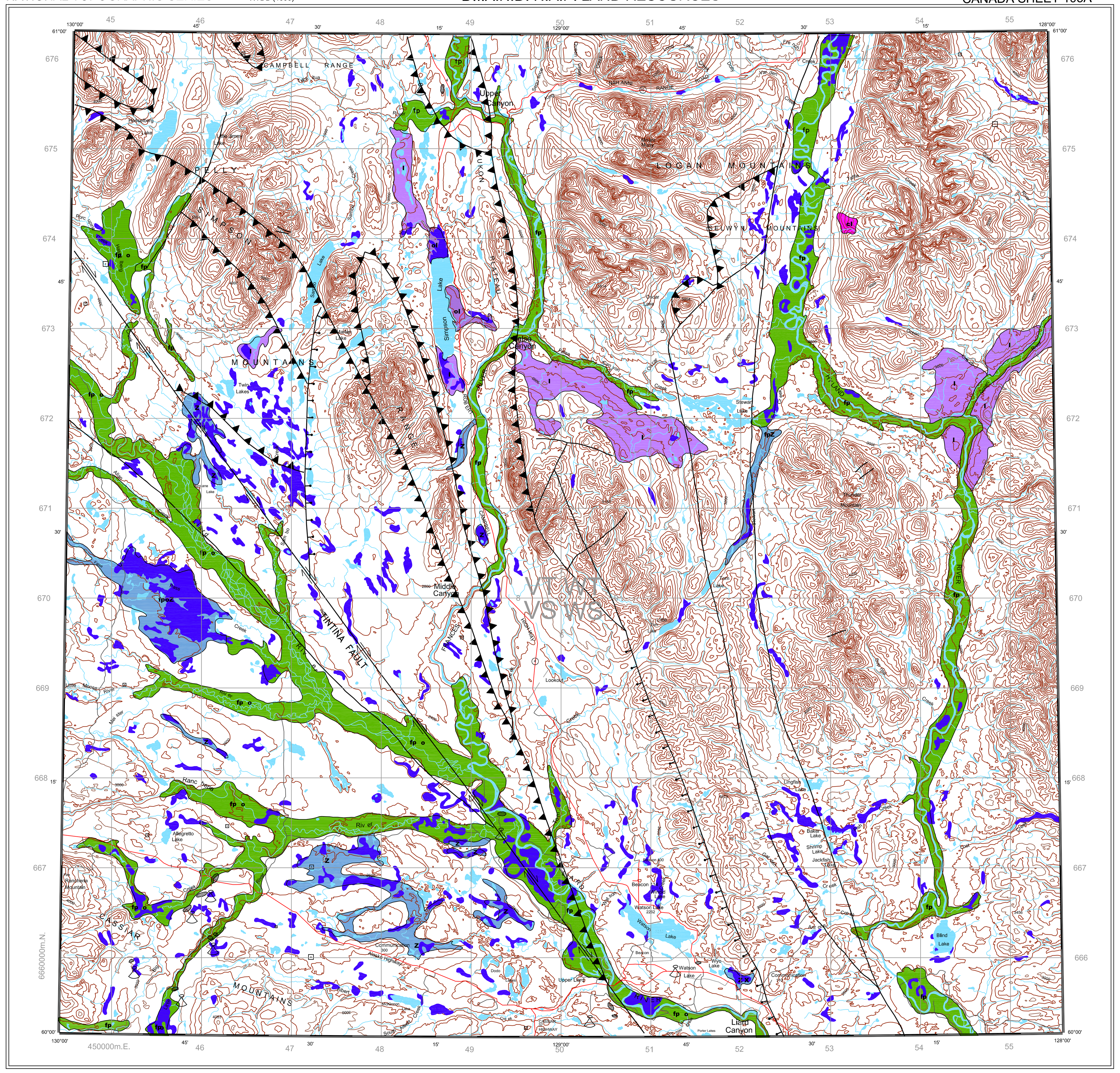
NATIONAL TOPOGRAPHIC SERIES NTDB (1995) D.I.A.N.D. N.A.P. LAND RESOURCES CANADA SHEET 105A



