DESCRIPTIVE NOTES

The map area (NTS 87-H/12) 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 (late Tonian-early Cryogenian) age. The Neoproterozoic sedimentary strata belong to the Shaler Supergroup, an approximately 4 km-thick succession of shallow marine carbonate rocks and evaporite rocks with interbedded terrigenous rocks that were mainly deposited in a shallow intracontinental epeiric sea, referred to as the Amundsen Basin (Rainbird et al., 1994; Rainbird et al., 1996a; Thorsteinsson and Tozer, 1962; Young, 1981). The basin is considered to have formed within the supercontinent Rodinia and exposures of similar rocks, in what are now the Mackenzie Mountains of the northern Cordillera, suggest that it extended for more than 1000 km to the southwest (Long et al., 2008; Rainbird et al., 1996a). The sedimentary succession is intercalated with mafic sills of the ca. 720 Ma Franklin igneous event (Heaman et al., 1992). The sills are of variable thickness up to 100 m, but most are 20–60 m thick. In many cases, individual sills extend for 20 km or more along-strike with little significant change in thickness. Sills constitute anywhere from 10 to 50 per cent of the stratigraphic section. Sills of similar type and age also occur in the Coppermine Homocline, Brock Inlier and Duke of York Inlier to the south (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 (Denyszyn et al., 2009; Heaman et al., 1992; Macdonald et al., 2010). The Shaler Supergroup in Minto Inlier is capped by a succession of flood basalt flows and interflow sedimentary rocks (Natkusiak Fm), more than 1 km thick, which are the extrusive equivalent of the sills (Baragar, 1976; Jefferson et al., 1985). 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). Three magma populations are identified in the lavas, which have correlatives in the different sill subtypes. The oldest sills and corresponding basal lavas are enriched in incompatible trace elements and may have olivine-enriched bases. Younger diabasic sills correspond to the major sheet-flow units of the lava succession. Basal strata of the Shaler Supergroup (Rae Group) are exposed only at the northeastern end of 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). The irregular edge of Minto Inlier is defined by an erosional unconformity that separates the Neoproterozoic rocks from Lower Cambrian sandstone and siltstone that pass upward into a thick succession of mainly dolomitic carbonate rocks, ranging in age from Cambrian to Devonian (Thorsteinsson and Tozer, 1962). Structurally, the Minto Inlier is relatively simple, composed of the open, northeast-trending Holman Island syncline and a smaller Walker Bay anticline to the northwest. Beds typically dip no more than 10° and there is generally no penetrative cleavage or other apparent outcrop-scale fabric. The origin of the folding is unknown but it occurred after deposition of the early Neoproterozoic rocks and before uplift, erosion and deposition of overlying lower Cambrian siliclastic rocks, which are not folded. All rocks are dissected by east-northeast to east-trending faults that form a horst and graben system with up to 200 of metres of stratigraphic separation on individual faults. The zone of faulting is about 100 km wide and stretches from the head of Minto Inlet in the west to Wynniatt Bay in the east and is spectacularly imaged as prominent lineaments on recently published aeromagnetic maps (e.g. Kiss and Oneschuk 2010).

NTS 87-H/12 is underlain by stratigraphic units from the Jago Bay, Minto Inlet and Wynniatt formations of the Shaler Supergroup. Together with diabase sills, the Neoproterozoic strata comprise the gently southeast-dipping northern limb of the Holman Island Syncline. The outcrop pattern of bedrock units on this map sheet is strongly influenced by evenly spaced, horst and gräben, with variable along-strike separation and are thus akin to piano keys. Proterozoic rocks were steeply rotated close to some of these faults, as exemplified along the Qiyuktukam River at UTM, 553667E, 7944405N. There are no particularly well exposed sections of the Shaler Supergroup on this map sheet. Many of the Shaler Supergroup and diabase outcrops exhibit variable reddish, oxidative alteration that is interpreted to reflect chemical weathering and development of incipient regolith. This would likely have occurred in the ca. 200 Ma interval between intrusion of the Franklin diabase and deposition of the unconformably overlying Cambrian sandstones. Rocks of the Jago Bay Formation are mainly dolostones deposited in shallow subtidal to intertidal environments and are best characterized by their yellowish-weathering. Stratigraphically overlying strata of the Minto Inlet Formation are mainly recessive, crumbly weathering, laminated white gypsum with interbedded grey-green calcisiltite, gypsiferous siltstone and nodular gypsum. The dark gray limestone member, which outcrops close to Aqiarulik Lake, should not be confused with carbonates of the overlying Wynniatt Formation. Strata of the lower carbonate member of the Wynniatt Formation outcrop sporadically in the south-eastern part of the map area; overlying members are exposed only in the extreme southeast corner. Only 4–5 diabase sills occur within the stratigraphic section represented by this map area; they are all of the type 2 (diabasic) as described in the legend. A topographically prominent, apparently cross-cutting, irregular intrusion trends north-northwest from the northern shore of Minto Inlet on the west side of the map area (hill referred to as Kin'ngahuin). This feature may represent a broad magmatic feeder because it cuts across strata and parts of the body appear to feed laterally into more typical, continuous sills.

