INTRODUCTION This map is one of a set of two 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 1999 field season in parts of the Akunak Bay (NTS 55N/10.13.14.15) area. Previous work in this area includes mapping at scales of one inch to eight miles (Wright, 1967), 1:250 000 (Tella and Schau, 1994) and 1:125 000 (Reinhardt and Chandler, 1973; Reinhardt et al., 1980). The Akunak Bay area represents a small portion of the northern Hearne domain within the western Churchill Province (Fig. 1). South of Snowbird Tectonic Zone (STZ), the northern Hearne domain is predominantly composed of Archean juvenile oceanic crust which is assumed to be underlain by more evolved continental crust of the Rae domain. The principal objectives of the new mapping in the Akunak Bay area were to evaluate the nature and tectonothermal reworking of Archean rocks during the Proterozoic. and to upgrade the reconnaissance database, thereby providing an improved geological and structural framework for mineral exploration strategies. Detailed descriptions of the lithological and structural characteristics of the rock units from this area, and results of recent bedrock mapping in the adjoining portions to the west and east were reported elsewhere (Tella and Annesley, 1987, 1988; Tella, 1993; Tella et al., 1992, 1993, 1997a, b, 1999, 2000; Hanmer et al., 1999a, b, c; Mills et al., 1999; Ryan et al., 1999, 2000; Sanborn-Barrie, 1999; Sandeman et al., 2000). All field data for the present map-set were compiled digitally using FIELDLOG (Brodaric and Fyon, 1989) and AutoCAD with final

DESCRIPTIVE NOTES

LITHOLOGY

output generated using ArcInfo.

Geological overview The Akunak Bay area (Fig. 1) includes previously mapped eastern portions of the Archean MacQuoid Gibson supracrustal belt. Big lake shear zone, and the Cross Bay plutonic complex (Tella et al., 1997a, b. 1999; Hanmer et al., 1999a). The region is underlain by Neoarchean, amphibolite facies, polydeformed sedimentary and mafic volcanics rocks (units As, Av, Am), tonalitic orthogneisses (unit At) and felsic to mafic intrusions (units Adi, Ag, Atp). North of Akunak Bay, across Chesterfield Inlet, a polydeformed and metamorphosed, layered gabbro-mafic granulite anorthosite complex, the Uvauk complex (unit A'ucx; Tella et al., 1993; Tella and Schau, 1994; Mills et al., 1999), structurally overlies part of the orthogneiss (unit At) terrane. Relatively undeformed diorite (unit A'di) and gabbro (uni A'gb) intrusions of Neoarchean and/or Paleoproterozoic age are present throughout the region (sheets 1 and 2). East-and north-northeast- trending, ductile high-strain zones (unit Pgm) are sporadically distributed. Metamorphosed mafic dykes (units Pd, Pdd; in part correlative to ca. 2.19 Ga MacQuoid dykes; Tella et al., 1997a), ultrapotassic amprophyre dykes (unit PdI), and several quartz-monzonite (unit Pgd) to granite (unit Pgr) intrusions record relatively younger Proterozoic magmatic activity. The potential MacQuoid dykes, which cut two sets of Archean structural abrics, were subsequently metamorphosed and affected by at least two deformation events, suggesting that significant Paleoproterozoic tectonothermal events affected previously deformed Archean rock units in the Akunak