TEN THOUSAND METRE UNIVERSAL TRANSVERSE MERCATOR GRID NAD 83 ZONE 9

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: MAY 11, 1999

WATSON LAKE

YUKON TERRITORY

105A

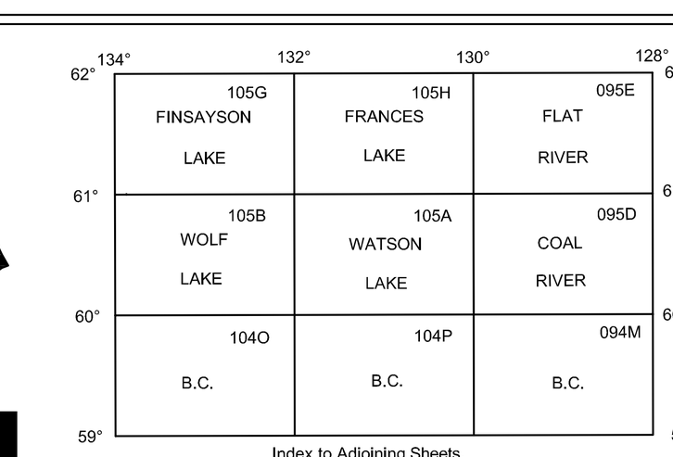
Scale

10 0 10 20 30 km

5 0 5 10 15 miles

CONTOUR INTERVAL 200 FEET Elevations in Feet above Mean Sea Level
North American Datum 1983 Transverse Mercator Projection
Universal Transvers Mercator Grid ZONE 9

N



Index to Adjoining Sheets.

Magnetic Declination 1988 varies from 29° 32' easterly at the centre of the west edge to 29° 40' easterly at the centre of the east edge. Mean annual change 20.4' westerly.

GEOPROCESS FILE - SUMMARY REPORT

WATSON LAKE MAP AREA - NTS 105A

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 attached to each map. A file containing the documentation used to construct these maps is available at Exploration and Geological Services Division, Indian and Northern Affairs Canada 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, geological structures 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 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 areas.

BEDROCK GEOLOGY (Gabrielse, 1967)

The Watson Lake map area is entirely within the Omineca Belt and includes portions of the Selwyn, Kaska and Mackenzie mountains. The dominant geological feature is the northwest-trending Tintina Fault that traverses the area. The physiographic expression of this fault, the Tintina Trench, is narrow in the northwest of the map area (10 km) but flares out to form the Liard Lowlands, a very wide, low-lying region to the southeast.

The region southwest of the Tintina Fault is dominated by 570-450 million year old quartzite, slate, siltstone, thick- bedded limestone, argillite and phyllite of the Cassiar Terrane. These continental shelf sedimentary rocks of ancient North America include the Rocky Mountain Group and the Atan Formation. Northeast of the Tintina Fault, there are two geological belts. The westernmost belt occupies most of the central and northern parts of the map area and includes variably metamorphosed 390-325 million year old conglomerate, black slate, siltstone, sandstone, quartzite, greywacke, greenstone and granite gneiss overlain by limestone, conglomerate, chert, argillite, slate, chert breccia and pebble conglomerate. These meta-sedimentary, volcanic and granitic rocks are in several fault-bounded packages belonging to the Nisutlin, Slide Mountain and Pelly Gneiss Assemblages which comprise the Yukon-Tanana Terrane. The northernmost belt is separated from Yukon-Tanana Terrane metamorphic rocks by a fault. East of this fault are the 800-530 million year old Hyland Group shale, slate, quartz-pebble conglomerate, grit, quartzite, maroon shale and slate, green argillite, limestone, dolomite, schist and gneiss, and 530-390 million year old Road River Group black slate, shale, argillite and phyllite. The Hyland and Road River groups comprise the Selwyn Basin portion of ancient North America.

Numerous, large 100 million year old biotite-hornblende granodiorite and quartz diorite plutons of the Selwyn Suite occur in the northern part of the map area. Northwest of the town of Watson Lake (i.e., the Liard River valley) in the Tintina Trench, 50 million year old, coal-bearing siltstone, shale and sandstone form small exposures; however, these rocks underlie a much greater area, defined by drilling. Young (1-10 million year old), columnar-jointed, olivine basalt flows are exposed in the south and southwestern parts of the map area along the Alaska Highway and Little Rancheria River.

