordey, S.P. and Makepeace, A.J. (compilers), 1999. Yukon Digital Geology Geological Survey of Canada Open File D3826, Exploration and Geological Services Division Yukon, Indian and Northern Affairs, Open File 1999-1 (D)



After: Hughes, O.L. in Morison, S.R. and Smith, C.A.S. (editors), 1987, XII th INQUA Congress Field Excursions A20, p12 to 16 - Research in Yukon, National Research Council of Canada, Ottawa, Canada, 110p



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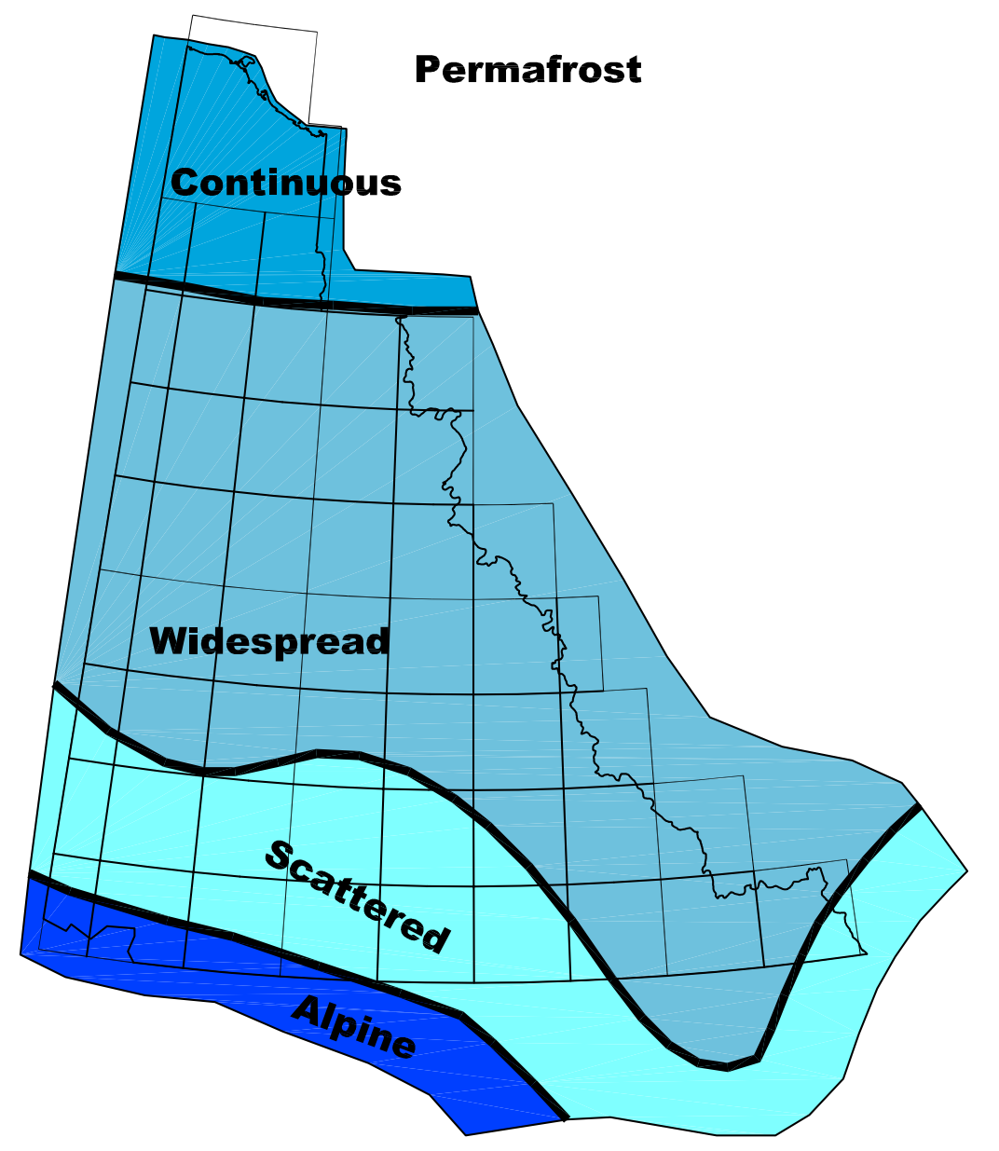
