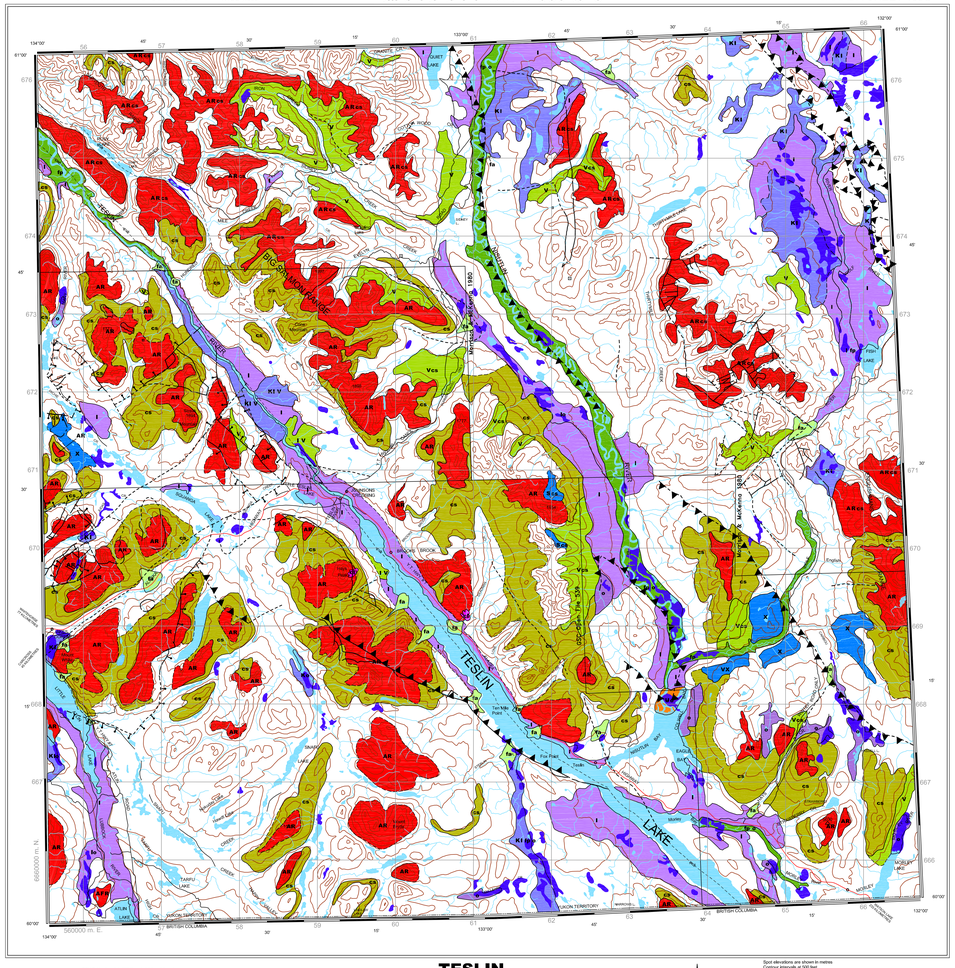
NATIONAL TOPOGRAPHIC SERIES NTDB (1995) D.I.A.N.D. N.A.P. LAND RESOURCES CANADA SHEET 105C



GEOPROCESS FILE - SUMMARY REPORT

TESLIN MAP AREA - NTS 105C

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 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 the 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 N.T.S. map area is described according to morphological 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.

Four felsic intrusive suites ranging in age from 188 to 80 million years form numerous plutons that cut the varied terranes. The most voluminous is the approximately 110 million year old suite of quartz monzonite, quartz monzodiorite and biotite granite plutons of the Cassiar Suite.

Mineral Occurrences and Deposits

There are 60 known mineral prospects listed in Yukon MINFILE for the Teslin map area, of which 22 host mineralization. Despite the small number of occurrences, there is a large diversity of types of mineralization. Most occurrences are vein-type, mainly lead-silver, copper plus or minus gold-silver, and gold silver. Tin and tungsten skarns are associated with the 110 million year old granitic plutons that intrude carbonates in the northeastern part of the map area. A few asbestos and chromium occurrences associated with ultramafic rocks of Cache Creek Terrane are documented. A single stratabound barite-lead-zinc-silver occurrence has been discovered in Cassiar Terrane rocks. The largest mineral deposit is the Red Mountain porphyry molybdenum deposit (187 million tonnes of 0.167% molybdenum) which is centred around a small, 100 million year old pluton that intrudes Kootenay Terrane metamorphic rocks. Production has been reported from only one property - a rhodonite occurrence in Kootenay Terrane. Placer gold has been reported from Iron, Sydney and Seaforth creeks.

