GEOLOGICAL MAP OF SASKATCHEWAN

2021 Edition

Map Legend

Phanerozoic Sedimentary Rocks[1]

CENOZOIC

Paleogene to Neogene

- Td — Undifferentiated diamictite (Paleogene to Neogene): Poorly sorted, containing matrix-supported rounded to very angular clasts (pebbles to cobbles); clasts of Mannville Group, Winnipegosis Formation, Athabasca Supergroup and crystalline basement; matrix contains carbonate; quartz clasts are highly fractured; <110 m
- Tu — Undifferentiated Paleogene and Neogene: Quartzite and chert gravel, locally conglomeratic; sand and clayey silt
- Twm — Wood Mountain Formation (Miocene): Terrestrial conglomerate and sandstone; abundant mammalian and other vertebrate fauna; silicified wood common; <20 m
- Tch — Cypress Hills Formation (Eocene to Miocene): Fluviatile conglomerate, mainly quartzite; interchannel lacustrine marlstone with minor volcanic ash beds toward the east; abundant mammalian and other vertebrate fauna; <80 m; fossiliferous fine-grained sandstone with local conglomerate of the Swift Current Creek Beds; <20 m
- Tr — Ravenscrag Formation (Paleocene): Fluviatile-lacustrine buff, grey, and white sandy claystone, locally cemented, green-grey to buff feldspathic sandstone, siltstone and shale; minor coal; includes kaolinite beds of the Willow Bunch Member; <245 m

MESOZOIC

Cretaceous

- Kfe — Undifferentiated Eastend, Whitemud, Battle, and Frenchman formations (Maastrichtian): Nonmarine to estuarine with marine pelecypod beds near base, yellow-brown fine-grained silty and clayey volcanic lithic sandstone with interbedded grey to greenish shale (Eastend Fm); mainly fluviatile, kaolinitic mudstone and sandstone, grey-purple mudstone and carbonaceous shale, thin lignite beds; dark brown to purplish black bentonitic silty shale, mauve-grey weathering; fluviatile-lacustrine grey-green sandstone, nonmarine red and green shale and mudstone, locally dolomitic or calcareous, kaolinitic and carbonaceous with thin lignite beds, dinosaur fauna, including *Triceratops* and *Tyrannosaurus rex*, amphibians and fish (Frenchman Fm); <130 m
- Kb — Bearpaw Formation (Campanian to Maastrichtian): Marine grey claystone, shale, and siltstone; minor brownish grey sandstone; concretionary beds and thin bentonite layers; commonly with foraminifera and molluscs; <400 m
- Kbr — Belly River Formation (Campanian): Fluviatile to minor marine light grey-buff sandstone, siltstone, and mudstone with sharp lateral variations; local coal and bentonite; mollusc coquinas; <200 m
- Klp — Lea Park Formation (Campanian): Marine grey shale, minor siltstone, fine-grained sandstone, and bentonite beds; abundant foraminifera and molluscs; <200 m
- Kmr — Milk River Formation (Santonian to Campanian): Marine greenish grey bentonitic siltstone and shale; <265 m
- Kuc — Upper Colorado Group - First White Speckled Shale, Carlile Formation, Second White Speckled Shale Formation (Cenomanian to Santonian): Marine calcareous shale, claystone, and mudstone locally with coccolith debris; siltstone, shale, mudstone, bentonite beds and chalk; <275 m
- Klc — Lower Colorado Group - Belle Fourche Formation, Fish Scales Formation, Westgate Formation, Viking Formation, Joli Fou Formation (Albian to Cenomanian): Marine siltstone, mudstone, shale, sandstone, conglomerate, minor coeval kimberlite in the Fort à la Corne area; <270 m
- Km — Mannville Group (Aptian to Albian): Fluviatile to marine quartzose sandstone, mudstone and siltstone; clay-intraclast-rich quartz arenite > siltstone and mudstone; quartz arenite, minor pebbly quartz arenite, minor clay intraclasts; minor coeval kimberlite in the Fort à la Corne area; <290 m
- Kss — Success Formation (Kimmeridgian to Berriasian): Fluviatile white to light grey-green kaolinitic quartzose sandstone and mudstone with subordinate feldspar, sphaerosiderite, chert, marcasite, and carbonaceous fragments; cobble and silt end-members, trough cross-bedding and truncated cross-sets; glauconitic with upward-coarsening sets; <90 m

PALEOZOIC

Devonian

- Dw — Winnipegosis Formation (Eiffelian to Givetian): Marine platform carbonate, basinal reefs with bituminous inter-reef laminites; <120 m
- Da — Ashern Formation (Eiffelian): Marine reddish brown to greenish grey argillaceous dolostone and dolomitic shale; local anhydrite; <35 m
- Dml — Meadow Lake Formation (Emsian to Eiffelian): Marine grey to buff and greyish pink to reddish brown argillaceous dolostone with interbeds of mudstone, limestone, sandstone, and local evaporites; restricted to northwest of the Meadow Lake Escarpment; <280 m

Silurian

- Sl — Interlake Formation (Rhuddanian to Homerian): Marine dolostone with thin argillaceous and arenaceous marker beds in lower part; <220 m

Ordovician

- Osw — Stonewall Formation (Richmondian to Rhuddanian): Marine dolostone with thin argillaceous and arenaceous marker beds; minor anhydrite beds in southeastern Saskatchewan; <50 m
- Osm — Stony Mountain Formation (Richmondian): Marine dolostone and dolomitic limestone; argillaceous dolostone to dolomitic shale near base and thin anhydrite at top in southeastern Saskatchewan; <50 m
- Orr — Red River Formation (Edenian to Richmondian): Marine interbedded dolomitized mudstone and wackestone; dolomudstone; <170 m

Cambrian

- Cd — Deadwood Formation (Upper Cambrian to Lower Ordovician): Marine interbedded fine-grained quartzose sandstone, siltstone, and shale, usually tints of green and red, commonly glauconitic in upper portion; medial silty limestone in southwest; basal medium- to coarse-grained sandstone; Cambro-Ordovician boundary near top in southeast; <510 m

[1] The Phanerozoic portion of this map largely represents a subcrop map and therefore does not reflect the entire stratigraphic record of southern Saskatchewan; this also means that none of the unconformities are indicated in the legend; this additional information can be found in Saskatchewan Ministry of the Economy (2014). Estimated maximum formation thicknesses are given at the end of each unit description.

