GEOLOGY OF MANITOBA

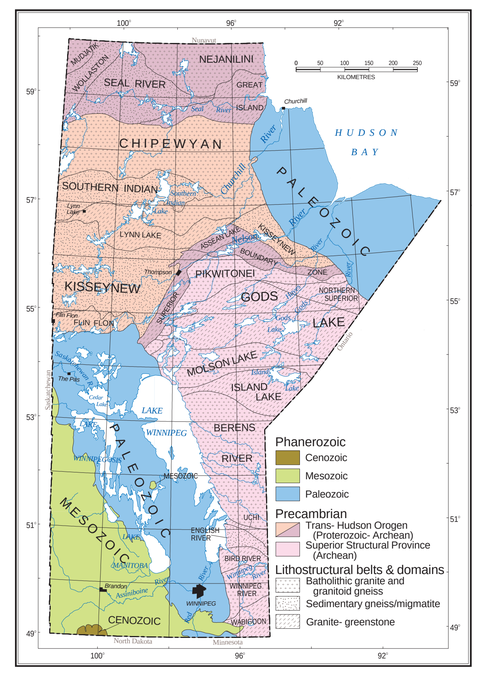
Scale 1:1 000 000

Kilometres 20 0 20 40 60 80 100 Kilometres

Miles 10 0 10 20 30 40 50 60 Miles

June 03, 2004

MAJOR GEOLOGICAL SUBDIVISIONS



LEGEND

PHANEROZOIC

Cenozoic

Tertiary

Paleocene

TTM — Turtle Mountain Formation (~158m): Goodlands Member: bentonitic carbonaceous sand, silt and clay; thin lignite beds. Peace Garden Member: grey silty shale and minor sand.

Mesozoic

Cretaceous

Upper Cretaceous

KB — Boissevain Formation (30-42m): greenish-grey sandstone; minor shale, in part kaolinitic.

KRM (c, o, m) — Riding Mountain Formation (285-340m): Coulter Member (c): soft grey bentonitic clayey siltstone and shale. Odanah Member (o): hard grey siliceous shale. Millwood Member (m): soft greenish bentonitic shale.

KVR — Vermilion River Formation (50-190m): Morden Member: black carbonaceous shale. Boyne Member: grey calcareous speckled shale and carbonaceous shale. Pembina Member: thinly interbedded carbonaceous shale, bentonite, and bentonitic shale.

KF — Favel Formation (15-45m): calcareous speckled shale (Second Specks); minor limestone, bentonite and oil shale.

Upper and Lower Cretaceous

KA — Ashville Formation (55-115m): dark grey carbonaceous shale, in part bituminous; minor sand, silt and bentonite. (Local occurrence of thick bar-type sandstone in subsurface: Ashville or Viking Sand).

Lower Cretaceous

KSR — Swan River Formation (0-105m): sandstone, in places glauconitic; kaolinitic shale, minor lignite. May include some non-marine Jurassic beds in the north. Also includes channel &/or karst fill within Palaeozoic outcrop belt. Locally missing from outcrop sequence due to non-deposition.

Jurassic

J — Amaranth Formation: red argillaceous dolomitic siltstone and sandstone overlain by gypsum or anhydrite. Reston Formation: limestone and dolomite, shale interbeds. Melita Formation: fine-grained sandstone, variegated shale, minor limestone. Total Jurassic thickness 0-280m.

Paleozoic

Permian (?)

P — St. Martin Complex (0-300m): carbonate breccia (fragments Ordovician to Devonian), polymictic breccia, granitic microbreccia, trachyandesite. Comprises crater fill in crypto-explosion (meteorite impact?) structure.

Devonian

Upper and Middle Devonian

DSR — Souris River Formation (65-95m): sequence of basal red shale (First Red Beds), argillaceous micrite, high-Ca micritic limestone, and upper dolomite in northern area; complex facies of limestone and dolomite to the south.

Middle Devonian

DDB — Dawson Bay Formation (45-60m): sequence of basal red shale (Second Red Beds); bituminous dolomite grading upward to micritic limestone to brachiopod biomicrite (high-Ca); red to grey fossiliferous calcareous shale; highly fossiliferous coral stromatoporoid limestone (high-Ca), locally dolomitized.

DW / DEP — Elm Point Formation: high-Ca limestone biomicrite (platform facies). Winnipegosis Formation: Lower Member: dolomitized platform facies (grades laterally to D ep). Upper Member: thin inter-reef bituminous laminates or thick reefal carbonates (Dwu). Total thickness 12-105m.

