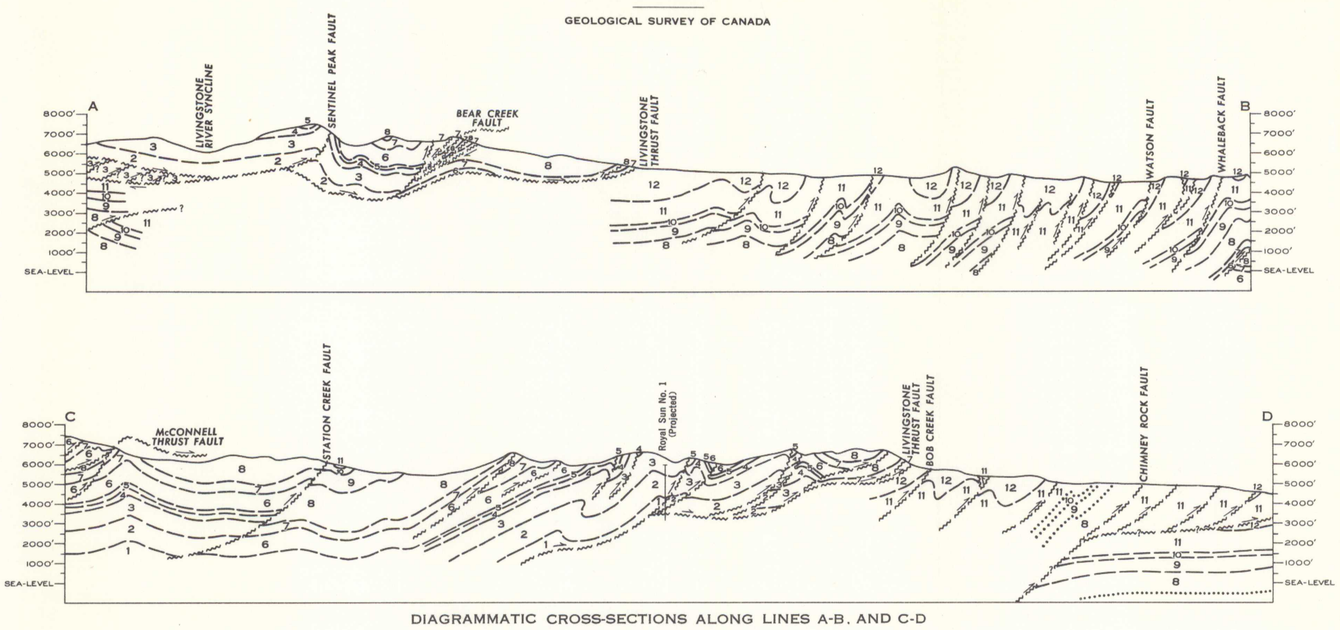
CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA



DIAGRAMMATIC CROSS-SECTIONS ALONG LINES A-B. AND C-D

LEGEND

MESOZOIC

CRETACEOUS
UPPER CRETACEOUS

12 BELLY RIVER FORMATION: crossbedded, grey and green sandstone, silty grey and green shale

ALBERTA GROUP (9-11)

11 WAPIABI FORMATION: dark grey shale, silty shale, thin, grey sandstone

10 CARDIUM FORMATION: grey sandstone, silty grey shale

9 BLACKSTONE FORMATION: dark grey, silty shale, thin sandstone

LOWER CRETACEOUS
BLAIRMORE GROUP

8 Grey and greenish grey sandstone, green and maroon, silty mudstone; conglomerates

7 KOOTENAY FORMATION: dark grey and black shale, carbonaceous shale, dark grey and black sandstone; coal

JURASSIC
FERNIE GROUP

6 Dark grey and black shale, black and brown sandstone, thin black limestone; basal conglomeratic sandstone

PALAEOZOIC

PENNSYLVANIAN(?) AND PERMIAN

5 ROCKY MOUNTAIN FORMATION: grey sandstone, silty dolomite, chert; may include Triassic Spray River formation in part

MISSISSIPPIAN
RUNDLE GROUP (2-4)

