

# GEOPROCESS FILE SUMMARY REPORT

## WATSON LAKE MAP AREA N.T.S. 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 Introduction and User's 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's 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 and summaries followed by summaries of the bedrock geology, surficial geology and terrain hazards for this N.T.S. 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 N.T.S. 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 contained in several fault-bounded packages that belong to the Nisutlin, Slide Mountain and Pelly Gneiss assemblages that compose 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 bodies of 100 million year old biotite-hornblende granodiorite and quartz diorite of the Selwyn Suite form large plutons 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 and 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 to 1990 is 26 ounces (740 gms).

### **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 streamlined 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 Center in Victoria provided the seismic information.

### ***Seismicity***

There are thirteen recorded seismic events 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 landform 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 metres 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.

## References

### Watson Lake Map Area N.T.S. 105A

**Note:** To be thorough, check the references for adjacent N.T.S. map sheets and the General Reference List (See Introduction and User's 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.**

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- 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.  
**The mylars for these maps are stored at the Exploration and Geological Services drafting department. Blue line copies are located in the G.P.I. files.**
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