

LEGEND

- QUATERNARY**
- PLEISTOCENE AND RECENT**
- 17 Glacial till, lake silts and clays, gravel, sand, silt
- CRETACEOUS**
- UPPER CRETACEOUS**
- 16 DUNVEGAN FORMATION: sandstone, shale, conglomerate (marine and non-marine)
- LOWER CRETACEOUS**
- 15 FORT ST. JOHN GROUP (14, 15)
- 14 SIKANI FORMATION: shale, sandstone, siltstone (marine) (includes some Upper Cretaceous beds at top)
- 13 BUCKINGHORE FORMATION: shale, silty shale; minor sandstone (marine)
- LOWER CRETACEOUS AND JURASSIC**
- 12 BULLHEAD GROUP: sandstone, shale, coaly shale, conglomerate, coal (marine and non-marine)
- JURASSIC**
- 11 FERNIE GROUP: shale, siltstone; minor sandstone and ironstone (marine)
- TRIASSIC**
- 10 TOAD, GRAYLING, LIARD, AND PARDONET FORMATIONS: shale, calcareous sandstone; calcareous siltstone, limestone, dolomite (marine)
- PERMIAN (?)**
- 9 Chert (marine)
- MISSISSIPPIAN**
- 8 Sandstone, siltstone, shale, limestone (marine) (In some localities the upper part includes beds of Pennsylvanian age)
- 7 PROPHET FORMATION: limestone, dolomite, chert, cherty limestone and dolomite, calcareous chert (lower part consists of shale, chert and argillaceous limestone) (marine)
- DEVONIAN**
- UPPER AND MIDDLE DEVONIAN**
- 6 BESA RIVER FORMATION: shale, silty shale, calcareous shale, siltstone; minor limestone (marine) (mainly Upper Devonian but contains a Middle Devonian fauna towards the northwest)
- MIDDLE DEVONIAN**
- 5 Limestone, argillaceous limestone; minor dolomite and calcareous shale (marine)
- SILURIAN**
- 4 Dolomite, silty dolomite; minor quartzitic sandstone and limestone (marine) (In some localities may include some beds of Ordovician age)
- ORDOVICIAN**
- 3 Platy limestone, nodular limestone, dolomite, shale, calcareous shale, siltstone, dolomitic siltstone (marine) (In some localities may include some beds of Silurian and/or Cambrian age)
- LOWER PALAEOZOIC (UNDIVIDED)**
- 2
- CAMBRIAN**
- MIDDLE CAMBRIAN**
- 1 Quartzitic sandstone, sandstone, dolomitic sandstone, dolomitic siltstone, dolomite (marine)
- LOWER PALAEOZOIC OR EARLIER?**
- 1 MISCHINKA GROUP: limestone, chlorite schist, phyllite, calcareous sericite schist, schistose sandstone; minor white vein quartz (marine)

Geological boundary (approximate or assumed)

Bedding (horizontal, inclined, vertical, overturned)

Thrust fault (position approximate; teeth in direction of dip)

Thrust fault (assumed; teeth in direction of dip)

Anticlinal axis (position approximate; arrow in direction of plunge)

Synclinal axis (position approximate; arrow in direction of plunge)

Fossil locality

Coal mine

Geology by E. J. W. Irish 1959, 1960, 1961, 1962

Cartography by the Geological Survey of Canada, 1963

Mean magnetic declination, 28° 26' East decreasing 3.9 annually. Reading vary from 28° 12' E in the SE corner to 28° 54' E in the NW corner of the map-area.

DESCRIPTIVE NOTES

The map-area includes the western edge of the Great Plains, the Foothills and the Rocky Mountains, the latter two divisions trending N15° W. The Rocky Mountains, about 35 miles wide, in the most westerly part of the area, are underlain mainly by Palaeozoic rocks, and are characterized by steep to precipitous ridges and peaks with intervening heavily timbered valleys. Many of the main ridges extend approximately east-west across the trend of the mountains and have an average elevation of about 6,500 feet though some peaks rise to more than 8,500 feet above sea-level. Average relief is about 3,000 feet. On the gentler slopes, timber-line is at about 5,000 feet.

The foothills region, between the Plains and the Rocky Mountains, is about 30 miles wide. It is underlain predominantly by Lower Mesozoic strata and consists of irregularly shaped ridges that tend to parallel the trend of the structures. In general, the average altitude of the Foothills is lower than that of the Rockies and the ridges are less rugged.

The eastern boundary of the Foothills is quite abrupt. It occurs at the eastern side of Butler Ridge, Hackney Hills, and other high ridges formed by folded and faulted Lower Cretaceous sandstone formations. East of these ridges and forming the western boundary of the Great Plains are low rounded hills separated by wide valleys with gently sloping sides.

Low-grade metamorphic rocks of the Misinchka Group (1) comprise a succession of slightly altered sedimentary strata estimated to be more than 4,000 feet thick; owing to structural repetition the exact thickness could not be measured. The northeastern limit of these beds is probably more irregular than is indicated on this map. These metamorphosed strata are assumed to be the oldest rocks within the map-area but their age relationship with the Lower Palaeozoic strata could not be determined.

