MARGINAL NOTES

The Big Sand Lake region (NTS 64G) lies in the Churchill Structural Province and is underlain by Early Proterozoic rocks. The region includes parts of two geological domains (key map below):

(1) the east half of the Southern Indian domain; and

(2) the southwestern margin of the Chipewyan domain.

These domains are a gneiss belt and a granitic batholithic terrane, respectively.

The **Southern Indian domain** extends across the southern half of the map area and contains abundant intrusive rocks and less than 30% supracrustal rocks. These comprise paragneiss, amphibolite and migmatite as rafts and discontinuous belts. They exhibit middle- to upper-amphibolite facies metamorphic mineral assemblages and polyphase deformation. The domain is divisible into two lithologically distinct segments:
i) a *western segment* of granodiorite and paragneiss that extends from the western boundary of the map area to the western shore of Southern Indian Lake,
ii) an *eastern segment* of younger granitic rocks and varied gneisses that extends from the western shore of Southern Indian Lake to the eastern boundary of the map area.

The *western segment* is divisible into a northern predominantly intrusive zone and a southern metasedimentary zone. This is similar to the division of the gneisses of the Southern Indian domain to the west in the Brochet map area (NTS 64F, Manitoba Energy and Mines, 1989). The northern zone contains variably magnetic gneissic granodiorite to tonalite with abundant inclusions of quartzofeldspathic gneiss (**Gj**). This is a hybrid of granodiorite–tonalite orthogneiss (**Gn**) and inclusion layers of hornblende-bearing metagreywacke derived gneiss (**Nh**). Garnet-bearing and variably cordierite-bearing greywacke metatexite (**W**g, **W**d) are interleaved with these rocks. The gneissic granodiorite (**Gn**)(1878 ± 14 Ma, Van Schmus and Schledewitz, 1986) is coeval with rhyolite in the Ruttan Group (1878 ± 3 Ma, Baldwin *et al.*, 1987) in the Leaf Rapids domain to the south in the Uhlman Lake area (NTS 64B, Manitoba Energy and Mines, 1986a) and the Pool Lake tonalite (PT) (1876+8/-7 Ma, Baldwin *et al.*, 1987) in the Lynn Lake domain of the Granville Lake map area (NTS 64C, Manitoba Energy and Mines, 1986b). The Pool Lake tonalite intruded the Wasekwan Group following a major phase of deformation.

The southern zone is dominated by compositionally uniform graphitic garnet–biotite metatexite (**W**g) similar to the migmatite interleaved with the granodioritic orthogneisses (**Gn**) and hybrid gneiss (**Gj**) in the northern zone. Metatexite (**W**g) grades into areas of stromatic migmatite and variably garnetiferous tonalite to granodiorite (**Tj**) with inclusions of metatexite (**W**g).

The gneisses of the western segment are also intruded by pyroxene- and hornblende-bearing granodiorite (**Gp**x, **Gp**h), tonalite (**T**, **Tp**) and diorite (**D**). The diorite is most abundant in the James Lake area. These intrusive rocks are foliated and contain white granitic *lits*. The MacBen Lake hornblende gabbro outcrops in the southwest corner of the map area. It contains layers of pyroxene gabbro and olivine pyroxenite (Hinds, 1972). The pyroxenite layers contain up to two percent combined pyrrhotite and chalcopyrite. The age of the MacBen Lake gabbro is uncertain, but is considered to predate the deposition of the Sickle Group (Hinds, 1972), which unconformably overlies Wasekwan metavolcanic rocks in the Lynn Lake domain to the southwest in the Granville Lake map area (NTS 64C, Manitoba Energy and Mines, 1986b).

The *eastern segment* of the Southern Indian domain, between the west shore of Southern Indian Lake and the east boundary of the map area, is a zone with a more highly varied lithostratigraphy and a large volume of Chipewyan type granitic rocks. This segment also includes the region on the west shore of Southern Indian Lake around Pukatawakan Bay near the southeast boundary of the map area. This varied lithostratigraphy comprises tonalitic gneiss (**Tn**), quartzofeldspathic gneiss (**N**h), metagreywacke derived paragneiss to migmatite (P**Wv**, **W**g), metavolcanic derived amphibolite (**Ao**, P**V**), polymictic metaconglomerate (A**C**), meta-arkose (A**S**) and gneissic to migmatitic interlayered meta-arkose and metagreywacke (**Sn**). This suite of rocks extends to the east into the Southern Indian domain of the Northern Indian Lake region (NTS 64H, Manitoba Energy and Mines, 1987; Corkery and Lenton, 1979) where it is part of the Partridge Breast Lake - Gauer Lake block. Corkery and Lenton (Manitoba Energy and Mines, 1987) have interpreted the Partridge Breast Lake - Gauer Lake block as a down-dropped fault block containing well preserved metavolcanic and metasedimentary rocks. The eastern segment of the Southern Indian domain of the Big Sand Lake map area is interpreted to be the more highly intruded western margin of the Partridge Breast Lake - Gauer Lake block.