4 ETHERINGTON FORMATION: light grey and buff, silty dolomite, grey limestone; green and maroon shale, chert and dolomite breccia

3 MOUNT HEAD FORMATION: dark grey and black limestone, grey and buff dolomite, grey limestone, dolomite and limestone breccia

2 LIVINGSTONE FORMATION: massive, grey limestone, crinoidal limestone; grey dolomite

1 BANFF FORMATION: banded, black, cherty dolomite shaly, black limestone

Rock outcrop (attitude not attainable)
Sedimentary contact (approximate, assumed)
Bedding (horizontal, inclined, vertical, overturned)
Fault, thrust (approximate, assumed)
Fault, normal (solid circle on down-thrown side)
Anticline, trace of axial plane (approximate, assumed)
Syncline, trace of axial plane (approximate, assumed)
Anticline, overturned
Syncline, overturned
Plunge of fold axis
Fossil locality
Well, abandoned
Coal adit

Note 1: no exposures; cuttings from Oilfield Development No. 1 well suggest the presence of highly deformed and thickened Cardium strata close to or at the surface beneath Chimney Rock fault.

Geology by D. K. Norris, 1955

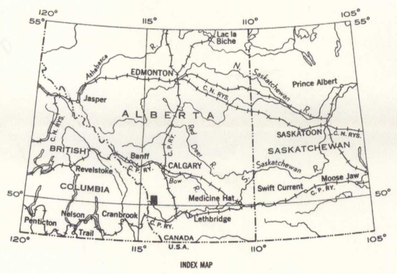
Roads (loose surface)
Cart track
Trail
Building
Township boundary (surveyed)
Township boundary (unsurveyed)
Section line and number
Stream (position approximate)
Contours (interval 500 feet)
Height in feet above mean sea-level

Approximate magnetic declination, 21° 48' East

Cartography by the Geological Cartography Unit, 1958

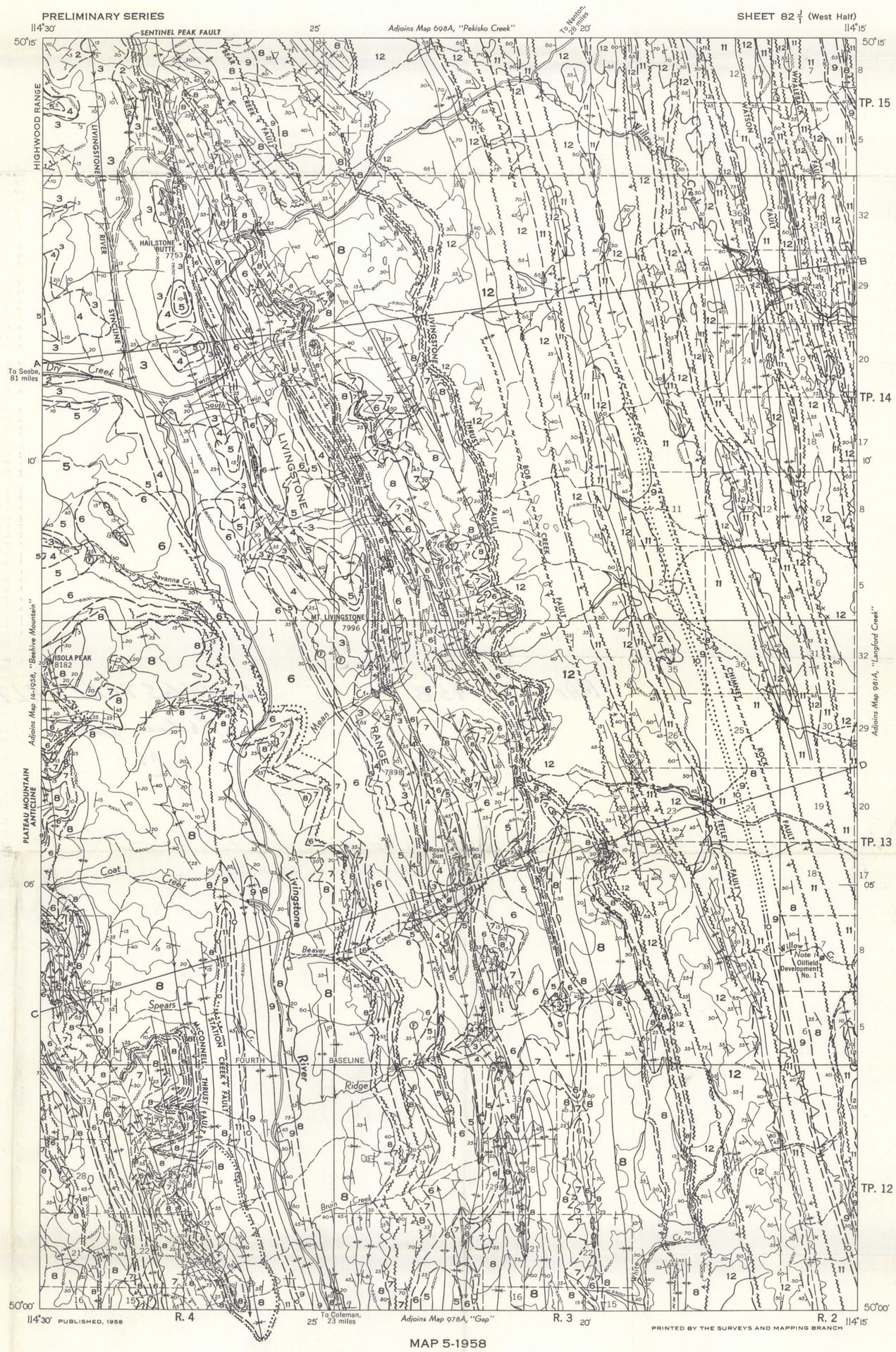
Air photographs covering this area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

