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GEOLOGY

IMAIQTAQTUQ

Victoria Island, Northwest Territories



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ABSTRACT

NTS 87-G/02 is divided into fault-bounded domains by late north-trending (west-side down) and east-trending (north-side down) normal faults. Paleozoic sedimentary rocks of the Uvayualuk, Mount Phayre, Victoria Island, and Thumb Mountain formations are exposed along the coast to the west of the north-trending faults. Mostly Neoproterozoic sedimentary rocks of the upper Wynniatt and lower Kilian formations of the Shaler Supergroup (Minto Inlier) occur to the east of the north-trending faults. The northeast-trending, 4 km wide NE-trending Imaiqtaqtuq Fault Zone flanks the southeast coast of Minto Inlet, and records sinistral transtensional motions. Upper Wynniatt Formation limestones are injected by Type 1 and Type 2 Franklin sills near the coast, but only Type 2 sills are documented further south, where carbonate, shale, and evaporitic rocks

of the Kilian Formation are well exposed beneath thick capping sills that form a series of south-dipping cuestas.

RÉSUMÉ

Le feuillet 87 G/2 est divisé en domaines limités par des failles normales de direction sud (compartiment ouest affaissé) et de direction ouest (compartiment nord affaissé) de formation tardive. Des roches sédimentaires du Paléozoïque appartenant aux formations d'Uvayualuk, de Mount Phayre, de Victoria Island et de Thumb Mountain affleurent le long de la côte, du côté ouest des failles de direction sud. Du côté est des failles de direction sud, on trouve principalement des roches sédimentaires du Néoprotérozoïque appartenant à la partie supérieure de la Formation de Wynniatt et à la partie inférieure de la Formation de Kilian du Supergroupe de Shaler (boutonnière de Minto). La zone de failles d'Imaiqtaqtuq, de direction nord-est et d'une largeur d'environ 4 km, flanque la côte sud-est de l'inlet Minto et conserve la trace de mouvements de transtension senestre. Près de la côte, les calcaires de la Formation de Wynniatt supérieure sont injectés de filons-couches de l'événement de Franklin des types 1 et 2. Plus au sud, seules des intrusions de type 2 ont été relevées là où des roches carbonatées, des shales et des roches évaporitiques de la Formation de Kilian sont bien exposés sous d'épais filons-couches sommitaux inclinés vers le sud, qui forment une série de cuestas.

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 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, 20°19'E, decreasing 44.6' annually.

This map is not to be used for navigational purposes.

Title photograph: Paleozoic strata exposed along South Shore of Minto Inlet, Victoria Island, Northwest Territories.

Photograph by J. Prince. 2014-149

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ABOUT THE GEOLOGY

Descriptive Notes

The Imaiqtuqtuq map area (NTS 87-G/2) lies within the Minto Inlier, a ~300 km long by 100–150 m 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 (Rainbird et al., 1996a; Long et al., 2008). 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).

Shaler Supergroup rocks were injected by tholeiitic basaltic sills of the ca. 723–720 Ma Franklin igneous event (Heaman et al., 1992; Macdonald et al., 2010). 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). The 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 (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. Where data permit, the different Franklin magma types are annotated as 1 or 2 on the map (see legend).

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 remotely sensed 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 70% of the map's terrestrial surface area. The extent of Quaternary cover shown on the map is not

meant to be comprehensive, but to highlight areas where bedrock attributions are uncertain.

NTS 87-G/2 (Imaiqtaqtuq) extends along the southern shore of Kangiryuaqtiuk / Minto Inlet. North trending linear features are prominent on aeromagnetic maps (Kiss and Oneschuck, 2010). Some of these aeromagnetic linears correspond to west-side down normal faults in outcrop (UTM, 480180E, 7898000N). Along the coast, only Paleozoic strata are exposed to the west of these faults, suggesting overall west-side down motion. Some of these faults may be reactivated Neoproterozoic syn-magmatic faults. The Paleozoic rocks include Cambrian tan dolostone of the Uvayualuk Formation (Dewing et al., 2015) (UTM, 479140E, 7896850N), which is conformably overlain by Cambrian red-and-green weathering shale and dolostone of the Mount Phayre Formation and then by Cambrian to Lower Ordovician carbonate rocks of the Victoria Island formation and the Upper Ordovician Thumb Mountain Formation. Prominent east to east-northeast striking normal faults also cut these rocks. Along the shore of Kangiryuaqtiuk / Minto Inlet to the west of UTM, 480200E, 7897900N), an excellent 550 m thick section of Victoria Island formation strata is separated from dolostone of the older Uvayualuk Formation to the south by one of these faults (running through Nauyaan Tahia), implying significant north-side-down motion.

