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NATMAP CARTNAT
Canada's National Geoscience Mapping Program
Le Programme national de cartographie géoscientifique du Canada

DESCRIPTIVE NOTES

INTRODUCTION

This map is one of a set of six 1:50 000 scale colour Open File maps, published as contributions to the Western Churchill NATMAP Project. These maps present preliminary results of bedrock mapping carried out by the Geological Survey of Canada during the 1998 field season in parts of the MacQuoid Lake (NTS 55M) and the Gibson Lake (NTS 55O) map areas. Previous work includes mapping at scales of one inch to eight miles (Wright, 1967), 1:125 000 (Reinhardt and Chandler, 1973; Reinhardt et al., 1980), and 1:50 000 (Tella et al., 1997a, b; LeCheminant et al., 1997). The present bedrock mapping was undertaken at 1:50,000 scale (Figs. 1, 2), with emphasis on establishing the nature and extent of Paleoproterozoic tectonothermal reworking of older, Archean rocks. Detailed descriptions of the lithological and structural characteristics of the rock units are reported elsewhere (Hanmer et al., 1999a, b, c; Mills et al., 1999; Ryan et al., 1999).

This project is part of the Western Churchill NATMAP program, a collaborative program between the Geological Survey of Canada (GSC), the Government of the Northwest Territories (GNWT), Indian and Northern Affairs Canada (INAC), and industry. All field data were compiled digitally using FIELDLOG and AutoCAD with final output generated using ArcInfo software.

GEOLOGICAL OVERVIEW

The Gibson-MacQuoid lakes region is underlain by a polydeformed and metamorphosed Archean terrane that was tectonothermally reworked in the Paleoproterozoic (Tella et al., 1997a, b; Hanmer et al. 1999a, b). It includes (i) the eastern part of the Archean MacQuoid supracrustal belt, and (ii) the Cross Bay plutonic complex (Fig. 2). The MacQuoid supracrustal belt is divided into the MacQuoid homocline, a predominantly metasedimentary belt (**Ats**, **Adt**) with panels of gneissic tonalite (**Att**), flanked to the north by a predominantly volcanic belt (**Av**, **Avf**, **Avm**) intruded by gabbro (**Agb**) and late Archean tonalite-granodiorite plutons (**Atp**, **Adt**). The Cross Bay plutonic complex is composed of tonalitic and dioritic gneisses (**At**, **Adt**), cross-cut by granitic plutons (**A'g**, **A'gd**, **Pgr**). Along its southern margin, the plutonic complex is separated from the supracrustal belt by the approximately east-west trending, strike-slip, Big lake shear zone. Dabase dykes (**Pdm**), several sets of lamprophyre dykes (**Pp**), and granite intrusions (**Pgr**) were emplaced during the Paleoproterozoic. Polymictic conglomerates of the South Channel Formation (**Psc**) that occur in the northwestern portion of NTS 55M/16 are described elsewhere (Rainbird et al., 1999).

MACQUOID HOMOCLINE

The southern part of the map area (NTS 55M/9, 55N/11, 12) is underlain by the moderately north-northwest dipping MacQuoid homocline (Fig. 2) composed of panels of clastic metasedimentary rocks (**Ats**) and subordinate, mafic to intermediate ± felsic volcanic rocks (**Av**, **Avs**), with gneissic tonalite (**Att**), and predominantly tonalitic plutons (**Atp**). The metasedimentary rocks are dominated by biotite ± garnet semipelites, and biotite psammites, with lesser oxide-facies iron-formation (**Aif**), and rare conglomerate and quartz arenite. With few exceptions, primary compositional layering is absent, but laminated quartz-magnetite iron formation occurs in discontinuous layers, 5cm-30 m thick, set in laterally discontinuous, 100-500 m thick, aluminous garnet ± sillimanite pelite horizons. The semipelites and psammites locally contain quartz, quartz + feldspar + biotite, and garnet + biotite ± staurolite ± aluminosilicates (kyanite ± sillimanite ± andalusite). Relatively minor volumes of mafic rocks (**Am**) interlayered with the metasedimentary units are fine grained, locally banded and generally homogeneous amphibolites, with locally well developed compositional banding on the 2-5 cm scale, and rarely preserved pillow structures. Tonalitic rocks (**At**, **Atp**) represent approximately 50% of the homocline, but also constitute a significant proportion of the region as a whole.

