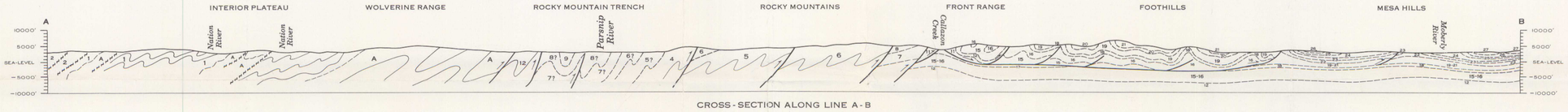
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS




CROSS-SECTION ALONG LINE A-B

PRELIMINARY SERIES

SHEET 93 O

## LEGEND

CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT
30 Glacial till, gravel, sand, silt, clay

FORMATIONS EAST OF AND IN THE ROCKY MOUNTAIN TRENCH

CENOZOIC
TERTIARY
PALEOCENE
29 Shale, sandstone, conglomerate

CRETACEOUS OR TERTIARY
PALEOCENE OR EARLIER
28 SIFTON FORMATION: coarse conglomerate

MESOZOIC
CRETACEOUS
UPPER CRETACEOUS
27 DUNVEGAN FORMATION: marine and non-marine sandstone, shale, conglomerate

LOWER CRETACEOUS
FORT ST. JOHN GROUP (22-26)
26 CRUISER FORMATION: marine shale, minor sandstone
25 GOODRICH FORMATION: fine-grained sandstone, minor shale
24 HASLER FORMATION: dark marine shale, minor sandstone
23 COMMOTION FORMATION: sandstone, shale, coal, conglomerate
22 MOOSEBAR FORMATION: dark marine shale

BULLHEAD GROUP (19-21)
21 GETHING FORMATION: sandstone, conglomerate, shale, coaly shale, coal; includes locally marine sandstone of MONAGH FORMATION at base
20 BEATTIE PEAKS FORMATION: marine shale, silty shale, fine-grained shaly sandstone
19 MONTEITH FORMATION: crossbedded sandstone, quartzite; minor conglomerate, siltstone, shale

JURASSIC AND CRETACEOUS
LOWER CRETACEOUS AND EARLIER
18 FERNIE AND NIKANASSIN FORMATIONS: dark marine shale, shaly sandstone
17 Shale, greywacke, slaty argillite, shale- and chert-pebble conglomerate, ironstone

TRIASSIC
UPPER TRIASSIC
16 PARDONET FORMATION: shale, bituminous shale, siltstone, limestone, dolomite; crossbedded calcareous sandstone in basal part

LOWER (?), MIDDLE, AND UPPER TRIASSIC
15 Calcareous siltstone and sandstone, black shale

PALAEOZOIC
PENNSYLVANIAN AND/OR PERMIAN
14 Massive chert (forms boundary along 15)

MISSISSIPPIAN AND (?) LATER
RUNDLE GROUP (AND YOUNGER?)
12 Limestone, dolomite, calcareous siltstone, chert

DEVONIAN AND (?) MISSISSIPPIAN
11 Calcareous siltstone and shale, shaly limestone

DEVONIAN
MIDDLE DEVONIAN
10 Limestone, calcareous shale
13 Undivided, limestone

ORDOVICIAN AND SILURIAN
9 Dolomite, quartzitic sandstone; minor limestone

CAMBRIAN AND ORDOVICIAN
UPPER CAMBRIAN AND LOWER ORDOVICIAN
8 Nodular limestone, calcareous siltstone, shale, calcareous schist

CAMBRIAN
LOWER (?) CAMBRIAN
7 Orthoquartzite, dolomite, red shale, conglomerate

PRECAMBRIAN AND PALAEOZOIC
CAMBRIAN AND EARLIER
MISINCHINKA GROUP (4-6)
6 Black slate, slaty greywacke; minor quartzite, conglomerate
5 Limestone, calcareous schist; minor slate, chlorite schist
4 Chlorite and sericite schist, phyllite, schistose grit, and quartz-pebble conglomerate

