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CANADA-NUNAVUT GEOSCIENCE OFFICE
OPEN FILE MAP 2023-04

BEDROCK GEOLOGY
DALY BAY AREA

Kivalliq, Nunavut
NTS 56-A, 46-D west, 46-E southwest, and 56-H south

Map Information Document

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CANADA-NUNAVUT GEOSCIENCE OFFICE
BUREAU GÉOSCIENTIFIQUE CANADA-NUNAVUT
KANATAMI-NUNAVUMI GEOSCIENCE TITIGAKVIIT

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Abstract

New geological mapping in the Tehery Lake–Wager Bay area of northwestern Hudson Bay, Nunavut, frames the emplacement, depositional, and metamorphic histories of the dominant rock types, major structures, and links to neighbouring areas of the central Rae Craton and Chesterfield Block. The area is divided into six domains (Ukkusiksalik, Douglas Harbour, and Gordon domains and Daly Bay Complex presented here, and Lunan and Kummel Lake domains on adjoining maps) defined by large-scale structures and characterized by differing metamorphic assemblages, Sm-Nd and U-Pb isotopic data, and/or specific lithologies. Meso- to Neoarchean granitoid rocks underlie most of the area and are tectonically intercalated with Archean (volcano)sedimentary packages (Kummel Lake, Lorillard, and Paliak belts). These rocks are locally intruded by ca. 2.62 to 2.58 Ga Snow Island suite granite and cut by younger, thin, east-trending diabase dykes. Paleoproterozoic (volcano)sedimentary rocks are preserved in the Kingmirit belt (Daly Bay Complex) and in basement-cover infolds of Ketyet River group-equivalent strata (Douglas Harbour and Ukkusiksalik domains). In the south, the Daly Bay Complex (comprising mostly mafic granulite-facies rocks) and Kummel Lake Domain (a granulite-grade core complex) share some characteristics with rocks of the Kramanituar and Uvauk complexes, which may delineate the northeastern segment of the ca. 1.90 Ga Snowbird tectonic zone. The Paleoproterozoic Trans-Hudson Orogeny had widespread, penetrative structural and metamorphic effects on the area, and led to the intrusion of the ca. 1.85 to 1.81 Ga Hudson suite monzogranite and mafic ultrapotassic rocks, and ca. 1.83 Ga monzodiorite in the Ukkusiksalik and Douglas Harbour domains. The area is cut by large, southeast-trending gabbro dykes of the 1.267 Ga Mackenzie igneous event.

Résumé

La nouvelle cartographie géologique dans la région du lac Tehery-baie Wager, au nord-ouest de la baie d'Hudson, au Nunavut, encadre l'histoire de la mise en place, du dépôt et du métamorphisme des types de roches dominants, les principales structures et les liens avec les régions avoisinantes de la partie centrale du craton de Rae et du bloc de Chesterfield. La région est divisée en six domaines (domaines d'Ukkusiksalik, de Douglas Harbour et de Gordon et complexe de Daly Bay présentés ici, et domaines de Lunan et de Kummel Lake sur les cartes adjacentes) définis par des structures à grande échelle et caractérisés par des assemblages métamorphiques, des données isotopiques Sm-Nd et U-Pb et/ou des lithologies spécifiques différents. Des roches granitoïdes du Mésoarchéen au Néoarchéen couvrent la majeure partie de la région et sont tectoniquement intercalées avec des assemblages (volcano)sédimentaires de l'Archéen (ceintures de Kummel Lake, de Lorillard et de Paliak). Ces roches sont localement injectées par des intrusions de granite de la suite de Snow Island datant d'environ 2,62 à 2,58 Ga et recoupées par des dykes de diabase plus jeunes, minces et de direction est. Des roches (volcano)sédimentaires du Paléoprotérozoïque sont conservées dans la ceinture de Kingmirit (complexe de Daly Bay) et dans des replis de socle-couverture de strates équivalentes au groupe de Ketyet River (domaines de Douglas Harbour et d'Ukkusiksalik). Au sud, le complexe de Daly Bay (composé principalement de roches mafiques du faciès des granulites) et le domaine de Kummel Lake (un complexe à noyau métamorphique du faciès des granulites) partagent certaines caractéristiques avec les roches des complexes de Kramanituar et d'Uvauk, qui pourraient délimiter le segment nord-est de la zone tectonique de Snowbird d'environ 1,90 Ga. L'orogenèse trans-

hudsonienne du Paléoprotérozoïque a eu des effets structuraux et métamorphiques étendus et pénétrants sur la région et a conduit à l'intrusion de monzogranite de la suite d'Hudson d'environ 1,85 à 1,81 Ga et de roches ultrapotassiques mafiques, ainsi que de monzodiorite d'environ 1,83 Ga dans les domaines d'Ukkusiksalik et de Douglas Harbour. La région est recoupée par de grands dykes de gabbro de direction sud-est, issus de l'événement igné de Mackenzie (1,267 Ga).

LICENCE AGREEMENT

ACCORD DE LICENCE

SHEET 1 OF 1, BEDROCK GEOLOGY

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Map projection Universal Transverse Mercator, zone 16
North American Datum 1983

Base map at the scale of 1:250 000 from Natural Resources Canada, with modifications
Elevations in metres above mean sea level

Shaded-relief image derived from the digital elevation model supplied by Natural Resources Canada
Illumination: azimuth 315°, altitude 45°, vertical factor 5x

Mean magnetic declination 2023,11°24′W, decreasing 19.6′ annually
Readings vary from 14°00′W in the NE corner to 8°51′W in the SW corner of the map.

This map is not to be used for navigational purposes.

Title photograph: Archean basement granodiorite gneiss (unit Ãggd) cut by Hudson pegmatite dyke (unit pPHm) in a boulder at the Hudson Bay coast, Nunavut (photo location 7). Photograph by H.M. Steenkamp. NRCan photo 2022-252

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Data may include additional observations not portrayed on this map. *See* map info document accompanying the downloaded data for more information about this publication.

