Natural Resources Canada
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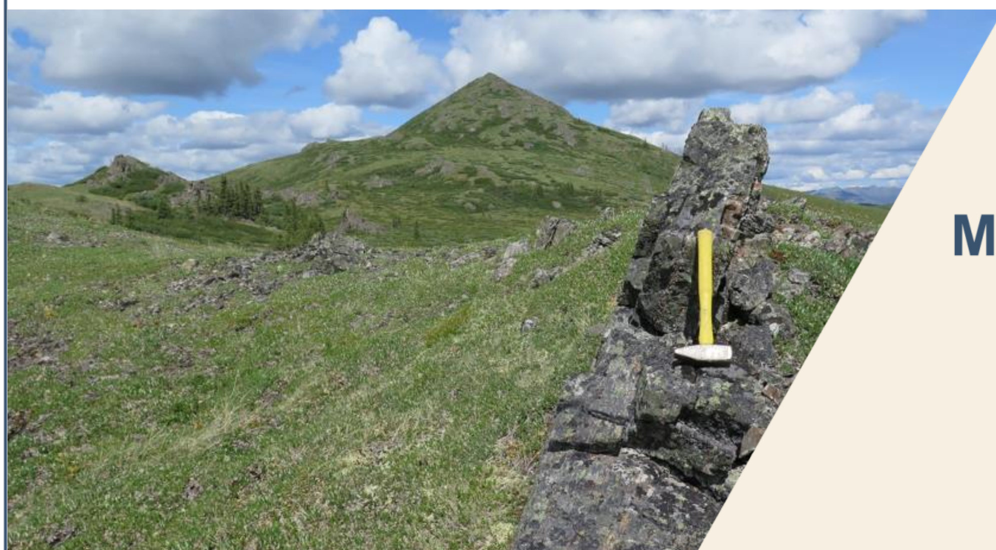
CANADIAN GEOSCIENCE MAP 376

BEDROCK GEOLOGY

KLAZA RIVER AREA

Yukon



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Abstract
The Klaza River area is underlain dominantly by Paleozoic rocks of Yukon Tanana terrane, and mid-Cretaceous to Paleogene rocks. The geology of the central map area is dominated by metasedimentary rocks and lesser amphibolite layers of the pre-Late Devonian Snowcap assemblage, with Stevenson Ridge schist to the west. Permian Sulphur Creek suite forms sparse intrusions of K-feldspar augen and non-porphyritic granite. The northern geology is dominated by the mid-Cretaceous Dawson Range batholith and Mount Nansen Group volcanic rocks, which are overlain by upper Cretaceous Carmacks Group volcanic rocks. Mid-Cretaceous Maloney Creek batholith dominates the southeast part of the map area. Late Cretaceous Casino suite hypabyssal rocks occur sparsely to the east, and have known porphyry and epithermal mineral potential (e.g. Klaza deposit). Paleogene volcanic and hypabyssal rocks are scattered across the map, predominantly in the west.

Résumé
La région cartographique de Klaza River renferme surtout des roches paléozoïques du terrane de Yukon-Tanana, ainsi que des roches s'échelonnant du Crétacé moyen au Paléogène. La géologie de la partie centrale est caractérisée par la présence prépondérante de roches métasédimentaires. On y trouve aussi, en moindres quantités, des couches d'amphibolite de l'assemblage de Snowcap (pré-Dévonien tardif) et, dans le secteur ouest, des unités du schiste de Stevenson Ridge. La suite de Sulphur Creek du Permien se manifeste par des intrusions clairsemées de granite oeillé à feldspath potassique et de granite non porphyrique. La géologie de la partie nord est dominée par le batholite de Dawson Range et les roches volcaniques du Groupe de Mount Nansen du Crétacé moyen, lesquelles sont surmontées par les roches volcaniques du Groupe de Carmacks du Crétacé supérieur. Le batholite de Maloney Creek du Crétacé moyen constitue l'unité dominante de la partie sud-est de la carte. Des roches hypabyssales de la suite Casino du Crétacé tardif sont présentes de manière éparse à l'est et recèlent un potentiel en minéralisations porphyriques et épithermales (p. ex. gisement de Klaza). Des roches volcaniques et hypabyssales du Paléogène sont présentes un peu partout dans la carte, mais sont plus fréquentes dans le secteur ouest.

