GEOPROCESS FILE
SUMMARY REPORT

McQUESTEN MAP AREA
N.T.S. 115P

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 McQuesten map area is entirely within the Omineca Belt. The region has relatively low relief, and since only the southernmost portions have been glaciated, the topographic expression is subdued and dominated by low rounded hills and broad valleys. The most pronounced feature in the region is the very broad Tintina Trench which diagonally cuts the map area in half from northwest to southeast.

Bedrock in the southwest half of the map area is dominated by pre-250 million year old cataclastic sedimentary, volcanic and intusive rocks of the Nisutlin and Simpson Assemblages, including quartz-mica schist, orthogneiss, paragneiss, quartzite, phyllite and limestone. These high grade metamorphic rocks are structurally overlain by gabbro, peridotite, serpentinite and diorite of Slide Mountain Terrane. The entire package, collectively known as Yukon Tanana Terrane, is intruded by numerous large, 100 million year old plutons of granite, syenite, granodiorite and quartz monzonite, and overlain by 70 million year old andesite and trachyte of the Carmacks Group.

Bedrock northeast of the Tintina Trench is composed almost entirely of 800-530 million year old Hyland Group schist, quartzite, phyllite and limestone which is overlain in the north by varicoloured slate, quartzite, slate, phyllite, limestone. Also in the northernmost part of the map area, the package of old metamorphic rocks is overlain by 530-390 million year old Road River Group limestone, slate, phyllite and quartzite; and 390-325 million year old Earn Group quartzite, slate, sandstone and conglomerate. Numerous, generally small, 100 million year old plutons and dykes of granite, granodiorite, quartz monzonite, syenite and monzonite of the Selwyn Suite intrude the rocks in the northern part of the map area. Felsic volcanic flow rocks of similar age are exposed in the area of the northeastern map boundary.

Mineral Deposits and Occurrences

There are approximately 35 known mineral showings in the McQuesten River map area. The majority of the mineralization is in the northeastern corner where 100 million year old granitic rocks intrude the ancient meta-sedimentary rock package. The mineral deposits and occurrences consist of silver-lead-zinc veins typical of the Keno Hill region, and polymetallic veins and skarns containing tin, tungsten, gold, silver, lead, zinc, and/or antimony. Other types of mineralization include a uranium showing, a sedimentary exhalative barite occurrence and an ultramafic associated asbestos showing. The Clear Creek drainage basin continues to produce significant amount of placer gold as do several other creeks in the northern part of the map area.

SURFICIAL GEOLOGY

Recent work by Bond (Bond, 1997) in this area provides an updated glacial history of the early glaciations and a map at 1:250,000 scale of sediment distribution and types.

During late Tertiary time (2 million years ago), smooth rounded summits and valleys formed as a mature landscape with a well-developed system of streams which drained in a southerly direction. After a period of tectonic stability (e.g., inactive faults), uplift occurred (e.g., upward movement in the crust) which continued into the Quaternary time period (2 million years to present, Templeman-Kluit, 1980). Drainage systems became entrenched and with the onset of Quaternary glaciation, drainage reversals in a northerly direction occurred throughout central Yukon (Templeman-Kluit, 1980).

"During their maximum extent, pre-Reid ice sheet inundated the area leaving isolated nunataks on Klondike Plateau and the northern part of Stewart Plateau near Syenite Range. North trending intervalley channels on Stewart Plateau represent confined ice flow in Stewart and McQuesten River valleys from ice obstructions in Tintina Trench. Undifferentiated pre-Reid materials are thick in the lowlands of Klondike Plateau and in the Tintina Trench "(Bond, 1996).

Reid ice advanced from the east and southeast and occupying the major valleys within the Stewart Plateau, Tintina trench and Willow Creek Valley (Bond, 1997). Outwash terraces are present along the Stewart and McQuesten river valleys.

The McConnell ice sheet impinged into the east boundary of the study area, terminating approximately 20 km northeast of Stewart Crossing and in the Tintina Trench. McConnell deposits consist mainly of a sandy till within the ice limit and of outwash deposits immediately west of it.

Colluvium covers most mid- to high-elevation surfaces in this area. The colluvium is usually loose, friable and is composed of frost shattered or weathered rock, and locally includes till reworked by slope and permafrost processes. Colluvium tends to show imbrication of flat stones roughly sub-parallel to the slope.

Till is commonly found in greater thickness at lower elevations, and as a thinner (less than two metres) blanket at higher elevations.