FORMATIONS WEST OF THE ROCKY MOUNTAIN TRENCH

MESOZOIC AND CENOZOIC
CRETACEOUS AND/OR TERTIARY (Mainly)
3 Granite, granodiorite

MESOZOIC
TRIASSIC AND JURASSIC
TAKLA GROUP
2 Basic tuffs, breccias, agglomerates, and flows

PALAEOZOIC
CARBONIFEROUS
MISSISSIPPIAN AND/OR PERMIAN
SLIDE MOUNTAIN GROUP OR CACHE CREEK GROUP
1 Greenstone, argillite, limestone, slate, banded quartzite

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A WOLVERINE COMPLEX (A, B)
Quartz-mica schist, granitoid gneiss, granite-pegmatite

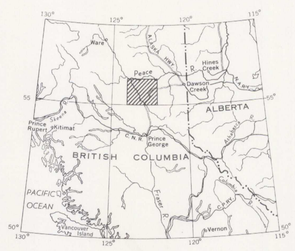
B Amphibolite, pseudodiorite

Geological boundary (approximate)
Bedding (horizontal, inclined, vertical, overturned)
Schistosity and gneissosity (inclined, vertical, dip unknown)
Bedding, schistosity (estimated from aircraft)
Thrust fault (assumed, teeth on upper plate)
Tear-fault; lineament suggesting fault of unknown character (assumed)
Anticline (defined, approximate)
Syncline (defined, approximate)
Anticline, syncline (overturned)

Geology by J.E. Muller, 1959, 1960. Part of Cretaceous geology compiled from published maps of the Geological Survey and B.C. Department of Mines and from unpublished information of D.F. Stott

Cartography by the Geological Survey of Canada, 1961

PUBLISHED, 1961
COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA




INDEX MAP

In response to public demand for earlier publication, Preliminary Series maps are issued in this simplified form and will be clearer to read if all or some of the map-units are hand-coloured

MAP 11-1961
GEOLOGY
# PINE PASS
BRITISH COLUMBIA

Scale: One Inch to Four Miles = 1/253,440
4 2 0 4 8 12 Miles

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

LEGEND

Main highway
Roads (all weather, dry weather)
Trail
Railway
District boundary
Intermittent stream
Marsh
Contours (interval 500 feet)
Height in feet above mean sea-level

Base-map prepared by the Army Survey Establishment, R.C.E., Dept. of National Defence, 1949-1955

Approximate magnetic declination, 27° 50' East

Geographical names subject to revision

PRINTED BY THE SURVEYS AND MAPPING BRANCH

## DESCRIPTIVE NOTES

From southwest to northeast the area is divided into the following units: (1) the Interior Plateau—low rolling country of volcanic-sedimentary rocks, culminating in the crystalline Wolverine Range; (2) the Rocky Mountain Trench—a wide plain with only a few Palaeozoic bedrock exposures; (3) the Rocky Mountains—largely with flat-topped mountains of late Precambrian schists in the southwest, but with rugged early Palaeozoic carbonate-quartzite mountains in the northeast; (4) the Front Range—moderately steep Mississippian and Triassic carbonate-clastic sediments; and (5) the Foothills—Lower Cretaceous sandstones and shales.

The Cordilleran ice-sheet covered all but some peaks above 6,000 feet elevation and moved in a general northeasterly direction.

Highway 97 and the Pacific Great Eastern Railway provide easy access from Prince George and Dawson Creek. The Manson Creek road from Fort St. James north, runs near the western edge of the area. Parsnip River is navigable by riverboats; Nation River may be ascended to Wolverine Range, and Peace River may be travelled through Finlay and Ne-parie-pas Rapids to the canyon below Gold Bar. Pack-horses may be used in the Foothills and most of the Front Range, but they are not recommended for the Rocky Mountains or the Interior Plateau, where helicopters are the most efficient means of travel.

