CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 57-4

CANMORE, ALBERTA

(82 0/3, in part)

(Report and Map 11-1957)

By

D. K. Norris

OTTAWA
1957

Price, 50 cents

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CANMORE, ALBERTA

INTRODUCTION

Mineable coal seams of the Canmore area have been examined by a number of geologists in the past three-quarters of a century. The first detailed work was that of G. M. Dawson in the years 1881 to 1884; this was followed by extensive research by D. B. Dowling between 1903 and 1923. A detailed examination of the stratigraphy and structure of the immediate vicinity of Canmore was made in 1934 by B. R. MacKay who incorporated the most recent findings from mining operations to that date (MacKay, 1935)[1]. In more recent years the adjoining area to the southeast was mapped by M. B. B. Crockford (1949).

In this paper the stratigraphy and structure within the south half of Canmore area (Map 323A) is reviewed, with special emphasis on mineable coal seams in the lower one-third of the Kootenay formation. The southeastward continuation of the lowest seams is suggested on the basis of correlations of seams on the east face of Wind Ridge with those on the northeast shoulder of Mount Allan, 3 miles southeast of the map-area.

LOCATION AND ACCESSIBILITY

Canmore area lies within the Front Ranges of the Rocky Mountains in Bow River valley. It is flanked on the west by Mount Rundle and on the east by Fairholme Range. Canmore, the only town within the area, is 60 miles west of Calgary and lies on both the Trans-Canada Highway and the Canadian Pacific Railway.

The area covered by this report is roughly 3 miles square and lies in the southeast corner of the Canmore sheet (82 O/3 W 1/2).

ACKNOWLEDGMENTS AND FIELD WORK

Field work in the south half of Canmore area was carried on by the writer during the last part of the summer of 1956.

Although particular emphasis was laid on the presence and extent of mineable coal seams in the lower part of the Kootenay formation, the Palaeozoic rocks above the Mount Rundle fault were subdivided and mapped where they occurred within the area.

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

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STRATIGRAPHY

TABLE OF MESOZOIC FORMATIONS

Era	Period or epoch	Formation, group or member		Lithology	Thickness feet
MESOZOIC	Lower Cretaceous	Blairmore		Nonmarine sandstone, conglomerate shale	1,000+
		Kootenay formation	Upper sandstone and conglomerate member	Nonmarine sandstone, conglomerate shale, coal	1,890
			Shale member	Nonmarine shale, sandstone, coal	1,130
			Basal sandstone member	Nonmarine ? sandstone, siltstone	50
	Jurassic	Fernie group	Upper part	Marine shale, siltstone, sandstone	800
			Pigeon Creek member	Marine siltstone	125
			Lower part, contains Rock Creek member	Marine shale, basal limestone breccia	250
	Unconformity				
	Triassic	Spray River fm.	Sulphur Mountain member	Marine siltstone, shale	600
	Disconformity				

TRIASSIC

Spray River Formation

Exposures of the Spray River formation are limited to the vicinity of Pigeon Creek in the southeast corner of the area. There the formation is estimated to be 600 feet thick. Neither the upper nor lower contact is exposed within the area, although the former is well exposed south of the area on Pigeon Creek about 1 mile above its confluence with Wind Creek.

Outcrops on Pigeon Creek consist largely of hard, blue-grey siltstone ranging from very thin to thick bedded (as defined by Gray, 1955) and characteristically weathering a creamy brown. The lowest bed exposed in the Creek is a resistant siltstone, which occurs about 50 feet above the base of the formation in the Ribbon Creek area to the southeast (Crockford, 1949). The uppermost bed is a dense, blue-grey siltstone, readily traceable throughout the area and for 2 to 3 miles to the southeast. It stands out particularly well because of the recessive nature of the overlying shales of the Fernie group.

JURASSIC

Fernie Group

Only the lower half of the Fernie group is well exposed within the area, although outcrops are plentiful on Pigeon Creek above its confluence with Wind Creek. There, in a gully on the southwest side of the Creek, the group is almost completely exposed and is about 925 feet thick.