The youngest units in the metasedimentary gneiss section in the eastern segment are polymictic metaconglomerate (A**C**), meta-arkose (A**S**) and gneissic to migmatitic, variably interlayered, meta-arkose and metagreywacke (**Sn**), which overlie the metavolcanic and metasedimentary rocks of the Partridge Breast Lake suite (P**V**, P**Wv**). The age relationship of the other members of the supracrustal derived gneisses (**N**h, **W**g, **Ao**) relative to the Partridge Breast Lake suite (P**V**, P**Wv**) is less certain. The graphitic garnet–biotite gneiss (**W**g) appears to underlie rocks of the Partridge Breast Lake suite and also metavolcanic derived amphibolite (**Ao**); lack of reliable facing criteria and poorly exposed unit contacts makes this age relationship speculative. Two separate phases of volcanism have been proposed for metavolcanic derived amphibolite (**Ao**) with the older phase occurring at Pukatawakan Bay and a younger phase in the Whyme Bay area of Southern Indian Lake (Frohlinger, 1972).

The age relationship of the gneissic tonalite (**Tn**) at the north end of Southern Indian Lake is uncertain. It may be equivalent in age to the older gneissic tonalite (**Tn**) that outcrops along the west side of Big Sand Lake and extends westward into the Brochet map area (NTS 64F, Manitoba Energy and Mines, 1989). This older gneissic tonalite at the west edge of the map area (NTS 64G) predates the gneissic granodiorite (**Gn**) dated at 1878 ± 14 Ma.

In the Big Sand Lake map area, the eastern segment of the Southern Indian domain lies along the northerly-trending western edge of a broader exposure width of a batholithic terrane (ca. 210 km) that includes the Chipewyan batholith and the Baldock batholith. Intrusive rocks characteristic of the Chipewyan batholithic complex occur extensively along Southern Indian Lake and appear to merge with the Baldock batholith (BL**Gp**) south of Long Point. The Baldock batholith is the main rock type to the immediate south in the northeast corner of the Uhlman Lake map area (NTS 64B, Manitoba Energy and Mines, 1986a) and is similar in whole rock chemistry and mineralogy to the main granitic phase of the Chipewyan batholith (C**Gp**). A hornblende- and variably pyroxene-bearing monzonite to quartz monzonite (**Zh**), that is very similar to the Katimiwi megacrystic hornblende monzogranite (K**Zp**) of the Chipewyan batholith, occurs on the northwest flank of the Baldock batholith in the Whyme Bay and Pukatawakan Bay areas on Southern Indian Lake. These Chipewyan type granitic rocks postdate a magnetiferous tonalite (**Tm**), and a suite of variably magnetic diorite (**D**, **Dm**). A megacrystic granite (**Gp**), which outcrops on Strawberry Island and also at Pukatawakan Bay, may postdate the Chipewyan type granites.

Throughout the Southern Indian domain, various phases of deformation can be documented. In the southeast quarter of the map area the earliest phase identified produced large scale easterly-trending upright folds with shallow to intermediate easterly-plunging fold axes (Cranstone, 1972; Frohlinger, 1972). These structures were subjected to either coplanar folding or folding about northeasterly-trending axial planes. At Strawberry Island and Pukatawakan Bay axial traces of the early folds wrap around granite intrusions (**Gp**). In the remainder of the map area the rare preservation of early folds, such as at Mulcahy Lake, also indicate refolding (Frohlinger, 1972), but the orientation and configuration of the early structures is less certain. The later folding phase was accompanied by the development of broad shear zones and synkinematic intrusions. In some areas, large scale folds wrap discontinuously around elongate domal to sheath-like plutons. Zones of shearing and faulting trend east-southeast, and from east-southeast to northeast (arcuate) on the south margin of the orthogneisses (**Gn**, **Gj**) in the area of Hurst Lake. On the northern edge of the orthogneisses at the south end of Big Sand Lake trends are to the northeast. The foliations in these zones of high strain have intermediate to steep northerly dips. A major northeast-trending ductile shear zone (ca. 10 km wide) is interpreted to extend from Dickinson Lake, on the southwest edge of the map area, through Mulcahy Lake to the Nutter Lake area. The most consistent dip direction is to the NW at intermediate to steep values. Regardless of orientation, these shear zones contain mineral assemblages and metamorphic fabrics consistent with conditions of the upper amphibolite facies of metamorphism. These ductile shear zones were also the loci of younger, brittle faults indicated by narrow zones of retrograde metamorphism and rare zones of pseudotachylyte or fault gouge.
An *en echelon,* north- to northeasterly-trending, system of syn- or post-Chipewyan batholith shear zones and faults extends for ca. 100 km along the length of Southern Indian Lake south to the Leaf Rapids domain (NTS 64B). The interpretation of this system is based on observed faults, truncation of lithologic trends, variations in foliation trends, topographic lineaments and discontinuities in magnetic trends (Geological Survey of Canada, 1962). The system coincides with the western edge of the greater exposure width of a batholithic terrane (Chipewyan and Baldock batholiths) and the proposed western edge of the Partridge Breast Lake - Gauer Lake fault block. Localized northwest-trending faults occur near the north termination of this system in the Missi Falls area (control structure) on Southern Indian Lake.

