REGIONAL GEOLOGY

The Trans-Hudson Orogen in northern Saskatchewan (Reindeer Zone) forms a collage of west- to southwesttrending juvenile arcs and sedimentary basins that were accreted to the Archean Hearne, Superior and Sask cratons during Paleoproterozoic collision (e.g., Lewry et al., 1990), Along Reindeer Lake, the northwestern flank of the orogen is exposed and includes, from lowest to highest structural levels, the Glennie, Kisseynew, La Ronge, Rottenstone and Peter Lake domains (see inset map), with the first three domains forming part of the orogen internides. The Glennie and La Ronge domains consist of ca. 1.90-1.87 Ga juvenile volcanic rocks and arc-flanking sedimentary basins. The Kisseynew Domain outcrops in the core region of the orogen and consists predominantly of metaturbidites of the Burntwood Group, as well as fluvial to shallow marine sediments along its northern and southern margin. Sedimentary rocks of the Kisseynew Domain are constrained by U-Pb dating to younger than ca. 1,85 Ga (Ansdell and Yang, 1995) but in the Reindeer Lake area they are tectonically interleaved with supracrustal rocks that are older than ca. 1.90 Ga (Levesque Bay assemblage; Corrigan et al. (1999b)). The La Ronge Domain forms a continuous, curvilinear belt up to 50 km in width, which is correlative with the Lynn Lake Belt in Manitoba. It consists of ca. 1.88 Ga metavolcanic and metasedimentary rocks of the Central Metavolcanic Belt, intruded by pre- to post-tectonic plutons (Thomas, 1993). The metavolcanic rocks are predominantly mafic in composition and range from low-K tholeiitic to calc-alkaline (Watters 1981) and have been interpreted as being formed in an ensimatic island-arc setting (Thomas, 1993). Most plutons exhibit strong calc-alkaline trends and isotopic and trace element characteristics that are consistent with emplacement in a continental arc setting (MacHattie, 2000). The Rottenstone Domain is lithologically complex and varies in composition along strike of the orogen. In its southwestern extent, outside of the Reindeer Lake area, it comprises tonalite, migmatite and metasedimentary rocks of unknown age, intruded by the 1865-1850 Ma Wathaman Batholith (Lewry et al., 1990). Along Reindeer Lake, the Rottenstone Domain consists of volcanic, plutonic and sedimentary rocks potentially representing northern extensions of the La Ronge Domain, as well as remnants of a foreland basin (Park Island assemblage; Corrigan et al., 1999b). The Wathaman Batholith has been interpreted on the 1984; Meyer et al., 1992). Although the bulk of the Wathaman Batholith is structurally bounded by the Needle Falls/Reilly Lake/Parker Lake shear zones system, related satellite intrusions occur throughout the La Ronge Domain

which are described in more detail below. The contact between the Rottenstone and La Ronge domains had been historically interpreted to transect this map area (see map inset). However, our field observations, supported by isotopic data, suggest a tectonostratigraphic continuity between the two lithotectonic domains, at least in part, necessitating a re-evaluation of domain definition (see Corrigan et al., 1998a; 1999b). The only unit that is exclusive to the Rottenstone Domain is the Park Island assemblage (described below), but the latter was not recognized as a distinct unit prior to this study. For these reasons, we will refer to the entire tectonostrationaphic assemblage, from the Central Metavolcanic Belt to the Park Island assemblage, as components of the La Ronge Domain. When referring to a geographic area historically included in the Rottenstone Domain, we will put the name in quotes. However, we do not dispute that the Rottenstone Domain southwest of Reindeer Lake may be lithologically distinct from the La Ronge Domain. LA RONGE DOMAIN

and within the southern margin of the Peter Lake Domain, implying that the La Ronge arc was stitched to the Archean Hearne margin by ca. 1865 Ma. The present map comprises portions of the La Ronge and Rottenstone domains,

