

46. *THE CASCADE ANTHRACITIC COAL-FIELD OF THE ROCKY MOUNTAINS, CANADA.* By WM. HAMILTON MERRITT, Esq., F.G.S., Assoc. R.S.M., Memb. American Inst. of Mining Engineers, &c. (Read June 23, 1886.)

THIS Coal-field occurs in the most eastern valley of the Rocky Mountains, the Bow-River valley.

The Cretaceous rocks, which underlie a large area of foot-hills and prairie to the east, have here been caught up and crop out in the bottom of a trough between two parallel rows of mountains, composed of Palæozoic rocks, which rise to a height of about 3000 feet above the river on either side, or some 7000 feet above the sea. The softer shales and sandstones of the Cretaceous rocks have been worn away and form the valley-bottom, and are for the most part covered with gravel from 100 to 200 feet in thickness. The height of the valley above the sea is some 4300 feet.

Both the rocks of the mountains on either side and those of the valley are tilted up and show a dip of between 30° and 40° to the west of south (magnetic) and a strike of from 25° to 30° north of west (magnetic).

Though there are minor local disturbances of the rocks, this dip and strike may be said to be constant throughout the Coal-field.

From palæontological evidence, the age of the Palæozoic rocks is thought by Mr. Whiteaves, Palæontologist to the Geological Survey of Canada, to be of Lower or Sub-Carboniferous, or possibly Devonian age, though probably the former.

The fossils which I collected from these rocks were chiefly Crinoids, *Zaphrentis*, *Spirifera*, and long-winged *Spirifera*.

The rocks are massive Limestones and Dolomites.

The Cretaceous rocks consist of clay shales, black shales, argillaceous sandstone rock, and sandstone. Several Coal-seams have been found about the centre of the trough.

The general section (fig. 1), though not accurately to scale, will suffice to illustrate the occurrence of this trough of Cretaceous Coal-bearing deposits*.

The accompanying sections of the Coal-seams, drawn to scale (fig. 2), were made by me from three exposures of the Coal, which are at some distance from one another.

At the upper exposure "A," there are two seams a quarter of a mile apart, 5 feet and 3 feet thick respectively.

At the centre exposure "B" seven seams are seen, varying from

* At the best exposure of the Coal-seams, where this general section was taken, the unconformity of these Cretaceous rocks is not visible, nor can the faults, which we know must occur, be located, owing to the rocks being, in places, much hidden by overlying gravel. The unconformity of the Cretaceous rocks in the trough is shown at other places at some distance from the section in question, and to attempt to draw in the true folding of the Cretaceous rocks in this part of the trough, or to indicate the exact position of faults I suspect, other than on the east side of the trough, would be entire guess-work.

ANTHRACITIC COAL-FIELD OF THE ROCKY MOUNTAINS.