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- Shear, generic, approximate
- Shear, thrust, approximate
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- Geolines - fault
- Geolines - overprint
- Geolines - unit construct line
- Geolines - contact
- Geolines - fold
- Geolines - trace
- Map Units - Overprints

Descriptive Notes

The Tehery-Wager mapping activity was a collaborative, multidisciplinary project led by the Canada-Nunavut Geoscience Office and the Geological Survey of Canada (GSC) through Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM-2) program, and was developed following a two-week reconnaissance survey led by the GSC in the area in 2012. Bedrock geology, surficial geology, lake- and stream-sediment sampling, and ground-gravity transects were conducted with thematic scientific contributions from researchers at the University of British Columbia Okanagan, Dalhousie University, Université du Québec à Montréal, Université Laval, and University of New Brunswick. The aim of this activity was to increase the level of geological knowledge across the area from Tehery Lake to Wager Bay, Nunavut (NTS 56-A, 56-B, and parts of 46-D, 46-E, 56-C, 56-F, 56-G, and 56-H), in addition to evaluating the potential for a variety of commodities including base and precious metals, industrial minerals, diamonds and other gemstones, carving stone, and aggregate deposits (Steenkamp et al., 2015, 2016; Wodicka et al., 2015, 2016, 2017a). The project also aimed to assist northerners by providing geoscience training to college students in the field and temporary employment to locals as camp attendants and wildlife monitors, producing topographic maps that feature traditional Inuktitut place names (Peplinski et al., 2017), and ensuring that new geoscience information is accessible for future land-use decisions.

The 1:150 000 scale bedrock mapping component of the Tehery-Wager activity included three field seasons (2015–2017) and used a helicopter-supported, targeted approach for traverse set-outs based on airborne geophysical data (Geological Survey of

Canada, 1978, 1998; Keating et al., 2003; Coyle and Kiss, 2012a–h), satellite imagery, and historical information from previous mapping campaigns. The first reconnaissance-level geological surveys of the study area were Operation Baker (Wright, 1955; Wright, 1967; Lord and Wright, 1967) and Operation Wager (Heywood, 1967a, b). More detailed geological assessments were later conducted in the Daly Bay area (Gordon and Heywood, 1987; Gordon, 1988; Hanmer and Williams, 2001) and along the coastline of Wager Bay (Henderson et al., 1986; Henderson and Broome, 1990; Henderson and Roddick, 1990, Henderson et al., 1991). Data from those campaigns were digitized and used to inform the geological interpretations across the Tehery Lake–Wager Bay area that are presented here. The geological interpretations also take into consideration the data and observations documented in previous geochronological (Henderson and Roddick, 1990; van Breemen et al., 2007; Therriault, 2019; Therriault et al., 2018, 2022), geophysical (Spratt et al., 2014; Tschirhart et al., 2016; Wodicka et al., 2017a), and geochemical (Peterson et al., 2002; Peterson et al., 2015; Steenkamp et al., 2015) studies that relate to the rock units found within this area.

GEOLOGICAL BACKGROUND

The Tehery Lake–Wager Bay area is situated in the central part of the Rae Craton, which is a major constituent piece of the western Churchill Province of Laurentia. The Rae Craton comprises largely Meso- to Neoarchean and Paleoproterozoic metaplutonic and metasedimentary rocks cut by Mesoproterozoic dykes. Greenschist- to amphibolite-facies meta(volcano)sedimentary rocks in the central part of the craton include the 2.74 to 2.68 Ga Woodburn Lake group (Zaleski et al., 2000; Pehrsson et al., 2013), 2.73 to 2.69 Ga Committee Bay belt (Skulski et al., 2003a, b; Sanborn-Barrie et al., 2014), and 2.97 Ga Prince Albert and ≥2.765 to 2.75 Ga Roche Bay belts (Wodicka et al., 2011; Corrigan et al., 2013, Richan et al., 2015). The Chesterfield Block to the south of the Rae Craton also comprises Archean greenstone belts, namely the 2.74 to 2.64 Ga Yathkyed, Angikuni, and MacQuoid belt segments, and the northern Rankin Inlet belt (Davis et al., 2006; Hanmer et al., 2006; Sandeman et al., 2006; Lawley et al., 2016; Acosta-Góngora et al., 2018a).

Much of the western Churchill Province is intruded by ca. 2.62 to 2.58 Ga feldspar-porphyritic granitoid rocks of the Snow Island suite, which also has lesser mafic and extrusive components (Peterson et al., 2015, in press). K-feldspar-porphyritic monzogranite with crystallization ages of 2.615 to 2.585 Ga have been identified in the Tehery Lake–Wager Bay area (van Breemen et al., 2007; Wodicka et al., 2017a), confirming the presence of Snow Island suite plutonism. Peterson et al. (in press) recently proposed that the Snow Island suite represents a unified, short-lived, northwest-verging continental arc, and suggested that the Tehery Lake–Wager Bay area south of the Chesterfield shear zone (CSZ), together with the Chesterfield Block and Snowbird Domain, may have formed part of a continental terrane that initially formed outboard of the Rae Craton and collided with an oceanic arc (Axis Lake gabbro of the Tantato Domain; Acosta-Góngora et al., 2018b) at ca. 2.62 Ga. At the peak time of Snow Island suite granite emplacement, i.e. at 2.605 Ga, the combined Tantato-Snowbird-Chesterfield-Tehery terrane collided with the proto-Rae block (Peterson et al., in press).

The Snow Island igneous event is interpreted to have had widespread thermotectonic effects that grew metamorphic zircon and monazite at ca. 2.62 to 2.60 Ga in the Uvauk Complex (Mills et al., 2007) just south of the Tehery Lake–Wager Bay area, and monazite at ca. 2.58 Ga in the Committee Bay belt (Berman et al., 2010). The Uvauk Complex also records subsequent tectonometamorphism at ca. 2.56 to 2.50 Ga (Mills et al., 2007) linked with the MacQuoid Orogeny (Berman, 2010), while the Committee Bay belt was locally affected by the ca. 2.35 Ga Arrowsmith Orogeny (Berman et al., 2010, 2013a). Furthermore, evidence for both the MacQuoid and Arrowsmith orogenies are recorded in supracrustal rocks on Southampton Island, east of the Tehery Lake–Wager Bay area (Berman et al., 2013b).