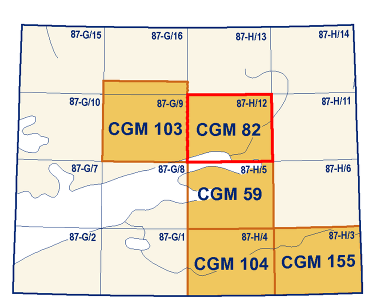
In the northern half of the map area, gräben preserve Cambrian sedimentary rocks, including thick sections of the lower clastic unit and overlying tan dolostone unit, which features distinctive orange-weathering. An excellent section is exposed along the Qiyukiuluak River at UTM, 561510E, 7946849N. The earliest fault movement preceded deposition of Cambrian strata and occurred at the same time as folding of the Shaler Supergroup, but reactivation during Cambrian time is suggested by thickness variations between adjacent fault panels. The sub-Cambrian unconformity and Cambrian strata are offset across faults indicating significant post-Cambrian, probably normal, fault activity.

Abstract

NTS 87-H/12 is underlain by the Jago Bay, Minto Inlet and lower Wynniatt formations of the Shaler Supergroup, but there are few well exposed sections in this map area. Together with diabase sills, these strata comprise the gently south-dipping northern limb of the Holman Island Syncline. The outcrop pattern on this map is strongly influenced by evenly spaced, east-northeast-trending horst and gräben, with variable along-strike separation (up to 200 m). Many outcrops exhibit reddish, oxidative alteration that is interpreted to reflect pre-Cambrian chemical weathering. In the northern half of the map area, gräben preserve Cambrian sedimentary rocks, including the lower clastic unit and overlying, orange-weathering, tan dolostone unit. A topographically prominent, irregular diabase intrusion trends north-northwest from the northern shore of Minto Inlet. This may represent a broad magmatic feeder because it cuts across strata and parts of the body appear to feed laterally into more typical, continuous sills.

Résumé

Le feuillet NTS 87-H/12 expose des roches de la fenêtre Protérozoïque Minto qui sont superposés en discordance par des roches sédimentaires Paléozoïques. Les roches Protérozoïques appartiennent au Supergroupe de Shaler, Formations de Minto Inlet et Wynniatt Inférieur; lesquelles sont injectées par des filons et filons-couches diabasiques et localement ultramafiques de l'évènement Franklin. Les strates constituent le flanc nord du Synclinal Holman Island, et pendent doucement vers le sud. Le feuillet expose peu de bonnes sections stratigraphiques. Le patron d'affleurement est fortement influencé par des failles normales orientées est-nord-est, générant une série de horst et graben. Les déplacements de ces failles génèrent de forts décalages des contacts, du au faible pendage des strates. Au nord de la carte, des grès basaux Cambriens, et une dolomite beige massive sont préservés dans les graben. Les roches sous la discordance sont affectés par une altération rouge, interprété comme le résultat d'exposition oxidative sub-aérienne au Cambrien. Du au faible pendage de la discordance, des affleurements situés à plusieurs kilomètres de ce contact sont aussi affectés par cette altération. Un filon diabasique majeur s'étend vers le nord-nord-ouest à partir de la côte de Minto Inlet, et représente peut-être un filon nourricier exploitant une faille syn-magmatique puisqu'il coupe plusieurs contacts. Les filons couches dans ce secteur appartiennent aux deux populations géochimiques (types 1 et 2, voire légende).