Valley bottom sediments are composed of sandy and gravelly alluvium commonly capped by organic- or silt- rich blankets.

TERRAIN HAZARDS

The main source of information for the terrain hazards is derived from surficial geology and geomorphology maps of Thomas and Rampton (1982a and b) adjoining map 115P, and on Bond (1997). The Geological Survey at the Canada Pacific Geoscience Center in Victoria provided the seismic information.

Mass Movement Processes

Permafrost is present on north-facing slopes, and processes such as solifluction, soil creep, nivation and cryoturbation occur locally. Slow mass movement processes such as creep, solifluction lobes and stripes are common on colluvium-covered slopes. Fine-grained sediments in the valley bottoms may be underlain by permafrost with high ice content, which may become thermokarst if disturbed. This risk is less severe if the fine grained deposits are underlain by gravel. Avalanches and rock falls are a risk on steep slopes, and bedrock such as the Klondike schist and ultramafic rock may fail if slope conditions such as degrading permafrost or excessive moisture are present. An example of a mass movement failure is the large landslide above the town site of Dawson (NTS map area 116B/C) which is chiefly composed of friable ultramafic bedrock.
Several small landslides were mapped by Bond (1997), as seen on the map accompanying this short report.

Permafrost

This map area lies within the widespread discontinuous permafrost zone (Brown, 1968). Permafrost is very common in thick organic-rich silt deposits. Large bodies of segregated ice, ice wedges and ice layers are visible in many of the placer mine pit walls excavated in such sediments (French and Pollard, 1986; Mougeot, 1994) in map sheet 116B/C, north of this area. Locally, the solid ice bodies were as thick as 15 metres and could be as thick as 100 metres. Most fine textured sediments in poorly drained areas with peat, thick moss and/or organic soils are underlain by permafrost. The uppermost metres of bedrock are also locally frozen where composed of altered, friable schist. The active layer is at its thickest by mid- to end- August. Erosion of the surface or slopes of these sediments, either by creek, river, forest fire or human activities can result in either mudslides, detachment slides, thermokarst subsidence, and/or deterioration of the drainage for several years.

Flooding and Other Risks

High water levels have been experienced as a result of floating ice jams.

Unusually high water levels can be caused by snow melt run-off, rainstorms events, or a combination of both, as well as ice jams during the spring break-up period. The effect of snow melt and heavy rain are greater on smaller drainage basins. The main source of information for the terrain hazards is derived from surficial geology and geomorphology maps of Thomas and Rampton (1982a and b) which adjoin 115P. It is assumed that similar processes may be active in this map area. The Geological Survey of Canada Pacific Geoscience Center in Victoria provided the seismic information. There is no mapped information available.

Seismicity

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

<u>References</u>

McQuesten Map Area
N.T.S. 115P

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.

Abercrombie, S.M., 1990, Petrology, geochronometry and economic geology: The ZETA tin-silver prospect, Arsenic Ridge, west-central Yukon (115P/14 and 116A/3). Unpublished M.Sc. thesis, University of British Columbia, Vancouver, British Columbia.

Aho, A.H., 1963, Silver in the Yukon. Canadian Mining and Metallurgy Bulletin, Vol. 56, No. 611, p. 232-239.

Bond, J. D, 1996, Quaternary History of McQuesten map area, Central Yukon. ***In:*** Yukon Quaternary Geology, Vol. 1, Exploration and Geological Services Division, Indian and Northern Affairs.

Bond, J. D., 1997, Late Cenozoic History of McQuesten (115P), Yukon Territory. Unpublished M.Sc. thesis, University of Alberta, Edmonton, Alberta 161 p. with map at 1:250,000 scale.

Bostock, H.S., 1964, Geology, McQuesten, Yukon Territory. Geological Survey of Canada, Map 1143A, scale 1:253,440.

Brown, R.J.E., 1967, Permafrost in Canada. Geological Survey of Canada, Map 1246A, (scale 1:7,603,200).

Burn, C.R., 1994, Notes on ground ice and permafrost in selected placer pit walls, Klondike and Mayo districts, Yukon Territory. ***In:*** Quasi-frozen high pit wall stability analysis of placer mines, Yukon Territory: Phase 1. Vol. 1 - Summary, Vol. II - Technical Reports. Exploration and Geological Services Division, Yukon, Department of Indian and Northern Affairs Canada, Open-File 1993-6(T).

Emond, D., 1985, Geology, mineralogy and petrogenesis of the Oliver Creek breccia/vein tin occurrence, McQuesten River, Yukon. Unpublished M.Sc. thesis, Carleton University, Ottawa, Ontario, 196 p.