DA — Ashern Formation (5-12m): dolomitic shale and argillaceous dolomite, red to greenish grey; local basal breccia.

HUDSON BAY BASIN AREA

DMR — Moose River Formation (~50m): fine-to-med-grained dolomite limestone, argillite limestone and argillite dolomite; minor anhydrite, chert, red shale.

DK — Kwataboahegan Formation (~45m): limestone, med-to dark-brown, fossiliferous, bituminous, partly reefal; minor dolomite.

Lower Devonian

DSTR — Stooping River Formation (~80m): aphanitic to finely crystalline limestone, sparsely fossiliferous; minor argillite limestone and dolomite.

DKR — Kenogami River Formation (~10m): Upper Member (u): finely crystalline to aphanitic limestone; thin interbeds argillite silty sandy dolomite.

Silurian

SKR — Kenogami River Formation (~200m): Lower Member (l): dolomite, slightly calcareous and argillite; some limestone and dolomite limestone; minor anhydrite Middle Member (m): red-brown to green-grey calcareous argillite sandy siltstone and silty shale; minor sandstone; some gypsum.

SAT — Attawapiskat Formation (30-60m): limestone, crypto-crystalline to calcarenitic and oolitic, in part reefal, vuggy. Interfingers laterally with SKR.

SER — Ekwan River Formation (~45m): limestone, skeletal calcarenites; in part argillaceous and dolomitic.

SSR — Severn River Formation (~235m): limestone, dolomitic limestone and dolomite, very fine-grained, fucoidal, in part algal bioclastic and pelletal; minor anhydrite and shale.

Ordovician (and Lower Silurian)

ORHR — Red Head Rapids Formation (~25m): dolomite, thin-bedded microcrystalline; in part silty and argillaceous.

Upper Ordovician

OCR — Churchill River Group (~145m): Caution Creek and Chasm Creek formations: limestone, slightly to moderately dolomitic and argillaceous, microcrystalline, variably bioclastic; minor shale, dolomite, chert and anhydrite.

OBCR — Bad Cache Rapids Group (~70m): Portage Chute Formation: thin basal sandstone-shale member; limestone, mottled, slightly dolomitic and argillaceous, variably fossiliferous; considerable nodular chert and siliceous limestone. Surprise Creek Formation: microcrystalline dolomite, slightly bioclastic, prominent bituminous lamination; some anhydrite and salt casts.

Silurian

S (A) — Interlake Group (50-105m): Fisher Branch (FB), Inwood (I), Moose Lk (ML), Allkamegi (A), East Arm (EA) and Cedar Lake (CL) formations: micritic, fossiliferous, stromatolitic and biostromal dolomites with several sandy/argillaceous marker beds.

Ordovician (and Lower Silurian)

OS — Stonewall Formation (10-20m): dolomite, fine grained, sparsely fossiliferous, in part conglomeratic. Medial sandy argillaceous marker may define Ordovician-Silurian boundary.

Upper Ordovician

OSM (sw, gp) — Stony Mountain Formation (35-45m): Gunn and Penitentiary members (gp): calcareous shale, fossiliferous limestone and argillaceous dolomite. Gunton and William members (gw): nodular dolomite and sandy argillaceous dolomite.

ORR (fg, ch, dh) — Red River Formation (45-150m): Dog Head Member (dh): mottled dolomitic limestone; passes northward to dolomite. Cat Head Member (ch): cherty dolomite; passes southward to mottled limestone. Selkirk Member (s): mottled dolomitic limestone and limestone; passes northward to dolomite Fort Garry Member (fg): massive to laminated dolomite; minor argillaceous dolomite and high-Ca limestone; in part cherty.

OW — Winnipeg Formation (0-60m): basal sandstone overlain by complex sequence of quartzose sandstone and shale.

PRECAMBRIAN

Proterozoic

32 — Diabase dykes (Mackenzie swarm), known, and interpreted from aeromagnetic anomalies.

CHURCHILL PROVINCE

Intrusive Rocks

31 — Granite, granodiorite and tonalite: (31a) fluorite granite; (31b) porphyritic granite and pegmatite; (31c) hypersthene-bearing porphyritic granite-monzonite; (31d) leucogranite-leucotonalite; (31e) hornblende granite-syenite.

30 — Tonalite-granodiorite: (30a) tonalite-granodiorite gneiss; (30b) quartz-eye tonalite.