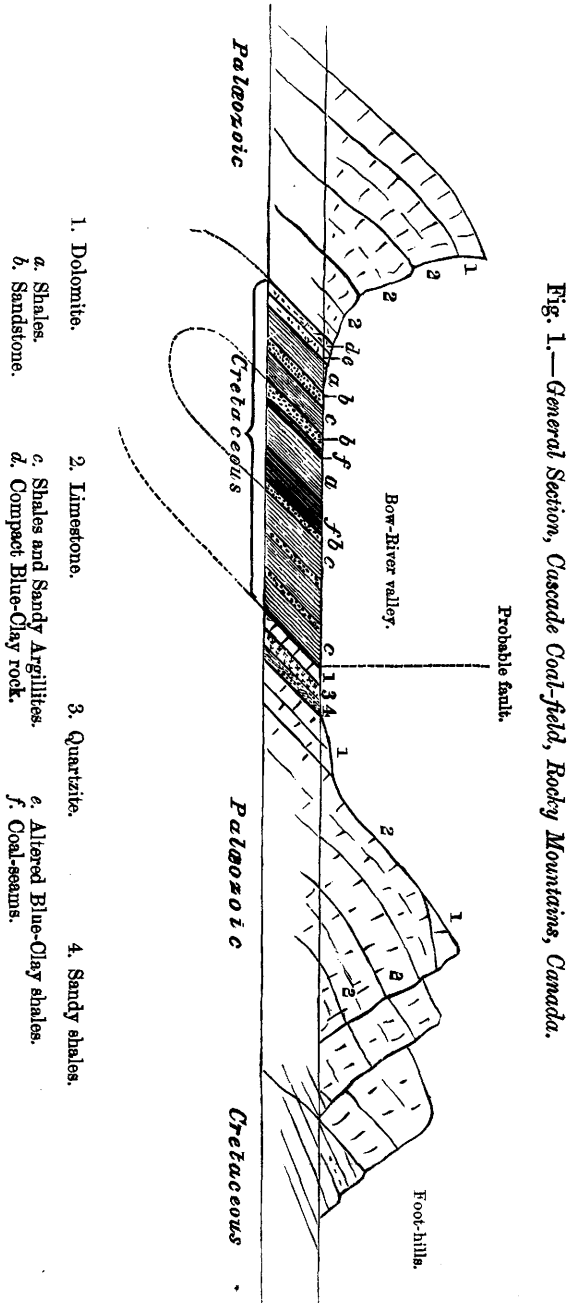


Fig. 1.—General Section, Cascade Coal-field, Rocky Mountains, Canada.

5 feet to 1 foot in thickness; and at the lower exposure "C" the two seams to be seen are 10 feet and 12 feet in thickness.

The measures, except at the exposures referred to, are covered up with gravel, as previously mentioned.

The Coal has been altered by metamorphic influence from the lignitic character of the coal occurring in this formation to the east in the plains. It has been changed to an anthracite of a light and free-burning order, which might perhaps be more properly designated a semianthracite. Its specific gravity is 1.4.

A number of analyses have been made of the coal from the various seams, and a fair average of these is well represented in the composition of this coal as given by Mr. Hoffman, of the Canadian Geological Survey, viz. :—

Hygroscopic water	71
Volatile combustible matter	10.79
Fixed carbon	80.93
Ash	7.57
	<hr/>
	100.00

Owing to the great pressure to which these seams have been subjected and the distortion that has accompanied the folding of the beds, the coal, in places, is friable and shows slickensides; but elsewhere it is of a compact laminated character; and sometimes, though more rarely, the laminated structure is not apparent in the compact Coal.

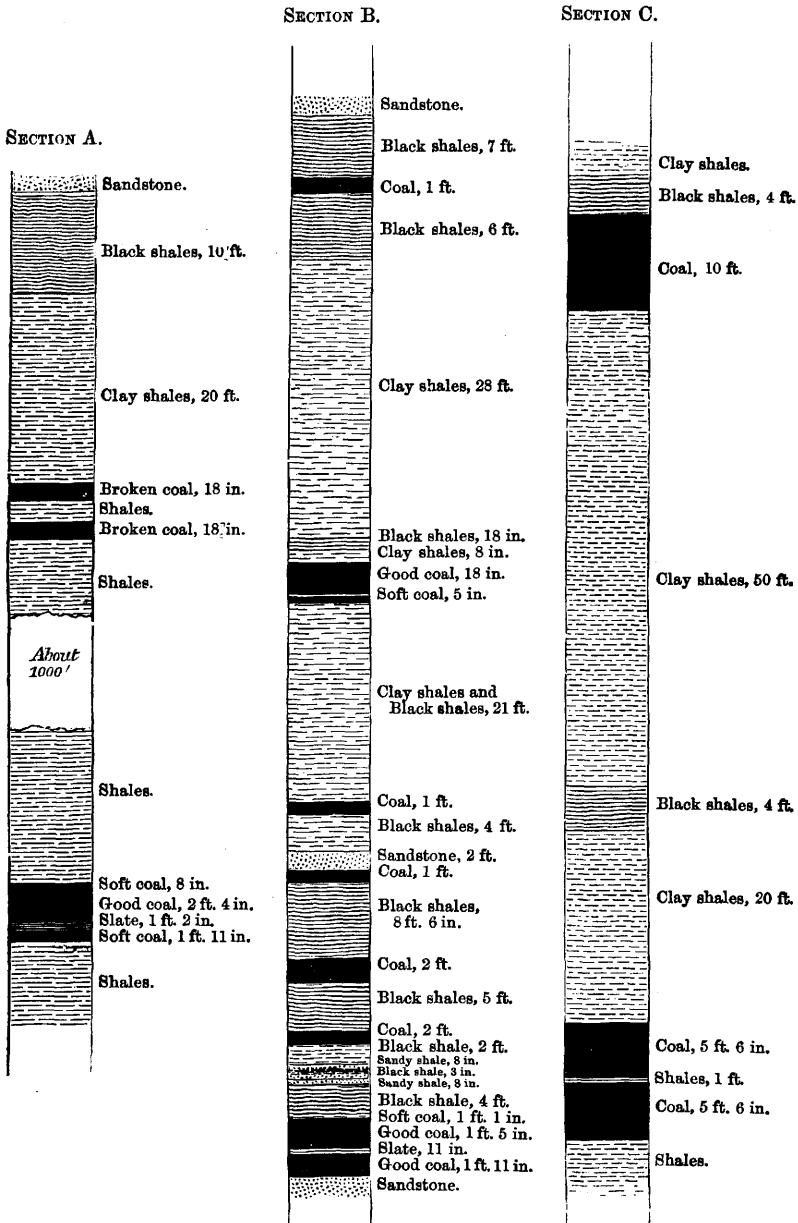
When subjected to a sudden high temperature it slowly breaks into angular fragments without actual decrepitation, and in an ordinary fire it burns with a steady white glow without decrepitation, leaving in either case a white ash.

