GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

PART OF SHEET 74 N/7

LEGEND

PROTEROZOIC OR LATER

ATHABASCA FORMATION (12, 13)

- 13 — Sandstone member
- 12 — Basal breccia member

PROTEROZOIC OR EARLIER

MARTIN FORMATION (10, 11)

- 11 — Conglomerate member; minor sandstone
- 10 — Arkose member

ARCHAEAN (?)

- 9 — Quartz veins, in part younger than (11)
- 8 — Pegmatite dykes
- 7 — Quartz feldspar porphyry; 7a, granite porphyry

TAZIN GROUP (1-5)

- 5 — Leucogranite; quartz, orthoclase - microcline, plagioclase granite; 5a, contains planar quartz segregations
- 4 — 4a, 'Gunnar granite', granitoid paragneiss; 4b, gneissosity absent, massive granite; 4c, porphyritic; 4d, aplitic granite; 4e, syenitic phase
- 2 | 3 — 2. Acid paragneiss, less than 15% mafic minerals; quartz, feldspar paragneiss, well banded; 2a, massive phase; 2b, quartzite; 2c, quartz, orthoclase, mica, lenticular paragneiss, in part augen; 2d, feldspar porphyroblasts developed; 2e, feldspathized phase, quartz replaced by feldspar and carbonate; 2f, granitized phase, 'Gunnar granite' replacing or forming lit-par-lit injections in the above; 2g, hydrothermal alteration with the development of kaoline, sericite, carbonate and hematite
  3. Intermediate paragneiss, 15 - 50% mafic minerals; quartz; feldspar, biotite, hornblende paragneiss; 3a, quartz, feldspar, chlorite paragneiss
- 1 — Quartzite; 1a, grit and sandy quartzite; 1b, pebble conglomerate; 1c, chert, cherty quartzite; 1d, ferruginous grit, quartzite and chert; 1e, sericitic, schistose quartzite and grit
- 6 — Basic paragneiss, more than 50% mafic minerals; amphibolite, hornblende - feldspar paragneiss, hornblende-feldspar-quartz paragneiss, ubiquitous retrograde chlorite; 6a, basic gneiss, metamorphosed diabase, diorite and gabbro; 6b, chlorite schist; 6c, feldspar porphyroblasts developed, in part augen; 6d, tremolite schist; 6e, 'Gunnar granite' replacing or forming lit-par-lit injections; 6f, serpentinized

Drift-covered area
Area of sand and gravel
Area of rock outcrop
Geological contact (defined, with dip when known; approximate, gradational)
Bedding (horizontal, inclined)
Bedding (inclined, vertical; top of bed unknown)
Schistosity, foliation (inclined)
Paragneiss banding. Parallelism of alternating bands of different composition (inclined, vertical)
Gneissosity. Parallelism of planer and linear minerals; to be distinguished from banded gneissosity above (inclined, vertical)
Lineation (plunge known) may be combined with other symbols . . . 30
Drag fold (arrow indicates plunge, relative movement known) may be combined with other symbols . . . 30
Drag fold (arrow indicates plunge) . . . 30
Fault (defined, approximate, assumed, dip unknown)
Fault (inclined, vertical, arrows indicate relative movement)
Anticline (defined, inferred axial trace)
Syncline (inferred axial trace)
Glacial striae
Rock trench and stripped area
Mineral occurrence . . . × ra
Mylonite, breccia (alone or as subscript to legend symbols) . . . m x
Highly contorted beds, bands or gneissosity (alone or as subscript to legend symbols) . . . k

MINERAL SYMBOLS

Chalcopyrite....cp
Pyrite..........py
Hematite.......hem
Radioactive mineral stain..ra
Pitchblende.....U