In the Reindeer Lake area, the La Ronge Domain comprises compositionally diverse metavolcanic, netavolcaniclastic and metasedimentary rocks of the ca. 1.89-1.88 Ga Central Metavolcanic Belt (Thomas 1993; Maxeiner 1997); ca. 1.89 Ga calc-alkaline plutonic rocks of the Crowe Island Complex (Corrigan et al., 1999a); an arcflanking sedimentary assemblage consisting predominantly of meta-turbidites (Milton Island Assemblage); and plutons of predominantly dioritic to granitic composition. Maxeiner (1997) and Corrigan et al. (1997, 1998a) identified two strands of the Central Metavolcanic Belt within the La Ronge Domain, which they named the Lawrence Point and Reed Lake volcanogenic belts. Other supracrustal units were identified north of the La Ronge Domain in an area previously interpreted as part of the Rottenstone Domain. These supracrustal units are particularly well exposed at two localities, in the Laxdal/Doucet islands and Clements Island area, respectively. In both areas, sedimentary and volcaniclastic rocks predominate, with recognizable volcanic protoliths forming only about 5 to 10% in total. Among the volcanic and volcaniclastic rocks, mafic compositions predominate, with intermediate to felsic compositions forming only a moderate to minor amount. Evidence for hydrothermal alteration is suggested by the widespread occurrence of cordierite-anthophyllite assemblages, especially in the Reed Lake and Clements Island strands. Both oxide- and silicate-facies banded iron-formation occur within the supracrustal rocks of the La Ronge Domain. Oxide facies banded iron-formation is particularly well exposed on the northeastern shore of Doucet Island, as well as on a small island about 6.75 km northeast of Clements Island on map sheet 64E/01. Silicate-facies banded iron-formation occurs in the Lawrence Point volcanogenic belt, on the north shore of Laxdal Island, and in thin bands within the Clements Island strand. The iron-formations are typically associated with pyrite-pyrrhotite \pm chalcopyrite bearing gossan zones. Preliminary U-Pb zircon data suggest an age of 1905 + 22/-3 Ma (Corrigan et al., in prep.) for a metayolite from the Clements Island strand, indicating a temporal correlation with the oldest volcanic components of the

Flin Flon Belt (David et al., 1993), as well as with volcanic rocks of the Leaf Rapids belt in Manitoba. The Crowe Island Complex forms a distinctive package of medium to fine-grained banded orthogneiss of mixed dioritic, tonalitic, granodioritic and granitic composition. Dynamic recrystallization is pervasive and the degree of partial melting ranges from incipient, to about 40 percent. This unit locally hosts rafts of supracrustal rocks that are similar in composition to parts of the Central Metavolcanic Belt. Moreover, preliminary U-Pb ages of 1891 \pm 3 and 1884 + 5/-3 Ma obtained from a tonalite and a granite from this suite, respectively, together with εNd values ranging between + 2 and + 4 (Corrigan et al., in prep.), suggest a possible relationship with the Central Metavolcanic Belt previous compilation maps, this unit had been interpreted as part of the Rottenstone Domain (i.e., unit "Rgt" in Johnston and Thomas, 1984). In light of the new isotopic and field data, Corrigan et al. (1998a; 1999b) proposed tha the Crowe Island Complex forms an integral part of the La Ronge domain, perhaps representing the plutonic root of the Central Metavolcanic Belt.

The Milton Island metasedimentary assemblage (Corrigan et al., 1998a; 1999b) consists of variably migmatized finely graded and thinly layered psammite and semi-pelite that contain white stromatic migmatitic segregations cosomes) of pure quartz and/or granitic composition, separated from the paleosome by thin biotite-rich selvages. The main phyllosilicate is biotite, with minor muscovite and traces of graphite. Fibrolite is rarely seen on outcrop but is normally visible in thin sections. Garnet is only rarely observed. A characteristic feature of this unit is the local although it is locally interlayered with thin (up to a few tens of metres) felsic volcanic or epiclastic rocks, as well as rare calc-silicate bands. In the few places where its contact with the underlying Central Metavolcanic Belt (CMB) is rock, in turn grading into laminated psammitic rocks of the Milton Island assemblage within a layer thickness of about one metre or less. The Park Island metasedimentary assemblage (Corrigan et al., 1998a; 1999b) is a newly recognized package of siliciclastic rocks that consists of a basal conglomerate, arkose, calcareous arkose, psammite and calcareous