In central Nunavut, Paleoproterozoic metasedimentary rocks are distributed to the west of the Tehery Lake–Wager Bay area in the <1.96 Ga Amer and <2.00 Ga Ketyet River groups, to the northwest in the <2.19 Ga Montresor and <2.46 Ga Chantrey groups, and to the northeast in the <1.90 Ga Penrhyn group on Melville Peninsula (Hinchey et al., 2007; Rainbird et al., 2010; McEwan, 2012; Partin et al., 2014; Calhoun, 2017; Percival et al., 2017). Rocks preserved in basement-cover infolds in the northern part of the Tehery Lake–Wager Bay area are interpreted as correlative with the lower formations of the Ketyet River group (Panagapko et al., 2003; Ferderber et al., 2013). The base of the lower succession of the Ketyet River group comprises abundant quartz arenite, impure arenite, and greywacke and local shale interbedded with two massive to pillowed mafic volcanic flow sequences (Rainbird et al., 2010; McEwan, 2012). The structures and sedimentology of the siliciclastic rocks are interpreted to represent a lacustrine to fluvial depositional setting. The volcanic rocks near the base of the Ketyet River group display a geochemical signature typical of tholeiitic continental flood basalt and may be related to the ca. 2.19 Ga Tulemalu/MacQuoid dykes and ca. 2.15 Ga Schultz swarm further to the west and southwest (Tella et al., 1997; Kerswill et al., 1999; Pehrsson et al., 2002; Rainbird et al., 2010; McEwan, 2012).

The Paleoproterozoic cover sequence records the intense weathering of a stable yet subsiding supercontinent, *Kenorland*, partial rifting, and extension of the Rae Craton with supercontinent breakup, flooding and deepening of basins, and subsequent foreland basin development during the early amalgamation of Laurentia in the supercontinent *Nuna* at ca. 1.9 Ga (Rainbird et al., 2010). Amalgamation began with the collision of the composite Rae-Chesterfield and Hearne domains, and resulted in the Snowbird Orogeny (Berman et al., 2007; Martel et al., 2008; Thiessen et al., 2018). The Snowbird tectonic zone (Hoffman, 1988), a crustal-scale geophysical lineament characterized by shear zones, mylonitic fabrics, and a string of uplifted mafic granulite domains along the southeastern Rae Craton margin (e.g. Kramanituar (Sanborn-Barrie et al., 2001, 2019), Uvauk (Mills et al., 2007), and Daly Bay (Gordon, 1988; Hanmer and Williams, 2001) complexes, and Hanbury Island shear zone (Tella and Annesley, 1988), formed or was reactivated during the Snowbird Orogeny (e.g. Baldwin et al., 2006; Berman et al., 2007). As an example, Mills et al. (2007) constrained the ca. 2.71 Ga anorthosite–gabbro of the Uvauk Complex as being structurally emplaced over ca. 2.68 Ga tonalite gneiss to the south at ca. 2.56 to 2.50 Ga during the MacQuoid Orogeny, and subsequent high-pressure granulite-facies deformation and magmatism at ca. 1.9 Ga (Snowbird Orogeny) ended with rapid exhumation of the complex to shallower crustal levels.

Syn- to post-orogenic plutonism is ubiquitous across the Rae Craton owing to crustal thickening that occurred during the Paleoproterozoic Trans-Hudson Orogen (THO; Hoffman, 1988; Corrigan et al., 2009). Granitic plutons, sills, and dykes of the Hudson igneous suite cut the dominant regional fabrics and were emplaced at ca. 1.85 to 1.81 Ga at mid-crustal levels across the THO hinterland (van Breemen et al., 2005). These rocks are present across much of the western Churchill Province, but are highly concentrated west of Hudson Bay. Peterson et al. (2002) interpreted the Hudson igneous suite as syn-orogenic to early postorogenic intrusions derived from in situ melting of lower- to middle-crust wall rocks that contained garnet (giving low Y and HREE characteristics to the melts), and that migrated very short distances in the crust given their low thermal inertia and absence of equivalent extrusive rock types. Ultrapotassic lamprophyre and mafic syenite (Martell syenite), and the Dubawnt minette dykes and related volcanic rocks of the Dubawnt Supergroup (Gall et al., 1992) were produced synchronously with the Hudson igneous suite and have similar isotopic and trace element compositions (Peterson et al., 2002). In the Tehery Lake–Wager Bay area, several large plutons of Hudson monzogranite have been identified and confirmed with crystallization ages of ca. 1.843 to 1.808 Ga (Henderson and Roddick, 1990; Wodicka et al., 2017a; Therriault et al., 2018; Therriault, 2019). Similarly, the occurrence of ultrapotassic and minette rock types has been extended northeastward from the Baker Lake basin into the Tehery Lake–Wager Bay area (Steenkamp et al., 2015, 2016; Wodicka et al., 2015, 2016). Conversely, postorogenic rapakivi granite and its extrusive equivalents (Pitz Formation rhyolite) of the ca. 1.75 Ga Nueltin igneous suite are concentrated where post-THO extensional faulting and basin development is preserved (Peterson et al., 2002), and have therefore not been identified in the Tehery Lake–Wager Bay area.

The final addition of new rock material in the Tehery Lake–Wager Bay area was the emplacement of diabase (gabbro) dykes, including relatively small (1–5 m thick), undated, roughly east-trending porphyritic dykes and much larger (10–50 m wide), southeast-trending dykes that trace northwestward back to the source region for the 1.276 Ga Mackenzie dyke swarm (LeCheminant and Heaman, 1989).

GENERAL GEOLOGY, STRUCTURE, AND METAMORPHISM IN THE TEHERY LAKE–WAGER BAY AREA

The Tehery Lake–Wager Bay area can be broadly separated into six domains (Fig. 1 and 2; Ukkusiksalik, Douglas Harbour, and Gordon domains and Daly Bay Complex presented here, and Lunan and Kummel Lake domains on adjoining maps) that are delineated by large-scale structures and characterized by differing metamorphic assemblages, Sm-Nd isotopic and U-Pb data, and/or the presence/absence of specific lithologies. Sm-Nd isotopic data from 12 felsic metaplutonic rocks of van Breemen et al. (2007) and 34 new samples collected during the Tehery-Wager activity indicate that the central part of the study area south of the CSZ can be divided into two crustal domains based on Nd model ages (Wodicka et al., 2017a): the Gordon Domain to the east with 3.29 to 2.76 Ga Nd model ages, and Lunan Domain to the west characterized by generally younger 2.97 to 2.72 Ga Nd model ages. The Gordon Domain is also characterized by distinctly older plutonic rocks, including a granodiorite gneiss with a U-Pb Mesoarchean crystallization age of ca. 2860 Ma, in addition to Neoarchean plutonic rocks of ca. 2714 to 2676 and 2615 to 2602 Ma age, while Archean plutonic rocks within the Lunan Domain are only of Neoarchean age (ca. 2711 to 2699 and 2584 Ma) (Table 1[1]). A transition zone between the two domains (Fig. 1 and 2) includes both evolved and juvenile rocks with ca. 3.09 to 2.75 Ga Nd model ages, and the complexly deformed, upper amphibolite-facies ca. 2700 Ma Archean Lorillard supracrustal belt (Table 1). This zone also coincides with a north-south-trending lineament visible in the magnetic field and regional Bouguer gravity

