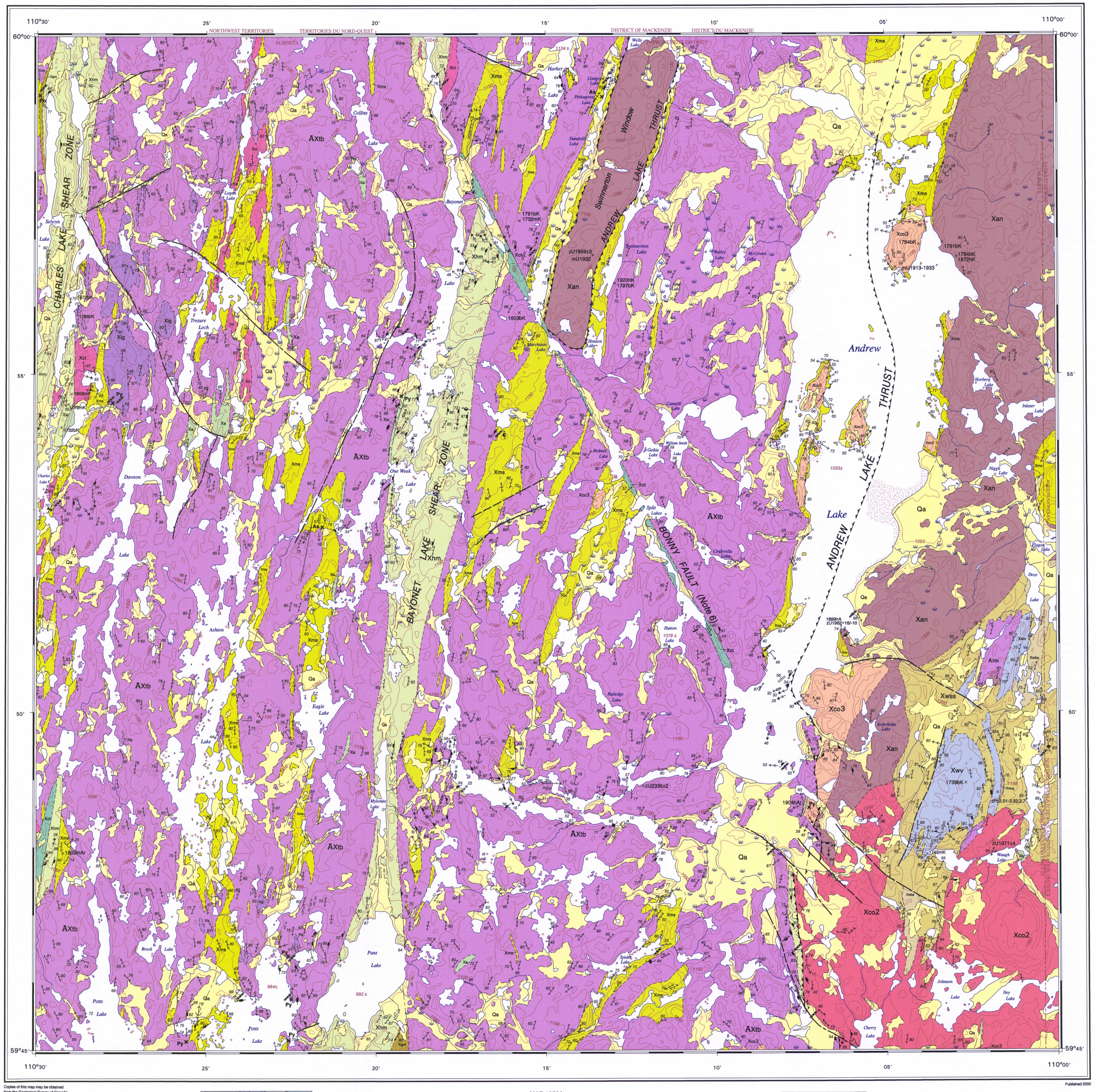
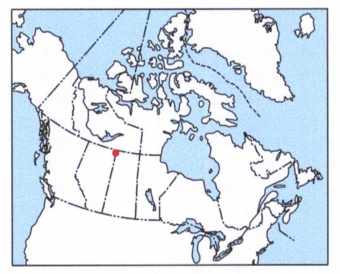
Natural Resources Canada / Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA