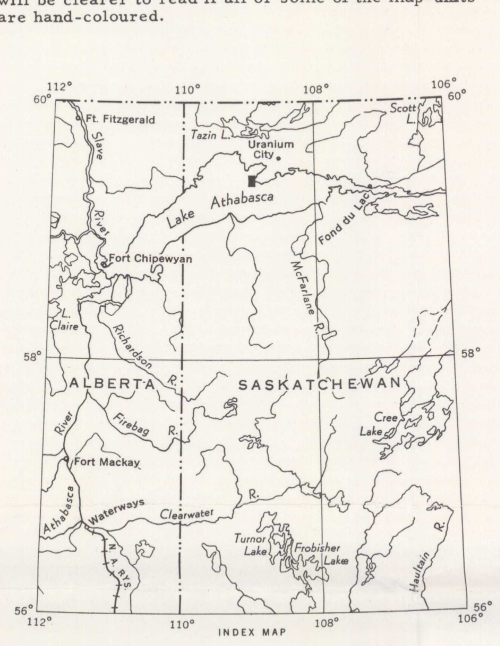
Geology by C.K. Bell, 1954, 1955

Cartography by the Geological Survey of Canada, 1959

Approximate magnetic declination, 25° 21' East

Air photographs covering this area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

In response to public demand for earlier publication, Preliminary Series maps are now being issued in this simplified form, thereby effecting a substantial saving in time. There is no loss of information, but the maps will be clearer to read if all or some of the map-units are hand-coloured.



DESCRIPTIVE NOTES

Crackingstone Point is 11 miles southeast of Bushell and 3½ miles west of Gunnar Mines. Access is by boat, or by aircraft (18 miles), from Uranium City. Relative relief is 150 to 200 feet. Topography is stratigraphically controlled, the prominent northeast-trending shorelines being fault-line scarps.

In the legend the Tazin group is based on successive ages of rock metamorphism; granitization and intrusion resulting in younger rocks lying within and cutting the geological section. In the conventional stratigraphic sense, top determinations suggest that the original, pre-metamorphism, sedimentary section progressed from the oldest on the mainland to the youngest on Johnston Island. Field evidence suggests some repetition by folding and faulting.

Quartzite (1) and grit (1a) are white, grey to buff coloured due to hematite veinlets and iron-oxide dust. Individual bedding planes are traced up to 4,000 feet; but commonly groups of beds lense out or show a gradational facies change along strike. Pebble-conglomerate (1b) is composed of imbricately arranged, oval, 2-inch or smaller, quartz and chert pebbles in a grey cherty matrix. Dark red to brown chert beds (1c) form structural markers. Thin ferruginous beds (1d) weather to hematite-red coloured mud. The contact between similar rocks and paragneiss is exposed 8 miles to the northeast. It is gradational over tens of feet, the transitional rock becoming sericitic and schistose (1e), then finally feldspathic. Most Tazin paragneiss is developed from rocks similar to these.

Acid paragneiss (2) consists of quartz, microcline, albite-oligoclase, and minor sericite. A mixture of iron-oxide dust, sericite, and epidote cloud the feldspars causing widespread red colouration to the originally white or grey rock. Biotite and retrograde chlorite are the mafic minerals. The rock weathers white, grey, through pink, red, to green-brown. Well-developed banding caused by mineralogical differences represents the position of original beds. Where the parent sediments were thickly bedded the resulting paragneiss is massive (2a), although microscopic gneissosity tends to parallel original bedding directions. Megascopically this paragneiss is distinguishable from granite by its sugary texture. Where more than 75% of the rock is quartz it is mapped as quartzite (2b). These quartzites represent zones of less intense feldspathization, although some are highly brecciated and contain abundant chlorite and sericite. A coarse-grained, red, lenticular (phacoidal) gneiss (2c) is traced from Sampson Island 7,500 feet east to the islands in Nunim Channel. Granitization within the paragneiss is common on Mitchell Island and on the north shore of the mainland. Where the identity of the host rock is recognizable as acid paragneiss, it is mapped as (2f).