Unmetamorphosed Proterozoic Rocks[2]

MESOPROTEROZOIC

Ectasian to Stenian Intrusive Rocks

- MDd — Diabase dykes and sills: Includes Mackenzie Dyke Swarm (1270 Ma), Douglas River Suite (1165 Ma), Moore Lakes Suite (1108 Ma)

Ectasian to Stenian
Athabasca Supergroup (1840 to 1500 Ma)

McFarlane Group

- MAFc — Carswell Formation: Siliciclastic rocks and stromatolitic carbonate
- MAFd — Douglas Formation: Mudstone, fine- to very fine-grained arenite [1767 Ma]; deposition ongoing at |1541 Ma|
- MAFod — Otherside Formation, Davy Member: Pebbly quartz arenite and quartz arenite
- MAFob — Otherside Formation, Birkbeck Member: Quartz arenite
- MAFoa — Otherside Formation, Archibald Member: Pebbly quartz arenite, quartz arenite
- MAFlm — Locker Lake Formation, Marsin Member: Pebbly quartz arenite
- MAFlb — Locker Lake Formation, Brudell Member: Conglomeratic quartz arenite
- MAFls — Locker Lake Formation, Snare Member: Pebbly quartz arenite

PALEOPROTEROZOIC

Wolverine Point Group [1662 Ma]

- PAWq — Quartz arenite ± mudstone ± phosphatic hardgrounds (1644 Ma)

Lazenby Lake Group

- PALl — Larter Formation: Quartz arenite ± pebbly, mudstone
- PALs — Shiels Formation: Quartz arenite with pebbly layers

Manitou Falls Group [1814 Ma]

- PAMd — Clampitt-Dunlop formations: Clay-intraclast-rich quartz arenite ± mudstone
- PAMh — Hodge Formation: Pebbly quartz arenite ± conglomerate
- PAMw — Warnes Formation: Clay-intraclast-rich quartz arenite
- PAMb — Bird and Collins formations: Conglomeratic quartz arenite, ± pebbly quartz arenite
- PAMr — Read Formation: Conglomerate to mudstone, quartz arenite
- PAMy — Reilly Formation (outlier located 90 km southeast of Athabasca Basin): Conglomeratic quartz arenite

Fair Point Group [1810 Ma]

- PAFq — Conglomeratic and pebbly quartz arenite

Martin Group

- PATvm — Mafic flows; intraformational to Martin Group sedimentary rocks (unit PATs) (1818 Ma)
- PATs — Conglomerate, sandstone, arkose, siltstone [1905 Ma]

Statherian Intrusive Rocks

- PTJg — Jan Lake Intrusive Suite: Leucogranite, aplogranite, granite, pegmatite (1774 to 1730 Ma)

[2] The Athabasca Basin portion of this map is a geological bedrock and subcrop map and therefore does not reflect the entire stratigraphic record of the Athabasca Basin region; this also means that none of the unconformities are indicated in the legend; this additional information can be found in Bosman and Ramaekers (2015).

General Information

This map represents our current state of knowledge and is based on its precursor compiled by Macdonald and Slimmon (1999). It is a geological bedrock and subcrop map; therefore, the legend of the unmetamorphosed sedimentary basins does not reflect the entire stratigraphic record of southern Saskatchewan (Saskatchewan Ministry of the Economy, 2014) or the Athabasca Basin region (Bosman and Ramaekers, 2015). The 1:1 000 000 scale topographic map base uses CanVec files, an acronym for Canadian Vector, which are a digital cartographic reference product produced by Natural Resources Canada. Map projection is UTM NAD83 CSRS98 (Canadian Spatial Reference System 1998) in Extended Zone 13. The map was processed overall using ArcMap 10.x software.

The lithological codes (e.g. PTAbd) are constructed using the following format: the first letter (capitalized, bold, italicized) denotes the geological era or period; the second and, in some cases, third letters denote a major geological subdivision (e.g. 'A' – Athabasca Supergroup, 'R' – Rae craton, 'T' – Trans-Hudson Igneous Supersuite, 'm' – Mannville Group, 'W' – Wollaston Supergroup, etc.). For most crystalline Precambrian rocks, the last one to two lower case letters denote rock type (e.g. 'o' – conglomeratic rocks, 'sn' – pelitic rocks, 'vm' – mafic volcanic rocks, etc.), but the last letters in the Athabasca Supergroup and Phanerozoic sedimentary rock codes indicate Group, Formation, Member or rock type. A full explanation of codes is given in the accompanying Summary of Investigations publication.

Information from this publication may be used if credit is given. It is recommended that reference to this publication be made in the following form: Maxeiner, R., Ashton, K.E., Bosman, S., Card, C., Kohlruss, D., Love, M., Love, T., Marsh, A., Morelli, R. and Slimmon, W.L. (2021): Geological map of Saskatchewan, 1:1 000 000 scale; Saskatchewan Geological Survey, Saskatchewan Energy and Resources.

Credits: Revisions since 1999 are based on detailed mapping and geochronology completed by the co-authors of this map and other authors. Detailed references for this work are not given, but include work in the Rae Province (K. Ashton, C. Card), the Hearne Province (C. Card, R. Maxeiner, C. Harper), work completed throughout the Reindeer Zone (K. Ashton, R. Maxeiner, R. Morelli), and the Athabasca Supergroup based on drillcore interpretation from drilling by the mineral exploration industry in the Athabasca Basin region (S. Bosman). Revisions for the Phanerozoic are a result of government compilations and targeted field work (A. Marsh, D. Kohlruss, S. Bosman), which enabled a more detailed breakdown of the subglacial distribution of Phanerozoic strata.

