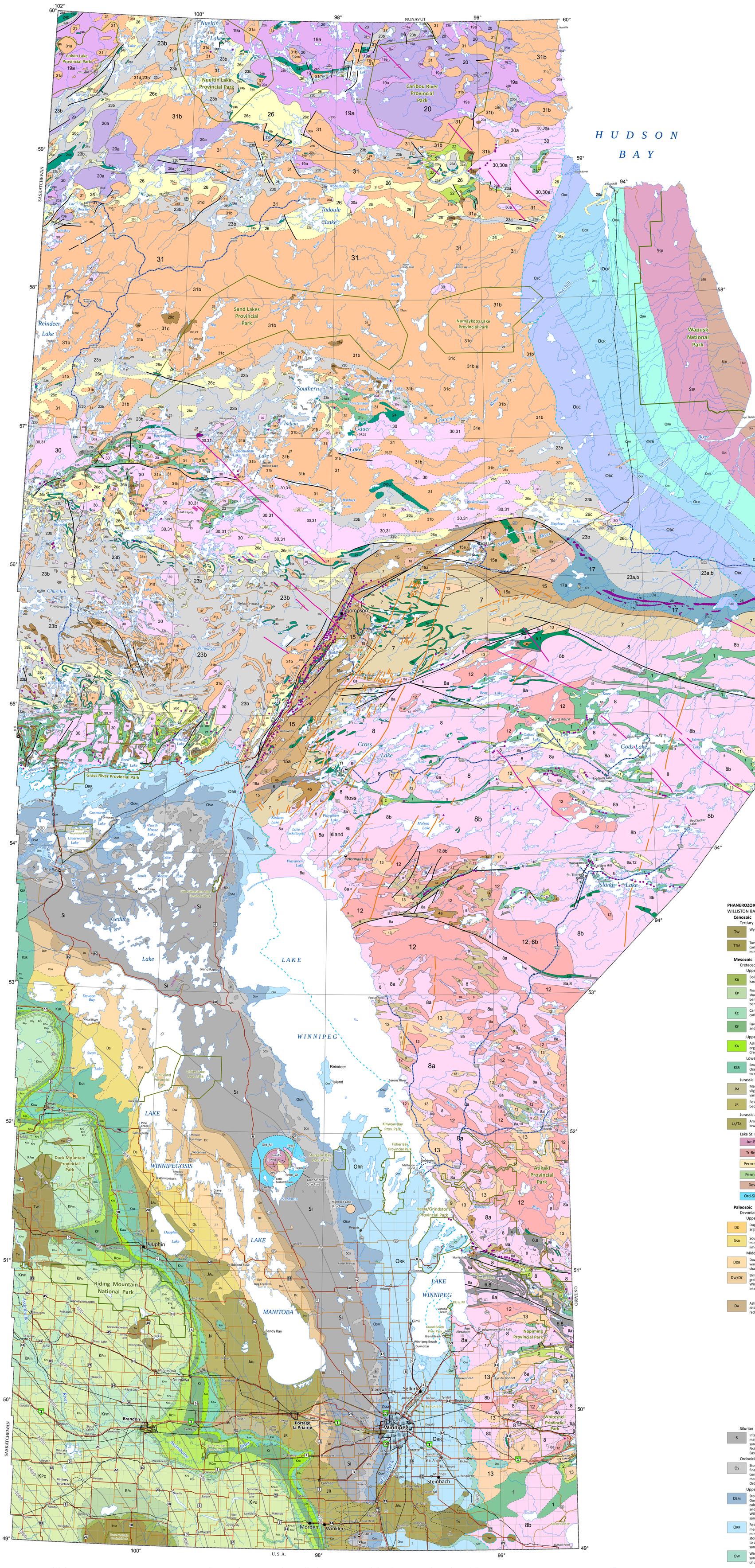

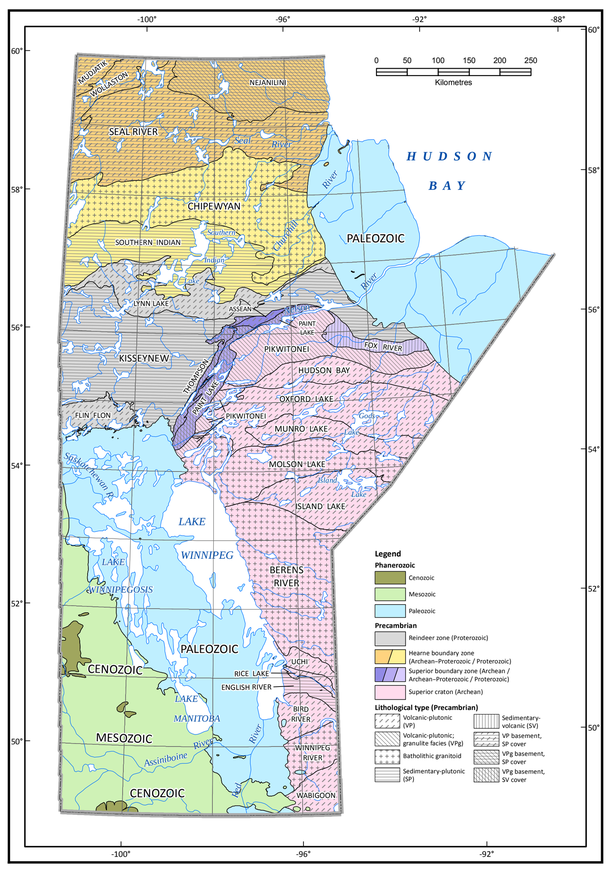

GEOLOGY OF MANITOBA

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LEGEND

PHANEROZOIC

WILLISTON BASIN

Cenozoic

Tertiary

- TW — Wynyard Formation: sandy and silty sediments.
- TTM — Turtle Mountain Formation (158 m max. thickness): 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 (44 m max. thickness): greenish-grey sandstone; minor shale, in part kaolinitic.
- KP — Pierre Formation (285-340 m): Coulter Member (c): soft grey, bentonitic, clayey siltstone and shale; Odanah Member (o): hard grey siliceous shale; Millwood Member (m): soft greenish bentonitic shale; Pembina Member (p): thinly interbedded carbonaceous shale, bentonite and bentonitic shale; Gammon Member (g): dark grey to brown mudstone or silty shale.
- KC — Carlile Formation (191 m max. thickness): Boyne Member (b): grey calcareous speckled shale, carbonaceous shale and brown siltstone; Morden Member (m): black carbonaceous shale.
- KF — Favel Formation (15-45 m): calcareous speckled shale, minor limestone, calcarenite, bentonite and oil shale; includes the Assiniboine Member and Keld Member.

Upper and Lower Cretaceous

- KA — Ashville Formation (55-115 m): Belle Fourche member (b): grey-black to black carbonaceous, organic shale, bentonite; Westgate Member (w): dark grey noncalcareous shale, bentonite; Skull Creek Member (s): dark grey shale, sand, siltstone.

Lower Cretaceous

- KSR — Swan River Formation (0-105m): sandstone, in places glauconitic; kaolinitic shale, minor lignite; channel and karst infill within Paleozoic outcrop belt; locally missing from outcrop sequence due to nondeposition.

Jurassic

- JM — Melita Formation (180m max. thickness): Upper Melita Member: greenish grey to brownish grey, slightly calcareous shale with thin coquina beds and dense limestone. Lower Melita Member: varicoloured shale with interbeds of calcareous sandstone.
- JR — Reston Formation (65m max. thickness): lower beds of greenish grey and grey shale; middle beds of dense, argillaceous, light-coloured limestone; and upper oolitic to sandy beds.

Jurassic and Upper Triassic

- JA/TA — Amaranth Formation (0-140 m): upper member (Ja): widespread, thick gypsum and anhydrite; lower member (Ta): red, argillaceous, dolomitic siltstone and sandstone.