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). The Chipewyan batholithic complex also extends eastward into the Northern Indian Lake map area (NTS 64H, Manitoba Energy and Mines, 1987). In the Big Sand Lake map area the domain comprises two major components with several phases in each component:

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

(1a) leucocratic granite with rapakivi texture (C**Gd**),

(1b) leucocratic seriate granite (C**G**),

(1c) hornblende ± biotite megacrystic syenogranite to quartz monzonite (C**Zp**), similar to the monzogranite (C**Gp**) but with less quartz and more hornblende, magnetite, sphene and fluorite,

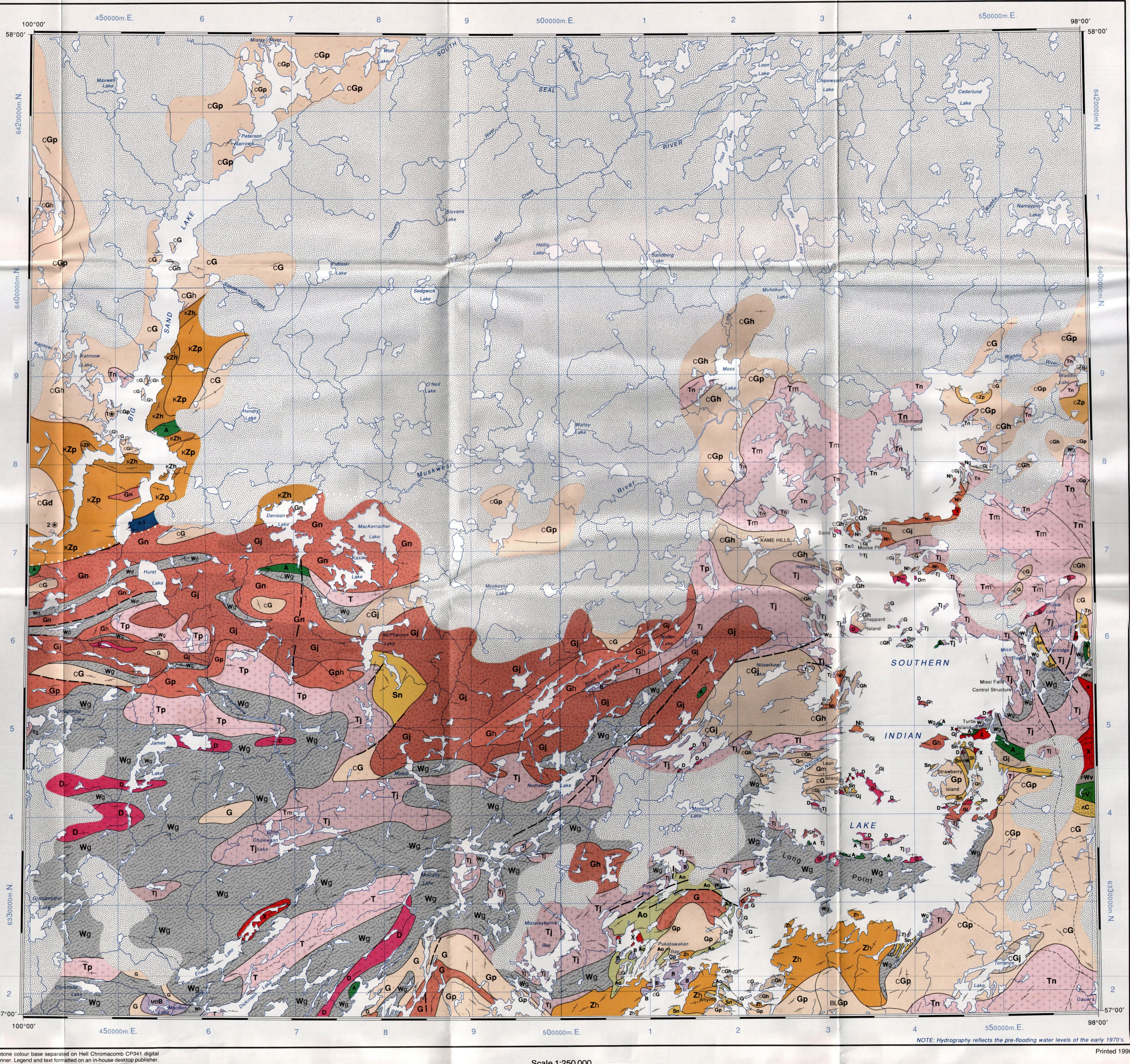
(2) Katimiwi hornblende monzogranite (K**Zp**) characteristically honey-brown with megacrysts of microcline,