Metasedimentary and mafic volcanic supracrustal rocks (units As, Av) Between Akunak Bay and Butts Lake (sheets 1, 2), polydeformed metasedimentary rocks (unit As) and intercalated mafic volcanic rocks (unit Av) are exposed in a northwest-trending belt, which is truncated to the west by a north-northwest-trending fault that extends towards Little Big Island. West of this tectonic break, planar fabrics trend northeast with moderate to steep dips (> 45°) to both the northwest and southeast. To the east and south, the metasedimentary rocks and associated mafic volcanic rocks are intruded by felsic plutons (unit Par). The metasedimentary rocks consist of biotite + garnet + plagioclase + quartz + sillimanite schists and biotite granofels with locally developed garnet layers, oxide iron formations, and subordinate intercalated amphibolite. The garnet-rich layers contain small amounts of arsenopyrite shown as gossan zones, sheet 1). The mafic volcanic rocks, exposed southwest of Akunak Bay, contain rarely preserved pillow structures. Southwest of Promise Point granite plutons (unit Pgr; sheet 1) and southeast of Butts Lake (sheet 2), netasedimentary rocks (unit As) contain biotite + garnet + plagioclase + quartz ± sillimanite assemblages. They are fine- to medium-grained iron-rich pelites and psammites that are well banded with layers rich in quartz quartz + feldspar, and garnet + biotite ± sillimanite. For the most part, they wrap around and dip away from domail layered tonalitic orthogneiss (unit At), but discordant relationships are locally preserved along some contact zones. suggesting that the orthogneiss is in part intrusive. These supracrustal rocks extend west and east into the adjoining region (Tella et al., 1992, 1993, 1999; Tella, 1993; MacQuoid homocline of Hanmer et al., 1999a; Ryan et al., 1999).

K-feldspar augen granite (unit Ag) A well-foliated to locally massive, coarse-grained, pink to grey, K-feldspar augen granite is exposed in the northeastern portions of the map area, north of the Uvauk complex (sheet 1). Its contacts with the adjoining rock units (units At, A'gb) are not exposed. The granite contains less than 2% mafic minerals (biotite, trace magnetite), and apatite, zircon, monazite and titanite as accessory phases. Locally, the granite displays well-developed, northeasttrending, quartz-ribboned porphyroclastic (K-feldspar) mylonite fabrics in narrow (1m wide), discontinuous bands ages of ca. 2.73 Ga and ca. 2.74 Ga respectively (J.C. Roddick, GSC, unpublished data, 1994).

Tonalitic gneisses and plutons (units At, Atp) The tonalitic gneisses and plutons are the eastward extension of similar rock units in the MacQuid-Gibson lakes region (see Tella et al., 1997a; Hanmer et al., 1999a for details). In the Akunak Bay area, the tonalite gneisses (unit At) are fine- to medium-grained, light to dark grey to pink, well-layered units consisting of distinct compositional phases that range from tonalite to granodiorite. Mafic xenoliths containing garnet-hornblende-clinopyroxene assemblages, and metasedimentary supracrustal inclusions are locally present. The gneisses contain a regionally pervasive foliation (S_a). This planar fabric commonly trends northeast to east-northeast with moderate to steep dips both to the northwest and to the southeast. However, northeast of the Big lake shear zone (Blsz; unit Pgm) and west of Akunak intrudes the gneissic tonalite. Southeast of Big lake shear zone, smaller bodies of tonalite are present within the gneisses. The age of the tonalite plutons is unknown although coarse, pink pegmatite dykes, possibly related to large granite plutons (units Pgd, Pgr), cut the tonalite gneisses.

Uvauk Complex (unit A'Ucx) The lithological character, tectonic setting, and tectonothermal aspects of the Uvauk complex were previously outlined by Tella et al. (1993), Tella and Schau (1994), and Mills et al. (1999). The complex comprises a layered conditions. The complex forms an east-northeast trending triangular segment, the boundaries of which are marked by well developed ultramylonites derived from anorthosite, gabbro, diorite and tonalite protoliths. The overall geometry of e complex is that of an east-northeast-trending synform which overlies an amphibolite-facies tonalite gneiss terrane (unit At). The northern and southern margins converge and terminate to the west near Uvauk Inlet where the mylonitic fabric dips (70°-85°) towards the south. A shallow (10°-30°) east-northeasttrending mineral stretching lineation is well developed throughout the complex

Based on reconnaissance studies, Tella et al. (1993), and Tella and Schau (1994) interpreted the Uvauk complex as an Archean allochthonous remnant of a ductile high-strain zone developed under granulite facies that was subsequently affected by later tectonothermal events. Based on preliminary geochronology, the above authors suggested that the complex records two granulite facies mylonite events - a ca. 2.59 Ga event overprinted by a ca. 1.94 Ga event. Ongoing detailed work around Uvauk Inlet by Mills et al. (1999), indicates that anorthosite within the complex was emplaced as a synkinematic intrusion into the gneissic wall rocks. Field relations are equivocal Mills et al. (1999) documented eastward transport of the anorthosite body with respect to its wall rocks.