BEDROCK GEOLOGY

The Teslin map area is in the Intermontane and Omineca Belts which occupy the southwestern and northeastern portions of the map area, respectively. The regions are separated by two large, through-going, northwest-trending, strike-slip faults that parallel the Teslin Lake and River valleys. The two faults are known as the "Teslin Suture Zone" or "Teslin Fault".

The southwestern part of the map area hosts a complex array of volcanic and sedimentary rocks of the Cache Creek Terrane that range from 350-250 million years in age. The volcanic rocks are composed of altered basalt and andesitic greenstone with associated peridotite, serpentinized peridotite, diorite and gabbro. Cache Creek Terrane sedimentary rocks are composed of well-bedded grey to green ribbon chert, shale, siltstone and greywacke. All Cache Creek Terrane rock successions are folded and complexly faulted.

The northwestern-most part of the map area, as well as the region immediately east of the Teslin Lake and River valley is underlain by the 220-160 million year old rocks of Stikine Terrane. Stikine Terrane is dominated by folded Laberge Group greywacke, shale and siltstone with minor conglomerate that overlie Lewes River Group limestone and greywacke. These two sedimentary packages collectively comprise the fill of the Whitehorse Trough. Quesnel Terrane occupies a narrow belt of rocks immediately east of Teslin Lake. They are similar to Stikine Terrane in that they are the same age and dominated by greywacke, siltstone and shale, but they also contain augite porphyry, augite tuff, diorite, gabbro, dunite and pyroxenite.

Northeast of Stikine and Quesnel Terrane are rocks of the Kootenay Terrane (Nisutlin subterrane) that are in thrust fault contact with Cassiar Terrane (North American margin) along the Nisutlin River valley. Kootenay Terrane is composed of very old (300 million years to greater than one billion years old) metamorphosed sedimentary and igneous rock packages that include schist, greenstone, marble, metagabbro, metadiorite, amphibolite, hornblendite, gabbro, graphitic phyllite and quartzite (in other areas of the Yukon these rocks are known as the Nasina and Nisling assemblages of the Yukon-Tanana Terrane). Cassiar Terrane is composed of variably metamorphosed, 345-325 million year old volcanic-rich clastic rocks, limestone, phyllite, quartzite and siltstone that overlie a sedimentary package of shale, chert, sandstone, chert pebble conglomerate and siliceous argillite. The sedimentary package overlies the pre-450 million year old Ingenika Group sandstone, grit, siltstone, limestone, dolostone, schist, quartzite and gneiss. Cassiar Terrane rocks are structurally overlain by a northwest-trending strip of sedimentary and volcanic rocks of the Slide Mountain Terrane which includes peridotite, pyroxenite, serpentinite, conglomerate, greywacke, limestone and chert.

SURFICIAL GEOLOGY

The main sources of information for the Teslin map sheet are a series of four surface geology and soil maps at the 1:100 000 scale (Morison and McKenna, 1990) and a surface geology map at the 1:250 000 scale (Morison and Klassen, in press).

The surface deposits of the Teslin map sheet 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 map sheet was covered by the Cassiar lobe which flowed westward and northwestward from the Cassiar Mountains (Jackson, 1994).

The distribution of Quaternary deposits in this area follows a general pattern. High elevation slopes are covered with colluvial or morainal veneer over bedrock. In most cases, at elevations of 1200 metres and above, the bedrock is weathered, frost shattered or covered by colluvium.

Moraine deposits cover most mid-elevation slopes, the base of which can consist of mixed moraine blankets and colluvial fans or aprons. Large portions of the map surface are covered by morainal deposits or till. 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 adjoining map sheets (Jackson, 1994) indicates a wide range of content: sand (20 to 70%), silt (20 to 80%) and commonly lower clay (5 to 30%). The low clay content is reflected by the low plasticity and high permeability of the matrix. Morainal deposits can provide a stable base, if there is no permafrost present. Isolated lenses of low-rich permafrost may occur locally on north-facing slopes and at high elevations, where thick organic deposits are present over the Quaternary sediments. Many of the till covered slopes are channeled or gullied.

In some valleys, benches of glaciofluvial sand and gravel flank the low elevation slopes. Glaciofluvial sand and gravel of variable thickness and composition are found in Lubbock River and Michie Creek valleys, Teslin River and Squanga Creek valleys, and in the northeast corner of the map area in the Red River valley. These deposits are mostly free of permafrost, commonly have stable surfaces and may contain undesirable lithologies (weak) for their potential use as aggregate.

