MARGINAL NOTES

The Brochet region (NTS 64F) lies in the Churchill structural Province and is underlain by Early Proterozoic rocks. The region includes parts of three geological domains (key map below):

(1) the extreme northern tip of the Lynn Lake domain;

(2) the west half of the Southern Indian domain; and

(3) the southwestern quarter of the Chipewyan domain.

These domains are, respectively, (1) a volcano-plutonic belt, (2) a gneiss belt, and (3) a granitic batholithic terrane.

The **Lynn Lake domain** in NTS 64F consists of tonalitic to granodioritic intrusive rocks (**T**) with scattered amphibolite inclusions. These granitoid rocks form the northern part of an intrusive complex in the Barrington Lake area and are similar to those in the Melvin Lake area of the Southern Indian domain immediately north (Gilbert, in prep). The main part of this complex lies to the south in the Granville Lake map area, NTS 64C (Manitoba Energy and Mines, 1986). The position of the northern boundary of the domain is established by the nature of the supracrustal rocks: paragneisses predominate north, and volcanic rocks south of the boundary.

The **Southern Indian domain** extends across the southern half of the map and into the lithologically similar Rottenstone migmatite complex of the Rottenstone domain (Reindeer Lake North, NTS 64E; Macdonald and Thomas, 1983) in Saskatchewan. The domain contains abundant intrusive rocks and less than 20% supracrustal rocks comprising paragneiss, amphibolite and migmatite as rafts and discontinuous belts. The supracrustal rocks exhibit middle to upper amphibolite and locally granulite facies metamorphic mineral assemblages, and polyphase deformation. Large scale folds defined by metamorphic layering wrap discontinuously around elongate domal to sheath like plutons.

The northern half of the Southern Indian domain is interpreted to be a gneiss belt derived from a minor suite of metavolcanic rocks (PB**Ao**), compositionally varied metagreywacke (PB**N**, **N**g, **N**h), and tonalite-granodiorite intrusions (PB**Tn**, **Gn**). The gneissic granodiorite (**Gn**) is similar in age (1878 ± 14 Ma, Van Schmus and Schledewitz, 1986) to the rhyolites of the Ruttan Group (1878 ± 3 Ma, Baldwin *et al.*, 1987) in the Leaf Rapids domain to the south in the Granville Lake area, NTS 64C. The southern half of the domain, on the other hand, displays a segment of the crust that contains a compositionally uniform greywacke derived paragneiss to migmatite (**W**, **W**g), overlain by volcanic derived layered amphibolites (**Ar**), in turn overlain by metaconglomerate (**C**) or gneissic conglomerate (**Cn**) of uncertain age. Sickle Group arkose derived gneisses (**Sn**) are the youngest suite of rocks.

The best preserved lithologic sequence in the north half of the Southern Indian domain occurs along the western edge of the map area, at Paskwachi Bay on Reindeer Lake. Volcanic derived amphibolites with poorly preserved pillows (PB**Ao**) are structurally overlain by paragneiss (PB**N**) comprising fine grained biotite, feldspar and quartz with accessory magnetite, garnet, hornblende or sillimanite, and locally garnetiferous metagreywacke, interlayered with heterolithic breccia or garnetiferous iron formation. Prior to regional metamorphism these rocks were intruded by a suite of dioritic tc tonalitic rocks (PB**Tn**) and variably mineralized gabbro (**A**) sills. The relative age of the gabbro (**A**) sills to the diorite-tonalite (PB**Tn**) intrusive rocks is uncertain. This supracrustal-intrusive complex (Paskwachi Bay suite) was subsequently metamorphosed. Tonalitic to granodioritic orthogneiss (**Tn**, **Gn**), magnetiferous (variably garnetiferous) quartzofeldspathic migmatite (**N**g) and hornblende–magnetite quartzofeldspathic migmatite (**N**h) with amphibolite interlayers, which occur along the eastern and northern shores of Paskwachi Bay, are considered to be high grade metamorphic equivalents of the Paskwachi Bay suite. These high grade rocks are interleaved with garnet–biotite metatexite (**W**g) and garnetiferous tonalite (**Tj**). They extend across the northern half of the Southern Indian domain to the Big Sand Lake area on the eastern edge of the map area. A U-Pb age of 1878 ± 14 Ma (Van Schmus and Schledewitz, 1986) for the granodioritic to tonalitic felsic orthogneiss (**Gn**), in the Big Sand Lake area is nearly identical to ages of rhyolites of the Ruttan Group (Baldwin *et al.*, 1987) 115 km to the southwest in the Leaf Rapids domain (NTS 64B, Manitoba Energy and Mines, 1986). This suggests the rocks of the Paskwachi Bay suite (PB**N**, PB**Tn**) and their high grade equivalents (**N**g, **N**h, **Tn** ,**Gn**) may be part of a pre-Sickle volcanic-plutonic suite.

