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DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

GEOLOGICAL SURVEY

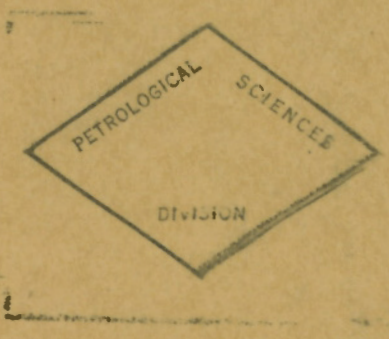
PAPER 47-11

MOBERLY CREEK MAP-AREA
ALBERTA

(REPORT AND MAP)

BY

A. H. LANG



OTTAWA

1947

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(Summary Account)

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Illustration

MOBERLY CREEK MAP-AREA, ALBERTA

INTRODUCTION

GENERAL STATEMENT

Moberly Creek map-area (latitudes 53°30' to 53°45', longitudes 118°00' to 118°15') includes 177 square miles northwest of Entrance, a village on the main line of the Canadian National Railways 190 miles west of Edmonton. The present contribution on this map-area is part of a broad scheme to provide geological maps and reports of that part of the Foothills belt now being actively prospected for petroleum.

The only published geological information on the map-area is contained in reports by J. MacVicar (1917, 1920, 1924), who made a reconnaissance survey of the region in 1916. The present report is based on field work commenced in the autumn of 1945 and continued in 1946. The writer was assisted by C.A. Waggoner in 1945, and by H.C.B. Leitch, D.A.W. Blake, and W.J. Underhill in 1946. He is indebted for many courtesies to members of the Alberta Forest Branch and the Brûlé Lumber Company, to Mr. J. Christopherson of Imperial Oil, Limited, and to Messrs. S.H. Clark and Ennis Taylor of Entrance.

ACCESSIBILITY

Entrance is the outfitting point for a large region to the northwest, including the Smoky River territory, which for many years has been visited by coal prospectors and large hunting parties and, more recently, by exploratory parties representing oil companies. Access has been by two main Forestry trails, both of which cross Moberly Creek area. The more westerly route, called the Mountain trail, enters the map-area from the south and extends westward along the north side of Wildhay River. This route was gradually improved by the Forest Branch, the Shell Exploration Company, and the Brûlé Lumber Company, with the result that in 1946 it was possible to reach Wildhay River by truck, a distance of 27 miles from Entrance, and a sawmill was built at the end of the road. From this point travel is by a good pack trail.

The other route, called the Lower trail, crosses the map-area diagonally, entering 3 miles north of the south-east corner. Half a mile farther it crosses Moberly Creek at the Moberly ranger station, which is 20½ miles from Entrance. Thence it proceeds northwesterly and reaches Little Berland River, near the northwest corner of the area, at the Little Berland ranger's cabin, which is 35½ miles from Entrance. The trail then follows down the Little Berland for a mile, crosses it, and continues northwesterly beyond the map-area. During the winter of 1946-47 five oil companies combined to build a road from Entrance to Muskeg River. This road, which more or less follows the route of the Lower trail, is indicated approximately on the map, from information kindly supplied by J. Christopherson of Imperial Oil Limited.

The map-area contains a few branch trails, the most important of which are: (1) a trail along the north side of Wildhay River, linking the Mountain and Lower trails; (2) the

Evans trail, which extends up Moberly Creek, crosses a divide, and, west of the map-area, joins a trail extending up Little Berland River from the Lower trail; (3) the Donald's Flats trail, which leads down Little Berland and Berland Rivers from the Lower trail. A poor trail runs from the Evans trail to Wildhay River, crossing a high ridge 1½ miles northwest of Moberly Lookout. Another, which joins the Mountain and Evans trails by way of Collie Creek, is good where it follows that creek, but poor thereafter. A short part of a trail that follows the gravel bars of Mumm Creek from its crossing of the Mountain trail lies in the southwest corner of the area. Trapper's trails that follow the meadows of Pinto and Polecat Creeks can be used by horses, but are swampy in places.

