GEOPROCESS FILE
SUMMARY REPORT

SHELDON LAKE MAP AREA
N.T.S. 105J

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 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 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 (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 Introduction and User's 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 areas.

BEDROCK GEOLOGY

The Sheldon Lake map area is entirely within the Omineca Belt. The South MacMillan River drainage dominates the north part of the map area. Ross River flows from northeast to southwest.

Most of the map area is underlain by 530-390 million year old Road River Group black slate, shale, argillite and phyllite. The southwest part has been intruded by mid-Cretaceous South Fork volcanics consisting of biotite-quartz-hornblende-feldspar crystal tuff. Intrusions of the Selwyn Plutonic Suite occur throughout the map area. Black shales and chert-pebble conglomerate of the Devonian-Mississippian Earn Group occur mainly in the northern part of the map area.

Tertiary quartz-sanidine porphyries, ash-flow tuffs and flows, and basalt occur in the southeast part of the map area.

Mineral Deposits and Occurrences

Yukon Minfile lists 42 mineral prospects, of which 31 host known mineralization. The majority of mineralized showings are skarn or vein deposits, most of which are lead-zinc-silver +/- copper, or, less commonly, tungsten +/- molybdenum and copper. There are three known copper-silver-molybdenum porphyry deposits. There are four sedimentary exhalative deposits, and one coal deposit.

SURFICIAL GEOLOGY

The main sources of information for the Sheldon Lake area are a terrain inventory (Jackson, 1987), surficial geology maps (Jackson, 1993) and a report by Jackson (1994) which discusses the terrain hazards and surficial geology of NTS map sheets 105K, J, F and G.

The surface deposits of the Quiet Lake map sheet are associated with the most recent Cordilleran ice sheet (McConnell), believed to have covered south and central Yukon between 26,500 and 10,000 years ago.

The Pelly Mountains occupy most of the central part of the map sheet. During the last Cordilleran ice advance, they were covered by ice caps, which shed ice both south to the Selwyn Lobe of the Cordilleran Ice Sheet and north to the Cassiar Lobe (Hughes *et al.* 1969). Because of the rugged topography of the Pelly Mountains and great elevations involved, the ice bodies separated in a complex series of tongues or lobe extensions through the narrow valleys. Jackson (1994) warns that this complex ice geometry in conjunction with the variable bedrock geology of the Pelly Mountains renders drift prospecting extremely difficult in this area. The highest peaks of the Pelly Mountains were exposed above the ice caps (nunataks). Now, bedrock is exposed for most of the surface of the Pelly Mountains. Sorted polygons, solifluction lobes, block fields and rock glaciers are common in that part of the map. Lateral moraine deposits from the Cassiar Lobe form benches along major valleys such as the Gray, Caribou, Pony and Scurvy Creeks and Salmon River. At lower elevations, these same valley floors are covered with glaciofluvial sand and gravel. Rock glaciers are common at elevations greater than 5000 m, mostly on north and northeast facing slopes. A few small glaciers are still active in the Pelly Mountains.

Northeast of Pelly Mountains, moraine and glaciofluvial deposits from the Selwyn Lobe cover most of the Pelly River valley. The surface of the Selwyn lobe ice was estimated at 1645 m (Duk-Rodkin, *et al.,* 1986). Numerous drumlins or streamlined landforms are indicative of northwestward flowing ice. The creek and valley floors are commonly occupied by glaciofluvial sand and gravel. 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 this area indicates a wide range of sand content (20 to 70%), silt (20 to 80%) and an usually low clay content (5 to 30%). This low clay content is reflected by the low plasticity of the matrix. Morainal deposits usually can provide a stable base, if there is no permafrost present.

In the southern part of the map sheet, around Quiet Lake, the areas located at lower elevations are covered by moraines and glaciofluvial sand and gravel deposited during the retreat of the Cassiar Lobe of the Cordilleran Ice. Till in the Pelly Mountains generally shows a high carbonate content due to the abundance of carbonate bedrock. Glaciolacustrine deposits in this area are restricted to few small basins, the largest is located in the Rose River valley.

In general, deglaciation in this area was marked by widespread ice stagnation alternating with periods of ice thickening (Jackson, 1987). The higher elevations, such as mountains peaks were the first to emerge from the ice and as deglaciation proceeded, the ice bodies were controlled by valley configurations. Sequences of glaciofluvial benches of sand and gravel, and glaciolacustrine deposits are witness to this gradual and fluctuating ice retreat. The last area to be free of ice was the Tintina Trench. According to Jackson (1987), the lowest major lake was ponded along the Tintina Trench in the Pelly River by isostatic downwarping.

The Pelly River valley is also benched and covered by glaciofluvial sand and gravel. The glaciofluvial sand and gravel has variable thickness and composition, usually stable surfaces and may contain undesirable lithologies (weak) for their potential use as aggregate. The lowermost terraces of the Pelly River are composed of mixed alluvial deposits and can be prone to flooding.

The White River tephra, deposited approximately 1200 years ago, is visible in the soil profiles of alluvial (modern) deposits of the Pelly River.

TERRAIN HAZARDS

Snow avalanches and slope failures resulting in rock avalanches on steep bedrock slopes represent the highest risk hazard in the area.

Seismicity

Three seismic events were recorded in this area with a magnitude of 4.999 or less.

Mass Movement Processes

Landslides have occurred in a variety of lithologies in the area (Jackson, 1994). Large rock avalanches and rock falls are still taking place, as indicated by the large number and volume of talus cones and aprons throughout the mountainous portions of the map. Snow avalanches are common and can entrain large volumes of boulders and debris. Numerous landslides have been mapped in the Pelly Mountains (Jackson, 1994, Jackson and Isobe, 1990). Five large rock avalanches in non-carbonate rocks involved volumes of material greater than 1 to 5 x 10^6 m^3 and are reported to have traveled great distances (Jackson and Isobe, 1990). All these failures took place in very steep arrêtes or cirque walls and the addition of moisture via snow and rain plays a key role in triggering of such large and rapid rock slides. Development of any kind in close proximity to steep escarpments, ridges, cirques and arrêtes prone to these hazards should be discouraged.

Failures in unconsolidated deposits are also a concern, due to the presence of permafrost and associated processes such as thermokarst and solifluction. These failures can be rapid and involve large volumes of material or they can occur slowly, on small surfaces. Erosion of friable sediments such as glaciolacustrine sediments by streams may cause bank erosion.

Permafrost

Rock glaciers are common throughout the Pelly Mountains. They can be as thick as 10 m, and show surface movements of up to 51 m. Snout advances of 2.5 m over 17 years have been recorded in Nahanni National Park, west of this map sheet (Jackson and McDonald, 1980).

Permafrost is widespread in the area and is often present in colluvial and morainal blankets at high elevation. Its presence is commonly indicated by solifluction lobes, stripes and sorted stone polygons. Thermokarst collapse and thaw slides are possible hazards in fine-grained glaciolacustrine and fluvial sediments.

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. The steep portion of alluvial fans, in addition to the flooding risk, are also exposed to the additional possibility of mud and debris flows associated with rapid discharge increase.

References

Sheldon Lake Map Area
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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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