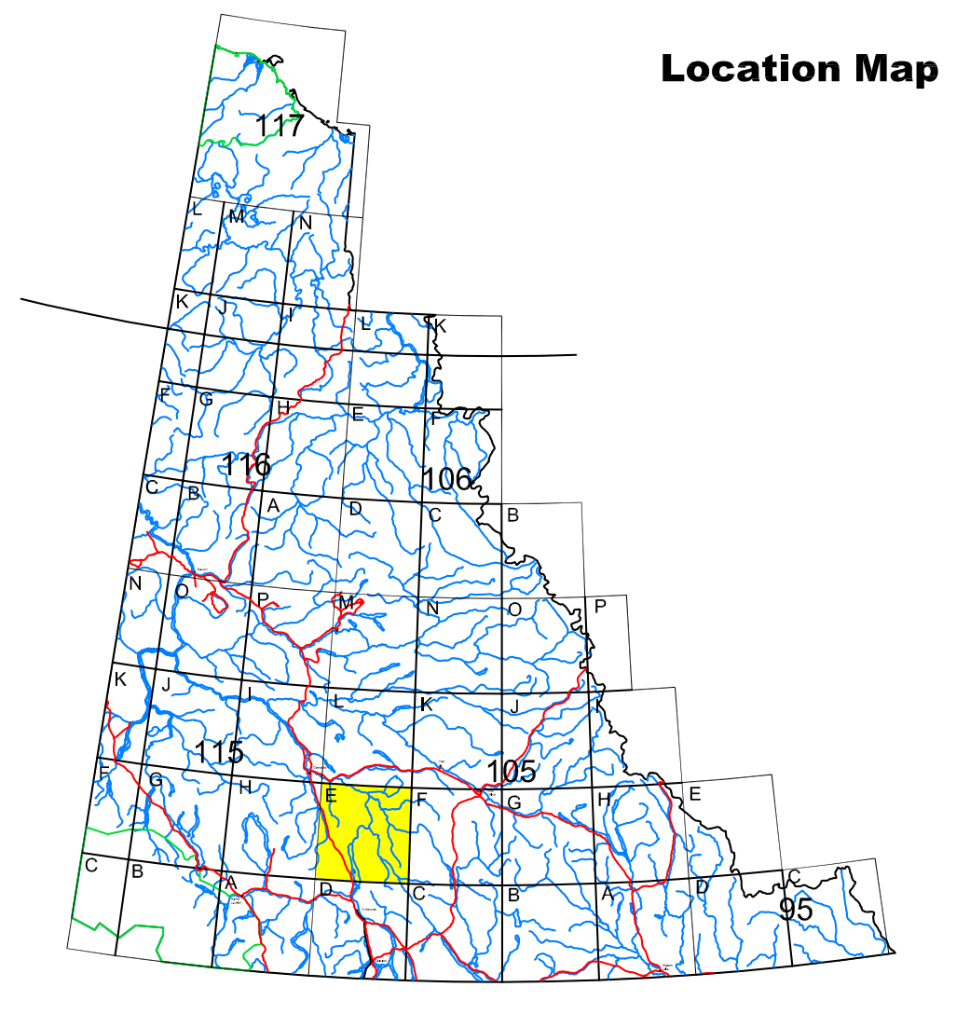


After: Brown, R.J.E., 1978, Permafrost: Plate 32, Hydrological Atlas of Canada, Fisheries and Environment, Canada. 34 plates



Exploration and Geological Services Division
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Yukon GEOPROCESS File

Geological Processes and Terrain Hazards of Lake Laberge 105E

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

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