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.



PRELIMINARY SERIES

SHEET 82 J/1 (West Half)



PUBLISHED, 1958

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MAP 5-1958

LIVINGSTONE RIVER

WEST OF FIFTH MERIDIAN

ALBERTA

Scale: One Inch to One Mile = 1/63,360

Miles 1 ½ 0 1 2 3

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

Map 5-1958

DESCRIPTIVE NOTES

The Livingstone River map-area in the southern foothills of Alberta includes the Livingstone Range as a central backbone and a small part of the southern end of the Highwood Range in the extreme northwest corner. Several major west-dipping thrust faults trend slightly west of north through the area. They are, from east to west respectively, Whaleback, Watson, Chimney Rock, Tetley, Livingstone, Bear Creek, Sentinel Peak, and McConnell faults.

The principal structural feature is the Livingstone thrust whose surface trace divides the area into two physiographic units. To the east of the fault is a subdued but hilly grass-land bearing largely broad-leaved trees, and to the west is considerably more rugged topography, with sparse grassy meadows and largely coniferous trees.

East of the Livingstone thrust, strata of the Belly River formation, and the Alberta and Blairmore groups are closely folded and faulted on steep-dipping thrusts. Resistant sandstones form strike ridges, and thick sequences of recessive shales underlie broad alluvial valleys. As outcrop is confined mainly to the ridges, the structural interpretation is necessarily subjective, but to the west of the Livingstone thrust exposures are good, and the mapping of units is less open to question. There, the resistant Palaeozoic rocks are folded to form a complex anticlinal structure expressed as the Livingstone Range. This range rises gently northward from the south boundary of the map-area to reach a maximum elevation at Mount Livingstone. From there it forks and slopes north to Twin Creeks, only to rise again to form Hailstone Butte and Sentinel Peak, the last remnants of the Range, as it is finally cut off by the Sentinel Peak fault.

West of Livingstone Range is Livingstone River valley. In the south half of the valley the river is incised in west-dipping recessive strata of the upper part of the Blairmore group and the Blackstone formation, and in the north half in Fernie shales and Palaeozoic rocks along the axis of the Livingstone River syncline.