[1] Table 1 contains a compilation of U-Pb data and Nd model ages (where applicable) from samples within the Tehery Lake–Wager Bay area and immediate vicinity. For more details on the age data cited in the text (e.g. dating method, age uncertainties, data sources, etc.), the reader is referred to this table.

data (Wodicka et al., 2017a), and is marked, at least in part, by numerous 1 to 5 metre wide, steeply dipping high-strain zones with local reverse-sense indicators and widespread, strongly developed foliation and mineral lineation fabrics in the field. The Gordon and Lunan domains have been broadly correlated to the north with the Mesoarchean Repulse Bay and Neoarchean Committee Bay blocks, respectively (Pehrsson et al., 2013; Spratt et al., 2014; Wodicka et al., 2017a, b), but the extrapolation of the transition zone north of the CSZ and precise connection to those blocks remain unknown owing to a lack of adequate isotopic data in that area and added complexity from structural offsets across the Chesterfield and Wager shear zones. Alternatively, it is possible that the Lunan and Gordon domains initially formed outboard of the proto-Rae Craton (Peterson et al., in press) and therefore have no counterparts in the Rae Craton north of the CSZ. In general, the composite Lunan-Lorillard-Gordon Domain preserves upper amphibolite- to granulite-facies metamorphic assemblages largely attributed to the THO, as well as common evidence of partial retrogression to moderate amphibolite-facies conditions.

The Chesterfield shear zone, which separates the upper amphibolite- to granulite-facies rocks of the Lunan-Lorillard-Gordon Domain in the hanging wall to the south from lower amphibolite-facies rocks of the Douglas Harbour Domain in the footwall to the north (Fig. 1 and 2), is characterized by strongly deformed to mylonitic rocks that dip either steeply to the north-northwest or moderately to steeply to the south-southeast at surface (Steenkamp et al., 2016; Wodicka et al., 2016). By contrast, magnetotelluric, gravity, and magnetic data consistently indicate that the CSZ forms a south-dipping structure at depth (Spratt et al., 2014; Tschirhart et al., 2016). The trace of the CSZ can be loosely followed in magnetic anomaly patterns from the north side of Baker Lake to the southern shore of Wager Bay. Where porphyritic rocks of the Snow Island suite are present along the CSZ, they develop a characteristic augen texture.

The Douglas Harbour Domain (Fig. 1 and 2) preserves the lowest grade metamorphic assemblages (lower to moderate amphibolite-facies) and is therefore interpreted as preserving the structurally highest crustal level of the THO in the Tehery Lake–Wager Bay area. Thick-skinned thrust sheets preserve stacked repetitions of basement gneiss and supracrustal rocks, which are interpreted as correlative with the lower stratigraphy of the Ketyet River group (Panagapko et al., 2003; Ferderber et al., 2013). U-Pb crystallization ages of Archean basement gneiss and plutonic rocks within the Douglas Harbour Domain range in age from ca. 2904 to 2608 Ma (Table 1).

The Douglas Harbour Domain is bounded to the north by the Wager shear zone (WSZ; Fig. 1 and 2), a major dextral strike-slip shear zone with mylonitic fabrics (Fig. 3) and sub-horizontal mineral lineations that run east to west (Henderson et al., 1986; Henderson and Broome, 1990; Henderson and Roddick, 1990, Henderson et al., 1991; Therriault et al., 2017; Therriault, 2019). Based on magnetic survey data, the western end of the WSZ bends to the northwest and merges with the Amer mylonite zone through a right-lateral extensional step-over (Therriault, 2019). A secondary splay also splits off the WSZ to the southwest and becomes the Quoich River fault (Panagapko et al., 2003). Recent field and geochronological work has led to the identification of a number of plutonic intrusions with ca. 1840 to 1822 Ma crystallization ages that locally cut pre-existing fabrics along the WSZ, and provide evidence of high-temperature ductile deformation in the WSZ that was active as late as ca. 1754 to 1738 Ma (Table 1). The youngest movement along the WSZ is coeval with dextral strike-slip movement along the Amer mylonite zone to the west and widespread post-orogenic plutonism (Kivalliq igneous suite; Therriault, 2019; Therriault et al., 2022).

Rocks of the Ukkusiksalik Domain north of the WSZ (Fig. 1 and 2) contain lithologies similar to those of the Douglas Harbour Domain, including supracrustal rocks of probable Archean age (Paliak belt; Henderson et al., 1986; Jefferson et al., 1991) and of Paleoproterozoic age (lower Ketyet River group-equivalent). Archean basement rocks have been dated at only two localities, at ca. 2707 and 2606 Ma (Table 1). Unlike elsewhere in the Tehery Lake–Wager Bay area, pelitic rocks in the Ukkusiksalik Domain preserve rare, relict high-pressure metamorphic mineral assemblages (kyanite-bearing) that are overprinted by lower-pressure, high-temperature assemblages (sillimanite- and cordierite-bearing), which are common in the Gordon and Lunan domains (H. Steenkamp, work in progress).

The southern part of the Tehery Lake–Wager Bay area preserves two large granulite domains: the Kummel Lake Domain and the Daly Bay Complex (Fig. 1 and 2). The Kummel Lake Domain comprises mostly Archean granodiorite to monzogranite basement gneiss with a greasy green colour, abundant in situ leucosome and magnetite (creating a widespread strongly magnetic anomaly), and local orthopyroxene, including in leucosome (Steenkamp et al., 2016; Wodicka et al., 2016). Preliminary unconstrained 3D inversions of the regional gravity data across this area show the Kummel Lake Domain as a dense body that dips shallowly to the north, below the Lunan-Lorillard-Gordon Domain (Wodicka et al., 2017a). A strong magnetic anomaly defines the surface expression of the northern margin of the Kummel Lake Domain (Fig. 2), which, where mapped, corresponds to an outward-dipping, greenschist-facies fault. The fault geometry, combined with the subsurface geometry of the domain and metamorphic contrast across the domain boundary, suggest that the Kummel Lake Domain has been exhumed as a metamorphic core complex. It is possible that the Kummel Lake Domain shares aspects of the tectonometamorphic histories of the mafic granulite complexes along the Snowbird tectonic zone, but more data are required to test this.

