GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

LEGEND

QUATERNARY

21 — *Till, gravel, sand, clay, silt*

CENOZOIC

TERTIARY
MIOCENE AND/OR LATER
ENDAKO GROUP

20 — *Basalt, andesite, related tuffs and breccias*

19 — *Conglomerate, sandstone, mudstone, lignite;* **19a**, *may be older than 18*

PALEOCENE (?) TO MIOCENE

18 — *Rhyolite, dacite;* **18a**, *related dykes;* **18b**, *may be intrusive*

CENOZOIC AND/OR MESOZOIC

CRETACEOUS AND (?) TER
UPPER CRETACEOUS A LEOCENE

17 — *SIFT TION: co lomerate, sandstone, shale*

PRE-TERTIARY F WEST OF McLEOD LAKE FAULT

MESOZOIC

JURASSIC OR CRETAC S

16 — *Gneissic q z diorite and granodiorite*

TRIASSIC AND/OR JURASSIC
UPPER TRIASSIC AND/OR LOWER JURASSIC
TAKLA GROUP

15 — *Andesitic and basaltic flows, tuffs, breccias;* **15a**, *conglom rate, greywacke, argillite, limestone*

PALEOZOIC

PENNSYLVANIAN (?) AND ERMIAN
CACHE CRE K OUP (12, 13)

12, 13 — 13, *Basaltic desitic flows, tuffs, breccias; minor ch rgillite*
12. *Limes on chert, argilli*

MISSISSIPPIAN (?)

11 — *MOUNT MURRAY INTRU NS: diabase ite*

SLIDE MOUNTAIN GROUP O)

9, 10 — 10. *Limestone*
9. *Basaltic pillow lavas, an rela d p lastic rocks, argillite, chert, grey*

CAMBRIAN AND/OR LATER
LOWER CAMBRIAN AND/OR LATER
CARIBOU GROUP (7, 8)

7, 8 — 8. *SNOWSHOE FORMATIC , grey micaceous quartzite, phyllitic quartzite, phyllite; includes minor pegmatite of A*
7. *MIDAS FORMATION (?): black quartzose phyllite, argillite*

WOLVERINE COMPLEX

A — *Granodiorite, granite, pegmatite*

B — *Granitoid gneiss, micaceous, garnetiferous chloritic schists, pegmatite, and small bodies of granodiorite; minor feldspathized quartzite*

PRE-TERTIARY FORMATIONS EAST OF McLEOD LAKE FAULT

MESOZOIC

TRIASSIC (?) AND/OR JURASSIC (?)

14 — *Argillite, greywacke, shaly limestone; minor andesite and basalt*

PALEOZOIC

DEVONIAN AND (?) LATER
MIDDLE DEVONIAN AND (?) LATER

6 — *Limestone, silty and shaly limestone*

ORDOVICIAN AND SILURIAN
UPPER ORDOVICIAN TO MIDDLE SILURIAN
SANDPILE GROUP

5 — *Limestone, dolomite; quartzite, calcareous, and dolomitic sandstone*

CAMBRIAN
MIDDLE (?) AND UPPER CAMBRIAN TO LOWER ORDOVICIAN
KECHIKA GROUP

4 — *Limestone, silty limestone, calcareous siltstone, calcareous schist*

CAMBRIAN AND (?) EARLIER
LOWER CAMBRIAN AND (?) EARLIER

3 — *Dolomite, limestone, quartzite, sandy dolomite; black and green slate*

PROTEROZOIC

CAMBRIAN AND/OR EARLIER
LOWER CAMBRIAN AND/OR EARLIER
MISINCHINKA GROUP

2 — *Black slate, slaty greywacke; minor quartzite, conglomerate, greywacke*

1 — *Chlorite and sericite schist, phyllite, schistose grit, quartz-pebble conglomerate*

Areas interpreted from aeromagnetic maps
Geological boundary (approximate, assumed)
Bedding, tops known (horizontal, inclined)
Bedding, tops unknown (inclined, vertical)
Schistosity, gneissosity (inclined, vertical, dip unknown)
Fault (defined, approximate, assumed)
Anticline (defined, approximate)
Syncline (defined, approximate)
Glacial striae
Glacial grooves
Drumlin (direction of ice movement known)
Fossil locality — Ⓕ
Mineral occurrence — Cu×

