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GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

DESCRIPTIVE NOTES

This open file geological map presents results of bedrock mapping undertaken in the region during 1986 and 1987 field seasons and include geochronological data. The objectives of the mapping were to upgrade the reconnaissance database, and to address some of the outstanding structural, metamorphic, and metallogenic problems in the region, thereby providing a framework for regional correlation and tectonic synthesis of rock units of this part of the Churchill Structural Province. Detailed accounts of bedrock geology and structure covering the region were published in GSC Current Research reports.The reader is referred to the references listed here for a comprehensive overview of the geology and structure of this region.

The data for this 1:250,000 scale coloured map were compiled digitally using FIELDLOG (Brodaric and Fyon, 1989) and AutoCAD with final output generated through direct collaboration with the Cartography Unit, GICD using GIS software.

PREVIOUS GEOLOGICAL MAPPING

The Chesterfield Inlet map area represents a portion of an Archean and Early Proterozoic granite- greenstone-gneiss terrane within the Churchill Structural Province of the Canadian Shield. The map area straddles the boundary between the Rae and Hearne subprovinces (Hoffman, 1988). The region was previously mapped by Bell (1885,1887), Lord (1953), Weeks (1932), and Wright (1967), the latter at a scale of one inch to eight miles. The results of more recent regional bedrock mapping in the map area and in the surrounding region were reported by Armitage et al. (1993), Heywood (1973), LeCheminant et al. (1987a,b), Reinhardt et al (1980), Sanborn-Barrie (1993, in press), Schau and Ashton (1980), Schau and Tella (1993), Schau et al. (1982), Tella and Annesley (1987,1988), and Tella et al (1986,1989,1990,1992,1993). Previous structural, stratigraphic, thermobarometric, and geochronological studies outlined several crustal-scale ductile, high-strain zones that separate and expose different levels of crust (Tella et al. 1990). Tectonic juxtaposition of som of these crustal segments is believed to have occurred in the Early Proterozoic prior to emplacement of 1.85 Ga fluorite granites. The highlights of structural work were summarized previously (see transect A-B, Figures 1,2 in Tella et al. 1992).

REGIONAL GEOLOGY, STRUCTURE AND METAMORPHISM

The Archean and/or Early Proterozoic lithologies in the Chesterfield Inlet region are dominated by polydeformed and regionally metamorphosed granulite gneiss (**Agrn**), layered quartzofeldspathic gneiss (**Agn**), pelitic gneiss and migmatite (**As**), granitoid plutons (**Ag, A'gp, A'gq**), with subordinate amphibolite (**Amv**) and gabbro (**A'gb**). The Hanbury Island shear Zone (**A'his**) is composed of mixed lithologies which include granulite, anorthosite, gabbro, pyroxenite, and granitoids. A two-mica granite (**A'gm**) of uncertain age intrudes units **Agn** and **As**, but its relationship to other rock units is not known. Post-tectonic Early Proterozoic intrusive activity is recorded by fluorite granite (**A'gf**). SSE-trending biotite lamprophyre dykes (**A'bl**) and NNW- trending Mackenzie dykes (**A'gbm**) are present in a few localities, but are too small to be represented on the map.

The granulite suite (**Agrn**) is dominated by well layered and compositionally banded, quartzofeldspathic granulites interlayered with minor proportions of mafic granulite, paragneiss, granitic gneiss, layered anorthosite, and anorthositic gabbro. The suite is widely distributed in the northwestern part of the map area. The granulites are predominantly tonalitic, and contain orthopyroxene-clinopyroxene-garnet-hornblende-plagioclase-quartz-opaques assemblages. Most paragneiss layers contain abundant garnet-biotite +/- cordierite + quartz + plagioclase. Metamorphic transitions from granulite to amphibolite grade, both along and across strike, are present throughout the region. The granulite suite is compositionally and structurally similar to the Archean Kramanituar (Schau et al. 1982; Sanborn-Barrie, 1993, in press), Uvauk (Tella et al. 1993) and the Daly Bay (Gordon, 1988) Complexes that are exposed between Baker Lake and Daly Bay. They collectively represent the Aqxarneq gneisses (Schau and Tella, 1993).