The Daly Bay Complex is a Paleoproterozoic, dominantly mafic granulite domain that is juxtaposed alongside Archean basement orthogneiss via mylonitic shear zones and later, brittle normal faults. It is dominated by pyroxene-plagioclase tonalitic igneous phases with lesser anorthosite to gabbro intrusions, and garnet leucogranite derived from a largely pelitic sedimentary protolith (Gordon, 1988; Hanmer and Williams, 2001). In contrast to the Kummel Lake Domain, the Daly Bay Complex has been modeled as having inward-dipping sheared margins and is interpreted as having been tectonically emplaced over amphibolite-facies basement orthogneiss of the Gordon Domain by northward-directed thrusting (Gordon and Lawton, 1995).

While evidence of early (ca. 2.7, 2.6, 2.55, and 1.95–1.90 Ga) tectonometamorphic events are becoming increasingly recognized with ongoing research (H. Steenkamp, work in progress; N. Wodicka, work in progress), the entire Tehery Lake–Wager Bay area has been penetratively overprinted by the intensely pervasive ca. 1.88 to 1.81 Ga THO, which involved the closure of the Manikewan ocean and culminated with the subduction of the Superior Craton from the south below the crustal collage that makes up the western Churchill Province (e.g. Hoffman, 1988; Corrigan et al., 2009). The THO has forced the transposition of many pre-existing fabrics and the development of new fabrics and structures. Early folds (F_1; timing unknown) are refolded by the dominant northeast- or southwest-trending F_2 folds thought to have developed through progressive northwestward compression of the THO. Most F_2 folds plunge shallowly to moderately to the northeast. The pervasive regional deformation at this time also produced the predominant L_2 mineral lineations, and S_2 foliation fabrics and gneissosity. Both the WSZ and CSZ may have initially formed during the Archean (e.g. Peterson et al., in press), but were reactivated during (and after for the WSZ) the THO based on geochronological and metamorphic data (Henderson and Roddick, 1990; Therriault, 2019; Therriault et al., 2018, 2022; H. Steenkamp, work in progress). A later compressional event created broad, northwest- or southeast-trending open folds (F_3) that, with interference over F_2 folds, created Type 1 refolds (Grasemann et al., 2004) resulting in canoe- and donut-shaped map patterns.

GEOLOGICAL UNITS

Archean orthogneiss (units At, Agd, Aggd, Amg)

The basement gneiss across the Gordon, Lunan, Douglas Harbour, and Ukkusiksalik domains is predominantly medium-grained biotite±hornblende±magnetite±muscovite granodiorite (unit Agd). Lesser biotite±hornblende±epidote tonalite (unit At) typically occurs as magnetic lows at the cores of antiformal domes and locally contains thin sheets of supracrustal rocks separating it from other basement rocks. The gneissic to migmatitic Agd and At units contain medium- to coarse-grained, injected or locally derived monzogranite veins that have been transposed parallel to the regional foliation fabric (S_2). Pods, bands, and lenses of intermediate to mafic rock (e.g. units Agab, Aamph) are locally present and generally similarly deformed (Fig. 4). These rocks may represent older plutonic or volcanic phases, transposed and boudinaged dykes, or intrusions that postdate the emplacement of the basement granodiorite and tonalite; however, in many places, strong overprinting renders identification of the intermediate to mafic protoliths difficult. In the Gordon Domain, an area along the southern coast of Wager Bay (NTS sheets 46-E and 56-H) comprises biotite+magnetite±hornblende granodiorite to monzogranite with local occurrences of orthopyroxene (unit Aggd; Fig. 5), indicating the area underwent granulite-facies metamorphism (e.g. Derome, 1988). Biotite±hornblende±magnetite monzogranite plutons and sheets (unit Amg) are intercalated with the unit Agd granodiorite across much of the area and generate moderate magnetic anomalies. Although this unit is predominantly monzogranite, it locally varies compositionally from syenite to syenogranite, and texturally from homogeneous and medium-grained, to more gneissic and coarse-grained, to K-feldspar megacrystic. In a few localities south of the CSZ, preserved contact relationships suggest that unit Amg monzogranite intrudes supracrustal rocks of the Lorillard supracrustal belt (unit ALsp). Unit At tonalite and unit Agd granodiorite samples across the area yield U-Pb ages of ca. 2904 to 2903, 2860, and 2714 to 2676 Ma (Table 1), indicating variability in basement orthogneiss-protolith crystallization histories (van Breemen et al., 2007; Wodicka et al., 2017a, b). An orthopyroxene-bearing monzogranite sample from the Aggd unit yielded a poorly constrained crystallization age of ca. <2720 to >2703 Ma, while a few dated unit Amg monzogranite plutons give uniform ages of ca. 2699 to 2689 Ma (Table 1).

Archean Kummel Lake Domain (units AKLggd, AKLgmg, AKLsp, AKLan)

The Kummel Lake Domain is underlain predominantly by granulite-grade granodiorite (unit AKLggd) and monzogranite (unit AKLgmg) that are characterized as having a greasy green overall colour, abundant magnetite and in situ melt leucosome, migmatitic textures, and the local presence of orthopyroxene (including in leucosome). It also preserves discontinuous, folded panels of supracrustal rocks, termed the Kummel Lake belt (unit AKLsp), that correspond to magnetic-low anomalies (Fig. 2) in the otherwise strongly magnetic, granulite-facies basement rocks (units AKLggd, AKLgmg). The Kummel Lake belt (unit AKLsp) comprises garnet±clinopyroxene amphibolite, garnet-biotite semipelite–pelite with abundant leucosome, and lesser silicate-facies iron-formation. A garnet-biotite semipelite sampled from the Kummel Lake belt yielded a maximum depositional age of ca. 2725 to 2670 Ma, and contains evidence of metamorphism at about 2612 to 2570 Ma, 2554 to 2505 Ma, and 1840 Ma (Table 1). Gabbroic anorthosite (unit AKLan) is locally associated with the supracrustal rocks in the Kummel Lake Domain. Unit AKLggd granodiorite and unit AKLan leucogabbro yield preliminary crystallization ages of ca. 2711 and 2696 Ma, respectively (Table 1). Supracrustal rocks and ca. 2.71 Ga gabbroic anorthosite in and around the Uvauk Complex to the south of NTS sheet 56-C (Tella, 1993; Tella and Schau, 1994; Mills et al., 2007), as well as the granulite suite of Tella et al. (1993; unit Agrn) present to the south of NTS sheet 56-B (described as quartzofeldspathic granulite interlayered with minor mafic granulite, paragneiss, granitic gneiss, anorthosite, and anorthositic gabbro), appear to continue into the Kummel Lake Domain, although extrapolation of structural features and lithological boundaries require more focused work to confirm this.

