DESCRIPTIVE NOTES

The map area (NTS 87-H/4) 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).

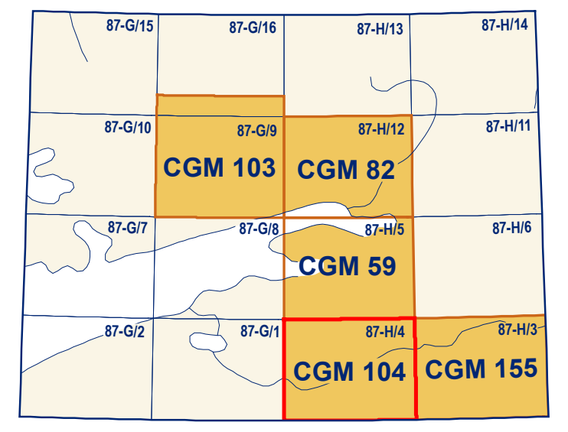
NTS 87-H/04 is underlain by stratigraphic units from the middle to upper Kilian Formation, Kuujjua Formation and Natkusiak Formation of the Shaler Supergroup. Together with diabase sills, the strata comprise the gently south-dipping northern limb of the Holman Island Syncline, whose axis lies along the southern edge of the map sheet. Exposures of the Kilian Formation (clastic-carbonate and tan carbonate members) are limited in the northern half of the map sheet area due to the recessive nature of the strata and the dominance of thick diabase sills that form a prominent southeast dip slope down to the Kuujjua River. The upper Kilian Formation, Kuujjua Formation and basal Natkusiak Formation, are best exposed along a prominent cuesta that faces north-norteast along the south side of the Kuujjua River. The Kilian generally is quite recessive but a good exposure of the tan carbonate member (nPK3) and upper evaporite member (nPK4) is located near UTM, 568071E, 7894971N. In most places within the map area, the basal contact of the Kuujjua with the upper evaporite member is poorly exposed, but at one locality (UTM, 556153E, 7890758N), it is a well developed erosional unconformity overlain by a thin, discontinuous, chert-cobble conglomerate. The conglomerate, in turn, is overlain by a green, parallel-stratified volcanic-lithic wacke, which passes upward into a dark green siltstone, that is interbedded with a cleaner (quartzose) sandstone, more typical of overlying crossbedded quartzarenite of the Kuujjua Formation. The underlying Kilian Formation strata at this location are strongly altered (chloritized with FeS staining) and drab (normally red), suggesting that deposition of the overlying strata was accompanied by introduction of reducing hydrothermal fluids. This important outcrop shows that volcanism, normally associated with the overlying Natkusiak Formation, was already active at the beginning of Kuujjua time. One of the thickest and best preserved sections of the Kuujjua Formation is exposed near the eastern end of the cuesta at UTM, 571404E, 7893899N (see section 86-22 of Rainbird, 1992 and section 4 of Jefferson, 1985). Other good exposures of the Kuujjua Formation are located at UTM, 565423E, 7893681N (section 86-18) and UTM, 564149E, 7884097N (section 86-14). The Kuujjua and Natkusiak formations are also well exposed along the flanks of two, north-flowing tributaries of the Kuujjua River. The contact between the two formations generally is planar and conformable but there are numerous places where soft-sediment deformation features are preserved in the underlying sandstone indicating that the sand was unlithified at the time of the main eruption (see Rainbird, 1993). As well, irregular fragments of basalt have been observed within the sandstone. The most complete exposures of the Natkusiak Formation are located at approximately UTM, 557694E, 7889062N and UTM, 564681E, 7885879N and are described in detail by Williamson at al. (2013). Members nPN1 and nPN3 are composed of basaltic flows and associated interflow deposits that are regionally distributed, but the intervening volcaniclastic nPN2 member is discontinuous and of variable thickness. It thins markedly from the central part of the map area toward the northwest and is absent in the western half of the map area. At least 5 diabase sills occur within the map area and generally are spaced at regular intervals within the host sedimentary rocks. The sills are of the type 2 (diabasic) described in the legend. Several steep, northwest-striking, mostly west-side down, normal faults are spaced evenly across the map area and are evident as prominent linear topographic lows. At approximately UTM, 542418E, 7894570N, the lineament coincides with a thin diabase dyke, suggesting that emplacement was coincident with faulting, a relationship that has been documented elsewhere in the region (Bédard et al., 2012). East-west block faulting, common in map areas to the north, is largely absent from NTS 87-H4.

