58-3

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 58-3

# CHUNGO CREEK MAP-AREA ALBERTA

(83 C/9)

(Report and Map 6-1958)



By

R. J. W. Douglas

OTTAWA
1958

*Price, 50 cents*

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## Appendix

# CHUNGO CREEK MAP-AREA, ALBERTA

## INTRODUCTION

Chungo Creek map-area was previously examined by B. R. MacKay of the Geological Survey of Canada, the results of his investigations being presented as a preliminary map of the west half, Wapiabi Creek (1940)[1], and a preliminary report and map of the east half, Wawa Creek (1943). Geological data on those parts of the area not visited by the writer were obtained from these sources, modified in the present compilation by the use of aerial photographs which were not available to Dr. MacKay.

## LOCATION AND ACCESSIBILITY

The map-area lies mainly within the central Foothills of Alberta but includes a small part of the Interior Plains in the northeast. Brazeau Range extends a short distance into the southeastern part of the area and Bighorn Range crosses the southwest corner. The map-area lies between latitudes 52°30' and 52°45', and longitudes 116°00' and 116°30'. It adjoins Nordegg map-area (Douglas, 1956a) on the south, and George Creek map-area (Douglas, 1956b), on the west.

A single road crosses the map-area, extending north from the town of Nordegg to the sites of wells drilled on Chungo Creek and thence northward to a well drilled on Canyon Creek. This road may be impassable in bad weather and its continuation north of Chungo Creek was in disrepair in 1954. Alberta Forestry trails lead up the valleys of Blackstone River and Chungo Creek into George Creek map-area, passing through Blackstone and Chungo Gaps in the Bighorn Range. It is possible to take horses up Wapiabi Creek from its junction with Blackstone River to Wapiabi Gap in Nordegg map-area or, alternatively, from the road crossing of Stovepipe Creek across a low saddle to the junction of Sturrock and Wapiabi Creeks. Trails northeast of the road are little used.

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[1] Dates in parentheses are those of references given at the end of this section.

## FIELD WORK AND ACKNOWLEDGMENTS

Field work in Chungo Creek map-area was carried on by the writer during part of the summers of 1953 and 1954, assisted in the former year by W. B. Brady, R. G. Schmidt, R. A. Thrall and D. G. Rose, and in 1954 by R. G. Schmidt, D. F. Stott, D. C. Pugh, R. Dawson, J. Hawryszko and J. N. Arthur.

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TABLE OF FORMATIONS

| Era | Period or epoch | Formation or group | | Lithology | Thickness (feet) |
|---|---|---|---|---|---|
| Cenozoic | Paleocene | Paskapoo | | Nonmarine sandstone, shale and coal | 5,000± |
| Mesozoic | Upper Cretaceous | Brazeau | | Nonmarine sandstone, shale, and conglomerate | 5,000± |
| | | Alberta | Wapiabi | Marine shale and siltstone | 1,100± |
| | | Alberta | Cardium | Marine sandstone and shale | 200-250 |
| | | Alberta | Blackstone | Marine shale, siltstone, and grit | 1,100± |
| | | Disconformity ? | | | |
| | Lower Cretaceous | Mountain Park | | Nonmarine sandstone and shale | 200-300 |
| | | Luscar | | Nonmarine sandstone, shale and coal | 1,100± |
| | | Cadomin | | Nonmarine conglomerate and sandstone | 30-100 |
| | | Nikanassin | | Nonmarine sandstone and shale | 80-1,200 |
| | Jurassic | Fernie | | Marine shale, sandstone and carbonate | 400-500 |
| | | Disconformity | | | |
| | Triassic | Spray River | | Marine siltstone and dolomite | 0-500± |
| | | Disconformity | | | |
| Palaeozoic | Permian ? | Rocky Mountain | | Marine arenaceous dolomite and chert | 10.2 |
| | Mississippian | Rundle | | Marine porous and dense dolomite | 289-359 |
| | | Rundle | Shunda | Marine limestone, shale, anhydrite; breccia | 150-205 |
| | | Rundle | Pekisko | Marine limestone and dolomite | 107-198 |
| | | Banff | | Marine argillaceous limestone and shale | 570-601 |
| | Devonian | Exshaw | | Marine shale | 3.5-7.0 |
| | | Palliser | | Marine limestone and dolomite | 700 |
| | | Alexo | | Marine siltstone, dolomite, and limestone | 200± |
| | | Fairholme | Mount Hawk<br>Southesk<br>Perdrix<br>Cairn<br>Flume | Marine dolomite, limestone and greenish grey and black shale | 800-1,300 |
| | | Disconformity ? | | | |
| | Cambrian or later | Ghost River ? | | Marine dolomite and arenaceous dolomite | 198 |
| | | Disconformity ? | | | |
| | Upper Cambrian | Formation C | | Marine green shale and dolomite | 200± |

## UPPER CAMBRIAN

### Formation C

Formation C, the oldest exposed in the map-area, overlies a fault subsidiary to the Bighorn thrust beneath the Bighorn Range. It is the uppermost of three unnamed formations described in Nordegg map-area to the south (Douglas, 1956a).

The formation comprises upper and lower shales with a median dolomite. On Bighorn Range the lower part of the lower shale is absent through faulting. The uppermost beds consist of 30 feet of green and red shale with thin dolomite beds at the top. The middle part comprises about 60 feet of massive bedded, buff weathering, finely crystalline, buff dolomite and laminated arenaceous dolomite. The upper part consists of about 100 feet of green shale with zones of thin dolomite beds.

## CAMBRIAN OR LATER

### Ghost River ? Formation

Strata included in the Ghost River ? formation are exposed only on Bighorn Range. They consist of 198 feet of cryptocrystalline grey, green, buff, and pink dolomite, in part arenaceous. Grey shale and argillaceous partings, becoming green towards the base, split the dolomite into beds 1 foot to 3 feet thick.

## DEVONIAN

### Fairholme Group

The formations of the Fairholme group present on the Bighorn Range have been described in reports on the adjoining map-areas (Douglas, 1956a and b; McLaren, 1955).

Strata of this group do not outcrop on Brazeau Range, but in Arrow Brazeau No. 1 well the upper part of the group was penetrated between 1,220 and 2,265 feet depths. The following are descriptions taken from a log of representative core samples prepared by D. G. Penner, formerly of the Alberta Petroleum and Natural Gas Conservation Board.

The lowest strata encountered between 2,080 and 2,265 feet are considered to be part of the Perdrix formation. Allowing for the dip of the beds this interval represents a stratigraphic thickness of about 175 feet, a minimum for the formation as the base may not have been encountered. The formation has 270 feet

drilling thickness in Shunda No. 1 well in Nordegg map-area. The strata consist of dark brown to black, slightly calcareous shale, and dark brownish grey, finely crystalline to lithographic shaly limestone.

The Mount Hawk formation, encountered between 1,240 and 2,080 feet drilling depths, is about 800 feet in stratigraphic thickness and is divisible into two parts. The lower part, below 1,705 feet depth and about 350 feet in stratigraphic thickness, consists of grey calcareous shale with a greenish cast and some argillaceous limestone, dark brownish grey and finely crystalline. The upper part of the Mount Hawk contains two units: that below 1,350 feet depth consists of dark brownish grey, finely crystalline argillaceous limestone about 325 feet thick, and that above 1,350 feet comprises about 105 feet of buff, sugary textured, finely porous to slightly vuggy dolomite. These latter beds are similar in stratigraphic position and lithology to the upper part of the Southesk formation on Bighorn Range and grade laterally southeastward into black, argillaceous and silty, cryptocrystalline limestones at the Shunda Creek gap in Brazeau Range and Shunda No. 1 well in Nordegg map-area.

## Alexo Formation

The Alexo formation in the Arrow Brazeau No. 1 well on Brazeau Range was encountered between 1,025 and 1,240 feet depths, a stratigraphic thickness of about 200 feet. It includes greenish grey siltstone, in part calcareous and dolomitic, buff to brown, chalky porous limestone, and buff, fine-grained laminated dolomite. The formation is 267 feet thick on Bighorn Range, as measured by D. J. McLaren.

## Palliser Formation

On Brazeau Range the Palliser formation consists of massive bedded, brown dolomite, fine to medium crystalline, vuggy and porous, in zones overlain by interbedded finely laminated silty and argillaceous dolomite, dolomite breccia, and argillaceous, finely crystalline, dark grey fossiliferous limestone. The entire formation was penetrated in the Arrow Brazeau No. 1 well between 280 and 1,025 feet depths, a stratigraphic interval of about 700 feet. The lower 640 feet drilling thickness (600 feet stratigraphic thickness) consists mainly of buff, finely crystalline, sugary textured dolomite with porosity varying from traces of pinpoint porosity to fair, fine porosity and scattered vugs. The vugs may be filled with calcite and the pores spaces with black pyrobitumen. Some beds are calcareous or consist of finely crystalline, buff porous limestone. The upper 95 feet drilling thickness (90 feet

stratigraphic thickness) are dark brownish grey, finely crystalline, argillaceous limestone and fine- to medium-crystalline and fossiliferous limestone.

On Bighorn Range the Palliser formation consists of massive bedded, grey weathering, cryptocrystalline to finely crystalline limestone mottled with finely crystalline buff weathering dolomite. Argillaceous, thinly bedded limestones occur in the top 100 feet. The formation is 724 feet thick, as measured by D. J. McLaren at Wapiabi Gap just south of the area.

### Exshaw Formation

The Exshaw formation was not observed within the map-area. At Shunda Creek gap in Brazeau Range to the south, it consists of 7 feet of fissile black shale, carrying pyrite and rusty weathering, with a bentonite bed at the top. At Blackstone Gap in Bighorn Range to the west, the formation comprises 3.5 feet of hard black and fissile shale with a thin bentonite bed in the middle.

