Saskatchewan
Energy and Mines

Saskatchewan
Geological Survey

Map 229A. COMPILATION BEDROCK GEOLOGY SERIES

GEIKIE RIVER, NTS AREA 74H

SASKATCHEWAN

Scale 1:250,000

FIRST EDITION, 1983

LEGEND

NEOHELIKIAN/HADRYNIAN

dd — **Diabase-gabbro:** fine to coarse grained, massive to weakly foliated ± olivine ± biotite ± hypersthene; intruding Athabasca Group and basement in Moore Lakes Complex

PALEOHELIKIAN

ATHABASCA GROUP

WP — **Wolverine Point Formation:** sandstone and siltstone, locally tuffaceous

MF — **Manitou Falls Formation:** sandstone and conglomerate
MFd intraclast-rich member with from 1 to 10 percent intraclast layers; local interbedded siltstone and shale
MFc fluvial sandstone member, locally pebbly
MFb conglomerate member

LATE APHEBIAN (HUDSONIAN[1])

Cataclasite: mylonite and sheared rocks of the Needle Falls Shear Zone; derived from rocks of the Wollaston and Peter Lake Domains

WOLLASTON DOMAIN

LATE APHEBIAN (HUDSONIAN)

Wcgg — **Granitic pegmatite:** very coarse grained ± biotite

Wsg — **Syenogranite-monzogranite:** medium to coarse grained, equigranular, massive to foliated; grey, buff or pink; generally containing less than 10 percent biotite; local xenoliths of pt(Sbb)/mt(Wf); *mostly intrusive into Wollaston Group*

Wgdb — **Biotite granodiorite-tonalite:** medium to coarse grained, massive to foliated, grey to buff; local xenoliths and rafts of pt(Sbb)/mt(Wf); migmatite, local psammitic gneiss; *probably intrusive into unit Wfn*

EARLY TO MIDDLE APHEBIAN

Wollaston Group

Wfn — **Undifferentiated paragneiss:** pelite, psammopelite, metaquartzite, meta-arkose, calc-silicate rock, subcropping beneath Athabasca Group

Wcn — **Calc-silicate gneiss:** generally quartz-poor heterogenous calcareous metasediments with local minor sodium-rich rocks; highly variable texture, grain size and colour, locally anatectic; *pegmatitic with intrusive features, including:* massive calc-silicate rock, well layered calc-silicate gneiss, *amphibolite*, amphibolite gneiss, *diopside pseudo-gabbro* and minor marble: ± tremolite-actinolite ± diopside ± albite ± carbonate ± epidote ± sphene ± scapolite; *derived from impure limestones, dolomites, marls, and minor evaporite*

Wmn — **Psammitic gneiss:** fine to coarse grained, well foliated to massive; calcareous psammite containing less than 20 percent calc-silicate minerals (generally tremolite-actinolite ± diopside ± epidote); biotite psammite containing up to 10 percent biotite ± magnetite; local interlayered psammopelite

Wpsm — **Pelitic to psammopelitic gneiss and schist:** moderately to intensely foliated, containing more than 10 percent mafic minerals (commonly biotite) ± garnet ± cordierite ± sillimanite

Wpf: graphite-bearing pelitic gneiss

PROBABLY EARLY APHEBIAN (LATE ARCHEAN?)

Wqx — **Metaquartzite:** medium to coarse grained, equigranular, massive to foliated, highly sheared

Wms — **Muscovite schist:** coarse grained, sheared; *possibly derived from pelitic metasediments*

Wmv — **Mafic metavolcanic rock:** fine to coarse grained amphibolite and amphibolite gneiss with minor felsic gneiss; locally sheared

UNCONFORMITY

ARCHEAN, DEFORMED AND METAMORPHOSED WITH APHEBIAN SUPRACRUSTAL ROCKS DURING THE HUDSONIAN OROGENY

Wfm — **Foliated granitoid rock:** syenogranite to granodiorite, medium to coarse grained, generally moderately to well foliated, biotite-bearing with rare hypersthene

Wfb: biotite-hornblende bearing

ROTTENSTONE DOMAIN

APHEBIAN(HUDSONIAN)

Rgp — **Biotite monzogranite-granodiorite:** medium to coarse grained, massive to moderately foliated, equigranular to coarsely megacrystic; with intrusive igneous features

Rgn — **Monzogranite-granodiorite:** containing abundant xenoliths and rafts of amphibolite and hornblende-biotite gneiss derived from unit Pbn

