





GEOPROCESS FILE - SUMMARY REPORT DAWSON MAP AREA - NTS 116B and 116C (E1/2)

The GEOPROCESS File is a compilation of information and knowledge on geological processes EDITION: 2 PRINT DATE: and terrain hazards, including mass movement processes, permafrost, flooding risks, faults seismic activity and recent volcanism, etc. Please refer to the GEOPROCESS File User 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 Guide include summary papers on the geological framework, permafrost distribution, id Quaternary geology in Yukon and a list of comprehensive GEOPROCESS File reference nis report includes a brief discussion of the scope and limitations of the GEOPROCESS File compilation maps followed by summaries of the bedrock geology, surficial geology and terrain

hazards for this NTS 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 on 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

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 NTS 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 User Guide provides a framework and context for each of the bedrock

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

## BEDROCK GEOLOGY (Green and Roddick, 1961)

he Dawson map area is mainly within the Omineca Belt Plateau except for the northern ne-third which is in the Foreland Belt. The major physiographic feature in this map area is the intina Trench which forms a northwest-trending valley across the map area and broadens to more than 20 kilometres in width in the south. Northeast of the Trench the topography is mountainous and rugged (the Ogilvie Mountains). Southwest of the Tintina Trench the topography is subdued and characterized by low, rounded, dome-style mountains and hills. The variable physiography on each side of the Tintina Trench is a reflection of the bedrock geology

The bedrock geology southwest of the Trench is dominated by four packages of Yukon-Tanana Terrane metamorphic rocks: pre-570 to 320 million years Nasina (and Nisling) Assemblage micaceous quartzite, quartz-mica schist, quartz-biotite gneiss, graphitic schist and uartz-muscovite-chlorite schist; 350 million year old quartz-biotite gneiss; 290-245 million year old quartz-muscovite-chlorite schist and chloritic quartzite known as the Klondike schist; Slide Mountain Terrane greenstone, amphibolite and serpentinized ultramafic rocks.

Northeast of the Tintina Trench are four packages of variably deformed and metamorphosed sedimentary rocks. These include a pre-800 million year old package of Fifteenmile Group, Windemere Group and Wernecke Supergroup vari-coloured, thin-bedded argillite, slate, phyllite, quartzite, dolomite, conglomerate, limestone and siltstone; 800 to 530 million year old Hyland

NOTE: THIS MAP HAS BEEN PRODUCED BY THE COMPILATION OF DATA OM VARIOUS SOURCES. IT IS NOT TO BE USED TO DEFINE THIS MAP IS ISSUED AS A PRELIMINARY GUIDE FOR WHICH THE LL ACCEPT NO RESPONSIBILITY FOR ANY ERRORS, INACCURACIES

gritty quartzite, sandstone, quartz pebble conglomerate, black, maroon and green shales and slates, schistose quartzite quartz-chlorite schist, quartz-mica schist, phyllite, limestone, chert, dark green volcanic flows, breccia, tuff and agglomerate; 530-200 million year old Selwyn Basin stratigraphy that includes Road River Group black chert, black argillite, quartzite, dolomite, limestone and partly serpentinized volcanic rocks, Earn Group black argillite, shale, slate, limestone, quartzite and chert pebble conglomerate, and Tahkandit Formation chert, and cherty limestone; and graphitic quartzite, slate and phyllite of the 360-320 million year old Keno Hill Quartzite. Dykes and sills of 220 million year old gabbro and diorite intrude the Keno Hill

he northeast portion of the area is structurally complex and dominated by intense folding and large thrust faults including the Dawson. Tombstone and Robert Service Thrust Faults. Wernecke Supergroup rocks contain numerous large areas dominated by breccias (Wernecke Breccia). Tombstone Suite plutons composed of 90 million year old hornblende-biotite syenite and granite are found in the Tombstone Mountain area. Close to and southwest of the Tintina Trench are several 50 million year old granodiorite and quartz monzonite plutons. Within the Tintina Trench, northwest of Dawson, 50 million year old coal-bearing arkose, sandstone and conglomerate are associated with minor basalt flows. Mineral deposits and occurrences

The Dawson map area hosts a large and varied array of mineralization. Yukon MINFILE lists 168 occurrences. Numerous gold-bearing veins occur in the Dawson City and Tombstone Mountain areas. Lead-zinc-silver veins are common in the sandstone and carbonate rocks of Mackenzie Platform. Copper, gold, uranium, fluorine, tungsten, molybdenum, antimony nineralization is spatially related to the Tombstone suite plutons. The Brewery Creek bulk mineable gold deposit is an oxidized intrusive associated vein deposit containing 17 million tonnes of 1.4 g/t Au. The Marn skarn deposit contains approximately 300 000 tonnes of 8.6 g/t Au. 1% Cu. 0.1% W and 17 g/t Ag. Numerous asbestos occurrences are known and are genetically associated with Slide Mountain Terrane ultramafic bodies. The largest asbestos deposit was the Clinton Creek mine which produced 940 095 tonnes of asbestos from 16 million tonnes of ore. More than 15 coal occurrences, some past producers, are associated with sedimentary rocks in the Tintina Trench. The Blende deposit contains 19.5 million tonnes of 3.0 % zinc, 2,8% lead and 56 grams per tonne silver. Other mineral showings in the Dawson area include copper skarns and veins, and sedex barite and zinc. Although the Dawson area is famous for its placer gold production, most of the Klondike goldfields are in the Stewart River map area and not the Dawson map area.

## SURFICIAL GEOLOGY

Most of the Dawson map area is believed to be located in the unglaciated portion of the Western Yukon Plateau. Recent work by Duk-Rodkin (1996) in that area provides an update history of the early glaciations in that area.

