GEOPROCESS FILE
SUMMARY REPORT

LARSEN CREEK MAP AREA
N.T.S. 116A

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 Larsen Creek map area is mainly within the Foreland Belt except for the southwestern corner which is in the Omineca Belt. The entire map area is dominated by three packages of folded and faulted sedimentary rocks that are separated by the east-trending Robert Service and Dawson thrust faults. The two southern rock packages are composed of Selwyn Basin lithologies while the northern package includes Mackenzie Platform and older rocks.

The southernmost package is composed of 800-530 million years and older Hyland Group gritty quartzite, sandstone, quartz-pebble conglomerate, maroon and green shales, slate, quartz mica schist, phyllite and limestone that is overlain by black chert, argillite, quartzite and chert pebble conglomerate of the 530-390 million year old Road River Group. North of the Robert Service Fault and south of the Dawson Thrust, a similar assemblage of rocks exists which also contains the quartzite, slate and phyllite of the 360-320 million year old Keno Hill Quartzite, and the argillite, slate and phyllite of the 400-145 million year old Lower Schist. The northern half of the map area (north of the Dawson Thrust) is composed of a thick pre-570 million year old package of Wernecke Supergroup and Pinguicula Group argillite, slate and phyllite, quartzite, dolomite, conglomerate, limestone and shale overlain by Road River Group dolomite, limestone, shale and chert, 390-325 million years Earn Group shale, argillite, slate, chert and chert pebble conglomerate, and 325-245 million year old limestone, shale, chert, chert pebble conglomerate, shale, limestone and sandstone. Gabbro and diorite sills and dykes are scattered throughout the map area, but prevail in the brittle rocks south of the Dawson Thrust - the Hyland Group and Keno Hill Quartzite. Numerous small intrusions of 100 million year old granite are distributed in the southern part of the map area.

Mineral deposits and occurrences

The Larsen Creek map area hosts 33 mineral occurrences of which 25 contain mineralization. Most mineral showings are copper veins with variable amounts of lead and silver, and gold-silver veins. The largest mineral deposit in the map area is the Hart River volcanogenic massive sulphide deposit with 1 million tonnes of 1.45% Cu, 4.52% combined lead and zinc, 50 grams per tonne silver and 1.4 grams per tonne gold. The area also hosts a few barite-rich base metal sedimentary exhalative occurrences.

SURFICIAL GEOLOGY

There is very little surficial geology information available on this map area. A general surface geology map at 1:253,440 scale (Vernon and Hughes, 1965) derived from air photograph interpretation outlines major surface geology units and the report provides a basic framework for the glacial history of the area. A small portion of the western half of the map was included in a surface geology survey at 1:100,000 scale (Thomas and Rampton, 1982a and 1982b).

Since the formation and uplift of the Ogilvie Mountains, long term subaerial erosion has contributed to the formation of a pediment along major rivers and streams. Originally a gently sloping surface, it has been dissected by streams, modified by glacial activity, and is commonly overlain by glacial drift. Only segments of this pediment remain as colluvium covered, low relief slopes.

At least three major ice advances are inferred, based on geomorphic evidence only. Glaciers covering low valleys in the Wernecke Mountains were part of a large transection glacier network or system which flowed generally northwestwards. The oldest glaciation is not well defined in this area. The intermediate glaciers occupied the Hart River valley up to an approximate longitude of 136°20* and some of the adjacent valleys. The North McQuesten River valley was also glaciated by the main ice system as far as longitude 136° 05*, just west of the eastern map boundary. Cirques and tributary valleys also supported glaciers which in a few cases merged with the larger ice masses. More recent glaciation shows a more restricted distribution and in most cases tributary glaciers did not join the main valley glaciers and occupied fewer cirques. Based on the scarce geomorphic evidence of ice fluctuation, it is assumed that this recent ice retreated rapidly and continuously towards the southeast. The extent of the last glaciation is limited to the eastern most section of the Hart River, very close to the map boundary.

Glacial deposits are mapped at elevations ranging from 762 m (2500 ft) to 1229 m (4000 ft) along valley floors and walls. They consist of sandy till with gravelly inclusions derived from the sedimentary bedrock. Till is expected to be as thick as 30 m in valley bottoms and forms a thin discontinuous veneer along valley sides, below the glacial limits. Glaciolacustrine sediments are found in the McQuesten Lake area, at elevations below 762 m (2,500 ft). The silt and clay deposits show severe thermokarst ponding.

The southern Ogilvie Ranges were affected by valley glaciers originating and radiating from cirques and flowing outwards along the modern drainage valleys. These glaciers were least extensive during the last glaciation.

TERRAIN HAZARDS

Seismicity

There are five recorded seismic events within the Larsen Creek map area. All of the recorded events are in the western part of the map area and are 4.0 to 4.999 in magnitude.

Mass Movement Processes

There is little published information on mass movement hazards in this area. Steep cirque walls and arretes shown on the surficial geology map (Vernon and Hughes, 1966) are likely to represent avalanche and rock fall hazards. In addition, the very long exposure of surfaces to weathering, frost shattering and creep has resulted in well developed colluvial blankets on most surfaces at mid to high elevations, and thick alluvial fans and aprons in valley bottoms. These deposits can also be subject to slope and permafrost related processes. The surfaces are usually sensitive to disturbance, prone to slow to moderate long term mass movement such as retrogressive thaw slides, as well as more rapid detachment slides. A few slides were mapped (Thomas and Rampton, 1982a) in the Ogilvie Mountains, between latitude 64°15* and 64°25 N. Another large slide was mapped on the west side of Lake Creek (Vernon and Hughes, 1965).

Permafrost

This area lies within the extensive discontinuous permafrost zone (Heginbottom and Radburn, 1992) with low to moderate ice content in morainal and colluvial deposits above valley floors, low to moderate ice contents in alluvial and fluvial deposits, and moderate to high ice content in fine grained alluvial fans and terraces above stream level. Permafrost is assumed to be absent or thinner under south facing, well drained slopes. Vernon and Hughes (1966) quote observations from McTaggart (1960) of permafrost thickness in excess of 122 m in this map area, and assume that average thickness of permafrost can be as great as 100 m. They noted the presence of solifluction lobes, patterned ground, palsa bogs and pingos. Such features are likely widespread in this map area as well.

Active rock glaciers show unvegetated steep fronts and are usually located at elevations above 1820 m (6000 ft). Inactive glaciers are mostly vegetated and have rounder front profiles; they usually head at elevations as low as 1066 m. Rock glaciers occupy northeast to northwest facing cirques, and occasionally more southerly aspects, particularly in the Wernecke Mountains.

Debris covered glaciers can be as thick as 60 m and head in cirques with steep north facing headwalls.

Flooding and Other Risks

The lowermost terraces of the major rivers are subject to flooding. Some sections of the braided channels of the Hart River are probably unstable.

References

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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.

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