Sheet 1 of 1, Bedrock Geology

General Information
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Geology by J.J. Ryan, A.J. Parsons, and Y. Morneau, Geological Survey of Canada;

S. Israel and M. Friend, Yukon Geological Survey, 2016

Geological compilation by J.J. Ryan and S. Israel, 2017

Geology conforms to Bedrock Data Model v. 2.9

Geomatics and cartography by S.P. Williams and J.J. Ryan

Initiative of the Geological Survey of Canada, conducted under the auspices of the Cordilleran Project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program, with support from the Yukon Geological Survey

Map projection Universal Transverse Mercator, zone 7
North American Datum 1983

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications. Elevations in metres above mean sea level

Mean magnetic declination 2018, 19°27'E, decreasing 22.5' annually
Readings vary from 19°37'E in the NE corner to 19°16'E in the SW corner of the map.

This map is not to be used for navigational purposes.

Title photograph: Sparsely vegetated landscape on the north side of the Schist Creek complex in the southeast part of the Klaza River area, Yukon, looking northeast. Photograph by J.J. Ryan. 2018-001

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Map Viewing Files

The published map is distributed as a Portable Document File (PDF), and may contain a subset of the overall geological data for legibility reasons at the publication scale.

Cartographic Representations Used on Map

This map utilizes ESRI Cartographic Representations in order to customize the display of standard GSC symbols for visual clarity on the PDF of the map only. The digital data still contains the original symbol from the standard GSC symbol set. The following legend features have Cartographic Representations applied:

- Geopoints.

DESCRIPTIVE NOTES

INTRODUCTION

Bedrock exposure in this partially glaciated terrain (Duk-Rodkin, 1999) of west-central Yukon forms broad upland ridges that are dominated by extensive frost-shattered felsenmeer. Outcrops are rare in heavily forested valleys, but are found locally along stream cuts. Bedrock geology of the Klaza River area consists primarily of a central domain of metamorphosed and polydeformed Paleozoic basement intruded and overlapped by relatively little-deformed Mesozoic and Cenozoic successions. The present work has benefitted from observations outlined in Tempelman-Kluit (1974), Ryan et al. (2013a; 2013b; 2016), Israel et al. (2011), Israel and Westberg (2011), and Klocking et al. (2016). Interpretation of geological elements beneath cover and areas of difficult access was greatly aided by aeromagnetic data (e.g. Hayward et al., 2012).

GEOLOGICAL FRAMEWORK

Yukon-Tanana Terrane

The central part of the map area is dominantly underlain by the polydeformed and metamorphosed Yukon-Tanana terrane (YTT), dominated by Snowcap assemblage, which is constrained to lower Paleozoic to upper Devonian. The Snowcap assemblage is characterized by amphibolite-facies quartzite, micaceous quartzite, and psammitic quartz-muscovite-biotite (±garnet) schist (unit **P**DS1), large domains of amphibolite (unit **P**DS3), and rare, decametre-thick lenses of marble (unit **P**DS2). The amphibolite units are commonly massive, with lesser garnet amphibolite, and are interpreted as metamorphosed mafic sills and dykes, versus volcanic horizons. In the neighbouring Mount Nansen–Nisling River area to the east, Ryan et al. (2016) attributed many amphibolite units to the Devono-Mississippian Finlayson assemblage (unit DMF1), due to their apparent spatial association with the Simpson Range suite. However, no Simpson Range suite intrusions were identified in the Klaza River map area.