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

U-Pb zircon ages from igneous rocks of the Chipewyan batholith along the central west shore of Big Sand 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 (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 quartz diorite in the porphyritic monzogranite (C**Gp**) from the same area. The mean age in combination with the U-Pb age of 1878 ± 14 Ma (Van Schmus and Schledewitz, 1986) for a gneissic granodiorite to tonalite (**Gn**), from Big Sand Lake in the Brochet map area (NTS 64F), suggests that much, if not all, of the crust that composes the southern flank of the Chipewyan batholith is only slightly older then the batholith. This is in contrast to the radioisotope ages on the northern flank of the batholith that range from Archean to Proterozoic (Weber *et al., 1975*; Clark and Schledewitz, 1988).

A Rb-Sr whole rock "age" of 1800 ± 32 Ma and an initial ratio of 0.7028 ± 0.0006 (Halden *et al.*, in press) 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 87Sr/86Sr 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 press).

The **Big Sand Lake map region** is interpreted to represent part of an Early Proterozoic arc terrane of the Trans-Hudson orogen (Hoffman, 1981; Lewry *et al.*, 1985), that collided with an Archean craton, the Rae-Hearne provinces (Hoffman, 1988; Lewry and Collerson, in press), to the north and northwest. The continent-continent collision of the Archean Rae-Hearn continental plate and the Superior craton resulted in intense reworking of "The arcs, associated interarc sedimentary basins, and older crustal elements in the Trans-Hudson orogen" (Bickford *et al.*, 1990). The results of the continental collision have shaped the disposition of rock types as exposed at the present day erosion surface. A regional thermotectonic event between 1830 and 1805 Ma, with the peak of metamorphism at 1815 Ma (Gordon *et al.*, in press) in the Kisseynew and Flin Flon domains to the south, postdates the 1855 ± 10 Ma mean age of the Chipewyan batholith. This thermotectonism has been interpreted as reflecting a terminal continental collision involving major nappe formation (Bickford *et al.*, 1990; Green *et al.*, 1985; Lewry *et al.*, 1985). Refolding and associated shear zone development and subsequent faulting can be related to the later stages of the terminal collision that postdate the peak of metamorphism (Gibb, 1983). The pattern of shear zones, folds and faults is consistent with a zone of transpression and the related development of rhomb-shaped horsts and uplift terrains on a regional scale. Shear zones and subsequent reverse faults, which have a south of east orientation, would also have a strike slip component of movement as predicted by this model.



NOTE: *Hydrography reflects the pre-flooding water levels of the early 1970's.*

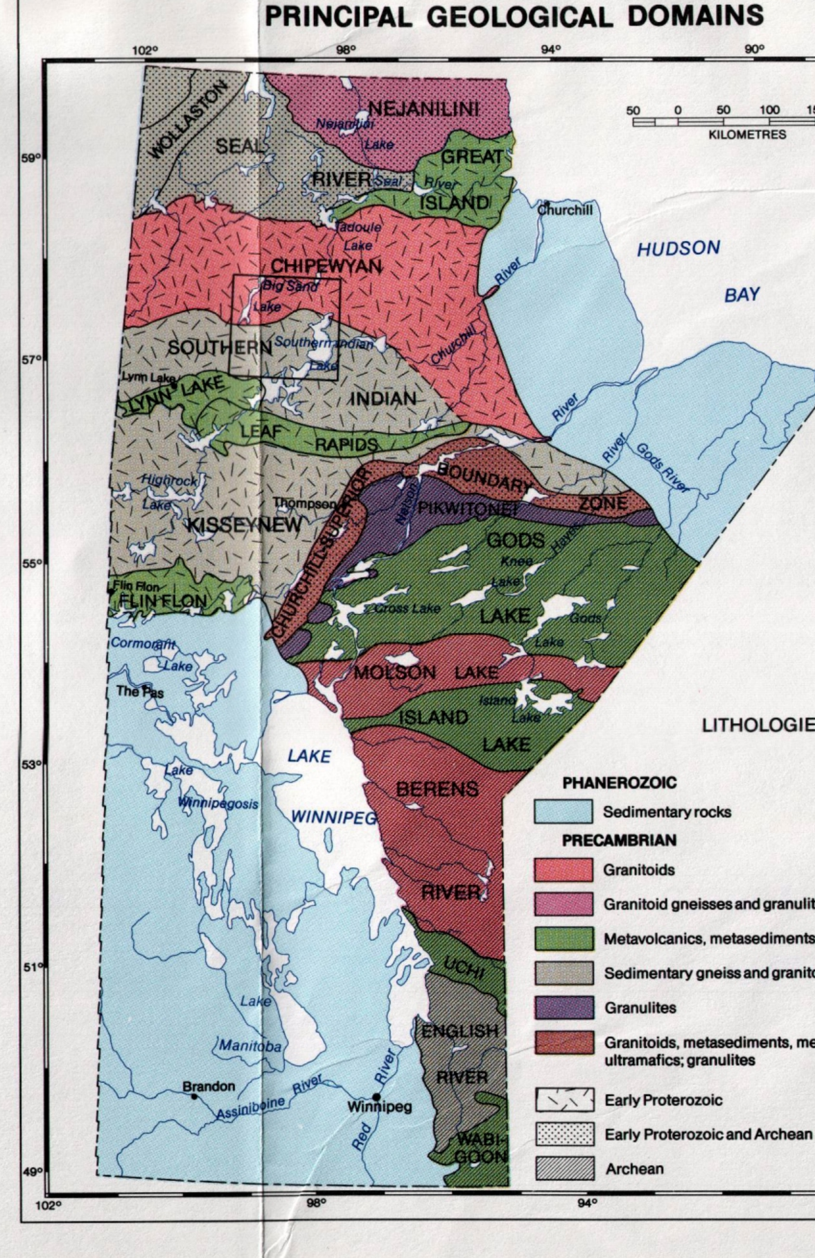
Pantone colour base separated on Hell Chromacomb CP341 digital scanner. Legend and text formatted on an in-house desktop publisher.

