GEOLOGY OF SOUTHWESTERN YUKON
1:250 000 scale
YGS Open File 2004-16

compiled by S. Israel

0 10 20 30 40 kilometres

INTRODUCTION

This map represents the bedrock geology in southwest Yukon. The legend located at the far right of the map describes numerous packages of rocks that are divided into separate units based mainly upon age and characteristic rock types. Each of the colours on the legend corresponds to coloured areas known as polygons on the map, which vary in both shape and size. The polygons represent the spatial distribution of the different rock units.

The first, striking feature of this map is the contrast between the rocks north of the Alaska Highway and those found south of the highway. This contrast can be seen by the differences in landforms; rounded, small mountains north of the highway and rugged, tall mountains south of the highway. The striking contrast is the direct result of over 300 million years of mountain building processes that are still active today.

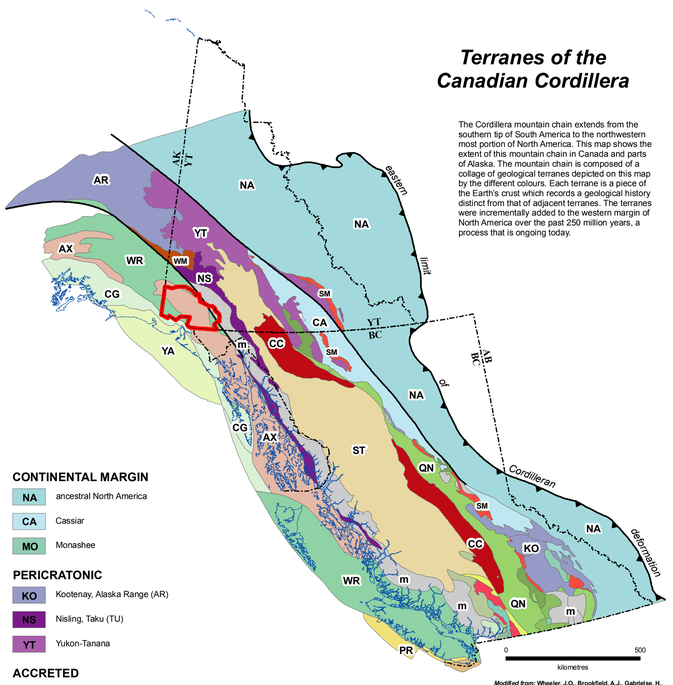
North of the Alaska Highway the land is made up of metamorphic rocks, those that have undergone physical changes brought on by very high pressures and temperatures found deep down in the Earth's crust, and igneous rocks, molten rocks that are injected into the Earth's crust from below. These metamorphic and igneous rocks are the remnants of a mountain belt that is at least 80 million years old that was formed near what was then the edge of the North American continent. Prior to the formation of this mountain belt, the rocks exposed today were covered by a thick accumulation of cover rocks and were buried several kilometres beneath the surface. During the formation of the mountain belt the land was gradually uplifted and the cover rocks were slowly eroded over 80 million years to expose those rocks now seen north of the highway.

South of the Alaska Highway the land is composed of sedimentary and volcanic rocks whose ages span between 300 and 3 million years old. The oldest rock units are composed of volcanic and sedimentary rocks that were deposited on the ocean floor. These rocks make up a large tectonic block known as the Wrangellia Terrane which is an ancient piece of crust that was formed somewhere out in the proto-Pacific ocean. During ongoing plate tectonic processes the Wrangellia Terrane traveled a great distance and eventually became part of the Yukon when it collided with North America. Following this collision of the Wrangellia Terrane with North America, other terranes continued to collide into the outer edge of Wrangellia.

For about the past 10 million years a tectonic block known as the Yakutat Terrane has been traveling north, sliding past the southwest Yukon and forcing itself underneath Alaska This continuing collision is responsible for the formation of the St. Elias Mountains, the highest coastal mountain range on Earth. The St. Elias Mountains are a young mountain range and have not been eroded to the point of those rocks north of the Alaska Highway. This is the main reason for the dramatic difference in landforms across the highway. The northward movement of the Yakutat Terrane is causing volcanoes in Alaska and earthquakes in both Alaska and the Yukon. Several earthquakes felt every year in the Yukon are the result of the mountains readjusting themselves to accommodate the arrival of the colliding Yakutat Terrane. The earthquakes occur along faults such as the Denali Fault, located within the Alaska Highway corridor, which has moved the rocks north of the Alaska Highway several hundreds of kilometres from Alaska to southwest Yukon.