Emond, D.S., 1985, Geology, mineralogy and petrogenesis of tin-bearing breccias, Oliver Creek, McQuesten River Area, Yukon Territory. ***In:*** Strong, D.F. and Taylor, R.P. (editors), Granite-Related Mineral Deposits; Geology, Petrogenesis and Tectonic Setting; Extended Abstracts of Papers Presented at the CIM Conference, Halifax, Nova Scotia. p. 116-119.

Emond, D.S., 1986, Tin and tungsten veins and skarns in the McQuesten River area, central Yukon. ***In:*** Yukon Geology, Vol. 1, Exploration and Geological Services Division, Whitehorse, Indian and Northern Affairs Canada, p. 113-118.

Emond, D.S., 1992, Petrology and geochemistry of tin and tungsten mineralized plutons, McQuesten River region (115P (north) and 1105M/13), central Yukon. ***In:*** Yukon Geology, Vol. 3, Exploration and Geological Services Division, Whitehorse, Indian and Northern Affairs Canada, p. 167-195.

Emond, D.S. and Lynch, T., 1992, Geology, mineralogy and geochemistry of tin and tungsten veins, breccias and skarns, McQuesten River region (115P (north) and 105 M/13), Yukon. ***In:*** Yukon Geology, Vol. 3; Exploration and Geological Services Division, Yukon, Indian and Northern Affairs, Canada, p. 133-159.

Erdmer, P., 1981, Comparative studies of cataclastic allochthonous rocks in McQuesten, Laberge and Finlayson Lake map-areas. Yukon. ***In:*** Yukon Geology and Exploration, 1979-80, Exploration and Geological Services Division, Whitehorse, Indian and Northern Affairs Canada, p. 60-64.

Foscolos, A.E., Rutter, N.W. and Hughes, O.L., 1977, The use of pedological studies in interpreting the Quaternary history of central Yukon Territory. Geological Survey of Canada, Bulletin 271, 48 p.
NTS 115O/N, 115P

Fuller, E.A., 1994, Surficial geological map of Stewart River valley, central Yukon (parts of 115O/8, 115O/9, 115P/5 and 115P/12; 1:50,000 scale map). Exploration and Geological Services, Yukon, Indian and Northern Affairs, Canada, Canada/Yukon Economic Development Agreement, Geoscience Open File 1994-7(G).
NTS 115O, 115P

Gabrielse, H. and Yorath, C.J. (eds.), 1991, Geology of the Cordilleran Orogen in Canada. Geological Survey of Canada, No. 4, 844 p.

Garrett, R.G., 1974, Mercury in some granitoid rocks of the Yukon and its relation to gold-tungsten mineralization. Journal of Geochemical Exploration, Vol. 3, No. 3, p. 277-289.

Geological Survey of Canada, 1965, Heavy metal content of stream and spring sediments, McQuesten Lake, Yukon Territory. Geological Survey of Canada, Preliminary Series Map 29-1964, scale 1:63,360.

Geological Survey of Canada, 1965, Heavy metal content of stream and spring waters, McQuesten Lake, Yukon Territory. Geological Survey of Canada, Preliminary Series Map 28-1964, scale 63,360.

Gorski, B., 1994, Soil classification and stratigraphic analysis. ***In:*** Quasi-frozen high pit wall stability analysis of placer mines, Yukon Territory: Phase 1. Vol. 1 - Summary, Vol. II - Technical Reports. Exploration and Geological Services Division, Yukon, Department of Indian and Northern Affairs Canada, Open-File 1993-6(T).

Green, L.H., 1958, McQuesten Lake and Scougale Creek map-areas, Yukon Territory (Report and Geologic maps 8-1958 and 9-1958). Geological Survey of Canada, Paper 58-4, 5 p.

Green, L.H., 1971, Geology of Mayo Lake, Scougale Creek and McQuesten Lake map areas, Yukon Territory (105M/15, 106/D2, 106D/3). Geological Survey of Canada, Memoir 357, 72 p. (includes colored geology maps).

Heginbottom, J.A. and Radburn, L.K. (comp.), 1992, Permafrost and ground ice conditions of northwestern Canada. Geological Survey of Canada, Map 1691A, scale 1:1,000,000.