The westernmost side of the map area hosts quartzite, psammite, and phyllite previously correlated with the Stevenson Ridge schist (units MSRS1 and MSRS2; *see* Ryan et al., 2014). This unit is regionally interpreted as being upper Devonian to lower Mississippian; however, a greywacke sample and a quartzite sample that we collected from the unit yielded youngest detrital zircon ages of 342 Ma (N. Joyce, unpublished data, 2016) and 260 Ma (N. Joyce, unpublished data, 2016), respectively, indicating that the regional character of this unit needs to be re-evaluated.

In the east-central part of the area, the Snowcap assemblage is intruded by scattered bodies of variably foliated K-feldspar-porphyritic to porphyroclastic augen granite, one of which yielded a preliminary age of ca. 261 Ma (N. Joyce, unpublished data, 2016), and are thus correlated with the Permian Sulphur Creek suite (unit PS1). Medium-grained, non-porphyritic monzogranite to syenogranite varieties (unit PS2) also occur there, and while similar in appearance to the Mississippian Simpson Range suite, one of these yielded a preliminary age of ca. 262 Ma (N. Joyce, unpublished data, 2016).

Mafic-ultramafic complexes

The Schist Creek mafic-ultramafic complex occurs in the southeast part of the map area and is dominated by serpentinite and peridotite with minor metagabbro. The complex appears to be in structural contact with the surrounding Snowcap assemblage. The serpentinite has a predominantly harzburgitic protolith, indicated by high-temperature deformed orthopyroxene porphyroclasts and aligned olivine, suggesting that it originated as lithospheric mantle (Dubman, 2016). The serpentinite is intruded by plagioclase-porphyritic metagabbro dykes (too small to be shown on map) that yield Late Permian ages (W. McClelland, unpublished data, 2016). Other minor lenses (10 to 100 m wide) of serpentinite, talc-tremolite schist, and listwaenite may be related to the Schist Creek complex.

Stikinia/Quesnellia

The Stikine plutonic suite (unit LTS) is represented by a single intrusion of weakly to moderately foliated white to beige hornblende-biotite granodiorite in the eastern side of the map area. It is correlated with intrusions of similar character immediately to the east in the vicinity of Mount Nansen that were dated by Mortensen et al. (2003) at 211 Ma. A metagabbro intrusion in the western side of the map area may also be Triassic in age, as it yielded an Ar/Ar metamorphic cooling age of ca. 175 Ma (N. Joyce, unpublished data, 2016). It is similar in appearance to the Snag Creek gabbro suite in the White River assemblage some 60 km to the west (Ryan et al., 2013a); however that gabbro suite is thought to be present only in parautochthonous North America. Younger Mesozoic rocks in the area lack evidence of regional polyphase deformation and metamorphism.

The very northeast corner of the map area is occupied by the Big Creek pluton of the Long Lake suite (unit EJL) that is composed chiefly of weakly to modestly foliated hornblende-biotite granodiorite. Late-phase granitic pegmatite and aplitic dikes are prominent in the plutons and in the country rocks. The Long Lake suite has a well constrained age range of between 190 and 180 Ma (Joyce et al., 2016).

Mesozoic-Cenozoic rocks

Middle Cretaceous to Eocene magmatic rocks are fairly common in the area. The northern part of the map area is underlain by numerous occurrences of well preserved mid-Cretaceous aphyric and feldspar-phyric andesite to dacite breccias, flows, and tuffaceous rocks of the Mount Nansen Group (unit mKN). Heterolithic quartz- and feldspar-phyric felsic lapilli tuff, and rare flow-banded quartz-phyric rhyolite are less abundant. The group has yielded U/Pb ages ranging between 110 and 105 Ma (N. Joyce, unpublished data, 2016; Klocking et al., 2016) making it comagmatic with the Whitehorse plutonic suite.