Lake St. Martin structure—Ordovician to Jurassic

- Jur-Ev — Jurassic Amaranth Formation, Upper (Evaporite) Member: thick gypsum and anhydrite
- Tr-Red — Triassic Amaranth Formation, Lower (Red Beds) Member: red, argillaceous, dolomitic siltstone and sandstone
- Perm-Gr — Permian intrusive rocks: granitic microbreccia, crater-fill in cryptoexplosion (meteorite impact?) structure.
- Perm-V — Permian volcanic rocks: trachyandesite
- Dev — Devonian: limestone; limestone breccia crater-fill in cryptoexplosion (meteorite impact?) structure
- Ord-Sil — Ordovician and Silurian: dolostone; dolostone breccia crater-fill in cryptoexplosion (meteorite impact?) structure

Paleozoic

Devonian

Upper and Middle Devonian

- DD — Duperow Formation (189 m max. thickness): limestone and dolostone with occasional argillaceous and anhydritic units.
- DSR — Souris River Formation (65-113 m): 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 (91 m max. thickness): basal red shale, bituminous dolomite grading upward to micritic limestone to brachiopod biomicrite (high-Ca), red to grey fossiliferous calcareous shale and highly fossiliferous coral stromatoporoid limestone (high-Ca), locally dolomitized.
- DW/DE — Elm Point Formation (Dt) (105m max. thickness): limestone, pale yellowish brown, dense, fine-grained biomicrite; pure high-Ca limestone to calcareous dolomite; grades laterally into Winnipegosis Formation (Dw): Lower Member: dolomitized platform facies; Upper Member: thin inter-reef bituminous laminates or thick reefal carbonate rocks.
- DA — Ashern Formation (24m max. thickness): dolomitic shale and argillaceous dolomite, red to greenish grey; local basal breccia.

HUDSON BAY BASIN

- DMR — Moose River Formation (~50m): limestone, argillaceous limestone, dolomitic limestone, dolostone, dolostone breccia, shale, evaporites
- DKW — Kwataboahegan Formation (~38m): fossiliferous limestone, bituminous limestone, dolostone

Lower Devonian

- DSR — Stooping River Formation (~80m): limestone, dolomitic limestone, argillaceous dolostone, dolostone
- DKR — Kenogami River Formation (218m avg.): upper member (173m avg.) (u): limestone, dolomitic limestone

Silurian

- SKR — Kenogami River Formation: middle member (155m avg.) (m): dolomitic silty shale/mudstone, siltstone, anhydrite. Lower member (50m) (l): dolomitic limestone
- SAT — Attawapiskat Formation (30-60m): fossiliferous limestone, dolomitic limestone
- SER — Ekwan River Formation (~45m): limestone, dolomitic limestone
- SSR — Severn River Formation (~235m max.): limestone, dolomitic limestone, argillaceous dolostone

Silurian

- S — Interlake Group: micritic, fossiliferous, stromatolitic and biostromal dolomite with sandy argillaceous marker beds; includes Fisher Branch, Moose Lake, Atikameg, East Arm, and Cedar Lake formations

Ordovician and Lower Silurian

- OS — Stonewall Formation (51m max.): dolomite, fine-grained, sparsely fossiliferous, in part conglomeratic; medial sandy argillaceous marker (t-marker) may define the Ordovician-Silurian boundary

Upper Ordovician

- OSM — Stony Mountain Formation (48m max.): Gunn and Penitentiary members: calcareous shale, fossiliferous limestone and argillaceous dolomite. Gunton and William members: nodular dolomite and sandy argillaceous dolomite
- ORR — Red River Formation (179m max.): Upper member: massive to laminated dolomite; minor argillaceous dolomite, high-Ca limestone. Lower member: mottled limestone to dolomite, cherty dolomite, argillaceous sandy dolostone, thin anhydrite beds
- OW — Winnipeg Formation (75m max.): basal sandstone overlain by complex sequence of quartzose sandstone and shale

Ordovician and Lower Silurian

- ORH — Red Head Rapids Formation (~74m): dolostone, argillaceous dolostone, anhydrite, halite

Upper Ordovician

- OCR — Churchill River Group (66m max.): Caution Creek formation: dolomitic limestone. Chasm Creek formation: limestone, dolomitic limestone
- OBR — Boas River Formation: argillaceous dolostone
- OBC — Bad Cache Rapids Group (97m max.): Portage Chute formation: basal sandstone and shale, and overlying limestone. Surprise Creek formation: limestone, dolostone, argillaceous dolostone, chert, anhydrite

PRECAMBRIAN

Proterozoic

- 32 — Diabase dykes (Mackenzie swarm): known; interpreted from aeromagnetic anomalies.