VOLCANIC BELT

The western part of the map area (NTS M/9, 55N/12) is underlain by volcanic (**Av**, **Avv**), gabbroic (**Agb**), and tonalitic rocks (**At**, **Atp**), with subordinate metasedimentary rocks (**Ats**; Fig. 2). In the south these rocks can be traced with continuity into the western segment of the MacQuoid supracrustal belt (Tella et al., 1997a). To the east (NTS 55P/12), the volcanic belt overlies the MacQuoid homocline, whereas to the west (NTS 55M/9, 55N/12) it forms the northern envelope to three tonalite-granodiorite plutons (**Atp**).

The southern part of the volcanic belt is a moderately north-dipping homoclinal panel. As previously noted to the west (Tella et al., 1997a), dominantly mafic volcanic rocks (**Av**) are flanked to the north by dominantly intermediate and minor felsic volcanic rocks (**Avv**). Locally, relict pillow structures are preserved in both mafic and intermediate compositions, with metamorphosed hornblende-garnet selvages, 1-5 cm thick. Although some of the more thinly layered amphibolites may be derived by the deformation of pillowed flows, the thickness of most of the layering suggests that it is probably derived from primary bedding in volcaniclastic sediments.

Intermediate to mafic volcanic rocks, with a minor felsic component (**Avv**) are generally fine grained, homogeneous, and light grey in colour. Locally, 2-3 mm angular to elliptical feldspar grains or light coloured rock fragments up to 5 mm long are preserved. These rocks are interpreted as crystal and lapilli tuffs, respectively. Rare felsic volcaniclastic rocks contain quartz eyes and angular fragments up to 5 cm long of the same composition as the matrix, and are interpreted as tuffs and lithic tuffs.

Map-scale panels of aluminous semipelite, quartz-rich, biotite-muscovite psammite, and muscovitic quartzite (**Ats**) occur between panels of volcanic rocks. Staurolite-garnet andalusite-sillimanite-kyanite semipelite predominates to the west of the Sandhill prospect, whereas psammitic rocks are more voluminous to the east.

Metasedimentary rocks (**Ats**) are less abundant in the northern part of the volcanic belt. At one locality, they are interlayered with a 25 m thick quartz pebble conglomerate and a 1 m by 25 m lens of quartz arenite (Hanmer et al. 1999a). At the latitude of Bowell Islands, intermediate volcanic rocks are flanked by an east-trending panel of uniform semipelitic rocks, with widespread, abundant garnet-sillimanite-kyanite and pervasive quartz-feldspathic segregations. These metasediments do not link laterally with similar lithologies to the south, and may represent an independent package. At the northern limit of the map area (NTS 55M/16), subordinate, interlayered mafic volcanic rocks contain relatively undeformed, garnetiferous pillowed flows. They are in fault contact with strongly foliated tonalite-granodiorite (**At**, **A'gd**) and mylonites of the Kramanluar complex (Sanborn-Barrie, 1994).

A panel of diorite and tonalite (**Adt**) trends eastward through Brown Lake, turning progressively northwards as one approaches the western limit of the map area. It is relatively free of inclusions and, although pervasively foliated, preserves interlocking igneous textures. East of Brown Lake it is concordant to the supracrustal wallrocks, but to the west it is interdigitated with volcanic rocks. It is interpreted to be a foliated, semi-concordant, plutonic body that has not recorded the same intensity of deformation as most of the rocks in the map area. The southwestern portion of the map area (NTS 55M/9, 55N/12) is underlain by three plutons of tonalite with subordinate granodiorite (**Atp**), the central one of which has been dated at ca. 2.68 Ga. As in the diorite-tonalite panel, they have the textural appearance of foliated plutons. Their northern margins have a deeply scalloped geometry, concordant to the wallrock foliation, such that they are separated by vertical, synformal keels occupied by the mafic volcanic and sedimentary rocks.