psammite. It structurally and stratigraphically overlies the CMB and the Milton Island assemblage. The polymictic

conglomerate contains pebble- to cobble-size clasts and occurs at the base of the assemblage. It grades upwards

from clast-supported to matrix-supported, coinciding with a gradual change in matrix composition from mafic- to felsic-dominated. Clasts are predominantly made up of fine-grained material and comprise, in order of decreasing abundance, syenite and monzonite, felsic volcanic rock, intermediate volcanic rock, calc-silicate and mafic volcanic rock, quartz pebbles, and oxide-facies banded iron-formation. The matrix composition is predominantly mafic towards the bottom and grades into a more felsic composition towards the stratigraphic top of the succession. The arkose is pink to grey and locally hosts well-preserved sedimentary structures such as cross-beds and upper-flow regime laminar beds. Thin, greenish calc-silicate beds with diopside-quartz-calcite mineralogy are locally present. Magnetite is present throughout in trace to minor amounts. The arkose and calcareous arkose grades stratigraphically upward into psammite and calcareous psammite. Partial melting has affected this unit to varying degrees, from only minor migmatitic segregation to almost complete remobilization, with a gradual increase of partial melt proportion northwards towards the Wathaman Batholith. Large enclaves of the arkose are enclosed within the 1865-1850 Ma Wathaman Batholith, constraining its minimum age of deposition. PLUTONIC ROCKS

Numerous large plutons occur throughout the La Ronge domain. They range in composition from mafic to ultramafic (small intrusions and dykes) to dioritic/quartz dioritic (Butler Island, Milton Island, Walter Island, and Cowie plutons), monzodioritic/granodioritic (Jackpine Bay pluton), monzogranitic (McMillan Lake pluton), to granitic (unnamed pluton north of Kinoosao). They transect an older fabric and an early generation of folds in the enclosing supracrustal rocks and orthogneiss, indicating that they postdate an early tectonometamorphic event. However together with the older supracrustal rocks, they are affected by the peak regional tectonometamorphic event isotopically dated in the area at ca. 1820-1810 Ma (Corrigan et al., in prep.). These plutons are compositionally indistinguishable from the Wathaman suite and fall within the same age range (Corrigan et al., in prep.). However unlike most of the plutons within the Wathaman Batholith, isolated plutons within the La Ronge Domain do not typically contain K-feldspar megacrysts. Part of the Wathaman Batholith outcrops in the northwest corner of the map sheet. At this location, it consists

mainly of coarse-grained to K-feldspar megacrystic granodiorite and granite. The granodiorite and granite are hornblende- and biotite-bearing, respectively. Although K-feldspar megacrysts are generally well-aligned and outline a rough foliation, individual megacrysts are not recrystallized, suggesting that crystal alignment is predominantly south by the Reilly Lake shear zone (Stauffer and Lewry, 1993), a ductile, inhomogeneous, moderately north-dipping shear zone about 100 metres thick. Consistent down-dip extension lineations and rare winged feldspar porphyroclasts iggest a reverse, top-to-the-south sense of shear (see also Lafrance and Varga, 1996). In lower-strain lenses within the Reilly Lake shear zone, crosscutting relationships between the Wathaman Batholith and the Park Island assemblage are preserved. The Reilly Lake shear zone is therefore localised at an old intrusive margin and is not a STRUCTURAL AND METAMORPHIC FRAMEWORK

Three distinct deformation episodes are recognized in the map area. The earliest tectonometamorphic event (D1-M1) is only rarely preserved and is best observed in supracrustal enclaves in low strain zones within the Wathaman atholith and its satellite plutons in enclosing wall rocks (Corrigan et al., 1998a, b). The D1 event resulted in the formation of large-amplitude recumbent folds and is interpreted to have developed during the accretion of the La

trending fabric and the peak metamorphic assemblages observed throughout the region, which resulted in the development of map-scale, recumbent, tight to isoclinal folds, as well as localized, foliation-parallel ductile shear zones. This event was accompanied by middle-amphibolite facies metamorphism under pressure and temperature conditions of approximately 4-5 kbar and 600-650 °C (Chakungal, 1999). Preliminary U-Pb monazite ages ranging between 1822 \pm 1 Ma and 1804 \pm 1 Ma provide an approximate age constraint for this event (Corrigan et al., in prep.). The third and last regional deformation event (D3-M3) is late-orogenic and resulted in the formation of large-amplitude, orogen-normal upright open folds that refold all earlier structures. There is no noticeable growth of metamorphic