Mineral Deposits and Occurrences

The Watson Lake map area is not richly endowed with mineralization although this may be a function of the low level of bedrock exposure in the region. Yukon MINFILE lists 46 mineral prospects, however, only 17 host known mineralization and 5 of these are coal occurrences. The remaining occurrences are dominated by lead-zinc-silver-copper veins with a few copper-molybdenum-tungsten-gold skarns and veins. The largest deposit in the map area is the Sa Dena Hes (Mount Hundere) skarn deposit which contained 3.9 million tonnes of 12.7% zinc, 3.9% lead and 48 grams per tonne of silver. This was a producing mine in 1991 and 1992, during which approximately half of the ore body was mined. Another skarn deposit with defined tonnage, the Bailey, contains 272 000 tonnes of 1% tungsten oxide. In addition to the coal deposits of the region, there has also been some interest in possible oil and gas reserves.

There is relatively limited historical or active placer activity within the Watson Lake map area. The majority of these occurrences are found along the Liard River. Recorded gold production from the Liard River between 1978-1990 is 26 ounces (740 g).

SURFICIAL GEOLOGY

The Watson Lake map area, in southeastern Yukon, is within the limits of the McConnell Glaciation. The map area is characterized by high elevations northeast of the Tintina Trench and more subdued topography southwest of the Trench. Lower areas are covered by morainic and colluvial deposits over bedrock. The flanks of valleys contain glaciofluvial gravel terraces and a variety of moraines. The Liard, Rancheria, Hyland, and Frances River valleys are covered by narrow alluvial plains. Fine-grained glaciolacustrine sediments are restricted to a few areas in the vicinity of Simpson Lake, and at the intersection of Green River and Hyland River. Numerous fluted and glacially stream-lined morainic deposits indicate ice movement in a northwest-southeast direction.

TERRAIN HAZARDS

The main source of information for the terrain hazards map is derived from surficial geology and soil survey maps. The Geological Survey of Canada Pacific Geoscience Centre in Victoria provided the seismic information.

Seismicity

There have been thirteen seismic events recorded within the Watson Lake map area. Nine are located on the southwest side of the Tintina Fault in the southwest corner of the map area. Three of the thirteen events are of magnitude >4.0 to <5.0 (these being the highest readings recorded in the area), and eight fall within the >2.0 to <3.0 magnitude range.

Mass Movement Processes

Unstable colluvial and alluvial fans are the most common landforms associated with mass movement hazards in this area. The movement of sediments on slopes (e.g., solifluction) is limited to north-facing slopes and higher elevations. No mapped information on avalanches or rock slides exists.

Permafrost

The Watson Lake area lies within the widespread permafrost zone (Brown, 1978). Permafrost has a more restricted distribution than in more northerly parts of the Yukon and is probably limited to slopes at higher elevation and northern exposures. In valley bottoms, permafrost is probably restricted to north-facing slopes covered by thick organic soils.

Flooding Hazards

Although no hydrological studies were available when this map was compiled, it is locally known that the lower reaches of the Rancheria, Liard, Hyland, Frances, and other small rivers, are flooded seasonally. In some years terrace surfaces up to 3 m above the stream channel are flooded. Unusually high water level can be caused by snowmelt runoff, rainstorm events and ice jams during the ice break-up period.

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

Watson Lake Map Area - NTS 105A

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

Most of the following references should be available for viewing in the DIAND library on the third floor of the Elijah Smith building in Whitehorse. The library and call number of some internal government reports are listed.

Abbott, J.G., 1977. Structure and stratigraphy of the Mt. Hundere area, southeastern Yukon. Unpublished M.Sc. thesis, Queen's University.

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

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*Klassen, R.W., and Morison, S.R., 1978. Surficial geology, Southern Yukon Territory - British Columbia. Geological Survey of Canada, Open File 594, (scale 1:100 000). (NTS 105A/1,2, 104P/15,16)

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*Mougeot, C.M., 1992. Soil Survey of selected Land Parcels, Watson Lake area. Community and Transportation Services, Lands Branch, Yukon Territory.

