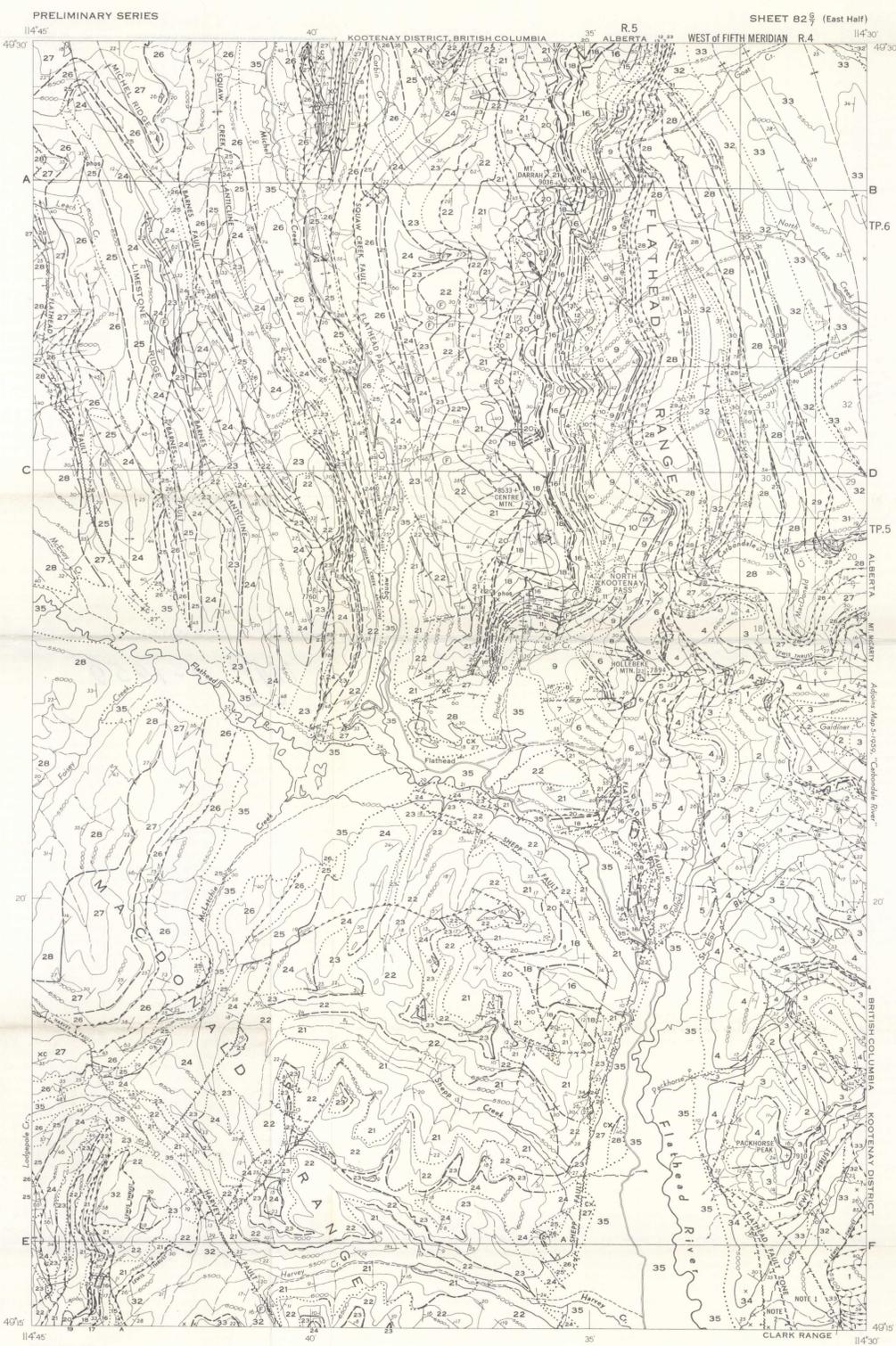


LEGEND

Note 1: Few exposures; undifferentiated Purcell lava and Kintla formation
 Note 2: Few exposures; undifferentiated Palliser and Alexo formations and 'Fairholme group'