PHYSICAL FEATURES

Moberly Creek map-area is almost entirely in the western part of the Foothills belt. The southwest corner contains a high, rocky ridge, with peaks up to 7,600 feet in elevation, which the writer has called Hoff Ridge for convenient reference. It is a continuation of the Boule Range, an outlying range of the Rocky Mountains that lies west of Brûlé Lake. The rest of the map-area contains ridges from about 6,000 to 4,500 feet in elevation, diminishing in height toward the northeast. Hoff Ridge and the ridges between it and the Lower trail have a general trend of north 45 degrees west, parallel with the strike of the underlying strata. Subsidiary ridges and shoulders, caused by dissection by tributary streams, trend about northeast or southwest. Ridges in the half of the map-area lying northeast of the Lower trail show a noticeable change in trend. There the principal ridges strike northeasterly, parallel with the main creeks. This change is due to the fact that the strata underlying this half of the area dip gently to the northeast, with the result that there are no upturned, alternating hard and soft beds to influence the erosion of the ridges, which in this part of the area have a gradual slope to the northeast, about equal to the gradient of the streams and the dip of the bedrock.

The northern part of the area is drained by Berland River and the southern part by Wildhay River. The latter stream is always known locally as "Hay" River, but the Geographic Board has adopted the name "Wildhay". Both rivers flow in fairly wide valleys with gravel flats at about 4,300 feet above sea-level. The Wildhay joins the Berland 35 miles northeast of the map-area, and the Berland eventually flows into the Athabaska. The creeks in the southwest half of the area show a roughly rectangular drainage pattern, generally flowing parallel with or at right angles to the northwesterly strike of the bedrock formations. In the northeast half of the area the drainage pattern is more irregular.

The higher parts of Hoff Ridge are above timberline, and contain excellent exposures of bare rock. Most of the remainder of the map-area is forested, chiefly with jackpine, spruce, and poplar. Large meadows occur along Berland and Wildhay Rivers and Moberly Creek. The northeast half of the area contains many large muskegs, both in the valley bottoms and on the sides of the ridges.

GENERAL GEOLOGY

GENERAL STATEMENT

Moberly Creek map-area is underlain by marine and non-marine sedimentary strata ranging in age from Devonian to Paleocene. The older formations are complexly folded and faulted, and outcrop in relatively narrow bands in the southwest half of the area. The Palaeozoic formations are exposed only along the cores of two parallel anticlines on Hoff Ridge. Except for certain repetitions by folding and faulting, the rock exposures are progressively younger to the northeast and southwest of the main anticline on this ridge.

The Palaeozoic and Triassic formations consist chiefly of hard limestone and quartzitic sandstone, which form excellent exposures, and Hoff Ridge owes its height to the resistance of these rocks to erosion. The remainder of the succession includes a hard bed of conglomerate and several ridge-forming beds of quartzitic sandstone, but the intervening beds are chiefly soft shale and sandstone that are exposed principally as intermittent outcrops along streams.

As the Foothills belt extends for many hundreds of miles, it is natural that the stratigraphic succession should vary somewhat in different districts. That in Peace River district, for example, 200 miles northwest of Moberly Creek area, is considerably different from the succession in southwestern Alberta and has a separate formational nomenclature. Most of the formations underlying Moberly Creek area can be correlated with ones to the southeast, and their names have been used wherever possible. The reasons for these correlations, and also for naming a few members, have been given in recent reports by the writer on nearby areas (1945, 1946, 1947) and are not repeated at length in this report. The present area contains, however, a sandstone formation that has not been reported southeast of Athabaska River, and which appears to be the southeasterly continuation of the Dunvegan formation of the Peace River section. It has been classed as such, and a few hundred feet of shale underlying it has been considered to represent the Fort St. John group of Peace River district.

TABLE OF FORMATIONS

Period or epoch	Formation or group, and approximate thickness (feet)	Subdivision and approximate thickness (feet)	Lithology
Paleocene	5,000 ±		Sandstone, shale, conglomerate, coal (non-marine)
	Brazeau 6,000 ±		Sandstone, shale, conglomerate (non-marine)
		Solomon member 100	Sandstone (marine)

Upper Cretaceous	Wapiabi 1,350		Shale, shaly sandstone (marine)
	Bighorn 474		Quartzitic sandstone, shale, sandy shale (marine and non-marine)
	Blackstone 1,000 ±		Shale, minor siltstone (marine)
	Dunvegan 330		Sandstone, shale, and sandy shale (marine and non-marine)
Lower Cretaceous	Fort St. John(?) 400		Shale and sandy shale (marine?)
	Luscar and (?) Mountain Park 2,000 ±		Sandstone, shale, conglomerate, coal (non-marine)
	Cadomin 12-60		Conglomerate
	Nikanassin 900 ±		Quartzitic sandstone and shale (marine and non-marine)
Jurassic	Fernie 1,300 ±		Shale and quartzitic sandstone (marine)
Triassic	Spray River 1,000 ?	Whitehorse member 155	Limestone and dolomite (marine)
			Quartzitic sandstone and siltstone (marine)
Carboniferous	Rundle 800		Limestone and dolomite (marine)
	Banff 600		Argillaceous limestone and calcareous shale (marine)
Devonian	Boule 300 +		Limestone and dolomite (marine)