Mafic Intrusions (units A'di, A'gb) Adjacent to Little Big Island and northwest of Uvauk Inlet (sheet 1), small plugs of relatively undeformed, coarsegrained, hornblende-diorite (unit A'di) cross cut the gneissic rocks (unit At). Several generations of pink- to white, nonzogranite dykes, probably related to Primrose and Promise Point granitoids (units Pgd, Pgr), intrude the diorite. Southeast of Butts Lake (sheet 2), a narrow (20-50m wide), north-northwest-trending elongate body of gabbro (unit A'ab) cross cuts metamorphosed supracrustal rocks (units As, Av) and tonalite orthogneiss (unit At). The gabbro postdates D₁-D₂ fabrics in the country rock. Large masses of gabbro (unit A'gb) and subordinate pyroxenite and ultramafic rocks are exposed northwest of the Uvauk complex (sheet 1), and to a lesser extent on Little Big Island (Tella et al., 1993). The gabbro is medium to coarse grained, homogeneous, commonly massive, and shows a well-developed ophitic texture. It intrudes the ayered tonalite gneisses (unit At) and is cut by white and pink granite dykes. Along the northern and southeastern shores of Little Big Island, small plugs of pyroxenite and dunite contain olivine phenocrysts set in a clinopyroxene matrix. Rafts of anorthosite and gabbro (correlative to the Uvauk complex) are sparsely distributed in the plugs. On the north side of Chesterfield Inlet similar ultramafic rocks cut the highly strained Uvauk complex (unit A'Ucx) and the

tonalite gneiss (unit At), and were emplaced late in the tectonic history of the region (Tella et al., 1993). The ultramafic

rocks may be correlated with similar units noted on Bowell Island to the west (Schau et al., 1982), and other small

ultramafic bodies described from the adjoining regions (Hanmer et al., 1999a, c; Reinhardt et al., 1973). Straight gneiss, mylonite (unit Pgm) Recrystallized straight gneisses and mylonites, predominantly derived from granitoid protoliths, form northeast- and east-trending linear belts. The Akunak Bay shear zone (ABsz), exposed west of Akunak Bay, is an east-trending belt of straight gneisses and mylonites, anastomosing on a 5-10 m scale. It separates the metasedimentary an metavolcanic supracrustal rock units in the south from the predominantly granitoid gneiss terrane in the north. Rarely preserved shear-sense indicators suggest an oblique, dextral movement. The eastern extension of the ABsz swings southeasterly towards Akunak Bay and appears to die out. The western extension links with a previously mapper straight gneiss unit in the Cross Bay plutonic complex. The precise age of the ABsz is unknown, but potential ca. 2.19 Ga MacQuoid dykes cut the ABsz suggesting that it predates dyke emplacement. Recrystallized straight gneisses and ribbon mylonites, exposed south of the ABsz, represent the eastern segment of the Big lake shear zone (Blsz) mapped previously to the west which coincides with the southern margin to the Cross Bay plutonic complex. In the Akunak Bay area, the foliation in the Blsz is steeply northwest-dipping, and contains a northeast-trending, subhorizontal lineation. Shear sense criteria suggest that the Blsz is a dextral, strikeslip structure. The easterly extension of the Blsz branches into several splays of discrete high-strain zones which appear to die out

and/or truncated by a north-northwest trending fault. East of the fault and west of Akunak Bay, the structural trends

are dominantly towards the northwest.

Mafic dykes (MacQuoid swarm, units Pd. Pdd) Southwest and east of Akunak Bay (sheets 1, 2), east-southeast to east-northeast-trending gabbro and diabase dykes (up to 20m) are abundant, with a concentration in the vicinity of the south shore of Chesterfield Inlet. They are onsidered to be the eastward extension of the ca. 2.19 Ga MacQuoid dyke swarm (Tella et al, 1997a, b; Hanmer et al., 1999a), although in the absence of definitive geochronology, it is possible that some dykes may belong to a different set of unknown age. The matic dykes are commonly plagicclasephyric with locally preserved coronitic garnet, and show well preserved chilled margins. The dykes intrude the polydeformed rocks, and are overprinted by subsequent

