CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

LEGEND

CRETACEOUS

UPPER CRETACEOUS

- 18 — *BELLY RIVER FORMATION: crossbedded sandstone; green and grey shale; nodular limestone*
- 17 — *WAPIABI (Upper Alberta) FORMATION: dark grey silty shale; fine-grained, grey sandstone*
- 16 — *BIGHORN (Cardium) FORMATION: fine- to coarse-grained sandstone; silty shale*
- 15 — *BLACKSTONE (Lower Alberta) FORMATION: dark grey, silty and concretionary shale; grey sandstone; basal chert-conglomerate*

LOWER CRETACEOUS

- 14 — BLAIRMORE GROUP: *green and grey sandstone; green, grey, maroon, and carbonaceous shale: conglomerate*
- 13 — *KOOTENAY FORMATION: undivided*
- 12 — *KOOTENAY FORMATION (Upper Part): massive-bedded, coarse-grained, black sandstone; grey and carbonaceous shale; conglomerate*
- 11 — *KOOTENAY FORMATION (Lower Part): thin-bedded, fine-grained, grey and brown sandstone; grey and carbonaceous shale; coal; basal, coarse-grained black sandstone*

JURASSIC

- 10 — FERNIE GROUP: *dark grey shale; grey and brown sandstone*

TRIASSIC

- 9 — *SPRAY RIVER FORMATION: arenaceous dolomite and limestone; dark grey shale and sandstone; black chert-conglomerate*

PENNSYLVANIAN (?)

- 8 — *ROCKY MOUNTAIN FORMATION: arenaceous dolomite and sandstone; dolomite; massive chert*

MISSISSIPPIAN AND (?) PENNSYLVANIAN

- *RUNDLE FORMATION (Member D): Buff and grey dolomite and limestone; green shale; arenaceous limestone and dolomite*
- 6 — *RUNDLE FORMATION (Member C): dark grey and brown, fine- to medium-grained limestone; black, calcareous shale; grey, fine-grained dolomite*
- *RUNDLE FORMATION (Member B): limestone and dolomite; green shale; arenaceous dolomite and sandstone; breccia*
- 4 — *RUNDLE FORMATION: (Member A): massive-bedded, coarse-grained, grey limestone and fine-grained, cherty, grey limestone and dolomite*
- 3 — *BANFF FORMATION: thin-bedded, argillaceous and cherty limestone; cherty and arenaceous dolomite*

DEVONIAN

- 2 — *EXSHAW FORMATION: black, fissile shale; argillaceous limestone;*
- 1 — *PALLISER FORMATION: massive-bedded, mottled limestone and dolomite; laminated dolomite; breccia*

MESOZOIC

PALAEOZOIC

Conglomeratic bed in Blairmore group

Rock outcrop

Bedding (inclined, vertical, overturned)

Anticlinal axis (showing direction of plunge)

Synclinal axis (showing direction of plunge)

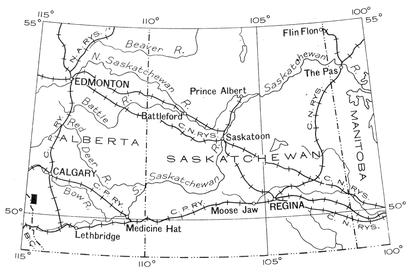
Fault (showing direction of dip)

Well (abandoned)

Coal adit

Geology by R. J. W. Douglas, 1947, 1948

Base map by Topographical Survey 1943
Cartography by the Geological Mapping Division 1950
Approximate magnetic declination 23°30′ East



DESCRIPTIVE NOTES

The map-area is underlain by folded and thrust-faulted Mesozoic and Palaeozoic strata. The latter rocks outcrop in the southwestern part of the area along the High Rock Range, which marks the boundary between British Columbia and Alberta, and in the Highwood Range, which extends northerly through the central part of the map-area. Mesozoic strata from Triassic to Upper Cretaceous in age, lie between these two ranges and east of the Highwood Range.

Four major thrust faults outcrop within or underlie parts of the map-area. The northern extension of the Lewis thrust underlies the Palaeozoic strata of the High Rock Range in the southwestern part of the map-area. It dips westward at a low angle. The McConnell thrust, in its southern part, causes little stratigraphic repetition as it lies entirely within the Spray River formation close to the western boundary of the Highwood Range; north of Highwood River, Palaeozoic strata lie above it, their southern limit being marked by a vertical tear fault of considerable magnitude. The northern part of the McConnell thrust is folded into several anticlines and synclines, and continues northward into the Dyson Creek map-area. The Dyson Mountain thrust, the surface trace of which lies in the Pekisko Creek and Dyson Creek map-areas, to the east and north respectively, underlies the northeastern part of the map-area. Palaeozoic strata lie above it beneath the western flank of the Sullivan Creek anticline.