Five gabbro bodies occur in the NTS 55M/9,16 and 55N/11, 12 map sheets. The first (**Agb**) occupies a triangular area between the central and western tonalite-granodiorite plutons (**Atp**; 55M/9). It is variably foliated, and contains xenoliths of strongly deformed mafic volcanic rocks. The second (**A'gb**) occurs on the east side of the central tonalite-granodiorite pluton. It varies from isotropic, medium grained gabbro to fine grained amphibolite, is locally foliated, and contains xenoliths of tonalite (**At**, **Atp**). The third, the Suluk gabbro (**A'gb**), lies east of the eastern tonalite-granodiorite pluton (55N/12). It is an isotropic, but locally sheared, pluton that cuts its foliated wallrocks but internally shows considerable grain size and compositional variation. Armitage et al. (1997) consider it to have been emplaced during the Paleoproterozoic, and potentially related to the mafic dykes (**Pdm**). Two other gabbro units (**A'gb**; 55M/16, 55N/11) are lithologically and texturally similar to the Suluk gabbro and may be coeval.

CROSS BAY PLUTONIC COMPLEX

An overlapped area underlain by tonalitic-dioritic-gabbroic gneiss (**At**, **Adt**), intruded by granitic plutons (**A'gd**, **A'g**, **Pgr**) straddles Cross Bay to the north and east of the supracrustal rocks. The tonalitic gneisses are intruded by semi-concordant sheets of biotite monzogranite-granodiorite. The granitoid sheets, 5cm-50 m thick, range from equigranular and medium-fine grained, to pegmatitic, to K-feldspar augen "granite" (**A'g**), and show a wide range of deformation states. South of Cross Bay, the tonalite (**At**) intrudes large, map-scale panels of diorite, gabbro, and undifferentiated amphibolite. All of the rocks in this tonalite-diorite-gabbro association are well foliated and/or lineated, and primary hornblende in the tonalites and diorites is totally replaced by biotite. Most of the map-scale panels of diorite and gabbro lie south and east of Cross Bay, and are separated from more uniformly tonalite compositions by the Cross Bay fault (Hanmer et al., 1999a, b).

The western side of the Cross Bay complex contains a large, arcuate pluton of coarse (3-4 cm), commonly K-feldspar-phyric, biotite granite-granodiorite (**A'g**). The granite is variably foliated parallel to its curved margins, ranging from isotropic, to augen granite, to very locally mylonitic. At the map scale it interdigitates semi-concordantly with the tonalite gneiss, but is locally discordant to the wallrock foliation. At the outcrop scale, moderately foliated granite locally contains strongly foliated, concordant rafts of tonalite. To the northwest (NTS 55N/13), variably deformed granite is in sheeted contact with well foliated intermediate volcanics (**Avv**) and metasedimentary rocks (**Ats**).

The eastern side of the Cross Bay complex (NTS 55N/11, 14) includes an irregularly shaped mass of leucocratic, biotite granite (**Pgr**) and granodiorite (**A'gd**). Variation in colour, texture and deformation state suggests the presence of several discrete plutons. The granites are pink to cream coloured, fine to medium grained, equigranular, and moderately foliated to isotropic, with well preserved igneous textures. Fluorite is common in leucocratic, isotropic varieties, which may be correlative with granite dated at ca. 1.83 Ga (Tella and Schau, 1994). Note the presence of a map-scale xenolithic raft of mafic dyke (**Pdm**; 55N/11). The granodiorite tends to be more strongly foliated, and may be compositionally deformed. Much of the biotite-granite mass was emplaced after the principal deformation of its host rock. However, the range of deformation states, and the local presence of well foliated monzogranite, suggest that some of these granitic rocks may have witnessed significant deformation. Granite, monzogranite and granodiorite plutons and sheets, of similar aspect, also occur north of the Cross Bay fault on Big Point peninsula (NTS 55N/13).

DYKES

A swarm of east-trending (270°-120°) mafic dykes (**Pdm**) commonly preserves primary textures, including well defined chilled margins. The dykes generally occur as thick, steeply dipping sheets, up to 500 m thick, outcropping as elevated ridges up to 5 km long, and discontinuously traceable for tens of kilometres. Internally, they are coarse grained and locally plagioclase-phyric. The dykes are composed predominantly of hornblende and plagioclase, but also contain locally preserved clinopyroxene, plagioclase and oxronitic garnet. They are the eastward extension of the ca. 2.19 Ga Tulemalu mafic dyke swarm (Tella et al. 1997a), informally termed the MacQuoid dykes.