SECTIONS ALONG LINES A-B, C-D AND E-F



- QUATERNARY
 PLEISTOCENE AND RECENT
 35 Till, gravel, sand, silt, alluvium
- TERTIARY
 EOCENE (?) AND OLILOCENE (?)
 34 KISHENEHN FORMATION (?): conglomerate
- CRETACEOUS
 UPPER CRETACEOUS
 33 BELLY RIVER FORMATION: green and grey sandstone, mudstone and shale
 ALBERTA GROUP (30-32)
 32 WAPIABI FORMATION: dark grey shale, silty shale, and siltstone
 31 CARDIUM FORMATION: dark grey sandstone, siltstone, and silty shale
 30 BLACKSTONE FORMATION: dark grey shale, silty shale, and siltstone
- LOWER CRETACEOUS
 29 CROWNEST FORMATION: agglomerate; tuff; volcanic sandstones and mudstone
- LOWER CRETACEOUS
 BLAIRMORE GROUP
 28 Grey and greenish grey sandstone; green and red mudstone; conglomerate; minor dark brown limestone
- JURASSIC (?) AND CRETACEOUS
 27 KOOTENAY FORMATION: dark grey carbonaceous sandstone, siltstone, shale, and conglomeratic sandstone; coal
- JURASSIC
 FERNIE GROUP
 26 Light grey calcareous siltstone, shale and sandstone; dark grey to black shale; dark grey siltstone and sandstone; light grey sandy limestone; black limestone
- TRIASSIC
 25 SPRAY RIVER FORMATION: grey dolomitic limestone and sandstone; brown shale and silty shale
- PENNSYLVANIAN AND PERMIAN
 24 ROCKY MOUNTAIN FORMATION: light grey quartzite, quartzitic sandstone and dolomitic sandstone; cherty dolomite
- MISSISSIPPIAN
 RUNDLE GROUP (21-23)
 23 ETHERINGTON FORMATION: light grey crinoidal limestone; grey sandy and silty limestone; cherty dolomite; minor green shale
 22 MOUNT HEAD FORMATION: dark grey to black, fine- and crypto-crystalline limestone; light grey, coarse- and medium-crystalline, crinoidal limestone; dark grey, silty dolomite and shale; light grey, silty and sandy, cherty, fine-crystalline dolomite
 21 LIVINGSTONE FORMATION: massive, light grey, fine- to coarse-crystalline, crinoidal limestone; coarse-grained, crinoidal calcarenite; minor fine-crystalline dolomite
- DEVONIAN
 20 BANFF FORMATION: medium grey, fine- to medium-crystalline, cherty and argillaceous limestone; dark grey and black, fine-crystalline, chert-banded, argillaceous limestone; black, silty shale and banded chert
- PALEOZOIC
 19 EXSHAW FORMATION: black shale
- DEVONIAN
 18 PALLISER FORMATION: massive, dark grey and brownish grey, mottled, fine-crystalline limestone and dolomite; brown, medium crystalline dolomite
 17 ALEXO FORMATION: silty dolomite and limestone; sandstone; limestone and dolomite breccia
- 'FAIRHOLME GROUP' (15, 16)
 16 Upper Part: brown, crystalline dolomite; black shale; dark grey, argillaceous and silty limestone; massive, light grey, coarse-crystalline dolomite ('reefs'); bedded, light grey, coarse-crystalline dolomite
 15 Lower Part: dark grey, fine-crystalline limestone; brown and grey, fine-crystalline dolomite; limestone and dolomite breccia
- CAMBRIAN
 MIDDLE CAMBRIAN (?)
 14 Massive, light grey, mottled, crystalline dolomite; light and dark grey, mottled dolomite and limestone
 MIDDLE CAMBRIAN
 13 Platy, green shale; mottled, nodular limestone and dolomite
 MIDDLE CAMBRIAN OR EARLIER
 12 Light grey and yellowish brown, coarse-grained quartzite
- PURCELL
 11 KINTLA FORMATION (Member C): red and purplish red quartzite and sandstone; hematitic sandstone
 10 KINTLA FORMATION (Member B): green argillite and dolomitic argillite
 9 KINTLA FORMATION (Member A): red siltstone, arenaceous siltstone, and argillite
 8 SHEPPARD FORMATION: brown-weathering, grey dolomite; algal dolomite; red and grey quartzite and argillite
 7 PURCELL LAVA: dark green and purplish green, chloritized, amygdaloidal sandstone and pillow andesite
 6 SIYEH FORMATION: grey dolomite; greyish blue limestone; green, red, and black argillite; sandy and conglomeratic limestone
 5 GRINNELL FORMATION: red argillite; white and red quartzitic sandstone; argillite-pebble conglomerate
 4 APPEKUNNY FORMATION: green argillite; green and white quartzite and quartzitic sandstone
 3 ALTYN FORMATION (2, 3) Middle and Upper Parts: yellowish brown-weathering, grey, fine-crystalline dolomite and nodular dolomite; sandy dolomite; black argillite
 2 Lower Part: dark grey argillite; dark grey, thin-bedded, colour-laminated limestone and dolomite
- 1 WATERLOO FORMATION: grey, banded, laminated and streaked limestone and dolomite; dark grey argillite and dolomite; red and green, fine-crystalline, argillaceous dolomite; white crypto-crystalline limestone