Copies of this map may be obtained
from the Geological Survey of Canada:
601 Booth Street, Ottawa, Ontario K1A 0E8
3303-33rd Street, N.W., Calgary, Alberta T2L 2A7
101-605 Robson Street, Vancouver, B.C. V6B 5J3



LOCATION MAP

MAP 1953A

GEOLOGY

ANDREW LAKE

ALBERTA-SASKATCHEWAN-NORTHWEST TERRITORIES

Scale 1:50 000/Échelle 1/50 000

kilometres 1 0 1 2 3 4 kilomètres

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

75D/12	75D/1	75C/4
74M/15	74M/16 1953A	74N/13
74M/10	74M/9 1952A	74N/12

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

Published 2000

CANADA ALBERTA Partnership on Minerals
Finding Minerals and Technology for Tomorrow

Canada

LEGEND

Coloured legend blocks indicate units that appear on this map

TALTSON MAGMATIC ZONE

CENOZOIC

QUATERNARY

- **Qa** — *Glacial and lacustrine sand and gravel; minor till*
- **Qv** — *Alluvium, colluvium*

PALEOZOIC

DEVONIAN

- **D** — *LA LOCHE and FITZGERALD formations*

PROTEROZOIC

PALEOPROTEROZOIC

- **XAG** — *ATHABASCA GROUP: thick bedded, coarse grained, hematitic quartz sandstone and pebbly sandstone; massive, locally laminated and crosslaminated; dark green, thinly laminated, silty argillite with slaty cleavage; quartz-hematite veining; weathers rust colour. Minor breccia*
- **Xct** — *CATACLASITE: highly fractured, recrystallized gneiss with randomized fabric (little or no planar fabric and no linear fabric); weathers rust colour. Minor breccia, mylonite*
- **Xgm** — *AMPHIBOLITE TO GREENSCHIST-GRADE MYLONITE: well foliated, light coloured mylonite to protomylonite with abundant sigma-type porphyroclasts. Protoliths include Taltson basement gneiss, Wylie Lake granite, Colin Lake granite, high-grade mylonite, Arch Lake granite, Charles Lake granite, Slave granite, and leucogranite (Note 3)*
- **Xlg** — *LEUCOGRANITE: weakly to nonfoliated, white to light grey to pink, muscovite-bearing, pegmatitic, coarse grained to megacrystic granite; rare biotite*
- **Xco3** — *COLIN LAKE WHITE GRANITE: weakly to nonfoliated, white to light grey, muscovite granite, biotite granite, leucogranite. Preliminary U-Pb monazite age is 1933-1921 Ma. Occurs as sub-km-scale bodies that intrude* (AXtb, Xms, Xan, and Xco2)
- **Xcg** — *CHIPEWYAN GRANITE: massive to weakly, locally moderately, foliated, medium- to coarse-grained pink to red granite. Includes rafts and xenoliths of basement gneisses and high-grade mylonites. U-Pb zircon upper intercept age is 1925 ±8 Ma (Note 1)*
- **Xws** — *WESTERN SLAVE GRANITE: massive to weakly, locally moderately, foliated, medium-to coarse-grained quartz monzonite, monzogranite, and granite; colour varies from white to pink; small clots of garnet, biotite, hercynite, and cordierite. Locally abundant rafts of granitic gneiss, and pelitic and quartzitic paragneiss. Dykes of Slave granite (1934 Ma; Note 1) on the margin of main pluton intrude Arch Lake granite and high-grade mylonite of LLSZ*
- **Xcl** — *CHARLES LAKE GRANITE: massive to foliated megacrystic granite with 15-30 per cent K-feldspar megacrysts in a medium grained, biotite-rich matrix. Megacrysts have distinctive biotite inclusions. Local fine grained porphyry with 2-3 per cent disseminated, fine grained pyrite. Unit is Granite F of Godfrey and Langenberg (1986). Deformed in CLSZ into amphibolite- to greenshcist- grade protomylonite to mylonite. Preliminary U-Pb age is 1933 Ma (Note 1)*
- **Xfc** — *FISHING CREEK GRANODIORITE: coarse grained, massive to weakly foliated quartz-rich granodiorite with 20-30 per cent plagioclase, 10-20 per cent euhedral K-feldspars with biotite inclusions, and 5-10 per cent biotite as small pods enclosing minor garnet. Not deformed in CLSZ; age unknown*
- **Xpm** — *HIGH-GRADE PROTOMYLONITE: foliated quartzo-feldspathic protomylonite with incipient sigma-porphyroclast development from K-feldspar megacrysts. Protolith is mainly Wylie Lake granodiorite*
- **Xhm** — *HIGH-GRADE MYLONITE: well banded, quartzo-feldspathic mylonite, protomylonite, and ultramylonite with sparsely preserved, subhorizontally stretched quartz lineations, amphibolite pull-aparts, and ductile feldspars indicative of upper amphibolite to granulite facies during shearing. Protoliths include Taltson basement gneisses, Wylie Lake granodiorite, Colin Lake pluton and Arch Lake granite (units* Xco1, and Xco2 *only). Variable greenschist and sub-greenschist grade overprint*

