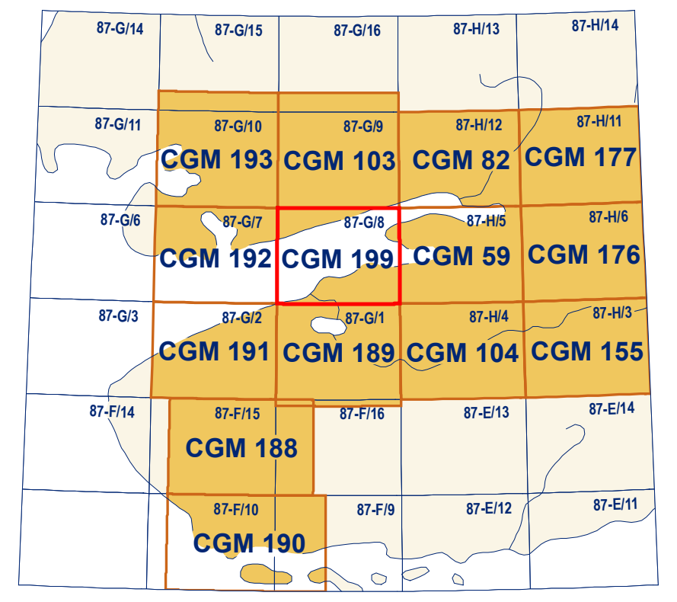
Abstract

NTS 87-G/08 (Iglulik) straddles Minto Inlet. On the north shore, massive to bedded carbonates of the Boot Inlet and Jago Bay formations, quartz rich sandstone of the Fort Collinson Formation, and evaporites of the Minto Inlet Formation (Neoproterozoic Shaler Supergroup) host Type 1 and feldspar-porphyritic Type 2 sills. To the east, the Iglulik Peninsula is underlain by rocks of the Minto Inlet Formation and limestones and shales of the lower Wynniatt Formation. Minto Inlet strata host Type 1 sills. The southern shore of Minto Inlet is underlain by the upper carbonate members of the Wynniatt Formation into which were intruded Type 1 and 2 sills. A thin cap of Paleozoic clastic and carbonate rocks overlies an erosional unconformity on a hilltop. Toward the south, sparse exposures of Lower Kilian Formation carbonates and evaporites host Type 2 sills. All Proterozoic strata dip shallowly to the south, marking the transition from the Walker Bay Anticline to the Holman Island Syncline. North-northwest trending synmagmatic normal faults are exposed locally. East-northeast-trending post-Proterozoic normal faults locally show north-side down motions and repeat contacts.

Résumé

Le feuillet 87-G/8 (Iglulik) du SNRC chevauche l'inlet Minto. Sur la rive nord, des roches carbonatées massives ou stratifiées des formations de Boot Inlet et de Jago Bay, des grès quartzeux de la Formation de Fort Collinson et des roches évaporitiques de la Formation de Minto Inlet (Supergroupe de Shaler du Néoprotérozoïque) encaissent des filons-couches de type 1 et des filons-couches porphyriques à feldspath de type 2. À l'est, le sous-sol de la péninsule Iglulik est constitué de roches de la Formation de Minto Inlet ainsi que de calcaires et de shales de la Formation de Wynniatt inférieure. Les strates de la Formation de Minto Inlet encaissent des filons-couches de type 1. Le sous-sol de la rive sud de l'inlet Minto renferme les membres supérieurs de roches carbonatées de la Formation de Wynniatt, qui sont injectés de filons-couches des types 1 et 2. Au sommet d'une colline, une mince couronne de roches détritiques et de roches carbonatées du Paléozoïque surmonte une discordance d'érosion. Vers le sud, des affleurements épars de roches carbonatées et de roches évaporitiques de la Formation de Kilian inférieure encaissent des filons de type 2. Toutes les strates du Protérozoïque sont faiblement inclinées vers le sud et assurent le passage de l'anticlinal de Walker Bay au synclinal de Holman Island. Des failles normales synmagmatiques de direction nord–nord-ouest affleurent par endroits. Les failles normales postprotérozoïques de direction est–nord-est montrent par endroits un déplacement inverse et répètent des contacts.