WATHAMAN BATHOLITH

PETER LAKE DOMAIN

APHEBIAN AND ARCHEAN ROCKS, STRONGLY REWORKED PROBABLY LATE IN THE HUDSONIAN

Pgn — **Felsic gneiss:** generally well foliated, fine to coarse grained gneiss with enclosed of mainly granite displaying remnant intrusive igneous features and feldspar megacrysts; ± biotite ± hornblende; generally monzogranitic to syenogranitic; local mafic rafts and xenoliths; *probably largely derived from unit Pg*

Pbgn — **Hornblendic gneiss:** medium to coarse grained, generally well foliated, tonalitic to gabbroic with minor amphibolite and biotite schist; *probably largely derived from unit Pbg*

Pbng: area cut by numerous granitic dykes and sills likely derived from the Wathaman Batholith

PARKER LAKE GNEISSES

HUDSONIAN WITH POSSIBLE ARCHEAN ELEMENTS

Pg — **Granitic plutonic rocks:** medium to coarse grained, massive to well foliated, locally porphyritic; ± biotite ± hornblende; generally syenogranitic to monzogranitic with minor quartz syenite; local mafic rafts and xenoliths

PROBABLY ARCHEAN

Pbg — **Basic to intermediate plutonic rocks:** medium to coarse grained, massive to well foliated, local remnant intrusive igneous features; quartz diorite to gabbroic, with minor anorthosite and ultramafic rock; local gravitational layering

Pqf — **Quartzofeldspathic gneiss:** fine to medium grained, massive to foliated, locally colour banded; ± biotite ± hornblende; *probably of supracrustal origin*

PETER LAKE COMPLEX

MUDJATIK DOMAIN

PROBABLY EARLY TO MIDDLE APHEBIAN (correlative with Wollaston Group)

Mn — **Undifferentiated paragneiss:** pelite, psammopelite, metaquartzite, meta-arkose, calc-silicate rock, intermixed with felsic gneiss (unit Mfn), subcropping beneath Athabasca Group

? UNCONFORMITY ?

PROBABLY MAINLY ARCHEAN

Mfn — **Felsic gneiss:** massive granitoid rock and granitic gneiss, subcropping beneath Athabasca Group

[1]The term 'Hudsonian' has been used by most authors in Saskatchewan to indicate the tectonometamorphic activity or progeny which affected Aphebian rocks and older basement during the interval approximately 1900 to 1600 Ma ago (see Douglas, 1990; Bell and Macdonald, 1980).

GEOLOGICAL NOTES

Rock exposure is poor in this region, particularly the northwest which is largely underlain by flat-lying Paleohelikian sedimentary rocks of the Athabasca Group. The Athabasca Group mainly comprises mature fluviatile sandstones and grits. A basal conglomerate is commonly present. The underlying crystalline basement rocks are characteristically rust stained and saprolitic to a depth of 50 m or more, probably as a result of pre-Athabasca weathering. The crystalline rocks have been grouped into lithostructural domains as established for the Saskatchewan Precambrian Shield (Lewry and Sibbald, 1977, 1980; Ray and Wanless, 1980; Macdonald and Broughton, 1980) and outcropping within the area are parts of the Wollaston, Peter Lake and Rottenstone Domains. Rocks of the Mudjatik Domain are inferred to subcrop beneath Athabasca Group sandstone in the northwest part of the map (Gilboy, 1982).

Wollaston Domain

Archean basement (unit Wfn) is exposed as granitic inliers in the Wollaston Domain. The unconformably overlying and folded Aphebian rocks are mainly composed of members of the Wollaston Group (units Wpsn, Wmn, Wcn and Wn), a regionally distributed metasedimentary succession that includes a widespread basal unit of graphitic pelite (subunit Wpf). An older Aphebian to possibly late Archean group of supracrustal rocks (units Wmv, Wms and Wqx) has also been recognized (the 'Needle Falls group' of Ray, 1979). This lower group includes sheared remnants of metavolcanics, pelitic schists and metaquartzites.

In the Moore Lakes Complex, gneisses of the Wollaston Domain and sedimentary rocks of the Athabasca Group are intruded by a large body of diabase/gabbro of probable Neohelikian/Hadrynian age.

Rottenstone and Peter Lake Domains

The Rottenstone Domain is represented in the area by granitic plutonic rocks of the Wathaman Batholith. A U-Pb zircon date of 1865±12 Ma has been obtained from this body (Ray and Wanless, 1980).