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

Cover illustration
Post-glacial raised beaches beneath thick Franklin diabase sill near Qiyuktarvik, Northwest Territories. Photograph by R.H. Rainbird. 2012-036

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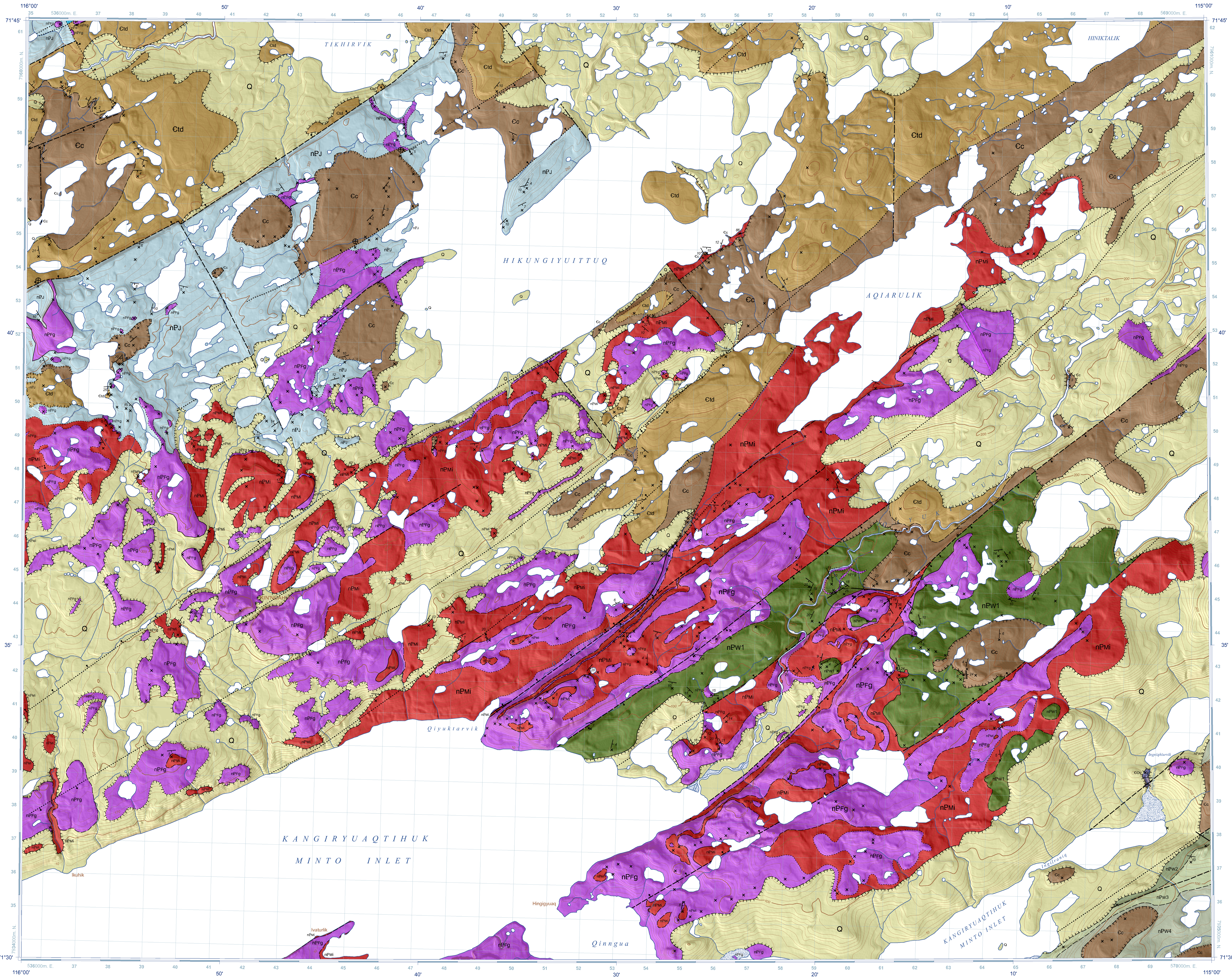
CANADIAN GEOSCIENCE MAP 82

GEOLOGY

KANGIRYUAQTIHUK / MINTO INLET

Victoria Island, Northwest Territories

1:50 000



CENOZOIC

Q Quaternary sediments.