DEVONIAN

Boule Formation

Where the axis of the main anticline on Hoff Ridge crosses the west boundary of the map-area a creek has eroded the core of the fold and exposed a little massive limestone and dolomite, which underlies the Banff formation. Although no fossils were found at this locality there seems no doubt that these beds represent the uppermost part of the Boule formation. This Upper Devonian formation is prominent in the Brûlé area to the southeast, where the use of the name "Boule" was extended from Jasper Park (Lang, 1947; Raymond, 1930).

As indicated on the map, two additional windows of the Boule formation are assumed to occur where other creeks have eroded the core of the anticline. These valleys are floored with drift and talus.

CARBONIFEROUS

Banff Formation

The Banff formation consists of about 600 feet of thin-bedded, argillaceous limestone and calcareous shale overlying the Boule formation conformably. These beds are exposed along the Hoff Ridge anticline near the west boundary of the map-area, and where this fold is truncated by Wildhay Valley half a mile south of the area. Extensive fossil collections were made from equivalent beds in Brûlé area.

As in Brûlé area, the Exshaw formation was not recognized definitely, but shales that may be equivalent to it were included in the lower part of the Banff formation.

Rundle Formation

The Rundle formation overlies the Banff conformably and consists of about 800 feet of fairly massive and thickly bedded, craggy, grey limestone and dolomite. The upper part of the formation contains numerous reef corals and some porous zones.

The Rundle is exposed for about 3 miles along the crest of the Hoff Ridge anticline and, farther northwest, it splits into two bands along the flanks of the fold. Another, irregular belt of the formation is exposed farther southwest, where a fault has thrust it above beds of the Spray River formation.

Several collections of corals and crinoid stems from these beds were submitted to R.A.C. Brown of the Geological Survey, who reported that they were suggestive of the Rundle fauna. He stated that the following lot, from Hoff Ridge immediately north of the south boundary of the map-area, and near the main anticlinal axis, was a definite Rundle fauna:

Diphyphyllum mutabile Kelly
Lithostrotionella ? sp.
cf. *Triplophyllum minnewankense* Shimer

TRIASSIC

Spray River Formation

The greater part of the Spray River formation consists of fairly hard, slabby, grey, brown, and purplish weathering, quartzitic sandstone and siltstone. These strata are overlain by distinctive beds of limestone and dolomite, which form the Whitehorse member of the Spray River formation.

The main part of the formation is exposed at many places on Hoff Ridge, where it is repeated by folding and faulting. The bed immediately overlying the Rundle consists of about a foot of basal "conglomerate" containing angular fragments of the underlying limestone in a matrix of calcareous sandstone. This indicates an erosional interval, which is to be expected as Permain strata are missing. The conglomerate is overlain by a fairly uniform succession of sandstone and siltstone, the upper 80 feet of which is slightly calcareous, indicating the beginning of the limy sedimentation characteristic of the Whitehorse member. Where these strata were best exposed for measurement, on the east side of Hoff Ridge, only 384 feet of sandstone and siltstone lay between the top of the Rundle and the base of the Whitehorse, whereas the apparent thickness in other parts of Moberly Creek area and the known thickness in nearby areas are about 1,000 feet. It is possible that the lower part of the section has been thrust over the upper part in such a way as to cut out part where it was measured.

An ammonite reported by F.H. McLearn to be a Lower Triassic form was found near the base of the Spray River formation, on the summit of Hoff Ridge at the south boundary of the map-area.

Whitehorse Member. The lower part of this member consists of 25 feet of buff weathering sandy limestone. This is overlain by 130 feet of thick-bedded, massive, white limestone and dolomite, making the total thickness of the member 155 feet. The Whitehorse member is well exposed along the northeast side of Hoff Ridge, and four small remnants occur on shoulders of the ridge on the southwest flank of the anticline. Another outcrop occurs on Mumm Creek half a mile south of the map-area, and permits the extrapolation of the member across the southwest corner of the area.