The group was divided into three mappable units: the Lower part, the Pigeon Creek member and the Upper part. They are 250, 125 and 800 feet thick respectively. The Lower part consists largely of recessive, black, fissile shale with a basal 4-foot bed of black, dense, non-calcareous siltstone with lenticular, limestone-pebble conglomerate. About 70 feet above the base of the Lower part is the Rock Creek member, a 2-foot bed of dark grey, calcareous, very fine-grained sandstone, which is abundantly fossiliferous. The Pigeon Creek member overlies the Lower part and consists of cliff-forming, thin- to thick-bedded, dark grey, calcareous siltstone. Dark grey shale and mudstone with occasional dark grey and brown siltstone interbeds occur in the lowest 550 feet of the Upper part and grade upward into recessive, grey, fine-grained, thin- to medium-bedded sandstone. The lower contact with the Pigeon Creek member is sharp, whereas the upper contact

with the Kootenay formation is gradational and is arbitrarily placed at the base of the first, cliff-forming sandstone.

LOWER CRETACEOUS

Kootenay Formation

Outcrops of the Kootenay formation are sparse below tree-line except in creek bottoms, because of the predominance of shale in the lower part of the formation. On ridge tops and above timber-line, however, exposures are good. The only complete section of the formation in the immediate vicinity is on the northeast face of Mount Allan and is continuous with the Jurassic section discussed above. Both upper and lower contacts are exposed. The formation is 3,070 feet thick and is divisible into three units; the basal sandstone member, the shale member, and the upper sandstone and conglomerate member. The first two of these are essentially as used by Crockford (1949). The units are, respectively, 50, 1,130 and 1,890 feet thick and are traceable to the northwest to Wind Ridge and the area of active mining.

In the Canmore area the lower contact of the Kootenay formation is placed, for convenience in mapping, at the lower limit of the cliff-forming basal sandstone member. The underlying recessive, grey sandstone is mapped within the upper part of the Fernie group. The upper contact of the Kootenay formation is drawn at the base of the first thick-bedded to massive, pebble-conglomerate or conglomeratic sandstone.

The basal sandstone member is a persistent, grey, medium- to coarse-grained, thick-bedded to massive, cliff-forming sandstone about 50 feet thick. At its base it is in gradational contact with recessive sandstone of the Fernie group and the succession at this stratigraphic level is similar to that in Mount Head area (Douglas, 1957) to the southeast, and in Moose Mountain area (Beach, 1943) to the east.

The overlying shale member has minor, lenticular, cliff-forming sandstone interbeds and contains most of the mineable coal seams in the Canmore area. Seven seams have been mined or prospected in the shale member. They are, in ascending order: Wind Creek, Dirty, Joe, Cairnes, Number 6, Number 5, and Big Seam. Five coal seams, including Dirty and Joe seams, in the lowest 600 feet of the shale member appear to continue from Wind Ridge southeast to Mount Allan, a distance of about 3 miles (see Figure 1). They have been prospected on the northeast face of Mount Allan as well as on the ridge extending northwest to form the divide between Pigeon and Wind Creeks. Many or all of these

seams may be mineable within this region.

The upper sandstone and conglomerate member is cliff-forming and easily differentiated from the recessive shale member below it. The lower two-thirds of the member consists dominantly of fine- to medium-grained, dark grey, thin- to medium-bedded sandstone, with rhythmical interbeds of dark grey-brown siltstones, black, silty shale and thin coal seams. Three seams have been mined in the lowest part of this unit on the east face of Wind Ridge. They are, in ascending order Lower Marsh, Upper Marsh and Granger seams. The upper third of the member caps Wind ridge, and is made up of interbedded dark grey-brown, calcareous, fine-, medium- and coarse-grained sandstones, black, carbonaceous shales, dark grey, chert-pebble conglomerates with pebbles up to 1 inch in diameter, and minor coal. The upper sandstone and conglomerate member appears to be the facies equivalent of Douglas' Upper part of the Kootenay formation in the Mount Head area, 60 miles to the southeast.

Blairmore Group

No outcrop of Blairmore strata occurs within the area and only about 1,000 feet are present on Mount Allan to the southeast (Crockford, 1949). Only the lowest beds are described, to indicate the differences in lithology from that of the underlying Kootenay formation.