The metamorphic Wolverine complex (A, B) is intruded by dykes and sills of granite-pegmatite, with muscovite crystals several inches in size, and small stocks of coarse-grained granite (3).

Amphibolite and pseudodiorite (B) may be metamorphosed equivalents of volcanic rocks of unit 1 and perhaps unit 2.

No unconformable relationship was found between Wolverine gneisses and (?) Carboniferous rocks. Both units were intruded and partly mantled by Mesozoic to Tertiary plutonic rocks.

Highly disturbed volcanic and sedimentary rocks of unit 1, of low-grade metamorphism, could be assigned to the Mississippian Slide Mountain group or the Permian Cache Creek group of neighbouring areas.

The volcanic rocks of unit 2 extend into Takla group rocks of Fort St. James area.

Low-grade metamorphic rocks of the Misinchinka group are divided lithologically into units 4-6. The upper unit of dark slates (6) grades without apparent unconformity into Lower (?) Cambrian orthoquartzite (7). The thickness of the group, obscured by close folding, is estimated to be between 5,000 and 10,000 feet.

About 2,000 feet of white, cream, and red, locally crossbedded orthoquartzite, interbedded with minor shale and slate, forms the base of unit 7. These rocks are overlain by some 1,400 feet of dolomite, interbedded with red shale, siltstone, and sandstone in the basal part. The unit, except for the shale, is cliff-forming, and probably contains the Lower Cambrian Archeocyathids, collected by the provincial mines department on highway 97, 17.1 miles from Parsnip River.

About 2,500 feet of limestone, commonly nodular, with shaly laminations (8) forms most of the high Rocky Mountain peaks. In the north it is intensely deformed and schistose. North of Azouzetta Lake it yielded trilobites of probably Upper Cambrian and Lower Ordovician age.

More than 2,000 feet of dolomite with minor orthoquartzite (9) carries mainly silicified Upper Ordovician and Silurian (Trenton) corals. Fossils of both ages occur in the Mount Selwyn region; Upper Ordovician fossils near Mount Hunter; and Silurian fossils in the Rocky Mountain Trench, north of Dastaiga Creek.

About 1,000 feet of Middle Devonian (early Givetian) limestone (10) occurs, but only in the northern part of the area.

Shaly carbonates (11), underlying Rundle limestone in the Front Range, may be early Mississippian (Banff) and/or late Devonian. Upper Devonian (highest Frasnian?) fossils were obtained along highway 97.

Some 1,000 feet of Rundle limestone with abundant chert (12) is the main cliff-unit of the Front Range. It is overlain by up to 450 feet of calcareous siltstone. Ten to 120 feet of massive chert (14) marks the Carboniferous-Triassic contact.

In the Front Range and below the Murray Range thrust, about 500 feet of black, recessive shales is the basal part of unit 15, with a Middle Triassic (Anisian) fauna from northeast of Mount Hunter. Above these shales is 2,000 feet of silty carbonates, with Middle Triassic (Ladinian) fossils in the lower half and abundant terebratulid and rhynchonellid brachiopods in the upper part.

Some 2,000 feet of clastic and carbonate beds are exposed in Foothills anticlines. These contain various Upper Triasaic (Karnian and Norian) ammonite faunas and form the Pardonet formation (16). South of Peace River the top is marked by about 250 feet of limestone with small sponge-like siliceous incrustations, overlying Monotis beds. Dolomite, occurring in Front Range synclines, is also included in unit 16.

Graded-bedded, locally schistose, argillite, greywacke, and conglomerate (17) in the structural window between the Rocky Mountains and the Front Range are probably Jurassic and/or Cretaceous.

Dark shales (18), overlying unit 15, are more than 1,000 feet thick near Peace River and underlie many valleys in the Foothills. They contain Upper Jurassic (Portlandian, sensu lato) fossils like those occurring in Nikanassin beds farther south, but Fernie equivalents may be present too.