A collection of fossils from this member, at the northeast side of Hoff Ridge, contained *Spiriferina* cf. *onestae* and *Myophoria* cf. *elegans*. Another collection, from the southwest flank of the anticline, one-quarter mile south of the south boundary of the area, contained *Trigonodus*? sp. and *'Monotis'*? sp. McLearn reported that these fossils were probably Middle Triassic forms. The name "Whitehorse member" was applied by Warrne (1945) to limestone beds carrying a Middle Triassic fauna at the top of the Spray River formation in the Cadomin district.

JURASSIC

Fernie Group

The Fernie group overlies the Whitehorse member with a slight erosional disconformity, and consists of about 900 feet of black shale and interbedded quartzitic sandstone. These beds outcrop intermittently along the northeast side of Hoff Ridge, but are poorly exposed. They appear to be thrust over the Nikanassin formation, and in places over the Luscar, and it is probable that the uppermost Fernie beds are missing. Beds of the Fernie group are also exposed at one locality on Mumm Creek half a mile south of the map-area; this occurrence is used as a basis for projecting the Fernie beds across the southwest corner of the area.

The following section of Fernie beds was measured on Hoff Ridge:

	Feet
Overlying beds concealed.	
Quartzitic sandstone and interbedded black shale	372
Black shale, with thin interbeds of quartzitic sandstone; considerably crumpled	357
Black shale, very thinly laminated	55
Black shale	110
Slight disconformity	894
Underlying beds - Whitehorse member of Spray River formation	

The only fossil collected from these beds was identified by F.H. McLearn as Pholas? sp., which, he stated, could be Jurassic.

LOWER CRETACEOUS

Nikanassin Formation

The Nikanassin formation consists of hard, grey sandstone similar to that in the upper part of the Fernie, with some interbedded black shale. These beds are exposed in places along the northeast slope of Hoff Ridge, and again along Collie Creek and its tributaries. One large outcrop occurs in the extreme southwest corner of the map-area. Nowhere is the formation sufficiently exposed to permit the measurement of a section. It was estimated to be about 900 feet thick in Brûlé area.

Three fossil collections consisting of numerous small pelecypods were obtained from these beds. F.H. McLearn supplied the following note regarding them:

"The three lots all carry what appear to be small species of Aucella. Larger species of this genus may also be present. I have not seen anything like them elsewhere. They have appeared in several collections sent to this Museum for identification, and have always been labelled "Nikanassin" or "Nikanassin?". Similar shells occur in the lower part of the Bullhead group in Peace River Valley. Everywhere they are recorded from below the coal beds. They are of very late Jurassic or early Lower Cretaceous age."

This fossil evidence indicates that the Nikanassin formation in this region is partly marine.

Cadomin Formation

The Cadomin formation consists of hard, closely packed and well-cemented conglomerate, which outcrops boldly. The pebbles are generally from $\frac{1}{2}$ to 1 inch in diameter and consist chiefly of grey and white quartzite, but cobbles up to 5 inches in diameter occur. The rock commonly fractures across the pebbles instead of around them. The bed varies in thickness from 12 to 60 feet and appears to be continuous. From 50 to 100 feet above it are beds and lenses of similar conglomerate separated by sandstone; these have been included in the lower part of the Luscar formation.

The Cadomin conglomerate was given formational rank in areas south of Athabaska River because it is a useful horizon marker for separating the Nikanassin and Luscar formations. At Folding Mountain, immediately south of the Athabaska, a second, thinner bed of conglomerate occurs in the lower part of the Luscar. In Moberly Creek area the increase in the number of conglomerate beds renders the rock less serviceable as a stratigraphic guide, and raises the question as to whether to class the lower, and apparently thicker and more continuous, bed as the Cadomin formation, or to group all the conglomerate as a fairly thick formation. The first-mentioned alternative was adopted.

Luscar and (?) Mountain Park Formations

Overlying the previously mentioned sandstone and conglomerate are the typical sandstones and shales of the Luscar formation, consisting of fine- to medium-grained, brownish and greenish weathering, grey and greenish grey sandstone, with interbedded grey, greenish grey, and black shale. Thin coal seams were seen, and it is probable that the thicker seams found in areas to the southeast also occur in Moberly Creek area, but are unexposed. The formation outcrops intermittently across a wide folded belt northeast of Hoff Ridge, but is nowhere sufficiently well exposed to permit measurement. An approximate thickness of 2,000 feet has been assigned, based on the thickness in other areas.

