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GEOLOGY

BOOT INLET

Victoria Island, Northwest Territories

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Cover Illustration

Reynolds Point Group strata cut by 2 sills. Boot Inlet, Victoria Island, Northwest Territories. Photograph by J.H. Bédard. 2014-145

ABSTRACT

NTS 87-G/7 is mostly underlain by Neoproterozoic rocks of the Shaler Supergroup, intruded by Franklin mafic and untramafic sills. Dolostone dominates the Boot Inlet and Jago Bay Formations, quartz-rich sandstone dominates the Fort Collinson Formation, whereas gypsum evaporites typify the Minto Inlet Formation. These gently south-dipping strata form the southern flank of the Walker Bay Anticline. North-northwest trending (syn-magmatic Proterozoic) and east-northeast trending (post-Proterozoic) normal faults

are ubiquitous, breaking up the outcrop pattern into polygonal blocks. Franklin intrusions belong to two magmatic series. Type 1 sills may have a peridotitic base and seem to have been preferentially emplaced just above the Fort Collinson sandstones. Thick Type 2 sills are commonly feldspar porphyritic, occur throughout the section, and form the crest of the Collingwood Hills. Dykes have planar to irregular contacts, some being localized along North-northwest trending faults. Paleozoic rocks outcrop in the westernmost part of the map area.

RÉSUMÉ

Le Feuillet SNRC 87-G/07 est surtout composé de roches Néoprotérozoïques du Supergroupe de Shaler, inhectés par des filons mafiques et ultramaficques Franklin. Les roches métasédimentaires incluent des dolomies des formations de Boot Inlet et Jago Bay, des grès quartzeux de la Formation de Fort Collinson, et des évaporites de la Formation de Minto Inlet. Les strates pendent doucement vers le sud, définissant le flanc sud de l'Anticlinal de Walker Bay. Des failles normales orientées nord-nord-ouest (syn-magmatiques Protérozoïques) et est-nord-est (post- Protérozoïques) sont omniprésentes, divisant le feuillet en blocs polygonaux. Les intrusions Franklin appartiennent à deux series magmatiques. Les filons-couches de Type 1 ont souvent des faciès basaux péridotitiques et semblent avoir étés mis en place de façon préférentielle immédiatement au-dessus des grès du Fort Collinson. D'épais filons de Type 2 sont souvent porphyriques à plagioclase, et forment la crête des collines Collingwood. Des intrusions discordantes peuvent avoir des contacts planaires (dykes) ou irréguliers, et sont parfois associées avec des failles nord-nord-ouest. Des roches Paléozoïques affleurent dans la partie ouest du feuillet.

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, 20º18'E, decreasing 45.6' annually.

This map is not to be used for navigational purposes.

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ABOUT THE GEOLOGY

Descriptive Notes

The Boot Inlet map area (NTS 87-G/7) 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 (late Tonian-early Cryogenian) age. The Neoproterozoic sedimentary rocks belong to the Shaler Supergroup, a ~4 km-thick succession of shallow marine carbonate rocks 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; Rainbird et al., 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 strata 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 (Denyszyn et al., 2009; Heaman et al., 1992; 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). 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 (annotated as 'o' where observed: 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 (annotated as 'p' where observed). 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.

The irregular edge of the exposed Minto Inlier is defined by an erosional unconformity that separates 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 (Dewing et al., 2015; Thorsteinsson and Tozer, 1962). 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 terrestrial surface area (Hodgson, 2012). The extent of Quaternary cover shown on the map is not meant to be comprehensive, but to highlight areas where bedrock attributions are most uncertain.

NTS 87-G/7 (Boot Inlet) is mostly underlain by Neoproterozoic rocks of the Reynolds Point Group (Boot Inlet, Fort Collinson, Jago Bay formations) with rare exposures of Minto Inlet Formation rocks. Detailed descriptions of these rocks are provided in Young and Long (1977), Young (1981) and Morin and Rainbird, 1993. In the northwestern part of the area, lack of data precludes subdivision of Reynolds Point Group rocks. Together with intercalated Franklin sills, strata dip gently to the south, forming the southern flank of the east-northeast trending Walker Bay anticline. The common bulls-eye contact patterns (e.g. UTM, 483500E, 7931500N) reflect the relative thinness of some units, the shallowly dipping contacts, and the significant topographic relief. The regional-scale erosional unconformity that separates Cambrian clastic rocks (Quyuk Formation: Durbano et al., 2015) and tan dolostone (Uvayualuk Formation: Dewing et al., 2015) from the Proterozoic rocks beneath is possibly exposed in the westernmost part of this map area (e.g. UTM, 465690E, 7921000N).