## MISSISSIPPIAN

The Mississippian succession in Chungo Creek map-area is similar to that in the adjoining Nordegg map-area (Douglas, 1956a) where it was provisionally divided into the Banff, Livingstone, and Mount Head formations, the last two comprising the Rundle group. Subsequently Stearn (1956) designated as the type section of the Shunda formation the succession exposed in secs. 19 and 30, tp. 40, rge. 14 on a creek tributary to Shunda Creek in Nordegg map-area. The Shunda formation, according to Stearn, is underlain by the Pekisko formation and overlain by unnamed beds of the Rundle group. In Nordegg map-area these beds were included in the lower part of the Mount Head formation, underlain by the Livingstone formation.

In areas beyond the type section, the Shunda formation is considered to be equivalent to the Dark Limestone beds of the Turner Valley member of the Livingstone formation (Douglas, 1953). It is recognized as a separate formation lying between the Pekisko and Turner Valley formations (Penner, 1958), these members of the Livingstone formation being raised to formation status.

In Chungo Creek map-area, the Mississippian is divided into the Banff formation and the Rundle group. The latter is composed of the Pekisko and Shunda formations and the overlying unnamed beds which may be equivalent to the Turner Valley and younger formations.

## Banff Formation

The Banff formation on Brazeau Range is divisible into two parts, the lower weathering back and shaly, and the upper more resistant and mainly bedded limestones, commonly forming cliffs. The lower part is best exposed in Nordegg map-area at Shunda Creek gap, where it is 270 feet thick. Massive, argillaceous and silty dolomite, 12.5 feet thick, occurs at the base overlain by fissile black and thinly bedded, laminated, calcareous shales that grade upwards into 136 feet of alternating calcareous shale and cherty argillaceous limestones in 1- to 6-inch beds. The upper part, on Coliseum Mountain, consists of about 300 feet of medium-bedded, argillaceous, finely crystalline limestone and dolomite, in part with scattered crinoid remains.

At Wapiabi Gap in Bighorn Range south of the map-area, W. B. Brady found the formation to be 601 feet thick and to consist of basal thinly bedded calcareous shale 56 feet thick, overlain by 117 feet of nodular limestones interbedded with calcareous shale and this in turn by 63 feet of partly covered, finely crystalline, black argillaceous limestone with some medium crystalline, dark grey crinoidal limestone. The upper part, 365 feet thick consists of interbedded finely crystalline, sparsely cherty, argillaceous limestone in beds up to 4 feet thick, with black calcareous shale and medium to coarsely crystalline, crinoidal limestones. Argillaceous dolomite occurs near the top.

## Rundle Group

### Pekisko Formation

The Pekisko formation on Shunda Mountain, Brazeau Range, consists of 107 feet of massive-bedded, cliff-forming limestone, mainly medium to coarsely crystalline and brownish grey, becoming more finely crystalline and dolomitic towards the top. Syringopora aculeata and Pseudozaphrentis sp., identified by P. Harker of the Geological Survey of Canada, were collected from the middle of the formation.

At Wapiabi Gap in Bighorn Range the Pekisko formation is 198 feet thick, the section measured and described by W. B. Brady. The lower 124 feet of beds mainly medium to coarsely crystalline, brownish grey, crinoidal limestone in massive beds with rare finely crystalline, dark grey limestone. The upper 73 feet are cryptocrystalline, greyish brown limestone with calcite-filled vugs, pisolitic 20 feet below the top.

The upper part of the Pekisko formation was drilled in the Triad et al. Brazeau No. 1 well in the upper fault slice of the

Rundle group between 10,895 feet depth and a fault at 11,002 feet depth. A summary description of the interval is given in the Appendix.

## Shunda Formation

The Shunda formation, at its type locality, was described by Stearn (1956) as consisting of 205 feet of argillaceous, finely crystalline limestone, in part finely laminated, in beds up to 3 feet thick some of which are completely brecciated. Some dark grey calcareous shale and dolomitic limestone are present.

In Chungo Creek map-area, the Shunda formation on Brazeau Range, is about 175 feet thick, but is mostly unexposed. On Shunda Mountain the top 15 feet consist of thinly bedded, black, cryptocrystalline limestone and finely laminated buff dolomite. At Wapiabi Gap in Bighorn Range the formation is 150 feet thick and consists mainly of dark grey, cryptocrystalline limestone in part argillaceous, laminated, or dolomitic, in beds up to 3 feet thick separated by thin black calcareous or green shale beds and partings. Some of the limestones are brecciated in the middle part of the interval.

The Shunda formation was penetrated by the Triad et al. Brazeau No. 1 well between depths of 10,767 to 10,895 feet and from 12,212 feet to a fault at 12,388 feet. Summary descriptions of these intervals are given in the Appendix.

## Upper Part of Rundle Group

On Shunda Mountain, Brazeau Range, the upper part of the Rundle group is 359 feet thick, and consists of several distinctive units. The basal 107 feet are massive bedded, medium crystalline, porous and vuggy dolomite with cryptocrystalline and finely crystalline, light brown, cherty dolomite in the middle. Lithostrotion sp., Syringopora pennsylvanica and Caninia sp. identified by P. Harker, were collected from these beds. The succeeding 50 feet are covered, except for the basal 2 feet which are a breccia of finely crystalline buff dolomite with calcite cement. This interval is overlain by 25 feet of massive bedded, fine- to medium-crystalline dolomite with disseminated fine, pyrobitumen-filled vugs, interbedded with fine-grained, laminated dolomite. The uppermost 77 feet are cryptocrystalline, thinly bedded, buff dolomite, weathering light creamy buff.

On Bighorn Range, at Wapiabi Gap, the upper part of the Rundle group is 289 feet thick. The basal 90 feet are massive-bedded, fine- to medium-crystalline, brown dolomite finely porous and vuggy, with black chert nodules at the top. These beds are overlain by 66 feet of thinly bedded, fine-grained and finely crystalline, grey to brown, argillaceous dolomite, succeeded by 41 feet of massive- to medium-bedded, fine- to medium-crystalline, brownish grey dolomite, finely porous and vuggy in the middle and with dark grey chert nodules at top and base. The uppermost 92 feet of strata are composed of 37 feet of interbedded cryptocrystalline, argillaceous, light grey to greenish grey, light creamy buff weathering dolomite, and shale, mainly green with red streaks, overlain by 55 feet of massive to thinly bedded, finely crystalline, brownish grey dolomite, silty and cherty at the top.

The upper part of the Rundle group was drilled by the Home Brazeau Syndicate No. 1 well between 9,500 feet depth and a fault at 9,595 feet depth, and by the Triad et al. Brazeau No. 1 well from 10,438 tc 10,767 feet depth and from 11,900 to 12,212 feet depth.

## PERMIAN ?

### Rocky Mountain Formation

The Rocky Mountain formation is absent on Brazeau Range and in wells drilled within the map-area. At Wapiabi Gap in Bighorn Range 10.2 feet of unfossiliferous, light grey, massive chert overlying 0.4 foot of conglomeratic sandstone with chert and dolomite pebbles are assigned to the formation.

## TRIASSIC

### Spray River Formation

The Spray River formation is absent on Brazeau Range. On Bighorn Range it is about 500 feet thick and divisible into two members: a lower Sulphur Mountain member and overlying it the Whitehorse member. The Sulphur Mountain member consists of thinly bedded, finely and evenly laminated, fine-grained, dull grey siltstone and sandstone which weathers dark rusty brown and reddish brown. The Whitehorse member consists of about 100 feet of light buff weathering, medium-bedded, finely crystalline, vuggy dolomite and silty, laminated dolomite.

## JURASSIC

### Fernie Group

The Fernie group is about 400 feet thick adjacent to Brazeau Range and about 500 feet thick west of Bighorn Range. It unconformably overlies the Rundle group on the former range and the Spray River formation on the latter. In George Creek map-area to the west, on a northern tributary to Blackstone River a mile east of Mons Cabin, the basal beds, the Nordegg member, consist of about 50 feet of black, medium-bedded, cherty and phosphatic dolomite with basal dark grey siltstone and shale. They are overlain by about 75 feet of black, fissile to paper-thin shale, succeeded by 20 feet of quartzose, fine-grained, grey sandstone, the basal part of the Rock Creek member. The sandstone is in turn overlain by 61 feet of dark grey shale with thin beds of brown weathering limestone and belemnite conglomerate, and this by 24 feet of greenish grey silty shale. Overlying grey shales, about 100 feet thick and in part concretionary, grade upwards into silty shale with interbedded, fine-grained siltstone and sandstone about 150 feet thick.

## LOWER CRETACEOUS

### Nikanassin Formation

The Nikanassin formation west of Bighorn Range is about 1,200 feet thick and consists of yellowish brown weathering, massive- to medium-bedded, fine-grained, grey, quartzose sandstone and siltstone, in part evenly bedded and finely laminated, interbedded with dark grey shale. A zone of abundant ridge-forming sandstones lies at the base of the formation, the contact with the underlying Fernie group being placed at the base of the lowest.

In the central part of the area, on the flanks of Brazeau Range, the Nikanassin formation is much thinner, probably not exceeding 200 feet in thickness. Commonly only the basal sandstone, about 20 feet thick, is exposed. In the wells drilled on Chungo Creek, the Nikanassin formation is penetrated in several fault slices. In what appear to be unfaulted intervals, the formation varies between 80 and 150 feet in drilling thickness, and is probably less than 100 feet in true thickness. The strata are dark grey, black and brownish grey shale, coal, and dark brownish grey to light brown, fine-grained, quartzose sandstone and siltstone (see Appendix for logs of wells).

## Cadomin Formation

The Cadomin formation is composed of about 30 to 50 feet of hard, resistant, ridge-forming conglomerate and conglomeratic sandstone. The pebbles up to an inch in diameter, are of rounded, grey, black and green chert and quartzite set in a matrix of coarse-grained, grey sandstone. In the wells drilled on Chungo Creek, fine- to coarse-grained, white to grey, quartzose sandstone beds commonly overlie the conglomerate beds and are included in the formation. The intervals vary from 90 to 120 feet in drilling thickness, the true thickness probably being less than 100 feet.