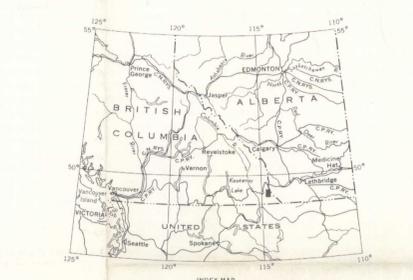
Geology by R.A. Price, 1956; R.A. Price and D.U. Wise, 1957. Compilation by R.A. Price

Cartography by the Geological Survey of Canada, 1959

Approximate magnetic declination, 21° 20' East

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

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.



1-1959
 GEOLOGICAL SURVEY OF CANADA
 DEPARTMENT OF MINES AND TECHNICAL SURVEYS
 MAP 1-1959
 GEOLOGY
 FLATHEAD
 BRITISH COLUMBIA AND ALBERTA
 PUBLISHED 1959
 COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA
 Scale: One Inch to One Mile = 1/63,360 Miles
 Geographical names subject to revision

DESCRIPTIVE NOTES

The Flathead map-area in the southern Rocky Mountains of Alberta and British Columbia, embraces parts of the Foothills and the Flathead, Clark, and Macdonald Ranges.

Two genetically and temporally distinct groups of structures occur: an older group characterized by thrust faults, generally sub-parallel to bedding, along which the pre-Cenozoic strata have undergone relative eastward and northeastward displacement; and a younger group consisting of normal faults, along which blocks have been displaced vertically and tilted.

The Lewis thrust dominates the older group with a minimum horizontal displacement of 25 miles. Other elements in the group can be dynamically related to it. In a window in the Lewis thrust sheet on Cate Creek, the Alberta group (30-32) and the Lewis thrust surface (33) are exposed beneath a northwest-plunging anticline in the Lewis thrust sheet. Northwest-trending folds and associated thrust faults within the Lewis thrust sheet indicate that it has undergone a relative northeastward displacement. A prominent, transverse, northwest-facing monocline in strata above the Lewis thrust surface extends from North Kootenay Pass to Lodgepole Creek, and marks the locus of a change in stratigraphic position of the Lewis thrust surface relative to overlying beds. At North Kootenay Pass for example, this monocline lies above a transverse zone along which the Waterton (1), Allyn (2, 3), Appekunny (4) and Grinnell (5) formations are successively truncated toward the northwest against the thrust surface. This truncation occurs along a monocline in the thrust surface, sub-parallel to that above in the southeast, and south-dipping parts of the Lewis thrust surface along the north end of the Clark Range.

The Howell, Barnes and Squaw Creek faults, together with other less prominent thrust faults and associated folds, indicate a relative eastward thrust displacement imposed discordantly on the earlier northwest-trending structures. Stratigraphic omissions occur locally across these later discordant thrust faults. The Howell fault cuts the Lewis thrust and displaces a western part of the Lewis thrust sheet over an eastern part. At the headwaters of Harvey and Lodgepole Creeks, a window in the Lewis thrust sheet exposes strata of the Alberta group (30-32) and the Belly River formation (33) which lie above the Howell fault. Northwest-trending, overturned folds in the Foothills beneath the Lewis thrust sheet have been overridden discordantly during the relative eastward displacement of the thrust sheet.