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The geological data that was used to create this map (including the 1:1 000 000 scale geology, fault and Precambrian basement elevation contour layers) are also available for viewing or download on the Saskatchewan Mining and Petroleum GeoAtlas: (https://gisappl.saskatchewan.ca/GeoAtlas)

Although the Ministry of Energy and Resources has exercised all reasonable care in the compilation, interpretation and production of this map, it is not possible to ensure total accuracy, and all persons who rely on the information contained herein do so at their own risk. The Ministry of Energy and Resources and the Government of Saskatchewan accept no liability for any errors, omissions or inaccuracies that may be included in, or derived from, this map.

Bracket conventions for age constraints; ages are given in million years (Ma):

(1920 Ma) - Crystallization age of igneous rock; also used to constrain maximum (unconformable relationship) or minimum (crosscutting) age of sedimentary sequence

[1920 Ma] - Youngest detrital zircon age; used to constrain maximum depositional age of a sedimentary sequence

{1920 Ma} - Minimum age based on other evidence (e.g. metamorphic overprint)

|1920| - Absolute age of deposition of sedimentary rock

Metamorphosed Rocks of the Western Churchill Structural Province

PALEOPROTEROZOIC

- PTHg — Granite, megacrystic granite; syenogranite (1850-1750 Ma); includes minor Archean rocks and unmetamorphosed Hudson and Nueltin suites

Rae Province

- PRTs — Thluicho Lake Group [1922 Ma] to {1889 Ma}: Conglomerate, sandstone, siltstone

paleo-unconformity between PRTs and units ARg, URgq, URgd

Intrusive rocks related to Arrowsmith and Taltson orogenies

- PRag — Anatectic monzogranite to granodiorite; inclusion-rich (1930 Ma; includes White Lake and Rogers Lake granites)
- PRgl — Leucomonzogranite to leucogranodiorite (1930 Ma; probably includes some 2330 Ma rocks)
- PRgq — Taltson Magmatic Suite: Granite to quartz diorite (1971 to 1959 Ma)

intrusive contact with ARsn, ARbm, ARg, URgl, URgn, URgqr, URgq, PRgl

Murmac Bay Group and similar-aged supracrustal rocks in Rae Province [2327 Ma] to {1940 Ma}

- PMs — Undifferentiated sedimentary and minor volcanic rocks (includes Waugh Lake, Virgin Schist groups)
- PMsn — Psammopelite to pelite, and derived gneiss, migmatite and anatectic granite (includes Careen Lake Group)
- PMam — Amphibolite including mafic volcanic, minor gabbro, and clastic sedimentary rocks (includes Virgin Schist Group)
- PMq — Quartzite, siltstone, psammite, dolostone, calc-silicate, and derived gneiss; minor amphibolite, psammopelite to pelite

paleo-unconformity between Murmac Bay Group and ARgt, ARd, ARgg, URgn, URgq; in part synchronous with PRg

Clearwater Intrusive Suite (2120 to 2110 Ma)

- PRCa — Anorthosite (2110 Ma)
- PRCg — Granite (2120 Ma)

intrusive contact with URgq, URgd

- PRg — North Shore Plutons: Granite; minor granodiorite, quartz monzonite, diorite (2327 to 2287 Ma)

intrusive contact with ARgt

Hearne Province

Hurwitz Group (possibly correlative with 1960 to 1900 Ma Upper Hurwitz Group in Nunavut)

- PHUc — Marble, calcic pelite, calc-silicate rock
- PHUsn — Pelite; derived schist and migmatite

paleo-unconformity between unit PRTs and units ARg, URgq, URgd

Wollaston Supergroup and similar-aged supracrustal rocks in Hearne Province (2075 Ma) to (1865 Ma)

- PWr — Arkose, calcareous arkose, psammite, psammopelite; derived gneiss; may include unit AHfn
- PWsn — Pelite to psammopelite; derived gneiss (includes Daly Lake Group)
- PWo — Conglomerate, arkose, bimodal volcanic rocks (includes Courtenay Lake and Geikie River groups)
- PWc — Mixed calc-silicate rock, pelitic gneiss, marble
- PWq — Quartzite, pelite, calc-silicate rocks, minor pebble conglomerate (includes Daly Lake and Campbell River groups, and Hidden Bay Assemblage)
- PWam — Amphibolite, mafic volcanic rock, arkose, psammopelite and calc-silicate rocks (includes rocks related to Hidden Bay Assemblage and Courtenay Lake Group)

paleo-unconformity between Wollaston Supergroup and southern Hearne craton

- PTPbd — Porter Bay Intrusive Suite (1918 to 1913 Ma) of Trans-Hudson Igneous Supersuite: Monzodiorite, gabbro; minor supracrustals

intrusive contact with AHag, AHbd

Cook Lake Igneous Suite (2086 to 2075 Ma)

- PTCg — Syenogranite, quartz-feldspar porphyry; in part intruding Wollaston Supergroup and unit AHag

NEOARCHEAN TO PALEOPROTEROZOIC

Mixed Orthogneisses

- URgq — Granitic to quartz dioritic gneiss (in part 2517 to 2325 Ma); amphibolite rafts; leucogranite sheets
- URgqr — Retrogressed granitic to quartz dioritic gneiss (derived from URgq)
- URbd — Quartz monzonite to norite; derived gneiss
- URgd — Granite, granodiorite; derived gneiss (in part 2565 to 2420 Ma)
- URgn — Granitic to granodioritic orthogneiss, quartz monzodiorite (2606 to 2300 Ma); leucogranite and amphibolite sheets
- URgl — Gneissic leucogranite to granite (in part 2707 Ma); minor gneissic pelite