The middle Cretaceous Whitehorse plutonic suite is represented by two distinct phases in the map area. The voluminous Dawson Range phase (unit mKW2) dominates the north side of the map area, and is composed of white to beige, hornblende-biotite granodiorite and lesser granite, tonalite, quartz diorite, and diorite (108–105 Ma: Mortensen et al., 2003, 2016). It is characteristically blocky hornblende-phyric, medium to coarse grained, and weakly foliated to unfoliated. The southern side of the map area hosts the easternmost occurrences of the Maloney Creek phase (unit mKW1) of the Whitehorse suite, and comprises grey to beige biotite-hornblende monzogranite to granodiorite. It is medium to coarse grained, unfoliated, and is smoky quartz–bearing. The Maloney Creek phase has yielded U/Pb and Ar/Ar ages of ca. 105 Ma (W. McClelland, unpublished data, 2016; N. Joyce, unpublished data, 2016). A single small gabbroic intrusion on the north side of the Schist Creek complex yielded a U/Pb age of ca. 106 Ma, and as such is correlated with a distinct phase of the Whitehorse Suite (unit mKW3).

The Late Cretaceous Casino suite (unit LKC) is represented in the southeast part of the area by small scattered occurrences of porphyritic dacite to rhyolite. It is generally fine to medium grained; alkali-feldspar-, plagioclase-, biotite-, and quartz-porphyritic. It locally exhibits flow banding. The Casino suite typically ranges in age from ca.73 to 78 Ma (e.g. Bennett et al., 2010; Mortensen et al., 2016).

The Late Cretaceous Carmacks Group (unit uKC; ca. 70–69 Ma) is prevalent in the northern third of the map area. It comprises a mafic, flow-dominated upper sequence, and an intermediate to mafic volcanic and volcaniclastic lower sequence. The Carmacks group has a strong aeromagnetic expression.

The Paleogene Rhyolite Creek complex (unit ⱣRC1; ca. 59–56 Ma: N. Joyce, unpublished data, 2016; J. Crowley, unpublished data, 2015) occurs as small erosional remnants of felsic and intermediate volcanic and hypabyssal rocks sparsely dotted across the map area. The felsic rocks are predominant and comprise smoky quartz±feldspar porphyritic, and locally flow-banded tan to cream rhyolite to rhyodacite dykes, flows, sills, and crystal and ash tuff. North-trending dyke complexes are common as a subset (unit ⱣRC2).

The Ruby Range suite (unit ⱣR) is characterized by fine- to medium-grained, unfoliated light grey to pinkish biotite±hornblende granodiorite with typical smoky grey quartz, and is coeval with the Rhyolite Creek complex. Hypabyssal varieties of this suite dominate the Mount Pattison complex in the western part of the map area, where they exhibit common miarolitic cavities with vuggy grey quartz, and are transitional in composition with the Rhyolite Creek complex.

STRUCTURAL GEOLOGY

The structural geology of the map area is typical of the Yukon-Tanana terrane in western Yukon and is characterized by at least two phases of isoclinal folding and development of transposition foliation. The main foliation observed in these rocks developed at upper greenschist-amphibolite-facies conditions and may represent a second-generation fabric. This regionally pervasive foliation is present in Permian and older rocks, a younger weak to moderate foliation is developed in the Late Triassic Stikine suite, and a weak foliation in the Long Lakes suite. The dominant transposition foliation is itself deformed by less pervasive open F_3 and F_4 folds. The contrasts in deformation character among the Permian rocks, the Stikine Suite, and the Long Lake suite indicate that the main foliation in the Paleozoic rocks is pre-Late Triassic, and that the weak to moderate regional foliation in the Stikine suite (lacking in the Long Lake suite) formed in Late Triassic to Early Jurassic time. Similar to the neighbouring Mount Nansen–Nisling River area to the east (Ryan et al. 2016), the main Paleozoic foliation in the map area is dominantly northeast-trending, in significant obliquity to the main foliation across much of western Yukon, which is typically northwest-trending. We interpret this as a consequence of Mesozoic folding of the late Paleozoic fabric.

