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CANADIAN GEOSCIENCE MAP 190

GEOLOGY

ULUKHAKTOK

Victoria Island, Northwest Territories

Map Information Document

Preliminary

Geological Survey of Canada
Canadian Geoscience Maps

2015

Canada

PUBLICATION

Map Number

Natural Resources Canada, Geological Survey of Canada
Canadian Geoscience Map 190 (Preliminary)

Title

Geology, Ulukhaktok, Victoria Island, Northwest Territories

Scale

1:50 000

Catalogue Information

Catalogue No. M183-1/190-2014E-PDF
ISBN 978-1-100-24696-3
doi:10.4095/297279

Recommended Citation

Bédard, J.H. and Rainbird, R.H., 2015. Geology, Ulukhaktok, Victoria Island, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 190 (preliminary), scale 1:50 000. doi:10.4095/297279

Cover Illustration

View west of shore south of Ulukhaktok (Victoria Island NWT) showing block faulting of Franklin Sills, Victoria Island, Northwest Territories. Photograph by J.H. Bédard. 2014-144

ABSTRACT

NTS 87-F/9 and NTS 87-F/10 are underlain by the upper Kilian Formation of the Neoproterozoic Shaler Supergroup and mafic sills of the Franklin event. Shallowly east- and northeast-dipping strata define the nose and southern flank of the Holman Island Syncline. Carbonate, shale, and evaporitic rocks of the Kilian Formation are poorly

exposed beneath capping sills or as thin contact-metamorphosed septa between sills. West of a major lake named Ingilraniq, a thick sill forms a high plateau disrupted by many north-south and east-west trending normal faults. A lower sill occupies the floor of some valleys. East of Ingilraniq, four thick sills separated by sedimentary septa form a series of cuestas. Resistant sills form prominent west-facing cliffs and mesas, and extend towards the east as diabase-floored plateaux.

RÉSUMÉ

Le sous-sol des feuillets 87-F/10 et 87-F/9 du SNRC est constitué de roches de la partie supérieure de la Formation de Kilian du Supergroupe de Shaler, ainsi que de filons-couches mafiques de l'événement de Franklin. Les strates faiblement inclinées vers l'est et le nord-est définissent le nez et le flanc sud du synclinal de Holman Island. Les roches carbonatées, les shales et les roches évaporitiques de la Formation de Kilian ne sont que très peu exposées dans des coupes sous des filons-couches sommitaux ou dans de minces feuillets séparant des filons-couches, où ils ont subi les effets d'un métamorphisme de contact. À l'ouest d'un grand lac nommé Ingilraniq, un épais filon-couche forme un haut plateau disséqué par plusieurs failles normales d'orientation nord-sud et est-ouest. Un filon-couche plus bas forme le plancher de vallées. À l'est du lac Ingilraniq, quatre épais filons-couches séparés par de minces feuillets de roches sédimentaires forment une série de cuestas. Des filons-couches résistants forment d'importantes falaises à regard ouest et des mésas et se prolongent vers l'est sous la forme de plateaux à surface constituée de diabase.

ABOUT THE MAP

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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.

Logistical support provided by the Polar Continental Shelf Program as part of its mandate to promote scientific research in the Canadian north. PCSP 005-10

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, 20º10'E, decreasing 42.5' annually.

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See documentation accompanying the data.

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Map Viewing Files

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ABOUT THE GEOLOGY

Descriptive Notes

The Ulukhaktok map area consists of the northeastern part of NTS 87-F/9 and northwestern part of NTS 87-F/10. 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 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 (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.

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 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 40% of the map's area (Dyke and Savelle, 2004). 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/9 (east side) and NTS 87-F/10 (west side) extends from the Hamlet of Ulukhaktok to the Amundsen Gulf and the Albert Islands on the southern flank of the Minto Inlier. Together with intercalated sills, strata dip gently to the east and northeast,

defining the nose and southern flank of the Holman Island Syncline. The map area is dominated by thick Type 2 sills that are separated by septa of the tan carbonate (unit nPK3) and upper evaporite (unit nPK4) members of the Kilian Formation. No Type 1 sills have been recognized in this mapsheet. The map area is informally divided into 3 areas: western, central-southern, north-western.

In the western part of the map area, between the coast and a major lake known as Ingilraniq, the landscape is dominated by a very thick (up to 150 m) sill that forms a high plateau. The outcrop pattern is broken up by a dominant set of roughly north-south trending normal faults, with subordinate east-west-trending faults, all of which are probably of Paleozoic age. The faults create linear valleys, many occupied by lakes, and have variable throws, such that blocks are offset in a chaotic way (*see* cover illustration). A lower sill is poorly exposed on some valley floors (UTM, 480560E, 7841600N), in Ulukhaktok (e.g. UTM, 471900E, 7848500N), and along the coast (Quaraukkat Cape, UTM, 480000E, 7833500N). A poorly exposed septum (~70 m thick, e.g. UTM, 477370E, 7837960N) of strongly contact-metamorphosed strata of the Kilian Formation tan carbonate (unit nPK3) member separates the upper and lower sills.

In the central-southern part of the map area, a major sill (~100 m thick) dominates the landscape, forming prominent cliffs that line the eastern shore of Ingilraniq (lake) and the shores of Shoal Bay and Safety Channel to the south. This sill forms a broad diabase-floored plateau extending many km inland. The upper intrusive contact is recessive and runs along an arc defined by four lakes (Hingilihuk, Anaruvik, Uyarahugyulik and Qikiqtalik). A lower sill is exposed on Nauyaat-Bold Bluff (UTM, 485800E, 7832000N) and the Albert Islands (UTM, 489900E, 7829500N). The two sills are separated by a ~70 m thick sequence of tan carbonate member strata (unit nPK3, UTM, 488420E, 783050N) that hosts a thin parasitic sill (UTM, 487470, 7849050). How the main upper and lower sills in this part of the map area are related to the upper/lower sills in the western area (discussed above) is uncertain as a result of unconstrained motion on inferred faults.

Toward the north and east, a ~70 m thick section of the upper evaporite member of the Kilian Formation (unit nPK4) is locally well exposed (UTM, 497700E, 7844460N) above the central-southern area capping sill. Above these sedimentary rocks, a ~50 m thick diabase sill forms prominent mesas in the north-eastern part of the map area (UTMs, 497630E, 7844700N; 497200E, 7843100N). This mesa-forming sill has a recessive upper contact that follows the base of another set of mesas further to the north-east, where ~50 m of unit nPK4 strata are exposed (e.g. UTM, 497780E, 7848400N). Another sill (~70 m thick), caps yet another set of mesas further to the north-east, and is intermittently exposed beneath the Quaternary cover all the way to the northeast corner of the map area.

Acknowledgments

Thanks are due to our cooks (Rosanda Belaar-Spruyt and Susie Memogana), pilots, mechanics and other support personnel, Technical Field and Supply Services, Polar Continental Shelf Program (notably Michael Kristjanson), Laboratoire de cartographie numérique et de photogrammétrie staff (notably Nathalie Côté and Étienne Girard), and the wonderful people of Ulukhaktok, notably: Isaac Inuktalik, Bryan Kudlak, Derek Ogina, Jack Alanak, Lena Egotak, Robert Kuptana, Gayle Okheena, Jasmine Klengenberg, and Angus Banksland. C.W. Jefferson is thanked for an informed and constructive review. This is a GEM1 product.

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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°51’00”W
Eastern longitude: 116°36’00”W
Northern latitude: 70°45’00”N
Southern latitude: 71°30’00”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