NEOARCHEAN

- ARgg — Leucogranodioritic to tonalitic orthogneiss; amphibolite rafts (ca. 2.7 to 2.5 Ga)
- ARg — Granite to granodiorite; derived orthogneiss (2680 to 2580 Ma)
- ARbm — Quartz monzodiorite to gabbro; derived gneiss (in part 2650 to 2575 Ma)
- ARbd — Norite-diorite-gabbro (in part 2639 to 2637 Ma)
- ARd — Garnetiferous diatexite (granitic to tonalitic, and pelitic precursors)
- ARvm — Intermediate to mafic volcanic rocks; intrusive equivalents; amphibolite (>2575 Ma)
- ARsn — Migmatitic psammopelite to pelite and derived anatectic granite (in part >2639 Ma)
- ARgn — Tonalitic orthogneiss (2740 Ma)

Ennadai Structural Complex (Central Hearne Craton) (2722 to 2681 Ma)

- AEsn — Psammopelite to pelite; derived schist and migmatite
- AEv — Mafic volcanic; minor felsic volcanic, wacke and iron formation (2708 to 2681 Ma)
- AEttg — Tonalite to granodiorite; derived gneiss and migmatite (2722 to 2681 Ma)

inferred structural contact between Central and Southern Hearne cratons

Southern Hearne Craton (2812 to 2529 Ma)

- AHdi — Swan River Intrusive Suite (2562 to 2560 Ma): Diorite, monzodiorite, anorthosite; minor gabbro
- AHbd — Swan River Intrusive Suite (2562 to 2560 Ma): Layered leucogabbro to gabbro-norite; diorite and ultramafic rocks; includes Zengle Lake gabbro (2529 Ma)
- AHg — Migmatitic granite to granodiorite complex
- AHt — Granodiorite to leucotonalite (2664 Ma)
- AHag — Granite, augen granite, leucogranite; derived gneiss (2680 to 2520 Ma); includes 2580 to 2566 Ma Lueaza River Granitoid Suite and lesser Proterozoic granites
- AHfn — Tonalite-granodiorite gneiss and migmatite complex; granitic gneiss (2812 to 2565 Ma); lesser Paleoproterozoic granites

MESOARCHEAN

- ARgt — Monzogranite to tonalite; derived gneiss (>3385 to 2941 Ma; includes Lodge Bay granite)

Metamorphosed Rocks of the Reindeer Zone

PALEOPROTEROZOIC

Missi Supracrustal Suite (1848 Ma) to (1831 Ma) (includes Mullock Lake Assemblage and historic McLennan, Sickle, and Ourom groups)

- PCMr — Arkose, conglomerate, psammite and derived migmatite; magnetic; felsic-intermediate arc volcanic and subvolcanic rocks
- PCMc — Calcic arkose, psammite, psammopelite
- PCMo — Polymictic conglomerate, arkose, wacke

paleo-unconformity and in part facies-equivalents to Burntwood Supracrustal Suite

Burntwood Supracrustal Suite (1867 Ma) to (1841 Ma) (includes 1867 to 1850 Ma Wunehikun Bay, Hebden Lake, Crew Lake assemblages; and historic 1855 to 1841 Ma Burntwood Group)

- PCBsd — Diatexitic pelite derived from unit PCBsn
- PCBsn — Pelite, psammopelite, minor psammite and wacke; generally graphitic; derived gneissic pelite and migmatite
- PCBc — Calcic psammopelite, calc-silicate rock, quartzite; minor marble, intermediate volcaniclastic rock, amphibolite, in part (>1897 Ma); derived gneiss and migmatite

paleo-unconformity between Burntwood Supracrustal Suite and older components of Amisk Lake Igneous Suite

Rottenstone Migmatite Complex

- PPrq — Psammite, feldspathic quartzite, arkose, conglomerate, quartzite and derived migmatite [2059 Ma]; includes Park Island Assemblage (<1865 Ma)
- PKsn — Pelitic to psammopelitic gneiss and derived migmatite [1848 Ma]; includes Kenyon Lake Assemblage
- PTRgn — Undifferentiated granodioritic to gneissic tonalite of Trans-Hudson Igneous Supersuite; derived anatectic granitoids

in part in structural contact with Amisk Lake Igneous Suite

- PTam — Amphibolite; unknown affiliation and protolith; includes mafic volcanic, mafic gneiss and minor plutonic precursors; in part likely high-grade equivalents of PTAvm

Trans-Hudson Igneous Supersuite in Reindeer Zone and Hearne Craton
Volcanic and plutonic rocks related to the Trans-Hudson Orogen, spanning the rifting to post-orogenic phases (2086 to 1730 Ma)

- PTe — Enderbite, charno-enderbite sills (1830 Ma)

Anatectic Leucogranitoid Suite (1835 to 1800 Ma)

- PTlg — Leucotonalite to leucogranodiorite (1816 to 1800 Ma); minor (1832 Ma) components
- PTgl — Leucogranite to leucotonalite (1837 to 1814 Ma)

Wathaman Intrusive Suite (1865 to 1850 Ma)

- PTWg — Megacrystic granite and quartz monzonite
- PTWbd — Megacrystic monzonite, diorite and gabbro

intrusive contact with Hearne craton, Rottenstone Migmatite Complex, and older Amisk Lake Igneous Suite

Amisk Lake Igneous Suite (1905 to 1832 Ma)
Arc to MORB igneous rocks related to the Manikewan Ocean in the Reindeer Zone, including rocks that were previously included in Amisk Group, Amisk Collage, 'successor-arc' plutons

Plutonic Rocks (1897 to 1832 Ma)

