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# CANADIAN GEOSCIENCE MAP 59

## GEOLOGY

# QIQITTIIVIK

Victoria Island, Northwest Territories

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### Cover Illustration

Southeast from Minto Inlet toward Uvayualuk. In cliff-face, Wynniatt Fm. black shale member overlain by orange-weathering dolostone of stromatolitic carbonate member, Victoria Island, Northwest Territories. Photograph by R. Rainbird. 2012-035

## ABSTRACT

NTS 87-H/5 is underlain by the upper Minto Inlet, Wynniatt and lower Kilian formations of the Shaler Supergroup. Together with diabase sills, the strata comprise the gently south-dipping northern limb of the Holman Island Syncline. The best exposures of the Wynniatt Formation (bedded-carbonate and shale) in the western Minto Inlier are located here. The lower half of the Kilian Formation (carbonate+evaporite) is intermittently exposed in the southern part of the sheet. Diabase sills are of diabasic type 2 (see legend). A dyke-like mafic intrusion occurs in the southwest part of the map area. The northern half of the area is affected by east–west block faulting, which preserves Cambrian sandstone and siltstone and a thick section of recrystallized Ordovician(?) dolostone (Victoria Island Formation). An unconformity between the Wynniatt Formation and the Cambrian lower clastic unit reveals extensive paleokarst with paleo-caverns infilled with quartzarenite. The quartzarenite exhibits soft-sediment deformation, water-escape cylinders and other collapse features.

## RÉSUMÉ

Le Feuillet NTS 87-H/5 expose des roches de la fenêtre Protérozoïque Minto qui sont superposés en discor-dance par des roches sédimentaires Paléozoïques. Les roches Protérozoïques appartiennent au Supergroupe de Shaler, Formations de Minto Inlet Supérieur, Wynniatt et Kilian Inférieur; lesquelles sont injectées par des filons et filons-couches diabasiques de l'évènement Franklin. Les strates constituent le flanc nord du Synclinal Holman Island, et pendent doucement vers le sud. Le feuillet expose les meilleurs affleurements de la Formation Wynniatt (carbonates et shales) de la fenêtre Minto occidentale. La partie inférieure de la Formation de Kilian (carbonates +évaporites) est exposée localement dans la partie sud du feuillet. Les filons diabasiques sont du type 2 (voire légende). Une intrusion mafique discordante affleure dans la partie sud-ouest du feuillet. La partie nord du feuillet est affectée par des failles orientées est–ouest, avec préservation dans des graben de grès Cambriens et de siltstones et dolomies recristallisés d'âge Ordovicien(?) de la Formation Victoria Island. La discordance entre les roches du Wynniatt et la couverture clastique cambrienne est marquée par des paléokarstes et paléo-grottes remplies par de l'arénite à quartz où l'on voit de la déformation de sédiment non-consolidé, des structures cylindriques crées par la déshydratation, et d'autres structures d'effondrement.


## ABOUT THE MAP

### General Information


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Geology by R.H. Rainbird and J.H. Bédard, 2010, 2011

Geomatics by É. Girard

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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

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, 20º31'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.

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Preliminary publications in this series have not been scientifically edited.