To the east of the main north-trending faults, Neoproterozoic carbonate rocks of the Wynniatt and Kilian formations and intercalated mafic Franklin sills dominate, although an isolated fault-bounded block of Paleozoic rocks can be seen at UTM, 482400E, 7898400N. Together with intercalated sills, Proterozoic strata generally strike east- to east-northeast and dip gently toward the south, defining the northern flank of the Holman Island Syncline. Rare steeper dips reflect either structural entrainment by block faults, or steeper jogs of generally shallow, concordant intrusive contacts. Near the coast of Kangiryuaqtiuk / Minto Inlet, grey, microbially laminated limestone of the Wynniatt Formation stromatolitic carbonate member (unit nPW3; Thomson et al., 2014) is well exposed in several sections (UTM, 495000E, 7902200N; 489900E, 7899800N; 486240E, 7898000N). Several thick sills are prominent along the coast, but faulting makes correlation difficult, and it is unclear how many sills are present. Most are of Type 2, but a thick Type 1 sill is the lowermost exposed along the coast at UTM, 493080E, 7902420N and UTM, 488230E, 7900855N, to either side of Hikuhilaq (bay). Toward the southwest, there are no geochemical data on sills along the coast, but there are three places where these data reveal a thin Type 1 sill higher in the unit nPW3 section (UTM, 487000E, 7898950N; 486720E, 7898730N; 483125E, 7896810N). All other sills in this map area for which data are available are of Type 2. Another sill embedded in the unit nPW3 strata shows an outcrop pattern suggestive of a dextral Z-fold (UTM, 484600E, 7897400N). A thin layer of black nodular limestone marking the base of the upper carbonate member (unit nPW4) outcrops immediately beneath a thick capping sill (UTM, 491000E, 7898500N) that can be traced towards the southwest until it disappears under the Quaternary cover west of Imaiqtaqtuq (lake). The southern edge of this capping sill is reworked by northeast trending faults of the Imaiqtaqtuq Fault Zone.

The ~3 km wide Imaiqtaqtuq Fault Zone (IFZ) is composed of several prominent northeast trending faults that are manifested as linear valleys and strong aeromagnetic lineaments (Kiss and Oneschuck, 2010). The faults repeat sill contacts, as well as the lithostratigraphic contact between units nPW3 and nPW4 (e.g. UTM,

495940E, 7900090N vs. UTM, 496820E, 7899180N). Some of the slivers between the main faults are broken up by smaller northwest trending cross-faults that have allowed blocks to tilt, again leading to structural repetition of contacts (UTM, 492550E, 7897280N; 491990E, 7896820N). Some of the gabbroic slivers in the IFZ show a consistent, spaced fracture system that is visible on Google Earth satellite imagery (represented as inferred joints, e.g. UTM, 490700E, 7896350N), and which trends north-northeast, oblique to the main bounding faults. A northwest-trending fault that may belong to the older, syn-magmatic fault population (Bédard et al., 2012) passes near a meter-thick Fe-oxide exoskarn that decorates the upper intrusive contact of a sill (UTM, 498340E, 7899860N) at the Tuhuk occurrence (informal).

To the south of the northeast trending valley that extends from Imaiqtaqtuq (lake) towards the coast, and which forms the southern margin of the Imaiqtaqtuq Fault Zone, three distinct sills are separated by septa of fissile black nodular limestone and stromatolitic limestone of the Wynniatt Formation upper member (unit nPW4). A ~100 m thick sequence of black, nodular limestone (unit nPW4: UTM, 497800E, 7899000N) separates the 3rd sill from a 4th sill which disappears beneath Quaternary deposits to the south. This package of 4 sills is dissected by many fractures, but offsets are minor. The westward extension of the two lower sills appears to be truncated by the northeast trending fault that runs through Imaiqtaqtuq (lake), and which defines the southern limit of the IFZ. Although the 3rd sill can be traced towards the southwest as far as Imaiqtaqtuq (lake), it is covered by Quaternary deposits toward the west, but has an intrusive upper contact against thin-bedded nodular limestone of unit nPW4 to the south (UTM, 487530E, 7888820N). These contact-metamorphosed carbonate rocks are capped by a ~60 m thick sill that extends for over 9 km towards the south, but is covered by Quaternary deposits on its eastern and western sides. This sill is probably correlative with the 4th sill described above. Towards the south and east, this sill is succeeded up-section by a thin package of massive limestone of the basal evaporite member of the Kilian Formation (unit nPK1, UTM, 487990E, 7878130N). This unit nPK1 limestone is capped by a poorly-exposed 5th sill that forms a series of isolated knolls that scatter towards the northeast. Further to the southeast, rare rubbly outcrops are attributed to the Kilian Formation tan carbonate member (unit nPK2) on the basis of their appearance on the Landsat7 and SPOT5 imagery, and through correlation with outcrops in the next map area to the south (NTS 87-F/15). A 5 km wide expanse of Quaternary deposits separate these unit nPK2 outcrops from a ~30 m thick, ridge forming sill (6th sill) that is underlain by about 30–40 m of thin bedded unit nPK2 limestone. Above this sill, a poorly exposed septum of contact-metamorphosed, shaly carbonate rocks attributed to the clastic-carbonate member of the Kilian Formation (unit nPK3) are preserved beneath yet another sill (7th), which extends into adjoining mapsheets (NTS 87-G/1 and NTS 87-F/15).

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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: 118°00'00"W
Eastern longitude: 117°00'00"W
Northern latitude: 71°15'00"N
Southern latitude: 71°00'00"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.

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