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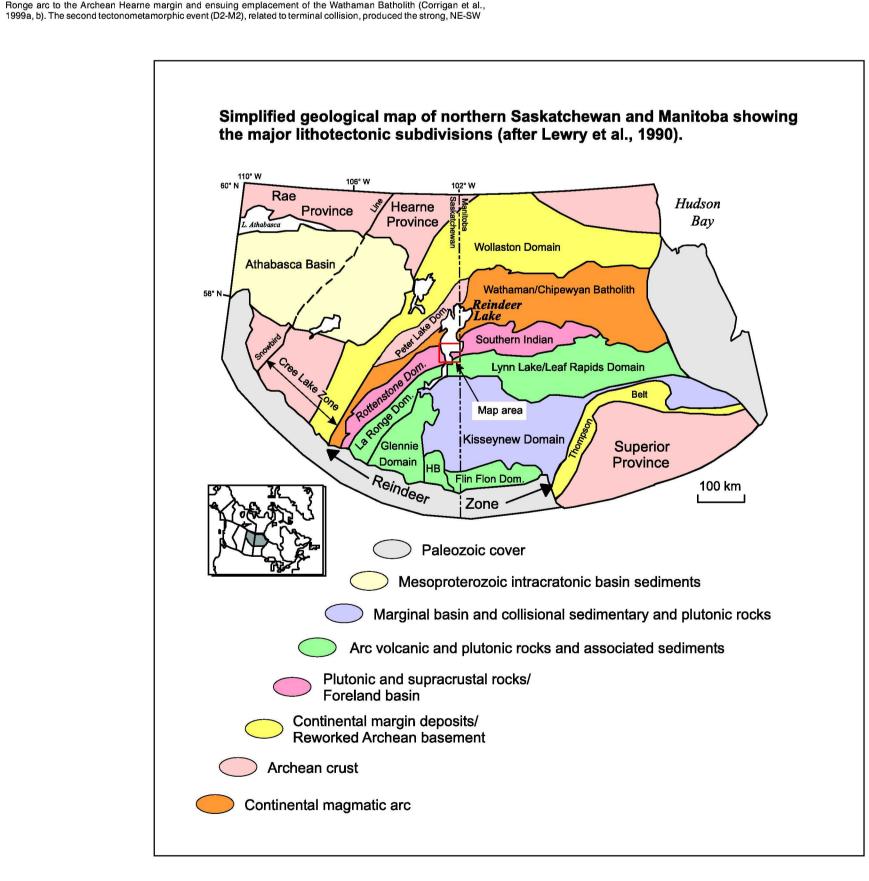
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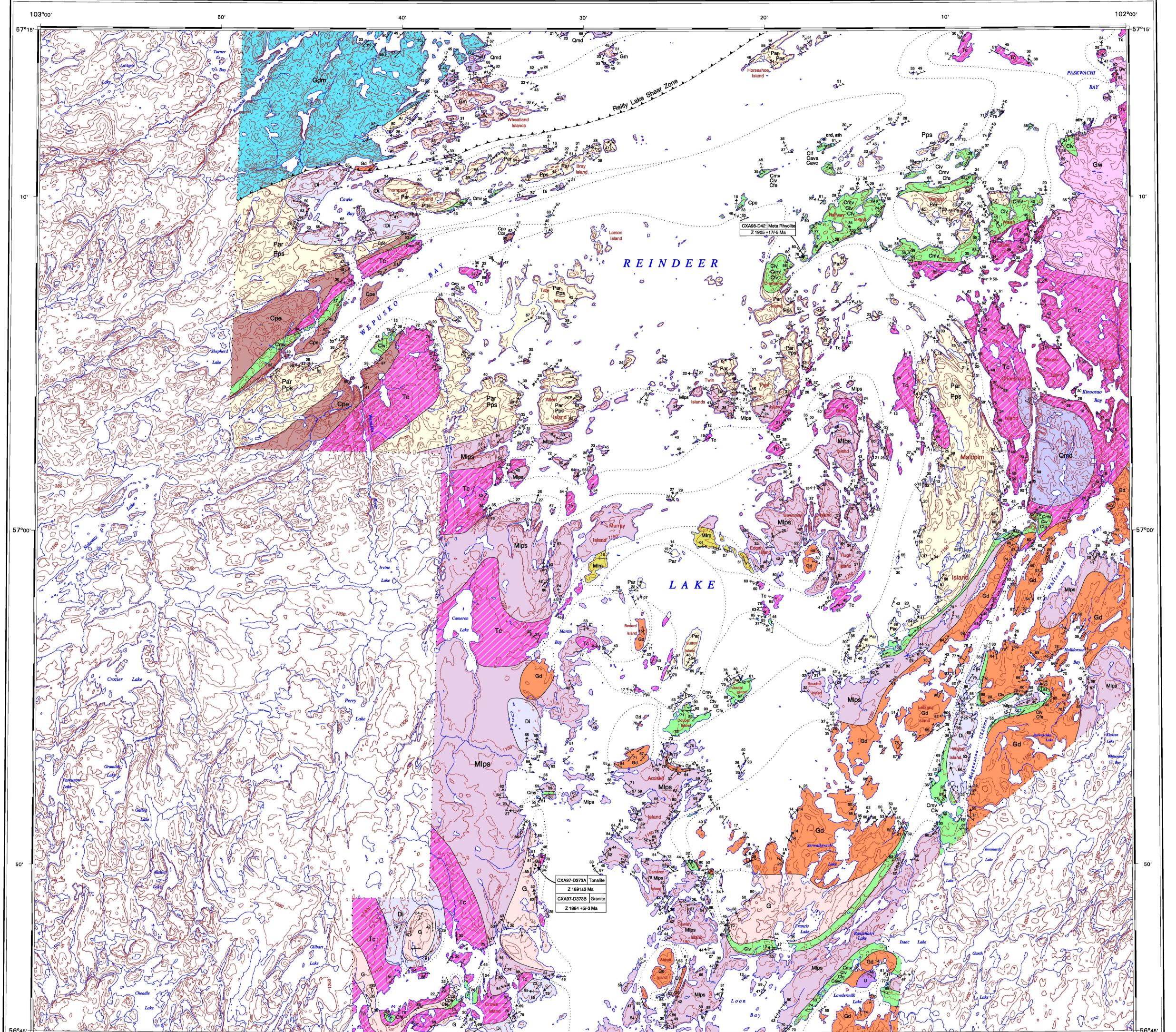
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Geological mapping by D. Corrigan (Project Leader), T. MacHattie, L. Piper, and D. Wright