PRE-TECTONIC (GRANULITE-GRADE) TALTSON PLUTONIC ROCKS

- **Xal** — *ARCH LAKE GRANITE: massive, weakly to well foliated, mylonitic granite to syenogranitic gneiss with 30 to 50 per cent lenticular, 1x3 cm K-feldspar crystals in a fine- to medium-grained matrix of biotite, quartz, feldspar, and magnetite. Locally forms L-S tectonite with rods of blue quartz in association with high-grade mylonite in the Charles Lake and Leland Lakes shear zones (Note 3). U-Pb zircon age is 1938 ±1 Ma (Note 1)*
- **Xan** — *ANDREW LAKE GRANODIORITE: massive to well foliated biotite-hornblende granodiorite to diorite orthogneiss with 30 to 40 per cent, equant, 5-10 mm K-feldspar phenocrysts in a medium- to coarse-grained matrix of biotite, hornblende, quartz, and feldspar. Locally cut by pink Slave? granite dykes. Deformed into high grade mylonite in Andrew Lake shear zone. U-Pb zircon ages are 1959 ±3 Ma and 1962 +16/-10 Ma (Note 1)*
- **Xco2** — *COLIN LAKE GRANITE (main phase): moderately to well foliated, lineated, mylonitic K-feldspar megacrystic biotite granite gneiss with 30 to 50 per cent lenticular 3x8 cm K-feldspar crystals in a medium- to coarse-grained matrix of biotite, quartz, feldspar, and minor hornblende. Locally forms dip-lineated L-S tectonite in high-grade mylonite of the Andrew Lake shear zone (Note 3)*
- **Xco1** — *COLIN LAKE QUARTZ DIORITE: massive to moderately to well foliated, biotite-rich quartz diorite that intrudes the Waugh Lake Group. Preliminary U-Pb zircon age is 1971 Ma (Note 1)*

WAUGH LAKE GROUP (Xwss-Xwbs) 2.01 to 1.97 Ga; Note 1

- **Xwbs** — *Waugh Lake Biotite Schist: foliated, biotite-rich schist, phyllite, phyllonite, minor quartzite; locally abundant quartz veins; minor pegmatite*
- **Xwv** — *Waugh Lake Volcanic Rocks: foliated, medium- to coarse-grained, chlorite- and biotite-rich mafic schistose gneiss deformed at greenschist to sub-greenschist grade*
- **Xwcg** — *Waugh Lake Conglomerate: foliated, medium- to coarse-grained, muscovitic, feldspathic, pebble to granule conglomerate; metagraywacke*
- **Xwss** — *Waugh Lake Paragneiss: foliated, medium- to coarse-grained, sericitic gniess, schistose gneiss; minor conglomerate, chlorite-rich schistose gneiss, quartzite*

RUTLEDGE RIVER GROUP 2.13 to 2.09 Ga; Note 4

- **Xms** — *Metasedimentary Gneiss: large inliers of quartzite, semipelitic gneiss, and pelitic gneiss; common mineral assemblages in pelitic gneiss include biotite+garnet+sillimanite+cordierite in the Leland Lakes area (74M/14), with biotite+garnet+sillimanite common in areas to the east; locally pervasive pegmatite veins and dykes. Correlative with Rutledge River supracrustal gneisses of the northern Taltson magmatic zone (Note 4)*