During deglaciation, large volumes of meltwater were dammed in some valleys and formed large glacial lakes. Beachlines, lake bottom sediments, and modern lakes are now found in many of these valleys. Teslin Lake, Little Atlin and Atlin Lakes, as well as the Nisutlin River valley and the Red River valley north of Fish Lake are bordered by glaciolacustrine silt and clay deposits which can be as thick as 15 m. They commonly contain massive ice bodies and are prone to retrogressive thaw slide and thermokarst degradation when disturbed either by river erosion, forest fires, or other changes in surface conditions.

The White River tephra, deposited approximately 1,200 years ago, is visible in the upper horizons of soil profiles on most surfaces, and can sometimes be used as an indicator of active mass movement or erosion.

TERRAIN HAZARDS

There are no terrain hazard maps available for this area. Information on terrain hazards is derived from surface geology and soil maps.

Slope failures in steep bedrock represent the highest risk hazard in the area. Although not documented in any of the publications available and not present on the terrain hazard map, the potential for rock slides and avalanches should be kept in mind when an area is investigated.

Seismicity

There are five recorded seismic events within the map area. All of the recorded events are 2.0 to 2.999 or less in magnitude.

Mass Movement Processes

Snow and rock avalanches involving potentially large volumes of boulders and debris could occur on steep bedrock slopes. Development close to steep escarpments, ridges, cirques and arrêtes prone to these hazards should be discouraged. Colluvium- covered slopes are usually unstable.

Permafrost

The Teslin map sheet lies within the Discontinuous Permafrost Zone (Brown, 1967), ice content is expected to be nil to low in glaciofluvial and fluvial coarse-grained deposits in most landforms, such as terraces, fans, eskers, karnes, as well as in recent slides. Ice content in morainal and colluvial deposits is expected to be low to moderate. Morainal and colluvial deposits located at high elevations covered by thick organic deposits are the most likely to contain significant ice content. Permafrost is also detected by the presence of thick organic mats in poorly drained sites, solifluction lobes and stripes and sorted stone polygons.

High ice content is possible in fine-grained fluvial terraces located above stream level, in silty to clayey glaciolacustrine sediments. Thermokarst collapse and thaw slides are possible hazards in fine-grained glaciolacustrine deposits around Atlin, Little Atlin, Teslin Lakes area, east of Quiet Lake and in the Red River valley north of Fish Lake.

Flooding and Other Risks

Floods related to ice-jams, snow melt and summer rainstorms are a possible hazard in the lower reaches of most streams in the area. The steep portions of alluvial fans are exposed to the flooding risk and to the additional risk of mud flows and debris flows associated with rapid discharge increase.

References

Teslin Map Area - NTS 105C

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.

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).

LEGEND

LEGEND TERRAIN HAZARDS

MAP SYMBOL	TERRAIN HAZARDS	ASSOCIATED RISK LEVELS, COMMENTS
	Mass Movement Processes	
A	Snow Avalanches.	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	Soliflucted.	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
	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 slopes, 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.
icw	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.
mrl	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)

Aiphoto Lineament

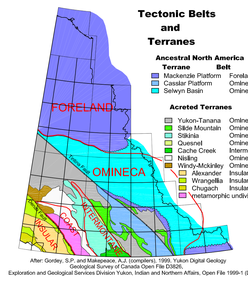
LEGEND QUATERNARY VOLCANISM

No known recent volcanism in map area 105C

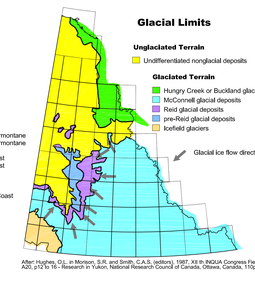
OTHER FEATURES

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)



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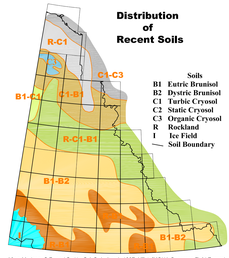
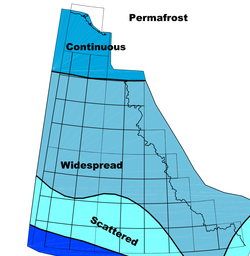
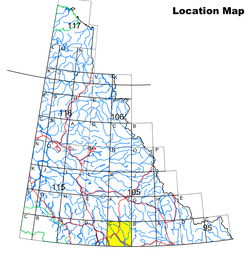


After: Morison, S.R. and Smith, C.A.S. (editors), 1997. XII th INQUA Congress Field Excursions A2Da and A2Db - Research in Yukon, National Research Council of Canada, Ottawa, Canada, 110p



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

Location Map



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

Yukon GEOPROCESS File

Geological Processes and Terrain Hazards of Teslin 105C

by

Mougeot, C.M. and Walton, L.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

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