Rocks of the Peter Lake Domain are exposed in a wedge between the Wollaston and Rottenstone Domains. The central, less deformed portion comprises massive to weakly foliated plutonic rocks of the Peter Lake Complex in which igneous textures are commonly preserved despite subsequent metamorphism. Two main plutonic suites are recognized. An older generation of basic to intermediate rocks (unit Pbg) includes minor ultramafic and anorthositic material; some basic bodies display remnant gravitational layering. A U-Pb zircon date of 2538±10 Ma suggests this basic suite represents an Archean intrusive material (Ray and Wanless, 1980). The younger plutonic suite is represented by granitic intrusives (unit Pg) which commonly cut the basic rocks.

Deformation increases markedly towards the margins of the Peter Lake Domain and the plutonic rocks pass gradationally into the highly foliated Parker Lake Gneisses. The margin with the Wollaston Domain is marked by intensely sheared cataclasites and mylonites of the vertically dipping Needle Falls Shear Zone.

Metamorphism

Most of the area has been subject to amphibolite facies metamorphism under low pressure Abukuma-type conditions. Garnet, cordierite and sillimanite are common in the supracrustal gneisses of the Wollaston Domain. The sporadic occurrence of hypersthene in the Archean basement suggests that the granulite facies was locally attained. Lower metamorphic conditions prevailed in and adjacent to parts of the Needle Falls Shear Zone, as demonstrated by absence of the previously mentioned index minerals and the common presence of muscovite. Garnet, cordierite and sillimanite are almost totally absent from the Peter Lake Domain, thereby making determination of a precise metamorphic subfacies difficult for these rocks.

Economic Geology

The Key Lake uranium-nickel deposit, situated northwest of Highrock Lake, lies close to the erosional edge of the Athabasca Group and is covered by up to 80 m of glacial sands. Of principal importance in the discovery of the deposit was the finding of an extensive train of mineralized boulders in the Zimmer Lake vicinity. Mineralization is concentrated in two narrow, northeast-trending orebodies, the Gaertner and Deilmann. Uranium is present as pitchblende with minor coffinite and uraninite. Nickel is present as gersdorffite (NiAsS), millerite (NiS), bravoite ((Fe,Ni)S$_2$) and niccolite (NiAs). Accessory minerals include pyrite, sphalerite, galena, chalcopyrite and various complex nickel arsenides and nickel-bismuth compounds.

The West Bear occurrence underlies a drift-covered area northwest of Michael Lake. The mineralized zone mainly comprises pitchblende with some silver and is believed to occur along a north-northeast-trending shear.

Other mineralization in the area is summarized as follows:

1. Pb-Zn mineralization at the 'Marina showing', located at the north end of Johnson Lake, was discovered through the presence of galena-bearing boulders and includes galena with minor sphalerite, fluorite and silver. The mineralization is hosted in white quartzites in the basal part of the Wollaston Group close to a sheared contact with Archean granitic rocks of the Johnson River Granite and is discontinuous but traceable over a 7 km strike distance. Although some boulders assayed up to 16 percent Pb, high grades were not intersected by drilling.
2. Fluorite has been found in at least nine showings in the southeastern part of the area. The mineralization occurs as small veins and disseminations and is generally spatially associated with either the Needle Falls Shear Zone or with late faults.
3. Uraninite, molybdenite and chalcopyrite of presumed syngenetic origin occur in segregation pegmatites cutting basal graphitic pelites of the Wollaston Group north of Fraser Lakes.
4. Weak uranium mineralization, mostly in the form of gummite staining, occurs in segregation pegmatites in psammites of the Wollaston Group. Examples of this type are seen at Ox Lake and also at the northeast end of Highrock Lake.
5. Weakly radioactive gummite-stained pegmatites cut the granitic rocks of the Johnson River Granite south of Johnson Lake.
6. Molybdenite is found in small veins and disseminations amongst pyrite-bearing granitic rocks intruding psammitic metasediments west of Johnson Lake.
7. Uraninite and molybdenite of presumed syngenetic origin occur in calc-silicate metasediments in the Yurchison Lake vicinity.

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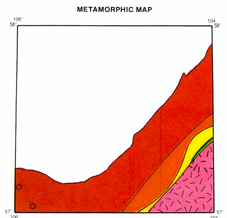
[2]A more complete bibliography for Geikie River, NTS 74H is available from the Saskatchewan Geological Survey, Regina.