Primrose monzogranite (unit Pgd) Bocks in this unit are exposed as plutons on either side of Chesterfield Inlet (sheet 1). They consist of pale-pink, well foliated to massive, in part fluorite-bearing, granodiorite to granite phases. They intrude the polydeformed, layered conalitic gneisses of the Cross Bay complex (unit At; Hanmer et al., 1999a), and show complex commingling texture: which are well exposed on Bowser Island and along the south shore of Chesterfield Inlet (Sandeman et al., 2000). Parts of some plutons are massive. Preliminary geochronology yields U-Pb zircon magmatic ages in the range ca. 1.83 Ga - ca. 1.81 Ga. (Davis et al., 1999).

Promise Point granite (unit Pgr) A number of K-feldspar phyric, granite plutons are widely distributed in a NE-trending belt south of Akunak Bay (sheets 1, 2). They are in part magnetite- and fluorite-bearing and some have associated aeromagnetic anomalies. Although all plutons are grouped into one unit, they may not all be coeval. Locally, distinction between Promise Point and Primrose granites is difficult. The white commonly well foliated and inclusion-rich Primrose suite may represent earlier phases of the Promise Point suite. Individual plutons range in composition from granodiorite to granite. They are equigranular to massive, pink, and typically poor in mafic phases (< 2% biotite). South of Butts Lake they exhibit weakly to well foliated margins, Gradational (migmatitic?) contacts with the orthogneiss (unit At) are locally present. and country rock xenoliths are common. U-Pb geochronology on similar plutonic suites from the adjoining regions to the east and west, yielded magmatic zircon ages in the range ca. 1.81 Ga - 1.83 Ga. (Tella and Schau, 1994; Tella et al., 1997a, b: Davis et al., 1999).

Northeast- and southeast- trending, typically undeformed, ultrapotassic lamprophyre dykes, up to 3 m wide occur throughout the region. They are probably related to the ca. 1.85 Ga alkaline igneous suite in the central Keewatii (LeCheminant et al., 1987). They are dark grey to black, medium- to fine-grained, and phlogopite \pm hornblende-phyric

(see also Tella et al, 1993). The dykes exhibit mutually cross-cutting relationships with the Promise Point granite plutons (unit Pgr) and suggest, diverse, ca. 1.83 Ga magma commingling (Sandeman et al., 2000).

STRUCTURE AND METAMORPHISM At least four deformation events (D,-D4) affected the supracrustal units and the tonalite orthogneiss. The fabric elements shown on the maps represent composite fabrics developed during these four events. Field observations in the Akunak Bay area together with fabric relations established in the adjoining MacQuoid-Gibson belt (Hanmer et al., 1999b; Ryan et al., 1999; Tella et al., 1997a, b) suggest that the regionally pervasive foliation in rock units As, Av, At, and Atp is a D_2 fabric element. In supracrustal units (units As, Av), this fabric represents a composite S_2 , developed from the transposition of an older S_2/S_1 fabric. Elsewhere in the region, the foliations are of unspecified generation and represent main foliation trends within specified rock units. The linear fabrics are composite. Southwest of Akunak Bay (sheet 2), an early isoclinal, doubly plunging, east-southeast trending fold set (F,) in the volcanic unit (unit Av) is coaxially refolded by an open to tight fold set (F₂), which in turn, is modified by open, northeast-trending F₃ folds and north-northeast-trending F₄ folds. South of Little Big Island (sheet 1), a map-scale F₂ old is truncated by the ABsz suggesting that D_2 predates the ABsz. The D_1-D_2 are interpreted to be Archean events. D₃-D₄ are considered to be Proterozoic tectonothermal events because potential ca. 2.19 matic dykes, which cut the D₂ fabrics, were metamorphosed and deformed subsequent to their emplacement. These dykes provide a minimum age for S₂ fabric development and a maximum age for the metamorphism which affected the dykes. If the correlation to the MacQuoid swarm is valid, these mafic dykes record Paleoproterozoic, post ca. 2.19 Ga. deformation and metamorphism that also affected all older rock units. These structural observations are consistent with those reported from the adjoining area to the west (Hanmer et al., 1999a, b; Ryan et al., 1999; Tella et al., 1999). It should be noted, however, that D₃-D₄ told sets in the Akunak Bay area may not necessarily be correlative to D₃-D₄ fold sets noted in the adjoining Cross Bay Plutonic complex (Hanmer et al., 1999b; Ryan et al., 1999). Although not all ca. 1.83 Ga plutons (units Pgd, Pgr) show post-emplacement deformation, some were clearly affected by D_3-D_4 deformation events. Associated structures include northeast- and north- trending F_3-F_4 open folds.