A west-trending paragneiss belt (**As**), consisting of garnet+biotite +/- staurolite +/- muscovite +/- alumino silicate + plagioclase + quartz assemblages structurally overlie the layered quartzofeldspathic gneiss (**Agn**). Gneissosity in the paragneiss is concordant with that in the layered gneiss for the most part, but discontinuous, layer-parallel, ductile, high-strain zones (metres to tens of metres wide) are present along the entire length of the contact, suggesting a tectonic break between the two units (**Agn** and **As**). The rocks in this belt are commonly fine- to medium grained iron-rich pelites that are compositionally well banded with quartz, quartz+feldspar, and garnet+biotite +/- staurolite +/- alumino silicate rich layers. Porphyroblasts of kyanite upto 2 cm long are present in the southwestern portion of the map area. Several discontinuous interlayers of silicate iron formation consisting of magnetite, garnet, grunerite, and hornblende occur in the paragneiss belt. They show prominent aeromagnetic anomalies (Geological Survey of Canada, 1966). The iron formation is finely banded on a millimetre to centimetre scale, and thickness seldom exceeds more than a few tens of metres. The iron formation appears to have limited economic potential. Most rocks in the gneiss belt are stromatic migmatites. The melanosome is biotite-quartz-feldspar schist with or without Al-silicates, and the leucosome is composed of quartz and feldspar. The leucosome is either layer-parallel or cuts the schistosity at low angles. This belt of pelitic rocks extends west into the Gibson lake map area where the structural characteristics are similar (Tella et al. 1992,1993). Rocks within unit (As) are considered to be higher grade equivalents of aluminous and iron-rich sedimentary successions of the Rankin Inlet Group (Tella et al. 1986). Thermobarometric calculations, based on a number of different mineral equilibria, from the adjoining region to the east, yielded P-T estimates of ca 3.4kb and 635˚C for the assemblages in this unit (Tella et al. 1990).

At least four sets of folds are present in the paragneiss belt (**As**). An early isoclinal, doubly plunging, recumbent fold set (F1) is refolded by a NW-plunging open to tight fold set (F2), whichin turn, is modified by moderately (< 45˚) west plunging open F3 folds, and north plunging F4 folds.

Unit (**Agn**) comprise mixed assemblages of polydeformed, amphibolite grade orthogneiss, migmatite, biotite-muscovite-sillimanite +/- cordierite +/- garnet gneiss, minor proportions of iron-rich metasediments, and different generations of mafic dykes, now transformed into garnetiferous amphibolites. Granite dykes of several ages cut the rocks of this unit on all scales. The layered gneiss contains xenoliths of metamafic rocks consisting of garnet-hornblende- clinopyroxene assemblages, agmatite, and rafts of anorthosite and gabbro. Mylonitic rocks containing coarse K-feldspar porphyroclasts form concordant layers (tens of meters wide) within quartzofeldspathic gneiss. The map distribution of this unit (**As**) defines a broad, west-plunging antiform. Several generations of complex anastomosing pegmatite dyke swarms intrude the layered gneiss near the settlement of Chesterfield Inlet. The youngest set of dykes are highly radioactive (K-U-Th rich; with readings: and T_1-14000 cps; T_2-600 cps; T_3-270 cps on a McPhar TV1-A scintillometer; Tella and Annesley, 1987).

Numerous discontinuous, folded, ductile, high-strain zones, which display excellent mylonitic textures, are an integral part of unit **Agn** (Tella and Annesley, 1987, 1988). They are well exposed along the Hudson Bay shoreline and along the Chesterfield Inlet. High-strain zones, a few metres to over hundreds of metres wide, are commonly separated by low-strain segments. Protoliths include deformed orthogneiss, migmatite, paragneiss, and minor anorthosite, gabbro, and several generations of metamafic and granite dykes. Mineral stretching lineations are generally less well developed, but where present, they plunge shallowly (< 30˚) NNE, NE, or SW. Kinematic indicators (rotated feldspars) suggest both sinistral and dextral senses of shear due to folding. The ductile shear zones appear to have a complex deformational history of multiple periods of development, each punctuated by injection and subsequent mylonitization of different sets of mafic and granitic dykes. The age of deformation, metamorphism of the country rock, and subsequent development and folding of ductile strain zones, are all believed to be Archean.

A medium- to coarse-grained, massive to weakly foliated gabbro intrusion (**A'gb**) of probable Early Proterozoic age, is exposed in the central region south of Chesterfield Inlet. A number of gabbro plugs and dykes (too small to be represented on the map) also occur as isolated outcrops throughout the region. They cut the granulite suite (**Agrn**), layered gneiss (**Agn**), and pelitic gneiss (**As**).

