GEOPROCESS FILE
SUMMARY REPORT

GLENLYON MAP AREA
N.T.S. 105L

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 Glenlyon map area is in the Omineca Belt except for the extreme southwesterly corner which is in the Intermontane Belt. These two belts are separated by the northerly extension of the Seminof Fault identified by Tempelman-Kluit (1984) in the Laberge map area. The largest geological feature in the map area is the Tintina Trench and Fault which cuts across the northeastern part of the map area and provides the basin for much of the Pelly River.

Rocks northeast of the Tintina Fault are mostly part of the Selwyn Basin and are composed of 400-320 million year old chert, argillite, quartzite, limestone and chert conglomerate including the Crystal Peak Formation chert conglomerate; Kalzas Formation limestone; and Earn Group chert, argillite, quartzite and minor limestone. The sedimentary package is structurally overlain by 570-440 million year old basaltic and andesitic flows, breccia, diorite, tuff, slate and phyllite.

Southwest of the Tintina Fault are three major northwest-trending belts containing distinct rock packages. Adjacent to the Tintina Fault is a thick sequence of Cassiar Terrane quartzite, quartz-mica schist, amphibolite, marble, limestone, phyllite and slate that range in age from pre-600 to 360 million years old and may include the Harvey and Askin Groups. This package has been intruded by several large 100 million year old granitic batholiths.

The second belt, further to the southwest, and separated from the previous belt of rocks by the D'Abbadie Fault, consists of 400-320 million year old metamorphosed quartz-rich sedimentary rocks and volcanic strata of the Nisutlin Assemblage (Slide Mountain Terrane). These rocks include locally garnetiferous quartz-mica schist, amphibolite, quartzite, marble, argillite, phyllite, limestone, greenstone, greenschist, diorite and serpentinite (Yukon-Tanana Terrane) intruded by 185 million year old Klotassin Suite granodiorite batholiths.

The third belt is the most southwesterly package. It is separated from Slide Mountain Terrane rocks by the Seminof Fault, and is composed of 220 million year old andesitic and basaltic flows, breccia, tuff and minor rhyolite of Quesnellia; 210 million year old Lewes River Group limestone, basalt, andesite, conglomerate and greywacke, and 200-160 million year old Laberge Group arkose, conglomerate, sandstone, siltstone and argillite. Laberge and Lewes River Group sedimentary rocks collectively compose the Whitehorse Trough of Stikinia.

Some small exposures of the South Fork (90 million years old) and Carmacks Group (70 million year old) volcanic rocks occur in the map area.

Mineral Deposits and Occurrences

The Glenlyon area hosts 61 mineral occurrences, of which approximately half contain mineralization. The most significant are sedimentary-exhalative barite-zinc-lead occurrences which mainly occur in Earn Group rocks. The largest of these, the Clear Lake deposit, hosts 5.5 million tonnes of 11.34% zinc, 2.15% lead and 41 grams per tonne silver. Other deposit types include lead-zinc skarns and copper-lead-silver-gold veins. There are also a few small coal occurrences.

SURFICIAL GEOLOGY

Surficial geology information available for this map sheet consists of 4 maps at 1:100,000 scale (Ward and Jackson 1993a, b, c and d).

Most of the map area has been glaciated by the Cordilleran ice sheet during the McConnell glaciation (25,000 to 10,000 years ago). Earlier glaciations also reached this area. Moraines associated

with Reid and pre-Reid ice have been mapped at high elevations on isolated summits and at the very edge of the northwest corner of the map, beyond the extent of the McConnell glacial limits.

During the McConnell glaciation, the southeast corner of the Glenlyon map sheet was covered by the Cassiar lobe which flowed in a general northwest direction. Reid moraines are exposed at elevations ranging from 3500 m to 4600 m. Nunataks, or rock summits unaffected by the Cordilleran Ice sheet are situated at elevations around 4900 m.

The northern and eastern portions of the map sheet were covered by the Selwyn Ice Lobe which also flowed in a general northwest direction from the Selwyn Mountains. The higher summits of the Glenlyon and Little Salmon Ranges were unglaciated and are now partially covered by colluvial or steep bedrock slopes.

In the northwest corner of the map, close to the ice terminus, glacially streamlined landforms spread out radially, indicating ice flow directions ranging from south to southwest to northwest. Terminal moraines associated with the Selwyn Lobe have been mapped in the northwesternmost corner of the map, and directly west of this map area. Lateral moraines are mapped at elevations just below 4000 m in the McMillan ranges and at elevations of 5000 m in the southern map area. Isolated patches of Reid tills are exposed above these younger moraines throughout the map area. 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 content of sand (20 to 70%), silt (20 to 80%) and lower clay content (5 to 30%). This low clay content is reflected by the low plasticity of the matrix and good percolation rates. Morainal deposits can usually provide a stable base, if there is no permafrost present.

Glaciofluvial deposits are abundant throughout the map area and occupy most of the main valley floors. Benches of gravelly sand to gravel occur in most valleys. The glaciofluvial sand and gravel have variable thickness and composition, and are usually stable surfaces, however they may contain undesirable lithologies (weak) for their potential use as aggregate.

Significantly large glaciolacustrine deposits are present in the McMillan River valley (commonly between 1700 and 1900 m) south and northeast of Drury Lake in the Tadru and Ess Lakes area, and along the Pelly River valley south of Glenlyon River. The glaciolacustrine sediments are dominantly composed of silt and very fine sand and clay. The sediments were deposited in valleys blocked by ice. 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. Slumping is common in these deposits when undercut by streams, as is the case along the McMillan River.

Modern stream deposits are often covered by thick organic blankets and in those cases permafrost is often present. The lowermost terraces of the streams are subjected to frequent erosion or deposition due to stream erosion or seasonal flooding.

TERRAIN HAZARDS

Seismicity

There are 16 recorded seismic events within the map area. All of the recorded events are 4.0 to 4.999 or less in magnitude.

Mass Movement Processes

At high elevations avalanches and rock slides are a serious risk on steep rock faces. Most areas identified as such are located in the McMillan, Little Salmon and Glenlyon ranges. Colluvial fans should be considered as unstable surfaces, with solifluction lobes and mud flows active on most colluviated slopes.

Most of the landslides mapped in this map area are associated with stream erosion of glaciolacustrine deposits along the McMillan River. A few large slides were also mapped in the Glenlyon Ranges.

Permafrost

The map area 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, kames, as well as in recent slides. Ice content in morainal and colluvial deposits is expected to be low to moderate and is commonly indicated by the presence of thick organic mats in poorly drained sites, solifluction lobes and stripes, and sorted stone polygons. Rock glaciers are very common in the Glenlyon Ranges and are associated with conditions favorable to permafrost.

High ice content is possible in fine-grained fluvial terraces located above stream level, and in silty to clayey glaciolacustrine sediments. Ice lenses or veins are also common at the toe of colluviated (inactive) slopes covered by thick mosses. Thermokarst processes may be triggered by surface disturbances such as forest fire, road construction or logging.

Flooding and Other Risks

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

References

Glenlyon Map Area
N.T.S. 105L

To be thorough, check the references for adjacent N.T.S. map sheets and the General Reference List (see Information and User's Guide).

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NTS 115I, 115H, 105E, 105L

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