- PTAgd — Granite, granodiorite, tonalite
- PTAgn — Strongly foliated and refolded granitic to quartz dioritic gneiss
- PTAqd — Diorite to quartz diorite (minor granodiorite)
- PTAbd — Gabbro to diorite (minor ultramafic intrusions)

Volcanic Rocks (1905 to 1860 Ma)
(includes tectonic slivers of Burntwood and Missi supracrustal suites)

- PTAvf — Felsic to intermediate volcanic, volcaniclastic and minor subvolcanic intrusive rocks; derived gneiss
- PTAvi — Intermediate to felsic volcanic, volcaniclastic and minor subvolcanic intrusive rocks
- PTAvm — Mafic to intermediate (ultramafic) volcanic rocks; derived amphibolite

Clam Lake Structural Inlier (possibly related to Hearne craton)

- PTBg — Augen granite and derived gneiss (2045 Ma); possibly intruding Archean granite and orthogneiss (unit AHag)

- PZg — Porphyroclastic felsic gneiss derived from supracrustal and plutonic precursors; minor Archean components of ASlt (Nistowiak thrust)

structural contact

NEOARCHEAN TO PALEOPROTEROZOIC

Black Bear Island Lake Structural Inlier (possibly related to Hearne craton)

- AHgg — Black Bear Island augen granite and derived gneiss (2518 Ma)

Pelican, Hunter Bay, Iskwatikan and Nistowiak tectonic windows (exposing rocks of the Sask craton)

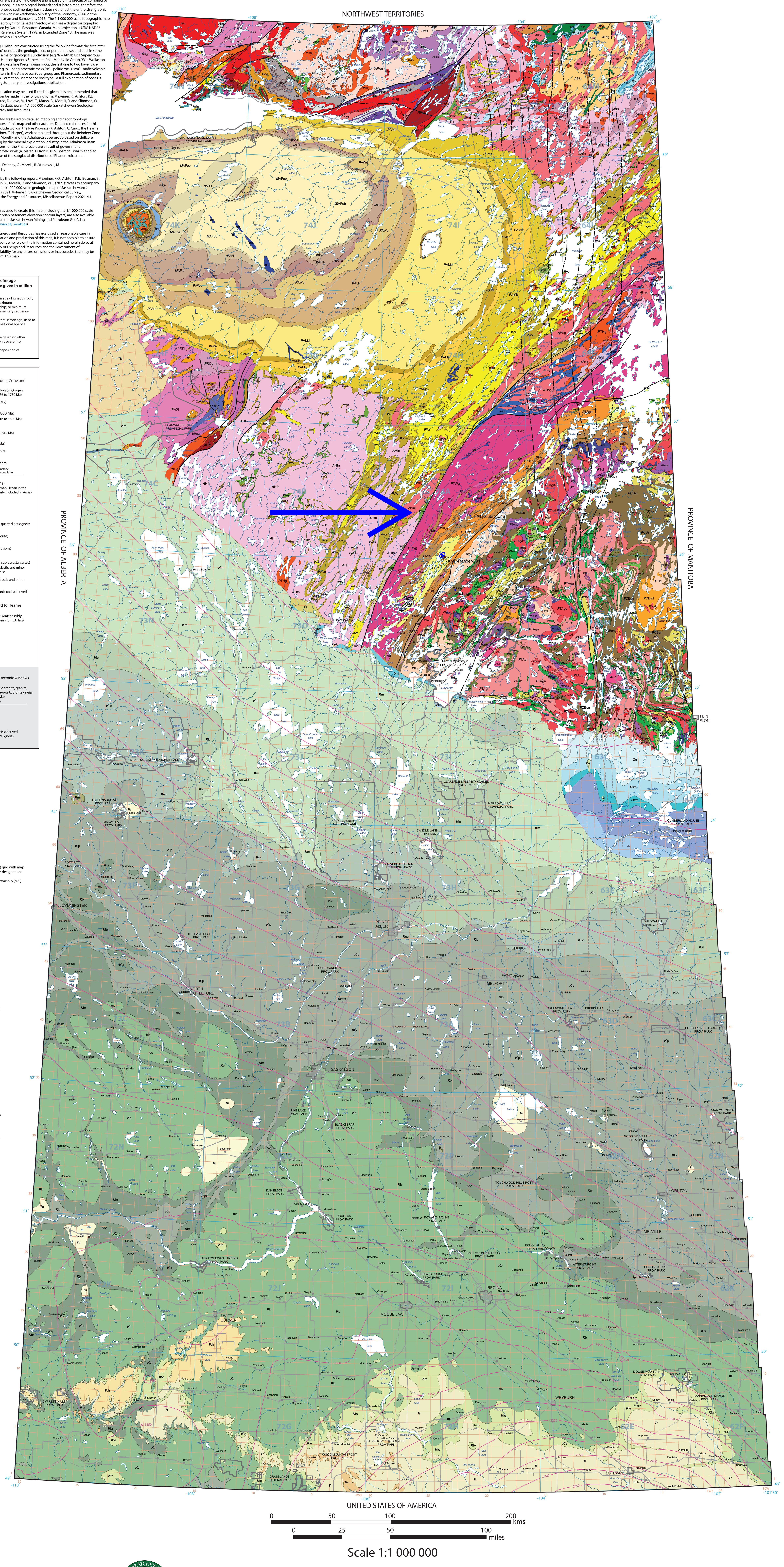
- ASg — Mirond Lake Igneous Suite: Charnockitic granite, granite, minor gabbro and ferrodiorite, tonalite-quartz diorite gneiss and derived migmatite (2488 to 2422 Ma)