Carbonate rocks of the Boot Inlet Formation are widespread. Massive to brecciated, orange tinged dolomitized zones are common near faults. Most outcrops are composed of rhythmically layered grey calcareous and buff dolomitic arenite and siltite, but stromatolites, ooidstones and intraformational conglomerates are locally prominent. Excellent exposures can be seen at UTM, 494500E, 7930000N. The locally well exposed Fort Collinson Formation is typified by variably dolomitic, medium bedded, orange to grey weathering quartz arenite, commonly with herringbone cross-stratification. The lower part of the formation is composed of parallel-stratified to crossbedded, quartz-sand bearing oolitic grainstone. Its overall thickness varies from 50–100 m (Young and Long, 1977, Rainbird et al., 1994). It is common to see tectonic repetition of these rocks by the play of the two major fault systems (e.g. UTM, 495000E, 7930000N vs. 489000E, 7928300N). Rocks of the Jago Bay Formation are well exposed on the north facing slopes at UTM, 487000E, 7924000N. Jago Bay rocks comprise massive, thick-bedded, yellowish-grey-weathering limestone or dolostone that alternate with thinner-bedded carbonate grainstones, silty limestones, and stromatolitic units. Rare gypsum interlayers have been observed near the gradational upper contact with the Minto Inlet Formation. The thickness of the Jago Bay Formation exceeds 200 m in the map area. A thin sliver of crumbly weathering, thin to thick-laminated white gypsum with interbedded grey-green calcisiltite, red gypsiferous siltstone and nodular gypsum of the Minto Inlet Formation occurs along the coast on the eastern edge of the map area.

At least two and perhaps three Type 1 sills are exposed in the map area, but block-faulting makes correlation difficult. One example (LP-sill = the Lower Pyramid sill of Hayes et al., 2015) with a prominent olivine-rich base was emplaced just above the Fort Collinson quartz arenite. It is exposed on a prominent pyramid-shaped hill at the head of Boot Inlet (Ungirun, UTM, 483500E, 7931500N, *see* cover illustration), and probable correlatives occur across the valley at UTM, 488860E, 7928250N (north of Qiliqtingualik hill) and 494550E, 7928720N. Similar Type 1 sills with peridotitic bases intruded the same stratigraphic horizon to the northeast in map areas 87-G/8 and

87-G/9. Another Type 1 sill caps hills at UTMs, 490420E, 7927300N and 488800E, 7927100N (north of Qiliqtingualik hill), and appears to be slightly higher in the Jago Bay section. Other Type 1 sills are hosted by Boot Inlet Formation limestone (UTM, 494425E, 7931650N).

Several Type 2 sills occur in this map area. Feldspar-porphyritic rocks characterize a prominent sill ('UP' sill, Upper Pyramid sill) emplaced within the Jago Bay Formation (e.g. UTM 483500E, 7931500N, *see* cover illustration), about 20 m above the LP sill at the summit of Ungirun. A very similar and probably correlative sill occupying the same stratigraphic position can be traced for considerable distances eastward into adjoining maps (e.g. NTS 87-G/8, 87-G/9), and caps the hills across the valley to the south and southeast ('UP' sill: UTM, 488870E, 7928030N; 495500E, 7929600N). Other (unanalyzed) sills that may belong to Type 2 may also be present within the Boot Inlet Formation. Crosscutting, dyke-like bodies may have planar (e.g. UTM 489530E, 7931380N) or irregular contacts. A good example (Type 2) of the latter at UTM, 493620E, 7530320N has a straight contact on the east that appears to be fault-bounded, with irregular lit-par-lit injections on its western side.

North-northwest trending normal faults are interpreted to have been active during Franklin magmatism (Bédard et al., 2012) and show both east- and west-side-down normal motions. These faults were probably reactivated later, during motion along the younger faults. The main east-northeast to northeast-trending normal faults, along with contemporaneous east-west and north-south-trending oblique-slip faults, were initially active during deposition of the basal Cambrian clastic unit (Quyuk Formation), but continued to move afterwards (Durbano et al., 2015). These two sets of intersecting faults break up the outcrop pattern into polygonal blocks. Prominent aeromagnetic discontinuities allow major faults to be traced beneath the Quaternary cover (e.g. UTM, 472720E, 7926200N).

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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°30’00”N
Southern latitude: 71°15’00”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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