Several collections of fossil plants from these strata were submitted to W.A. Bell of the Geological Survey, who reported as follows:

Field No. 2-52 (Geol. Surv. Cat. No. 3612) 3,000 feet up creek flowing into Wildhay River east of Hoff Ridge.

Conifers

Athrotaxites ungeri Halle

Field No. Y-319 (Geol. Surv. Cat. No. 3613) 1 mile up Collie Creek, east bank.

Caytoniales
Sagenopteris mclearni Berry
Nilssoniales
Nilssonia johnstrupi Heer
Conifers
Athrotaxites ungeri Halle

Field No. Y-210 (Geol. Surv. Cat. No. 3614) northeast side of Hoff Ridge near west boundary of map-area.

Ferns
Cladophlebis parva ? Fontaine
Conifers
Podozamites lanceolatus (Lindley and Hutton)
Elatocladus (Sequoia ?) smittiana (Heer) Seward
Pityophyllum nordenskioldi (Heer)

Field No. Y-318 (Geol. Surv. Cat. No. 3615) 1 mile up north branch of Collie Creek.

Conifers
Athrotaxites ungeri Halle

Field No. Z-116 (Geol. Surv. Cat. No. 3616) Hoff Ridge near west boundary of map-area.

Conifers
Podozamites lanceolatus (Lindley and Hutton)
Elatides curvifolia (Dunker)

Field No. Y-119 (Geol. Surv. Cat. No. 3617) halfway between Hoff Ridge and Collie Creek.

Ferns
Sphenopteris latiloba Fontaine
Coniopteris sp.
Cycadeoids (Bennettitales)
Ptilophyllum speciosum (Heer)
Conifers
Elatides curvifolia (Dunker)

Bell stated that all of these collections indicated an Aptian (late Lower Cretaceous) age and a correlation with the typical Luscar formation.

Fort St. John Group (?)

It is assumed that about 400 feet of shale and sandy shale underlying the beds classed as the Dunvegan formation represent the Fort St. John group. These strata are exposed only at two localities

east of Collie Creek, where they are difficult to separate lithologically from the Luscar formation. The reason for correlating them tentatively with the Fort St. John group is explained below, in the discussion of the Dunvegan formation.

UPPER CRETACEOUS

Dunvegan Formation

Several thick quartzitic sandstone beds with interveining shale and sandy shale constitute a mappable unit extending northwesterly across the area from the point where the road from Brûlé ends at Wildhay River. The sandstone is generally grey or greenish grey, and buff weathering; in places it is dark green and glauconitic. At most localities there are two buff-forming sandstone beds about 40 feet thick, the remainder of the succession being composed of thin sandstone and shale beds; the total thickness of the formation is about 330 feet. Dip slopes and folds cause the formation to outcrop intermittently across widths of 1,000 to 1,500 feet.

Much time was spent searching for fossils in these beds, but only one unidentifiable pelecypod and a collection of plants could be found. The plants, which were obtained where Moberly Creek crosses the formation, were reported upon by W.A. Bell as follows:

Conifers
Sequoia sp.
Pagiophyllum sp. cf. Geinitzia reichenbachii

The Pagiophyllum is too poorly preserved to be of any value. The Sequoia by itself does not permit of an age evaluation; although it is similar in form to a species occurring in the Dunvegan formation the species is too close in form to Elastocladus (Sequoia?) smittiana from the Lower Cretaceous to be of much stratigraphic value.

Although the palaeontological evidence is meagre, this map-unit is believed to represent the southeasterly continuation of the Dunvegan formation of Peace River district, which McLearn (1945) has described as consisting of 550 feet of thick sandstone beds with interbeds of thin sandstone, shale, and limy beds. He states that it contains freshwater and marine shells and fossil leaves, and that it is generally regarded as the oldest Upper Cretaceous formation although the upper part of the underlying Fort St. John group may also be of Upper Cretaceous age.

In Brûlé map-area the Luscar formation is overlain by 6 inches of fine-grained conglomerate similar to a bed called "the grit" at the base of the Blackstone formation of more southerly areas. This is overlain by unfossiliferous black shale typical of the lower part of the Blackstone. At one locality a 20-foot bed of sandstone lithologically similar to those classed as Dunvegan in Moberly Creek area occurs about 400 feet above "the grit". This bed did not constitute a mappable unit, and it was classed as a member of the Blackstone formation, but it was pointed out that it probably represented the Dunvegan formation.