Printed 1990

Scale 1:250 000

KILOMETRES 5 0 5 10 15 20 25 KILOMETRES

PRINCIPAL GEOLOGICAL DOMAINS



Every possible effort has been made to ensure that the information presented on this map is accurate. However, the Province of Manitoba and Manitoba Energy and Mines do not assume liability for any errors that may occur. References are included for users wishing to verify critical information.

LEGEND

Manitoba Energy and Mines
Geological Services
Geological Compilation Map Series
Big Sand Lake, NTS 64G
1:250 000

PRECAMBRIAN

Early Proterozoic

Younger Plutonic Rocks

X – Pegmatite

CHIPEWYAN DOMAIN

Chipewyan Batholithic Complex

1,2 ⊛ C**G** / C**Gh** – C**G** - granite ± hornblende; C**Gh** - hornblende granite; C**Gp** - megacrystic biotite ± hornblende–magnetite granite; 1: *1857 ± 9 Ma*; C**Gd** - leucocratic granite with rapakivi texture; 2: *1854 ± 12 Ma*; C**Gh** - megacrystic granite with variably gneissic tonalite to granodiorite inclusions; C**Gj** - megacrystic granite with inclusions of variably gneissic to migmatitic supracrustal rocks

C**Zp** – Megacrystic syenogranite to quartz monzonite

Katimiwi Plutonic Rocks

K**Zp** / K**Zh** – K**Zp** - megacrystic hornblende monzogranite; K**Zh** - megacrystic hornblende monzogranite with inclusions of variably gneissic gabbro, diorite and tonalite

K**I** – Anorthositic gabbro

SOUTHERN INDIAN DOMAIN

Arkosic Suite

A**S** – Quartzose meta-arenite, quartzite

A**C** – Polymictic conglomerate

Sn – Fine grained arkosic gneiss to migmatite; **Sl** - **Sn** with areas of A**C**

Partridge Breast Lake Suite

P**V** – Metabasalt

P**W** – Pelitic to psammitic metagreywacke, magnetite–muscovite–sillimanite–bearing; P**Wv** - pelitic to psammitic metagreywacke with minor felsic to mafic metavolcanic interlayers

Older Plutonic Rocks

Gn / **Gj** – **Gn** - gneissic magnetite granodiorite to tonalite with quartzofeldspathic layers ± hornblende; **Gj** - magnetite granodiorite with inclusions of quartzofeldspathic gneiss (**N**h)

Tn – Gneissic tonalite to granodiorite ± hornblende, with white granitic *lits*

Metamorphic Rocks of Uncertain Affinity

A – Amphibolite, locally metagabbro, locally agmatitic

Nh – Quartzofeldspathic gneiss ± magnetite with amphibolite and/or hornblende–biotite–bearing interlayers

Wh / **W**g – **W**h - hornblende metagreywacke gneiss; **W**g - biotite metatexite ± garnet ± graphite; **W**d - biotite metatexite ± cordierite

Ao – Amphibolite with locally preserved pillow structures (metabasalt)

Plutonic Rocks of Uncertain Age

G / **G**m / **Gj** – Granite; **Gp** - megacrystic granite; BL**Gp** - Baldock granite, megacrystic
Gm - magnetiferous granite; **G**h - hornblende granite; **Gj** - granite with inclusions of supracrustal rocks

Zh – Monzonite to quartz monzonite, ± hornblende, ± clinopyroxene

B – Metagabbro; MB**B** - MacBen Lake gabbro

D – Metadiorite to leucodiorite; **Dm** - magnetite quartz diorite; **Dl** - agmatitic diorite with abundant pegmatite