A set of less abundant, predominantly northeast-trending, diabase dykes (**Pdd**) of uncertain age are present in the region. They are up to 3m thick, fine grained, steeply dipping dykes with locally well defined chilled margins, and commonly contain plagioclase phenocrysts.

Narrow (25cm-2m) lamprophyre dykes (**Pdl**), dated at ca. 1.83 Ga (MacRae et al., 1996), are present throughout the map area. They are variable in orientation, but the majority trend approximately northwest-southeast. For the most part, they are not deformed, although it is not uncommon for dykes, cross-cutting at a high angle to wallrock foliation, to contain a well-parallel or oblique internal fabric. Both foliated and isotropic lamprophyre dykes occur in the discovery outcrop of the diamondiferous Akluliik dyke, near the Sandhill prospect (NTS 55N/12). Such fabrics are probably related to the local conditions of dyke emplacement and cooling, and do not necessarily reflect a regional tectonometamorphic event. Fine-grained potassic dykes of hornblende syenite share the same field relations as the lamprophyres, and are spatially associated with them locally.

STRUCTURE

A single, regionally pervasive foliation is developed predominantly parallel to lithological layering in the supracrustal rocks (**Av**, **Avv**, **Ats**), gabbro (**Agb**), tonalite (**At**, **Adt**), and diorite (**Adt**). Detailed mapping in the western part of the volcanic belt shows that this foliation is derived by the transposition of layering and a layer-parallel tectonic foliation (S_1). In the MacQuoid homocline, this main foliation (S_1) is a moderately (40-50°) northwestward dipping L/S fabric with a sporadically developed, moderately to steeply, north to northeast-pitching extension lineation (not differentiated). The southern part of the volcanic belt carries a moderately northwest to north-northeast dipping L/S fabric, in which a strong extension lineation is widely developed and typically oriented down the dip. 2.68 Ga tonalite plutons are syn-kinematic with respect to D_2 deformation (Hanmer et al., 1999a, b), indicating that S_1 and L_1 were largely developed by that time. The strong development of D_2 fabrics in the southern part of the volcanic belt, the down-dip extension lineation, and the potential for south and southeast directed thrust nappes in the Yathkyed Lake and Rankin Inlet areas (Tella et al., 1986; Relf et al., 1988) are suggestive of thrust tectonics in the map area; however, unequivocal identification of D_2 faults and/or shear-sense indicators is lacking.

Elsewhere in the region, the foliations represented on the maps are of unspecified generation. They include attitudes of the main foliation (in rock units **Ats**, **Adt**, **Adl**) as well as those of undifferentiated and unspecified generation (in rock units **A'db** to **Pgr**). Some foliation data (eg., in **Pgr**, **A'gr**) may represent fabrics from country rock inclusions. Appropriate rock unit symbols are noted adjacent to such fabric data.

In the Cross Bay plutonic complex, the dominant foliation was deformed about south-plunging F_3 folds, associated with a coaxial extension lineation (not differentiated), and subsequently by east-northeast trending F_4 folds. The plutonic complex is bounded to the south by the pre-, syn- and post-D_4, dextral, strike-slip Big lake shear zone (Hanmer et al., 1999b). Metamorphosed, ca. 2.19 Ga, MacQuoid dykes everywhere post-date the main fabric in the Archean supracrustal rocks, tonalite (**At**, **Adt**) and diorite (**Adt**), but within the Cross Bay plutonic complex and the Big lake shear zone they were deformed during D_4-D_5. Therefore, D_3 and D_4 are regional Paleoproterozoic events. Granitic plutons within the plutonic complex were intruded post-D_3 and pre-D_4 fabrics, respectively, and likely represent Paleoproterozoic magmatic events.