intrusive contact with unit ASlt

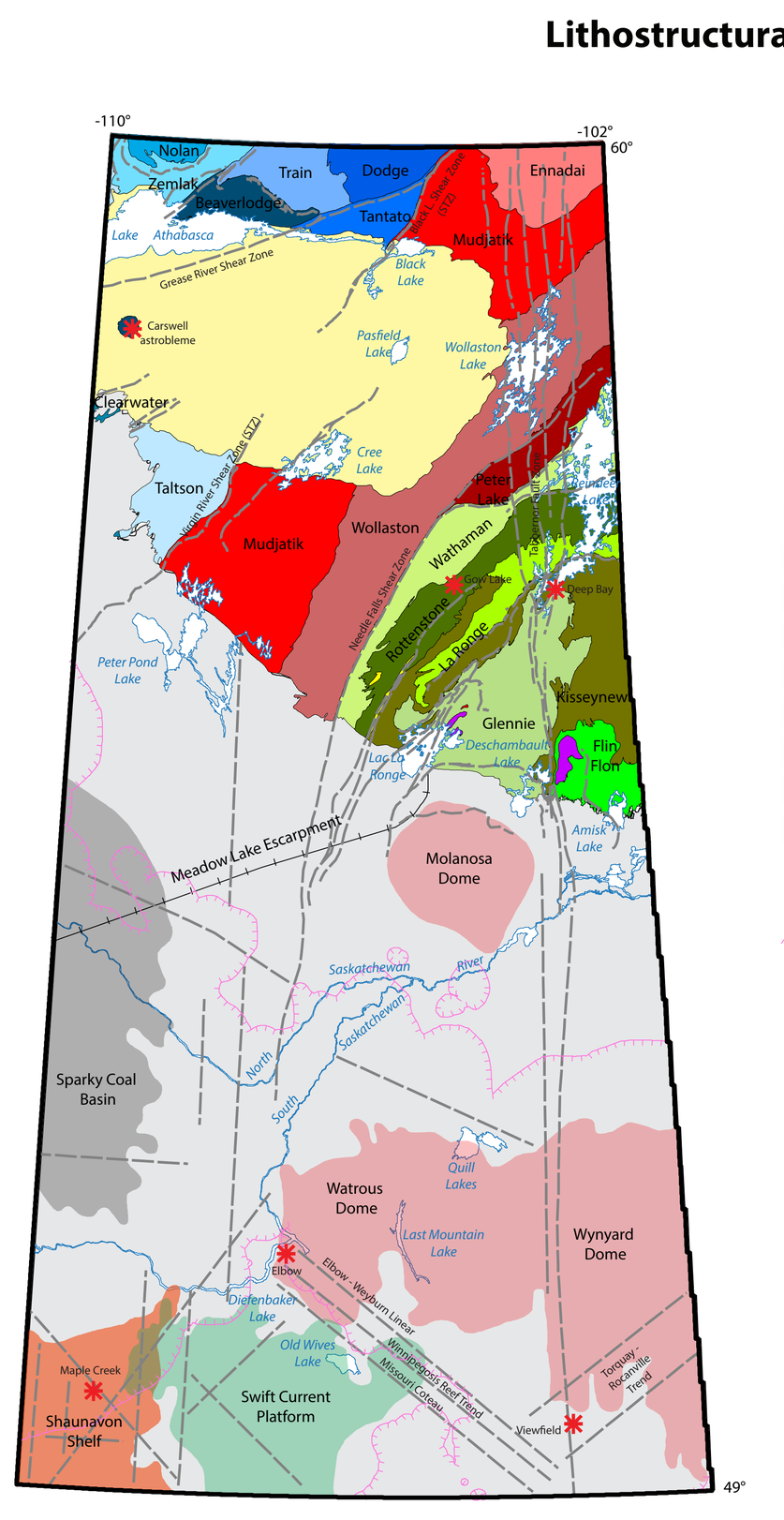
- ASlt — Leucogranodiorite to leucotonalite gneiss; derived migmatite (3117 to 2804 Ma); includes 'Q gneiss'

Map Symbols

- -1500 — Elevation contour of Precambrian basement relative to mean sea level in metres
- Geological contact (defined or approximate)
- Late fault or fault system: brittle to semi-brittle (brittle-ductile), in some cases overprinting older shear zones; defined, inferred in Athabasca and Phanerozoic basins
- Early thrust fault or shear zone: generally inclined with mainly horizontal translation, width up to kilometre-scale, generally early tectonic history, placed in basal part of thrust zone
- Multiply-reactivated shear zone: generally subvertical, but some moderately inclined with variable or unknown translation, width up to kilometre-scale
- Provincial highway
- Railway
- River
- City
- Provincial/national park
- 62M, 52°, -102° — National Topographic System (NTS) grid with map sheet labels and latitude/longitude designations
- 60, 25 — Dominion Land Survey grid with Township (N-S) and Range (E-W) designations
- Town/village



Lithostructural Domains of the Canadian Shield and Phanerozoic Structural Elements