G / **Gh** – **G** - granodiorite; **Gp** - megacrystic biotite granodiorite to tonalite; **Gp**h - megacrystic hornblende granodiorite to tonalite; **Gp**x - megacrystic pyroxene granodiorite to tonalite; **G**h - hornblende granodiorite; **Gl** - hornblende granodiorite with areas of **Sn** or **W**g; **Gh** - granodiorite with inclusions of **Tj**

T / **Tj** – **T** - tonalite to granodiorite; **T**g - biotite tonalite to granodiorite ± garnet; **Tp** - megacrystic biotite tonalite to granodiorite ± garnet; **T**m - magnetite tonalite to granodiorite; **Tn** - gneissic to foliated tonalite and granodiorite; **Tl** - gneissic tonalite (**Tn**) with abundant inclusions of quartzofeldspathic gneiss (**N**h); **Tj** - biotite tonalite to granodiorite ± garnet, with inclusions of greywacke metatexite (**W**g)

Reference for U-Pb zircon ages:
1, 2 ⊛ *Van Schmus and Schledewitz, 1986.*

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°)

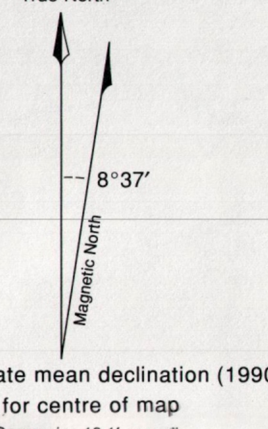
Foliation (dip unknown, 0°-29°, 30°-59°, 60°-79°, 80°-90°)

Fault (inferred)

Domain boundary

Area of little or no outcrop

2 ⊛ Sample locality for U-Pb zircon age determination



Approximate mean declination (1990) for centre of map
Decreasing 12.1′ annually

SELECTED BIBLIOGRAPHY

Baldwin, D.A., Syme, E.C., Zwanzig, H.V., Gordon, T.M., Hunt, P.A. and Stevens, R.D.
1987: U-Pb zircon ages from the Lynn Lake and Rusty Lake metavolcanic belts, Manitoba: two ages of Proterozoic magmatism; Canadian Journal of Earth Sciences, v. 24, p. 1053-1063.

Bickford, M.E., Collerson, K.D., Lewry, J.F., Van Schmus, W.R. and Chiarenzelli, J.R.
1990: Proterozoic collisional tectonism in the Trans-Hudson orogen, Saskatchewan; Geology, v. 18, p. 14-18.

Clark, G.S. and Schledewitz, D.C.P.
1988: Rubidium-strontium ages of Archean and Proterozoic rocks in the Nejanilini and Great Island domains, Churchill Province, northern Manitoba, Canada; Canadian Journal of Earth Sciences, v. 25, p. 246-254.

Corkery, M.T. and Lenton, P.G.
1979: Lower Churchill River project: regional mapping; **in** Manitoba Mines Natural Resources and Environment, Mineral Resources Division, Report of Field Activities, 1979, p. 4-7.

Cranstone, J.R.
1972: Geology of the Southern Indian Lake area, northeast portion; Manitoba Mines, Resources and Environmental Management, Mines Branch, Publication 71-2J, 82 p.

Frohlinger, T.G.
1972: Geology of the Southern Indian Lake area, central portion; Manitoba Mines, Resources and Environmental Management, Mines Branch, Publication 71-2I, 91 p.

Fumerton, S.L., Stauffer, M.R. and Lewry, J.F.
1984: The Wathaman batholith: largest known Precambrian pluton; Canadian Journal of Earth Sciences, v. 21, p. 1082-1097.

Gibb, R.A.
1983: Model for suturing of Superior and Churchill plates: an example of double indentation tectonics; Geology, v. 11, no.7, p. 413-417.

Geological Survey of Canada
1962: Aeromagnetic series, 64G; Map 7028G; 1:253 440.

Gordon, T.M., Hunt, P.A., Bailles, A.H. and Syme, E.C.
in press: U-Pb zircon ages from the Flin Flon and Kisseynew belts, Manitoba: chronology of Early Proterozoic crust formation at an Early Proterozoic accretionary margin; **in** The Early Proterozoic Trans-Hudson orogen of North America (Lewry, J.F.,and Stauffer, M.R., ed.); Geological Association of Canada Special Paper.

Green, A.G., Hajnal, Z. and Weber, W.
1985: An evolutionary model of the western Churchill Province and western margin of the Superior Province in Canada and the north-central United States; Tectonophysics, v.116, p. 281-322.