## Luscar Formation

The Luscar formation forms the bedrock in only a small part of the map-area and even there is poorly exposed. The characteristics and divisions (Lower and Upper parts) noted in the Nordegg map-area (Douglas, 1956a) to the south are evident in the samples from the Triad et al. Brazeau No. 1, Home Brazeau Syndicate No. 1 and Home Brazeau No. 1 wells. Summary descriptions of the strata penetrated may be found in the Appendix. Of particular note are: the basal quartzose sandstone and interbedded fissile black shale with rare, probably thin, coal seams; the glauconitic sandstones and fossiliferous limestones of the upper part of the Lower Luscar; and the greenish grey to dull grey sandstones interbedded with greenish grey shale and coal of the Upper Luscar. Details in the succession vary in the several intervals penetrated by the wells and thickness differ, probably in part due to the dip of the beds and repetition by small faults. Drilling thicknesses of four intervals of the Lower Luscar are 960, 1,035, 1,185, and 1,330 feet, the stratigraphic thickness probably being about 850 feet. The Upper Luscar is probably about 250 feet thick, drilling thicknesses of 310, 360, and 410 feet having been measured.

## Mountain Park Formation

The Mountain Park formation is about 300 feet thick in the southeastern part of the area, thickening westward to about 1,200 feet in George Creek map-area to the west. It consists of massive- to medium-bedded, fine- to coarse-grained, greenish grey sandstone and greenish grey silty shale. In wells drilled on Chungo Creek the sandstones are mainly fine grained and drilling thicknesses of 240, 200, and 235 feet were measured, representing a stratigraphic thickness of about 200 feet.

## UPPER CRETACEOUS

### Alberta Group

The formations comprising the Alberta group, the Blackstone, Cardium and Wapiabi, have been described by D. F. Stott from several localities within the map-area (see Stott, 1956, for preliminary account). Thicknesses and descriptions that follow are partly based on his data. For purposes of mapping in the belts of highly disturbed Alberta group strata smaller divisions of the group were used, essentially those established by previous investigators (Hake, Willis and Addison, 1942; Webb and Hertlein, 1934, and Scott, 1951). The various zones of the Blackstone, and particularly the subdivisions of the Barren zone, are recognizable in the samples from the Triad et al. Brazeau No. 1 well and form the basis, in part, of the interpretation shown in structure-section A-B. Examination of the samples from this and adjoining wells is, however, not complete and the interpretation shown may need revision.

#### Blackstone Formation

The Blackstone formation is divisible into four zones which, from base to top, have been termed the Barren, Inoceramus labiatus, Rusty Shale, and Concretionary zones by previous authors. No complete section of the formation is evident within the map-area, but several partial sections, separated by faults, permit some attempt to determine the succession and thickness of the strata. The formation is about 1,100 feet thick.

The Barren zone is exposed along Wapiabi Creek above its junction with Sturrock Creek. There the greater part may be examined although repeated several times by faults. The contact with the underlying Mountain Park formation is exposed on both fault slices containing that formation on Wapiabi Creek. Fissile, rusty weathering shales with a basal conglomerate with pebbles up to 3 inches in diameter of black chert and sandstone of the Mountain Park formation lie in sharp contact with massive green, silty shale on the eastern fault slice and with medium-grained, green sandstone on the western fault slice.

The Barren zone consists of six to eight units each about 40 to 125 feet thick, and typically formed of fissile and silty shale in their lower parts and interbedded silty shale and thinly bedded siltstone, sandstone, or grit in their upper parts. In the lower and upper units the arenaceous upper parts are thin. In the second and fifth units, counting from the base up, the siltstones are thick and in the third, thin beds of grit, conglomerate, and sandstone are present. Rusty weathering concretions are present in the

lower part, particularly in the shales, and very large concretions in the siltstones. The zone is characteristically rusty weathering. The top is drawn at the base of the overlying grey weathering shales of the Inoceramus labiatus zone. The Barren zone is about 400 feet thick. In the Triad et al. Brazeau No. 1 well, coarse-grained sandstone occurs in what is tentatively termed the third unit and the siltstones of the overlying fourth and fifth units are glauconitic. The outcrops of the lower and upper units are mainly shale. Medium-grained, glauconitic sandstone lies at the base.

No complete section of the Inoceramus labiatus zone is exposed within the map-area. It consists of about 400 feet of fissile, dark grey shale that weathers grey to silvery grey, and thinly bedded, finely laminated and crossbedded siltstones, in part calcareous, that weathers pale yellowish buff. The shales and siltstones form alternating bands, probably about six in number, that vary in thickness from about 50 to 100 feet.

The Rusty Shale zone consists typically of about 140 feet of silty, rusty weathering and sulphur-stained shale interbedded with thin bands of siltstone towards the top and becoming somewhat fissile towards the base. Thin bentonite bands occur near the base and in well samples, where the characteristic weathering is not developed, their presence is taken as marking the base of the zone.

The uppermost zone of the Blackstone formation, the Concretionary zone, comprises abut 160 feet of dark grey, silty, rusty weathering, concretionary shale with, near the top, bands of siltstone and fine-grained, finely laminated grey sandstone. The contact with the overlying Cardium formation is transitional and is placed at the base of the lower sandstone unit of that formation. This unit is commonly massive, but may locally be thinly bedded and argillaceous at the base.

## Cardium Formation

The name Cardium is herein applied to the strata formerly referred to as the Bighorn formation in this and adjacent areas. The formation, as generally developed in the map-area, comprises lower and upper sandstones with intervening shales, siltstones, and thin sandstones, totalling 200 to 250 feet in thickness.

The lower sandstone consists of 25 to 65 feet of light grey, fine-grained sandstone, massive to thinly bedded, in part finely laminated, crossbedded and argillaceous. It is overlain by about 15 feet of interbedded fine-grained sandstone and siltstone and silty, rubbly, dark grey or carbonaceous shale. These beds are overlain by 20 to 30 feet of dark grey, silty to fissile, concretionary shale, succeeded by 15 to 20 feet of massive-bedded, dark

greenish grey, concretionary, argillaceous siltstone. This siltstone occupies a stratigraphic position similar to the middle sandstone of the formation in Nordegg map-area to the south. Succeeding beds consist of 80 to 100 feet of dark grey shale, in part silty, with concretions and thin bands of fine-grained sandstone. The upper sandstone is thinly bedded, fine grained, finely laminated, grey, and 20 to 30 feet thick.

## Wapiabi Formation

The Wapiabi formation is divisible into seven zones which are in ascending order; the Striped, Lower Concretionary Siltstone, Lower Concretionary Shale, Platy Shale, Upper Concretionary Shale, Upper Concretionary Siltstone, and Transition. The formation is shown as two units on the map, upper part and lower part. The upper part comprises the Upper Concretionary Siltstone and Transition zones, and may be the stratigraphic equivalent of the basal beds of the Brazeau formation in other areas. The total thickness of the formation is about 1,100 feet. The entire formation is exposed on Wapiabi Creek, on Chungo Creek above the well sites, and on Blackstone River 2 miles west of the area. It is partly exposed on Blackstone River a mile below the bridge.

The basal Striped zone consists of 75 to 100 feet of silty shale and thinly bedded siltstones, with rare bentonite streaks and, locally, basal beds of chert pebbles and grit embedded in the shale or in concretionary bands. The Lower Concretionary Siltstone is massive, rubbly, argillaceous siltstone with large concretions and is about 130 feet thick. It is generally more resistant than the underlying and overlying zones. The Lower Concretionary Shale zone consists of about 150 feet of fissile to silty, rusty weathering shale, with small ovoid concretions and rare, thin beds of siltstone. The Platy Shale zone, about 350 feet thick, consists of alternating beds of fissile to silty, grey weathering shale, and shale interbedded with thinly bedded, finely laminated, crossbedded, buff weathering siltstone and calcareous siltstone. The Upper Concretionary Shale zone comprises about 150 feet of dark grey, silty, rusty weathering, concretionary shale.

The Upper Concretionary Siltstone zone consists of massive, argillaceous, sparsely glauconitic siltstone with rare large concretions. It is 135 to 175 feet thick. The siltstone grades into silty shale or thinly bedded, fine-grained, sandstone. A fine conglomerate of black chert pebbles is present at the top. The Transition zone, about 135 feet thick, consists mainly of silty, concretionary shale at the base grading upwards into interbedded greenish grey shale and fine-grained, greenish grey, thinly bedded sandstone.

## Brazeau Formation

The Brazeau formation comprises a succession of nonmarine sandstone, shale, and conglomerate that lies between the underlying marine Alberta group and the overlying nonmarine Paskapoo formation of Paleocene age. Its thickness is about 5,000 feet, slightly thinner in the northeastern part of the area. The overlying beds referred to the Edmonton and Paskapoo formations by MacKay (1940, 1943), are herein all included in the Paskapoo formation, following the usage established by Lang (1947) and Bell (1949).

Several lithological subdivisions are possible, although the strata are of nonmarine origin, and assist locally in the interpretation of the structure. Of these, three persist in their general characteristics throughout the area and also in the map-areas to the north. The Brazeau is accordingly, considered to be divisible into lower, middle, and upper parts. Approximate contacts between these three divisions are indicated on the accompanying map. In the interstream areas they are traced mainly on aerial photographs. The surface traces of numerous sandstones are apparent as continuous outcrops or ridges, and more clearly outline the structure in areas underlain by the Brazeau formation than do the scattered strikes and dips.

The lower part of the Brazeau formation is about 1,000 feet thick. It is characterized by several thick, massive sandstones, conglomeratic sandstones, and conglomerates interbedded with dark grey to greenish grey, rather hard and massive shales and thin sandstones. The massive sandstones persist for several miles along strike. The conglomerate and conglomeratic phases appear to be local and occur at several stratigraphic levels. Pebbles noted were subrounded, mostly less than an inch in diameter, rarely up to 4 inches. They consist of light and dark grey quartzite and chert, rarely pink and green. The basal sandstone was not conglomeratic within the map-area although it is so locally in areas to the north and northwest.

On Blackstone River between Nelson Flat and Hansen Creek the basal sandstone of the formation is massive to thinly bedded, greenish grey, and fine to medium grained. It overlies interbedded shales and sandstones that are included in the Transition zone of the Wapiabi formation with a striking banded appearance. The basal sandstone is succeeded by two other massive sandstones and these, in turn, by four thick beds of conglomerate or conglomeratic sandstone. Interbedded with them are dark grey and greenish grey shales, in part silty, thin sandstones and, close above the basal sandstone, thin coal seams and carbonaceous shale.