Archean Lorillard belt (units ALsp, ALif)

Supracrustal rocks belonging to the Lorillard belt (unit ALsp) lie primarily within the transition zone that separates the Gordon and Lunan domains south of the CSZ (Fig. 1 and 2; Wodicka et al., 2017a, b). These rocks occur as discontinuous panels and layers surrounded by monzogranite (unit Amg) sheets/injections and granodiorite (unit Agd) basement gneiss, and comprise varying combinations and abundances of sillimanite quartzite, garnet-biotite±cordierite semipelite–pelite, mafic (amphibolite) to intermediate rocks of probable volcanic origin, biotite psammite, garnetite, iron-formation (including unit ALif), and lesser calc-silicate and marble. Metamorphosed gabbro and peridotite are common within the Lorillard belt acting as relatively rigid and commonly boudinaged layers without pervasive internal fabrics. Complete lithological descriptions are presented in Steenkamp et al. (2015, 2016). A U-Pb crystallization age of ca. 2700 Ma has been obtained for an intermediate rock with basaltic andesite geochemistry, while quartzite to psammite samples record U-Pb zircon maximum-depositional ages of ca. 2705 to 2650 Ma (Table 1). Some of the dated supracrustal rocks contain metamorphic zircon or monazite overgrowths and grains at ca. <2700, >2580, 1943, and 1879 to 1857 Ma (Table 1; H. Steenkamp, work in progress). It is unclear whether the Lorillard belt rocks are genetically related to supracrustal rocks in the Kummel Lake Domain (unit AKLsp) or Paliak supracrustal belt (unit APsp); however, based on their geographic positions and interpreted peak metamorphic mineral assemblages, these three packages of rocks are interpreted to have different tectonometamorphic histories.

Archean Paliak belt (unit APsp)

Supracrustal rocks intercalated with basement orthogneiss (units Agd and Amg) and exposed north of the CSZ within both the Douglas Harbour and Ukkusiksalik domains are termed the Paliak belt (unit APsp; Henderson et al., 1986; Jefferson et al., 1991). These rocks include garnet-biotite±sillimanite±cordierite semipelite to pelite, garnet±clinopyroxene amphibolite, white quartzite, and lesser peridotite and iron-formation. Semipelite is locally gossanous, and both the semipelite and amphibolite have garnet porphyroblasts up to 3 to 4 cm wide. The iron-formation is silicate facies with layers of quartz, garnet, magnetite, and grunerite amphibole. The quartzite commonly contains sillimanite and is only a few metres thick. Distinction between the Paliak belt (unit APsp) and the Paleoproterozoic supracrustal rocks (unit pPsp) is not always straightforward, particularly at the scale of mapping, and it is possible that some of the unit APsp panels identified on the map also contain unit pPsp rocks, or vice versa. However, a key characteristic that helps to distinguish these two units is how highly deformed and intercalated the Paliak belt rocks are with the basement orthogneiss (units Agd and Amg). The Paliak belt also contains similar lithologies compared to the Lorillard belt (unit ALsp), but has slightly lower grade metamorphic-mineral assemblages and a considerably lower abundance of mafic lithologies (Panagapko et al., 2003). A sample of garnet-biotite-sillimanite pelite from an exposure of Paliak rocks (unit APsp) that is surrounded by Paleoproterozoic supracrustal rocks (unit pPsp) yielded a maximum depositional age of ca. 2695 to 2660 Ma and contains metamorphic zircon overgrowths dated at ca. 1872 Ma (Table 1).

Archean igneous rocks (units Aamph, Agab, ASIs)

Intermediate and mafic igneous rocks are relatively common across the Tehery Lake–Wager Bay area; most are present as pods, layers, and lenses in basement orthogneiss and supracrustal rocks. However, most occurrences are too small for representation at the current map scale. Unit Aamph encompasses a suite of rock types including intermediate compositions, such as diorite, through more mafic compositions, such as amphibolite. In general, these rocks are medium to coarse grained and commonly contain metamorphic garnet, magnetite, and local biotite. Portable X-ray fluorescence data collected in the field indicate that most intermediate to mafic rocks have variably metasomatized andesitic to basaltic compositions with several subpopulations having chemical characteristics that suggest derivation from either primitive and mantle-like sources or more evolved sources (Lawley et al., 2015; Steenkamp et al., 2015).

Unit Agab represents isolated bodies of coarse-grained gabbro that occur in basement orthogneiss and are only locally deformed at their margins or strongly deformed throughout to produce augen textures, depending on the local strain intensity. Undeformed gabbro comprises cumulate orthopyroxene-clinopyroxene with interstitial plagioclase overprinted by coronitic growth of amphibole, garnet, and local biotite (Fig. 6).

Megacrystic K-feldspar monzogranite to monzonite (unit ASIs), correlative to the ca. 2.6 Ga Snow Island suite (Peterson et al., 2015; in press), occurs as large plutons and smaller sheets intercalated with basement orthogneiss within the Lunan, Gordon, Douglas Harbour, and Ukkusiksalik domains, inside the Gordon-Lunan transition zone, and along the CSZ. Internally, the plutons contain round K-feldspar grains up to 5 cm wide, locally with white plagioclase rims constituting pseudo-rapakivi texture, in a matrix of plagioclase, quartz, and biotite (Fig. 7). Positive magnetic anomalies within the plutons correlate with dioritic and gabbroic phases that contain plagioclase phenocrysts. The compositional variability is believed to be due to magma mixing of mafic and felsic igneous phases (Steenkamp et al., 2015). The plutons are characterized as having strongly sheared to mylonitic outer margins that extend into the underlying granodiorite gneiss, resulting in porphyroclastic K-feldspar and metamorphic amphibole, biotite, and elongate garnet growth parallel to the shear direction. Geophysical modelling of the prominent Borden complex in NTS 56-A, combined with field observations and U-Pb age data, suggest that the southern body represents a thin slice of Snow Island suite porphyry

(~800 m of structural thickness) that was displaced from the roof of the northern Borden body and transported south along a flat-lying shear zone (Peterson et al., in press). The smaller unit ASls sheets that are intercalated with basement orthogneiss commonly display pale pink K-feldspar augen set in a fine-grained, dark grey matrix and local pinhead garnet porphyroblasts. U-Pb zircon age determinations for variably deformed unit ASls plutonic rocks of felsic to mafic composition across the Tehery Lake–Wager Bay area range between ca. 2615 and 2584 Ma (Table 1).