MINERALS

Copper	**Cu**	*Mercury*	**Hg**
Gold	**Au**	*Molybdenum*	**Mo**
Lead	**Pb**	*Silver*	**Ag**
Magnesium	**Mg**	*Tungsten*	**W**
		Zinc	**Zn**

Geology west of McLeod Lake fault by J. E. Armstrong, H. W. Tipper, and J. W. Hoadley, 1946; H. W. Tipper, 1961.
Geology east of McLeod Lake fault by J. E. Muller, 1961

Descriptive notes by J. E. Muller and H. W. Tipper

Geological cartography by the Geological Survey of Canada, 1968

Road, all weather — Route 16
Other roads
Cart tract
Railway
Post Office — P
Horizontal control point
District boundary
Indian Reserve boundary
Intermittent stream
Marsh
Contours (interval 500 feet) — 5000
Height in feet above mean sea-level — 2788

Base-map compiled and drawn by the Army Survey Establishment, R C E, 1956-1961

Magnetic declination 1967 varies from 25° 36′ easterly at centre of east edge to 25°56′ easterly at centre of west edge. Mean annual change decreasing 3.9′

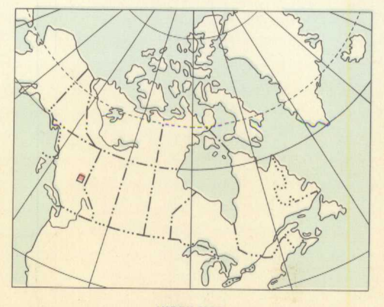
Published, 1969
Copies of this map may be obtained from the Geological Survey of Canada, Ottawa

Printed by the Surveys and Mapping Branch

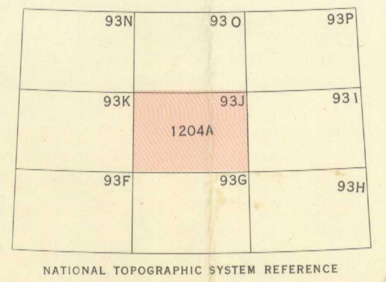
MAP 1204A
GEOLOGY
McLEOD LAKE
BRITISH COLUMBIA

Scale 1:253,440
1 inch to 4 miles

Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres



INDEX MAP



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE

British Columbia McLeod Lake
1 inch to 4 miles
Map 1204A
1969

DESCRIPTIVE NOTES

The western two thirds of the area consists of heavily drift-covered rolling country, of low hills, lakes, and swamps, forming the northeastern part of Nechako Plateau. A depression, controlled by McLeod Lake fault and followed by the Hart Highway, separates Nechako Plateau from the higher McGregor Plateau. It also separates the main geological divisions of the area. To the east, McGregor Plateau is bounded by Parsnip Valley. The upper part of this valley loses its distinction as the Rocky Mountain Trench and disperses into several fault-valleys, veering off into the Rocky Mountains east of the area. The trench resumes its course southwest of McGregor Plateau with a 20-degree change in direction, as the upper Fraser Valley.

In the southeast corner of the area, glacial deposits are widespread; their depth may be 300 to 400 feet in major valleys, but elsewhere they are probably less than 25 feet deep.

Numerous well-developed drumlins, eskers, and meltwater channels clearly indicate that the last ice-movement across the area was from southwest to northeast, varying from N70° E in the south to N25°E in the north. In the valley of Salmon River, south of Summit Lake, two tills are exposed, probably representing two glacial advances.

Anzac River valley and its tributaries appear to have been sculptured by valley glaciers. But drumlins in that valley and grooves on surrounding mountains show that subsequently an ice-sheet moving northeastward covered mountain tops up to 6,000 feet elevation. Glacial-lake deposits are widespread in the southwest quarter west of Stuart River, in the southeast quarter south of Summit Lake, and west of Great Beaver Lake.

Bedrock exposures are sparse and much less extensive than suggested by the map. Continuous stratigraphic sections are not available, and structural relations are not well established.

The Wolverine Complex (A,B) is believed to consist of metamorphosed and granitized Cariboo Group rocks (7,8) but may include both older and younger strata. The time of metamorphism and granitization was post-Lower Cambrian, possibly in part as late as Mesozoic. The granites (A) are mainly leucocratic, some entirely devoid of mafic minerals, and are apparently restricted to areas of Wolverine gneisses (B). Unit B includes small areas of Cariboo Group quartzites, and conversely, unit 8 includes small bodies of granodiorite and gneisses (B).