The middle part of the formation is about 2,200 to 2,800 feet thick and consists of interbedded sandstones and shales. The sandstones are softer than those stratigraphically below and are, accordingly, less resistant to erosion, outcrop less readily, and appear less persistent along strike. They are more common in the middle third of the unit. Individual sandstone beds are up to 50 feet thick but mainly range from 10 to 20 feet. They are, however, lenticular and show indications of having been deposited as channel-fills. They are massive to thinly bedded, commonly, crossbedded, fine to medium grained, and greenish grey, weathering light to dark brown. The interbedded shales and silty shales are light to dark greenish grey, in part bentonitic, exceeding the sandstones in amount in the lower and upper thirds of the unit.

The upper part of the Brazeau formation is about 1,200 feet thick. Its base is marked by a zone of resistant sandstones that form a persistent ridge throughout the map-area. The sandstones are mainly fine to medium grained, greenish grey, up to 25 feet thick. Locally, as on lower Colt Creek, they are coarse grained and sparsely conglomeratic with pebbles up to a half inch in diameter of grey, white, and pink quartzite and chert. The overlying beds are largely shale, light to dark greenish grey, in part grey and carbonaceous with thin coal seams, and 1- to 2-foot beds of pale yellowish weathering bentonitic clay.

## PALEOCENE

### Paskapoo Formation

The Paskapoo formation is the youngest exposed in the map-area, occurring mainly in the northeastern part, but also in the trough of the Brazeau syncline. As used here it includes the beds mapped both as the Edmonton and Paskapoo formations by MacKay (1940, 1943). The base of the formation is marked by a zone of resistant, ridge-forming sandstones, individual beds of which, as on Colt Creek just beyond the map-area, are 20 to 25 feet thick, massive, generally rather soft but in part indurated, and brown weathering. Locally they attain a thickness of 75 feet. On Blackstone River and Chungo Creek the basal sandstones are sparsely conglomeratic, with $\frac{1}{2}$-inch pebbles of grey quartzite. This sandstone zone is considered to be equivalent to the basal sandstones and Entrance conglomerate of the Paskapoo formation in the Entrance (Lang, 1947), Sterco, and Mercoal map-areas to the northwest. This is concluded from its stratigraphic position with respect to the sandstone zone of the upper part of the Brazeau formation, with which it maintains a fairly constant stratigraphic separation of about 1,200 feet, and with respect to overlying coal seams, the lowest of which lies about 800 feet above it.

The lower 1,300 feet of the Paskapoo formation, shown separately on the accompanying map, contain several coal seams, the lowest of which as previously noted lies about 800 feet above the base. Three seams, 1 foot to 3 feet thick, occur along Colt Creek. Four seams 6 inches to 4 feet thick were observed in the vicinity of Blackstone River and the mouth of Chungo Creek.

The highest beds observed were on the lower part of Blackstone River where they are massive, pale buff to almost white weathering, rather soft sandstones. They occur in beds up to 50 feet thick and, immediately below the Ancona fault, overlie interbedded thin sandstones, green shale and thin coal seams. It is probable that the coal seams are in the lower part of the formation. MacKay (1943) reported a series of coarse, brown weathering sandstones and conglomerates, and earthy shales which, on the uplands north of Wawa Creek, weather into large, fantastically shaped hoodoos. These beds are presumed to be the youngest exposed within the area but were not examined by the writer.

## STRUCTURAL GEOLOGY

Chungo Creek map-area includes a small part of the Interior Plains in the northeast and extends across the eastern part of the Disturbed belt to the Bighorn Range in the southwest corner. Three thrust faults of considerable magnitude, the Bighorn, Brazeau and Ancona thrusts, cross the area, the parts west of their surface traces being termed the Bighorn, Brazeau and Ancona thrust sheets, respectively. The surface trace of the Ancona thrust is considered to mark the northeastern edge of the Disturbed belt within the map-area.

### PLAINS

Strata of the Paleocene Paskapoo formation underlie the Plains. Mainly they dip gently and are folded into a broad, low, northwest-trending anticline and syncline. Beneath the Ancona thrust on Nordegg River the beds are somewhat contorted but dip mainly southwest and on Blackstone River they are vertical to overturned and dip southwest. In this part of the map-area the top of the Brazeau formation is estimated to lie 2,500 to 3,000 feet below the surface and the top of the Alberta group at an additional depth of 4,000 feet.

## ANCONA THRUST SHEET

The main structural features of the Ancona thrust sheet are from northeast to southwest, the Colt Creek syncline, the Stolberg anticline, and the Sunbeam fault.

The Colt Creek syncline (MacKay, 1943) is a broad southeast-plunging syncline within Paskapoo strata (see structure-section E-F), the northeast flank of which adjoins the underlying Ancona thrust. The Colt Creek syncline and Ancona thrust are probably the northwest continuations of the Ancona syncline and Fault No. 1 of the Saunders Area (Erdman, 1950).

To the southwest, Brazeau strata are folded into an asymmetrical anticline, the Stolberg anticline, the southwest flank of which is somewhat the steeper. It varies in dip from 40° to 85°, whereas the northeast flank dips from 10° to 45°. The northeast flank of the Stolberg anticline or southwest flank of Colt Creek syncline is broken by two northeast-dipping thrust faults, the more westerly of which has the greater displacement. The Stolberg anticline plunges both to the northwest and southeast within the map-area, reaching a culmination about midway between Nordegg River and Colt Creek. The oldest beds at the surface were not examined by the writer but are thought to be of the lower part of the Brazeau formation, the base of which is probably close below. Where crossed by Colt Creek and Nordegg River the crest of the Stolberg anticline is in beds 600 and 2,000 feet, respectively, above the base of the Brazeau formation. The surface structure is not expected to persist to depth without change. As shown in structure-section E-F, northeast- and southwest-dipping splays off the underlying Ancona thrust may be present, repeating strata of the Alberta group and older formations.

Brazeau strata on the southwest flank of the Stolberg anticline are repeated by the Sunbeam fault, above which, in the northwest, much of the Wapiabi formation is brought to the surface. The trace of the Ancona thrust converges with that of the Sunbeam fault in the northwest as the Ancona thrust cuts across the Colt Creek syncline and Stolberg anticline. Only a thin contorted zone of steeply dipping upper Brazeau strata separates the two faults on Blackstone River and they probably merge north of the map-area.

The Sunbeam fault slice is essentially a southwesterly dipping homocline that varies in dip from 50° to 25°. The Sunbeam fault in the northwest is overlain at the surface by Wapiabi strata but in the southeast it cuts rapidly up-section through the Brazeau formation and presumably ends in or causes small repetitions within the Paskapoo formation on the southwest flank of the

Stolberg anticline in Alexo map-area to the southeast (Erdman, 1950). Paskapoo strata, probably mainly the lower part, underlie the southwest part of the fault slice but are very poorly exposed. Some reversals of dips and divergence of strikes suggest the presence of faults as well as folds. Brazeau and Wapiabi strata of the Sunbeam fault slice appear in the Chungo window in the Brazeau thrust sheet.

In the Chungo window Brazeau and upper Wapiabi strata form a northeast-dipping homocline, the southwest flank of the Sunbeam syncline. The Brown Creek fault repeats upper Wapiabi strata on Dorothy Creek and brings the Lower Concretionary shale over the Platy shale on Chungo Creek. It dips northeastward and displacement is thought to increase at depth (see structure-section A-B). On Brown Creek northwest of the map-area the fault repeats upper Wapiabi strata and a short distance farther north it appears to merge with the southwest-dipping Brazeau thrust without offsetting it. The southeast extension of the Brown Creek fault is not definitely known but may be present at depth on the northeast flank of a highly faulted anticlinal structure within Brazeau and upper Wapiabi strata on Blackstone River, beneath the Brazeau thrust. The strata on the southwest flank of this anticlinal structure are repeated by southwest-dipping faults of small displacement which apparently merge upwards with the overlying Brazeau thrust (see structure-section C-D). The structure between the Brown Creek fault and the Brazeau thrust is largely unknown, but is probably complex. Tight folds and faults are shown in a general way in structure-section A-B. These structures cause considerable thickening within the Alberta group and older formations.

## BRAZEAU THRUST SHEET

The Brazeau thrust in the southeast part of the map-area and along its northeasternmost surface trace brings Wapiabi and Brazeau strata over the Paskapoo formation. The strata above it are folded into an asymmetrical syncline, the Swale Creek syncline, and the thrust plane is inferred to be similarly synclinally folded, but to a lesser degree (see structure-section E-F). The strata of the Sunbeam fault slice beneath the Brazeau thrust are also inferred to be synclinally folded into the structure termed the Sunbeam syncline. The east flank of the Sunbeam syncline may be faulted as previously noted, but is not so shown on the map or sections.

Lower Mesozoic and Palaeozoic strata of the Brazeau thrust sheet are brought to the surface along the Brazeau Range on the Brazeau Range fault, thought to be subsidiary to the underlying thrust as it merges with it southeast of the map-area. The Palaeozoic strata are folded into an asymmetrical anticline, the

Brazeau anticline of Erdman (1950), the east flank of which is vertical to overturned and broken by the Coliseum Mountain fault and another minor fault. Between the Coliseum Mountain and Brazeau Range faults is a southwest-dipping slice of strata ranging from upper Rundle group to lower Luscar. It would appear that the Brazeau Range fault marks the eastern limit of Palaeozoic strata above the Brazeau thrust in the southeastern part of the map-area, and that the strata above the Brazeau Range fault were folded into the Brazeau anticline and adjacent syncline to the east, the trough of the latter being the locus of the Coliseum Mountain fault.

The Brazeau anticline plunges northward, accompanied by a tightening of the fold in the Mississippian formations and a sharp increase in plunge within the lower Mesozoic formations. Its north end appears to be truncated by an east-west striking tear fault which is mapped as lying above the Brazeau Range fault, that fault continuing northward without offset, and is joined with a fault that repeats the Cardium formation. Strata in this part of the map-area are poorly exposed, but it appears that the Brazeau anticline within Palaeozoic strata gives way to a synclinal structure, the Brazeau syncline which is steeply plunging, 35°NW within Cardium strata, and may lie in about the structural position of the syncline above the Brazeau Range fault occupied by the Coliseum Mountain fault.