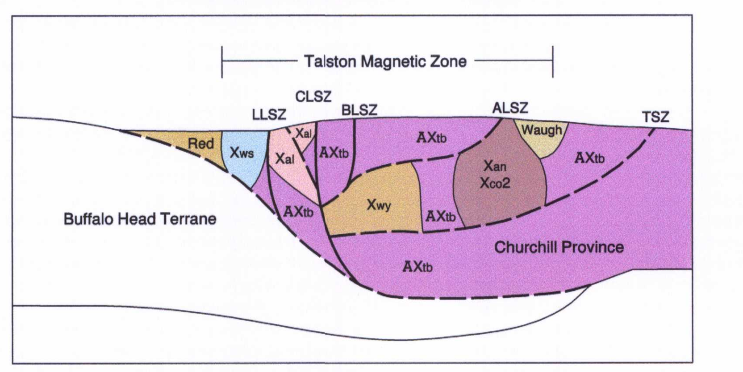
TALTSON BASEMENT COMPLEX

ARCHEAN OR PROTEROZOIC

MESOARCHEAN TO PALEOPROTEROZOIC

- **Xa** — *AMPHIBOLITE: well foliated, layered biotite amphibolite; local mafic granulite*
- **Xtbs** — *SYENOGRANITE GNEISS: well foliated to mylonitic, biotite-, K-feldspar-rich syenogranite gneiss. Locally intercalated with layered gneisses; pervasively intruded by medium grained pink granite dykes coplanar to fabric. A concordant U-Pb zircon age is 2138 ±1 Ma (Note 1)*
- **AXtbh** — *HORNBLENDE GRANITE GNEISS: well foliated to mylonitic hornblende-bearing, white weathering granite gneiss. U-Pb zircon age is 2380 ±10 Ma (Note 1)*
- **AXtb** — *LAYERED GNEISSES: well foliated, banded, mylonitic, biotite-hornblende granite to granodiorite gneiss, hornblende diorite gneiss; locally well layered, locally dismembered and ptygmatically folded; locally highly sheared straight gneiss. Pervasively intruded by medium grained pink granite, dykes, sills, and small tabular intrusions forming up to 50 per cent of some outcrops. Preliminary U-Pb zircon ages range from 2.14 to 3.2 Ga (Note 1)*
- **Atbt** — *TONALITE GNEISS: well foliated to mylonitic, biotite-rich tonalite gneiss with interlayered amphibolite gneiss. Locally intercalated with layered gneisses. Pervasively intruded by medium grained pink granite dykes coplanar to fabric. Zircons give a three point U-Pb upper intercept age of 3076 +15/-5 Ma (Note 1)*
- **mf** — *MAFIC GRANULITE*

SCHEMATIC STRATIGRAPHIC RELATIONSHIPS



Schematic crustal cross-section illusrating the crustal geometry of the Talston magnetic zone (TMZ) as proposed by McDonough et al. (CJES 2000). Evolution of the TMZ includes: (a) easterly dipping subduction of oceanic crust beneath the Churchill Province and a development of a continental arc prior to 1970 Ma; (b) continental collision and terminal phase of crustal thickening at about 1934 Ma with continental subduction of the Buffalo Head terrane and development of a doubly vergent sinistral transpressive orogen at granulite grade; (c) continued shortening and underthrusting of Buffalo Head crust at about 1900 Ma. with amphibolite to upper greenschist grade shear zone activity at the present erosion level. Basement blocks after McNicoll et al. (CJES 2000):

- **Xes** — *EASTERN SLAVE GRANITE: massive to weakly foliated, locally cataclasized, medium- to coarse-grained granite with equant 1-4 cm K-feldspar crystals in an equigranular matrix of quartz, feldspar, biotite, and locally abundant garnet in association with paragneiss xenoliths. Locally abundant of xenoltihs of paragneiss, banded basement gneiss, and high-grade mylonite (CLSZ?)*
- **Xdl** — *DIP-LINEATED MYLONITE: foliated quartzo-feldspathic migmatitic mylonite with prominent downdip, stretched quartz-feldspar lineation*
- **Xwy** — *WYLIE LAKE GRANODIORITE: moderately to well foliated, mylonitic, coarse grained, biotite-rich granite to granodiorite gneiss; locally abundant lenticular K-feldspar megacrysts in a medium- to coarse-grained matrix of biotite, chlorite, quartz, feldspar, and minor hornblende. An upper intercept U-Pb zircon age is 1963 +6/-4 Ma (Note 1)*