### Map Viewing Files

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

## *ABOUT THE GEOLOGY*

### Descriptive Notes

The map area (NTS 87-H/5) 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 the 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/5 is underlain by stratigraphic units from the upper Minto Inlet, Wynniatt and lower Kilian formations of the Shaler Supergroup. Together with diabase sills the strata comprise the gently south-dipping northern limb of the Holman Island Syncline. Exposures of the Minto Inlet Formation are limited to a few small outcrops near the southern shore of Minto Inlet in the northern part of the map area. Rocks are crumbly weathering, thin- to thick laminated white gypsum with interbedded grey-green calcisiltite, gypsiferous siltstone and nodular gypsum. Some of the best exposures of the Wynniatt Formation in the western Minto Inlier are located in this map area. The lower carbonate member (nPW1) and black shale member (nPW2; for descriptions, see legend) are best exposed in two creek sections located at UTM, 537945E, 7926620N and UTM, 542231E, 7928002N. The stromatolitic member (nPW3; see legend) outcrops well at UTM, 552845E, 7930500N and the lower part of the upper carbonate member (nPW4; see legend) occurs along a canyon downstream from a spectacular waterfall at UTM, 563391E, 7926880N. The upper part of the upper carbonate member is quite recessive but part of it is well exposed along a creek at UTM, 565510E, 7920837N. The contact with the Kilian Formation occurs near the top of a hill that is about 2 km north of Qiqittiivik (approx. UTM, 549293E, 7912967N. To the south of this lake is a good section through the carbonate-evaporite member (nPK1) of the Kilian (see legend). The overlying clastic carbonate-member (nPK2) is partly exposed on the west side of a narrow canyon located along the southern border of the map sheet at UTM, 560597E, 7906343N. Approximately 10–12 diabase sills occur within the map area and generally are spaced at regular intervals within the host sedimentary rocks. Most sills are of the type 2 (diabasic) described in the legend. There is a greater concentration of thicker sills in the southeast part of the map area. Cross-cutting, dyke-like bodies occur in the southwest part of the map area (South Feeder Dyke Complex of Bédard et al., 2012) and are observed to feed upward into one of the aforementioned sills at UTM, 547642E, 7908530N. Dykes occupy normal faults with variable senses of motion. A single occurrence of the type 1 (high Ce/Yb) magma type occurs in a brecciated dyke tip of the Southern Feeder Dyke Complex (UTM, 544426E, 7911257N). Most of the northern half of the map area is affected by the block faulting described

above. An east–west fault in the middle of the map is truncated by a series of northeast-trending faults that define gräben,which preserve significant sections of Cambro-Ordovician sedimentary rocks, including all four units described in the legend. An unconformity between the Wynniatt Formation and the Cambrian lower clastic unit is well exposed at UTM, 554990E, 7926029N. Here an extensive paleokarst with paleo-caverns infilled with quartzarenite is developed over a broad area (Mathieu et al, 2013). Overlying crossbedded quartzarenite exhibits soft-sediment deformation, water-escape cylinders and other collapse features. Excellent exposures of the Cambro-Ordovician stratigraphy include a creek section at UTM, 542899E, 7922716N, a section that begins just east the paleokarst occurrence and ends on a hill (Uvayualuk), and a hill section in the northeast corner of the map area.

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## Author Contact

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### Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 11
Horizontal Datum: NAD83
Vertical Datum: mean sea level

### Bounding Coordinates

Western longitude: 116°00’00” W
Eastern longitude: 115°00’00” W
Northern latitude: 71°30’00” N
Southern latitude: 71°15’00” N

### Data Model Information

This Canadian Geoscience Map does not conform to the Bedrock Mapping Geodatabase Data Model v.3.1.

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2. À la fin du premier terme, cet Accord sera automatiquement renouvelé pour des termes successifs d'un (1) an, en vertu de la section 6.0 qui suit.

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   ii. par un préavis écrit de résiliation émis par le Détenteur de licence, en tout temps, et cette résiliation prendra effet trente (30) jours suivant la réception d'un tel préavis par le Canada; ou

   iii. par consentement mutuel des parties.

2. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, les obligations qui incombent au Détenteur de licence en vertu de la section 4.0 continueront de s'appliquer et les droits du Détenteur de licence en vertu de la section 2.0 cesseront immédiatement.

3. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, le Détenteur de licence devra immédiatement effacer ou détruire toutes les Données obtenues en vertu de cet Accord, ou à l'intérieur d'un délai raisonnable lorsque les Données sont nécessaires pour terminer la livraison de Produits dérivés commandés avant la résiliation de cet Accord.

## 7.0 GÉNÉRAL

1. **Lois d'application**
   Le présent Accord est régi et interprété en vertu des lois en vigueur dans la province de l'Ontario. Les parties acceptent de tomber sous la juridiction de la Cour supérieure de la Province de l'Ontario.

2. **Totalité de l'Accord**
   Le présent Accord constitue l'intégralité de l'entente conclue entre les parties relativement à l'objet du présent Accord. Toute modification à cet Accord ne peut être que par écrit, doit porter la signature de chaque partie et exprimer clairement l'intention de modifier cet Accord.

3. **Solution des litiges**
   Si un litige survient à propos de cet Accord, les parties tenteront de le résoudre par des négociations de bonne foi.