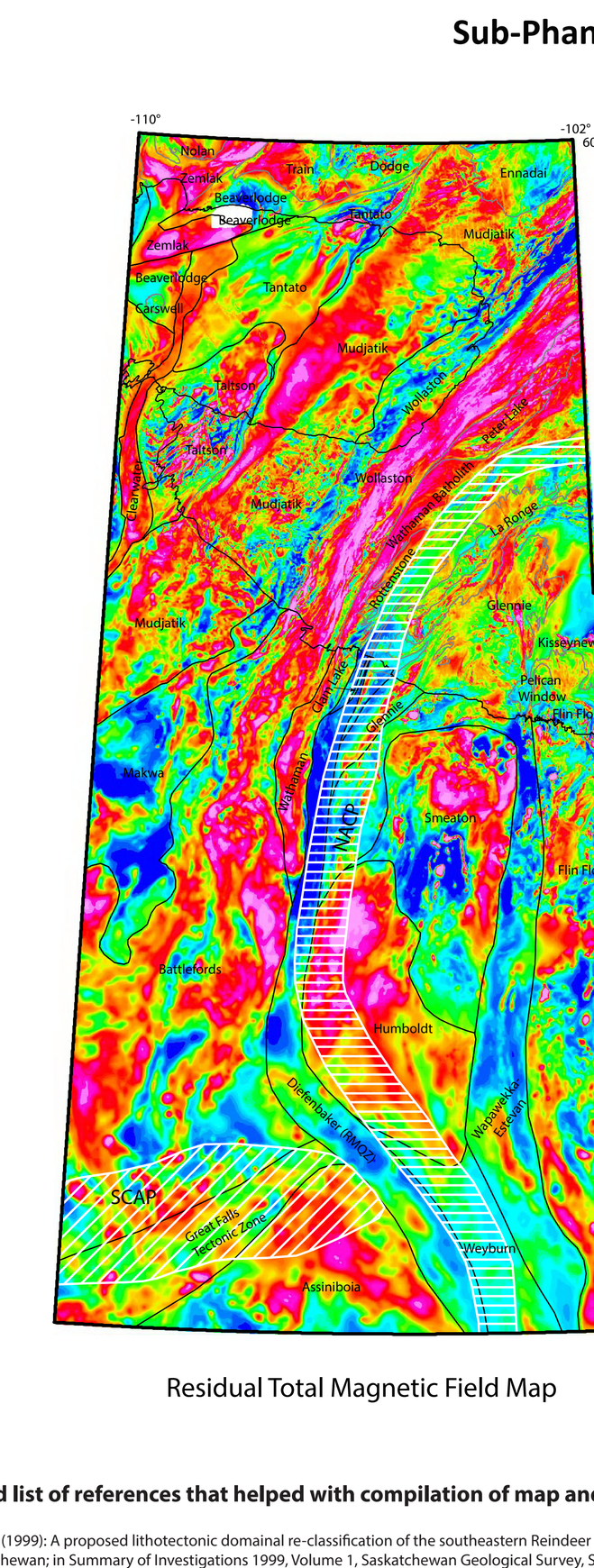


The Rae and Hearne provinces, comprising Archean basement rocks and overlying Proterozoic platformal cover sequences, are part of the western Churchill Structural Province and are separated from each other by the enigmatic Snowbird tectonic zone (STZ). The Rae and Hearne cratons are dominated by Archean rocks and are flanked by the Paleoproterozoic Taltson Orogen to the west and Trans-Hudson Orogen to the east. The Sask craton underlies much of the southeastern Shield but is only exposed in small tectonic windows. It is structurally overlain by Paleoproterozoic volcano-plutonic arc rocks and derived clastic sedimentary rocks of the Reindeer Zone. These rocks formed in an oceanic environment as the Rae-Hearne, Sask, and Superior (exposed in central Canada) cratons converged prior to amalgamating during the Trans-Hudson orogeny. The Canadian Shield in Saskatchewan has been further subdivided into a number of domains distinguished by rocks with distinct lithological and/or structural characteristics (Saskatchewan Geological Survey, 2003). Orosirian to Calymmian rocks of the Athabasca Supergroup are contained in the current geographical remnant called the Athabasca Basin. Sediments that formed these rocks were deposited unconformably on rocks of the western Churchill Structural Province.. The major lineaments, shown on the Canadian Shield, are the traces of a selection of major structures that include multiply-reactivated shear zones, thrusts, and brittle to semi-brittle faults.

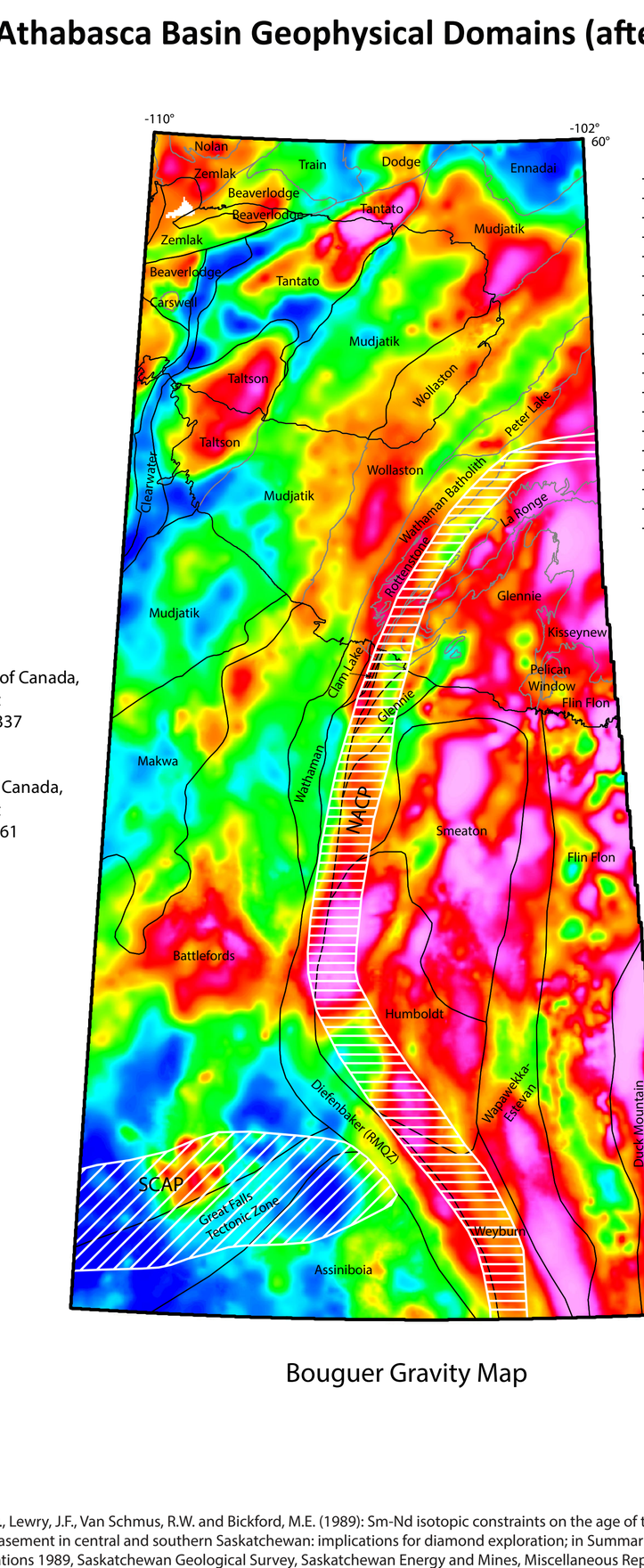
The surface of the Precambrian basement below the Phanerozoic exhibits many structural features that have been identified through seismic and well data (Kent and Christopher, 1994; Christopher, 2003). Many are dome-like features with positive relief that may simply be resistant erosional remnants, while others are reactivated fault blocks that affected facies distribution of overlying strata through time. Many of these features are expressed as orthogonal lineaments coincident with the basement structural fabric. Some have also been recognized at surface, like the Missouri Coteau, while others, such as the Swift Current Platform, are only recognized through isopach mapping or trends in structure maps.