Terranes of the Canadian Cordillera

The Cordillera mountain chain extends from the southern tip of South America to the northwestern most portion of North America. This map shows the extent of this mountain chain in Canada and parts of Alaska. The mountain chain is composed of a collage of geological terranes depicted on this map by the different colours. Each terrane is a piece of the Earth's crust which records a geological history distinct from that of adjacent terranes. The terranes were incrementally added to the western margin of North America over the past 250 million years, a process that is ongoing today.



Modified from: **Wheeler, J.O., Brookfield, A.J., Gabrielse, H., Monger, J.W.H., Tipper, H.W. and Woodsworth, G.J. 1991. Terrane map of the Canadian Cordillera. Geological Survey of Canada, Map 1713 and Gordey, S.P., Makepeace, A.J., (compilers). 2003. Yukon Digital Geology, version 2.0. Geological Survey of Canada, Open File 1749 and Yukon Geological Survey, Open File 2003-9(D), 2 CD-ROMS.**

CONTINENTAL MARGIN
- NA ancestral North America
- CA Cassiar
- MO Monashee

PERICRATONIC
- KO Kootenay, Alaska Range (AR)
- NS Nisling, Taku (TU)
- YT Yukon-Tanana

ACCRETED

INTERMONTANE
- SM Slide Mountain
- QN Quesnellia
- HR Harper Ranch, Klinkit
- OK Okanagan
- CC Cache Creek
- ST Stikinia
- WM Windy-McKinley

COAST
- CD Cadwallader
- MT Methow
- BR Bridge River
- HA Harrison
- CK Chilliwack
- SH Shuksan

OUTER
- CG Chugach
- YA Yakutat
- PR Pacific Rim
- CR Crescent

INSULAR
- AX Alexander
- WR Wrangellia

OTHER
- m undivided metamorphic rocks

SOUTH OF ALASKA HIGHWAY/HAINES ROAD

QUATERNARY
- Q — **Q: QUATERNARY** unconsolidated glacial, glaciofluvial and glaciolacustrine deposits; fluviatile silt, sand, and gravel, and local volcanic ash, in part with cover of soil and organic deposits

MIOCENE TO PLIOCENE AND (?) YOUNGER
- NW — **NW: WRANGELL LAVAS** mafic to felsic volcanic rocks (1) with local conglomerate (2)

MID TO LATE MIOCENE
- MW — **MW: WRANGELL SUITE** fine- to medium- grained, hornblende +/- biotite granodiorite and porphyritic (K-feldspar) hornblende granodiorite; medium-grained, uniform biotite diorite and pyroxene gabbro; subvolcanic hornblende +/- biotite rhyolite, rhyodacite, dacite, and trachyte

OLIGOCENE
- OT — **OT: TKOPE SUITE** light pinkish-grey, medium- to coarse-grained, homogeneous, biotite and/or hornblende granite (locally miarolitic); lesser light creamy-grey biotite-hornblende granodiorite, dark grey biotite-hornblende quartz diorite and gabbro diorite

PALEOCENE TO OLIGOCENE
- OA — **OA: AMPHITHEATRE** yellow-buff to grey-buff sandstone, pebbly sandstone, polymictic conglomerate, siltstone and mudstone; minor brown-grey carbonaceous shale and thin lignitic coal; mostly fluvial and lacustrine deposits, local debris-flow deposits; some shallow marine **(Amphitheatre; Kulthieth)**

EOCENE
- ES — **ES: SEWARD SUITE** non- to weakly foliated, light to mid-brownish-grey, medium-grained, biotite- and hornblende-biotite tonalite and granodiorite; rarer granite and quartz diorite