Geological compilation by M.R. McDonough, 1994

Quaternary Geology compiled by J. Bednarski 1995

Digital cartography by the Geological Survey of Canada (Calgary)

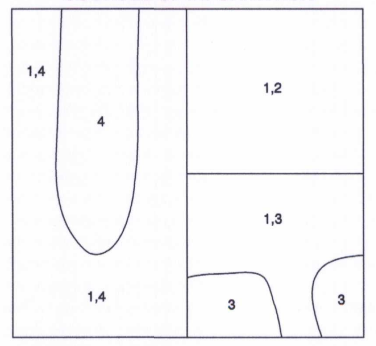
Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital base map at the scale of 1:50 000 from Geomatics Canada, Natural Resources Canada, modified for publication by the Geological Survey of Canada

Magnetic declination 2000, 19°22' East, decreasing 18.1' annually

Elevations in feet above mean sea level

SOURCES OF INFORMATION



1. McDonough, M.R., Grover, T.W., McNicoll, V.J., and Lindsay, D.D. 1993. Geological Survey of Canada (Calgary), Paper 93-1C, p.221-232; and McDonough, M.R., unpublished mapping, 1993, 1994.
2. Godfrey, J.G., 1961, Alberta Research Council, Preliminary Report 58-3
3. Godfrey, J.G., 1963, Alberta Research Council, Preliminary Report 61-2
4. Godfrey, J.G., 1966, Alberta Research Council, Preliminary Report 65-6

NOTES

1. U-Pb zircon and monazite ages of magmatic gneisses of the Taltson magmatic zone (NTS 74M, 74L) range from 1.97 to 1.92 Ga. Gneisses of the Taltson basement complex (TBC) range in age from 3.2 to 2.14 Ga (see McNicoll et al., 1993, 1994; McDonough et al., 1995; McNicoll and McDonough, 1994; McDonough and McNicoll, 1997; McNicoll et al., in press; McDonough et al., in press. New detritial zircon U-Pb data and strong lithological resemblance led McDonough and McNicoll (1997) to reassign the Burntwood Group strata Godfrey (1986) to the Athabasca Group following the original designation of Fahrig (1961).
2. Ar-cooling ages for mica from the NTS 74M area cluster around 1800 Ma, and hornblende-cooling ages are about 1900 Ma (Baadsgaard and Godfrey, 1972; Plint and McDonough, 1995; McDonough, 1997).
3. Leland Lakes shear zone (LLSZ) and Charles Lake shear zone (CLSZ) are composite shear zones active under granulite to upper amphibolite facies conditions prior to ca.1934 Ma, and later at amphibolite to greenschist and sub-greenschist facies conditions from ca.1900 to 1800 Ma. Bayonet Lake shear zone (BLSZ) is a granulite-grade splay of CLSZ, and is offset by about 10 km by a dextral, greenschist-grade shear zone, the Whaleback Lake shear zone. The Andrew Lake shear zone is a shallow- to moderate-dipping, upper amphibolite to granulite facies shear zone with down-dip stretching lineations and corresponding kinematic indicators that show that Taltson basement complex gneisses were thrust to the east-northeast in a dextral-oblique sense over Andrew Lake granodiorite and Colin Lake granite. Its strain dissipates to the south into the Colin Lake pluton, where dip-lineated L-S tectonites are found in the eastern portion of the pluton. The Bonny Fault is a brittle fault with approximately 4.5 km of sinistral offset (see McDonough et al., 1993; McDonough et al., 1994; McDonough et al., 1995; Plint and McDonough, 1995; Schetselaar and McDonough, 1996; Grover et al., 1997; McDonough, 1997; McDonough et al., in press).
4. Metasedimentary gneisses of unit Xms occur as enclaves within TBC gneisses, and as rafts within plutonic units. These gneisses are correlative with 2.13 to 2.09 Ga supracrustal gneisses of the Rutledge River basin (Bostock and van Breemen, 1994), and form a cover sequence deposited on gneisses of the Taltson basement complex (McDonough et al., in press).
5. For discussion of mineral occurrences see McDonough and Abercrombie (1995), McDonough (1997) and references therein.