In the south half of the Southern Indian domain compositionally uniform graphitic garnet–biotite metatexite (**W**g) is the most extensive supracrustal rock type. It is similar to the migmatite that is interleaved with the more varied metagreywacke (**N**g, **N**h) and tonalitic gneiss (**Gn**) in the north half of the Southern Indian domain. Metatexite (**W**g) grades into areas of stromatic migmatite and variably garnetiferous tonalite to granodiorite (**Tj**) with inclusions of metatexite (**W**g). A Rb-Sr age of 1910 ± 50 (intial ratio $^{87}Sr/^{86}Sr$ = 0.7015) for the metatexite (**W**g) (Clark, 1984) is consistent with the age of the metavolcanic rocks of the Wasekwan Group in the Lynn Lake domain to the south (NTS 64C) (Baldwin *et al.*, 1987).

The graphite–garnet–biotite metatexite (**W**g) extends south and southeast into the Melvin Lake and Dunsheath Lake area where it grades into paragneiss (**W**) derived from greywacke-siltstone turbidites. The paragneiss (**W**) in the Melvin Lake area and Dunsheath Lake area (southeast corner of the map) is similar to the Zed Lake greywacke to the immediate southwest, in the Granville Lake map area. The greywacke in the Dunsheath Lake and Melvin Lake area structurally overlies conglomerate and arkosic gneiss (**C**, **Sn**) (McRitchie, 1976, 1977). Similar conglomerates and more localized arkosic gneiss also occur in the Zed Lake area where they are interpreted to overlie the greywacke in a synformal structure. However, despite the lower metamorphic grade and the more common preservation of primary features in the Zed Lake area, a scarcity of facing criteria makes stratigraphic relationships in the Southern Indian Lake domain uncertain (Gilbert *et al.*, 1980). The interpreted stratigraphic relationship of conglomerate overlying metagreywacke delineates a series of steeply overturned folds that lie in a 10 km wide zone trending parallel to the boundary between the Southern Indian domain and the Lynn Lake domain. The southern limb of a steeply overturned syncline in the Zed Lake-Dunsheath Lake area contains a fine grained, thinly layered amphibolite (**Ar**). This amphibolite (**Ar**), interpreted to be derived from volcanic rocks (Gilbert, in prep), lies between conglomerate (**C**) and metagreywacke (**W**). The southern limb of this steeply overturned fold lies along the south edge of the Southern Indian domain and can be extrapolated to the east into a region of predominantly tonalitic orthogneiss containing only enclaves of conglomerate (**C**) or thinly layered amphibolite (**Ar**). The extrapolation of this fold limb to the east into the area between Melvin Lake and the north end of Barrington Lake is based on the interpretation of aeromagnetic trends (Gilbert, in prep).

The supracrustal gneisses and orthogneisses of the Southern Indian domain are intruded by:

(1) magnetiferous quartz diorite (**D**m),

(2) megacrystic hornblende, locally clinopyroxene bearing granodiorite to tonalite (**Gp**h, **Gp**x),

(3) variably magnetiferous or garnetiferous tonalite (**T**m,**Tp**),

(4) garnetiferous biotite granodiorite to tonalite (**Tj**) with inclusions of garnetiferous biotite metatexite (**W**g),

(5) megacrystic monzogranite of the Chipewyan batholith (c**Gp**),

(6) Paskwachi Bay quartz diorite (PB**D**); gabbro, diabase (**B**); Melvin Lake gabbro, norite (M**B**).