The Meadow Lake Escarpment marks the northern erosional edge of Ordovician-Silurian carbonates, north of which Middle Devonian strata infill the erosional low on top of Cambrian sandstones (Haidl, 1989). The Punnichy Arch (comprising the Watrous and Wynyard domes) is a basement-controlled antiformal complex, which extends along the northern solution edge of the Middle Devonian Prairie Evaporite salt beds and represents the northern rim of the Williston Basin. The Winnipegosis Reef Trend, marking the southwestern edge of the Prairie Evaporite, and the Elbow-Weyburn Linear, delineating the eastern margin of the Swift Current Platform, both parallel the surface expression of the Missouri Coteau. The Swift Current Platform, a dome-like feature reactivated through time, is a region of thinning Devonian strata and has undergone numerous vertical fluctuations throughout the Phanerozoic, acting as a depositional basin during the Middle Jurassic. The Shaunavon Shelf demarcates the western flank of the Swift Current Platform and terminates the Middle Jurassic Shaunavon Sandstone facies. The Molanosa Dome is another basement-controlled feature that remained tectonically active through much of the Phanerozoic, acting as a paleo-upland during deposition of Cretaceous strata. The Sparky coal basin represents an area during the Early Cretaceous, where peat growth was equilibrated with sea-level rise for an extended period, leading to the development of broad depositional flats and the subsequent formation of coal. The northeast-trending, basement-controlled Torquay-Rocanville Trend in southeast Saskatchewan coincides with down-warped stratigraphy and a series of salt sinks. It also parallels and is possibly coincident with the northern projection of the Weldon-Brockton-Froid-Fromberg fault zone from the U.S. portion of the Williston Basin (Christopher, 1961; Gerhard et al., 1987).

Sub-Phanerozoic and Sub-Athabasca Basin Geophysical Domains (after Kreis et al., 2004)



Residual Total Magnetic Field Map



Bouguer Gravity Map

Sources for imagery

Magnetic: Geological Survey of Canada, Open File 7799, 2016, 1 sheet https://doi.org/10.4095/297337 (Open Access)

Gravity: Geological Survey of Canada, Open File 8081, 2017, 1 sheet https://doi.org/10.4095/299561 (Open Access)

Rae Province
Beaverlodge
Clearwater
Taltson
Tantato

Hearne Province
Battlefords
Makwa
Mudjatik

Reindeer Zone (includes Sask craton)
Clam Lake
Diefenbaker (equivalent to Reindeer Magnetic Quiet Zone)
Flin Flon
Glennie
Humboldt
Kisseynew
Smeaton
Rottenstone
Wapawekka-Estevan
Wathaman
Weyburn

Wyoming Province
Assiniboia
Great Falls Tectonic Zone

Superior Province
Duck Mountain

In 2004, Kreis et al. used provincial total field aeromagnetic and Bouguer gravity maps, aided by seismic data, to subdivide the sub-Phanerozoic Precambrian rocks into a number of geophysical domains based on extrapolation of major features on the exposed Shield. The Clearwater and Taltson domains of the Rae craton were extended to the southwest. The Mudjatik and Wathaman domains of the Hearne craton were also extrapolated southwestward, whereas the Wollaston Domain was subdivided into the Makwa and Battlefords domains based on magnetic susceptibility. The Assiniboia Domain was identified as an entity distinct from the Battlefords Domain based on the disruption of magnetic signatures that may mark the Great Falls Tectonic Zone, which separates the Wyoming and Hearne cratons. A number of ~1.76 Ga post-tectonic, anorogenic high-level granitic and extrusive rocks comprising the Swift Current Anorogenic Province (SCAP; Collerson et al., 1989; white diagonal hatch) further disrupt the aeromagnetic pattern in this area. The Diefenbaker Domain corresponds to the Reindeer magnetic quiet zone (RMQZ; Burwash et al., 1993) and represents the southern extension of the Rottenstone Domain; it overlaps with the broadly correlative North American Central Plains conductivity anomaly (NACP; Reitzel et al., 1970; white horizontal hatch) and occurs along the boundary between the Hearne and Sask cratons, the latter of which has been subdivided by magnetic characteristics into the Smeaton, Humboldt and Weyburn domains. Structurally overlying rocks of the Wapawekka-Estevan Domain flank the Sask craton and probably represent a boundary zone between the craton and juvenile rocks of the exposed Glennie and Flin Flon domains to the north and east, respectively, where the craton has also been overprinted by the Tabbernor fault zone. The Duck Mountain Domain represents a transition zone between juvenile rocks of the Reindeer Zone and predominantly Archean rocks of the Superior craton to the east, and may be correlative with the Superior Boundary Zone in Manitoba.

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