The Flathead fault, a west- and south-dipping normal fault, dominates the younger group of structures, and other elements in the group can be related directly to it. The stratigraphic throw across the Flathead fault and related step is about 20,000 feet at Gate Creek; it decreases progressively to less than 1,000 feet at the northeast corner of the area. The block lying to the west and south has been tilted towards the fault and is cut by a complex of minor normal faults. An asymmetrical graben, lying adjacent to the Flathead fault on the west, is the site of a prominent physiographic 'trench', the Flathead Valley, which was the site of rapid accumulation of sediments of the Kishenehn formation (?) during an interval in the active life of the fault.

Thickness of lithologic units in the Purcell succession are as follows: Waterton formation (1), at least 500 feet in the valley of St. Eloi Brook; lower part of the Allyn formation (2), approximately 425 feet at the headwaters of St. Eloi Brook; middle and upper parts of the Allyn formation (undifferentiated) (3), 825 feet at the headwaters of St. Eloi Brook; Appekunny formation (4), 1,700 feet (graphic calculation) in the vicinity of Pollock Creek; Grinnell formation (5), 350 feet at the headwaters of Pollock Creek; Siyeh formation (6), 1,130 feet 1.25 miles south of North Kootenay Pass, comprising a basal argillite and dolomite unit 30 feet thick, a middle dolomite unit, 1,000 feet thick, and an upper argillite unit, 100 feet thick; Purcell lava (7), 30 feet between the north and south branches of Lost Creek, including a 30-foot zone of chloritized andesite pillow lavas in a matrix of 'half-breccia' at the base; Sheppard formation (8), 120 to 160 feet along the east side of Flathead Range; Members A (9), B (10), and C (11) of the Kintla formation - 650, 500, and 400 feet respectively at North Kootenay Pass. Chloritized diorite sills 5 to 35 feet thick occur in the Allyn, Appekunny, Siyeh, Sheppard, and Kintla formations.

The Cambrian quartzite unit (12), approximately 150 feet thick, is unconformable over Purcell strata without local evidence of disconformity between North Kootenay Pass and Goat Creek there is a progressive northward truncation of 1,000 feet of Kintla strata against its base.

The Cambrian shale unit (13), approximately 210 feet thick, has yielded Alberta from within the upper 110 feet.

The Cambrian dolomite unit (14), 245 feet thick on Mount Darragh and 350 feet thick at North Kootenay Pass, has a 'regolith-like' deposit of calcareous mudstone filling depressions and fractures in its upper surface in exposures between the north and south branches of Lost Creek.

The lower part of the 'Fairholme group' (15), 325 to 400 feet thick, comprises a basal, recessive-weathering, dolomite, limestone, and breccia unit, 100 to 170 feet thick; and an upper, dark grey, very fine-crystalline limestone unit, 210 to 240 feet thick.

The upper part of the 'Fairholme group' (16), 680 to more than 850 feet thick, embraces a complex of intertonguing lithologic units. A basal zone, up to 150 feet thick, grades laterally from dark brownish grey, medium- and coarse-crystalline, bedded dolomite to brownish shale. The remainder of the upper part includes the Mount Hawk formation. It consists of dark grey, fine-crystalline, argillaceous and silty limestone, generally with the Arca member of light grey, coarse-crystalline, bedded dolomite at the top, underlain by the Grotto member of dark brownish grey, medium- and fine-crystalline dolomite. Locally, as at the head of Goat Creek and the south branch of Lost Creek, the Mount Hawk formation is abruptly gradational laterally into the Southeast formation. The latter comprises the Penchee member of massive, very coarse-crystalline, light grey, dolomite 'reefs', and in part, the overlying Grotto and Arca members.

The Alexo formation (17), 25 to 100 feet thick along the Flathead Range, is thinnest where it overlies the Southeast formation.

The Palliser formation (18), 600 feet thick on Mount Darragh, comprises the Morro member, 500 feet thick, and the Costigan member, 160 feet thick.