The Hanbury Island Shear Zone (**A'his**) is an ENE to NE trending, ENE plunging, synformal ductile shear zone formed under amphibolite to granulite facies conditions (Tella and Annesley, 1988). The zone overlies a relatively lower grade granitoid gneiss (**Agn**) terrane. The mylonitic layering contains disrupted and boudinaged mafic and quartzofeldspathic layers, and heterogeneously strained coronitic gabbro and anorthositic gabbro. A shallow (10˚-30˚) ENE plunging mineral stretching lineation is well developed. The zone is an integral part of high-strain zones exposed between Daly Bay (Gordon, 1988) and Baker Lake (Sanborn-Barrie, 1993, in press; Schau and Ashton, 1980; Schau and Tella, 1993; Tella et al. 1993), and is interpreted as a deformed remnant of a ductile thrust composed of deep-crustal rocks emplaced into its present position during the late Archean or Early Proterozoic (Tella and Annesley, 1988).

An equigranular, megacrystic (K-feldspar), and magnetite-rich leucogranite (**A'gp**) occupies most of the north-eastern portions of the map area. The magnetite rich character of the pluton is reflected in a pronounced aeromagnetic signature (Geological Survey of Canada, 1966). The large pluton is mylonitized at the southern and western margins adjacent to the Hanbury Island Shear Zone (**A'his**). One sample from this pluton yielded a U-Pb zircon maximum age of 2.5 Ga and a minimum age of 1.78 Ga.

A well foliated, biotite-muscovite leucogranite (**A'gm**), which forms WNW-trending elongate masses, is extensively exposed in the southern part of the map area. The granite is coarse- to medium grained, grey- to white weathering, and weakly to well foliated. The regional foliation within the unit trends west-northwest and dips steeply (60˚-75˚) to the south, although local reversals to the north are noted. Abundant garnet and muscovite xenocrysts, inclusions of pelitic gneiss (**As**) and layered gneiss (**Agn**), and minor metagabbro are present within the granite. Textural and mineralogical characteristics suggest the granite is peraluminous S-type.

Several quartzdiorite to granodiorite plutons (**A'gq**) are well exposed in the central part of the map area. They are massive to weakly foliated, but show well developed migmatitic margins that contain abundant, but discontinuous, amphibolite layers up to 100 m wide. The margins in part are agmatitic and contain lenses and centimetre-scale layers of sillimanite-muscovite schist. The central portions of the plutons are relatively undeformed.

Two large relatively undeformed granite plutons (**A'gf**) intrude the layered gneisses (**Agn**). One of the plutons, exposed on Fairway Island, yielded a U-Pb zircon age of 1.826 Ga (J.C. Roddick, GSC, pers. com.). The plutons range in composition from quartzmonzonite to granite. They are equigranular to massive, pink to salmon coloured plutons that contain abundant inclusions and rafts of layered gneiss, paragneiss, and metagabbro. Pegmatite and aplite dykes, related to the plutons, are widespread throughout the region. The plutonic rocks are undeformed in the cores, but show a weak to well developed foliation at the margins, migmatitic aureoles (up to 100 m wide), and gradational contacts with the country rocks. The abundance of inclusions of country rocks increases towards the margins of the plutons. The above lithological characteristics are similar to those described in the Gibson Lake (NTS 55N) map area (Reinhardt and Chandler, 1973; Reinhardt et al. 1980; Tella et al. 1992,1993).

Lamprophyre dykes (**A'bl**; not shown on the map) are relatively rare in the region. They are dark grey to black, relatively undeformed, medium- to fine-grained rocks with large biotite/phlogopite phenocrysts. They are texturally similar to lamprophyre dykes described from the Rankin Inlet region (Tella et al., 1986; Digel, 1986), and probably are related to the ca. 1.85 Ga alkaline igneous suite in the central Keewatin (LeCheminant et al., 1987b).

Northwest trending gabbro dykes (**A'gbm**; not shown on the map), probably part of the 1.27 Ga Mackenzie swarm, were noted in a few localities in the central part of the gneiss terrane. They are massive, relatively fresh, and coarse grained.