LATE EARLY CRETACEOUS
- EKK — **EKK: KLUANE RANGES SUITE** mid-grey, medium- to coarse-grained, biotite-hornblende granodiorite, quartz diorite, quartz monzonite, and hornblende diorite
- EKP — **EKP: PYROXENITE CREEK ULTRAMAFIC** medium-grained hornblende pyroxene gabbro, and biotite-hornblende diorite; olivine and hornblende clinopyroxenite

UPPER JURASSIC TO LOWER CRETACEOUS
- JKD — **JKD: DEZADEASH** clastic succession (1) but locally including undifferentiated younger strata (2)

LATE JURASSIC TO EARLIEST CRETACEOUS
- JKS — **JKS: SAINT ELIAS SUITE** nonporphyritic and porphyritic (K-feldspar), biotite-hornblende granodiorite; lesser nonporphyritic biotite and/or hornblende tonalite; locally includes biotite-hornblende quartz monzodiorite, quartz diorite, granite, and quartz monzonite

CRETACEOUS AND (?) OLDER
- KY — **KY: YAKUTAT** greywacke and conglomerate in thick members or interbedded with siltstone, argillite, or slate; melange with blocks (to several km) of greenstone, limestone, marble, granitic rocks, chert, and greywacke in a matrix of cherty and tuffaceous pelite **(Yakutat Gp.)**
- KV — **KV: VALDEZ** dark grey argillite and greywacke; includes granitoid dykes, sills, and locally plugs, green pillow lava, breccia, and tuff; metamorphosed equivalents include brown schists, granitoid gneisses and dark green amphibolite **(Valdez Gp.)**

UPPER TRIASSIC
- uTrC — **uTrC: CHITISTONE** thin interbedded light to dark grey argillaceous limestone and dark grey argillite; massive light grey limestone, limestone breccia and darker grey, well-bedded limestone; white to creamy white gypsum and anhydrite **(McCarthy, Chitistone and Nizina limestones)**
- uTrN — **uTrN: NICOLAI** amygdaloidal basaltic and andesitic flows, with local tuff, breccia, shale and thin-bedded bioclastic limestone; volcanic breccia, pillow lava and conglomerate at base; locally includes dark grey phyllite and minor thin grey limestone of Middle Triassic **(Nicolai Greenstone)**

PENNSYLVANIAN TO (?) LOWER PERMIAN
- CPS — **CPS: SKOLAI** volcanic rocks succeeded upward by clastic strata (1) and including minor limestone (2)

LATE TRIASSIC AND (?) OLDER
- PTrK — **PTrK: KLUANE ULTRAMAFIC SUITE** mafic to ultramafic intrusions in 1) Wrangell Terrane and 2) Alexander Terrane

LATE PENNSYLVANIAN TO EARLY PERMIAN
- CPI — **CPI: ICEFIELD RANGES SUITE (270-290 MA)** mid- to dark greenish-grey, medium-grained, nonfoliated and foliated, biotite-hornblende quartz monzodiorite-quartz diorite-diorite, veined and intruded by leucocratic granodiorite and quartz syenite (agmatite); pink hornblende syenite **(Icefield Ranges Suite)**

PALEOZOIC, (?) DEVONIAN AND/OR YOUNGER
- PSC — **PSC: STEELE CREEK** massive medium- to coarse-grained, rusty grey-green hornblende pyroxene gabbro, minor medium grained gabbro-diabase and gabbro-pegmatite intrusions; rare pods of black peridotite; screens of flows, volcaniclastic rocks, minor argillite, and rare chert **(Mt. Cairnes Gabbro-Greenstone Complex; Steele Ck-Mt. Constantine Gabbro Complex)**

DEVONIAN TO UPPER TRIASSIC AND (?) OLDER
- DTrI — **DTrI: ICEFIELD** a grouping of diverse, dominantly upper Paleozoic partly equivalent strata subdivided into three dominant facies including pelitic rocks (1), carbonate (2), and volcanic rocks (3)

SILURIAN AND DEVONIAN
- SDB — **SDB: BULLION** a grouping of carbonate (1) and clastic (2) strata that may be partly equivalent