The chemistry of the magnetiferous quartz diorite (**D**m) is comparable to that of the post-Sickle Black Trout diorite in the Lynn Lake domain (NTS 64C). Both rock types have an alkali-calcic affinity and both have elevated iron, phosphorous and titanium values. The intrusion of the magnetiferous quartz diorite (**D**m) and the Black Trout diorite predates a regional metamorphism and intrusion of the Chipewyan batholith. The various granodiorites and tonalites (**Gp**h, **Gp**x, **T**m, **Tp** and **Tj**) predate, or are contemporaneous with, the crystallization age of the main part of the Chipewyan batholith (c**Gp**) at 1855 ± 10 Ma (Van Schmus and Schledewitz, 1986). A U-Pb age of 1838 ± 11 Ma (Van Schmus and Schledewitz, 1986) was determined for the Paskwachi Bay quartz diorite (PB**D**). This stock, which postdates the Chipewyan monzogranite (c**Gp**), contains inclusions of gneissic country rock (PB**N**) indicating an earlier metamorphic event. However, the quartz diorite is foliated and recrystallized indicating a second phase of metamorphism and deformation. The Melvin Lake gabbro to norite appears to be of a similar age. The intrusion trends to the northeast, oblique to the main fabric of the country rocks in the Melvin Lake area; well preserved igneous layering is parallel to the trend of the intrusion. Emplacement of the Melvin Lake norite may have been controlled by a related northeast-trending fault. The synformal shape of Melvin Lake norite may in part represent an original lopolithic structure, but localized development of foliation indicates the intrusion was tectonized. (Gilbert, in prep.)

The **Chipewyan domain** is a batholithic complex that underlies the northern half of the map area. It can be traced west and correlated directly with the Wathaman batholithic complex in Saskatchewan (Lewry *et al.*, 1981; Fumerton *et al.*, 1984). In the Brochet map area there are two major components with several phases in each component:

(1) magnetiferous biotite monzogranite with variable hornblende (c**Gp**) characterized by variable proportions of microcline megacrysts,

(1a) leucocratic granite with Rapakivi texture (c**Gd**),

(1b) leucocratic seriate granite (c**G**l),

(2) Katimiwi hornblende monzogranite (K**Zp**) characterized by a honey-brown colour and megacrysts of microcline,

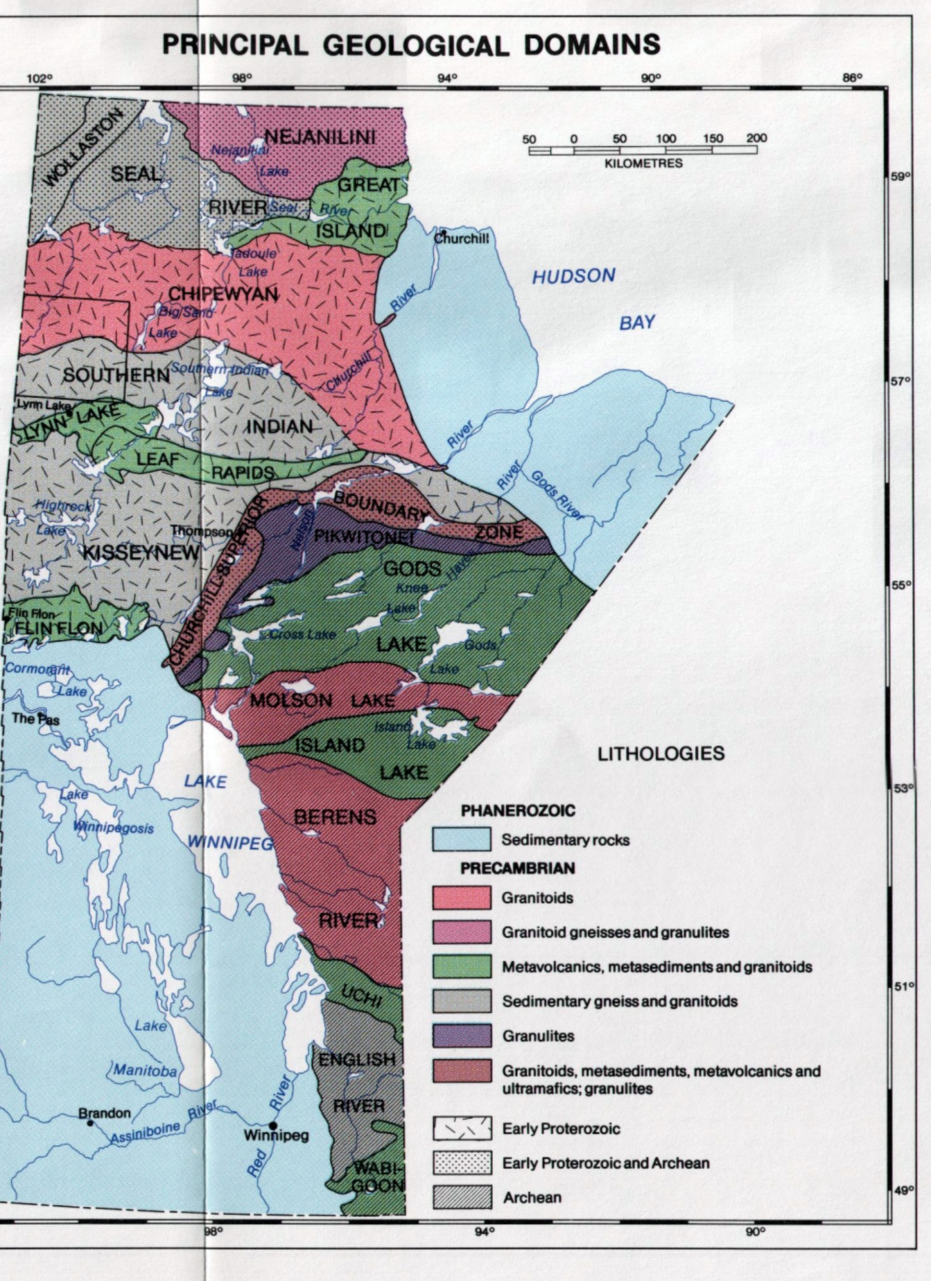
(2a) Katimiwi pyroxene bearing monzonite to monzogranite (K**Zp**x) characterized by an olive-brown colour and megacrysts of microcline,