REFERENCES

Baadsgaard, H. and Godfrey, J.D.
1972: Geochronology of the Canadian Shield in northeastern Alberta I. Andrew Lake area; Canadian Journal of Earth Sciences, v. 4, p. 541-563.

Bostock, H.H. and van Breemen, O.
1994: Ages of detrital and metamorphic zircons and monazites from a pre-Taltson magmatic zone basin at the western margin of Rae Province; Canadian Journal of Earth Sciences, v. 31, p. 1353-1364.

Fahrig, W.F.
1961: The geology of the Athabasca Formation; Geological Survey of Canada, Bulletin 68, p. 41.

Godfrey, J.D.
1986: Geology of the Precambrian Shield in northeastern Alberta; Alberta Research Council, Map EM 180, 1:250 000 scale.

Grover, T.W., Pattison, D.R.M., McDonough, M.R., and McNicoll, V.J.
1997: Tectonometamorphic evolution of the southern Taltson magmatic zone and associated shear zones, northeastern Alberta; Canadian Mineralogist, v. 35, p. 1051-1067.

McDonough, M.R.
1997: Structural controls and age constraints on sulphide mineralization, southern Taltson magmatic zone, northeastern Alberta; *in* Exploring for Minerals in Alberta, (ed.) R.W. Macqueen; Geological Survey of Canada, Bulletin 500, p. 1-12.

McDonough, M.R. and Abercrombie, H.J.
1995: Mineral occurrences in Middle Devonian carbonates, Salt River and Stoney Islands (Slave River) areas, northeastern Alberta (NTS 74M); *in* Current Research, Part C; Geological Survey of Canada, Paper 95-1C, p. 125-130.

McDonough, M.R. and McNicoll, V.J.
1997: U-Pb age constraints on the timing of deposition of the Waugh Lake and Burntwood (Athabasca) groups, southern Taltson magmatic zone, northeastern Alberta; *in* Radiogenic Age and Isotopic Studies: Report 10, Current Research, Part F; Geological Survey of Canada, Paper 1997F, p. 101-111.

McDonough, M.R., Grover, T.W., McNicoll, V.J., and Lindsay, D.D.
1993: Preliminary report of the geology of the southern Taltson magmatic zone, northeastern Alberta (74M/14, 74M/15 and 74M/16); *in* Current Research, Part C; Geological Survey of Canada, Paper 93-1C; p. 221-232.

McDonough, M.R., Grover, T.W., McNicoll, V.J., Lindsay, D.D., Kelly, K.L., and Guerstein, P.G.
1994: Geology, Tulip Lake East-Half, Alberta-NWT (NTS 74M/14); Geological Survey of Canada, Open File 2820, scale 1:50 000.

McDonough, M.R., Grover, T.W., McNicoll, V.J., and Schetselaar, E.M.
1995: Age and kinematics of crustal shortening and escape in a two-sided oblique-slip collisional and magmatic orogen, Paleoproterozoic Taltson magmatic zone, northeastern Alberta; *in* Report of LITHOPROBE Alberta Basement Transects Workshop, (ed.) G.M. Ross; LITHOPROBE, Report 47, p. 246-308.

McDonough, M.R., McNicoll, V.J., Schetselaar, E.M., and Grover, T.W.
in press: Geochronological and kinematic constraints on crustal shortening and escape in a two-sided oblique-slip collisional and magmatic orogen, Paleoproterozoic Taltson magmatic zone, northeastern Alberta; Canadian Journal of Earth Sciences, submitted June 1999.

McNicoll, V.J., McDonough, M.R., and Grover, T.W.
1993: Preliminary U-Pb geochronology of the southern Taltson magmatic zone, northeastern Alberta; *in* Report of LITHOPROBE Alberta Basement Transects Workshop, (ed.) G.M. Ross; LITHOPROBE, Report 31, p. 129.