National Topographic System reference and index to adjoining published Geological Survey of Canada maps

Cover illustration
Looking north at Iglulik Peninsula. Minto Inlet and Wynniatt Formations cut by thin sills, Victoria Island, Northwest Territories. Photograph by R.H. Rainbird.
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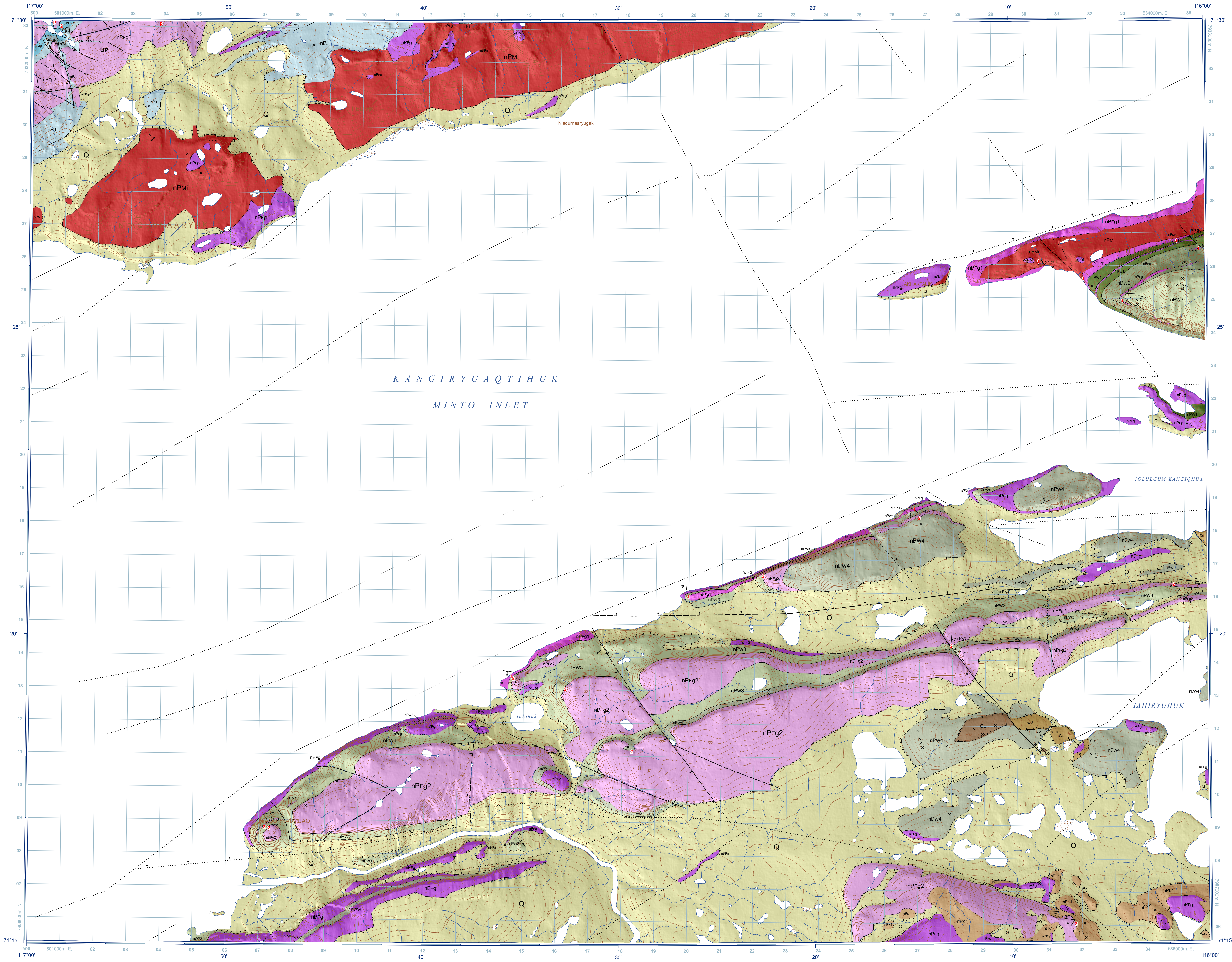
CANADIAN GEOSCIENCE MAP 199

GEOLOGY

IGLULIK

Victoria Island, Northwest Territories

1:50 000



CENOZOIC

Q	Quaternary sediments.

CAMBRIAN

ЄU	**Uvayualuk Formation:** Light brown dolomudstone to dolarenite. Thrombolite mounds are locally well developed and together with metre-scale cross-stratification suggest a shallow marine setting. Although no fossils were recovered from this unit, the lower contact is gradational with mudstones that contain Cambrian trilobites. Thickness is 30–45 m.