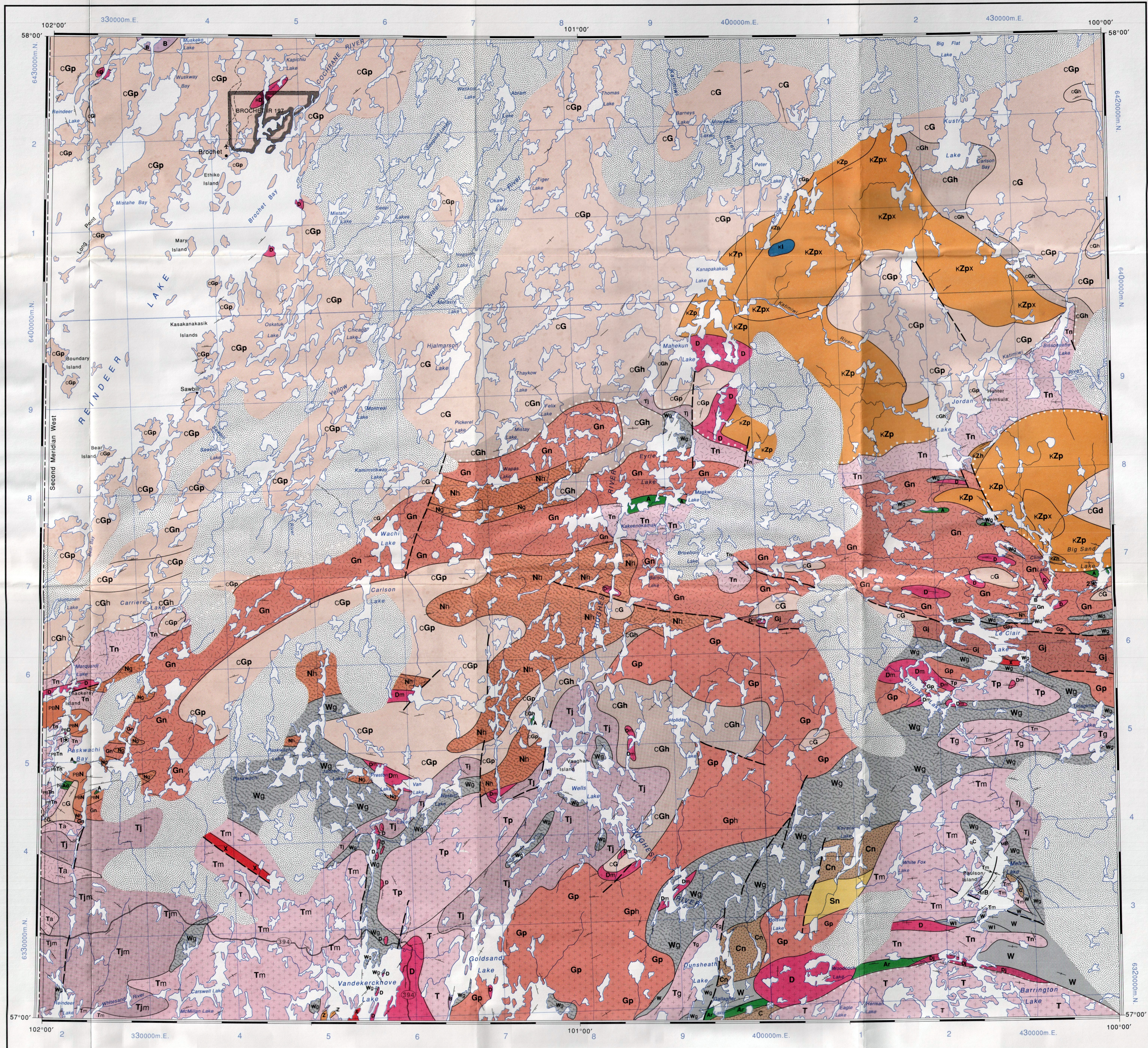
(2b) Katimiwi anorthositic gabbro (K**I**)