The complex interplay of northwest- and northeast-trending faults that are prevalent in the Mount Nansen–Nisling River area to the east (Ryan et al. 2016) and in the eastern half of the Klaza River area, give way to north- and north-northwest-trending faults that are more obvious in aeromagnetic data (*see* Fig. 1 on the map). These structures offset the margin of the Whitehorse plutonic suite, and may help control the distribution of the Paleogene Rhyolite Creek complex, preserved locally in grabens, indicating that these faults have Paleocene or younger offset.

The preservation of high-temperature tectonite fabric in the Schist Creek complex suggests that mantle and/or lower crust were juxtaposed with siliciclastic rocks of the Snowcap assemblage along a major detachment fault (cf. Canil et al., 2003). This detachment was likely reactivated as a thrust fault emplacing Schist Creek complex within, or on top of, the Snowcap assemblage during Permian to Jurassic deformation. The Schist Creek complex lies along a distinct lineament (greater than 100 km long) shown on the regional geology map, that offsets units as young as Carmacks Group. We interpret that this may reflect reactivation of a fundamental basement structure; however, poor bedrock expose along its trace precluded direct observation. Mississippian rocks like the Simpson Range suite and the Finlayson assemblage rocks have not been identified on the northwest side of this lineament in the area.

The boundary between the Snowcap assemblage and the Stevenson Ridge schist on the west side of the map is not exposed, and is masked by the Paleocene rocks. It is not clear if that boundary is structural or stratigraphic in nature.

MINERALIZATION

The main mineral occurrences in the Klaza River and surrounding area are porphyry to epithermal style that are concentrated around Mount Nansen (just off the eastern limit of the map area), and appear to be most strongly linked to the Late Cretaceous Casino suite (e.g. Klaza and Cyprus occurrences; *see* Hart and Langdon, 1998; Mortensen et al., 2016). A number of Casino suite plugs and hypabyssal intrusions are newly recognized in the southeast corner of the map suggesting further potential for mineralization. There are some very prominent gossan zones in the north central part of the map area, near the Bract Minfile occurrence (115J001, Table 1 on the map.). The gossans are associated with disseminated pyrite. They are hosted exclusively in volcanic rocks of the Mount Nansen Group, and appear to be associated with north-south-trending faults. These faults also appear to offset, at least in part, Late Cretaceous Carmacks Group, as well as Paleocene hypabyssal rocks, perhaps placing controls on the age of the faulting, and perhaps mineralization, as being Paleocene.

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Additional Information

The Additional Information folder of this product's digital download contains figures and tables that appear in the map surround as well as additional geological information not depicted on the map, nor this document, nor the geodatabase.
-PDF of each figure/table that appears in the CGM surround.

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Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 7
Horizontal Datum: NAD83
Vertical Datum: mean sea level

BOUNDING COORDINATES

Western longitude: 139°00’00”W
Eastern longitude: 137°30’00”W
Northern latitude: 62°22’00”N
Southern latitude: 62°00’00”N

SOFTWARE VERSION

Data has been originally compiled and formatted for use with ArcGIS™ desktop version 10.2.2 developed by ESRI®.

DATA MODEL INFORMATION

Bedrock

Geological Dataset accompanying this publication complies with the GSC’s Project Bedrock Schema (version 2.8). A document explaining the data model attributes and domains is available in …\Data\DataModelInfo.

Consult PDFs in Data folder for complete description of the feature classes, feature attributes, and attribute domains.

The Bedrock Data Model and the Bedrock Domains documents are intended to describe all bedrock features which may be compiled at the 1:50 000 scale. Therefore, some of the feature classes and feature attributes described in these documents may not be present.

The structure of the XML workspace is not completely consistent with that of shapefiles. For ease of use, shapefiles were exported from the original Bedrock Geodatabase by subtype.