Abstract

NTS 87-H/4 is underlain by the middle to upper Kilian, Kuujjua and Natkusiak formations of the Neoproterozoic Shaler Supergroup. Together with at least 5 diabase sills (type 2), spaced at regular intervals within the host sedimentary rocks, the strata comprise the gently south-dipping northern limb of the Holman Island Syncline. The northern half of the map area is dominated by a thick sill, which forms a prominent southeast dip slope down to the Kuujjua River. Sedimentary strata are best exposed along a prominent cuesta that faces north-northwest along the south side of the Kuujjua River. The upper two members of the Kilian Formation are sporadically exposed along the base of the cuesta. Crossbedded quartzarenite of the disconformably overlying Kuujjua Formation is prominent along the cuesta's face along with conformably capping basalt flows of the Natkusiak Formation. Both are also well exposed along the flanks of two, north-flowing tributaries of the Kuujjua River. Several steep, northwest-striking, west-side down normal faults are spaced evenly across the map area.

Résumé

Le Feuillet NTS 87-H/4 expose des roches Néo-protérozoïques des Formations du Kilian Moyen à Supérieur, Kuujjua et Natkusiak. Les roches sédimentaires appartiennent au Supergroupe de Shaler, et sont injectées par 5 filons-couches diabasiques de l'évènement Franklin. Les strates constituent le flanc nord du Synclinal Holman Island, et pendent doucement vers le sud. La partie nord du feuillet est dominée par un filon-couche épais, qui forme un banc qui va jusqu'à la rivière Kuujjua. Les roches sédimentaires sont bien exposées le long d'une falaise qui s'élève au sud de cette rivière et aussi le long de ses tributaires du côté sud. Les deux membres supérieurs du Kilian sont exposés sporadiquement au pied de la falaise. Les arénites quartzifères à lits entrecroisés de la Formation de Kuujjua sont en discordance sur les strates du Kilian. Le sommet de la montagne est formé par les laves et volcaniclastites de la Formation de Natkusiak. Il y a plusieurs failles normales orientées nord-ouest, avec pendange vers l'ouest.