More than 2,000 feet of Monteith sandstone, with Lower Cretaceous (Berriasian to Lower Valanginian) fossils, overlies unit 18 and forms many anticlinal ridges. It is in gradational contact with up to 1,500 feet of Beattie Peaks interbedded shale and sandstone (20) with a Lower Valanginian fauna. A few hundred feet of Monach sandstone forms prominent ledges and contains several Middle Vaianginian, Buchia beds. This appears to grade into the continental part of the Bullhead group (Gething formation) and is mapped with it (21). Gething beds, probably more than 4,000 feet thick, are commonly more highly folded than underlying beds. Aptian plants have been collected by earlier workers.

From bottom to top, the Fort St. John group is subdivided in five marine units of Albian age: Moosebar formation (22), 800 feet; Commotion formation (23), 1,300-1,500 feet; Hasler formation (24), 1,100-1,200 feet; Goodrich formation (25), 550-600 feet; and Cruiser formation (26), 800-900 feet. This is capped by Upper Cretaceous Dunvegan sandstone (27). Conglomerate with boulders of limestone, chert, and some volcanic rock, outcrops on the lower part of Paranip River, and is probably equivalent to the Sifton Formation (28). Farther upstream finer clastic sediments (29) contain fossil leaves. Both units may be of Cretaceous or Tertiary age.

In the Interior Plateau, topographic lineaments suggest northwest-striking thrust(?) faults and northeast-striking block(?) faults. The lineament separating this geological province from the Rocky Mountain province is along the east edge of the Rocky Mountain Trench; it is perhaps a major thrust fault. The trench may owe its existence to erosion of highly disturbed Palaeozoic and soft Tertiary sediments below this thrust.

The Rocky Mountains, Front Range, and western Foothills are major thrust blocks of, respectively, Precambrian to Devonian, Mississippian to Triassic, and Triassic to Cretaceous sediments. The first two are folded and sliced by secondary thrusts, and separated by a structural window exposing autochthonous(?) Mesozoic rocks.

The western part of the Foothills is considered as a wrinkled sheet of Mesozoic sediments, with typical boxed anticlines, overriding the Mesozoic-Palaeozoic cover of the Precambrian basement. The eastern part is only gently deformed.

Continuation of the Peace River arch into the overthrust belt may explain the absence of Ordovician to Middle Devonian sediments in the central part of the area. Block-faulting of the subsurface under the advancing thrust-sheets may have caused the irregular thrust pattern in the northern part.

The economic possibilities—as yet untested—of the Nation River region, are for muscovite and perhaps other minerals such as beryl in the pegmatites, and placer gold. No reason can be seen why the rocks east of the Rocky Mountain thrust are not as likely to contain oil and gas as those of the Peace River plains.


Armstrong, J.E.: Fort St. James Map-area, Cassiar and Coast Districts, British Columbia; Geol. Surv., Canada, Mem. 252 (1949).
Armstrong, J.E., et al.: Carp Lake, Cariboo District; Geol. Surv., Canada, Map 979A (1949).
Beach, H.H., and Spivak, J.: Dunlevie - Portage Mountain Map-area, British Columbia; Geol. Surv., Canada, Paper 44-19 (1944).
Matthews, W.H.: Carbon Creek - Mount Bickford Area; B.C. Dept. Mines, Bull. 24 (1947).
McKechnie, N.D.: Coal Reserves of Hasler Creek - Pine River Area; B.C. Dept. Mines, Bull. 36 (1955).
Wickenden, R.T.D., and Shaw, G.: Stratigraphy and Structure in Mount Hulcross - Commotion Creek Map-area, British Columbia; Geol. Surv., Canada, Paper 43-13 (1943).


MAP 11-1961
PINE PASS
BRITISH COLUMBIA
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