29 — Mafic to intermediate rocks: (29a) gabbro; (29b) anorthositic gabbro; (29c) diorite; (29d) tonalite-diorite; (29e) hypersthene-bearing tonalite-diorite, enderbite.

28 — Ultramafic rocks (28a) peridotite-pyroxenite; (28b) serpentinite; (28c) hornblendite-hornblende peridotite and pyroxenite.

Metamorphic and Metasedimentary Rocks

27 — Migmatite, agmatite and gneiss complex.

26 — Arkose-, arenite-, and quartzite-derived gneiss and migmatite (Sickle Group, Missi Group and Sickle Metamorphic Suite): (26a) orthoquartzite and minor conglomerate (includes Churchill quartzite and Great Island quartzite of possibly younger age); (26b) arkose, feldspathic wacke, conglomerate and quartzite; (26c) arkosic gneiss and migmatite, local arkosic wacke; (26d) felsic gneiss of unknown derivation.

25 — Metaconglomerate with minor arkosic gneiss.

24 — Amphibolite and mafic gneiss: (24a) calc-silicate gneiss and interlayered amphibolite; (24b) calc-silicate rocks, local quartzite and/or marble; (24c) iron formation.

23 — Greywacke- and mudstone-derived gneiss and migmatite (Amisk Group and Wasekwan Group in part; Nokomis Group and Burntwood River Metamorphic Suite: (23a) greywacke, argillite, slate and metagreywacke, local minor grit and conglomerate; (23b) psammitic and semi-pelitic gneiss, pelitic schist and migmatite.

Metavolcanic Rocks (includes Amisk and Wasekwan Groups and Great Island volcanic rocks)

22 — Felsic metavolcanic rocks, flows and pyroclastic deposits: (22a) rhyolite; (22b) dacite.

21 — Mafic and intermediate metavolcanic flows, pyroclastic deposits and associated metasediments; local ultramafic flows: (21a) andesite; (21b) basalt; (21c) ultramafic flows.

Archean and Inferred Archean

20 — Charnockite-mangerite and derived granitoid gneiss: (20a) remobilized granite and granitoid orthogneiss.

19 — Granitoid complexes: (19a) grey, foliated granodiorite and granodioritic gneiss; (19b) enderbite and pyroxene-granulites and abundant local supracrustal rafts.

SUPERIOR PROVINCE AND SUPERIOR BOUNDARY ZONE

Proterozoic

18 — Granite, granodiorite: (18a) granodiorite with inclusions of unit (15).

17 — Metasedimentary and mafic/ultramafic metavolcanic rocks, serpentinized peridotite, serpentinite, pyroxenite and mafic/ultramafic differentiated intrusions of the Fox River belt and Ospwagan Group (17a) shale, dolomitic limestone, siltstone, sandstone, iron formation; (17b) basalt and komatiite; (17c) iron formation.

16 — Amphibolite.

15 — Layered migmatitic gneiss derived from units (4) to (9), aplite and pegmatite: (15a) transitional zone containing migmatitic gneiss and rocks of units (4) to (9).

14 — Mafic/ultramafic and diabase dykes (Molson swarm), known, and interpreted from aeromagnetic anomalies.

Archean

Late Intrusive Rocks

13 — Granite, minor granodiorite.

12 — Granodiorite, minor tonalite and migmatite.

Late Metasedimentary and Metavolcanic Rocks (Oxford Lake Group, Island Lake Series, San Antonio Formation)

11 — Greywacke, conglomerate, arkose, arenite.

10 — Mafic and felsic fragmental volcanic rocks, porphyritic mafic to felsic flows, derived sediments.

Metamorphosed Early Intrusive Rocks, Gneisses and Migmatites

9 — Migmatitic gneiss containing tonalite (8) and amphibolite (5).

8 — Tonalite, minor granodiorite, granite, related gneiss: (8a) tonalitic and granodioritic gneiss, migmatitic gneiss, augen-gneiss; inclusions of units (5) and (6). (8b) undifferentiated granitic rocks.

7 — Felsic granulites with minor gabbro and anorthosite: enderbite, opdalite, charnockite, and related gneiss; inclusions of units (5a) and (6).

6 — Metasedimentary gneiss.

5 — Amphibolite: (5a) mafic and minor ultramafic granulite, banded iron formation, quartzite, and calc-silicate rocks.

4 — Gabbro, gabbronorite: (4a) diorite; (4b) anorthosite.