At the base is a cliff-forming unit of interbedded sandstone, and chert and quartz pebble-conglomerate about 50 feet thick, and apparently conformable with top Kootenay beds. This is overlain by 160 feet of dark grey shale with occasional interbeds of fine-grained, grey sandstone and minor green and maroon shale, typical of the Blairmore group. Sandstones with occasional conglomerate interbeds make up the remainder of the exposed section on Mount Allan.

STRUCTURAL GEOLOGY

LAC DES ARCS THRUST SHEET

The Cascade coal area lies within the Lac des Arcs thrust sheet (Clark, 1949). Along the western boundary of the area is the Mount Rundle fault, by which Cambrian, Devonian, and Mississippian formations have been thrust over the coal-bearing Kootenay strata. Repetitions within Devonian and Mississippian strata, evident in the majestic peaks of the Three Sisters in northwest Canmore area, are due to tight folds and splays from the Mount Rundle fault.

The Kootenay formation is folded into a prominent, asymmetrical syncline, the Mount Allan syncline, which extends throughout the length of Ribbon Creek map-area to the southeast (Crockford, 1949), and is overridden by the Mount Rundle fault northwest of the Three Sisters (see cross-section A-B). The west flank of the syncline is vertical to overturned 45 degrees, whereas the east flank dips west at 10 to 20 degrees. The thickness of the shale member on Wind Ridge (1,260 feet) is comparable with that on Mount Allan (1,130 feet) and has apparently not been greatly deformed by faulting. The upper sandstone and conglomerate member, however, appears to be considerably thickened beyond that due to observed folds, and steep, west-dipping thrusts may be present (see cross-section A-B).

As a general rule, blocky coals are restricted to the shale member, and sheared coals mainly to the upper sandstone and conglomerate member. Furthermore, sheared and friable seams are cut by few faults in contrast to the strong, blocky seams which are cut by many. For example, Upper Marsh seam is intensely sheared by movement along the seam and cut by few faults whereas Cairnes seam is little sheared but cut by a profusion of small, mostly normal faults.

A gently west-dipping sequence of the Fernie group and the Spray River formation follows the Bow River valley, but is partly covered by Pleistocene and Recent material. Spray River beds outcrop low on the west flank of Fairholme Range, where they dip 30 to 35 degrees southwest. The underlying Rocky Mountain formation and Rundle group immediately northeast of the area are relatively undisturbed. High on the east flank of Grotto Mountain in Fairholme Range, however, a minor west-dipping fault has thrust Banff beds onto Rundle. From that point eastward the sequence continues down through Devonian into Cambrian strata in a series of open anticlines and synclines. The Cambrian beds are in fault contact with Rundle strata at the Lac des Arcs thrust.

ECONOMIC GEOLOGY

COAL

Considerable reserves of coal for underground mining, both of slack and blocky varieties, seem to be present in the Canmore area. There is evidence of as many as six coal seams, ranging in thickness from 2 to 19 feet, in the lowest 600 feet of the shale member of the Kootenay formation, some or all of which may be mineable for 3 miles or more southeast along strike from the present working. Excellent core recovery below Wind Ridge as well as the bright and blocky condition of the coal in the out-

crop of many of the seams on the northeast face of Mount Allan would suggest structurally strong coals in this interval.

INDUSTRIAL MINERALS

Sand and gravel, and building stone are abundant in the Canmore area. Occurrences of both close to the railway and the Trans-Canada Highway are particularly amenable to exploitation. The sand and gravel deposits are of both alluvial and glacial origin and although of poor quality as constituents for concrete, because of their high silt content, they should prove of value in the construction of the new Trans-Canada Highway. Medium-bedded siltstones in the Spray River formation have been utilized in the construction of the Banff Springs hotel. Occurrences of this rock, almost at road level on either side of Pigeon Creek close to its confluence with Bow River, have been prospected. There are, moreover, vast quantities of this material forming a dip-slope on the southwest flank of Pigeon Mountain only 2 to 3 miles distant from the new highway.

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