LOWER ORDOVICIAN TO DEVONIAN AND (?) OLDER
- ODG — **ODG: GOATHERD** a grouping of carbonate (1) and clastic (2) strata that may be in part equivalent

CAMBRIAN TO ORDOVICIAN AND (?) YOUNGER
- COD — **COD: DONJEK** greywacke-greenstone assemblage (1) with minor carbonate (2)

NORTH OF ALASKA HIGHWAY/HAINES ROAD

QUATERNARY
- Q — **Q: QUATERNARY** unconsolidated glacial, glaciofluvial and glaciolacustrine deposits; fluviatile silt, sand, and gravel, and local volcanic ash, in part with cover of soil and organic deposits

LOWER EOCENE
- lEs — **lEs: SKUKUM** various felsic volcanic dykes, plugs, domes, laccoliths and flows (1) and volcanic conglomerate (2)

EARLY TERTIARY
- ETN — **ETN: NISLING RANGE SUITE** medium- to coarse-grained equigranular to porphyritic rocks of intermediate (g), fine- to coarse-grained, equigranular and porphyritic granitic rocks of felsic composition (q) and felsic dyke rocks (f)

UPPER CRETACEOUS
- uKC — **uKC: CARMACKS** a volcanic succession dominated by basic volcanic strata (1), but including felsic volcanic rocks dominantly (?) at the base of the succession (2) and locally, basal clastic strata (3) (70 Ma approx)

LATE EARLY CRETACEOUS
- EKP — **EKP: PYROXENITE CREEK ULTRAMAFIC** medium-grained hornblende-pyroxene gabbro, and biotite-hornblende diorite; olivine and hornblende clinopyroxenite

MID-CRETACEOUS
- mKW — **mKW: WHITEHORSE SUITE** grey, medium- to coarse-grained, generally equigranular granitic rocks of felsic (q), intermediate (g), locally mafic (d), and rarely syenitic (y) composition

EARLY JURASSIC
- EJgA — **EJgA: AISHIHIK SUITE** medium- to coarse-grained, foliated biotite-hornblende granodiorite; biotite-rich screens and gneiss schlieren; foliated hornblende diorite to monzodiorite with local K-feldspar megacrysts; may include unfoliated monzonite of the Long Lake Suite
- EJL — **EJL: LONG LAKE SUITE** mostly felsic granitic rocks (q) but locally grading to syenitic (y)

PROTEROZOIC TO MESOZOIC
- PMm — **PMm: UNDIVIDED METAMORPHIC ROCKS** dark purplish brown staurolite-cordierite-biotite hornfels with relict schistose textures; quartz-sericite-chlorite schist; minor quartzite

DEVONIAN TO CRETACEOUS
- PMw — **PMw: WINDY** oceanic assemblage of ultramafic rocks (1), greenstone (2), chert (3), carbonate (4), and metamorphosed equivalents? (5)
- PMw4

MIDDLE PERMIAN
- PK — **PK: KLONDIKE SCHIST** poorly understood assemblage of metamorphosed pelitic/volcanic rocks, (1) and minor marble (2), including phyllite of uncertain association (3)

LATE DEVONIAN TO MISSISSIPPIAN
- DMPW — **DMPW: PELLY GNEISS SUITE - SOUTHEAST** variably deformed granitic rocks of predominantly felsic (q), to intermediate composition (g), southwest of Tintina Fault

DEVONIAN, MISSISSIPPIAN, AND (?) OLDER
- DMN — **DMN: NASINA** graphic quartzite and muscovite-quartz-rich schist (1), (3)-(5), and (7)-(8) with interspersed marble (2) and probable correlative successions (7)-(9); eclogite occurrences (10)

LATE PROTEROZOIC AND PALEOZOIC
- PPN1 — **PPN: NISLING** assemblage characterized by mica-quartz schist (1) and abundant locally thick limestone members (2); (3) includes possibly equivalent strata northeast of Tintina Fault
- PPN2

GEOLOGICAL CONTACTS
- contact, defined
- contact, approximate
- contact, assumed
- contact, extrapolated

FAULTS
- fault, normal/reverse
- fault, thrust, upright
- fault, dextral
- fault, movement undefined