CHURCHILL PROVINCE

Intrusive Rocks

- 31 — Granite, granodiorite and tonalite: (a) fluorite granite; (b) porphyritic granite and pegmatite; (c) hypersthene-bearing porphyritic granite–monzonite; (d) leucogranite–leucotonalite; (e) hornblende granite–syenite.
- 30 — Tonalite-granodiorite: (a) tonalite-granodiorite gneiss; (b) 'quartz eye' tonalite.
- 29 — Mafic to intermediate rocks: (a) gabbro; (b) anorthositic gabbro; (c) diorite; (d) tonalite–diorite; (e) hypersthene-bearing tonalite–diorite, enderbite.
- • 28 — Ultramafic rocks: (a) peridotite-pyroxenite; (b) serpentinite; (c) hornblendite–hornblende peridotite and pyroxenite.

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

- 27 — Migmatite, agmatite and gneiss complex.
- 26 — Arkose-, arenite-, and quartzite-derived gneiss and migmatite (Sickle Group, Missi Group and Sickle Metamorphic Suite): (a) orthoquartzite and minor conglomerate; (b) arkose, feldspathic wacke, conglomerate and quartzite; (c) arkosic gneiss and migmatite, local arkosic wacke; (d) felsic gneiss of unknown derivation.
- 25 — Metaconglomerate with minor arkosic gneiss.
- 24 — Amphibolite and mafic gneiss: (a) calc-silicate gneiss and interlayered amphibolite; (b) calc-silicate rocks, local quartzite and/or marble; (c) iron formation.
- 23 — Greywacke- and mudstone-derived gneiss and migmatite (Amisk Group and Wasekwan Group in part; Nokomis Group and Burntwood River Metamorphic Suite): (a) greywacke, argillite, slate and metagreywacke, local minor grit and conglomerate; (b) psammitic and semi-pelitic gneiss, pelitic schist and migmatite
- 22 — Metavolcanic rocks (includes Amisk Group and Wasekwan Group and Great Island volcanic rocks): (a) rhyolite; (b) dacite.
- 21 — Mafic and intermediate metavolcanic flows, pyroclastic deposits and associated metasediments; local ultramafic flows; (a) andesite; (b) basalt.

Archean and Inferred Archean

- 20 — Charnockite–mangerite and derived granitoid gneiss; (a) remobilized granite and granitoid orthogneiss.
- 19 — Granitoid complexes; (a) grey, foliated granodiorite and granodioritic gneiss; (b) enderbite and pyroxene-granulites and abundant local supracrustal rafts.

SUPERIOR PROVINCE AND SUPERIOR BOUNDARY ZONE

Proterozoic

- 18 — Granite, granodiorite; (a) 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; (a) shale, dolomitic limestone, siltstone, sandstone, iron formation; (b) basalt and komatiite; (c) iron formation.
- 16 — Amphibolite
- 15 — Layered migmatitic gneiss derived from units (4) to (9), aplite and pegmatite; (a) transitional zone containing migmatitic gneiss and rocks of units (4) to (9).
- 14 — Mafic/ultramafic and diabase dykes (Molson swarm): known; 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; (a) tonalitic and granodioritic gneiss, migmatitic gneiss, augen-gneiss; inclusions of units (5) and (6); (b) 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; (a) mafic and minor ultramafic granulite, banded iron formation, quartzite, and calc-silicate rocks.
- 4 — Gabbro, gabbronorite; (a) diorite; (b) anorthosite; (c) layered mafic and ultramafic rock.