LOWER CAMBRIAN

ЄQ	**Quyuk Formation:** Red-brown to orange weathering fine- to coarse-grained quartz arenite and mudstone at the base of the Paleozoic succession. Sedimentary structures are lamination, wave and current ripples, and 10 cm to 2 m thick cross-stratified beds. Reactivation surfaces and foresets with rounded tops indicate an influence by tidal currents. Depositional environment is considered to be shallow marine. Mudstones contain Lower Cambrian trilobites. Distribution and thickness are variable; thickness ranges from 0 m to 90 m.

NEOPROTEROZOIC

nPFg	**Franklin intrusions (ca. 720 Ma):** Typically massive, laterally extensive, diabasic or gabbroic sills with columnar jointing (~3–50 m thick, rarely up to 150 m). Some sills are composite with internal intrusive contacts. Less common, 1–40 m wide dykes are generally oriented NNW with irregular to very linear contacts. Commonly associated with fault breccias or drag folds in host metasediments. Dyke / sill junctions commonly have complex contact zones of calc-silicate contact-metamorphic rocks (reddish garnet rimmed by bright green vesuvianite), black Fe-oxide skarns, and minor sulphides.
nPFg2	**Franklin intrusions Type 2:** Younger (based on crosscutting relationships), more evolved, predominantly diabasic sills show enrichment in magnetite, ilmenite, quartz, and alkali feldspar towards their cores, but are rarely layered. Some sills are porphyritic and contain 10–15% plagioclase>clinopyroxene> olivine phenocrysts and glomerocrysts up to 5 mm. Porphyritic rocks are marked as 'p' on the map where the texture has been recognized. Intrusions of this series are marked as '2' where geochemical data exist.
nPFg1	**Franklin intrusions Type 1:** Older, more primitive intrusions are commonly layered, with microdiabasic lower and upper border zones and olivine-enriched basal cumulate (olivine gabbro to feldspathic wehrlite,) that is locally capped by a thin, (1–2 m) feldspathic pyroxenite cumulate. The olivine cumulate is commonly covered with bright orange lichen, weathers chocolate brown, and shows a characteristic layer-parallel ribbed weathering. The upper one half to three quarters of sills comprise massive olivine and pigeonite gabbros, a magnetite gabbro with characteristic pitted weathering (magnetite oikocrysts) and a granophyric sandwich horizon containing abundant ocelli of granophyre and coarse, bladed clinopyroxene crystals. Intrusions of this series are marked as '1' where geochemical data exist.

NEOPROTEROZOIC-TONIAN TO CRYOGENIAN

Shaler Supergroup (nPMi– nPK1)

Kilian Formation (nPK1)

nPK1	**Carbonate-evaporite member:** Alternating, decametre-scale subunits of evaporite and carbonate-dominant lithofacies; evaporite: laminated red mudstone and dolomitic mudstone with interbedded nodular anhydrite and laminated gypsite and anhydrite, minor stromatolitic dolostone. Carbonate lithofacies: dolostone and minor limestone lutite/siltite rhythmite capped by arenite/rudite laterally linked stromatolites, forming repetitive metre-scale cycles. Molar-tooth structure common.

Wynniatt Formation (nPW1–nPW4)

nPW4	**Upper carbonate member:** Base characterized by distinctive nodular, black calcareous shale, overlain by thin, rhythmically bedded and normally graded, quartz-sandy calcarenite. Upper, metre-scale alternations of stromatolitic dolostone and crossbedded intraclast grainstone. Local herringbone crossbedded quartz arenite and microbially laminated lime mudstone. Chert is common. Approximately 300 m thick.
nPW3	**Stromatolitic carbonate member:** Stromatolitic dolostone with build-ups that have local synoptic relief of several meters; main build-up contains oncoids up to 20 cm. Interbedded intraclast grainstone with rip-ups and scours; mudstone/dololutite with molar-tooth structure. Parallel or microbially laminated dololutite with mudcracks, and teepee structures. Sharp, erosive upper contact. Approximately 160 m thick.
nPW2	**Black shale member:** Dark grey parallel-laminated siltstone and silty mudstone with discontinuous to continuous beds of ripple-topped quartz arenite common near top. Structures include flute and gutter casts, ball and pillow structures, channel and fill structures, and climbing ripples in siltstone. Carbonate nodules and pyrite are present throughout. Up to approximately 200 m thick.
nPW1	**Lower carbonate member:** Lower parallel-laminated dolosiltite and calcilutite with mudcracks, teepee structures and chert; minor carbonaceous mudstone. Middle hummocky cross-stratitified dolarenite and calcilutite with scours, rip-ups and molar-tooth structure; stromatolitic dolostone, intraclast dolograinstone. Upper stromatolitic dolostone, intraclast dolograinstone and carbonaceous siltstone capped by regionally extensive orange-weathering stromatolitic dolostone, up to 10 m thick. Approximately 120 m thick.
nPMi	**Minto Inlet Formation:** Four informal members in ascending stratigraphic order: maroon-green gypsiferous siltstone-calcilutite, dark grey limestone, bedded white gypsum, and cyclical calcisiltite to nodular gypsum. Evaporite lithofacies include laminated to thin-bedded and cross-laminated white gypsite and grey anhydrite, red gypsiferous siltstone and buff to grey calcisiltite. Chickenwire, nodular anhydrite and crosscutting satinspar veinlets common in upper evaporite as are up to 2 m thick beds of crystalline gypsum. Carbonate lithofacies includes dark grey to buff-grey laminated to thin-bedded dolosiltite with molar-tooth and fine-grained dolarenite with hummocky cross-stratification. Approximately 250 m thick.