Sandstones, siltstones and dolomites containing a Middle Cambrian fauna occur on the upper slopes of two ridges on the west side of Opika River valley (2). About 1,500 feet of these strata are known to be present but the total thickness may be several thousand feet.

Rocks, mainly of Ordovician age 4 outcrop within the western part of the main ranges and comprise impure, platy nodular grey limestone, siltstone and grey shale. These beds are lithologically similar to underlying Cambrian and overlying Silurian strata and unit 4 may include some beds older and/or younger than Ordovician. It is estimated to be about 2,000 feet thick and contains Lower, Middle and Upper Ordovician fossils.

In those parts of the map-area where present information does not permit more precise subdivision, the rocks have been designated as Undivided Lower Palaeozoic (3), comprising strata of units 4 and 5 and possibly also some of unit 2.

Unit (5) comprises about 2,200 feet of dolomite with lesser amounts of limestone and quartzitic sandstone. These very resistant dolomites form rugged peaks and cliffs of the lower mountains. Fossils from Middle Silurian fossils have been collected from them. The uppermost several hundred feet of the succession yielded no fossils and may be, in part, of Devonian age.

Unit 6 has Middle Devonian fossils and is mainly limestone, argillaceous limestone and calcareous shale; it is 800 to 1,100 feet in thickness and overlies strata of unit 5 with apparent conformity.

Unit 7 includes at least 800 feet of shale and calcareous shale assigned to the Besa River formation. The lower contact with the Middle Devonian carbonate rocks appears conformable but is rather abrupt. Fossils from lower limestone, siltstone and shale succession throughout most of the map-area are of Upper Devonian (Famennian) age. However, fossils from limestone beds within this shale where it occurs west of Mount Lashier and on the east side of Opika River valley indicate a Middle Devonian (Givetian) age. It appears, therefore, that the Besa River formation is diachronous; the shale thickening to the northwest at the expense of the underlying carbonate facies.

The lower part of the Prophet Formation (8) is a transitional sequence from the underlying rocks of unit 7 and consists of 500 feet of interbedded argillaceous limestone, chert and shale. Shale decreases upwards and chert becomes more prominent in the higher beds. These strata are overlain by 800 to 900 feet of resistant, interbedded chert, calcareous chert, cherty limestone and limestone. At least the upper part of the transitional sequence is of Lower Mississippian age. Fossils from the remainder of the Prophet Formation are also of Mississippian age.

The Prophet Formation is, in most places conformably overlain by a 100- to 600-foot-thick succession of shales, siltstones, sandstones and limestones (9). At most exposures only late Mississippian fossils have been collected from these beds but, at a locality about 14 miles northeast of Gold Bar, a fauna indicating a Pennsylvanian or Permian age was collected from beds not far below the overlying chert formation.

Unit 10 consists of dark-coloured bedded chert, between 20 and 60 feet thick. At most places within the map-area it lies disconformably upon unit 9 and, where present, is an excellent stratigraphic marker. It may be of Permian age.

Triassic strata of unit 11, including the Toad, Grayling, Liard and Pardonet Formations underlie a large part of the Foothills region. Basal shales representing typical Grayling lithology are present in only a few of the more westerly exposures. Elsewhere calcareous siltstones of the Toad Formation, containing a Lower Triassic fauna near the base, rest directly on chert of unit 10. Sandy and silty beds of the Liard Formation, mainly of Middle Triassic age, succeed those of the Toad and are in turn overlain by strata of the Upper Triassic Pardonet Formation. The whole succession, about 4,000 feet thick, lies disconformably on either unit 9 or 10. The formations have gradational boundaries and are not mapped separately.

Shales of the overlying Fernie Group (12) occur mainly on the flanks of several anticlines and synclines within the Foothills. The group is about 100 feet thick in the northerly exposures but thickens westerly and southwesterly to about 600 feet. Sinemurian and Toarcian fossils have been collected from these shales.

The Bullhead Group (13) forms the ridges at the eastern edge of the Foothills and also underlies most of the area south of Peace River and west of Pardonet Hill. In the south of the map-area the group consists of a lower marine part about 3,000 feet thick and an upper non-marine, coal-bearing part (Gething Formation) about 1,200 feet thick. In the northeastern part of the map-area the group is about 1,200 - 1,500 feet thick and appears to consist almost entirely of Gething Formation. Lower Cretaceous (Valanginian) fossils were collected from beds about 1,000 feet above the Fernie Group on a ridge 3 miles south of Chowade River. Aptian plants have been collected from the Gething Formation.

The Fort St. John Group in this map-area comprises the Buckingham and Sikani Formations. Shales of the Buckingham Formation (14) - up to 3,300 feet thick are confined, mainly, to a region of low relief between the Foothills and Halfway River; most outcrops are along the stream valleys. The Sikani Formation (15) underlies areas east of Halfway River and east of the uplands west of it. Sandstones of the lower part are exposed all along the east side of Halfway River within the map-area and contain fossils of the Neogastropiles fauna. The estimated thickness is 1,000 feet.