Most Promise Point granite plutons (unit Pgr) in the Akunak Bay area are nonfoliated and do not appear to have been West of Akunak Bay and south of Chesterfield Inlet, two contrasting structural domains are juxtaposed along a th-northwest-trending fault that extends from west of Butts Lake to the south shore of Chesterfield Inlet (sheets 1, 2). In the eastern domain, dominated by supracrustal rock assemblages, the structural trends are predominantly northwest, where as they are commonly northeast-trending in the western tonalite-gneiss domain. The ABsz, which cuts D, fabrics in the supracrustal rocks and in the tonalite gneiss, is not offset by this north-northwest trending fault. These field relationships suggest that the juxtaposition of the two domains occurred prior to the development of the The presence of garnet, biotite ± aluminosilicates (Andalusite, sillimanite) in sedimentary rocks, and of garnet biotite + plagioclase ± clinopyroxene assemblage in mafic volcanic rocks suggest amphibolite facies conditions of regional metamorphism for the supracrustal units. The porphyroblast-fabric relations in the Akunak Bay area suggest

that the regional metamorphism in the supracrustal rocks was syn- to post-D, with peak conditions attained during

early D_z which outlasted peak metamorphic conditions. Random growth of a second generation of sillimanite across

the D_o fabrics in the supracrustal rocks suggest that a post-D_o metamorphic event occurred at elevated temperatures.

Neoarchean polydeformed lithologies in the Akunak Bay area comprise amphibolite facies sedimentary and mafic volcanic supracrustal rocks, tonalitic orthogneisses, and variably deformed gabbro to granite plutons. A mylonitised layered anorthosite-gabbro-mafic granulite suite, the Uvauk complex, structurally overlies part of the orthogneiss terrane. Metamorphosed potentially ca. 2.19 Ga mafic dykes, and relatively undeformed ca. 1.83 Ga granite and comagmatic(?) lamprophyre dyke swarms record Proterozoic igneous events. At least four deformation events (D,-D,) affected the supracrustal units and the tonalite orthogneiss. Field observations suggest that the regionally pervasive foliation in supracrustal rock units is an S₂ (D₂) developed from the transposition of an older S_0/S_1 tabric. The D_1-D_2 are interpreted to be Archean events. D_3-D_4 are Paleoproterozoic tectonothermal events because potential ca. 2.19 mafic dykes cut the D₂ fabrics and were subsequently metamorphosed and deformed. These dykes provide a minimum age for S₂ fabric development and a maximum age

ACKNOWLEDGEMENTS

We extend our thanks to the following: L. Lepage, C. Studnicki-Gizbert, and M. ter Meer for excellent field assistance; Polar Continental Shelf Project for generous helicopter support; J. Boles and J. Atkinson - our helicopter crew; M&T Enterprises Ltd., Rankin Inlet, for expediting services, Discussions and exchange of ideas on regional tectonic and metamorphic framework with W. Davis and R.G. Berman during their field visits were most valuable. This open file was