SYMBOLS

- Single bedrock exposure; approximate area of abundant bedrock exposure
- Geological contact: defined to approximate, inferred
- Sub-Athabasca Group geological contact: inferred
- Structural lineament, possible to probable fault, as interpreted from geological, geophysical and/or airphoto evidence
- Major fold axial trace: antiform, synform
- Trend and approximate dip of dominant foliation surface: dip shallow (0-29°), moderate (30-59°), steep (60-84°), subvertical (85-90°)
- Inferred junction between Mudjatik and Wollaston Domains (after Gilboy, 1982)
- Weathered, saprolitic bedrock
- Shear zone
- $\times_3$ Mineral prospect, deposit:
  1. Key Lake Mine, U-Ni; Deilmann orebody (de Carle, 1981)
  2. Key Lake Mine, U-Ni; Gaertner orebody (de Carle, 1981)
  3. West Bear, U (Forsythe, 1980)
- $\textcircled{A}_4$ Sample location (geochronology):
  1. 1865±12 Ma, U-Pb zircon; 1646±40 Ma, K-Ar biotite (Ray and Wanless, 1980)
  2. 2538±10 Ma, U-Pb zircon; 2177±110 Ma, K-Ar hornblende; 1680±40 Ma, K-Ar biotite (Ray and Wanless, 1980)
  3. 2494±38 Ma, U-Pb zircon; 1626±40 Ma, K-Ar biotite (Ray and Wanless, 1980)
  4. 1752±41 Ma, K-Ar biotite (Stevens et al., 1982)
  5. 765±120 Ma, K-Ar whole rock (Stevens et al., 1982)
  6. 1895±45 Ma, Rb-Sr whole rock isochron (Bell and Macdonald, 1982); location is approximate centre of collecting area
  7. 2500 Ma, Rb-Sr whole rock 'scatterchron' (Bell and Macdonald, 1982); location is approximate centre of collecting area
  8. 2506±70 Ma, Rb-Sr whole rock isochron (Wanless and Loveridge, 1978); location not plotted because samples were collected over a wide area from at least three separate granitoid bodies

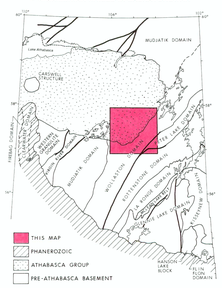
METAMORPHIC MAP



Note: All recorded metamorphic features in this area have been ascribed to one major metamorphic event of Hudsonian age

Metamorphic facies	Isograds
Upper amphibolite and granulite (undivided)	hypersthene
Upper amphibolite	cordierite + garnet (muscovite out)
Middle amphibolite	sillimanite
Lower amphibolite	staurolite,cordierite,diopside
Upper greenschist	garnet,andalusite
Mainly synorogenic plutonic rocks, regional metamorphic grade undefined	
Unmetamorphosed rocks	

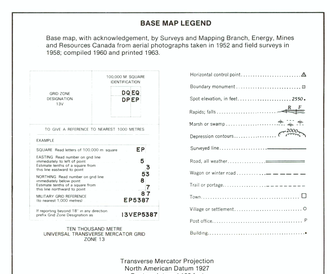
LITHOSTRUCTURAL DOMAINS OF THE PRECAMBRIAN SHIELD IN SASKATCHEWAN



Modified from Lewry and Sibbald (1977), and Macdonald and Broughton (1980)

BASE MAP LEGEND

Base map, with acknowledgement, by Surveys and Mapping Branch, Energy, Mines and Resources Canada from aerial photographs taken in 1952 and field surveys in 1958; compiled 1960 and printed 1963.



Transverse Mercator Projection
North American Datum 1927
Contour Interval 100 feet
Elevations in feet above mean sea level
Magnetic declination 21° 49' east at centre of map 1963
Annual change (decreasing) 3.6'

Geology compiled by G.E. Ray, 1980 with revisions by M.W. Thomas and R. Macdonald, 1983.

Map scribed by J. Bedo, 1983. Colour reproduction by electronic scanning of hand-coloured original. Legends and text phototypeset via in-house text-processing equipment and custom typesetting by Brigdens, Regina.

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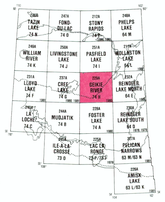
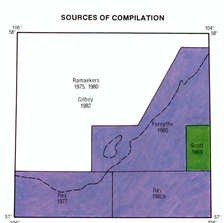
INDEX TO MAPS OF THE COMPILATION BEDROCK GEOLOGY SERIES



SOURCES OF COMPILATION



Saskatchewan Geological Survey 1:63 360 scale mapping

Saskatchewan Geological Survey 1:100 000 scale reconnaissance mapping

Saskatchewan Geological Survey Athabasca Group and sub-Athabasca Group mapping

This publication may be referenced as:

Ray, G.E. (1983): Compilation Bedrock Geology, Geikie River, NTS Area 74H; Saskatchewan Energy and Mines, Report 229 (1:250 000 scale map with marginal notes).

Map 229A. Compilation Bedrock Geology Series
GEIKIE RIVER, NTS AREA 74H
SASKATCHEWAN
1:250 000 Scale