In Peace River district the Fort St. John group consists of several dominantly marine formations lying between the Dunvegan and the coal-bearing Gething formation, which has been correlated with the Luscar. The strata below the Dunvegan in Moberly Creek area are very poorly exposed and neither "the grit" nor definitely marine beds could be found. Because of the interval of 400 feet between "the grit" and the presumably Dunvegan bed in Brûlé area, a comparable map-unit has been inserted between the Luscar and the Dunvegan, and classed tentatively as "Fort St. John group".

Blackstone Formation

The Dunvegan formation (?) is overlain by a thick succession of thin-bedded, fissile, black shale with a few thin beds of siltstone. The shale is commonly concretionary, and in places has the yellow, melantoritic weathering characteristic of the Blackstone formation. The upper part of the succession contains the diagnostic Blackstone fossil Inoceramus labiatus. The formation is very poorly exposed, and is known almost entirely from outcrops along Moberly Creek and Wildhay River. It is impossible to measure a section, and the estimated thickness of 1,000 feet or more is based on that of other areas.

Correlation. The Blackstone formation was defined as overlying the Dakota and underlying the Bighorn (Malloch, 1911, p. 21). Later, the name "Mountain Park" was substituted for "Dakota" (MacKay, 1930). In Peace River district the Dunvegan is overlain by the marine Kaskapau shale, and this, in turn, is overlain by the marine Badheart sandstone, which from fossil evidence is believed to be slightly younger than the Bighorn. The Kaskapau and Badheart were originally classed as members of the Smoky River formation (McLearn, 1929, p. 117), but the Smoky River is now regarded as a group (Smoky group) and the Kaskapau and Badheart as formations.

The strata lying between the Dunvegan and the Bighorn, in Moberly Creek area, seem to represent a link between the typical Blackstone and the typical Kaskapau. They cannot be correlated precisely with the Blackstone because, in Brûlé area, the Dunvegan appears to wedge out at an horizon about 400 feet above the base of the Blackstone. On the other hand, they cannot be regarded as the exact equivalent of the Kaskapau because the Badheart may be younger than the Bighorn. Because the practice has been to extend the nomenclature of southern Alberta as far northward as possible, the beds under discussion have been classed as "Blackstone", with the reservation that the lower part of the typical Blackstone may, in Moberly Creek area, be replaced by strata classed as "Fort St. John" and "Dunvegan".

Bighorn Formation

The shales of the Blackstone formation are overlain by a succession of hard, ridge-forming sandstone beds with some interbedded shale and sandy shale, which together constitute the Bighorn formation. The more massive beds outcrop fairly well along a series of ridges extending diagonally across the area. The following section was measured across one of these ridges:

	Feet
Overlying beds - Wapiabi formation	
Slight erosional disconformity	
Sandstone, green, fine-grained, slabby	69
Shaly sandstone, slabby; a few pebbles at base	75
Shale, lumpy and clay-like	12
Quartzitic sandstone, medium-grained, white .	37
Sandstone, reddish weathering, slabby	20
Quartzitic sandstone, fine-grained, white . .	36
Sandstone, reddish and greenish weathering; slabby; with shaly partings	59
Covered	163
Sandstone, grey, greenish weathering, fine grained	3
Underlying beds unexposed.	
Total thickness . . .	474

It is doubtful whether the lowest, thin sandstone bed should be included in the Bighorn or the Blackstone. If the base of the Bighorn were drawn at the bottom of the 59-foot bed, the thickness of the formation at this locality would be 308 feet.

Numerous specimens of Cardium cf. pauperculum were collected from one zone in this formation, on the north bank of Moberly Creek, thus confirming its correlation with the Bighorn of more southerly areas.

Several beds of sandstone outcrop near the north branch of Collie Creek, between the main belt of the Bighorn and the beds classed as Dunvegan. The Dunvegan and Bighorn sandstones are lithologically so similar that it is difficult, in the absence of fossils, to determine whether they are repetitions of the Dunvegan or of the Bighorn. They are, however, believed to be slightly more like the typical Bighorn beds and are mapped as such. Their occurrence seems to be local, as they are not exposed along Moberly Creek or Wildhay River.