The Big lake shear zone is a steeply dipping belt of S > L, amphibolite facies, porphyroclastic straight gneisses and thick (up to 2 km) ribbon mylonites (predominantly **P'gm**) that mark the southern margin of the Cross Bay complex (Fig. 2). Foliation in the straight gneisses and mylonites is steeply dipping, and has an east-trending, subhorizontal lineation. Locally, shear-sense criteria (eg. delta porphyroclasts, pressure shadows, rotated fold axial planes, shear bands, C/S fabrics, foliation fish) indicate the shear zone is a dextral, strike-slip structure. East of Big lake (NTS 55N/11) and north of Brown Lake (NTS 55N/12, 55M/9) it splays into several branches that apparently terminate within the map area. The western segment of the shear zone is stitched by a pluton of isotropic monzogranite (**Pgr**).

A map-scale discordance in the three-dimensional foliation pattern within the Cross Bay plutonic complex requires the presence of a discrete structural break, the Cross Bay fault (NTS 55N/13,14). The fault has no geological expression on the ground, and its trace is drawn according to cartographic evidence. Southwest of Cross Bay, the fault trace is interpolated where there is an abrupt separation between north trending, moderately (40-60°) west dipping foliation and similarly inclined foliation dipping to the southeast. It also separates tonalite gneiss to the west, and the tonalite-diorite-gabbro association to the east. On Big Point peninsula, it is drawn between folded tonalite gneiss (**At**), pervasively injected by monzogranite veins and sheets to the north, abruptly juxtaposed with planar, foliated diorite (**Adt**) cut by occasional pegmatite veins to the south.

In the southern part of the region (NTS 55N/11,12; 55M/9) the MacQuoid dykes cross-cut the regional foliation and compositional layering in both the Gibson-MacQuoid homocline (Fig. 2) and the tonalitic rocks (**At**) in the volcanic belt. The dykes are clearly post-kinematic with respect to the deformation in their wallrocks. Within the Big lake shear zone (Blsz), the fabric of the annealed straight gneiss (**P'gm**) wraps around a 90° bend in the margin of a MacQuoid dyke. In the Cross Bay complex, at least 8 mafic dykes, each conforming unequivocally to the field characteristics of the MacQuoid dykes to the south, were folded, foliated, and/or lineated during deformation involving the enclosing tonalitic wallrocks. These field relationships suggest that the Blsz and the Cross Bay complex have witnessed regionally extensive Paleoproterozoic deformation and metamorphism after ca. 2.19 Ga. These observations are consistent with those reported from the adjoining region to the west (Tella et al., 1997a,c).

METAMORPHISM

In the volcanic belt, aluminous metasediments contain pre- to syn-kinematic andalusite enclosed by the main foliation and partially replaced by sillimanite. Late syn-kinematic staurolite and kyanite overgrow the main fabric, which is also deflected about the ends of the crystals. Mafic volcanic rocks commonly contain 2-3 mm garnets, enclosed by the fabric developed in a fine grained hornblende-plagioclase matrix. Plagioclase rims commonly preserve the garnet shape, suggestive of post-kinematic decompression. Intermediate volcanic rocks (**Avv**) contain elongate hornblende porphyroblasts, randomly oriented (decussate) within the regional main foliation plane, which appear to represent a post-kinematic, regional metamorphic event of unknown age.

ECONOMIC GEOLOGY

The MacQuoid homocline and the southern part of the volcanic belt host many mineral occurrences, as well as several significant prospects including the Sandhill Zn-Cu-Pb-Ag massive sulphide (Armitage, 1998; Armitage et al., 1994, 1995), the Suluk Ni-Cu-Co magmatic sulphide (Armitage et al., 1997) and the Paleoproterozoic diamondiferous Akluliik lamprophyre dyke (**Pdl**; MacRae et al. 1995, 1996).

Gold occurrences are largely of structurally controlled vein type, hosted by a variety of Archean rocks. However, high gold assays were also obtained from at least two iron-formation hosted prospects (Hearn, 1990). Preliminary investigation near Grizzly lake indicates that pyrite and arsenopyrite occur within and adjacent to largely conformable quartz massive/veins, but that sulphide minerals are also disseminated throughout much of the cherty oxide-carbonate iron-formation.