Murray, J.M., and others, 1973. Hydrologic and ecologic studies related to land use near Watson Lake, Yukon Territory. Department of Indian Affairs and Northern Development, Arctic Land Use Research Program, Ottawa, Government of Canada.

*Rostad, H.P.W., Kozak, L.M., and Acton, D.F., 1977. Soil survey and land evaluation of the Yukon Territory. Department of Indian Affairs and Northern Development, Northern Environmental and Renewable Resources Branch, Land Management Division, Whitehorse, Yukon.

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Subsoil texture, Watson Lake area, Sheet 9, Yukon Territory. Soil and Soil Suitability Information Series, Agriculture Canada, Yukon, Indian and Northern Affairs, Canada, (scale 1:125 000).

Suitability for road construction, Watson Lake area, Sheet 9, Yukon Territory. Soil and Soil Suitability Information Series, Agriculture Canada, Yukon, Indian and Northern Affairs, Canada, (scale 1:125 000).

Soil drainage and permafrost, Watson Lake area, Sheet 9, Yukon Territory. Soil and Soil Topography and genetic material, Watson Lake area, Sheet 9, Yukon Territory. Soil and Soil Suitability Information Series, Agriculture Canada, Yukon, Indian and Northern Affairs, Canada, (scale 1:125 000).

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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	Solifluced.	low to intermediate
Z	Grouped, cryoturbated, soliflucted, 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
T	Rapid mass movements (debris torrent) with known point source. Limits of runout not implied by symbol.	high
E	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

Unit shown is late Tertiary/Pleistocene olivine basalt.