U-Pb zircon ages from igneous rocks of the Chipewyan batholith, northwest of LeClair Lake, yield a mean age of 1855 ± 10 Ma. This mean age is derived from a U-Pb age of 1857 ± 9 Ma (Van Schmus and Schledewitz, 1986) for a porphyritic monzogranite (c**Gp**), the main granitic phase in the Big Sand Lake area (NTS 64G; Schledewitz, 1983) and a U-Pb age of 1854 ± 12 Ma (Van Schmus and Schledewitz, 1986) for a Rapakivi textured phase (c**Gd**) of the monzogranite. A U-Pb age of 1860 ± 17 Ma (Van Schmus and Schledewitz, 1986) was determined for inclusions of tonalite in the porphyritic monzogranite (c**Gp**). This age , in combination with the U-Pb age determination of 1878 ± 14 Ma (Van Schmus and Schledewitz, 1986) for a gneissic granodiorite to tonalite (**Gn**) intruded by the Chipewyan monzogranite (c**Gp**) and the honey-brown megacrystic monzogranite (K**Zp**) suggests that much, if not all, of the crust that hosts the southern flank of the Chipewyan batholith is only slightly older then the batholith. This is in contrast to the age relationships on the northern flank of the batholith that range in age from Archean to Proterozoic (Weber *et al.*, 1975; Clark and Schledewitz, 1988). In the extreme northwest corner of the map area, inclusions of massive to gneissic hornblendic metadiorite (R**D**) are considered to be of Archean age. The zone containing these intermediate to basic inclusions is on strike with the igneous Peter Lake complex of the Peter Lake domain in Saskatchewan (Reindeer Lake North, NTS 64E). Similar metadioritic rocks of the Peter Lake complex have yielded a U-Pb age of 2538 ± 10 Ma (Ray and Wanless, 1980). While U-Pb zircon dating of felsic gneisses has confirmed the presence of crustal material of Archean age, 2582 ± 19 Ma, and 2556 ± 22 Ma, a gabbro pegmatite phase of a layered gabbro yielded an age of 1865 ± 10 Ma indicating that mafic rocks also intruded Archean crust during the Hudsonian orogeny (Bickford *et al.*, 1986).

Age relationships of the Chipewyan domain rocks are very similar to those in the Wathaman batholith component of the Rottenstone domain to the west. In addition, the spread of Archean to Hudsonian ages for the rocks on the north flank of the Chipewyan and Wathaman batholiths and the predominantly Hudsonian ages for the rocks on the south flank of the batholiths, are also very similar indicating that the entire complex in Manitoba and Saskatchewan is a single large orogenic complex.