My examination of this Cascade Anthracitic Coal-region was made last summer. Some of these Coal-seams had been previously visited by Dr. Dawson, of the Geological Survey of Canada, and a few remarks are made about these in the Report of Progress for the years 1882-84. The lower exposure "C" has been since opened up.

As those Fellows of the Geological Society who accompanied the British Association to Canada are aware, lignites occur in the Laramie and Cretaceous formations in places from Manitoba to the Rocky Mountains. The first seam that was opened up was in Manitoba, on the Souris River. This I tested in Winnipeg in 1879, and found it of inferior quality. The following will represent about the average composition of these eastern Lignites :—

	per cent.
Carbon	42
Volatile combustible matter	34
Hygroscopic water	16
Ash	8
	<hr/>
	100

Fig. 2.—Sections through Exposures of Coal-seams, Cascade Coal-field, Rocky Mountains, Canada. (Scale 20 feet to 1 inch.)



As the mountains are approached they influence the quality of the Coal very materially. From a number of specimens collected from outcrops by members of the Geological Survey, Dr. George M. Dawson and Mr. Hoffman suggest three horizons *, represented by districts at varying distances from the mountains or in the mountains.

1. In the prairie to the east, the true Lignites occur, the hygroscopic water ranging from 6 per cent. to 21 per cent., and the fixed carbon varying from 41 per cent. to 55 per cent. They continue to a line about 15 miles from the mountains. Throughout the area to the east of this 15-mile line the rocks are practically horizontal, and for about 100 miles to the east from this line the hygroscopic water is found to increase in a more or less regular ratio of about 1 per cent. for each 10 miles. At the 15-mile line the water-contents of the lignite are put at 5 per cent. Dr. Dawson hesitates to make the influence of pressure wholly responsible for a variation found to extend throughout horizontal beds for more than 100 miles; and as he computes from known variation in the coals that there is about 2 per cent. change in hygroscopic water for every 1000 feet of strata, he thinks a varying thickness of overlying or shore-beds on the mountain coast-line may have been washed away.

2. Between the eastern edge of the mountain (Palæozoic) formation, which is well defined and straight, and the above-mentioned 15-mile line to the east, the foot-hills show evidence of much disturbance and pressure.

Within this area the quality of the lignites approaches that of true coal, the hygroscopic water in them ranging from 1.63 to 6.12 per cent. and the fixed carbon from 50 to 63 per cent.

3. The anthracite or semi-anthracite, occurring in the Cretaceous and Laramie deposits which have been caught up in the Palæozoic rocks of the mountains, is found in long troughs lying in the mountains.

The general section that accompanies this paper shows one of these troughs, and in this case the accompanying coal has been altered into an anthracite, and is, I believe, the only case yet known in Canadian territory where the metamorphic influence has been carried so far in the coals occurring in the above-mentioned formations.

* Report of Progress of Geological Survey of Canada, 1882-84.