McNicoll, V.J., McDonough, M.R., and Grover, T.W.
1994: U-Pb geochronological studies in the southern Taltson magmatic zone, northeastern Alberta; *in* Report of LITHOPROBE Alberta Basement Transects Workshop, (ed.) G.M. Ross, LITHOPROBE, Report 37, p. 270-273.

McNicoll, V.J., Thériault, R.J., and McDonough, M.R.
in press: Taltson basement gneisses: U-Pb and Nd isotopic constraints on the basement to the Paleoproterozoic Taltson magmatic zone, northeastern Alberta; Canadian Journal of Earth Sciences, submitted June 1999.

Plint, H.E. and McDonough, M.R.
1995: 40Ar/39Ar and K-Ar constraints on shear zone evolution, southern Taltson magmatic zone, northeast Alberta; Canadian Journal of Earth Sciences, v. 32, p. 281-291.

Schetselaar, E.M. and McDonough, M.R.
1996: Shear zone mapping using ERS-1 SAR images of the paleoproterozoic Taltson magmatic zone northeast Alberta; ITC Journal (Holland), 1996-2, p. 166-175.

- **Xdh** — *DOG HEAD GRANODIORITE GNEISS: moderately to well foliated, locally mylonitic and/or isoclinally folded, coarse grained, heteroclastic, biotite-rich, hornblende-bearing granodiorite to quartz diorite gneiss; abundant lenticular K-feldspar megacrysts in a coarse grained matrix with plagioclase >K-feldspar, biotite, chlorite, quartz, and hornblende. Corresponds to Thesis Lake granite unit of Godfrey (1986), and is interpreted here to be a phase of the Wylie Pluton. The type locality at Dog Head on Slave River (74L/11), contains highly strained gneiss with abundant stringers of garnet-bearing anatectic melt, and was mapped by Godfrey (1986) as granitized metasediment on this basis. U-Pb age not known*

Geological boundary (defined, approximate, assumed)
Geological boundary (assumed projection under cover of younger deposits)
Bedding, tops known (inclined, vertical)
Foliation, high-grade mylonite (inclined, vertical)
Foliation, greenschist mylonite (inclined, vertical)
First foliation (inclined, vertical)
Second foliation (inclined, vertical)
Lineation, high-grade stretching (inclined)
Lineation, greenschist stretching (inclined)
Mesoscopic fold axis, vergence indicated by tick (inclined)
Mesoscopic W-fold axis (inclined)
Mesoscopic U-fold axis (inclined)
Mesoscopic sheath-fold axis (inclined)
Axial plane of mesoscopic fold (inclined, vertical)
Fault displacement unknown (defined, approximate)
Fault displacement unknown (assumed projection under cover of younger deposits)
Thrust fault, dextral oblique (defined, approximate)
Thrust fault, dextral oblique (assumed projection under cover of younger deposits)
Small scale thrust fault
Brecciation
Shear bands, ductile, dextral (inclined, vertical)
Shear bands, ductile, sinistral (inclined, vertical)
Shear bands, brittle, dextral (inclined, vertical)
Shear bands, brittle, sinistral (inclined, vertical)
Quartz vein (inclined, vertical)
Pegmatite vein (inclined, vertical)
Epidote vein (inclined, vertical)
Granite vein (inclined, vertical)
Joint (inclined, vertical)
Antiform and synform, trace of axial surface (fold upright; approximate)
K-Ar date (Ma; b, biotite; h, hornblende; m, muscovite) ... 1835 bK ×
Ar-Ar date (Ma; h, hornblende; m, muscovite) ... 1904 hAr ×
U-Pb date (Ma; z, zircon; m, monazite) ... zU 1963+4 ×
Pb-Pb age (Ga; z, zircon) ... zPb 2.01-2.32 ×
Gossan (no orientation implied)
Mineral occurance ... × Gp

MINERALS

Arsenopyrite	As
Chalcopyrite	Cp
Hematite	Hm
Magnetite	Mt
Molybdenite	Mo
Pyrite	Py
Pyrrhotite	Po

Recommended citation:
McDonough, M.R., Grover, T.W., McNicoll, V.J., Lindsay, D.D., Kelly, K.L., Guerstein, P.G. and Bednarski, J.
2000: Geology, Andrew Lake, Alberta-Saskatchewan-Northwest Territories; Geological Survey of Canada, Map 1953A, scale 1:50 000.

1953A