Natural Resources Canada
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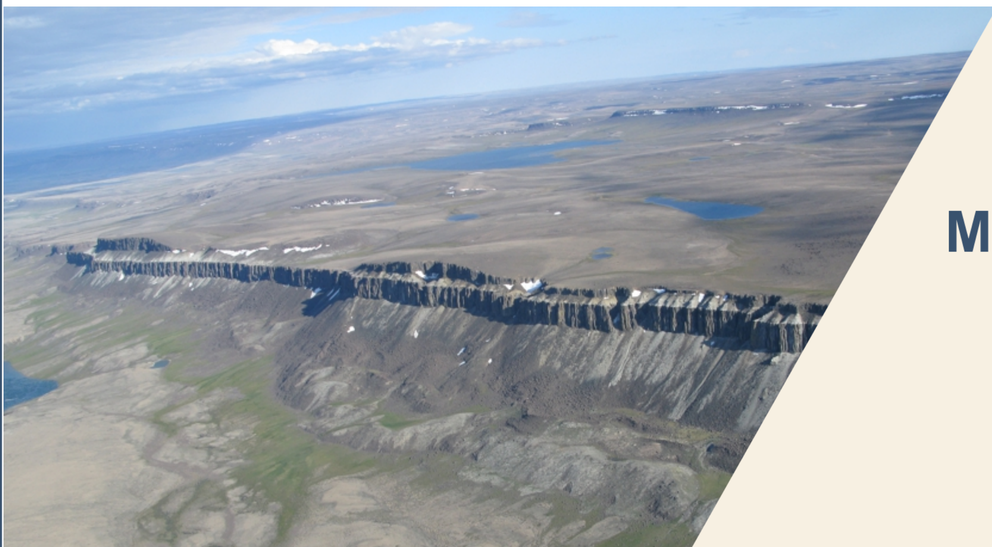
CANADIAN GEOSCIENCE MAP 189

GEOLOGY

QULLIQ

Victoria Island, Northwest Territories



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Cover Illustration
View to southeast of two sills emplaced into rocks of the Kilian Formation, Victoria Island, Northwest Territories. Photograph by J.H. Bédard. 2014-142

ABSTRACT
NTS 87-G/1 is underlain by shallowly dipping sedimentary rocks of the upper Wynniatt, Kilian, and Kuujjua formations of the Neoproterozoic Shaler Supergroup, intercalated Franklin sills, and by basaltic lavas of the Natkusiak Formation, which define the northern flank of the Holman Island Syncline. Carbonate rocks of the upper Wynniatt Formation are well exposed near the coast of Minto Inlet, where they are cut by two thick diabase sills, and by prominent east-northeast striking normal faults. Carbonate, shale, and evaporitic rocks of the Kilian Formation are exposed beneath thick capping

sills that form a series of cuestas. A northwest-trending fault zone near the eastern edge of the map truncates sills and guided ascent of basaltic dykes, some of which have meter-scale semi-massive sulfides concentrated at their contacts. Rocks of the Upper Kilian and Kuujjua formations are well exposed in a cliff near the southern edge of the map area. The cliff top and plateau to the south expose basal and sheet flow units of the Natkusiak Formation.

RÉSUMÉ

Le sous-sol du feuillet 87-G/1 du SNRC est constitué de roches sédimentaires faiblement inclinées de la partie supérieure de la Formation de Wynniatt et des formations de Kilian et de Kuujjua du Supergroupe de Shaler du Néoprotérozoïque, de filons-couches intercalés de l'événement de Franklin, ainsi que de laves basaltiques de la Formation Natkusiak, qui définissent le flanc nord du synclinal de Holman Island. Les roches carbonatées de la Formation de Wynniatt supérieure sont bien exposées près de la côte de l'inlet Minto, où elles sont recoupées par deux épais filons-couches de diabase ainsi que par d'importantes failles normales de direction est–nord-est. Les roches carbonatées, les shales et les roches évaporitiques de la Formation de Kilian affleurent au-dessous d'épais filons-couches sommitaux, qui forment une série de cuestas. Près de la bordure est de la carte, une zone de failles de direction nord-ouest tronque les filons-couches et semble avoir guidé la montée de dykes basaltiques, dont certains présentent des concentrations semi-massives de sulfures d'échelle métrique, près de leurs contacts. Une falaise près de la bordure sud de la région cartographique offre une bonne coupe des roches de la Formation de Kilian supérieure et de la Formation de Kuujjua. La coulée basale et les unités de coulée en feuillets de la Formation de Natkusiak sont exposées au sommet de la falaise et dans le plateau au sud.

ABOUT THE MAP

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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 2015, 19º37'E, decreasing 44.1' annually.

This map is not to be used for navigational purposes.

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Map Viewing Files

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About the Geology

Descriptive Notes

The Tahiluak map area consists of NTS 87-G/1 and a thin strip of northernmost NTS 87-F/16. It 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. 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. 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. 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. Only Type 2 intrusions have been identified in this mapsheet.

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 toward 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 area. 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-F/16, 87-G/1 (Tahiluak) extends from the shore of Kangiryuaqtihuk / Minto Inlet southward, across a series of lakes (Tahiluak, Qulliq, and Aimauqattaq) strung along the course of the Kuujjua River. Southerly younging metasedimentary rocks of the upper Wynniatt, Kilian, and Kuujjua formations strike east to east-northeast and dip gently to the south, defining the northern flank of the Holman Island Syncline. They are injected by seven thick Type 2 sills. Carbonate rocks located near sill contacts are generally transformed to pale marble. In the south, resistant Kuujjua Formation sandstone and Natkusiak Formation lavas form a high plateau.