Base metal occurrences include stratabound accumulations of sphalerite, galena and chalcopyrite spatially associated with siliceous zones in pyritic quartz-muscovite-garnet-staurolite-graphite schist at the Sandhill prospect (Armitage, 1998; Armitage et al., 1995). Alteration assemblages, similar to those of Sandhill (NTS 55N/12), have been traced for up to 12 km eastward along strike (Armitage et al., 1995). Sphalerite is also reported from sulphidic graphitic schist that occurs south of Grizzly lake, about 1 km east of the extensive auriferous iron-formation (Armitage et al., 1995). Several gossans containing laterally extensive, largely conformable, pyrrhotite-rich layers in siliceous zones are also present in this area. Sulphide-bearing quartz massive/veins are locally present in these gossans. The Suluk prospect (Armitage et al., 1997) is spatially associated with the gabbro (**A'gb**), 3 km southwest of the Sandhill prospect. Massive sulphide at Suluk is irregular in form, concordant with the foliation in the enveloping Archean volcanic rocks and is composed of massive nickeliferous pyrrhotite-pentlandite that contains abundant wallrock xenoliths. Polymetallic veins (Au plus Zn and/or Pb) may be present in the map area (Hearn, 1990; Armitage et al., 1995).

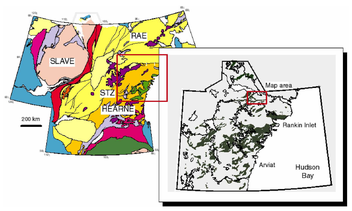

Figure 1. Schematic location map of the MacQuoid-Gibson Lakes map area represented by this set of maps. The Western Churchill map is composed of the Rae and Hearne domains separated by the Snowbird Tectonic Zone (STZ). Greenstone belt rocks in the enlargement window are represented in green.

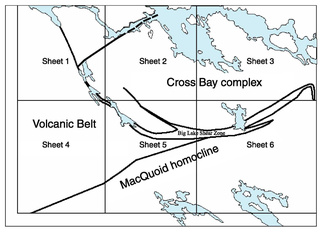

Figure 2. Sketch map showing the generalized lithological and structural subdivisions within the map area (see Figure 1 for location; rectangle box within the enlargement window).

Canada

Carving stone is quarried in a small-scale operation on the south side of Cross Bay (NTS 55N/13), Chesterfield Inlet. The carving stone is light to medium gray-green, and uniformly fine- to medium- grained. It contains few macroscopic veins and large fracture-free blocks can be readily obtained. The quarry pits appear to be located within large inclusions of ultramafic material within a gneissic tonalite (**At**) host. A detailed account of preliminary optical petrographical description and comparison of the currently quarried carving stone, and of similar materials from five new sites identified in the present bedrock mapping, is presented elsewhere (Hanmer et al., 1999c).