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.
- • As above, 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

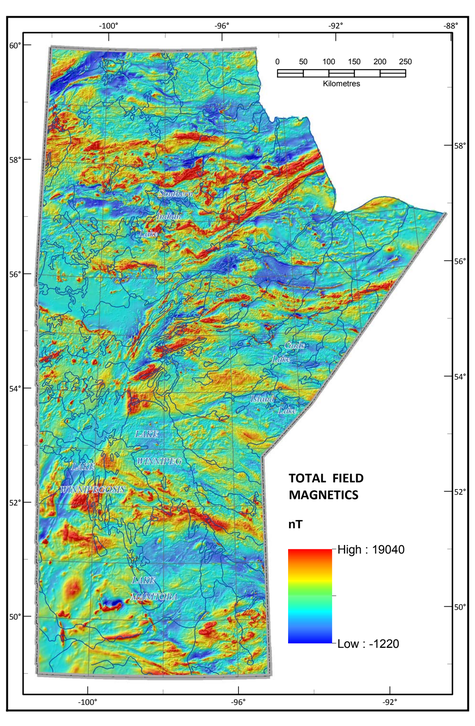
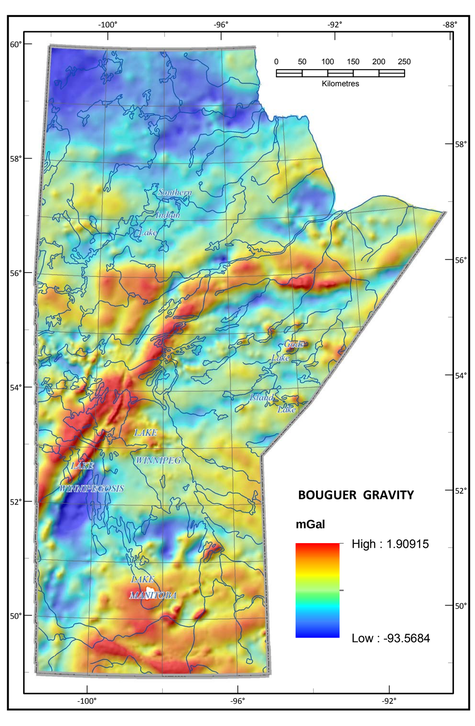
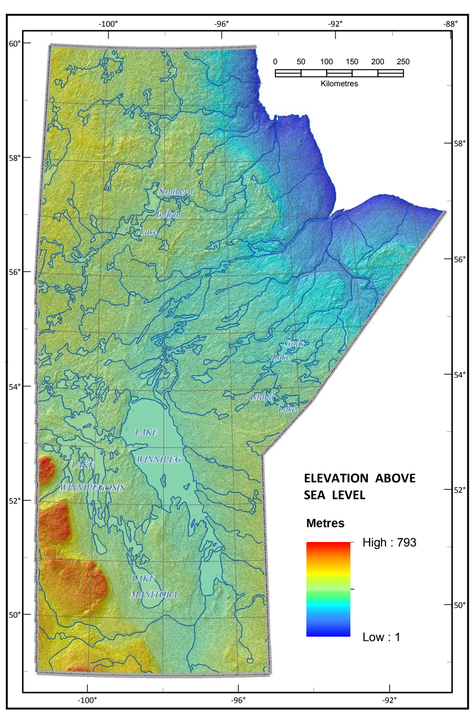
- Geological boundary (defined or approximate)
- Geological boundary, Precambrian (gradational; inferred from aeromagnetic signature and trend)
- Geological boundary, Paleozoic (estimated; subcrop)
- Fault
- Estimated limit of structural disturbance: Phanerozoic Lake St. Martin, Hartney and Highrock Lake structures
- Superior Boundary Zone margins under Phanerozoic cover extrapolated from aeromagnetic trends, etc.
- Phanerozoic–Precambrian boundary
- Structure contour on Precambrian basement beneath Phanerozoic cover. Contour interval: 100m

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 Precambrian geological compilation by McRitchie, W.D., Norris, W., Scoates, R.F.J. and Weber, W. Precambrian geology is a digital copy of: Manitoba Geological Services, 1979, Geological Map of Manitoba, Map 79-2.

1979 cartography by P. Buonpensiere and T. Franceschet.

2018 Phanerozoic edges by G. Keller and M.P.B. Nicolas.

DIGITAL CARTOGRAPHY by: Geological Survey of Canada staff, L. Chackowsky, and P. Lenton.

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