Intermediate paragneiss (3) is probably derived from greywacke and ferruginous sediments. It contains albite-oligoclase, microcline, and quartz with biotite and hornblende that is commonly partly altered to retrograde chlorite. Sugary-textured fresh surfaces are black to pale green. The rock is well banded, the mafic zones being separated by thin bands and lenses of quartz. Individual bands terminate along strike. Where quartz and chlorite predominate, the rock (3a) forms a differentially weathered, highly crenulated gneiss. Intermediate paragneiss is contemporaneous with the acid and basic paragneisses, and occurs as large masses which tend to grade into acid paragneiss along strike.

'Gunnar granite'(4a) the host rock at Gunnar Mines, is the main structural unit on the peninsula and is continuous for more than 12 miles along strike. It is a coarse- to medium-grained granitoid paragneiss composed of quartz, altered orthoclase, microcline-perthite and plagioclase; mafics are biotite with omnipresent retrograde chlorite. It is generally red due to alteration of the feldspars. The rock weathers a distinct orange-red. Gneissosity is formed by flat ovoids of quartz up to 2 inches long. Where cleavage is developed, the quartz forms lineations on the cleavage face. This rock metasomatically replaces all Tazin paragneisses with lit-par-lit banding being a common initial phase. Its contacts are sharp, gradational, or faulted and they may parallel or cross the gneissosity of adjacent paragneiss. Where gneissosity is absent the rock is a red to grey granite (4b) containing biotite, or more commonly, retrograde chlorite. This metasomatic granite suggests repeated metamorphism and possibly melting and mobilization. Porphyritic (4c) and aplitic granite (4d) are rare, generally in amounts too small to map. Small patches of 'Gunnar granite' are altered to a syenite-like rock (4e) by the removal of quartz and the addition of feldspar and carbonate. This is the 'sponge rock' in which the Gunnar orebody occurs. Large areas of granitoid paragneiss are mylonitized, and irregular, sharp-boundaried, chlorite-rich, breccia zones are common. Small chlorite-filled shear zones crisscross these rocks everywhere.

Leucogranite (5) is a massive, medium-grained pink granite that has sharp, crosscutting contacts with groups 1 to 4, although it is probably of metasomatic origin. It is red weathering and is in part a derivative of 'Gunnar granite'. The Assaf Island leucogranite (5a) contains small quartz segregations aligned parallel to the regional structure.

Basic paragneiss (6) is predominantly dark coloured, and is banded through gneissic to massive depending on its mineralogical composition. Most of the rocks are feldspathized and many contain minor granitic material. All weather orange-brown, green or black. Assignment of rocks to either 6 or 6a is not absolute because of their similar compositions, but many group-6 rocks are well banded and contain quartz, carbonate and tremolite, suggesting original limy sediments. During metamorphism some became mobile and were squeezed through the surrounding rock to form isolated amphibolite pods. Most show evidence of plastic deformation, Basic gneiss (6a) occurs as sill and dyke swarms which range in composition from fine-grained aphanitic diabase through coarse-grained diorite-gabbro types to amphibolites and hornblendites. Many have chilled edges. Inclusions are rare, but quartz, pegmatite and granitic segregations are common. Retrograde chlorite replaces up to 100% of the mafics in the above rocks, ultimately resulting in chlorite schist (6b). Hematite as veinlets, joint coatings, and dust is common, and rare magnetite is seen in 6a only.

Porphyries occur as small, irregular dykes which are red, brown or grey-green and weather orange-red. Each has a microcrystalline matrix composed of quartz, orthoclase-microcline, plagioclase, biotite (retrograde chlorite), sericite and secondary pyrite, iron-oxide dust and calcite. The basis of separation is the amount, composition and size of the phenocrysts. Both have a common origin, the porphyry with the most matrix being emplaced early. Quartz-feldspar porphyry (7) contains less than 20% phenocrysts; three quarters are quartz up to 5 mm long but average 1 mm, the rest are microcline and minor oligoclase less than 1 mm long. More than 50% of the granite porphyry (7a) consists of phenocrysts; three quarters of these are microcline with minor oligoclase, the other quarter is quartz. The feldspars average 6 mm, some being 2 cm long; quartz averages less than 5 mm. Most of the porphyries are slightly mylonitized, the phenocrysts being bent, fractured and corroded. When abundant, chlorite forms a rude foliation parallel to the regional structure. Both porphyries contain chloritized inclusions of the country rock. Veinlets of carbonate and quartz are common.