The lower part of the Misinchinka Group (1) consists of fine- to coarse-grained clastic sediments, metamorphosed to chlorite schists. Quartz grit and pebbles, up to ¼ inch, are preserved; in slaty rocks green and grey colour bands, showing graded bedding, are intersected by cleavage planes. The thickness of the unit is unknown. It is roughly equivalent to the late Precambrian Kaza Group of the Cariboo Mountains[2, 17].

The upper part of the Misinchinka Group (2) is in gradational contact with the lower part (1). It consists mainly of black slates and brown schistose greywacke, commonly with well-marked banding due to graded bedding, showing on cleavage planes. Grit and conglomerates are less common than in unit 1. In Pine Pass area the unit has a thickness of 2,500 feet or more. It is roughly equivalent to the Lower Cambrian or older Isaac Formation of the Cariboo Mountains[2, 17]. The entire Misinchinka Group may be equated to the Miette Group of Mount Robson area[15].

Unit 3 is in gradational contact with unit 2. Coarsely crossbedded quartzites, and quartzose, commonly calcareous sandstones are interbedded with grey, light green, and black slaty shale and calcareous siltstone. Beds of dolomite, in places bright red weathering, and limestone yield in a few places within and north of the map-area silicified *Archaeocyathus* on weathered dip-slopes. The age of the group is Lower Cambrian and (?) earlier. It is in large measure equivalent to the Gog Group of Mount Robson area[15] and the Atan Group of Kechika area[4].

The Kechika Group[4] (4) consists of schistose calcareous shales, slates, and siltstones with thin-bedded silty limestones. This incompetent unit is highly folded and bedding planes are commonly obscured by cleavage. The upper part of the unit contains several beds of pisolitic limestone with numerous disc-shaped algal structures, about ¼ inch in size, with parallel alignment. A trilobite fragment of probable Upper Cambrian age was found northeast of Mount Averil. In Pine Pass area a less disturbed section, about 3,000 feet thick, yielded Upper Cambrian and Lower Ordovician trilobites.

The Sandpile Group[4] (5) consists mainly of silty dolomite and limestone with some interbedded quartzite. The rocks are commonly thick bedded to massive and less schistose than those of unit 4. A collection of brachiopods, a trilobite, and bryozoa from south of Chuchinka Creek is of late Ordovician age. Several other localities have yielded coral faunas in dolomite and limestone, indicating Silurian (Clinton) age.

In more westerly exposures, west of Firth Lake and north of Chuchinka Creek, calcareous shale and siltstone with Middle Silurian graptolites (late Llandovery to early Wenlock) represent the farther offshore graptolite facies. In the creek west of Firth Lake they are in contact with dolomite containing Silurian corals. In Pine Pass area this unit consists of 1,200 feet of carbonates, locally underlain by up to 1,500 feet of sandstone.

A sequence of shaly and silty limestone (6) has yielded Middle Devonian (in part Givetian) corals and gastropods. A succession of dolomite and quartzitic sandstone is also included in this unit. The nature of the contacts between units 3, 4, 5, and 6 has not been determined within the area. In the Rocky Mountains of the adjacent Pine Pass area they are structurally conformable, but regional unconformities probably occur at the base of units 5 and 6.

No relationship has been established yet between strata east and west of McLeod Lake fault. Units 7 and 8 are interpreted as part of a belt of Cariboo Group rocks trending northwest from the type area[17]. Shales and quartzites predominate and may represent the Midas (7) and Snowshoe (8) Formations of the group but this cannot be demonstrated with certainty. Larger quartzite bands within the Wolverine Complex have also been assigned to the Snowshoe Group, but appear to grade into gneissic rocks in Pine Pass area[16].

The Slide Mountain Group (9, 10) is characterized by basaltic pillow lavas, thus distinguishing it from the less-volcanic Cache Creek Group. (12, 13). The limestone (10) forms one band, 200 to 300 feet thick, interbedded with the volcanic rocks. Crinoidal fragments are present.

The Mount Murray Intrusions (11) form sills and dykes in the Slide Mountain Group volcanic rocks (9), and are restricted to these rocks in this map-area. It has been suggested that they are genetically related to the Mississippian (?) volcanic rocks[1].