The northwestern corner of the map area (just south of Kangiryuaqtihuk / Minto Inlet), is underlain by grey microbially laminated limestone of the Wynniatt Formation stromatolitic carbonate member (Thomson et al., 2014; unit nPᴡ3, well exposed near UTM 503850E, 7905070N), which is injected by a thick sill (Sill 1, numbered in ascending stratigraphic order, UTM, 503500E, 7904500N). The contact between units nPᴡ3 and nPᴡ4 is intermittently exposed (e.g. UTM, 502780E, 7903535N) beneath Sill 2, which intrudes dark nodular limestone of the upper carbonate member (unit nPᴡ4). This domain is cut by many east-northeast-trending faults (e.g. UTM, 501655E, 7902120N). Quaternary deposits cover bedrock toward the south and east.

The central part of the map area is occupied by a series of prominent sills emplaced into rocks of the Kilian Formation. A thick (~ >100 m) lower sill (Sill 3) has poorly exposed lower contacts against fissile limestone and sulphate evaporite rocks of the basal Kilian member (Rainbird, 1993; unit nPᴋ1). Fault-guided dykes are exposed beneath Sill 3 at UTM 524540E, 7901260N, where a thick (~80 m) section of unit nPᴋ1 strata are exposed. This sill is very prominent east and south of Tahiluak (lake), but is covered by Quaternary deposits toward the west. Near the eastern edge of the map area, Sill 3 appears to give way to a series of northwest-trending dykes. One 30 m wide dyke, informally named the sulphide city dyke (SCD, UTM, 531520E, 7900540N) contains abundant mm- to cm-sized nodules of recrystallized limestone with garnet coronas, has ubiquitous (2–5%) sulphide minerals, and preserves a thin semi-massive sulphide zone (~10 cm wide, pyrrhotite-chalcopyrite partly replaced by magnetite) at its eastern contact (UTM, 531500E, 7900740N). The dykes probably exploited a northwest-trending fault zone (e.g. UTM, 531660E, 7899880N). A thick sequence (>100 m) of strata of units nPᴋ1 and nPᴋ2 separate Sills 3 and 4. Exposures of unit nPᴋ1 are typically of poor quality, but nodular, stromatolitic limestone is exposed at UTM, 530630E, 7900590N near the base of the slope; while good exposures of fissile blue-grey, shaly siltstone of the Kilian clastic carbonate member (unit nPᴋ2) can be seen at UTM, 526330E, 7894000N. A thin, parasitic Type 2 sill (not numbered) is emplaced near the contact between units nPᴋ1 and nPᴋ2 at UTM, 531735E, 7900130N. Sill 4 is about 100 m thick, forms a prominent cliff, and can be traced across the entire map area. Underlying strata of map unit nPᴋ2 are well exposed in the east, with thin wavy-lenticular bedded fine sandstone and siltstone with dessication and de-watering features (e.g. clastic dykes and dish structures). Rare stromatolitic carbonate interlayers become more common up-section toward the gradational contact with the overlying tan carbonate member (unit nPK3). Sill 4 forms a broad diabasic plateau east of Qulliq and Aimauqattaq (lakes). Upper contacts of Sill 4 against the unit nPK3 strata are exposed at UTM, 509856E, 7888390N, but only 20–30 m of strongly contact-metamorphosed unit nPK3 rocks separate Sills 4 and 5. Sill 5 is about 60 m thick and forms a spectacular cliff (cover illustration) near UTM, 514930E, 7889180N. This sill can easily be traced across the western half of the map area, but its eastward extensions across Aimauqattaq (lake) and the Kuujjua River are uncertain, whereas extensive Quaternary deposits cover it towards the south. A thin, contact-metamorphosed screen of the Kilian Formation upper evaporite member (unit nPK4) underlies the succeeding sill (Sill 6) in the western part of the map area (UTM, 505155E, 7880120N). Sill 6 is intermittently exposed toward the east (to UTM, 519000E, 7884370N). It is not clear if the sill exposed at a prominent bend in the Kuujjua River (UTM, 534330E, 7890860N), and south of Aimauqattaq (UTM, 525500E, 7887750N) is correlative with Sill 5 or Sill 6.

Toward the south, a cliff exposes buff sandstone and green to red siltstone and shale, with local nodular gypsum of the upper Kilian Formation (unit nPK4); thick, compound crossbedded, quartz arenites of the Kuujjua Formation (Rainbird, 1992); and basaltic lavas of the Natkusiak Formation (Jefferson et al., 1985; Williamson et al., 2013). A columnar-jointed sill (Sill 7) follows the contact between the Kilian and Kuujjua formations in the east (UTM, 5355170E, 7884040N); but to the west this contact is recessive (UTM, 526810E, 7882880N; 521950E, 7880280N). A thin sill injected the Kuujjua Formation at UTM, 535920E, 7883890N. The lowermost rocks of the Natkusiak Formation were assigned to a basal member (unit nPN1) on the basis of their rubbly flaggy appearance (Williamson et al., 2013). The base of the unit nPN3 member is inferred to correspond to the appearance of massive, columnar-jointed flows. The location of this transition is only approximate towards the west.

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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: 117°00'00"W
Eastern longitude: 116°00'00"W
Northern latitude: 71°15'00"N
Southern latitude: 70°59'00"N

Data Model Information

No Model

This Canadian Geoscience Map does not conform to either the Bedrock or Surficial Mapping Geodatabase Data Models. The author may have included a complete description of the feature classes and attributes in the Data\Data Model Info folder.

LICENCE AGREEMENT

ACCORD DE LICENCE