The major tectonic feature in the southwest corner of the area is the McConnell thrust, above which Fernie, Kootenay, and Blairmore strata are tightly folded and repeated on splays from the principal fault. The structure within this thrust sheet is exceedingly complex, primarily because the McConnell thrust glided in the Kootenay formation and is closely folded, along with several of its splays. The thrust rolls over the southward continuation of the Plateau Mountain anticline to its east side about 5 miles south of Isola Peak, only to return to its west flank near the south boundary of the map-area, on what is termed the Fly Hill anticline in the adjacent Gap map-area.

The Banff formation (1) is exposed only on Mean Creek on the north flank of Mount Livingstone where it is some 40 feet thick. It consists of black, fine-grained, medium- and thin-bedded, limy dolomite containing a profusion of blebs and stringers of black, limy, argillaceous chert, and some thin, black, shaly limestone interbeds. The contact with the overlying Livingstone formation (2) is sharp.

The basal bed of the Livingstone formation is a medium grey, fine- to medium-grained, thick-bedded limestone with lacy networks and stringers of light grey chert and a few beds of medium grey, very coarse-grained, crinoidal limestone. At the same locality the Livingstone formation is almost completely exposed. It is 1,100 feet thick and consists dominantly of medium to light grey, thick-bedded to massive, crinoidal limestone. The top beds are light grey, fine- to medium-grained, massive limestone with interbedded light grey, coarse-grained, crinoidal limestone overlain with sharp contact by the Mount Head formation. The contact is gradational locally within the map-area.

Excellent exposures of the Mount Head formation (3) occur on the southwest flank of Mount Livingstone. There the formation is 620 feet thick. It is readily divisible into several members. The Wileman member at the base is 65 feet thick and consists of medium and dark grey, fine-grained, thin- to medium-bedded, light grey-buff weathering, silty dolomite. It is conformably overlain by the Baril member, 100 feet thick, which consists of interbedded black, fine-grained, medium-bedded limestone and medium grey, fine-grained, medium-bedded dolomite. The overlying Salter member consists of 70 feet of interbedded, medium grey, fine-grained, thin-bedded dolomite and buff, fine-grained, dolomitic sandstone. Above the Salter is the Loomis member, 130 feet thick. It is made up of interbedded medium and dark grey, fine- to medium-grained, thick-bedded limestone with stringers of grey chert, and medium grey, fine-grained dolomite. Minor covered intervals may correspond to dolomite breccias exposed in other sections in the area. The overlying Marston member, 90 feet thick, consists dominantly of dark grey, fine-grained, medium-bedded, limy dolomite with minor black, very fine-grained, dolomitic limestone and greenish grey, silty shale. The Carnarvon member at the top of the Mount Head formation is composed of 165 feet of dark grey to black, fine- to crypto-grained, medium-bedded limestone with minor medium grey, crypto-grained, medium-bedded dolomite.

The Etherington formation (4), conformably overlying Mount Head strata, is generally poorly exposed but where the lower and upper contacts are exposed on the southwest flank of Mount Livingstone the formation is very thick. There, approximately 350 feet of interbedded, medium and light grey, fine-grained, medium-bedded dolomite with relief weathered silty bands, and grey, fine-grained, medium-bedded silty limestones are about 50 per cent exposed. The contact with the overlying Rocky Mountain formation is gradational and is drawn where sandstones become the dominant lithological type.

The Rocky Mountain formation (5) is 55 feet thick on the southwest flank of Mount Livingstone and 84 feet thick on Savanna Creek. It consists of grey, fine-grained, medium-bedded, lustre mottled, quartz sandstones with interbedded grey, massive chert and chert breccias. Minor dolomites with silt bands occur in the lower part of the formation.