The Cache Creek Group of central British Columbia consists of a very thick assemblage of interbedded sedimentary and volcanic rocks, mainly of Permian age. Foraminiferal limestones and ribbon cherts are characteristic of the group. In this map-area units 12 and 13 comprise rocks in direct continuation of a belt of Cache Creek rocks to the northwest. Scattered outcrops in the adjoining area[18] to the south indicate a continuation of this belt.

Unit 14, in McGregor Plateau, includes dark shale and argillite, well exposed in a small canyon south of Tacheeda Lake, and silty limestone, chert, and small bodies of basaltic to gabbroic rock. These rocks have not been dated but are lithologically like the late Palaeozoic to Jurassic formations of the Interior Plateau.

The Takla Group (15) in this area consists mainly of Lower Jurassic basic lavas and pyroclastic rocks, but scattered outcrops of sediments (15a) in the southern part are probably Upper Triassic. As no fossils have been found, correlation is based on lithological similarity to fossiliferous strata of adjoining areas.

Aeromagnetic maps suggest that the broad area with no outcrops extending southeast from Great Beaver Lake is underlain by sedimentary rocks of this group and some volcanic rocks that extend into the area from the south[18].

The intrusive rocks (16) are younger than the Takla Group volcanic rocks (15) and may be related to the Omineca Intrusions to the northwest.

Lithic sandstone, shale with leaf imprints, and conglomerate that bears angular schist, limestone, and quartz pebbles (17) lie unconformably on highly folded schists and are exposed in the railway-cut along Reynolds Creek. Plants, collected during the field work, suggest Paleocene age. However, G. E. Rouse later collected *Nilssonia vancouverensis* (Dawson) Bell, from the same locality, indicating late Upper Cretaceous age. The unit, and similar beds along Parsnip River in Pine Pass area, are probably correlative to the Sifton Formation of Kechika area[5].

The rhyolite and dacite of unit 18 are fresh rocks like the Eocene – Oligocene rhyolitic rocks to the south and west. Related dykes (18a) are present on Mount Mackinnon and many others not shown also cut the Wolverine Complex (B).

Miocene sedimentary rocks (19) are poorly consolidated and for the most part represent late Tertiary channels of Fraser River and its tributaries[4].

The Endako Group (20) is poorly exposed in this area but elsewhere in central British Columbia it forms extensive lava plateaux. The group is essentially undeformed. With the aid of aeromagnetic maps the area underlain by this group has been indicated, and contrary to earlier assumptions, does not include the low central area. In McLeod Lake area the group has a maximum thickness of less than 1,000 feet, for the most part not more than 200 feet. Coffeepot and Teapot Mountains are apparently volcanic necks that have come up along a fault.

Structural interpretation of the area is much impeded by the scarcity of outcrops. Furthermore, lineations indicating gross bedding and faults are, on most air photographs, largely obscured by strong glacial grooving at nearly right angles to the structure. Possibly the rocks are more closely faulted than shown, as in the much better exposed Rocky Mountains.

The McLeod Lake fault is the outstanding structural feature of the map-area, separating the rock sequence of central British Columbia on the west from the Rocky Mountain sequence on the east. To the north, in Pine Pass map-area[16], it continues along the western edge of the Rocky Mountain Trench. Aeromagnetic data indicate that the fault continues to the southeast corner of the map-area and into the Cariboo Mountains structural complex. A branch fault passing north of Mount Averil may extend into that of the Rocky Mountain Trench occupied by Fraser River. East of McLeod Lake fault the area is divided by faults along Parsnip River and upper Anzac River into the mainly Palaeozoic McGregor Plateau block, the mainly Proterozoic Misinchinka Range block, and a corner of Palaeozoic Rocky Mountains. In the McGregor Plateau block, discernible structures trend northward with about a 30-degree angle into McLeod Lake fault. They are provisionally interpreted as a series of folded, generally westward dipping, fault blocks. Several northeast-trending tear-faults have also been inferred. The Parsnip River fault may bring Cretaceous to Tertiary sediments overlying Proterozoic schist in contact with Cambrian rocks. The Misinchinka rocks are compressed into a steep synclinorium with some carbonate of unit 3 in the axial region. A fault, though not shown, may separate this structure from an adjoining anticlinorium exhibiting the oldest rocks.