Reynolds Point Group (nPF–nPJ)

nPJ	**Jago Bay Formation:** Lower predominantly wavy-bedded calcilutite with black shale partings, molar-tooth structure, minor beds of crossbedded quartz-sandy calcarenite and stromatolitic limestone. Upper is mainly laminated calcilutite with subordinate grainstone, calcareous sandstone, and gypsum near upper gradational contact with Minto Inlet Formation. Approximately 200 m thick.
nPF	**Fort Collinson Formation:** Medium-bedded, fine-to medium-grained quartzarenite, glauconitic quartzarenite and dolomitic quartzarenite. Herringbone crossbedding throughout with subordinate sub-horizontal planar stratification to low angle crossbedding. Approximately 100 m thick.

Contact; depositional, depositional-conformable or intrusive
- Defined
- Approximate
- Inferred

Contact; depositional-unconformable
- Defined
- Approximate
- Inferred

Fault, generic; steep dip
- Approximate
- Inferred or concealed

Fault, normal; upright
- Defined
- Approximate
- Inferred or concealed

Station location
- × Ground observation

Planar structure
- Bedding
  - 5 Inclined
- Intrusive contact
  - 10 Inclined
- Foliation
  - 20 Igneous layering

DESCRIPTIVE NOTES

The map area (NTS 87-G/8, Iglulik) lies within the Minto Inlier, a ~300 km long by 100–150 km wide belt of gently folded sedimentary and igneous rocks of early Neoproterozoic age (late Tonian-early Cryogenian). The Neoproterozoic sedimentary rocks belong to the Shaler Supergroup, a ~4 km thick succession of shallow marine carbonate and evaporite rocks with interbedded terrigenous metasedimentary strata deposited in a shallow intracontinental epeiric sea known as the Amundsen Basin (Thorsteinsson and Tozer, 1962; Young, 1981; Rainbird et al., 1994; 1996a). The basin is considered to have formed within the supercontinent Rodinia and similar rocks outcrop in the Mackenzie Mountains of the northern Cordillera, suggesting that the basin extended for more than 1000 km to the southwest (Long et al., 2008; Rainbird et al., 1996a). Basal strata of the Shaler Supergroup (Rae Group) are exposed only at the northeastern end of the Minto Inlier, near Hadley Bay, where they unconformably overlie Paleoproterozoic sedimentary rocks, which in turn, unconformably overlie Archean granitic rocks (Campbell, 1981; Rainbird et al., 1994).