During late Tertiary time (2 million years ago), smooth rounded summits and valleys formed 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 the onset of Quaternary glaciations caused drainage reversals in a northerly direction throughout central Yukon (Templeman-Kluit, 1980). For example, prior to glaciations, the Klondike River flowed southeast to Steward River with a drainage divide just east of the mouth of Hunker Creek (Thomas and Rampton, 1982b). The earliest glaciation in the area reached the Tintina Trench and the flow of the Klondike River was reversed.

The White Channel Gravel, well known in the Dawson area, consists of tall white gravel exposures seen along the Klondike Highway and along Hunker and Bonanza creeks. This gravel was deposited by a multi-channeled stream system (Morison, 1985) during the Pliocene. and continued during uplift of the area. Deposition of the White Channel Gravel is believed to have ended with the onset of pre-Reid glaciations in early Pleistocene (2 millions years ago). The elevated position of these gravel beds is the result of post depositional uplift and incision to

The early glaciations were more extensive than the younger ones. They reached the Tintina Trench from two different sources, the Cordilleran ice sheet (South Klondike and McQuesten valleys) and the Ogilvie Mountains (Brewey Creek, North Creek; Duk-Rodkin, 1996). The oldest

NOTE: A new digital compilation of Yukon Geology is now available by Steve Gordey and Andrew Makepeace (GSC Open File D3826 and/or DIAND Open File 1999-1(D)), and more recent MINFILE updates should also be verified (Yukon MINFILE, 2001).

CONTOUR INTERVAL 500 FEET Elevations in Feet above Mean Sea Level North American Datum 1983 Transverse Mercator Projection Universal Transvers Mercator Grid ZONE 7 (pre-Reid) glacial deposits include isolated patches of till outcrop within the pediment deposits beyond the Reid glacial limits. Erratic boulders have been found 100 m higher than the Reid moraines, indicating previous glacial activity. This till often contains very weathered clasts and its surface shows Reid glaciation is marked by major valley glaciers flowing from circues in the Southern Ogilvie Ranges (Thomas and Rampton, 1982a). The glaciers flowed down tributary valleys and in some cases joined

together. Outwash deposits associated with the retreat of Reid glaciers are now present in the McConnell glaciation was less extensive and not all cirques occupied by glaciers during the Reid glaciation were active at this time (Thomas and Rampton, 1982a). Glaciofluvial terraces resulting from this ice retreat are preserved as low terraces inset into the higher Reid terraces. Colluvium covers more than 70 % of the area (Duk-Rodkin, 1996) and commonly contains a large

**DAWSON** 

amount of ice-rich permafrost and frozen organic deposits. Some of the richest fossil sites of Pleistocene mammals are found in the Klondike area. Findings include steppe bison, small horse, woolly mammoth, Dall sheep and caribou, various members of the rodent family, short-faced bear, American lion and several others. The animals are believed to have occupied steppe-like grassland (Beringia) during the last glaciation (Harrington, in Morison and Smith

The main source of information for the terrain hazards map is derived from surficial geology and geomorphology maps of Thomas and Rampton (1982a,b) and Duk-Rodkin (1996). The Geological Survey of Canada Pacific Geoscience Centre in Victoria provided the seismic information.

TERRAIN HAZARDS

There are 68 recorded seismic events within the Dawson map area. Most of the events are on the northeast side of the Tintina Fault. The Tombstone Mountain area is host to a concentration of events, including two of magnitude 5.0-6.0 (the highest recorded readings in the map area) and eleven of magnitude 4.0 to 5.0 Mass Movement Processes

Permafrost is present on north-facing slopes, and processes such as solifluction, soil creep, nivation and cryoturbation can occur. Slow mass movement as creep, solifluction lobes and stripes are common on colluvium-covered slopes and within some of the moraine-covered slopes (Duk-Rodkin, 1996). Most landslides identified on the accompanying map were mapped by Duk-Rodkin (1996). Active layer detachment slides and retrogressive thaw flow slides are common in the moraines. Fine-grained sediments in the valley bottoms are underlain by permafrost with high ice content which may form thermokarst if disturbed. This risk is less severe if the fine-grained deposits are underlain by gravel, as is the case on mid- to high elevation terraces of the Klondike River (Mougeot, 1994). Avalanches and rock falls are always a possible 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 townsite of Dawson, which is chiefly composed of friable ultramafic bedrock.

The Dawson 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 some cases the solid ice bodies are 15 to 100 m thicl In general, 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 may be included when is it 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 mudslide, detachment slides, thermokarst subsidence, deterioration of the drainage for several years. Solifluction lobes are widespread throughout the area on colluviated slopes. Rock glaciers are common at high elevation on north- and northeast-facing slopes.

## 116B & 116C (E1/2) DAWSON 115O & 115N (E1/2) STEWART RIVER Magnetic Declination 1990 varies from 30 ° 77 easterly at the centre of the west edge to 31° 15' easterly at the centre of the west edge to 31° 15' easterly at the centre of the east edge.

High water levels have been experienced as a result of floating ice jams on the Yukon River downstream of Dawson City and on the Klondike River at/near the mouth as well as from open water flows from the Yukon River (McLellan, 1983). Dawson City has known several severe floods during its history which were caused mainly by ice jams and open water flow. High water levels have been frequent enough (at least six times since 1925) to justify the construction of a dyke along the Yukon River in Dawson City. The community of Rock Creek as well as several locations along the Klondike highway have also been subjected to floods induced by ice jams. Smaller drainage basins in the area experience unusually high water levels that can be caused by

snow melt run-off, rainstorm events, or a combination of both, and ice jams during the spring break-up period. The effect of snow melt and heavy rain is greater on smaller basins. References: Dawson Map Area - NTS 116B and 116C (E1/2) Note: To be thorough, check the references for adjacent NTS map sheets and the General

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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