In the northwest part of the map-area the Brazeau thrust and structures associated with it have been interpreted in several ways, changing as drilling and detailed mapping have gradually revealed some of the structural complexities (see interpretations by Sanderson, 1939; MacKay, 1940; Kunst and Walters in Link, 1949; Scott, 1951 and his discussion). Scott's interpretation, in which the Brazeau thrust was first recognized as having been folded and breached to form a window, is substantially that presented in the following paragraphs and the accompanying map, although differing somewhat in detail. The seismic data in the Kunst and Walters section were considered in the construction of structure-section A-B.

The Brazeau thrust, along its northeastern surface trace, dips southwest and brings the Brazeau formation over the Paskapoo. To the southwest, the thrust is synclinally folded, probably nearly conformably with the underlying Sunbeam syncline. Still farther southwest it is anticlinally folded with Brazeau and Wapiabi strata exposed beneath it in a window, herein termed the Chungo window, which extends from Nelson Flats on Blackstone River to north of Brown Creek a short distance northwest of the map-area. In the region of the window and to the north is the Chungo 'anticline' of Scott (1951), a term that in this report is restricted to the compound structure of anticlinally folded faults and fault slices northwest of

the Chungo window. The Brazeau thrust is a clearly defined linear feature on the northeast flank of the Chungo window where it dips northeast with northeast-dipping upper Wapiabi and lower Brazeau beds lying on northeast-dipping upper Brazeau strata. The surface trace of the Brazeau thrust on the southwest flank of the Chungo window is, however, subject to several interpretations. These depend to a large measure on the manner in which the faults exposed on the Blackstone River and Chungo and Brown Creeks are connected, strata of the intervening interstream areas being poorly exposed. The interpretation preferred by the writer and, of necessity, the only one shown on the accompanying maps and structure-sections, is that the southwest-dipping fault designated the Brazeau thrust is but one branch of a complex system. Possibly it is the initial thrust plane and overlying faults to the southwest are subsequent splays, merging with it at depth.

Wapiabi strata above the Brazeau thrust southwest of the Chungo window are repeated by several faults of small stratigraphic displacement. On Chungo Creek and to the northwest they repeat beds of the Lower Concretionary Shale and Siltstone zones. These faults may merge with one another or with the underlying Brazeau thrust and overlying Dorothy Creek fault.

The Dorothy Creek and other faults to the southwest, the Chungo Creek, Canyon Creek and Brazeau Range faults, repeat Blackstone and Cardium strata. Mainly they dip steeply southwest and have small stratigraphic displacements, bringing beds of the Inoceramus labiatus zone into contact with higher zones of the Blackstone or the Cardium and basal Wapiabi formations. In addition two unnamed faults lie to the southwest, mainly within Wapiabi strata.

The Dorothy Creek fault is sharply folded just south and north of Chungo Creek and again, en échelon to the northwest, on Dorothy Creek where a small window occurs in the fault plane. Beneath this window northeast-dipping Cardium and anticlinally folded Blackstone strata are exposed. Northwest of the map-area the Dorothy Creek fault splits into two branches which are anticlinally folded in the Chungo 'anticline' and merge with the northeast-dipping part of the Brazeau thrust. To the southeast, the Dorothy Creek fault is assumed to merge with the Brazeau thrust.

The Chungo Creek fault in the northwest part of the map-area splits into two branches which, northwest of the map-area, are folded anticlinally in the Chungo 'anticline' and dip northeastward, merge again and reappear as a single fault within the map-area just northeast of the northeast-dipping part of the Brazeau thrust. There, the Chungo Creek fault is synclinally folded, almost parallel with the underlying Brazeau thrust (see structure-section A-B). The position of the southeastern continuation of

the Chungo Creek fault on the southwest flank of the Chungo window is subject to some doubt. It is joined with the fault on Blackstone River that brings Blackstone over Wapiabi and thence, trends northeastward almost flat beneath the Swale Creek syncline to pass through the divide on the Sunbeam-Nelson trail. The fault pattern as thus interpreted (compare structure-sections C-D and A-B) is essentially the mirror image of the fault northwest of the Chungo window. However, the displacement on the fault at the divide on the trail is considerably less than is evident on Blackstone River. This may be due to the development, southeast of Blackstone River of a large anticline within the Blackstone and Bighorn formations with displacement on the fault increasing at depth.

The fault termed the Canyon Creek fault is thought to be the southeastern extension of the uppermost folded fault exposed on lower Canyon Creek northwest of the map-area. Southeast of Blackstone River the fault appears to lie in the axial region of the anticlinal fold in the Blackstone and Bighorn formations noted above, and possibly to continue southeast to merge with the overlying Brazeau Range fault. The fault termed the Brazeau Range fault in the northwest part of the map-area is thought to be the continuation of the Brazeau Range fault which underlies the Palaeozoic strata of the Brazeau Range in the southeast, the possibility of error in correlation being previously noted. The two unnamed faults southwest of the Brazeau Range fault are evident as minor features as far south as Blackstone River, and probably end in the Wapiabi strata of the axial region of the Brazeau syncline. Northwest of the map-area these faults increase in displacement.

The Brazeau syncline is a broad northwestward-plunging structure developed in the massive, thick Brazeau formation. Some Paskapoo strata lie in the trough near Chungo Creek. The northeast flank dips mainly at 50° to 70°SW and the southwest flank dips from 40°NE to 40°SW, overturned. Three small northeast-dipping thrust faults repeat beds of the southwest flank between Blackstone River and Wapiabi Creek. As previously noted the southeastern continuation of the Brazeau syncline appears to be essentially the syncline above the Brazeau Range fault occupied by the Coliseum Mountain fault.

The great contrast between the structure of the Brazeau thrust sheet in the southeast, where Palaeozoic rocks are exposed in the Brazeau Range, and that associated with the Chungo window in the northwest part of the map-area typifies one of the fundamental variations in structural behaviour of the strata under deformation characteristic of the central Foothills of Alberta.

In the southeast part of Chungo Creek map-area and in map-areas to the southeast such as Alexo and Saunders (Erdman,

1950), the Brazeau thrust dips gently southwest, albeit somewhat warped and folded, and brings Lower Cretaceous strata to the surface over broad areas and Palaeozoic strata in a smaller series of culminations. Southwest-dipping beds of the Brazeau and Paskapoo formations underlie the thrust. Lateral displacement is of the order of miles, apparently confined to a single plane although some splitting up of the northeasterly part of the thrust sheet is evident particularly by the Brazeau Range fault. In contrast, in the northwestern part of Chungo Creek map-area pre-Brazeau beds of the thrust sheet are split into numerous slices by faults with displacement of the order of thousands of feet, displacement of the mass having taken place on several thrust planes rather than a single plane. Furthermore the region is structurally low, for Upper Cretaceous rocks outcrop and Palaeozoic strata lie as much as 10,000 feet below the surface.

The Brazeau thrust is thought to have originated as a gently inclined plane along which, in southeasterly regions, displacement readily took place as the strata above and below the thrust plane remained essentially undeformed until late stages in the displacement, when warping of the underlying strata took place and subsidiary structures formed within the thrust sheet. In the northwest, however, proportionately little displacement took place on the initial thrust plane. This is thought to have been caused by gentle warping of the strata both above and below the thrust causing new fault planes to form, and by a gradual upturning of the southwestern portion of the Brazeau formation below the thrust to form what is now the Sunbeam syncline. As a result of the formation of the Sunbeam syncline the Brazeau thrust and the more easterly, early formed, splays were folded synclinally in the trough of the Sunbeam syncline and anticlinally to the southwest in the Chungo anticline. Concomitant with the upturning of the southwest flank of the Sunbeam syncline the northeasterly dipping Brown Creek fault formed and the strata between it and the southwesterly dipping Brazeau thrust were thickened and repeated by the development of faults and unknown structures. Displacement on the fault planes within the Palaeozoic and closely overlying formations of the Brazeau thrust sheet is thought to have continued to some extent after displacement at higher structural levels had ceased, owing to folding of the fault planes. Minor drag-folds and folded fault planes of the type evident in the Dorothy Creek fault slice and fault plane are thought to have been produced as a result, and partly also as a result of the overriding of adjacent overlying fault slices. The part of the Brazeau thrust sheet above the more westerly, late-formed splays overrode more easterly parts of the thrust sheet, particularly that part above the Brazeau Range fault along which Palaeozoic rocks were brought to the surface in the southeastern part of the map-area.

Alberta group and Mountain Park strata of the southwestern part of the Brazeau thrust sheet southwest of the Brazeau syncline are repeated by several closely spaced thrust faults that form part of a zone that passes through Nordegg map-area to the south and George Creek map-area to the west. One of these faults, herein termed the Wapiabi Creek fault, is folded. Cardium strata above and below the synclinally folded part are folded nearly concordantly, both synclines plunging to the northwest. Owing to lack of exposures in the vicinity of the anticlinally folded part of the fault the writer could not definitely establish which of the numerous closely spaced southwesterly dipping faults that contort strata of the Barren zone of the Blackstone formation form the root of the Wapiabi Creek fault. The correlation shown of this and other faults of the zone is but one of several possible interpretations.

Between the Wapiabi Creek fault and the southwest flank of the Brazeau syncline southeast of Wapiabi Creek the Cardium formation is folded into a tight anticline, the crest of which is broken by a northeasterly dipping fault that extends southeastward off the map-area. Other small northeast-dipping faults occur in the Wapiabi formation.

Southwest of the Wapiabi Creek fault, a fault termed the Sturrock Creek fault brings Mountain Park strata to the surface on Wapiabi Creek. To the north it appears to override the Wapiabi Creek fault slice and to have caused the overturning of the southwest flank of the Brazeau syncline near the west border of the area. Above the westernmost fault Blackstone and Cardium strata dip gently southwest and Wapiabi and Brazeau strata are folded into a syncline, essentially the northwestern continuation of the Black Mountain syncline of Nordegg area to the south. The Cardium formation on the west flank of the syncline appears as an isoclinal anticline close below the Bighorn thrust. The Black Mountain syncline within Brazeau strata plunges to the southeast in Nordegg map-area and to the northwest along the west border of Chungo Creek map-area. The region is, accordingly, a structural high which may be reflected in the underlying fault slices and to the northeast.