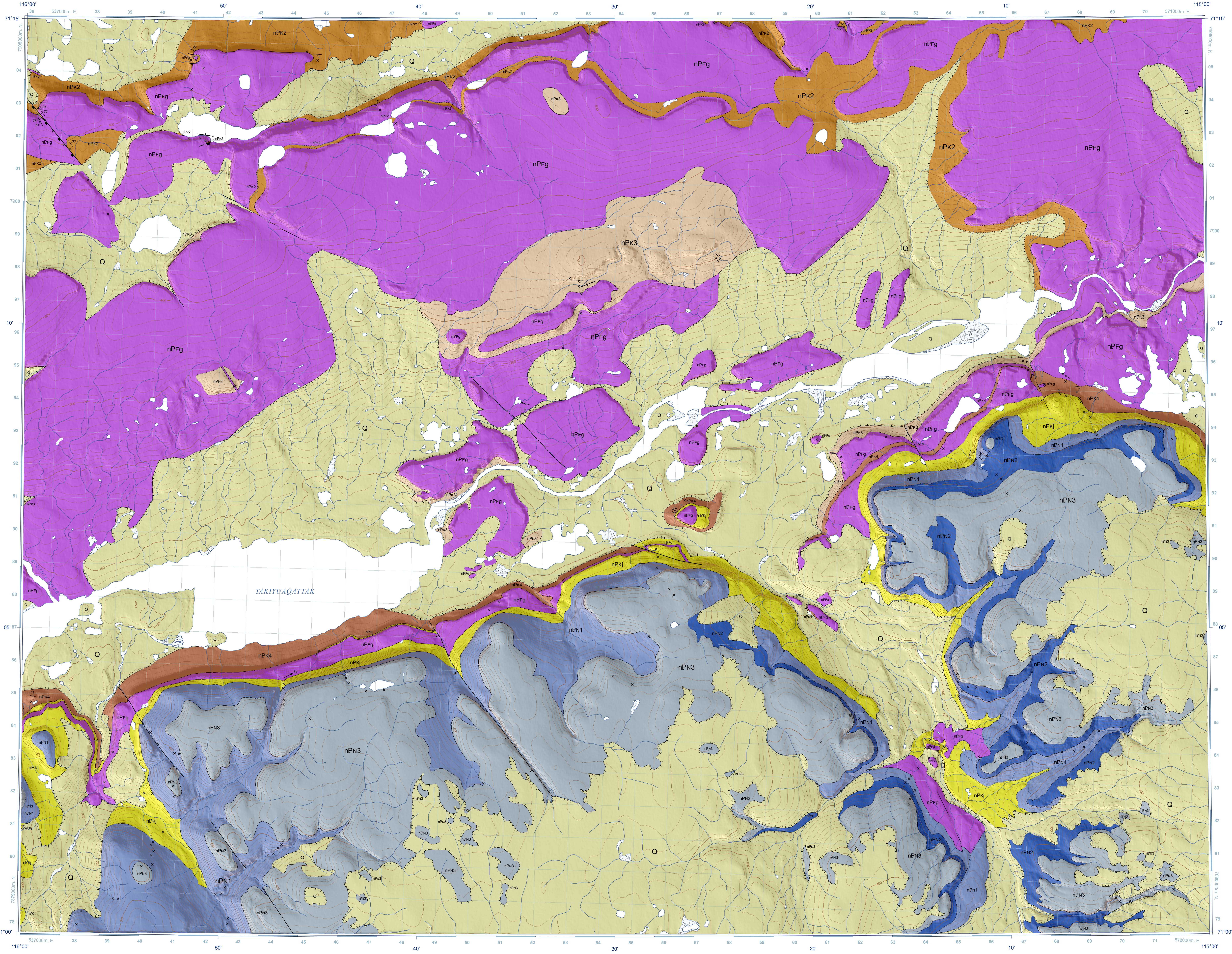
National Topographic System reference and index to adjoining published Geological Survey of Canada maps

Cover illustration
Looking east at flood basalt-capped cuesta with Kuujjua River and upper Kilian Formation and diabase sill in foreground, Victoria Island, Northwest Territories, 2011-07-13. Photograph by R. Rainbird.
2013-204

Catalogue No. M183-1/104-2012E-PDF
ISBN 978-1-100-21440-5
doi:10.4095/293344

Natural Resources Canada Ressources naturelles du Canada

CANADIAN GEOSCIENCE MAP 104
GEOLOGY
TAKIYUAQATTAK
Victoria Island, Northwest Territories
1:50 000



CENOZOIC

Q — Quaternary sediments.

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.

Natkusiak Formation (nPN1–nPN3)

nPN3 — **Sheet-flow member:** Blue-green to orange-weathering, laterally extensive, subaerial basalt flows; individual flows 15 to 50 m thick. Flow structure varies from colonnade-entablature to a massive base with typically vesicular flow tops. Rare interflow scoria, spatter, fumarolic concretions, volcanic necks and platy to disseminated native copper. Maximum thickness of 200 m, limited by erosional preservation.

nPN2 — **Lower recessive member:** Massive to parallel-stratified volcanic-pebble conglomerate overlain by thin, parallel- to cross-bedded, quartz-rich volcaniclastic sandstone. Framework composed of volcanic, carbonate and sandstone clasts; matrix-rich in quartz sand grains. Conglomerate sub-unit varies in thickness from 40 to 100 m; sandstone sub-unit from 5 to 10 m.

nPN1 — **Lower member:** Dark green to grey weathering, dominantly subaerial flows, varying from fine massive basalt to coarse sub-ophitic basalt. Pillowed and hyaloclastic breccia are common at unit's base indicating emplacement into shallow water. Thin (1 to 10 m) sheet flows with massive bases and vesicular flow tops, or discontinuous lobate flows. Degree of vesicularity varies throughout. Thickness 40 to 70 m.