Paleoproterozoic supracrustal rocks (units pPsp, pPq)

North of the CSZ in the Douglas Harbour and Ukkusiksalik domains are supracrustal rocks (unit pPsp) dominated by white quartzite, biotite psammite, and lesser biotite±garnet±sillimanite±muscovite semipelite and amphibolite that are relatively less deformed than any of the Archean supracrustal packages. These rocks, interpreted to be correlative with the lower stratigraphy of the Paleoproterozoic Ketyet River group, are primarily exposed in imbricated thick-skinned thrust sheets preserved in moderately to shallowly doubly plunging synformal structures (intersecting F_2 and F_3 folds), with the base of each thrust layer comprising Archean granodiorite (unit Agd) or monzogranite (unit Amg) basement. Mylonite zones several metres in thickness are present both above and below the thrust planes, which are generally concordant with S_2 mineral foliations and lithologic contact orientations. The white quartzite (unit pPq) is locally up to 170 m thick and contains sillimanite and muscovite. Thick biotite psammite layers are concentrated in the central and eastern exposures of unit pPsp, and locally contain a gneissic texture with thin leucocratic layers. The semipelite is locally gossanous and commonly associated with amphibolite, which contains clinopyroxene and rare garnet. Detrital zircon U-Pb age analysis of unit pPq quartzite and unit pPsp psammite and semipelite illustrates the predominant local sourcing of sediment with prominent ca. 2.72 to 2.67 Ga age peaks (Table 1).

Paleoproterozoic Daly Bay Complex (units ApPDBgd, pPDBpg, pPDBgl, pPDBgb, pPDBpgs, pPDBla, pPDBan, pPDBsp, pPDBq)

Previously restricted to rocks metamorphosed at granulite-facies conditions (Gordon, 1988), the Daly Bay Complex is herein more broadly defined to contain both the inner granulite-facies rocks and the surrounding, concentrically oriented belt of strongly foliated to mylonitic lower-grade rocks (i.e. roughly corresponding to the outer shear zone of Gordon, 1988). This new definition is consistent with the tentative correlation between amphibolite units within the 'outer shear zone' and granulite-facies mafic rocks south of the high-strain zone (W. Garrison, unpub. B.Sc. research project, 2016). The interior of the complex is dominated by orthopyroxene-clinopyroxene tonalite (pyroxene granulite of Gordon, 1988; unit pPDBpg; Fig. 8) that, based on field relationships, appears to be the oldest igneous phase in the complex (Gordon, 1988; Gordon and Lawton, 1995). This unit is injected with orthopyroxene(-clinopyroxene) tonalite–diorite–gabbro layers that both cut the predominant fabric of the tonalite and are transposed with that fabric. One of these layers, an orthopyroxene tonalite, yielded a crystallization age of ca. 1918 Ma (Table 1). The interior part of the complex also hosts relatively older, white-weathering garnet±sillimanite±biotite leucogranite (unit pPDBgl) that contains remnant pelitic gneiss enclaves, and younger gabbroic plutons (unit pPDBgb) that cut the fabric of the surrounding orthopyroxene-clinopyroxene tonalite and leucogranite. The core of the complex is mantled by more orthopyroxene-clinopyroxene tonalite and lesser leucogranite that have been more intensely deformed and locally sheared (unit pPDBpgs). Migmatitic granodiorite–granite (unit ApPDBgd) around Bernheimer Bay is thought to represent annealed mylonite units of Archean basement orthogneiss (units Agd, Amg) that may have facilitated some tectonic shuffling inside the complex (Hanmer and Williams, 2001), but this theory has not yet been tested. The inner mantle area also contains plutons of layered gabbroic anorthosite (unit pPDBla) and anorthosite (unit pPDBan) with a U-Pb zircon crystallization age of ca. 1908 Ma and U-Pb titanite cooling age of ca. 1902 Ma (Table 1), as well as supracrustal panels (unit pPDBsp) comprising psammite-semipelite schist and gneiss, orthoquartzite (unit pPDBq where thick enough for representation at this map scale), and local marble. A similar assemblage of supracrustal rocks (Kingmirit belt of Wodicka et al., 2017a) occurs in discontinuous panels in the footwall of the outer extensional fault around the complex, but retains only greenschist- to lower amphibolite-facies metamorphic minerals and relatively finer-grained textures (i.e. psammite-semipelite phyllite; W. Garrison, unpub. B.Sc. research project, 2016). A sample of semipelite collected from one of the Kingmirit belt panels gave a maximum depositional age of ca. 1975 Ma (Table 1), and it is currently assumed that the supracrustal rocks inside the complex share a depositional history with those at its margin.

It is unclear how and when the presumed Paleoproterozoic supracrustal rocks (unit pPDBsp) that appear to host the igneous phases of the Daly Bay Complex came to be buried. However, based on the above relationships and ages, heat from the magmatic emplacement of the mantle-derived orthopyroxene-clinopyroxene tonalite (units pPDBpg and pPDBpgs) contributed to localized granulite-facies metamorphism, and consequently melted the supracrustal wall-rocks. Later, orthopyroxene-bearing tonalite–diorite–gabbro injections and anorthositic rocks were emplaced syn-kinematically during the formation of the dominant fabric in the complex (Hanmer and Williams, 2001). This deformation event shortened the complex through north-verging compression (Gordon and Lawton, 1995) and produced internal folding and dislocation of the complex into two components, possibly with the migmatitic rocks around Bernheimer Bay facilitating some of that movement (Hanmer and Williams, 2001). Exactly how the Daly Bay Complex was uplifted and exposed from the middle to lower crust remains to be determined; however, there are likely some similarities to the rapid exhumation processes that affected the Kramanituar and Uvauk complexes (Sanborn-Barrie et al., 2001; Mills et al., 2007) related to the Snowbird Orogeny (e.g. Berman et al., 2007; Martel et al., 2008; Regis et al., 2019; Card et al., 2021).