Halden, N.M., Clark, G.S., Corkery, M.T., Lenton, P.G. and Schledewitz, D.C.P.
in press: Geochemical and Rb-Sr whole rock systematics of granite magmatism related to the origin of the Wathaman batholith; **in** The Early Proterozoic Trans-Hudson orogen of North America (Lewry, J.F., and Stauffer, M.R., ed.); Geological Association of Canada Special Paper.

Hinds, R.W.
1972: Geology of the Opachuanau Lake-Fraser Lake-Lemay Island area; Manitoba Mines, Resources and Environmental Management, Mines Branch, Publication 71-2G, 54 p.

Hoffman, P.F.
1981: Autopsy of Athapuscow aulacogen; a failed arm affected by three collisions, **in** Proterozoic basins of Canada (Campbell, F.H.A., ed.); Geological Survey of Canada, Paper 81-10, p.97-102.
1988: United plates of America, the birth of a craton: Early Proterozoic assembly and growth of Laurentia; Annual Review of Earth and Planetary Science, v. 16, p. 543-603.

Lewry, J.F. and Collerson, K.D.
in press: The Trans-Hudson orogen: extent, subdivision, and problems; **in** The Early Proterozoic Trans-Hudson orogen of North America (Lewry, J.F.,and Stauffer, M.R., ed.); Geological Association of Canada Special Paper.

Lewry, J.F., Sibbald, T.I.I. and Schledewitz, D.C.P.
1985: Variation in character of Archean rocks in the western Churchill province and its significance; **in** Evolution of Archean supracrustal sequences (Ayres, L.D., Thurston, P.C., Card, K.D. and Weber, W., ed.); Geological Association of Canada, Special Paper 28, p. 231-261.

Lewry, J.F., Stauffer, M.R. and Fumerton, S.
1981: A Cordilleran-type batholithic belt in the Churchill province in northern Saskatchewan; Precambrian Research, v. 14, p. 277-313.

Manitoba Energy and Mines
1986a: Bedrock Geology Compilation Map Series, Uhlman Lake, NTS 64B, 1:250 000.
1986b: Bedrock Geology Compilation Map Series, Granville Lake, NTS 64C, 1:250 000.
1987: Bedrock Geology Compilation Map Series, Northern Indian Lake, NTS 64H, 1:250 000.
1989: Bedrock Geology Compilation Map Series, Brochet, NTS 64F, 1:250 000.

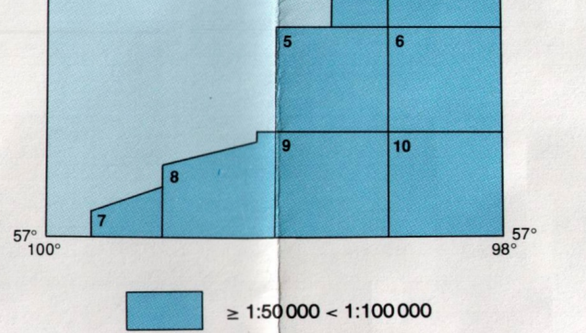
Schledewitz, D.C.P.
1983: Brochet-Big Sand project (NTS 64F, 64G west half); **in** Manitoba Energy and Mines, Mineral Resources Division, Report of Field Activities, 1983, p. 5-10.

Weber, W., Schledewitz, D.C.P., Lamb, C.F. and Thomas, K.A.
1975: Geology of the Kasmere Lake-Whiskey Jack Lake (north half) area (Kasmere Project); Manitoba Mines, Resources and Environmental Management, Mineral Resources Division, Publication 74-2, 163 p.

Van Schmus, W.R. and Schledewitz, D.C.P.
1986: U-Pb zircon geochronology of the Big Sand Lake area, northern Manitoba; **in** Manitoba Energy and Mines, Minerals Division, Report of Field Activities, 1986, p. 207-210.

Additional references for Big Sand Lake, NTS 64G, are available in Manitoba Energy and Mines, Bibliography Series BMG-1, 1989.

SOURCES OF INFORMATION



1 McRitchie, W.D., 1977: Big Sand Lake; Manitoba Mines, Resources and Environmental Management, Mineral Resources Division, Preliminary Map 1977M-2; 1: 250 000.

2 Schledewitz, D.C.P., 1983: Brochet - Big Sand Lake (West half), Manitoba Energy and Mines, Preliminary Map 1983M-1; 1: 250 000.

3 Cranstone, J.R., 1972: Moss Lake (East half); Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-20; 1: 50 000 (accompanies Publication 71- 2J).

4 Cranstone, J.R., 1972: Hammond Point; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-21; 1: 50 000 (accompanies Publication 71-2J).

5 Frohlinger, T.G. and Cranstone, J.R., 1972: Nutter Lake; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-18; 1: 50 000 (acompanies Publications 71-2I and 71-2J).

6 Cranstone, J.R., 1972: Missi Rapid; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-19; 1: 50 000 (accompanies Publication 71-2J).

7 Thomas, K.A. and Hinds, R.W., 1972: MacBen Lake; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-14; 1: 50 000 (accompanies Publications 71-2G and 71-2H).