Wapiabi Formation

The uppermost sandstone bed of the Bighorn formation is overlain with slight erosional disconformity by a few feet of greenish, glauconitic, shaly sandstone classed as the base of the Wapiabi formation. Above this sandstone is a thick succession of black, fissile, concretionary shale, which outcrops poorly. The top of the formation is composed of green, glauconitic, shaly sandstone, which is exposed at several localities because of repetition by folding and faulting. No complete section of the formation is exposed. Along Moberly Creek the stratigraphic interval between the top of the Bighorn and the base of the Solomon sandstone is

1,350 feet. The uppermost beds contain a smooth species of Baculites, which McLearn stated was probably diagnostic of the Wapiabi formation, and Liopistha montanensis and Oxytoma nebrascensis, which he reported were of late Upper Cretaceous age.

Numerous small exposures of uppermost Wapiabi strata appear in the imbricate zone extending northwestward from Moberly Lookout.

Brazeau Formation

The Wapiabi formation is overlain conformably by about 100 feet of distinctive, slabby, buff weathering sandstone, which outcrops well and forms several ridges where it is repeated by folds and faults. At one locality, a mile northwest of Moberly Lookout, this sandstone contains Tancredia? americana?, which McLearn identified as a late Upper Cretaceous species. This bed is undoubtedly the continuation of the one named the Solomon sandstone member of the Brazeau formation in Brûlé area. It has been mapped separately because of its importance as an horizon marker. There are, however, several repetitions of the member within the imbricate zone referred to above, which could not all be traced across the map-area, either because they are not continuous or because of lack of outcrops.

The hard, slabby bed referred to above is overlain by about 100 feet of softer, coarser grained, greenish sandstone containing a few scattered pebbles, and this is succeeded, in turn, by typical Brazeau conglomerate of variable thickness. The latter consists of pebbles averaging one-half to one inch in diameter, about two-thirds of them being white and grey quartzite and one-third black chert. These are rather widely spaced in a sandy matrix. The remainder of the formation consists of similar conglomerate beds or lenses alternating with greenish grey sandstone and shale. Both the conglomerate and the sandstone are commonly crossbedded. The finer grained beds contain unidentifiable plant remains.

PALEOCENE

The northeastern part of the map-area is underlain by a thick succession of beds very similar lithologically to those of the Brazeau formation except that they contain relatively less conglomerate and considerable coal. Four collections of fossil leaves from these strata were reported upon by W.A. Bell as follows:

Field No. Y-247 (Geol. Surv. Cat. No. 3619) Pinto Creek below crossing of Lower trail.

Equisetales
Equisetum sp.
Conifers
Sequoia langsdorfii (Brongniart) Heer
Angiosperms
Carpolithus (Trochodendroides?) arachioides (Lesquereux)

Remarks. Florule too small for judging precise age, but probably Paleocene.

Field No. Y-272A (Geol. Surv. Cat. No. 3620) on Pinto Creek about 4 miles east of Lower trail.

Conifers
Sequoia langsdorfii (Brongniart) Heer

Remarks. Not sufficient to indicate more than Tertiary, but it is a very abundant species in the Paleocene formations of western Canada.

Field No. Y-302 (Geol. Surv. Cat. No. 3621) 3½ miles up Polecat Creek from 6th meridian.

Conifer
Sequoia langsdorfii (Brongniart) Heer
Angiosperms
Carpolithus (Trochodendroides?) arachioides (Lesquereux)
Trochodendroides ? arctica ? (Heer)

Remarks. Tertiary, and most probably Paleocene.

Field No. Z-166 (Geol. Surv. Cat. No. 3622) north bank Berland River at Little Berland junction.

Angiosperms
Carpolithus (Trochodendroides?) archioides (Lesquereux)

Remarks. Apparently Paleocene as are preceding lots from Y-247, Y-272A, and Y-302.

This palaeontological evidence indicates that these strata are continuous with those classed as Paleocene in Brûlé (Lang, 1946, 1947) and Gregg Lake (Irish, 1946) areas, and of those classed as Edmonton and Paskapoo in Entrance area (Lang, 1945). In those areas the top of the Brazeau formation was drawn at the base of a distinctive conglomerate bed called the Entrance conglomerate. This bed could not be found in Moberly Creek area, and hence no definite boundary could be established between the Brazeau and Paleocene strata. An assumed boundary has, however, been placed along the approximate projection of the nearest exposure of the Entrance conglomerate in Gregg Lake area. On that basis, the Brazeau formation is estimated to be 6,000 feet thick, and the Paleocene strata within the map-area, 5,000 feet.

GEOLOGICAL STRUCTURES

Several folds and faults have been mapped in the southwest half of the map-area, and others have probably escaped detection because of overburden or lack of key horizons. Except for minor flexures, the few outcrops in the northeast half of the area exhibit gentle dips toward the northeast.