Paleoproterozoic igneous rocks (units pPHm, pPmd, pPup, pPdb)

Monzogranite to monzonite plutons, sills, and dykes (unit pPHm) are interpreted to be related to the ca. 1.85 to 1.81 Ga Hudson igneous suite (Peterson et al., 2002). The pluton phases are generally homogeneous, medium to coarse grained, and monzogranitic to syenogranitic with minor biotite and magnetite. Xenolith blocks and enclaves comprising basement orthogneiss and supracrustal rocks are locally present near the pluton margins. A weak, outcrop-scale foliation is present in some plutons as preferred exfoliation-weathering planes and biotite alignment. Sills tend to have a slightly more K-feldspar-rich composition, such as syenogranite to monzonite, and locally contain fluorite. Ubiquitous, randomly oriented granitic dykes are the youngest phase of the suite as they are undeformed and cut through all rock units except the Mackenzie dykes. Dated unit pPHm plutons and sills across the Tehery Lake–Wager Bay area yielded U-Pb ages ranging from ca. 1843 to 1808 Ma (Table 1). The Ford Lake batholith, the southern portion of which is exposed in NTS 56-G, gave ages (ca. 1826–1823 Ma; Table 1; LeCheminant et al., 1987) similar to other Hudson suite rocks, but is petrographically unique given the presence of coarse, locally porphyritic textures and higher abundance of mafic minerals (T. Peterson, work in progress).

The Wager pluton (Wodicka et al., 2017a) comprises biotite+magnetite±hornblende monzodiorite (unit pPmd) that intrudes basement gneiss of the Ukkusiksalik Domain and the western segment of the WSZ. It becomes increasingly abundant westward where the WSZ is thought to connect to the Amer mylonite zone via a right-lateral extensional step-over (west of the study area; Therriault, 2019). The monzodiorite is generally undeformed, medium grained, and contains distinctive grey translucent plagioclase crystals with white opaque rims. It is associated with a strong magnetic signal, contains deformed inclusions of granodiorite gneiss and supracrustal rocks, cuts the fabric of the basement orthogneiss units in these areas, and is cut by late, pervasive monzogranitic pegmatite dykes attributed to the Hudson igneous suite. A sample of monzodiorite-granodiorite yielded a U-Pb crystallization age of ca. 1833 Ma (Table 1), within the age range of the Hudson suite.

Medium- to coarse-grained, homogeneous plutons with ultrapotassic compositions (unit pPup) comprise varying proportions of phlogopite clinopyroxenite, biotite-pyroxene syenite, clinopyroxene melasyenite, leucosyenite, and rare biotite+clinopyroxene+olivine lamprophyre. The more mafic phases occur as rafts that are partly resorbed, and net-veined complexes are common along the margins of large intrusions (Steenkamp et al., 2015). Ultrapotassic plugs of varying sizes are scattered across the Lunan Domain, in the southern portion of the transition zone between the Gordon and Lunan domains, and north of the CSZ. Some plugs are associated with small intrusions of syenogranite (unit pPHm), for example in the cores of doubly plunging fold structures, while all bodies are cut by coarse-grained to pegmatitic monzogranite dykes (unit pPHm). All ultrapotassic intrusions produce strong magnetic signatures. The pPup unit has been dated at two localities, including within the large Armit Lake intrusion in the southern part of NTS 56-B, giving ages of ca. 1827 to 1825 Ma (Table 1). It is believed to be correlative with, and represent the deeper crustal equivalent of (at least south of the CSZ; Wodicka et al., 2015), the Martell syenite suite (Peterson et al., 2002).

Diabase dykes (unit pPdb) that trend roughly east-west are 1 to 5 m wide, weather dark brown, and dominantly contain plagioclase phenocrysts in a dark grey, aphanitic matrix. Gabbroic compositions and homogeneous, fine-grained textures are locally present where the dykes are widest. Although they have not been dated, it is possible that these dykes are related to the ca. 2.19 Ga Tulemalu/MacQuoid dyke swarm south and southwest of Chesterfield Inlet (Tella et al., 1997), the undated Thelon River dyke swarm (Buchan and Ernst, 2004; Wodicka et al., 2016; Jefferson et al., in press) exposed along strike to the west of the Tehery Lake–Wager Bay area, or the ca. 1700 Ma (Bleeker et al., 2011) east- and east-northeast-striking Pelly Bay dyke swarm identified on the mainland south of Boothia Peninsula (Ryan et al., 2009).

Mesoproterozoic dykes (unit mPM)

Diabase to gabbro dykes (unit mPM) of the ca. 1276 Ma Mackenzie igneous event (LeCheminant and Heaman, 1989) cut through all older rock units and trend to the southeast. They are generally medium to coarse grained, homogeneous, 10 to 50 m wide, and weather dark brown.

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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(s) of each figure that appears in the CGM surround.
-PDF of Table 1 that do not appear in the CGM surround

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Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 16
Horizontal Datum: NAD83
Vertical Datum: mean sea level

Bounding Coordinates

Western longitude: 90°00'00"W
Eastern longitude: 86°45'00"W
Northern latitude: 65°30'00"N
Southern latitude: 64°00'00"N

Software Version

Data has been originally compiled and formatted for use with ArcGIS™ desktop version 10.8.2 developed by ESRI®.

Data Model Information

Bedrock

Based on a data-centric approach, the GSC Bedrock Model was designed using the ESRI ArcGIS® environment. The model architecture is almost entirely tailored to the proprietary functionalities of the ESRI® File Geodatabase such as *SubTypes*, *Domain Values* and *Relationship Classes*.

Consult PDFs in Data folder for complete description of the model with its feature classes, tables, attributes, and domain values.

Note: the PDF document is not intended to describe the entire GSC Bedrock Model, but it provides a complete and detailed description of a subset of the model representing the published dataset.

For a more in depth description of the data model please refer to the official publication:

Brouillette, P., Girard, É., and Huot-Vézina, G., 2019. Geological Survey of Canada Bedrock Data Model and tools: design and user guide documentation including ArcGIS(TM) add-ins; Geological Survey of Canada, Open File 8247, 129 p, 1 .zip file. https://doi.org/10.4095/314673