8 Thomas, K.A. and Frohlinger, T.G., 1972: Mulcahy Lake; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-15; 1:50 000 (accompanies Publications 71-2H and 71-2I).

9 Frohlinger, T.G. and Cranstone, J.R., 1972: Pine Lake; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-16; 1: 50 000 (accompanies Publications 71-2I and 71-2J).

10 Cranstone, J.R., 1972: Torrance Lake; Manitoba Mines, Resources and Environmental Management, Mines Branch, Map 71-2-17; 1: 50 000 (accompanies Publication 71-2J).

In addition, recent unpublished data have been incorporated.

MAJOR DOMAINS

Synoptic geology by D.C.P. Schledewitz
Compilation by D. Lindal
Cartography by T. Franceschet

Suggested reference to this publication:
Manitoba Energy and Mines, 1990; Bedrock Geology Compilation Map Series, Big Sand Lake, NTS 64G, 1: 250 000.

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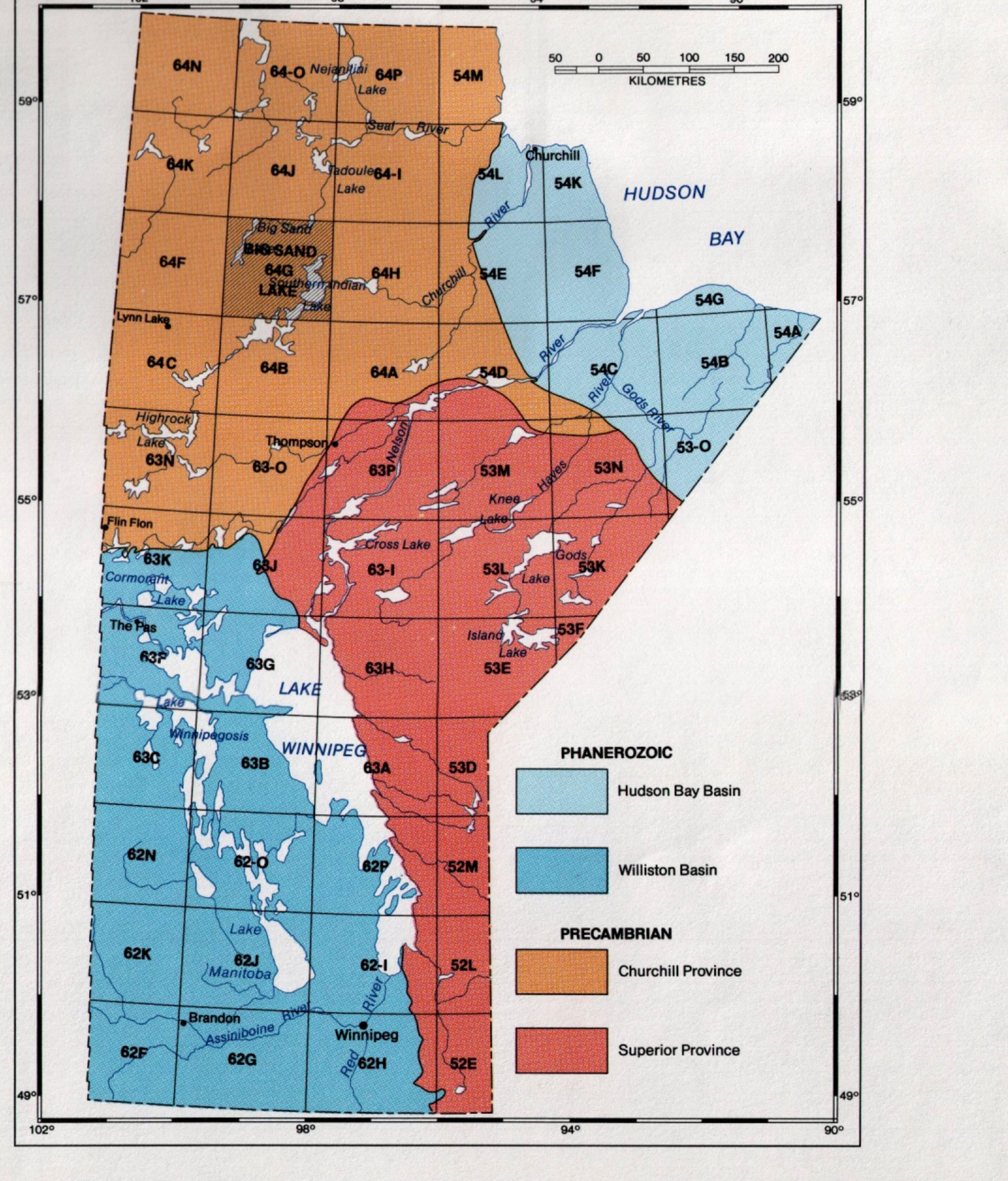

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