The Pinchi fault zone (or related fault zones) extends from Stikine River area southeastward for more than 500 miles to Quesnel Lake area. In Fort St. James map-area[1] it has been described as a southwest-dipping major thrust fault in which Permian rocks on the southwest side moved up relative to Mesozoic rocks on the northeast. In McLeod Lake map-area this fault marks the contact between the same two groups of rocks.

The area between the McLeod Lake and Pinchi faults is largely obscured by drift but several major and some minor northwest-trending faults have been interpreted from aeromagnetic information, topographic features, and limited bedrock information. In a belt 30 to 35 miles wide on the southwest side of and parallel with McLeod Lake fault are a multitude of north- and northeast-trending faults which are thought to be normal or strike-slip faults. The nature of movement on the northwest-trending faults is not known.

A little cinnabar has been found in carbonatized and sheared greenstones of the Takla Group northwest of Gordon Lake, generally associated with stringers of quartz. These cinnabar showings are near the Pinchi fault zone, which probably provided channelways for the mineralizing solutions.

A little placer gold and platinum have been recovered from Reed Creek, McLeod River, McDougall River, and from streams tributary to Salmon Lake, but not in commercial amounts. Muscovite occurs in books up to 3 inches square in the pegmatites of the Wolverine Complex. Several mineral occurrences are in serpentinized Mississippian (?) rocks north of the western end of Eaglet Lake[7, 8, 11]. Galena, sphalerite, molybdenite, and chalcopyrite are visible, and traces of silver, tungsten, and nickel are reported to be present. Near the northernmost bend of Fraser River and in Averil Creek, quartz veins carrying scheelite, galena, and sphalerite with traces of gold and silver have been explored[9, 13]. The veins cut schists and gneisses of the Wolverine Complex (B). Coarse crystalline magnesite interbedded with fine-grained dolomite occurs in 50-foot beds in unit 3 north of Anzac River. Clay suitable for pottery and earthenware occurs in Miocene sediments along Fraser River[3, 14].

[1]Armstrong, J. E.: Fort St. James map-area, Cassiar and Coast districts, British Columbia; Geol. Surv. Can., Mem. 252 (1949).
[2]Campbell, R. B.: Quesnel Lake (west half and east half); Geol. Surv. Can., Maps 3-1961 and 1-1963.
[3]Cummings, J. M., and McCammon, J. W.: Clay and shale deposits of British Columbia; B.C. Dept. Mines, Bull. 30, pp. 30-32 (1952).
[4]Gabrielse, H.: McDame map-area, Cassiar district, British Columbia; Geol. Surv. Can., Mem. 319 (1963).
[5]Hedley, M. S., and Holland, S. S.: Reconnaissance in the area of the Turnagain and Upper Kechika Rivers, northern British Columbia; B.C. Dept. Mines, Bull. 12 (1941).
[6]Lay, Douglas: Fraser River Tertiary drainage-history in relation to placer-gold deposits (Part II); B.C. Dept. Mines, Bull. 11 (1941).
Minister of Mines, British Columbia, Annual Reports for
[7]1918, p. 127 (1919);
[8]1923, p. 125 (1924);
[9]1928, pp. 191-192 (1929);
[10] 1932, p. 88 (1932);
[11] 1933, pp. 100-104, 117 (1934);
[12] 1934, pp. C15-16 (1935);
[13] 1935, pp. C30-32 (1936);
[14] 1947, pp. 208-209 (1948).
[15] Mountjoy, E. W.: Mount Robson (southeast) map-area, Rocky Mountains of Alberta and British Columbia; Geol. Survey. Can., Paper 61-31 (1961).
[16] Muller, J. E.: Pine Pass, Cariboo and Peace River districts, British Columbia; Geol. Surv. Can., Map 11-1961 (1961). (Revised map and Memoir in preparation.)
[17] Sutherland Brown, A.: Geology of the Antler Creek area, Cariboo district, British Columbia; B.C. Dept. Mines, Bull. 38 (1957).
[18] Tipper, H. W.: Prince George, Cariboo district, British Columbia; Geol. Surv. Can., Map 49-1960 (1961).
Biostratigraphic identifications by B. S. Norford (units 3-5), A. W. Norris (unit 6), F. M. Heuber and G. E. Rouse (unit 17).

MAP 1204A
McLEOD LAKE
BRITISH COLUMBIA

1204A