Shaler Supergroup strata were injected by tholeiitic basaltic sills of the ca. 723–720 Ma (Heaman et al., 1992; Macdonald et al., 2010) Franklin igneous event. Sills are generally 20–60 m thick, constitute 10–50% of the stratigraphic section, and commonly extend for 20 km or more along-strike with little change in thickness. Rare north-northwest striking dykes are interpreted to have intruded along syn-magmatic normal faults, to feed sills and possibly the flood basalts (Bédard et al., 2012). Sills of similar type and age also occur in the Coppermine Homocline, Brock Inlier and Duke of York Inlier to the south (Jefferson et al., 1994; Rainbird et al., 1996b; Shellnutt et al., 2004) and coeval, geochemically similar intrusions and volcanic rocks associated with the Franklin event extend from Greenland to the western Yukon (Heaman et al., 1992; Denyszyn et al., 2009; Macdonald et al., 2010). The Shaler Supergroup in Minto Inlier is capped by Natkusiak Formation flood basalt lava flows and interflow sedimentary rocks (Williamson et al., 2013). The lavas are up to 1 km thick and are the extrusive equivalent of the Franklin sills (Baragar, 1976; Jefferson et al., 1985; Dostal et al., 1986; Dupuy et al., 1995). Two main Franklin magma populations are identified and discriminated on the map where possible (*see* legend). Basal lavas and older sills (Type 1) are slightly enriched in very incompatible trace elements (high Ce/Yb), tend to be more primitive (higher MgO), and the sills may have peridotitic bases, with up to 55% olivine (Hayes et al., 2015). These primitive Type 1 sills have potential for Ni-Cu-PGE mineralization (Jefferson et al., 1994). Younger diabasic sills (low Ce/Yb, Type 2) correspond to the major sheet flow units of the lava succession. A prominent feldspar porphyritic facies characterizes some Type 2 intrusions (annotated as 'p' where observed). Note that feldspar porphyries are not observed in Type 1 intrusions, peridotite is never observed in Type 2 intrusions, whereas diabasic or gabbroic textures are undiagnostic of magmatic affinity.

The irregular edge of the exposed Minto Inlier is defined by an erosional unconformity that separates the Neoproterozoic rocks from Lower Cambrian sandstone and siltstone that passes upward into a thick succession of mainly dolomitic carbonate rocks ranging in age from Cambrian to Devonian (Thorsteinsson and Tozer, 1962; Dewing et al., 2015). Minto Inlier rocks are affected by open folds with northeast trending axial traces. Beds typically dip no more than 10° and there is generally no penetrative deformation fabric. The origin of the folding is unknown but it occurred after 720 Ma, before uplift and erosion of the Proterozoic rocks and prior to deposition of overlying lower Cambrian siliciclastic rocks (Durbano et al., 2015), which are not folded, but dip gently towards the northwest. Two main generations of faults are present (Bédard et al., 2012; Harris, 2014): north- to northwest trending syn-magmatic Proterozoic normal faults; and a younger set of east-northeast to east trending normal faults that cut all rocks in the area. The normal faults form horst and graben systems with up to 200 of metres of stratigraphic separation on individual faults, although throws are generally much less than this. A wide zone of intense east-northeast to east-trending normal faulting stretches from Boot Inlet in the west to Wynniatt Bay in the east. This regional-scale, en-echelon, stepping normal fault system records sinistral transtensional motion (Harris, 2014). Observed contacts and lithologies were extrapolated and/or inferred using aeromagnetic data and satellite imagery (e.g. orthorectified air photos, Landsat7, SPOT5, and Google Earth™). Many linear structures visible on air photos and linear discontinuities on the 1st-derivative aeromagnetic maps (Kiss and Oneschuk, 2010) are interpreted to be faults, although significant throws cannot always be demonstrated. Late Wisconsinan proglacial and glacial deposits cover about 50% of the map's terrestrial surface area (Hodgson, 2012). The extent of Quaternary cover shown on this map is not meant to be comprehensive, but to highlight areas where bedrock attributions are uncertain. NTS 87-G/8 (Iglulik) straddles Kangiryuaqtihuk / Minto Inlet and consists of three geographically separate domains. Together with intercalated mafic sills, strata dip gently to the south, forming the southern flank of the east-northeast trending Walker Bay Anticline, grading into the northern flank of the Holman Island Syncline south of Minto Inlet.

On the northern shore of Kangiryuaqtihuk / Minto Inlet, the prominent hills to the north expose rocks of the Fort Collinson, Jago Bay and Minto Inlet formations. Detailed descriptions of these rocks are provided in Young and Long (1977), Young (1981) and Morin and Rainbird (1993). The Fort Collinson Formation is sparsely exposed (UTM, 500830E, 79330100N), and is typified by variably dolomitic, medium-bedded, orange to grey-weathering quartz arenite, commonly with herringbone cross-stratification. It grades up into yellow-grey-weathering, thin to thick-bedded limestone or dolostone of the Jago Bay Formation. A thin layer of Jago Bay rocks underlies a major feldspar-porphyritic Type 2 sill that caps the hilltop (UTM, 500500E, 7931700N). This sill (UP sill) can be traced for considerable distances into adjoining map areas (NTS 87-G/8, G/9, G/10). The thin wedge of sill material exposed in the northwestern-most corner of the map area is probably an apophysis of this same sill. Jago Bay dolostone grades up into evaporite-dominated strata of the lower Minto Inlet Formation, which is poorly exposed along the coast (UTM, 505100E, 7928610N). A sill was injected near the Jago Bay/Minto Inlet contact, and there are sparse exposures of more sills emplaced within Minto Inlet rocks.