A Rb-Sr whole rock "age" of 1800 ± 32 Ma and an initial ratio of 0.7028 ± 0.0006 (Halden *et al.*, in prep) was derived from a plot of 28 samples collected along the southern margin of the Chipewyan batholith from Eyrie Lake (NTS 64F) east to the Northern Indian Lake area (NTS 64H), a distance of ca. 220 km. This composite age is consistent with Rb-Sr isotopic systematics for individual components of the batholith, which range in age from 1800 to 1818 Ma with initial $^{87}Sr/^{86}Sr$ ratios of 0.7021 ± 0.0007 to 0.7034 ± 0.0006. These Rb-Sr ages are younger than the previously listed U-Pb zircon ages and are considered to reflect a disturbance due to a post-magmatic metamorphic event. The restricted range of the initial ratios suggests "homogeneity of the source region for the granitic magmatism, coupled with a short crustal residence time" (Halden *et al.*, in prep).





Pantone colour base separated on Hell Chromacom CP341 digital scanner. Legend and text formatted on an in-house desktop publisher.

Printed 1989

Scale 1:250 000

KILOMETRES 5 0 5 10 15 20 25 KILOMETRES

Manitoba
Energy and Mines
Geological Services
Geological Compilation Map Series
Brochet, NTS 64F
1:250 000

LEGEND

PRECAMBRIAN

Early Proterozoic

Younger Plutonic Rocks

- **X** — Pegmatite
- **B** — Gabbro, diabase; M**B** - Melvin Lake gabbro, norite
- 1 PB**D** — Paskwachi Bay quartz diorite; 1: *1838 ± 11 Ma*

CHIPEWYAN DOMAIN

Chipewyan Batholithic Complex

- c**G** / c**Gh** — c**G** - Granite ± hornblende; c**Gp** - megacrystic biotite–magnetite monzogranite; c**Gh** - gneissic hornblende granite; c**Gd** - leucocratic granite with Rapakivi texture; c**G**l - leucocratic granite; c**Gh** - megacrystic granite with abundant inclusions of hornblende bearing quartzofeldspathic gneiss

Katimiwi Plutonic Rocks

- K**Zp** / K**Zh** — K**Zp** - Megacrystic hornblende monzogranite; K**Zp**x - megacrystic pyroxene bearing monzonite to monzogranite; K**Zh** - megacrystic pyroxene bearing monzonite to monzogranite with abundant inclusions of metadiorite
- K**I** — Anorthositic gabbro

SOUTHERN INDIAN DOMAIN

Metasedimentary Rocks

- **Sn** — Fine grained gneissic meta-arkose
- **C** — Polymictic conglomerate; **Cn** - gneissic metaconglomerate

Older Plutonic Rocks

- 2 **Gn** / **Gj** — **Gn** - Gneissic magnetite granodiorite to tonalite with quartzofeldspathic layers ± hornblende; 2: *1878 ± 14 Ma*; **Gj** - biotite–magnetite granodiorite with inclusions of quartzofeldspathic gneiss (**N**h)
- **Tn** — Gneissic to migmatitic tonalite to granodiorite ± hornblende, with white granitic *lit*; **T**a - tonalite to granodiorite gneiss to migmatite ± hornblende with discontinuous layers of amphibolite and magnetite tonalite (**T**m) (up to 10 - 15% of unit); PB**Tn** - Paskwachi Bay hornblende tonalite to quartz diorite, weakly foliated to mylonitic, with discontinuous zones of metagabbro and gabbroic gneiss and rare inclusions of garnetiferous metagreywacke and heterolithic breccia (debris flow)

Metamorphic Rocks of Uncertain Affinity

- **A** — Amphibolite, minor metagabbro, locally agmatitic; **Ar** - amphibolite with layers of hornblende–biotite and layers of intermediate to felsic schist and gneiss; PB**Ao** - amphibolite, with locally preserved pillow structures
- PB**N** / **N**g — PB**N** - Paskwachi Bay suite of paragneiss to migmatite, predominantly biotite–quartz–feldspar gneiss ± garnet ± magnetite ± sillimanite, sporadic interlayers of hornblende–quartz–feldspar gneiss ± epidote ± magnetite; localized garnetiferous silicate iron formation; **N**g - quartzofeldspathic migmatite ± magnetite ± garnet with biotite rich interlayers; **N**h - quartzofeldspathic migmatite ± magnetite with amphibolite and/or hornblende–biotite-bearing interlayers
- **W** / **W**g — **W** - Biotite–feldspar–quartz paragneiss to migmatite ± muscovite; **W**l - with sills of diorite; **W**g - biotite metatexite ± garnet ± graphite; **W**d - biotite metatexite ± cordierite