The fourth major thrust originates on the west limb of the Sullivan Creek anticline and, southward, rapidly increases in displacement. It is believed to be the northward continuation of the Livingstone thrust, in the map-areas to the south. A short distance south of Highwood River (See structure-section F-G), the fault plane is folded into an anticline and syncline, the anticlinal fold superimposed over the Sullivan Creek anticline and the adjacent syncline to the east. The strata above the Livingstone thrust show similar structures, with two higher fault planes also folded conformably, the uppermost of which has least closure. For much of their length these folded faults follow close to the bedding-planes of the Kootenay and Fernie strata, and, on their southward continuation, are believed to have been folded over the Palaeozoic strata of the Sullivan Creek anticline above the Dyson Mountain thrust. All folds in both strata and fault planes plunge southward.

The strata above the Four major thrusts are broken by other subsidiary faults that merge with them at depth or repeat only part of the observed stratigraphic succession. Folds resulting from drag due to displacement along the faults, or are produced simultaneously with the folding of the major thrust planes.

Of particular importance to the evaluation of the coal prospects of the area are numerous tear faults, most common to the Mesozoic strata adjacent to the northwest part of the Highwood Range. The dip of these faults, so far as could be determined, is vertical. They are believed to be the result of differential vertical displacement of the strata above the underlying thrust faults. The apparent horizontal offset of the beds may vary from a few feet to more than 1,000 feet. Only those tear faults that have large displacements, or that offset distinctive beds have been mapped; others may be present, especially in the areas underlain by the Kootenay formation, and would render mining of the coal seams of this part of the area difficult.

The oldest rocks exposed within the map-area are about 300 feet of the upper part of the PALLISER formation (1) of Upper Devonian age. The top 55 feet comprise porous, coarse-grained, fragmental limestone, finely laminated, argillaceous dolomite, and porous dolomite breccias. These are underlain by fine-grained, grey limestone, grey weathering, and mottled with granular light brown dolomite weathering brown. The overlying EXSHAW formation (2) is about 100 feet thick.

The Mississippian BANFF formation (3) is about 800 feet thick in the northern part of the map-area. It is overlain by the RUNDLE formation (4-7), which has been divided into four members. The thickness of the basal member (A) is known only on Flat Creek, where it is about 1,100 feet. Member B is readily divisible into three parts; the lower part, 150 feet thick, contains fine-grained, arenaceous dolomites, thin-bedded sandstones, cherty dolomite, and thin, porous dolomite breccias in the top, with a fine-grained grey limestone, 15 feet thick, locally porous, lying about 40 feet above the base; the middle part, 150 feet thick, is a massive-bedded, cliff-forming, fine- to coarse-grained limestone, locally porous; the upper part, 135 feet thick, is composed of cyclical repetitions of green shale, grey cherty limestone, and vuggy pyritic dolomite in beds 0·5 to 10·0 feet thick. Erosional disconformities were observed in these strata. Member C maintains a thickness close to 150 feet throughout its observed extent. Much of the member is an alternation of thin, black, calcareous shale and beds 1·0 to 4·0 feet thick of fine-grained, dark grey to brownish grey limestone. The upper part contains well developed cyclothems of brown, medium-grained, cherty limestone, dolomite, and green shale. Member D is about 210 feet thick, and contains, in its basal part, cyclothems of alternating green shale and rubbly, fine-grained dolomite. Limestone is more common in the central part, with a distinctive arenaceous limestone bed, finely laminated, crossbedded, and cherty, about 120 feet above the base. The upper part of the member is composed of dolomites, which may be fine-grained, dense buff to grey, and cherty, or brown, medium-grained, and granular, or detrital, with pyrobitumen filling the the pore spaces. The upper part, above the arenaceous limestone, becomes distinctly sandy along the west flank of the Highwood Range in the north, suggesting that it may pass laterally into the basal part of the Rocky Mountain formation of the Banff area.