Pegmatites (8) are simple quartz-orthoclase-muscovite dykes which are small and associated with 'Gunnar granite'. They are not gneissic and are therefore later than the regional metamorphism. Quartz veins (9) are small and of many ages including post-Martin Lake. Small quartz gash-veins occur in and adjacent to the pegmatites. Late vuggy quartz veins fill the northwest-striking faults on Johnston Island. Neither pegmatites nor quartz veins are economically important.

The terms Martin formation and Athabasca formation are to be defined in a later publication. The relationship between the two formations is unknown. Martin rocks (10, 11) may represent upper members of the Athabasca formation which are tilted and down-faulted between the Black Bay - Crackingstone fault systems, or they may be late Archaean. Martin rocks are separated from the Tazin by the Crackingstone Fault. The arkose member (10) is red-brown, massive and red weathering. It contains vaguely defined cross-bedding and channel marks together with the occasional pebble- and rare intraformational- conglomerate lenses. The conglomerate member (11) is intercalated with thinly bedded, coarse-grained, red sandstone. It is composed of subrounded cobbles of Martin formation arkose and siltstone plus Tazin group rocks.

Athabasca formation (12, 13) unconformably overlies the quartzitic rocks (1) on Johnston Island. In places a brown regolithic siltstone veneers and fills the highly jointed and cracked pre-Athabascan meta-sedimentary surface forming 'clastic dykes'. These dykes have been exposed by subsequent erosion down to the surface of unconformity. The basal breccia (12) consists of angular blocks of the underlying sediments. A few feet above the unconformity the boulders become sub-rounded. Overlying the conglomerate is a buff-coloured, crossbedded sandstone (13).

Tazin rocks are complexly folded along the south shore of Mitchell Island where the axial trace and plunge is southwest, as substantiated by lineations in the area. A large drag-fold traverses Sampson Island and the islands in Nunim Channel. Major anticlinal and synclinal structures strike from the mainland area southwest toward Crackingstone Point, but complex faulting makes it impossible to trace their continuations within the map-area. In detail some of the folding is on a scale of tens of feet and such extremely complex areas are designated on the map by a "k".

Important sets of faults occur striking northeast, northwest, and east. The most prominent and one of the youngest is the Crackingstone Fault which has been traced for 10 miles to the northeast. Gouge associated with this fault is up to 15 feet wide. It parallels the Black Bay Fault which, if projected along strike, would lie 1/2 mile north-northwest of Crackingstone Point. The Mitchell Island Fault also strikes northeast but is not traced far. The fault striking northwest into Milward Lake may be a continuation of the St. Mary's Channel Fault. East-striking faults are abundant but movement on them is generally small. Many minor faults and joints occur within the Tazin, but most are too small to map or they are hidden by drift. Most of the steeply dipping, northwest-striking faults on Johnston Island have right-hand strike separations with minor movement. All are filled with a silicified fault breccia. In the more metamorphosed Tazin paragneiss, silicification and red alteration caused by hematite mineralization accompanies most fault breccias.

No deposits of economic importance have been found within the map-area. Surface showings have been drilled on Mitchell Island and on the mainland. Minor amounts of radioactive minerals occur in shear zones in the 'Gunnar granite' and in the paragneiss.

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MAP 38-1959
GEOLOGY
MILLIKEN LAKE
SHEET 1
SASKATCHEWAN

Scale: One Inch to 800 Feet = $\frac{1}{9,600}$

Feet: 800 0 800 1600 2400

MAP 38-1959
MILLIKEN LAKE
SASKATCHEWAN
SHEET 1

38-1959 Sheet 1