Compilation and interpretation by D. Corrigan Digital cartography by D. Viner, Earth Sciences Sector Information Division (ESS Info) Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

GEOLOGY CENTRAL REINDEER LAKE SASKATCHEWAN

OPEN FILE 3750

Scale 1:100 000/Échelle 1/100 000 Universal Transverse Mercator Projection Projection transverse universelle de Mercator North American Datum 1983 Système de référence géodésique nord-américain, 1983 ©Her Majesty the Queen in Right of Canada, 2000 ©Sa Majestéla Reine du chef du Canada, 2000

Digital base map from data compiled by Geomatics Canada, modified by ESS Info

Mean magnetic declination 2000, 11°11'E, decreasing 9.4' annually Elevations north of 57°00' in metres above mean sea level and elevations south of 57°00' in feet above mean sea level

64 E/8 64 F/5 NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

LEGEND

than 8 percent biotite (age unknown)



INTRUSIVE ROCKS Magnetite-bearing leucogranite to leucotonalite; pink, medium to coarse-grained, equigranular, massive to weakly foliated; with quartz, plagioclase and microcline; less

Garnet-biotite leucogranite to leucotonalite, medium-grained, equigranular, locally with biotite shlieren, derived from partial melting of Milton Island metasedimentary

Wathaman Batholith and satellite intrusions

Granite; pink, medium- to coarse-grained, homogeneous, moderately to strongly recrystallized, poorly to strongly foliated; with biotite, K-feldspar, plagioclase, quartz ±

Megacrystic granite; similar to above but with 5 to 30 percent K-feldspar megacrysts

Granodiorite to quartz monzonite; light grey, medium to coarse-grained, equigranular, weakly to strongly foliated; with quartz, microcline, 5 to 20 percent biotite, \pm hornblende ± magnetite, with accessory epidote and titanite

Megacrystic granodiorite; weakly to moderately foliated, locally with magmatic foliation; contains hornblende, biotite, plagioclase, quartz, titanite \pm allanite \pm epidote, with 5 to 30 percent K-feldspar megacrysts

percent quartz; ± titanite; locally grades into granodiorite. Contains cognate mafic xenoliths and angular enclaves of supracrustal rocks. (U-Pb zircon; 1858 ± 3 Ma) Quartz monzodiorite; medium grey, with coarse K-feldspar (up to 20%) in medium-grained plagioclase(50%)-hornblende(20%)-biotite(<5%)-quartz(<5%)

Diorite to quartz diorite; medium grey, medium to coarse grained, equigranular,

massive to strongly lineated and/or foliated; 20 to 35 percent hornblende; up to 8

matrix. Massive, unrecrystallized, to well foliated and mostly recrystallized. Locally

hosts numerous cognate mafic xenoliths Metamorphosed layered mafic and ultramafic rocks; emerald green, greenish black, to white, fine grained to pegmatitic, massive to mylonitic, homogeneous to well banded; layers range in composition from meta-peridotite to anorthosite but gabbro and leucogabbro predominates. Layers vary in thickness from a few centimetres to a few tens of centimetres. Composition is variable and includes actinolite \pm hornblende \pm diopside \pm anthophyllite \pm phlogopite/biotite \pm serpentine \pm garnet \pm magnetite. Coarse anthophyllite blades, up to 5 cm long, are randomly oriented in the ultramafic

layers. Sub-ophitic texture is locally preserved in gabbro and leucogabbro

SUPRACRUSTAL ROCKS PARK ISLAND METASEDIMENTARY ASSEMBLAGE

Meta-Arkose; pink, fine to medium grained, massive to moderately foliated, granoblastic; thinly to thickly bedded; locally with trough cross-bedding and conglomerate lag deposits; up to 50 percent K-feldspar, ≤ 5 percent biotite + muscovite + magnetite ± sillimanite. Locally with large sillimanite faserkiesel

Meta-Psammite; light grey to light pinkish grey, medium grained, granoblastic, moderately to well foliated, thin to medium bedded; injected by 0 to 30 percent muscovite ± garnet bearing, white to pink pegmatite; up to 25 percent K-feldspar, up to 50 percent quartz, 10 to 25 percent muscovite, < 5 percent biotite, > 1 percent magnetite, locally large fibrolite faserkiesel

Polymictic meta-conglomerate; pink to greyish pink, poorly sorted to well sorted, matrix supported with moderately to strongly elongated pebble- to cobble-sized clasts of volcanic, plutonic, and sedimentary origin, including oxide facies banded iron-formation; matrix is fine to medium grained and biotite-hornblende to biotite-muscovite-rich; contains up to 20 percent biotite ± hornblende ± muscovite ± magnetite. Poikiloblastic hornblende crystals are locally abundant and characteristic

REWORKED UNCONFORMITY

MILTON ISLAND METASEDIMENTARY ASSEMBLAGE

Psammopelitic schist and gneiss; light grey to buff, fine to medium grained, granoblastic, well foliated, locally with graded bedding. Typically migmatitic with 5 to 40 percent layer-parallel leucosomes of tonalitic composition, with medium-grained bluish-green apatite; sillimanite or fibrolite knots locally abundant in the more pelitic layers; locally cut by amphibolite dykes; up to 20 percent biotite ± muscovite; ± graphite \pm pyrite \pm garnet (very rare)