Reference for U-Pb zircon ages:

1,2 *Van Schmus and Schledewitz, 1986*

Plutonic Rocks of Uncertain Age

- **B** — Metagabbro
- **D** / **Dj** — **D** - Metadiorite to leucodiorite; **D**m - magnetite quartz diorite; **Dj** - metadiorite to leucodiorite with abundant inclusions of **Ar**; R**D** - Reindeer Lake metadiorite with hornblendite zones (possibly Archean)
- **Gp** — Megacrystic biotite granodiorite to tonalite; **Gp**h - megacrystic hornblende granodiorite to tonalite; **Gp**x - megacrystic pyroxene bearing granodiorite to tonalite
- **T**g / **Tj** — **T**g - Biotite tonalite to granodiorite ± garnet; **Tp** - megacrystic biotite tonalite to granodiorite ± garnet; **T**m - magnetite tonalite to granodiorite; **Tn** - gneissic to migmatitic tonalite to granodiorite ± hornblende, with white granitic *lit*; **Tj** - biotite tonalite to granodiorite ± garnet, with inclusions of greywacke metatexite (**W**g); **Tj**m - predominantly **Tj**, with dykes and sills of **T**m

LYNN LAKE DOMAIN

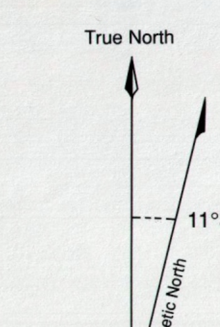
Plutonic Rocks of Uncertain Age

- **T** — Tonalite, granodiorite

NOTE:
The map units within the major lithostratigraphic divisions are in approximate chronological order.

SYMBOLS

- Geological boundary (approximate)
- Bedding, igneous layering (0°-29°, 30°-59°, 60°-79°, 80°-90°)
- Foliation (dip unknown, 0°-29°, 30°-59°, 60°-79°, 80°-90°)
- Syncline
- Fault (inferred)
- Domain boundary
- Area of little or no outcrop
- 2 Sample locality for U-Pb zircon age determination



Approximate mean declination (1989) for centre of map
Decreasing 12.6′ annually

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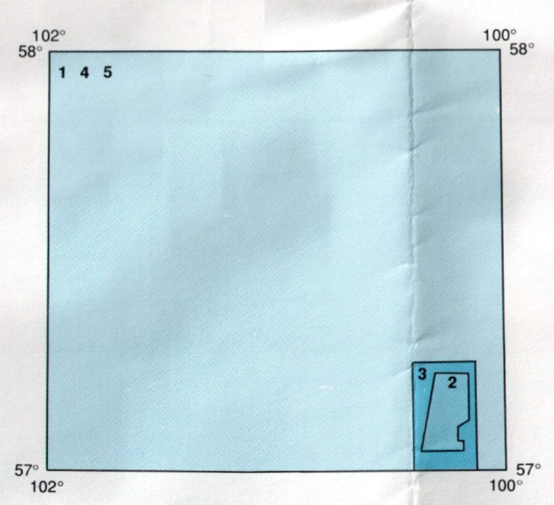

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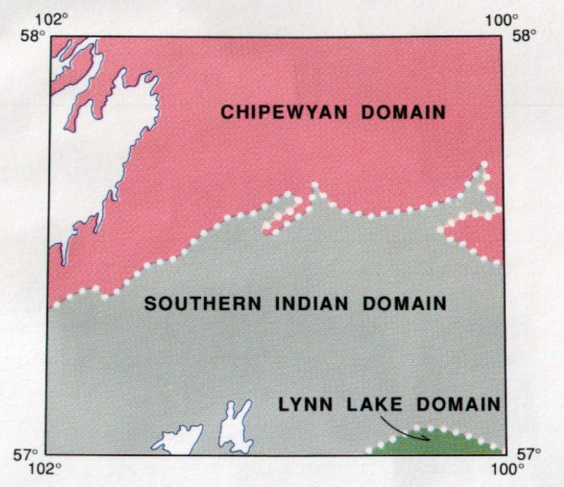
In addition, recent unpublished data have been incorporated.