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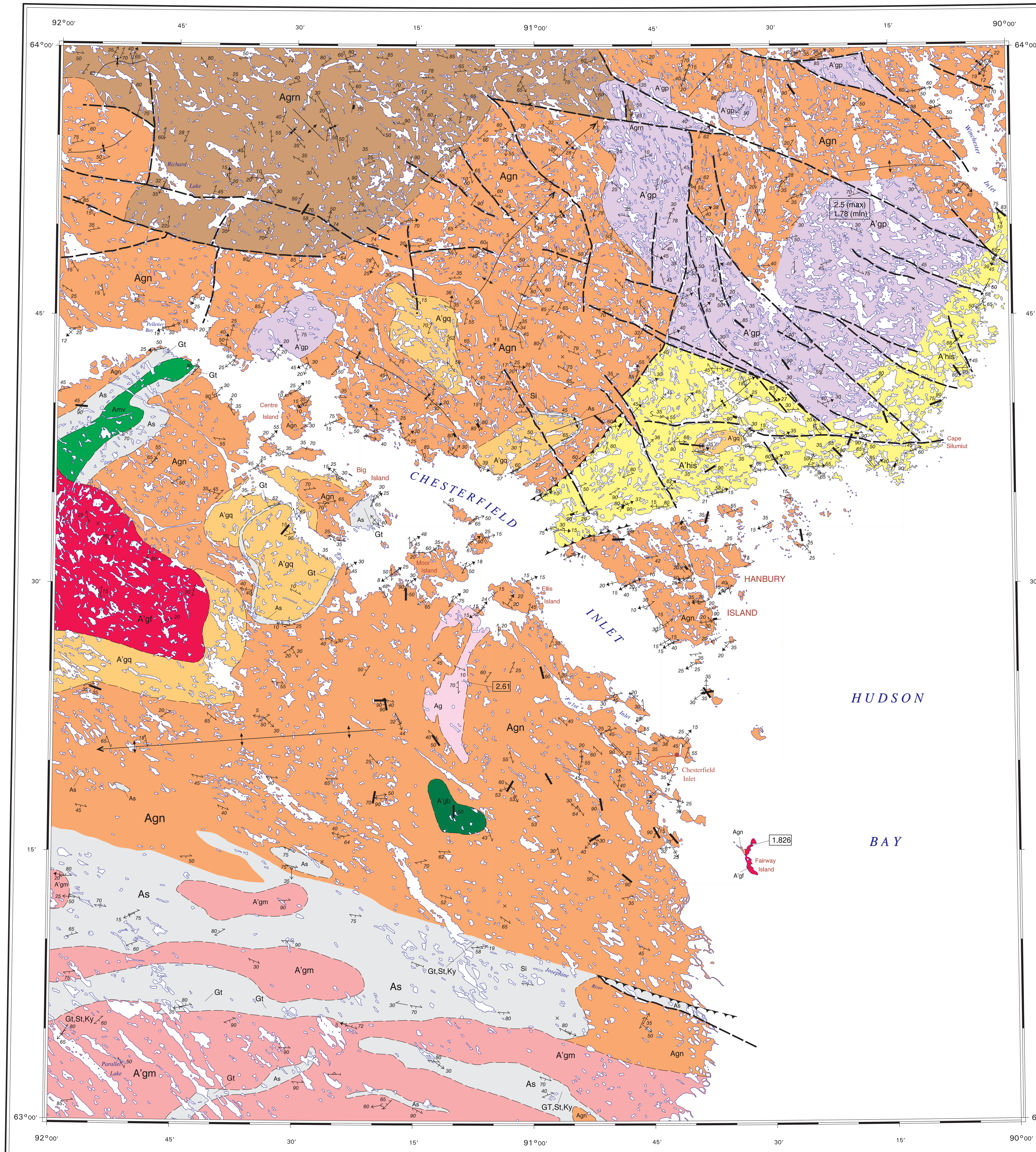

LEGEND

PROTEROZOIC

- **A'gbm** — Gabbro dykes (Mackenzie swarm); not shown on the map
- **A'bl** — Biotite lamprophyre dykes (not shown on the map)
- **A'gf** — Granite, massive to weakly cleaved, pink, equigranular toporphyritic; in part fluorite-bearing, and contains chalcopyriteand specularite on Fairway Island

ARCHEAN AND/OR EARLY PROTEROZOIC

- **A'gq** — Quartz diorite to granite plutons; massive to weakly foliated centres, and well foliated migmatitic margin
- **A'gm** — Biotite-muscovite leucogranite, in part contains xenocrystic garnets; intrudes layered gneiss and paragneiss (units Agn and As)
- **A'gb** — Gabbro: massive to weakly foliated, coarse grained by pink; locally cut pegmatite dykes
- **A'gp** — Granite - magnetite bearing, porphyritic, mylonitized margins