Strata of the Dunvegan Formation (16) underlie most of the interstream areas east of Halfway River. No thickness was obtained and no fossils were collected. The formation is known to be of Upper Cretaceous age in adjoining areas.

Unit 17 includes glacial lake clays and silts, boulder till, outwash sand, silt, and gravel, and recent stream deposits. The glacial and fluvio-glacial deposits occur as terraces remnants along all major valleys.

Folds and west-dipping thrust faults are the main forms of structural deformation throughout the map-area. The relatively incompetent rocks of the Misinchka Group in the southwest corner of the map-area are folded and tightly folded. No large folds or faults are apparent but repetition of beds indicates many small breaks; many of the folds are asymmetrical to overturned. Throughout the main part of the mountains, underlain mainly by massive, relatively competent dolomite, faults and folds are larger and more continuous. The most obvious structure in this region is a wide anticline having its culmination between the headwaters of Needham and Poutang Creeks and plunging steeply both to the northwest and southeast; two major thrust faults are folded around both noses of this structure; some imbricate faulting is present at both ends of the plunging fold. Still farther east, tight folds and imbricate thrust faults are present in the areas underlain by Mississippian strata. Throughout the Foothills Belt, long, narrow, and in part on echelon, folds are typical. In this region anticlines are narrow, compressed and separated by relatively wide synclines. Many anticlines are faulted and some have very steep southwest limbs, flat crests, and gently dipping northeast limbs. East of the Foothills several broad anticlines and synclines occur. Their axes are very irregular and their limbs dip at small angles. Some faults are probably present.

Placer gold has been found in small quantities on many gravel bars along Peace River. Gold is in very fine particles or 'colours'. High-grade bituminous coal seams of Lower Cretaceous age were formerly mined on a small scale just west of Butler Ridge and at Peace River canyon. Natural gas is produced from numerous wells drilled along and east of Halfway River valley, east of the Foothills. Four established gas fields - Highway, Gundy Creek, Blueberry West, and Kobes Townsend - lie within, or partly within, the northeastern part of the map-area. The wells in the Highway and Kobes Townsend fields produce from Mississippian, Triassic and Cretaceous formations while those in the Gundy Creek and Blueberry West fields produce only from Mississippian and Triassic strata. Two exploration wells were drilled in the southeastern corner of the area on either side of Butler Ridge. These were unsuccessful and were abandoned.

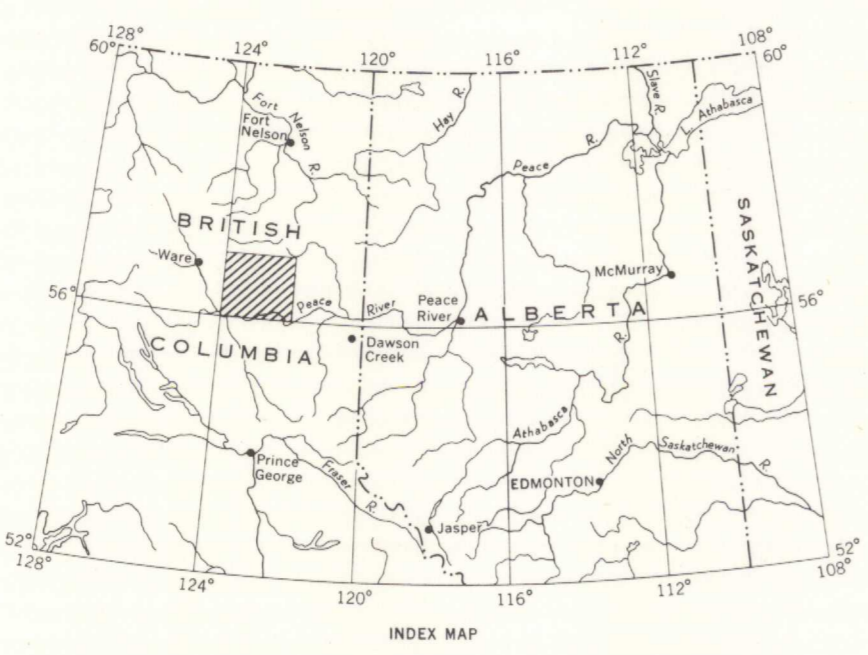
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MAP 22-1963
GEOLOGY
HALFWAY RIVER
BRITISH COLUMBIA

Scale: One Inch to Four Miles = $\frac{1}{253,440}$
4 2 0 4 8 12
Miles

Base-map by the Army Survey Establishment, R. C. E.,
Department of National Defence, 1950-1954.



- Legend
- Road, all weather
- Other roads
- Cart track
- Trail
- Building
- District boundary
- Horizontal control point
- Intermittent stream
- Marsh
- Contours (interval 500 feet)
- Height in feet above mean sea-level

NOV - 6 1963

MAP 22-1963
HALFWAY RIVER
BRITISH COLUMBIA
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