> CROWE ISLAND INTRUSIVE COMPLEX Mixed diorite, granodiorite, tonalite, and granite; medium grey to light grey, fine to

medium-grained, equigranular, massive to strongly foliated and gneissic; locally migmatitic; with biotite \pm hornblende \pm magnetite \pm epidote \pm titanite (U-Pb zircon; 1891±3 Ma tonalite and 1884+5/-3 Ma granite) CENTRAL METAVOLCANIC BELT AND ASSOCIATED METASEDIMENTS

Psammopelite, pelite; medium grey, fine to medium grained, migmatitic, granoblastic, well foliated, gneissic; with biotite, quartz, plagioclase, K-feldspar (locally microperthite) \pm garnet \pm fibrolite \pm graphite

Undivided metasedimentary and metavolcanic rocks. Includes:

Cfe; ferruginous psammite; pale reddish-brown to yellowish brown, fine to medium grained, well foliated, thin to medium bedded, rusty on weathered surfaces; locally with lean silicate facies iron formation and psammopelite intercalations; with muscovite, quartz, microperthite, plagioclase, with pyrrhotite, pyrite \pm graphite \pm limonite ± fibrolite ± biotite Clf; banded iron-formation; oxide facies and silicate facies; thinly-bedded, locally with garnetite layers; with quartz, magnetite, hornblende, grunerite-cummingtonite, garnet, ± biotite. Most northern samples contain the assemblage clinopyroxene-garnet-

quartz-magnetite \pm hornblende. Generally intercalated with mafic volcanic rocks, or Ccs; Calc-silicate gneiss; thinly-bedded to laminated, heterogeneous, with alternating silicate-rich and carbonate-rich layers, with calcite, diopside, epidote, plagioclase, quartz, phlogopite \pm grossular garnet \pm scapolite \pm titanite Cavc; Garnet-cummingtonite-biotite-plagioclase-quartz ± hornblende gneiss and schist; light grey, buff to rusty brown, fine to medium grained, heterogeneous, grades

with unaltered foliated amphibolite interpreted as hydrothermally altered and metamorphosed mafic to intermediate volcanogenic rock Cava; Cordierite-anthophyllite-biotite-plagioclase-quartz schist; medium grey, medium to coarse grained, heterogeneous, interpreted as hydrothermally altered and metamorphosed mafic to intermediate volcanogenic rock Cfv; Felsic volcanic rock; light grey to light greenish grey, very fine to fine grained, thinly laminated to massive, moderately foliated to mylonitic, locally interlayered with felsic to intermediate epiclastic and volcanic rocks; contains less than 10 percent biotite, ± garnet (U-Pb zircon: 1905+22/-3 Ma)

Civ; Intermediate volcanic rock; medium grey to greenish grey, fine to medium grained, moderately foliated or mylonitic, massive to finely layered, hornblende porphyroblastic; contains 10 to 20 percent biotite \pm actinolite \pm garnet \pm epidote Cmv; Mafic volcanic rock; greenish black to black, fine to medium-grained, strongly foliated to mylonitic, homogeneous to banded, hornblende porphyroblastic; commonly interlayered with epidote- and carbonate-rich calc-silicate bands; up to 80 percent hornblende and actinolite \pm garnet \pm biotite NOTE: Geological units containing sub-units are generally heterogeneous, even at

outcrop scale. Areas where the sub-unit name is shown on the map indicates that this is the dominant rock type in that locality.

Geological contact: defined, assumed, inferred . Strike and dip of bedding: top unknown . Strike and dip of main foliation (schistosity, gneissosity): inclined, vert., horizontal Strike and dip of second generation foliation: inclined Strike and dip of fold axial plane: 1st generation, 2nd generation Strike and dip of crenulation cleavage . Plunge of undefined linear fabric 1st generation . Trend and plunge of stretching lineation: undefined age, 1st gen., 2nd gen.

Trend and plunge of mineral lineation: undefined age, 1st gen., 2nd gen. Trend and plunge of fold axis, 1st generation: s-fold, z-fold, m-fold

Trend and plunge of fold axis, 2nd generation: s-fold, z-fold, m-fold Trend and plunge of U-fold: undefined age, 1st generation, 2nd generation

Thrust fault (defined, inferred) Mineral occurrence; Cordierite(crd), Anthophyllite(ath) .

U-Pb age determination

OPEN FILE

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