CAMBRO–ORDOVICAN

ЄOv **Victoria Island formation:** Light grey to almost white weathering, fine to coarsely crystalline fabric destructive dolostone that is widespread throughout northwestern Victoria Island. Locally preserved primary structures include horizontal bedding, crossbedded oolitic grainstone beds, thrombolite and stromatolite bioherms, microbial lamination, and intraformational conglomerate. Fossils are rare but include silicified gastropods. Silicification is widespread in the upper two-thirds of the unit. Chert occurs as prominent white-weathering beds and nodules, 5 to 60 cm thick, and composed of microcrystalline chert or as silicified stromatolites. Some vugs contain crystalline quartz. Depositional environment is interpreted as a broad, shallow carbonate platform.

CAMBRIAN

Єtd **Tan dolostone unit:** 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 Early Cambrian trilobites. Thickness is 30–45 m.

LOWER CAMBRIAN

Єc **Clastic unit:** 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:** Typically massive, laterally extensive, diabasic sills with columnar jointing (~3–50 m thick, rarely up to 100 m). Some sills are composite with internal intrusive contacts. Two types: 1) An older, more primitive type is commonly layered, with microdiabasic lower and upper border zones and olivine-enriched basal cumulate (olivine gabbro to feldspathic wehrlite) that may be 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. Upper ½ to ¾ of sills composed of massive olivine and pigeonite gabbros, a magnetite gabbro with common pitted weathering (magnetite oikocrysts) and a granophyric horizon containing abundant ocelli of granophyre and coarse, bladed clinopyroxene crystals. 2) Younger (based on cross cutting relationships), more evolved, diabasic sills showing 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. Less common, 1–40 m wide dykes. Irregular to very linear (generally oriented NNW). Commonly associated with fault breccias or drag folds in host metasediments. Dykes commonly connect to sills; some associated with calc-silicate contact metamorphic rocks (reddish garnet rimmed by bright green vesuvianite), black Fe-oxide skarns, and minor sulphides.

Shaler Supergroup (nPMi–nPW4)

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 (nPB–nPJ)

nPJ **Jago Bay Formation:** Lower predominantly wavy-bedded calcilutite with black shale partings, molartooth structure, minor beds of cross-bedded 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.

nPB **Boot Inlet Formation:** Rythythmically laminated to thinly bedded, dark-grey dololutite/calcilutite and light-grey dolosiltite/calcisiltite with common molar-tooth structure, gutters, scours, tool marks, convolute bedding and other loading features. Interbedded with trough cross-stratified to hummocky cross-stratified dolarenite/calcarenite, including ubiquitous oolitic arenite (grainstone). In the type area, near Boot Inlet, the upper part of the formation is characterized by a thick, tabular, stromatolitic reef complex composed of strongly dolomitized, digitate stromatolites interbedded with dolarenite grainstone. Only the upper half (~200 m) of the formation is exposed in the map area.

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

Contact; depositional-unconformable
- Defined
- Approximate
- Inferred

Fault, generic, steep dip
- Defined
- Approximate
- Inferred

Fault, normal; upright
- Defined
- Approximate
- Inferred

Structural lineament

Station location
- Ground observation

Planar structure
- Fault
  - Upright
- Jointing
  - Inclined
  - Vertical
- Bedding
  - Inclined
  - Horizontal
  - Cross-bed foreset

Linear structure
- Sedimentary structure
  - Soft-sediment or slump

Fold
- Fold axis
  - Anticline with plunge

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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

KANGIRYUAQTIHUK / MINTO INLET

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 2014, 19°35'E, decreasing 55' annually.

The Geological Survey of Canada welcomes corrections or additional information from users.

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

This publication is available for free download through GEOSCAN (http://geoscan.ess.nrcan.gc.ca/).

Preliminary publications in this series have not been scientifically edited.

CANADIAN GEOSCIENCE MAP 82
GEOLOGY
KANGIRYUAQTIHUK / MINTO INLET
Victoria Island, Northwest Territories

Canada