HANBURY ISLAND SHEAR ZONE (HISZ)

- **A'his** — Protoliths: granulite, tonolitic gneiss, paragneiss, gabbro, anorthositic, gabbro pyroxenite, and granitoids

ARCHEAN

- **Ag** — Megacrystic (K-feldspar) granite; coarse grained, well foliated
- **Amv** — Amphibolite; minor metavolcanic rocks, and garnet-biotite schist
- **As** — Garnet + biotite +/- staurolite +/- kyanite +/- sillimanite +/- muscovite paragneiss; metamorphosed quartz-magnetite banded iron formation, amphibolite; contain small metagabbro intrusions, and migmatitic gneiss
- **Agn** — Layered to banded hornblende-biotite (grey) orthogneiss, migmatite quartz-biotite; schist includes minor proportions of metamorphosed iron formation, garnet + biotite + sillimanite paragneiss, and two-pyroxene granulite (mostly northeast of Hanbury Island); contains xenoliths of metamafic rocks (garnet amphibolite, pyroxenite), in part and rafts of magnetite-rich coronite gabbro; cut by pegmatite, in part lamprophyre and diabase dykes, and quartz syenite plugs
- **Agrn** — Granulite suite (granitoid to mafic composition), in part includes minor proportions of layered anorthosite and gabbro; intruded by several generations of gabbro, lamprophyre, and granite

NOTE: Relative ages of units for the most part are uncertain and no chronological order is implied.

Rock outcrop . . . . ×
Lithological boundary (approximate) . . . .
Regional Foliation (genaration unknown, 1st, 2nd) 30 40 60
Axial Plane (F2) 40
Intersection Lineation 90
Mineral stretching Lineation 35
Fold Axis (F2, F3) 40 20
Fold style (U-fold, S-fold, Z-fold) 10 20 34
Fault (approximate) . . . .
Thrust fault (approximate) . . . .
Minor Fault (sense unknown) 35
Shear Zone (sense unknown, dextral, sinistral) 10 70 14
Joint, Vein and Dyke (pegmatite) 15 60 25
Trace of axial plane (antiform, syniform) . . . .
Slicken Striae 30
Zircon age (Ga) 2.61
Mineral occurence . . . . Gt

MINERAL OCCURENCES

Ky . . . . . . Kyanite porphyroblasts in As
St . . . . . Staurolite porphyroblasts in As
Si . . . . .Sillimanite porphyroblasts in As
Gt . . . . Garnet porphyroblasts in As

Geology by S. Tella 1986-87, Geological Survey of Canada

Digital map compilation by S. Tella, Geological Survey of Canada

Digital cartography by R.L. Allard, Geological Survey of Canada

Any revisions or additional information known to the user would by welcomed by the Geological Survey of Canada

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Copies of the topographical edition of this map area may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa, Ontario, K1A 0E9

Mean magnetic declination 1993, 11° 13' West, increasing 2.8' annually. Readings vary from 12° 24' W in the SE corner to 9° 54' W in the NW corner of the map

The proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area

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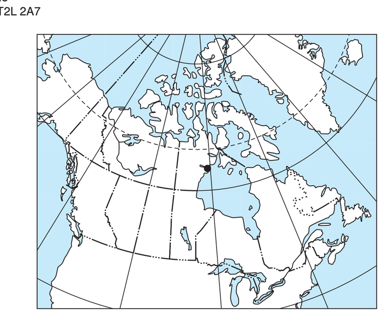


LOCATION MAP - CARTE DE LOCALISATION

OPEN FILE 2756

GEOLOGY

CHESTERFIELD INLET

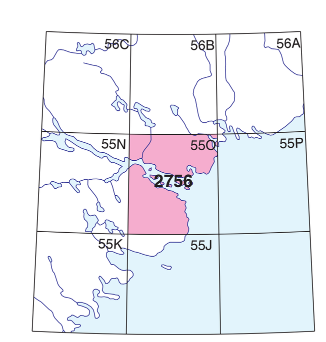
DISTRICT OF KEEWATIN
NORTHWEST TERRITORIES

Scale 1:250 000 - Échelle 1/250 000

Kilometres 5 0 5 10 15 20 Kilomètres

Transverse Mercator Projection
CM 91°00', Scale Factor 1

M.C. 91°00', facteur d'échelle 1
Projection transverse de Mercator



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