## BIGHORN THRUST SHEET

Only a small part of the Bighorn thrust sheet is contained in the southwestern part of the map-area. Palaeozoic rocks form the Bighorn Range and dip regularly southwest at 35° to 40°. They are separated from the thrust by a thin slice of lower Luscar strata, the splay following close to the base of the Upper Cambrian formation C. Three tear faults with small displacement break the Palaeozoic strata. Similar faults were closely examined by R. G. Schmidt in the adjoining George Creek map-area and were thought to have been produced by warping of the thrust sheet during its displacement.

## ECONOMIC GEOLOGY

### PETROLEUM AND NATURAL GAS

Several structures within the map-area are potentially oil and gas bearing.

In the Plains part of the map-area Paskapoo strata are gently folded. This part of the area was not examined by the writer but MacKay (1943) indicated an anticline in the northeast corner, whose extensions beyond the area are not known.

The Stolberg anticline in the Ancona thrust sheet reaches a culmination in the region between Colt Creek and Nordegg River, strata low in the Brazeau formation lying at the surface (see structure-section E-F). To the southeast in Alexo and Saunders map-areas (Erdman, 1950) the anticline is broad, both flanks dipping gently, and the adjoining Colt Creek-Ancona syncline to the northeast is likewise broad and gently folded. In the region between Alexo and Chungo Creek map-areas where drilled by Imperial Shell Stolberg No. 1 well Mississippian strata were encountered in the core of the anticline and are thought to be underlain by the Ancona thrust. Within the map-area, the closer folding, southwest asymmetry of the anticline and associated northeast-dipping thrust faults are thought to indicate décollement above the Ancona thrust, as the northwestward termination of the anticline against the thrust is approached. The culmination within the Brazeau formation, accordingly, is probably not reflected to the same degree within the Lower Cretaceous and older formations, although it is possible that they may lie at somewhat higher elevations than to the southeast. The Cardium formation should lie at a moderate depth with a closed anticlinal structure, possibly broken by northeast- and southwest-dipping thrust faults on the northeast and southwest flanks of the anticline, respectively.

The Sunbeam fault repeats Wapiabi and Brazeau strata on the southwest flank of the Stolberg anticline and probably cuts all formations at depth, merging with the underlying Ancona thrust within the Palaeozoic. The strata immediately above the thrust appear to lie at highest structural levels on Nordegg River, where the area underlain by the Wapiabi formation is broadest, and on upper Wawa Creek, where dips of the Brazeau strata are low. A gas seep was observed on the southeast side of Nordegg River near the Sunbeam fault.

The region of the Chungo window in the Brazeau thrust sheet is known as the Brazeau structure. Three wells have been drilled on Chungo Creek to test this feature (see structure-section A-B). All have been abandoned. The first well, Home Brazeau No. 1, commenced drilling in 1937 with cable tools and was completed in 1940 with rotary rig at 8,728 feet depth. It is reported to have encountered a small gas show at 6,615 feet depth in the

Mountain Park formation, and 10,000 Mcf per day and some naphtha at 8,480 to 8,550 feet depth in the lower Luscar formation. Home Brazeau Syndicate No. 1 well was started in 1945 and completed in 1946 at 11,689 feet depth. Natural gas, at 5,000 to 10,000 Mcf per day, is reported to have been encountered at 9,498 to 9,597 feet depth in the Rundle group. The Triad Richfield Dome Husky Brazeau No. 1 well commenced drilling in 1954 and was completed in 1955 at 12,518 feet depth. No data concerning oil and gas indications in this well are available.

The writer's interpretation of the Brazeau structure in the vicinity of the wells is shown in structure-section A-B. The Home Brazeau Syndicate and Triad et al. wells penetrated Rundle strata above the Brazeau thrust. A fault slice of Rundle below the Brazeau thrust was drilled by the Home Brazeau Syndicate well. Rundle strata are probably involved in the structures to the northeast of this fault slice but may lie at greater depths than expected on the northeast flank of the Sunbeam syncline above the Sunbeam fault. The Triad et al. well penetrated Rundle strata above the Dorothy Creek fault, a fault slice higher than that overlying the Brazeau thrust. Rundle strata probably also overlie the other faults to the southwest at comparable depths. The wells on Chungo Creek are drilled in the vicinity of the structurally highest part of the Chungo 'anticline', the compound fold involving the Brazeau thrust, and presumably also the structural high in the rocks below the Chungo window. Part of the Palaeozoic rocks of the Brazeau thrust sheet rises, in a general way, to higher elevations towards the southeast where they are exposed in the Brazeau Range. This rise is, in part, abrupt as evidenced by the steep northwest plunge and tear fault at the northerly end of the range. In addition, the Palaeozoic strata between the Brazeau thrust and Brazeau Range fault in the northwest part of the area are absent or thin in the southeastern part where the Brazeau Range fault, with increased displacement, overrides the easterly folded part of the thrust sheet. Accordingly the Palaeozoic rocks above the Brazeau Range fault may lie at higher elevations in the vicinity of Blackstone River than to the northwest whereas the Palaeozoic slice between the Brazeau Range fault and Brazeau thrust may be thin or absent.

In the southwestern part of the Brazeau thrust sheet the culmination in the Black Mountain syncline may be reflected to some extent in the zone of faulting to the northeast. It seems probable that for the more westerly of these fault slices the region is structurally high. Above the more easterly faults of the zone and beneath the folded Wapiabi Creek fault Palaeozoic strata may also lie at higher elevations than along strike, but strata at the surface are younger than those exposed to the southeast in Nordegg map-area.

## COAL

Coal seams are present in the Lower Cretaceous Luscar formation and the Paleocene formation, observed occurrences being indicated on the map.

The Luscar coal seams occur in the upper part of the formation, which outcrops on the southwest flank of the Brazeau Range. No data on the thickness of the seams are available, but at Nordegg to the south seams 7.75 and 21 feet thick are present. These seams may be thickened and the coal recoverable by strip mining in the vicinity of upper Stovepipe Creek on the crest of the Brazeau anticline, on upper Lookout Creek where upper Luscar and Mountain Park strata are folded disharmoniously with respect to lower formations, and on upper Shunda Creek where a southwest-dipping thrust fault causes small stratigraphic repetition. The region is rather flat and readily accessible from a road.

The Paskapoo coal seams occur in the lower part of the formation and outcrop along lower Colt Creek on the southwest flank of the Colt Creek syncline, and on Upper Colt Creek, Nordegg River, Chungo Creek and Blackstone River in the Sunbeam fault slice. The seams observed are less than 3 feet thick. On the northeast flank of the Colt Creek syncline, 3 miles east of the area, two seams, 5 and 2 feet thick respectively are exposed in a new road-cut.

# APPENDIX

## LOG OF WELLS

## Home Brazeau No. 1 Well

Location: l.s. 16, sec. 7, tp. 43, rge. 17, W. 5th mer.

Elevation: 4.454 feet.

Prepared by the writer from descriptions of the samples on file with the Geological Survey of Canada, Ottawa.

| Depth (feet) | |
|---|---|
| 0-6,430 | Blackstone formation |
| 6,430-6,745 | Mountain Park formation |
| 6,745-7,065 | Luscar formation, upper part |
| 7,065-8,260 | Luscar formation, lower part |
| 8,260-8,370 | Cadomin formation |
| 8,370-8,460 | Nikanassin formation |
| 8,460 | Chungo Creek fault |
| 8,460-8,728 | Luscar formation, lower part |

## Home Brazeau Syndicate No. 1 Well

Location: l.s. 5, sec. 17, tp. 43, rge. 17, W. 5th mer.

Elevation: 4,475 feet.

Prepared from a description of samples by D. G. Penner of the Alberta Petroleum and Natural Gas Conservation Board on file with the Geological Survey of Canada, Ottawa.

| Depth (feet) | |
|---|---|
| | **Cardium Formation** |
| 0- 100 | Sandstone, fine- to medium-grained, grey to white, non-calcareous, quartzose with minor dark mineral and mica. |
| 100- 150 | Shale, dark grey, silty and sandy, and sandstone, fine-grained, grey to white, quartzose. |
| 150- 310 | Samples missing. |
| | **Blackstone Formation** |
| 310- 600 | Rusty Shale zone; shale, dark grey, silty, with traces of grey, fine-grained sandstone; buff micaceous bentonite below 550 feet. |
| 600-1,910 | *Inoceramus labiatus* zone: shale, dark grey, in part slickensided, with traces of grey, very fine-grained sandstone and limestone; possible faults at about 1,200 and 1,850 feet depths. |
| 1,910-5,220 | Barren zone: shale, dark grey, silty to 3,960 feet depth, below which interbedded with grey, very fine-grained shaly, calcareous sandstone; grey, medium-grained, quartzitic, 'grit-like' sandstone at base; possible faults at about 2,000,2,750 (Chungo Creek faults), 3,400 and 4,450 feet depths. |

| Depth (feet) | |
|---|---|
| | Mountain Park Formation |
| 5,220-5,440 | Sandstone, fine-grained, greenish grey 'salt and pepper' texture, with coal streaks, and shale, green, silty and brown carbonaceous. |
| -5,440 | Dorothy Creek fault |
| | Blackstone Formation |
| 5,440-7,330 | Barren zone: shale, dark grey, silty, slickensided, with grey, fine-grained, glassy, sandstone and shaly siltstone; medium-grained, pyritic, 'grit-like' sandstone at 7,050, 7,250 and 7,310 feet depths, glauconitic at 7,310 feet depth; possible faults at 5,700 and 7,070 feet depths. |
| | Mountain Park Formation |
| 7,330-7,370 | Sandstone, fine-grained, light greenish grey, 'salt and pepper' texture and trace pale green, silty shale. |
| 7,370-7,470 | Shale, grey, light brown, and dark brownish grey; trace of sandstone as above. |
| 7,470-7,530 | Sandstone, as above, and very fine-grained siltstone. |
| | Luscar Formation |
| | Upper part |
| 7,530-7,560 | Shale, dark brownish grey, green and dull green with trace of coal at 7,540 feet depth, and light grey, fine-grained sandstone at 7,560 feet depth. |
| 7,560-7,580 | Shale, dark brownish grey, in part carbonaceous; coal; in part slickensided. |
| 7,580-7,620 | Sandstone, grey, fine-grained, 'salt and pepper' texture, with shale as above; buff, medium-grained at 7,620 feet depth. |
| 7,620-7,660 | Shale, dark brownish grey and green; coal at 7,650 and 7,660 feet depths. |