Early Metavolcanic and Metasedimentary Rocks (Rice Lake Group, Hayes River Group)

3 — Greywacke, mudstone, conglomerate, arkose, banded iron formation.

2 — Felsic to intermediate, mainly pyroclastic volcanic rocks; some flows, minor intrusive and sedimentary rocks.

1 — Basalt, minor andesite, minor sedimentary and mafic intrusive rocks; ultramafic rocks (serpentinite, serpentinized peridotite, pyroxenite) and differentiated ultramafic/mafic intrusions.

Ultramafic Rocks (associated with units 1, 4, 17, 21 and 28)

- Serpentinized peridotite, serpentinite, pyroxenite.
- Serpentinized peridotite, serpentinite, pyroxenite, under Phanerozoic cover, known from diamond drill hole intersections and interpreted from aeromagnetic anomalies
- Differentiated mafic/ultramafic intrusions (small, large)
- As above, under Phanerozoic cover. Known from diamond drill hole intersections and interpreted from aeromagnetic anomalies
- Extensive drift-covered areas with little or no bedrock exposure; geology inferred almost entirely from aeromagnetic signature and trend

SYMBOLS

- Geological boundary (defined or approximate)
- Geological boundary - Precambrian (gradational, inferred from aeromagnetic signature and trend)
- Geological boundary - Phanerozoic (estimated; sub-surface projected to bedrock where thickness of overburden exceeds 15 metres; subcrop
- Fault
- Estimated limit of structural disturbance: Phanerozoic Lake St. Martin, Denbeigh (Denby) and Highrock Lake structures
- Limit of Hudsonian tectonic overprint on the Superior Province (defined or approximate; inferred from aeromagnetic signature)
- Superior Boundary Zone margins under Phanerozoic cover extrapolated from aeromagnetic trends, etc.
- Structure contour on Precambrian basement beneath Phanerozoic cover. Contour interval: 100m

MINES & MINERAL DEPOSITS

	MINE/PROPERTY	COMMODITIES
1	Agassiz (MacLellan)	Au,Ag
2	Anderson Lake	Cu,Zn
3	BIRCHTREE	Ni
4	Bird Lake (Petra)	Cr
5	BURNT TIMBER	Au
6	CALLINAN	Cu,Zn,Au,Ag
7	Central Manitoba	Au,Ag
8	Chisel Lake	Cu,Zn
9	Chrome Group	Cr
10	Cryderman	Au
11	Dumbarton	Ni,Cu
12	Farley	Au
13	FLIN FLON	Cu,Zn,Se,Te,Au,Cd
14	Fox Mine	Cu,Zn
15	Ghost Lake (Lost Lake)	Zn
16	Gold Pan and Gold Seal	Au
17	Gull	Mo
18	Gunnar	Au
19	Jeep	Au
20	Lynn Lake Mine	Ni,Cu,Co
21	Mandy	Cu,Zn,Ag,Au
22	Manibridge	Ni
23	Moak	Ni,Cu
24	Namew Lake	Ni,Cu,Au
25	Nor-Acme	Au
26	Osborne Lake	Cu,Zn
27	Page Group	Cr
28	Pipe No 2 and Open Pit	Ni,Soapstone
29	Pipestone Lake	Fe,Ti,V
30	Poundmaker (Luleo)	Au
31	Rod (Little Stall Lake)	Cu,Zn
32	RUTTAN	Cu,Zn
33	San Antonio (Bissett)	Au
34	Schist Lake	Cu,Zn,Ag,Au
35	Soab North	Ni,Cu
36	Soab South	Ni,Cu
37	Solo-Oro Grande	Au,Ag
38	Spruce Point	Cu,Zn
39	Stall Lake	Cu,Zn
40	Sunbeam-Waverley	Au
41	TANCO (BERNIC LAKE)	Ta,Cs,Li,Be
42	THOMPSON OPEN PIT	Ni,Cu,Au,Ag
43	TROUT LAKE (EMBURY LAKE)	Cu,Zn
44	Westarm	Cu
45	White Lake	Zn,Cu,Ag,Au

SYMBOLS

- OPERATIONAL
- Non-Operational
- Important Mineral Property

COMMODITY ABBREVIATIONS

Beryllium	Be	Molybdenum	Mo
Cadmium	Cd	Nickel	Ni
Cesium	Cs	Selenium	Se
Chromium	Cr	Silver	Ag
Cobalt	Co	Tantalum	Ta
Copper	Cu	Tellurium	Te
Gold	Au	Titanium	Ti
Iron	Fe	Vanadium	V
Lithium	Li	Zinc	Zn

PRE-1979 GEOLOGY by: Bailes, A.H., Baldwin, D.A., Bannatyne, B.B., Bell, K., Downie, D.L., Elbers, F.J., Ermanovics, I., Gilbert, H.P., Hubregtse, J.J.M.W., Janes, D.A., Lamb, C.F., Lenton, P., McCabe, H.R., McRitchie, W.D., Norris, W., Potter, R.R., Schledewitz, D.C.P., Scoates, R.F.J., Syme, E.C., Trueman, D., Weber, W., and Zwanzig, H.V.