OTHER FEATURES

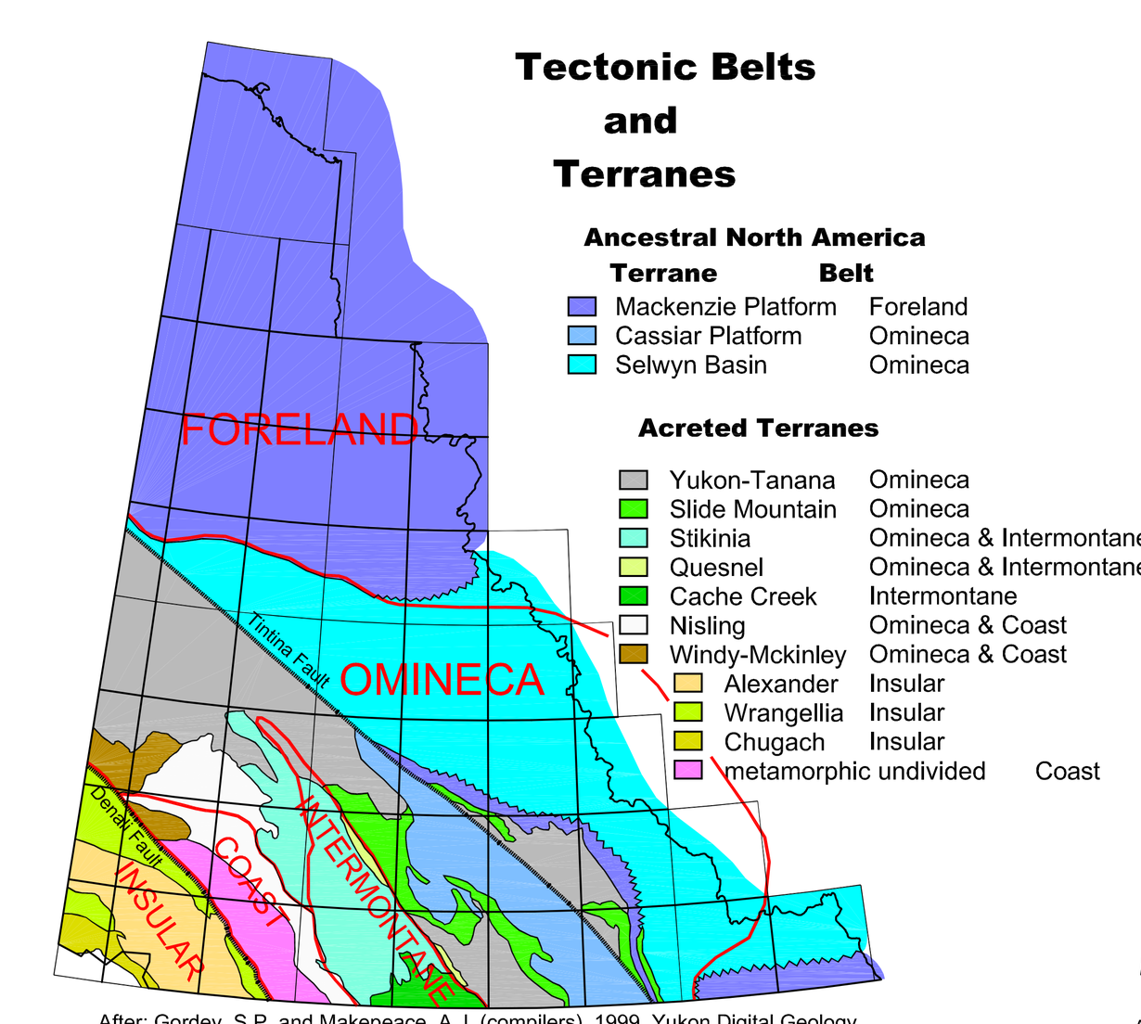
Roads

Streams

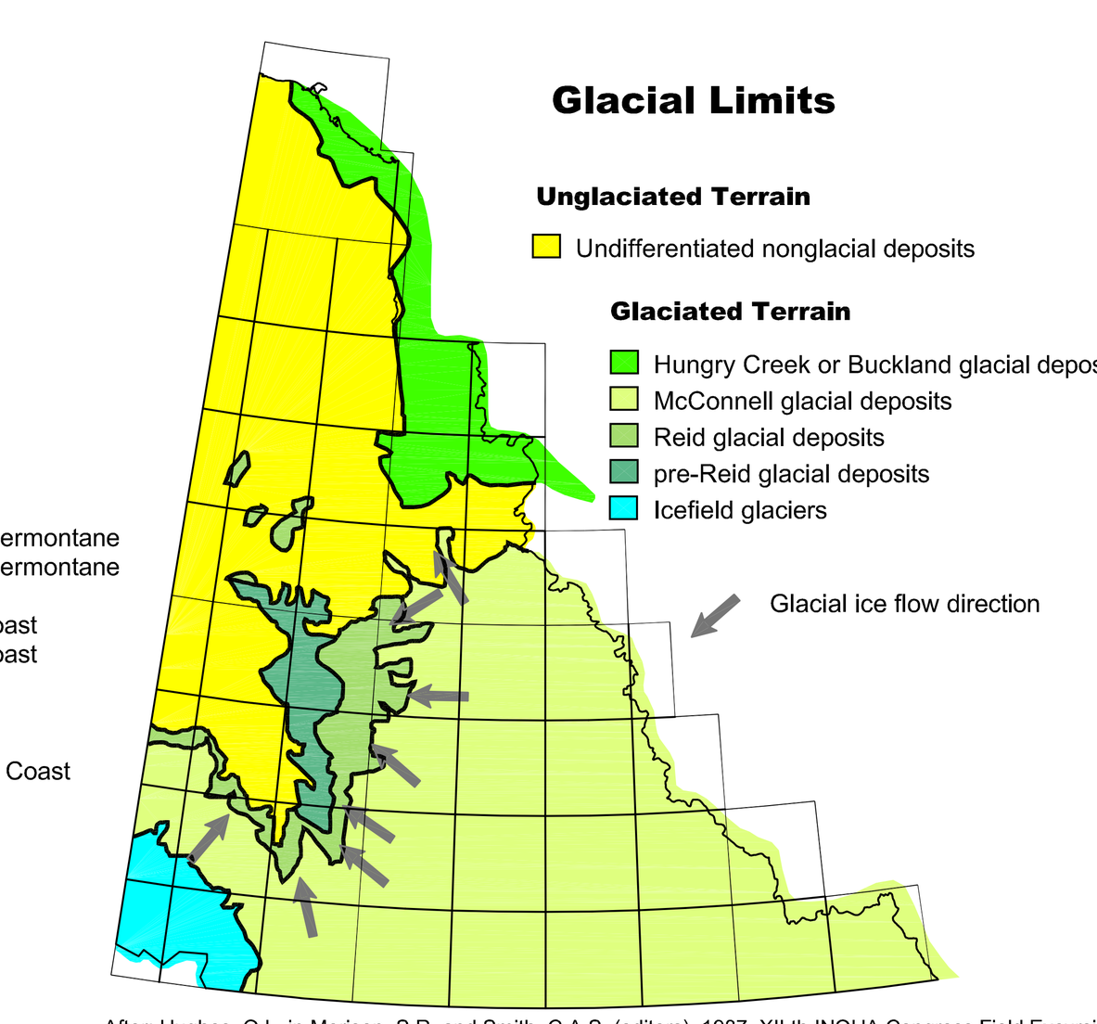
Lakes

Marsh

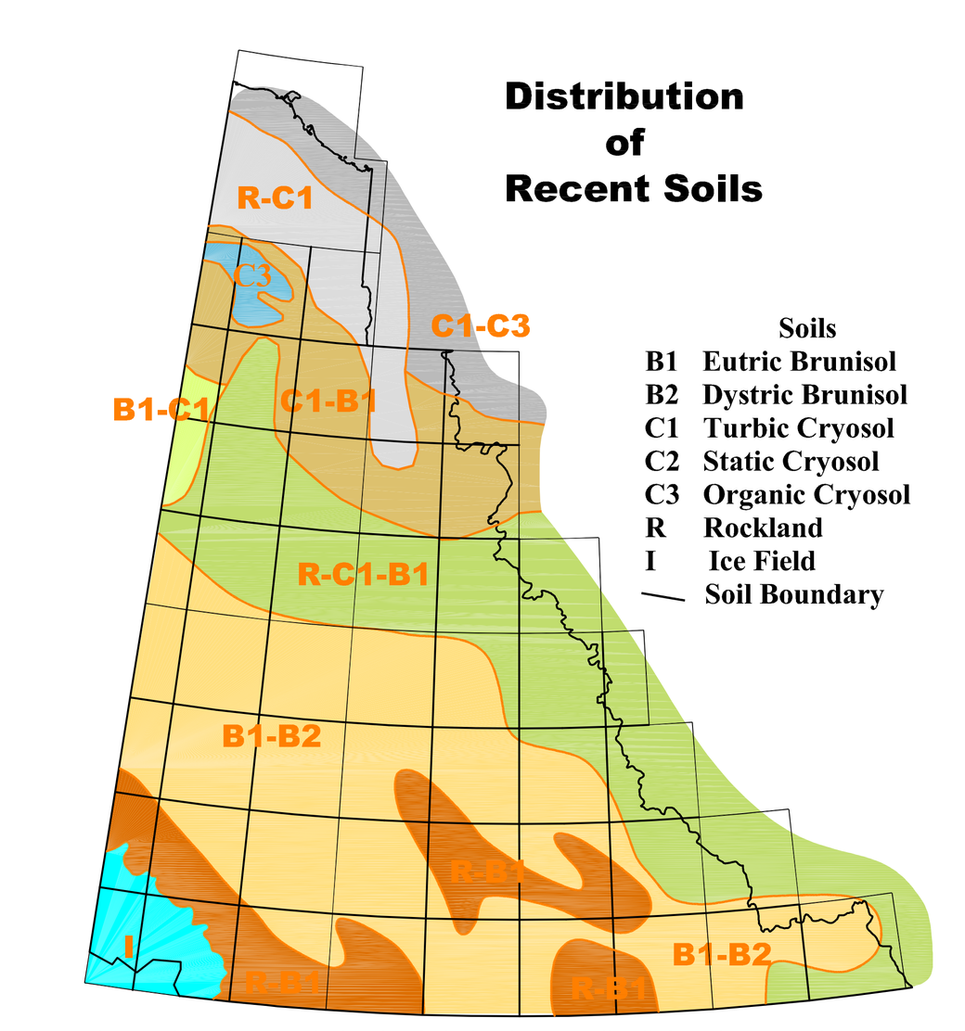