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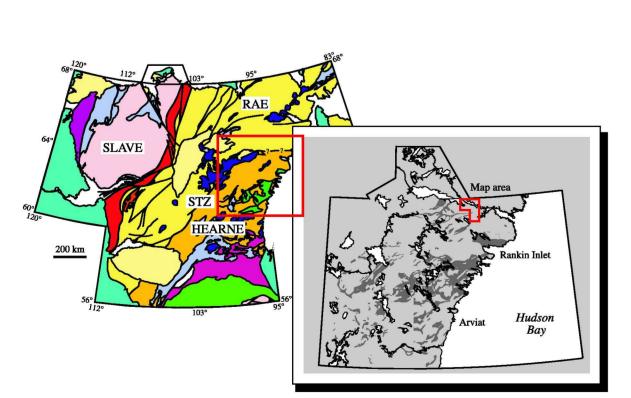
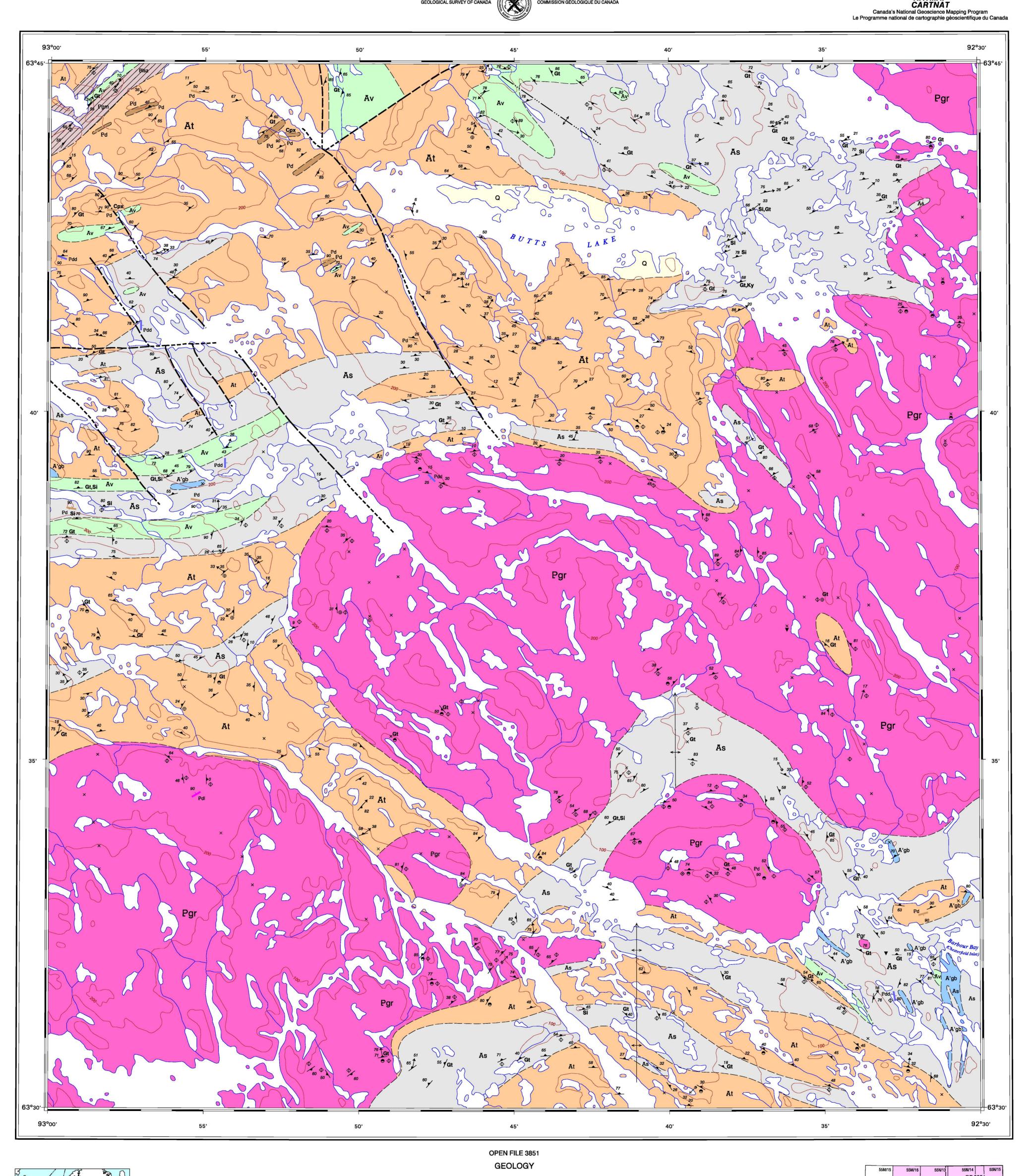


Figure 1. Schematic location map of the Akunak Bay map area represented by this set of maps. The Western Churchill map is composed of the Rae and Hearne domains separated by the Snowbird Tectonic Zone (STZ). Greenstone belt rocks in the enlargement window are represented in green.