FOLDS
- fold, anticline, upright
- fold, anticline, overturned
- fold, syncline, upright
- fold, syncline, overturned

NATURAL FEATURES
- rivers
- dry river bed
- waterbody
- wetlands

LAND STATUS
- Kluane National Park and Reserve
- proposed Asi Keyi Natural Environment Park Reserve (as of August 2003; currently Interim Protected)
- White River First Nation Interim Protected settlement lands
- First Nation Category A settlement lands
- First Nation Category B/FS settlement lands

MINERAL OCCURRENCES *(Size of symbol indicates status)*

PORPHYRY/SHEETED VEIN DEPOSITS: copper; gold; molybdenum; silver; uranium; other

MAFIC-ULTRAMAFIC ASSOCIATED DEPOSITS: copper; gypsum; nickel; platinum group metals; silver; other

VEIN/BRECCIA DEPOSITS: copper; fluorite; gold; lead-zinc; molybdenum; silver; other

SKARN/REPLACEMENT DEPOSITS: copper; gold; silver; lead-zinc; other

VOLCANIC ASSOCIATED DEPOSITS: copper; gold; nickel; other

INDUSTRIAL MINERAL DEPOSITS: asbestos; coal; gypsum; other

UNKNOWN DEPOSITS: copper; other

STATUS: showing; prospect; deposit or past producer

Magnetic Declination (for centre of map): 24°30´E decreasing 17´ annually

DATA SOURCES:

BEDROCK GEOLOGY: Gordey, S.P. and Makepeace, A.J. (comp.), 2003. Yukon digital geology, version 2.0. Geological Survey of Canada, Open File 1749, and Yukon Geological Survey, Open File 2003-9(D), 2 CD-ROMs.

FIRST NATIONS SETTLEMENT LANDS: Land Status Implementation, Land Resources, Yukon Region, Indian and Northern Affairs Canada; Renewable Resources, Yukon Government; and Claims and Indian Government.

HILLSHADE: 90m DEM provided by Renewable Resouces, Yukon Government; Hillshade produced by A.J. Stuart.

MINFILE: Deklerk, R. and Traynor, S. (comp.), 2004. Yukon MINFILE - A database of mineral occurrences. Yukon Geological Survey, CD-ROM.

PARKS & SPECIAL MANAGEMENT AREAS: Renewable Resources, Yukon Government.

TOPOGRAPHIC BASE: Natural Resources Canada; Renewable Resources, Yukon Government; and Land Information Management System, Yukon Government.

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Map compilation and digital cartography by A.J. Stuart and J.O. Bruce, Yukon Geological Survey.

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Any revisions or additional geological information known to the user would be welcomed by the Yukon Geological Survey.

NOTE: This map is issued as a preliminary guide only and is not intended to be used for navigation or to define legal boundaries. The map was produced by compiling data from various sources, and no responsibility will be taken by the Yukon Geological Survey for any errors, inaccuracies or omissions whatsoever.

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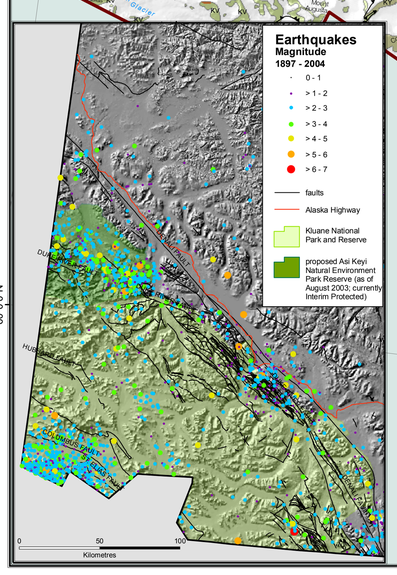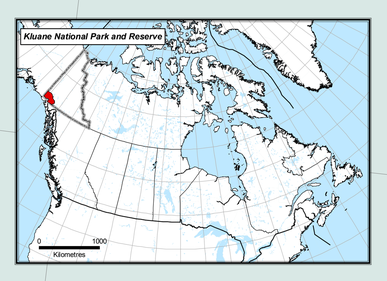
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