| Depth (feet) | |
|---|---|
| 7,660-7,690 | Sandstone, light grey, fine-grained, 'salt and pepper'texture; coal at 7,670 feet depth. |
| 7,690-7,750 | Shale, as above; coal at 7,720 feet depth. |
| 7,750-7,770 | Sandstone, light grey, medium-grained. |
| 7,770-7,810 | Shale, as above, and coal; soft white bentonite. |
| 7,810-7,880 | Sandstone and shale as above. |
| 7,880-7,890 | Sandstone, grey to white, coarse-grained, conglomeratic. |
| | Lower part |
| 7,890-8,040 | Shale, dark brownish grey and grey, very fine-grained sandstone; coal at 7,930 and 7,960 feet depths; brown ironstone at 7,940 to 7,960 feet depths. |
| 8,040-8,050 | Sandstone, greyish buff, fine-grained, 'salt and pepper' texture, glauconitic. |
| 8,050-8,150 | Shale, dark brownish grey to dark grey; coal. |
| 8,150-8,310 | Sandstone, light grey, fine- to medium-grained, 'salt and pepper' texture; glauconitic at 8,310 feet; some shale and coal. |
| 8,310-8,390 | Shale, as above, in part slickensided; brown fossiliferous limestone at 8,360 feet depth. |
| 8,390-8,420 | Sandstone, brown,fine- to medium-grained, calcareous. |
| 8,420-8,450 | Shale, dark brownish grey, firm. |
| 8,450-8,530 | Sandstone, brown, fine- to medium-grained, slightly calcareous. |
| 8,530-8,720 | Shale, dark brownish grey to dark grey, firm with siltstone and sandstone, brown, very fine-grained, calcareous at 8,580, 8,600 to 8,630, 8,650 and 8,670 to 8,690 feet depths; coal at 8,540 feet depth. |

| Depth (feet) | |
|---|---|
| 8,720-8,850 | Sandstone, brown, very fine- to fine-grained, calcareous with dark brownish grey, firm, silty shale at 8,770 and 8,800 to 8,840 feet depths. |
| | Cadomin Formation |
| 8,850-8,940 | Sandstone, grey to white, fine-grained, non-calcareous; grading to coarse-grained at 8,940 feet depth. |
| 8,940-8,967 | Conglomerate, bluish and black chert pebbles in coarse-grained sandstone. |
| | Nikanassin Formation |
| 8,967-9,070 | Shale, dark brownish grey, micaceous; coal at 8,980 and 9,030 feet depths; sandstone, very fine- to fine-grained, light brown, medium-grained at 8,990 feet depth and with coal at 9,000 and 9,050 feet depths. |
| | Fernie Group |
| 9,070-9,120 | Sandstone, light brown, fine-grained, glauconitic. |
| 9,120-9,200 | Shale, dark grey to black, firm, with fine-grained, light brown sandstone and siltstone 9,130 to 9,160 feet depth; brown limestone and pyrite nodules at 9,200 feet depth. |
| 9,200-9,270 | Sandstone, fine- to medium-grained, brown to grey, quartzose; pyrite nodules at 9,220 feet depth. |
| 9,270-9,320 | Siltstone, brown, shaly, slightly calcareous. |
| 9,320-9,390 | Shale, dark brown, silty, micro-micaceous; sandstone,fine-grained, grey to brown, at 9,340 to 9,380 feet depth. |
| 9,390-9,450 | Sandstone, dark brownish grey, fine-grained, calcareous with dark bluish grey chert. |

| Depth (feet) | |
|---|---|
| 9,450- 9,500 | Limestone, dark brownish grey, shaly, dense, cherty with hard black shale below 9,465 feet depth. |
| | Rundle Group |
| 9,500- 9,545 | Dolomite, buff to light brown, dense. |
| 9,545- 9,570 | Dolomite, white granular. |
| 9,570- 9,595 | Dolomite, light to dark brown, dense. |
| - 9,595 | Fault |
| | Fernie Group |
| 9,595- 9,680 | Sandstone, fine-grained, grey to white, quartzose, similar to that at 9,200 feet; and dark brownish grey shale. |
| - 9,680 | Fault |
| | Cadomin Formation |
| 9,680- 9,690 | Conglomerate, chert in coarse-grained sandstone and light grey, medium-grained sandstone. |
| - 9,690 | Brazeau thrust |
| | Luscar Formation |
| | Upper part |
| 9,690- 9,720 | Shale, black, coaly, slickensided. |
| 9,720- 9,750 | Sandstone, fine-grained, greenish buff, 'salt and pepper' texture, non-calcareous, and shale as above. |
| | Lower part |
| 9,750- 9,790 | Sandstone, fine-grained, greyish buff, calcareous. |

| Depth (feet) | |
|---|---|
| 9,790- 9,820 | Shale, dark brownish grey to black; coal. |
| 9,820- 9,870 | Sandstone, dark brown, medium-grained, glauconitic at 9,830 and 9,870 and shale as above; dark brown fossiliferous limestone 9,840 to 9,860 feet depth. |
| 9,870- 9,940 | Sandstone, fine-grained, greenish buff, and shale as above. |
| 9,940- 9,960 | Sandstone, dark brown, glauconitic. |
| 9,960-10,100 | Shale, black, slickensided with limestone at 9,980 and below 10,060 feet depths. |
| 10,100-10,710 | Shale, dark grey to black, slickensided, siltstone, brownish grey, and sandstone, fine-grained, light brownish grey. |
| 10,710-10,785 | Samples missing; top of Cadomin formation reported at 10,763 feet depth. |
| | Cadomin Formation |
| 10,785-10,845 | Sandstone, medium-grained, light grey, quartzitic. |
| 10,845-10,880 | Conglomerate, chert in coarse-grained sandstone. |
| | Nikanassin Formation |
| 10,880-10,905 | Sandstone, fine-grained, light brown, quartzose, and brownish grey, shaly siltstone. |
| 10,905-10,980 | Shale, dark grey to black, firm, with sandstone and siltstone as above. |
| | Fernie Group |
| 10,980-11,000 | Sandstone, fine-grained, light brown, glauconitic. |
| 11,000-11,075 | Shale, dark grey to black, with dark brown shaly siltstone. |

| Depth (feet) | |
|---|---|
| 11,075-11,120 | Sandstone, very fine- to fine-grained, bluish white, quartzose. |
| 11,120-11,260 | Shale and siltstone, as above. |
| 11,260-11,350 | Sandstone, fine-grained, medium grey, shaly, calcareous, cherty grading to limestone. |
| | Rundle Group |
| 11,350-11,400 | Dolomite, buff to light brown, dense, finely crystalline and slightly porous 11,365 to 11,380 and 11,400 feet depths. |
| 11,400-11,435 | Dolomite, light buff to medium brown, dense. |
| 11,435-11,490 | Dolomite, buff, dense to finely crystalline, brownish grey, platy, very finely crystalline below 11,450 feet depth; buff chert at 11,440; limestone finely crystalline, buff at 11,460. |
| 11,490-11,505 | Dolomite, grey, finely crystalline, shaly. |
| 11,505-11,520 | Limestone, finely crystalline, brown to dark brown, shaly. |
| 11,520-11,553 | Limestone, grey, dense, shaly; white crystalline anhydrite. |
| 11,553-11,595 | Dolomite, very finely crystalline, grey to brown. |
| -11,595 | Fault |
| | Luscar Formation |
| | Upper part? |
| 11,595-11,685 | Sandstone, fine- to medium-grained, grey, light brown and greenish buff, 'salt and pepper' texture, with shale, dark grey to brownish grey, in part slickensided. |

## Triad Richfield Dome Husky Brazeau No. 1 Well

Location: l.s. 12, sec. 8, tp. 43, rge. 17, W. 5th mer.

Elevation: 4,634 feet.

Prepared by the writer after partial examination of the samples stored by the Geological Survey of Canada, Ottawa, and from a descriptive log of cores below 10,438 feet depth supplied through the courtesy of Husky Oil and Refining Co., Ltd.