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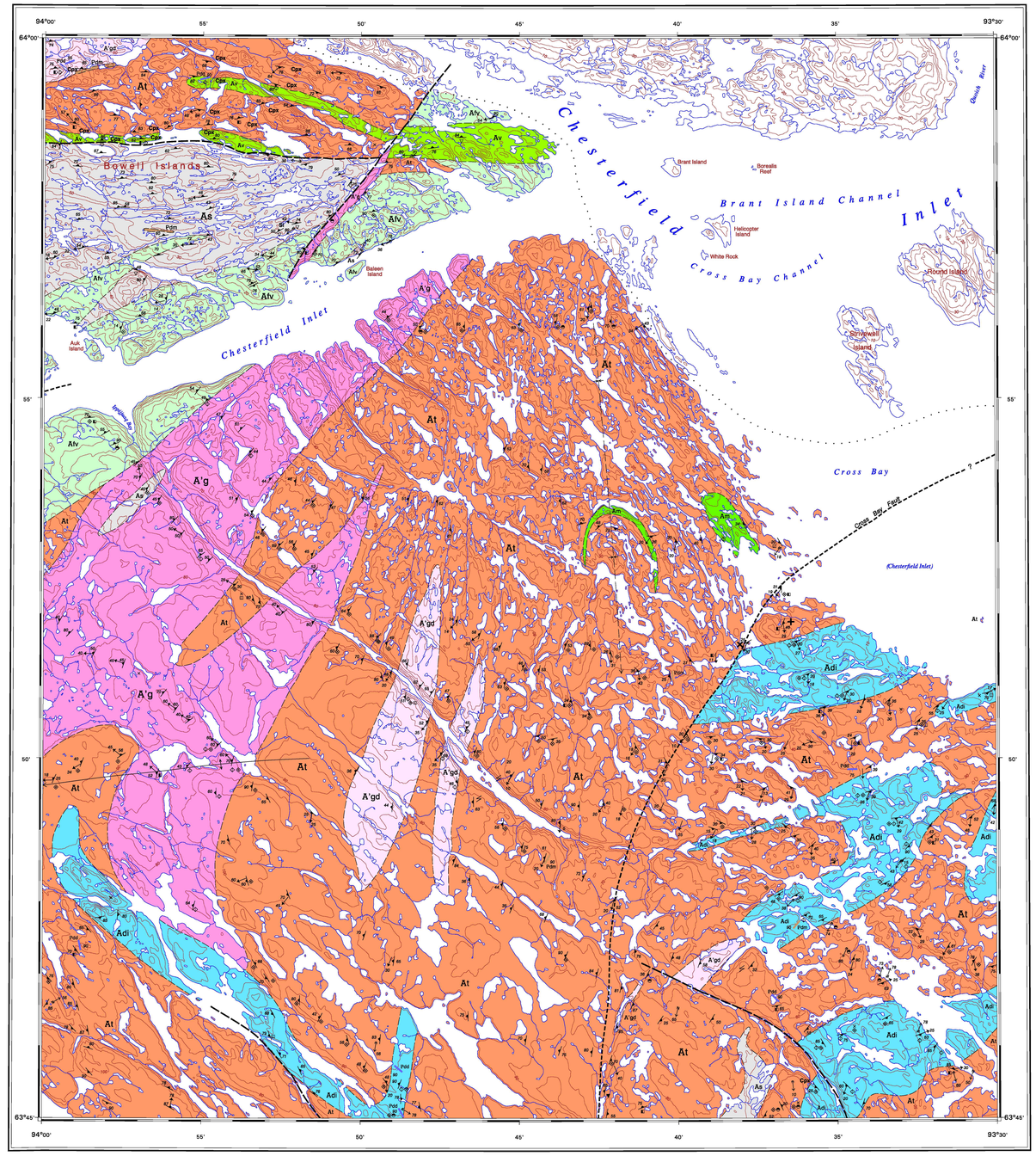

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GEOLOGY

PARTS OF MacQUOID - GIBSON LAKES AREA

KIVALLIQ REGION

NUNAVUT

Scale 1:50 000 - Échelle 1/50 000

Kilometres 1 0 1 2 3 4 Kilomètres

Universal Transverse Mercator Projection
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Projection transverse universelle de Mercator
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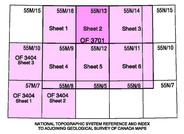

LEGEND

Relative ages of the units for the most part are uncertain and no chronological order is implied. Not all rock units or symbols appear on this map.

QUATERNARY

- **Q** — *Glacial, fluvial, and marine deposits*

PALEOPROTEROZOIC

- **Psc** — *Baker Lake Group: South Channel Formation; polymictic, clast-supported conglomerate*
- **Pgr** — *Granite, monzogranite; biotite-bearing, massive to weakly cleaved, pink to salmon coloured, equigranular to porphyritic; may contain disseminated magnetite and fluorite; locally contain panels of mylonitic straight gneiss (**P'gm**), northeast of Cross Bay*
- **Pdl** (90°) — *Biotite lamprophyre and mafic syenite dykes*
- **Pdd** (90°) — *Diabase dykes; northeast-trending*
- **P'gm** — *Straight gneiss, mylonite, principally derived from tonalite to granite protoliths; Big lake shear zone (hatched units) includes other lithologies*
- **Pdm** / **Pdm** (90°) — *Diabase dyke swarm (ca 2.19 Ga MacQuoid dykes); predominately east-trending, in part plagioclase phyric, generally metamorphosed; weakly deformed south of the Cross Bay plutonic complex; but highly deformed north of the straight g