PARTS OF AKUNAK BAY AREA

KIVALLIQ REGION

NUNAVUT

Scale 1:50 000/Échelle 1/50 000

Projection transverse universelle de Mercator Système de référence géodésique nord-américain, 1983

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Universal Transverse Mercator Projection

North American Datum 1983 [©] Her Majesty the Queen in Right of Canada, 2000

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. Glacial, fluvial, and marine deposits PALEOPROTEROZOIC Promise Point granite, monzogranite; biotite-bearing, massive to weakly foliated, pink to salmon coloured, equigranular to porphyritic; may contain disseminated magnetite and fluorite; south and southeast of Butts Lake (sheet 2) this unit contains abundant inclusions of older lithologies Primrose granodiorite-monzogranite; pink to grey, weakly to well foliated Phlogopite lamprophyre and mafic syenite dykes Straight gneiss, mylonite; principally derived from tonalite to granite protoliths; Big lake (Blsz) and Akunak Bay (ABsz) shear zones (hatched units) includes other lithologies; in part includes reactivated Archean straight gneiss and mylonite Pd Diabase dyke swarm (correlative to ca 2.19 Ga MacQuoid dykes); predominantly 90/ east-trending, in part plagioclase phyric; weakly deformed and metamorphosed ARCHEAN AND/OR PALEOPROTEROZOIC Gabbro: massive to weakly foliated, coarse grained; includes subordinate ultramafic rocks, pyroxenite Diorite to gabbro; weakly to well foliated Uvauk complex: layered anorthosite-mafic granulite-gabbro suite cut by diorite sheets; for the most part transformed into mylonite/ultramylonite; in part include Archean diorite and anorthosite Tonalite plutons: massive to well foliated; in part locally well lineated (L-tectonite); Tonalite (gneissic): layered to banded hornblende-biotite orthogneiss; includes discontinuous layers of semipelite/psammite (As); may contain abundant xenoliths of metamafic rocks (Av), and remnants of banded iron-formation K-feldspar, augen granite-granodiorite; well foliated, in part mylonitic Diorite to gabbro (gneissic) Mafic volcanic rocks with subordinate intercalated volcaniclastic rocks; rarely preserved strained pillows; in part metamorphosed to garnet amphibolite and Metasedimentary rocks; semipelite/psammite with garnet + biotite \pm and alusite \pm As kyanite ± sillimanite schist/paragneiss; local metamorphosed quartz-magnetite _____banded iron-formation Outcrop (observed) Lithological boundary (approximate) . Limit of geological mapping Main foliation (generation unspecified) Mineral lineation (generation unspecified)

> Geology by S. Tella, J.J. Ryan, H.A. Sandeman, S. Hanmer, and L. Wilkinson, Geological Survey of Canada; A. Mills, Department of Earth Sciences, Carleton University, 1999

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Co-ordinated by S. Hanmer through the auspices of the Western Churchill NATMAP Project

Fold axis (generation unspecified)

Fault (approximate trace; inferred) .

Fold style (U-, S-, Z-folds; unknown generation)

Axial trace of major fold (F, antiform, synform)

Axial trace of major fold (F2 antiform, synform)

Axial trace of major fold F₃ (antiform, synform, direction of plunge)

Axial trace of major fold F₄ (antiform, synform, direction of plunge)

Digital cartography by E. Everett, Geoscience Information Division

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

Digital base map from data compiled by Geomatics Canada, modified by the Geoscience Information Division

The proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area Magnetic declination 2000, 7°08'W, increasing 2.3' annually

Elevations in feet above mean sea level

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Sheet 2 of 2, Geology Recommended citation: Tella, S., Ryan, J.J., Sandeman, H.A., Hanmer, S., Mills, A., and 2000: Geology, Parts of Akunak Bay Area, Kivalliq Region, Nunavut Geological Survey of Canada, Open File 3851, scale 1:50 000