The ROCKY MOUNTAIN formation (8), of probable Pennsylvanian age, varies in thickness from about 20 to 75 feet, being thickest in the northwest. The beds included in the Triassic SPRAY RIVER formation (9) are only 90 feet thick along the eastern Highwood Range, but may be as much as 300 to 900 feet thick northwest and southwest of the range. The FERNIE group (10) is commonly highly contorted and underlies broad areas, but probably does not exceed 1,000 feet in thickness.

The KOOTENAY formation (11-13), west of the Highwood Range is divisible into two parts: the lower part, 560 feet thick along Highwood River, contains most of the coal seams observed and all those at present being prospected; the upper part is 380 feet thick along Highwood River. Both parts thicken rapidly to the west and northwest, and thin to the southeast of the Highwood Range, the entire formation (13) is about 500 to 600 feet thick, and is similar lithologically to the lower part of the formation of the west.

The BLAIRMORE group (14) is about 2,600 feet thick over much of the region west of Highwood Range, and thins to about 1,500 feet east of it. Distinctive beds are: the basal chert and quartzite conglomerate; the overlying 250 feet, with fine- to coarse-grained, quartz sandstone; a massive-bedded fine- to coarse-grained, green, arkosic sandstone, locally containing igneous and quartzite pebbles, and lying from 800 to 1,350 feet above the base of the group; and the upper 200 feet, with fine- to coarse-grained quartz sandstones, locally carrying chert and quartzite pebbles.

The base of the BLACKSTONE (Lower Alberta) formation (15), west of the Highwood Range is commonly marked by 0·5 foot of black chert conglomerate. The formation is about 800 feet thick in the northeast, and about 1,000 feet in the southwest, where sandstones are common and the shales silty. The BIGHORN (Cardium) formation (16) varies greatly in thickness and composition throughout the map-area. In the northeast, it is only about 100 feet thick, composed of two, fine-grained sandstones, with interbedded silty and concretionary shale, but west of the Highwood Range the formation thickens rapidly, reaching a maximum of about 1,000 feet in the extreme southwest, where it contains as many as eight separate beds of sandstone, with interbedded silty shales. The overlying WAPIABI (Upper Alberta) formation (17) is exposed only in the west, where it is about 2,300 feet thick. A minimum thickness only of about 3,700 feet can be inferred for the BELLY RIVER formation (18), the youngest in the map-area.

The coal seams of the Kootenay formation, in the area west of the Highwood Range between the Highwood River and Cat Creek, have been prospected by open-cuts, and several adits have been driven along some of the wider seams. The Kootenay strata there are repeated by five, high-angle thrust faults, and are offset between these faults by numerous vertical tear faults. The coal seams vary in thickness due to squeezing, and are commonly highly sheared.

The Sullivan Creek Oil Syndicate No 1 well, in l.s. 13, sec. 25, tp. 17, rge. 5, W. 4th mer., encountered Rundle strata in the core of the Sullivan Creek anticline. The well commenced in Kootenay strata. Faults with small displacement were encountered at depths of 720, 1,040, 1,560, 2,850, and 3,430 feet. Drilling depths to the tops of the various formations are as follows: Fernie group, at 510, 910, and 1,140 feet; Spray River (?) formation, at 2,190 feet; Rocky Mountain formation, at 2,380 feet; Rundle formation, Member D, at 2,400 feet; Member C, at 2,800, 2,850, and 3,460 feet; Member B, at 3,170 feet. The well was abandoned at a depth of 3,590 feet within the upper part of Member C of the Rundle formation. As interpreted in structure-section A-C, the well was located close to the crest of the Sullivan Creek anticline and encountered steeply dipping Rundle strata of the west flank of an anticlinal fold lying above the Dyson Mountain thrust. Rundle strata of the Sullivan Creek anticline above the thrust probably do not extend farther east than the surface trace of the crest of the anticline within Blairmore strata. The Sullivan Creek anticline plunges southward south of Highwood River.

Palaeozoic strata, with anticlinal structure, may lie close below the anticlinally folded Dyson Mountain thrust beneath the Sullivan Creek anticline shown in structure-section A-C. This structure is believed to be the southward extension of the Moose Mountain anticline to the north, but is probably separated from it by a structurally low area in the northwestern part of the Dyson Creek map-area. A south plunge may be inferred along its southward continuation south of Highwood River.

PRELIMINARY MAP 50-8

MOUNT HEAD

WEST OF FIFTH MERIDIAN

ALBERTA

Scale: 1 Inch to ½ Mile = 1/31,680

1 — 0 — 2 Miles

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