NOTE: Where areas have more than one identified process or hazard, the colour of the encompassing polygon is assigned based on a hierarchical scheme relating to the severity of the hazard. The relative order of severity is: Terrain Hazards (Mass Movement Processes then Fluvial Processes then Arctic,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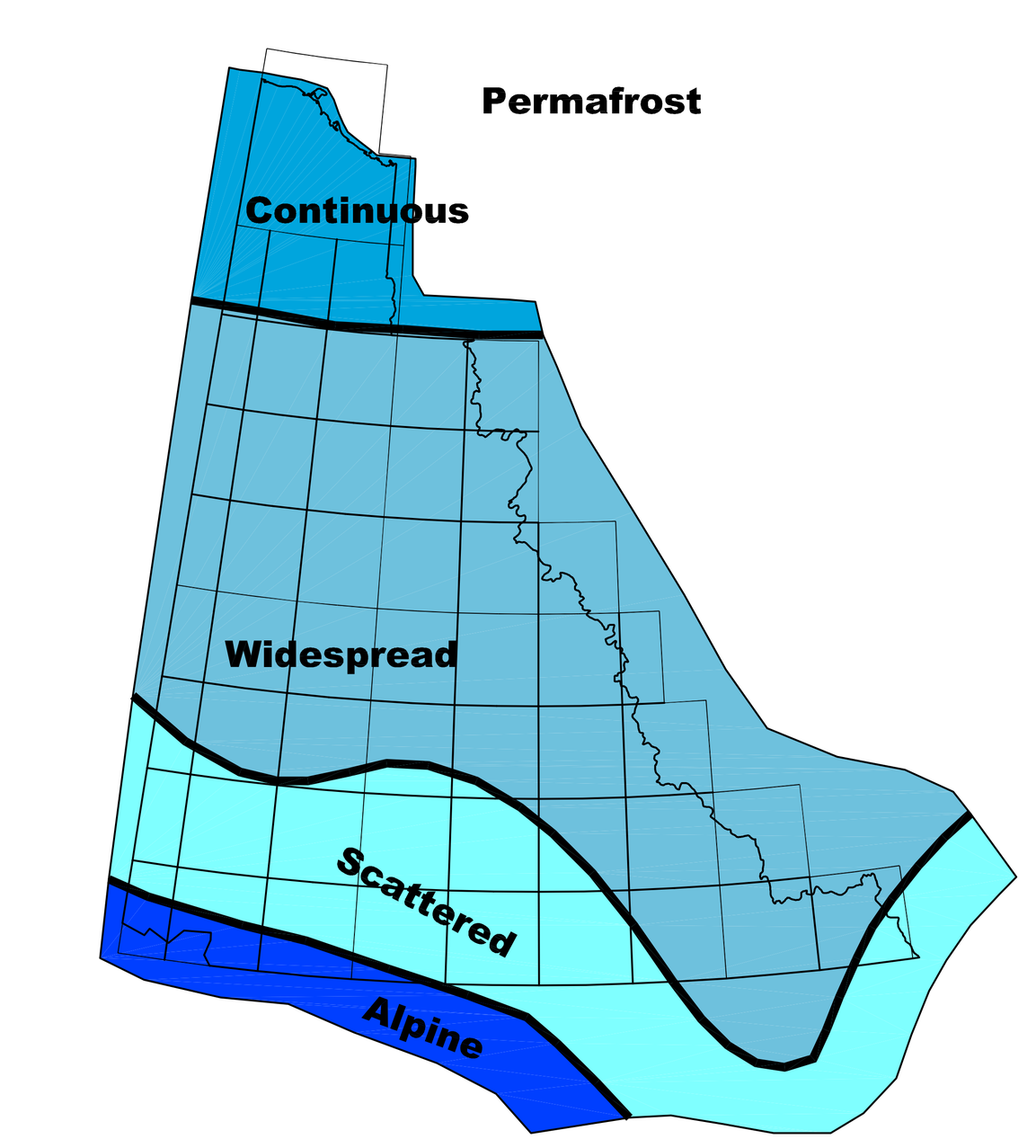