1979 GEOLOGICAL COMPILATION by: Bannatyne, B.B., McCabe, H.R., McRitchie, W.D., Norris, W., Scoates, R.F.J. and Weber, W.

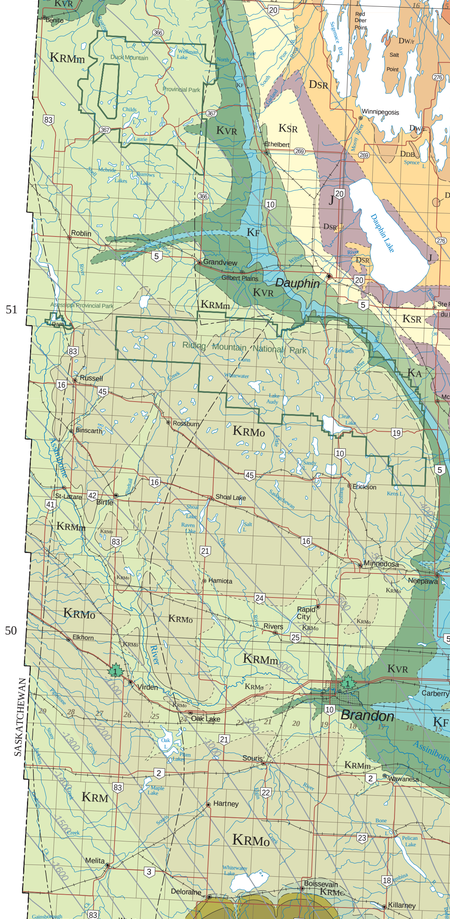
1979 CARTOGRAPHY by P. Buonpensiere and T. Franceschet.

DIGITAL CARTOGRAPHY by: Geological Survey of Canada staff, L. Chackowsky, and P. Lenton. Digital topographic base from Manitoba Surveys and Mapping. This map is a digital copy of: Manitoba Geological Services, 1979, Geological Map of Manitoba, Scale 1:1 000 000, Map 79-2. Ultramafic rock point data and mines/mineral deposits were derived from: Manitoba Geological Services, 1994, Geological Highway Map.

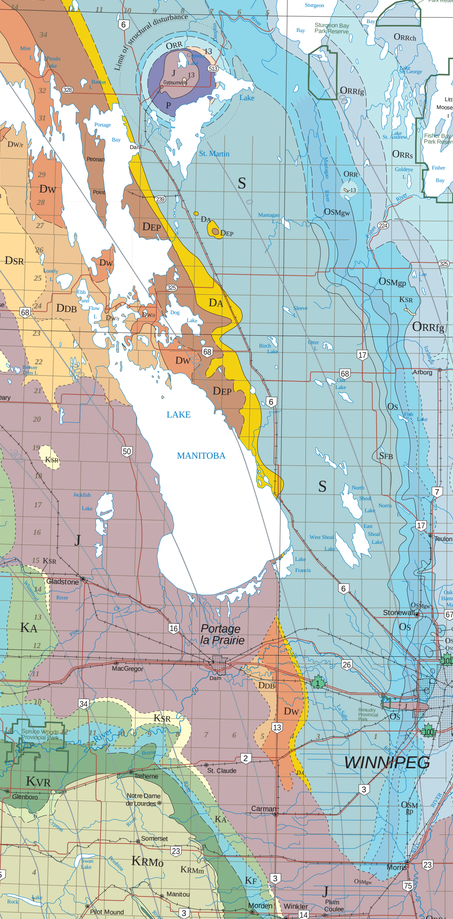
MANITOBA GEOLOGICAL SURVEY — MGS — 1928

Manitoba

TOTAL FIELD SHADED RELIEF



BOUGUER GRAVITY - TOTAL FIELD SHADED RELIEF



LITHOLOGY - TOTAL FIELD SHADED RELIEF