Shaler Supergroup (nPK1–nPKj)

nPKj — **Kuujjua Formation:** Two principal lithofacies: coarse quartzarenite typified by stacked tabular co-sets of simple and compound planar crossbedding and a less abundant fine-grained assemblage of interbedded fine sandstone, dolomitic siltstone and mudstone forming lenses up to 20 km wide. Rare basaltic peperites. ~120 m thick.

Kilian Formation (nPK1–nPK4)

nPK4 — **Upper Evaporite-Carbonate member:** Base is dolosiltite and dololutite with 10–20% ripple crosslaminated gypsiferous siltite. Bedding-parallel and crosscutting satinspar veinlets and desiccation cracks common. Changes up-section from creamy grey to pinkish grey, reflecting increase in hematitic siltstone relative to carbonate. Nodular sulphate more common in middle part of member. Upper consists mainly of parallel-laminated red dolomitic mudstone and wavy- to lenticular-bedded, buff- to pink-weathering dolosiltite -no sulphate. Diagenetic redox horizons desiccation cracks, halite pseudomorphs and tepee structures are ubiquitous. Present only in the southwest domain of the Minto Inlier. ~80 m thick.

nPK3 — **Tan Carbonate member:** Tan to green-grey, flaggy weathering dolostone and limestone. Gradation between parallel-laminated lutite and flat to wavy and hummocky bedded siltite. Lutite-rich layers are generally plane parallel laminated with rare siltite lenses (starved ripples?). Bed bases typically scoured grading up to lutite-rich tops. Intraformational clast breccia commonly infilling swales and gutters. Black chert nodules throughout and stromatolites at several horizons. One distinctive bioherm, from the middle of the tan carbonate member, is laterally traceable from Ulukhaktok along the Kuujjua River Valley to where it cuts across the Natkusiak plateau. ~60 m thick.

nPK2 — **Clastic-carbonate member:** Variegated (red, green, grey and black) pin-stripe-laminated mudstone and siltstone, particularly at its base. Desiccation cracks common in mudstone and wavy bedding and ripple crosslamination in coarse siltstone-fine sandstone interlayers. Wavy-flaser bedded and small-scale crossbedded, 4 m thick, buff-weathering, fine-grained quartzarenite near top. Wavy-bedded dolosiltite and laterally linked stromatolite interbeds are common and increase upsection. ~120 m thick.

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.

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

Contact; depositional-unconformable
- Defined
- Approximate
- Inferred

Fault, generic, steep dip
- Defined
- Inferred

Fault, normal; upright
- Approximate
- Inferred

Fault, reverse; upright
- Defined
- Approximate

Structural lineament

Station location
- × Ground observation

Planar structure
- Fault — Vertical
- Bedding — 15 Inclined
- ⊕ Horizontal
- Foliation — 30 Igneous layering

Linear structure
- Lineation — 15 Fault striae, fault grooves, slickensides, or mineral growth fibres
- Glacial striation or groove

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Recommended citation
Rainbird, R.H., Bédard, J.H., and Williamson, N., 2013. Geology, Takiyuaqattak, Victoria Island, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 104 (preliminary), scale 1:50 000. doi:10.4095/293344

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Geology by R.H. Rainbird and J.H. Bédard, 2011

Geomatics by É. Girard

Cartography by N. Côté

Initiative of the Geological Survey of Canada, conducted under the auspices of the Victoria Island PGE/Base Metals project, as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program.

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

CANADIAN GEOSCIENCE MAP 104
GEOLOGY
TAKIYUAQATTAK
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 225º, altitude 45º, vertical factor 1x

Proximity to the North Magnetic Pole causes the magnetic compass to be erratic in this area.
Magnetic declination 2013, 20º32' E, decreasing 53' 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.

Preliminary publications in this series have not been scientifically edited.

CANADIAN GEOSCIENCE MAP 104
GEOLOGY
TAKIYUAQATTAK
Victoria Island, Northwest Territories

Canada