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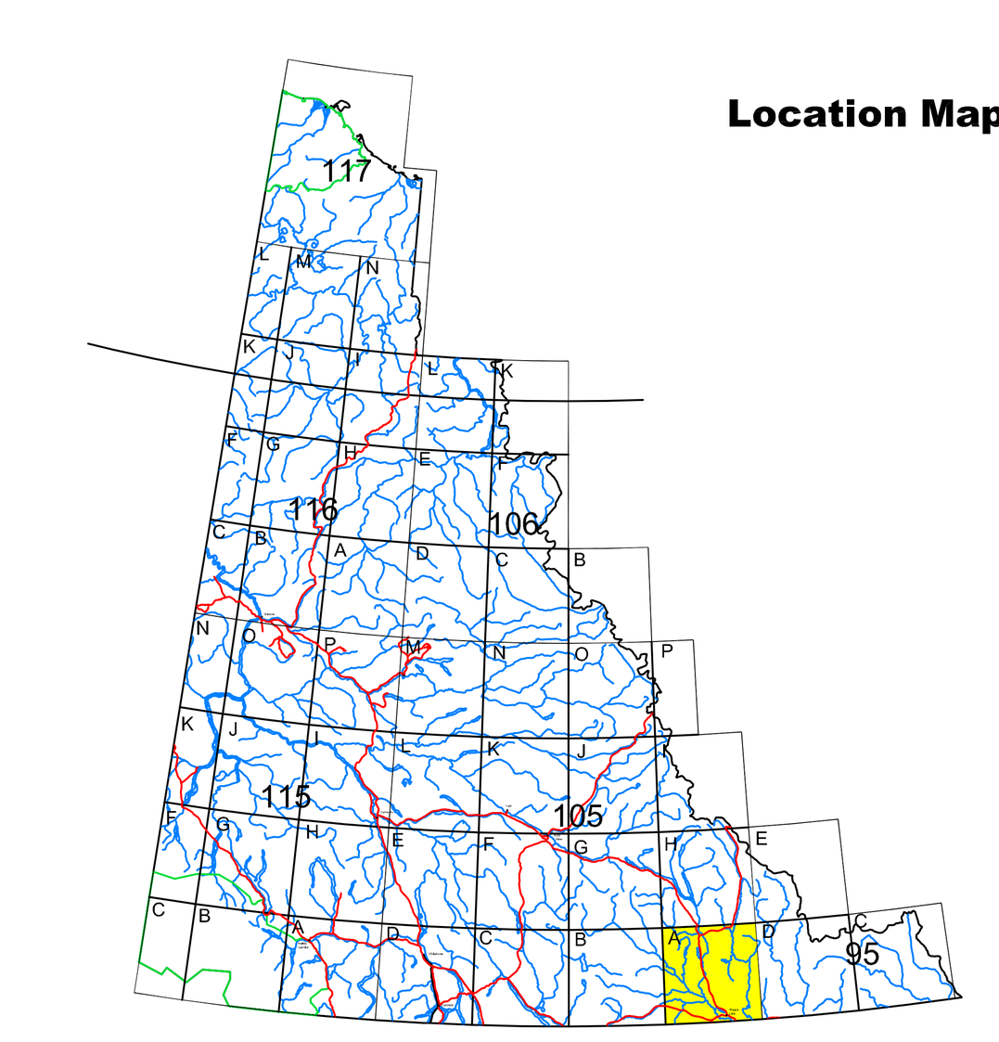
Location Map

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

Yukon GEOPROCESS File

Geological Processes and Terrain Hazards of Watson Lake 105A

by

Doherty, R.A., Mougeot, C.M. and vanRanden, J.A.

Copies of this map
may be obtained from Geoscience and Information Sales
c/o Whitehorse Mining Recorder, Indian and Northern Affairs Canada,
Room 102, 300 Main Street, Whitehorse, Yukon Y1A 2B5
(867) 667-3266; FAX; (867) 667-3267

Recommended citation: Doherty, R.A., Mougeot, C.M. and vanRanden, J.A., 1994.
Yukon GEOPROCESS File (2002), Geological Processes and Terrain Hazards of Watson Lake, 105A
Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada, 1:250 000 scale.