Kreft, B., 1993, Placer mining and exploration compilation (105M and 115P). Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Canada/Yukon Economic Development Agreement, Geoscience Open File 1993-10(G).
NTS 105M, 115P

Morison, S.R., 1983a, Surficial geology of Clear Creek drainage basin, Yukon Territory (NTS sheets 115P, 11, 12, 13, 14). Exploration and Geological Services Division, Whitehorse, Indian and Northern Affairs Canada, Open File 1983-2, scale 1:50,000.

Morison, S.R., 1983b, A sedimentologic description of Clear Creek fluviatile sediments (115P), central Yukon. ***In:*** Yukon Exploration and Geology 1982; Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, p. 50-54.

Morison, S.R., 1985, Placer deposits of Clear Creek drainage basin (115P), central Yukon. ***In:*** Yukon Exploration and Geology 1983; Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, p. 88-93.

Mortensen, J.K. and Von Gaza, P., 1992, Application of Landsat TM thermal imagery to structural interpretations of the Tintina Trench in west-central Yukon Territory. ***In:*** Yukon Geology Volume 3, Exploration and Geological Services Division, Whitehorse, Indian and Northern Affairs Canada, p. 214-223.

Mougeot, C., 1994, Geological descriptions of selected sites in the Dawson and Mayo Placer mining areas. ***In:*** Quasi-frozen high pit wall stability analysis of placer mines, Yukon Territory: Phase 1. Vol. 1 - Summary, Vol. II - Technical Reports. Exploration and Geological Services Division, Yukon, Department of Indian and Northern Affairs Canada, Open-File 1993-6(T).

Murphy, D.C., Heon, D., and Hunt, J., 1993, Geological map of Clear Creek map area, western Selwyn Basin, Yukon (NTS 115P/14). Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Canada/Yukon Economic Development Agreement, Geoscience Open-File 1993-1 (G), scale 1:50,000.

Murphy, D.C., Heon, D. and Hunt, J., 1993, Geological overview of Clear Creek map area (NTS 115P/14), western Selwyn basin.. ***In:*** Yukon Exploration and Geology 1992, Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, p. 61-69.

Murphy, D.C. and Heon, D., 1994, Geology and mineral occurrences of Sprague Creek map area (NTS 115P/15), western Selwyn Basin. ***In:*** Yukon Exploration and Geology 1993, Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, p. 29-46.

Murphy, D.C. and Heon, D., 1994. Geological map of Sprague Creek map area (NTS 115P/15), western Selwyn Basin, Yukon. Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Canada/Yukon Economic Development Agreement, Geoscience Open-File 1994-3 (G), scale 1:50,000.

Murphy, D.C. and Heon, D., 1995, Geology and mineral occurrences of Seattle Creek map area (115P/16), western Selwyn Basin, Yukon. ***In:*** Yukon Exploration and Geology 1994, Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, p. 59-71.

Murphy, D.C. and Heon, D., 1995, Geological map of Seattle Creek area, western Selwyn Basin area, western Selwyn Basin, Yukon. Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Canada/Yukon Economic Development Agreement, Geoscience Open-File 1995-3 (G).

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.

Tarnocai, S., Smith, S. and Hughes, O.L., 1985, Soil development on quaternary deposits of various ages in the central Yukon Territory. ***In:*** Current Research, Part A, Paper 85-1A, Geological Survey of Canada, p. 229-238.
NTS 115O/N, 116 B/C, 115P

Thomas, R.D. and Rampton, V.N., 1982a, Surficial geology and geomorphology; North Klondike River, Geological Survey of Canada, "B-Series maps" (1:100,000 scale) Map 6-1982.
NTS 115O, 115P, 116A, 116B

Thomas, R.D. and Rampton, V.N., 1982b, Surficial geology and geomorphology; Upper Blackstone River, Yukon Territory. Geological Survey of Canada, "B-Series maps", Map 7-1982 (1:100,000 scale).
NTS 116A, 116B

Vongpaisal, S., Herget, G., Gorski, B. and Mougeot, C., 1992, Quasi-frozen high pit wall stability analysis of placer mines, Yukon Territory: Phase 1. Vol. 1 - Summary, Vol. II - Technical Reports. Exploration and Geological Services Division, Yukon, Department of Indian and Northern Affairs Canada, Open-File 1993-6(T).

Wheeler, J.O. and McFeely, P., 1991, Tectonic Assemblage map of the Canadian Cordillera and adjacent parts of the United States of America. Geological Survey of Canada, Map 1712A.

Wheeler, J.O. and McFeely, P., 1991, Tectonic Assemblage map of the Canadian Cordillera and adjacent parts of the United States of America. Geological Survey of Canada, Map 1712A.