| Depth (feet) | |
|---|---|
| 0- 80 | Drift |
| | **Wapiabi Formation** |
| 80- 280 | Shale, dark grey, silty, and fine-grained, grey siltstone with sandy to gritty shale at 250 and 270 feet depths; samples missing at 280 feet depth. |
| | **Cardium Formation** |
| 280- 290 | Sandstone, fine- to medium-grained, dark grey and white, quartzose. |
| 290- 360 | Shale, dark grey, silty. |
| 360- 400 | Sandstone, medium-grained, brownish grey; coal at 400 feet. |
| 400- 520 | Sandstone, coarse-grained white, grey below 470 feet. |
| | **Blackstone Formation** |
| 520- 600 | Concretionary zone: shale, dark grey, silty, and sandstone, fine-grained, dark grey, argillaceous. |
| 600- 670 | Samples missing. |
| 670-1,100 | Rusty Shale zone: shale, dark grey, silty and fissile, with siltstone, dark grey; brown micaceous bentonite at 1,070 and 1,080 feet depths. |

| Depth (feet) | |
|---|---|
| 1,100-1,920 | Inoceramus labiatus zone: shale, dark grey, fissile, with siltstone, dark grey, finely laminated, in part slickensided. |
| | Barren zone |
| 1,920-2,250 | Shale, dark grey, silty, partly fissile 2,210 to 2,250 feet; sandstone, fine-grained, grey, laminated 1,920 to 1,950 and 2,110 to 2,160 feet depths. |
| 2,250-2,480 | Sandstone, fine-grained, glassy grey to dull black, glauconitic at 2,270, 2,330, and 2,440 to 2,470 feet depths; much silty shale. |
| -2,480 | Fault |
| | Barren zone |
| 2,480-2,740 | Shale, dark grey, fissile and silty, slickensided with sandstone, fine-grained, dull dark grey at 2,550 and 2,620 to 2,640 feet depths. |
| 2,740-3,020 | Sandstone, fine-grained, glassy grey to dull dark grey, glauconitic at 2,770. 2,810, 2,820 and 2,910 feet depths; shale, dark grey, silty 2,820 to 2,900 and 2,910 to 3,000; bentonite 2,960; samples missing 3,000 to 3,020. |
| 3,020-3,200 | Sandstone, medium-grained, brown, slightly glauconitic 3,030 to 3,050; shale, dark grey, silty with some fine-grained, light grey, sandstone at 3,080 and 3,140 feet depths. |
| 3,200-3,530 | Sandstone, medium- to coarse-grained, glassy to dull, light grey 3,200 to 3,240, 3,290 to 3,310, and fine-grained, 3,310 to 3,380 feet depths; shale, dark grey, silty. |
| 3,530-3,750 | Sandstone, fine-grained, light grey, 3,530 to 3,550, and shale as above, slickensided. |
| -3,750 | Fault |

| Depth (feet) | |
|---|---|
| 3,750-6,740 | Barren zone: not examined in detail; possible fault at about 5,150 feet depth (Brazeau Range fault). |
| | Mountain Park Formation |
| 6,740-6,980 | Sandstone, fine- to medium-grained, greenish grey with coaly streaks at 6,850 feet depth; shale, pale greenish grey, at 6,790 to 6,840, 6,880 to 6,900 and 6,940 feet depths. |
| | Luscar Formation |
| | Upper part |
| 6,980-7,000 | Shale, black carbonaceous and coal. |
| 7,000-7,020 | Sandstone, fine-grained, greenish grey; shale, silty, greenish grey, and coal at 7,020. |
| 7,020-7,230 | Sandstone, fine- to medium-grained, greenish grey to dull grey; shale, black, carbonaceous and coal at 7,070 and 7,110 to 7,130 feet depths. |
| 7,230-7,290 | Shale, greenish grey and grey carbonaceous; coal at 7,270 feet depth. |
| | Lower part |
| 7,290-7,480 | Shale, grey and greenish grey, silty; sandstone, fine-grained, dull grey at 7,300 feet depth, and coal and carbonaceous shale (slickensided) at 7,440, 7,470 and 7,480 feet depths. |
| -7,480 | Canyon Creek fault |
| | Luscar Formation |
| | Upper part |
| 7,480-7,530 | Sandstone, fine- to medium-grained, dull grey and brownish grey; shale, grey. |

| Depth (feet) | |
|---|---|
| | Lower part |
| 7,530-7,650 | Shale, grey; sandstone, fine-grained, dull grey at 7,600 to 7,620 feet depths; samples poor. |
| 7,650-7,730 | Sandstone, medium-grained, dark grey, glauconitic, and shale, dark grey, silty and glauconitic at 7,680 to 7,710 feet depths. |
| 7,730-7,890 | Shale, grey to dark grey; fossil fragments at 7,740 and 7,860 feet depths. |
| 7,890-7,950 | Sandstone, fine-grained, dull black; shale, dark grey, 7,920-7,930. |
| 7,950-8,060 | Shale, dark grey; coal at 7,990 and 8,050; sandstone, medium-grained, brownish grey, at 8,040. |
| 8,060-8,100 | Sandstone, fine-grained, glassy, brownish grey. |
| 8,100-8,210 | Shale, black, slickensided; sandstone as above at 8,140 and 8,160 to 8,180 feet depths. |
| 8,210-8,260 | Sandstone, medium-grained, brownish grey. |
| 8,260-8,360 | Shale, black. |
| 8,360-8,460 | Sandstone, fine-grained, brownish grey; medium grained at 8,390 and 8,400, coarse-grained, speckled black and white below 8,400 feet depth |
| 8,460-8,540 | Shale, dull black, silty, slickensided and calcite veined. |
| 8,540-8,740 | Sandstone, fine-grained, dull black to dull brownish grey; shale, carbonaceous, and coal at 8,600 to 8,620 and 8,650 to 8,660 feet depths. |
| 8,740-8,760 | Shale, dark grey; coal at 8,760; slickensided. |
| 8,760-8,860 | Sandstone, fine-grained, brownish grey; shale, dull dark grey, silty at 8,790, 8,830 and 8,840 to 8,860 feet depths. |

| Depth (feet) | |
|---|---|
| | Cadomin Formation |
| 8,860-8,980 | Sandstone, fine- to coarse-grained, white to speckled black and white; grey, chert conglomerate below 8,960 feet depth. |
| | Nikanassin Formation |
| 8,980-8,990 | Sandstone, fine-grained, dull black, carbonaceous; coal. |
| 8,990-9,000 | Coal, slickensided. |
| 9,000-9,010 | Sandstone, as above. |
| 9,010-9,050 | Shale, dark grey, slickensided; coal at 9,020; sandstone, fine-grained, dull black, glauconitic at 9,030. |
| -9,050 | Chungo Creek fault |
| | Luscar Formation |
| 9,050-9,310 | Sandstone, fine- to medium-grained, dull black to brownish grey; shale, dark grey, silty, slickensided at 9,070 to 9,100, 9,120, 9,170, 9,190 to 9, 230, 9,260 and 9,290 to 9,310 feet depths. |
| | Cadomin Formation |
| 9,310-9,420 | Sandstone, medium-grained, grey, coarse-grained below 9,360 feet; chert pebbles at 9,370. |
| | Samples to 10,438 not examined in detail. |
| 9,420-9,500 | Nikanassin formation? |
| -9,500 | Chungo Creek fault? |
| 9,500-9,850 | Luscar formation? |
| 9,850-9,940 | Cadomin formation? |

| Depth (feet) | | |
|---|---|---|
| 9,940 | -10,020 | Nikanassin formation? |
| 10,020 | -10,438 | Fernie group |

Following descriptions from Husky Oil and Refining Co., Ltd.

Rundle Group

Unnamed beds

| | | |
|---|---|---|
| 10,438 | -10,536.5 | Dolomite, very finely crystalline, light grey to buff dense, with grey and green shale partings and bands at 10,476 and below 10,482 feet depths. |
| 10,536.5 | -10,603.5 | Dolomite, very finely crystalline, greyish buff; white chert near top; traces of fine porosity. |
| 10,603.5 | -10,700 | Limestone and dolomite, very finely crystalline, dark grey, argillaceous, thin-bedded, with blebs and beds of white to grey anhydrite. |
| 10,700 | -10,767 | Limestone, fine- to medium-crystalline, brownish grey, pseudo-fragmental; blebs of calcite and anhydrite; recovery incomplete. |

Shunda Formation

| | | |
|---|---|---|
| 10,767 | -10,770 | Dolomite, finely crystalline, grey to brown. |
| 10,770 | -10,811 | Limestone, very finely crystalline, dense, partly brecciated, blebs of calcite and anhydrite; argillaceous below 10,798, with greyish green shale. |
| 10,811 | -10,895 | Dolomite, finely crystalline, grey to brown, grading to grey dolomitic shale; blebs of calcite and anhydrite. |

Pekisko Formation

| | | |
|---|---|---|
| 10,895 | -10,938 | Limestone, finely crystalline, dense, slightly dolomitic, tan to buff; scattered calcite blebs. |

| Depth (feet) | |
|---|---|
| 10,938-11,002 | Dolomite, finely crystalline, dense, slightly argillaceous, grey to brown, and limestone, finely crystalline, buff to grey, slightly dolomitic. |
| -11,002 | Dorothy Creek fault |
| | Luscar Formation |
| 11,002-11,087 | Shale, black, hard, coaly; siltstone and sandstone, fine-grained, grey to dark grey, calcareous; not completely cored. |
| | Cadomin Formation |
| 11,087-11,160 | Sandstone, fine- to coarse-grained, grey; layers and scattered pebbles of rounded black chert; not completely cored. |
| | Nikanassin Formation |
| 11,160-11,205 | Shale, grey to black, hard, micaceous and carbonaceous; siltstone, fine-grained, brown to grey; not completely cored or recovered. |
| | Fernie Group |
| 11,205-11,755 | Shale, black to dark grey, hard, in part silty; not completely cored; fault at 11,655 feet depth. |
| 11,755-11,900 | Siltstone, dark grey; dolomite, light brown, dense; chert, black to dark grey, massive. |
| | Rundle Group |
| | Unnamed beds |
| 11,900-11,948 | Dolomite, very finely crystalline, dense brown and grey with grey and green shale partings and bands; shale, grey and green below 11,936 feet depth. |
| 11,948-12,016 | Dolomite, finely crystalline, buff, brown and grey, dense to slightly porous, with grey shale partings and bands. |

| Depth (feet) | |
|---|---|
| 12,016-12,135 | Dolomite, very finely crystalline, brown to grey, with thin, grey shale partings to 12,064 feet depth; and partly brecciated and with white crystalline anhydrite below 12,046 feet depth. |
| 12,135-12,212 | Dolomite, medium to coarsely crystalline, dark grey to dark brown; dark grey shale and coral colouring at 12,142 feet depth; finely crystalline and dense below. |
| | Shunda Formation |
| 12,212-12,294 | Dolomite, very finely crystalline, dense, grey to brown with white crystalline anhydrite. |
| 12,294-12,342 | Limestone and dolomitic limestone, finely crystalline, dense, brown to grey, with anhydrite below 12,331 feet depth; possible fault at 12,320 feet. |
| 12,342-12,388 | Dolomite, finely crystalline, grey, dense, with anhydrite and shale, black, slickensided. |
| -12,388 | Brazeau thrust |
| | Fernie Group |
| 12,388-12,509 | Shale, black, slickensided with interbedded thin siltstone and sandstone, fine-grained, grey. |