The Banff formation (20), approximately 600 feet thick, is divisible into three lithologic units as follows: 110 feet of recessive-weathering black shale, limestone and banded chert; overlain by 230 feet of dark grey and black, dense, cherty, argillaceous limestone with 270 feet of medium and dark grey, fine- to medium-crystalline, cherty limestone at the top.

The Livingstone formation (21), 1,370 feet thick on Centre Mountain, is marked at the base by the lowest bed of coarse-crystalline limestone.

The Mount Head formation (22), 860 feet thick, is divisible into the following sequence of lithologic units: Salter member, 160 feet (on Centre Mountain), of recessive-weathering, light grey, medium- and silty dolomite; Loomis member, 300 feet (on Centre Mountain), of light grey weathering, cliff-forming, crinoidal limestone; Marston member, 100 feet (on Centre Mountain), of recessive-weathering, silty and argillaceous dolomite and limestone; Carnarvon member, 300 feet (2 miles north of Centre Mountain), of black and dark grey, fine- to crypto-crystalline limestone and argillaceous limestone.

The Etherington formation (23), 430 feet thick 2 miles north of Centre Mountain comprises: a recessive-weathering basal unit 100 feet thick, consisting of cyclical alternations of light grey, dolomite to coarse-crystalline limestone; plucky, yellowish grey, fine-crystalline, silty limestone and dolomite; green shale; a cliff-forming middle unit, 250 feet thick, consisting mainly of light grey, coarse-grained, colitic and bioclastic calcarenite; and an upper recessive-weathering unit, 100 feet thick, consisting of light and dark grey, silty and cherty limestone and dolomite with minor dolomitic siltstone and sandstone. The top is drawn where sandstone is dominant.

The Rocky Mountain formation (24) embraces two lithologic units. At the southwest headwaters of Michel Creek in the west limb of the Barnes anticline, the lower part, consisting of quartzite, sandstone, and dolomitic sandstone, is 610 feet thick; the upper part is 50 feet thick, consisting of fine-crystalline, grey, silty and cherty dolomite with minor shale, bedded chert, quartz-pebble conglomerate, and conglomeratic sandstone. Fossils collected from the lower 265 feet of the formation are reported to be of Pennsylvanian age. Plagioglypta canna White has been collected from the upper part.

The Spray River formation (25), estimated to be 300 feet thick, comprises a lower, recessive-weathering shale and silty shale unit, and an upper, dolomitic or siltstone, argillaceous siltstone and fine-grained sandstone unit.

Six and one half miles west of Mount Darragh, the Fernie group (26) is 1,230 feet thick. The lower part, comprising black shale and limestone with a basal phosphate bed, is poorly exposed, but is approximately 280 feet thick. The 'Grey beds', 640 feet thick (may be tectonically thickened), consist of light grey, silty, sandy, and shaly, argillaceous limestone with interbedded calcareous shale. The 'Green beds' are absent, but occur on Goat Mountain. The 'Passage beds' overlying the 'Grey beds' with sharp contact, are 310 feet thick.

The Kootenay formation (27) is approximately 1,600 feet thick within the Lewis thrust sheet in the northwestern part of the area, but it is less than 600 feet below the thrust sheet in the northeastern part.

The Blaimore group (28) is 1,800 feet thick (graphic calculation) beneath the Lewis thrust sheet in the Foothills, where the basal non-feldspathic sandstone unit is less than 250 feet thick including less than 50 feet of conglomerate at its base. Within the Lewis thrust sheet, in the vicinity of Foley Creek, the group is more than 3,500 feet thick, and non-feldspathic sandstone and conglomerate occur throughout the basal 500 feet. Higher beds are feldspathic and include reworked alkaline volcanic debris.

The Crownest formation (29) is known only from below the Lewis thrust sheet, where graphic calculations indicate a thickness of 900 feet.

Strata of the Alberta group (30-32) and the Belly River formation (33) are known only from below the Lewis thrust sheet and are generally poorly exposed. Indurated conglomerates assigned to the Kishenehn formation (7) (34) are composed exclusively of Palaeozoic fragments and show crude stratification that consistently dips towards the Flathead fault.

Trachyte and syenite bodies (A) are common in Macdonald Range where they vary in form from narrow dykes to irregular anastomosing masses. They occur within strata ranging from the Cambrian shale unit to the basal conglomerate of the Blaimore group.