Strata considered to be Triassic Spray River formation are exposed on Savanna Creek on the east flank of the Plateau Mountain anticline. There, approximately 25 feet of contorted, black, unfossiliferous, shaly siltstones with occasional small pyritic concretions are underlain by a 1-foot bed of black, medium-grained, lustre mottled, calcareous, quartz sandstone with scattered angular pebbles of black chert. Overlying beds are dark grey to black, silty shales of typical Fernie appearance. Similar black, shaly siltstones occur at an equivalent stratigraphic position in known Triassic strata on the west flank of Plateau Mountain. The formation is not recognized elsewhere as it is either too thin or absent, and Spray River strata are grouped with the underlying Rocky Mountain formation.

Strata of the Fernie group (6) are generally poorly exposed. However, on the east flank of the unnamed mountain 2½ miles S40°E. of Mount Livingstone the formation is almost completely exposed. There it is 880 feet thick. The lower contact is drawn at the base of a 3-foot, medium grey, coarse-grained, quartz sandstone containing black phosphate pebbles, and the upper contact at the top of the dark brown, medium-grained, massive quartz sandstone. At this point there is a distinct colour break within one and the same massive bed between brown Fernie sandstone and black Kootenay sandstone.

The Kootenay formation (7) is also most completely exposed at this locality and is 370 feet thick. It is divisible into three units termed the basal sandstone member, the shale member, and the upper sandstone and conglomerate member. In the shale member five coal seams ranging in thickness from ½ foot to 10 feet are interbedded with black, carbonaceous shale and black, fine- and medium-grained sandstones. Their lateral extent is not known.

The Blairmore group (8) unconformably overlies Kootenay strata. It is not well exposed and nowhere was it possible to measure a complete section. A fairly accurate overall thickness was attainable graphically in the southeast corner of the area north of White Creek. There the group is estimated to be 1,500 feet thick. The pebble-conglomerates, at the base, about 500 feet below the top, and within a few tens of feet of the top, were reliable markers in delineating structures involving the group.

The Blackstone formation (9) also outcrops poorly although the lower 200 to 300 feet are completely exposed along Livingstone River towards the south boundary of the map-area. There green, rubbly siltstones at the top of the Blairmore group occur within 10 feet of black, rubbly, rusty brown weathering, micaceous siltstones of basal Blackstone strata. The contact is not exposed. At this point the formation, measured graphically, is about 800 feet thick. Similarly, the Cardium formation (10) is rarely exposed and neither its contacts nor its thickness could be established with certainty.

Exposures of the Wapiabi formation (11) were sparse and were confined largely to the northeast, and especially along Willow Creek. Dark grey, and concretionary shales with minor dark grey, thin-bedded siltstones predominate in the lower part of the formation. Thin interbeds of medium grey, fine-grained sandstones in the upper part become more numerous as the transitional contact with the overlying Belly River formation (12) is approached. The base of the Belly River strata is characterized by a light grey, coarse-grained, strongly crossbedded, massive ridge-forming sandstone about 150 feet thick. Overlying beds are interbedded grey sandstones and silty grey and green shales. A maximum of about 2,000 feet of the formation is present in the map-area.

The coal seams observed in the Kootenay formation southeast of Mount Livingstone appear to be of little immediate economic interest because of their remoteness and inaccessibility. Moreover, strip-ratios are adverse as the seams are exposed on a mountain side.

Thus far two wells have been drilled in the Livingstone River map-area, Oilfield Development No. 1 well in l.s. 7, sec. 7, tp. 13, rge. 2, and Royal Sun No. 1 well in l.s. 2, sec. 17, tp. 13, rge. 3. Both were dry and abandoned. The structure most favourable to the accumulation of gas and possibly oil is the southward continuation of the Savanna Creek field. It is believed to pass through the southwest corner of the map-area and to continue beneath the Fly Hill and Turtle Mountain anticlines. No major culminations are believed to exist within this or the adjacent Gap map-area. It may be, however, that the culmination in the Blairmore Range is indicative of structural conditions beneath the Livingstone thrust similar to those at Savanna Creek.

MAP 5-1958
LIVINGSTONE RIVER
ALBERTA
SHEET 82 J/1 (West Half)