From the southwest corner of the map-area to Collie Creek the strata appear to lie in a series of thrust blocks separated by southwestward-dipping faults, with the beds in each block folded fairly steeply. One of these faults is assumed to occur near Collie Creek to account for the limited thickness of the Luscar between exposures of Nikanassin beds and the base of the Dunvegan. The folds in the block between the base of Hoff Ridge and Collie Creek probably plunge southeastward, as the Nikanassin and Cadomin formations have been found only in the southern part of the block.

The numerous repetitions of Upper Wapiabi and Solomon strata indicate a zone of complicated structures that cannot be interpreted completely because of lack of exposures. Some of these structures are obviously folds that have been dissected by erosion, and they appear to be underlain by a folded fault. Others can be explained most simply by assuming the existence of a series of eastward-dipping faults. This zone has been indicated as an "imbricate zone" because of its great complexity and because it is impossible to extrapolate all of the structures across the drift-covered parts of the zone.

COAL POSSIBILITIES

Coal seams up to 1 foot thick were seen in the Luscar formation. Numerous test pits were dug many years ago in the overburden covering this formation, but they are sloughed and no coal was seen on their dumps. It is quite probable that larger seams occur in the Luscar of Moberly Creek area, and that these could be found by drilling or deep trenching.

A 7-foot seam is exposed in the Paleocene strata at the junction of Teitge and Pinto Creeks, and what may be the same (or a related) seam is poorly exposed at about the same horizon on the north bank of Berland River. This horizon is roughly 2,000 feet above the assumed base of the Paleocene succession.

OIL AND GAS POSSIBILITIES

No wells have been drilled for oil or gas within the map-area. The nearest test is an unsuccessful one at Solomon Creek in Brûlé area. It is expected, however, that several wells will be drilled shortly at Muskeg River, about 20 miles northwest of Moberly Creek map-area. Should these find oil in commercial quantity the possibilities of Moberly Creek area will doubtless be considered, in which case attention may be given to the anticline that crosses Wildhay River and the tributaries of Collie Creek. These streams have cut deeply into the Nikanassin formation about 2,500 feet stratigraphically above the Palaeozoic limestone, an estimate based on assumed thicknesses of 1,300 feet for the Fernie and 1,000 feet for the Spray River. This structure may be truncated by the fault postulated to emerge in Collie Creek Valley.

REFERENCES

Irish, E.J.W.: Gregg Lake Map-area, Alberta; Geol. Surv., Canada, Paper 46-4, 1946.

Lang, A.H.: Entrance Map-area, Alberta; Geol. Surv., Canada, Paper 45-11, 1945.

_____ Brûlé Map-area, Alberta; Geol. Surv., Canada, Paper 46-5, 1946.

_____ Brûlé and Entrance Areas, Alta.; Geol. Surv., Canada, Mem. 244, 1947 (in press).

Malloch, G.S.: Bighorn Coal Basin, Alberta; Geol. Surv., Canada, Memoir 9-E, 1911.

MacKay, B.R.: Stratigraphy and Structure of Bituminous Coalfields in the Vicinity of Jasper Park, Alberta; Trans. Can. Inst. Min. Met., 1930, pp. 473-509.

MacVicar, J.: Foothills Coal Areas North of the Grand Trunk Pacific Railway, Alberta; Geol. Surv., Canada, Sum. Rept. 1916, pt. C, pp. 85-93 (1917).

_____ Coal Areas Northwest of Brûlé Lake, Alberta; Geol. Surv., Canada, Sum. Rept. 1919, pt. C, pp. 8-13 (1920).

_____ Preliminary Investigations of Coal Deposits on Smoky, Hay, and Berland Rivers, Alberta; Geol. Surv., Canada, Sum. Rept. 1923, pt. B, pp. 21-62 (1924).

McLearn, F.H.: New Species from the Coloradoan of Lower Smoky and Lower Peace Rivers, Alberta; Geol. Surv., Canada, Bull. 42, pp. 117-126 (1926).

_____ The Upper Cretaceous Dunvegan Formation of Northwestern Alberta and Northeastern British Columbia; Geol. Surv., Canada, Paper 45-27, 1945.

Raymond, P.E.: The Palaeozoic Formations in Jasper Park, Alberta; Am. Jour. Sci., 5th ser., vol. XX, 1930.