MAJOR DOMAINS



Synoptic geology by D.C.P. Schledewitz and H.P. Gilbert

Compilation by D. Lindal

Cartography by T. Franceschet

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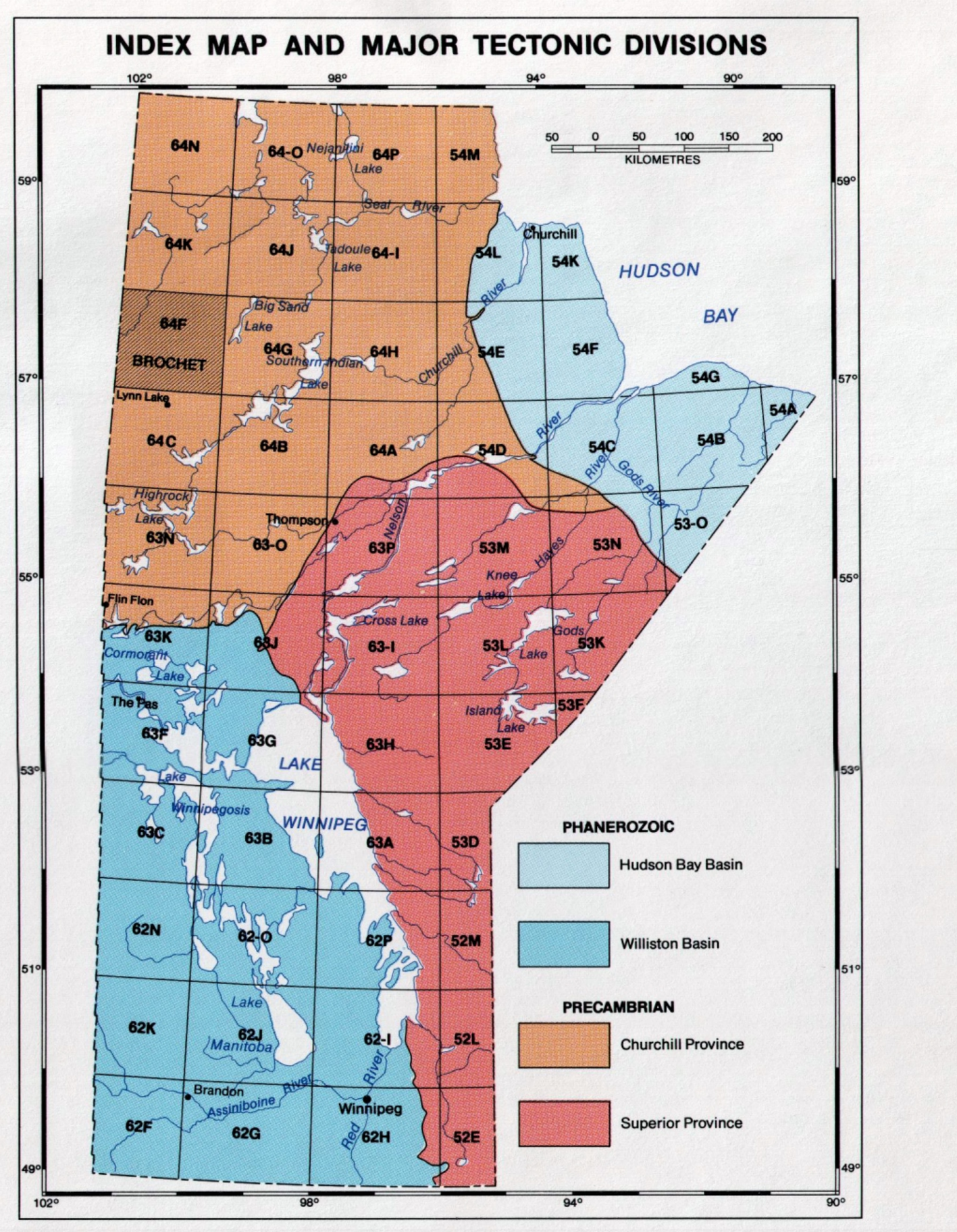
BEDROCK GEOLOGY COMPILATION MAP SERIES

BROCHET

NTS 64F



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