To the east, the Iglulik Peninsula is underlain by rocks of the Upper Minto Inlet Formation and the three lower members of the Wynniatt Formation. The Minto Inlet strata are crumbly weathering, thin- to thick laminated white gypsum with interbedded grey-green calcisiltite, red gypsiferous siltstone and nodular gypsum. Minto Inlet strata are injected by two, thick, Type 1 sills. Some of the best exposures of the lower carbonate (unit nPW1), black shale (unit nPW2), and stromatolitic carbonate (unit nPW4) members of the Wynniatt Formation are found on this peninsula (*see* legend for descriptions). Thin Type 1 sills intrude both units nPW1 and nPW2 strata.

The southern shore of Kangiryuaqtihuk / Minto Inlet is underlain by the stromatolitic carbonate (unit nPW3) and upper carbonate (unit nPW4) members of the Wynniatt Formation (Thomson et al., 2014). There is a thick, well exposed section of unit nPW3 rocks near UTM, 515940E, 7913070N; whilst good outcrops of black, nodular, fissile limestone from the base of the unit nPW4 member are exposed at UTM, 518180E, 79011290N; 528090E, 7914265N; 535810E, 7916040N. These sedimentary rocks are injected by five(?) sills. Carbonate rocks located near sill contacts are transformed to pale marble. The three lowermost sills intrude limestone of the unit nPW3 member. Two of them are Type 2 intrusions, but a Type 1 sill is intermittently exposed near the coast (UTM, 526900E, 7918600N; 520240E, 7915820N; 514400E, 7913210N). The two uppermost sills, emplaced within unit nPW4 rocks, are thick (~100 m), massive, diabasic Type 2 sills.

Toward the south, there are sparse exposures of the lower evaporite-carbonate member (unit nPK1) of the Kilian Formation. The contact between unit nPW4 strata and the overlying unit nPK1 is not exposed, and appears to have been injected by a thick (60–70 m) Type 2 sill. In the southeastern corner of the map area, gabbroic rocks could represent another sill emplaced within and above unit nPK1 evaporite-carbonate strata. A thin cap of Cambrian clastic rocks (Quyuk Formation) and massive tan dolostone (Uvayualuk Formation) are exposed on a hilltop above a preserved erosional unconformity just west of Tahiryuhuk (lake), at UTM, 529000E, 7912000N.

This sheet contains a few examples of the north-northwest trending normal fault system that was active during Franklin magmatism (Bédard et al., 2012). A fault exposed in the north (UTM, 500700E, 7932610N), is the tail-end of a regionally more extensive fault that extends into NTS 87-G/9. In the southeastern part of the map area, a prominent north-northwest-trending fault (UTM, 525730E, 7902890N) seems to extend into the next map area to the south (NTS 87-G/1).

The east-northeast-trending faults were initiated during deposition of the basal Cambrian clastic rocks (Quyuk Formation), but continued to move afterwards (Durbano et al., 2015). This sinistral transtensional fault system is poorly exposed in this map area, being mostly covered by Quaternary deposits, and faults show variable orientations. South of Minto Inlet, two major east-west-trending valleys are inferred to host faults of this system. The fault in the southern valley (UTM, 509900E, 7908250N) trends towards the mouth of the Kuujjua River and is conjectured to exist due to the presence of a prominent aeromagnetic lineament (Kiss and Oneschuck, 2010). The northern valley (UTM, 522950E, 7915390N) is also marked by a prominent aeromagnetic lineament, but its identification as a north-side down normal fault is more reliable because the contact between units nPW3 and nPW4 is repeated.

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Canadian Geoscience Maps

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Geomatics by É. Girard

Cartography by N. Côté

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Map projection Universal Transverse Mercator, zone 11.
North American Datum 1983

GEOLOGY

IGLULIK

Victoria Island, Northwest Territories

1:50 000

1 0 1 2 3 4 km

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

Shaded relief image derived from the digital elevation model supplied by GeoBase.
Illumination: azimuth 225°, altitude 45°, vertical factor 1x

Proximity to the North Magnetic Pole causes the magnetic compass to be erratic in this area.
Magnetic declination 2015, 19°35'E, decreasing 45.2' annually.

Data may include additional observations not portrayed on this map.
See documentation accompanying the data.

CANADIAN GEOSCIENCE MAP 199
GEOLOGY
IGLULIK
Victoria Island, Northwest Territories

Canada