1882.

NEW ZEALAND.

BROCKLEY COAL FIELDS, MALVERN HILLS DISTRICT

(REPORT ON, BY S. H. COX).

Return to an Order of the House of Representatives, dated the 24th day of August, 1882.

"That a copy of Mr. Cox's report on the Brockley and adjacent Coal Fields, in the Malvern Hills District, be laid before this House and printed."—(*Mr. McMillan.*)

SIR,— Colonial Museum, Wellington, 16th August, 1882.

I have the honour to forward a report by Mr. Cox, Assistant Geologist, on the Brockley Mine, Malvern Hills, which he examined last week in accordance with your instructions (of 2nd instant) for the purpose of ascertaining the quality of the coal and the probable extent of the workable seams.

In compliance with your further instructions of 8th instant, a short description is also given of the other coal deposits in the same district.

It will be observed that Mr. Cox reports that 300,000 tons of coal is the amount available in the Brockley Mine as at present opened out. The quality of the coal is intermediate between the Grey River coal of the West Coast and the Shag Point coal of Otago—for steam purposes.

I have, &c.,

The Hon. the Minister for Public Works. JAMES HECTOR.

REPORT on the BROCKLEY COAL MINE and Surrounding District, by S. HERBERT COX, F.C.S., F.G.S., Assistant Geologist.

SIR,— Wellington, 15th August, 1882.

I have the honour to inform you that, in accordance with your instructions, I have visited the Brockley Coal Mine, and that I took the opportunity of a spare day to pay a flying visit to the Rakaia Gorge and Acheron River coals.

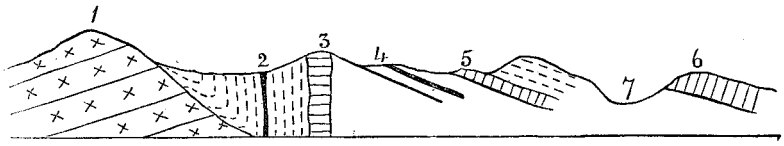
The Brockley coal seam is situated near the Hororata River, at the south-eastern end of the area of brown coal shown on Dr. Von Haast's map of the Malvern Hills District (Geological Reports, 1871–72, page 88), as extending from the Selwyn to the Hororata River, on the north-east side of the Wairiri Valley; and in Section IV. of the same report he shows at this point beds of brown coal, altered by dolerites. I have practically very little to add to this report from a geological point of view, except to state that the Brockley Mine is worked in a vertical seam 6 feet thick, striking west by south, included between a dyke, which also strikes west by south, and the quartz porphyries, which form the ridge between Brockley and Washpen Creeks, called Pullwool Peak on Dr. Von Haast's map. The tilting of this seam of coal by means of the dyke has taken place during more recent times, probably contemporaneously with the formation of the dolerites of the Harper Hills, and it has been attended by local alteration in the character of the coal. When this is considered, we are enabled to arrive at some estimate of the possible quantity of altered coal in the Brockley seam, for it is at once evident that beyond the boundaries of the dyke along its strike no alteration will have taken place, and this is borne out by the occurrence of seams of brown coal in the direction of the Selwyn. It is obvious that, in whatever manner the coal seam may have been dislocated between the dyke and the porphyries, it cannot have a greater extent than the superficial distance between these rocks, and if for convenience of calculation we assume that the coal has been inverted so as to lie vertical and parallel to the dyke throughout, we get the greatest amount possible. This would give us an outside measurement of 120 chains by 35 chains, or about 420 acres of coal 6 feet thick, equivalent to 2,520,000 tons, but this quantity could not be taken as a basis for any calculations, since up to the present time the coal has only been proved along its strike for a distance of half a mile, and the depth of 35 chains=2,800 feet, would, even if the coal occurred to that depth, make the cost of working too great to prove remunerative for many years to come.

Allowing then that coal has been traced for a distance of half a mile, and may be worked to a depth of, say, 1,000 feet, we should have 300,000 tons of coal available in the Brockley Mine.

To the southward of the Brockley Mine there is another outcrop of altered coal, known as Ayers's (Lee's) Mine, which is dipping to the southward at an angle of about 30°.

At this point there are two seams, one of which is reported to be 6 feet thick when it was opened out, but the drive had fallen in, and when I visited the locality, although some trouble had been taken to clear the place up, the outcrop only could be seen, and a fair estimate of the quality of the coal could not be made. There is, however, one seam at least 4 feet thick and another about 2 feet in thickness,

dipping towards the flat, and the analyses of these coals, as seen in the accompanying table, show them to be of very good quality. They are overlaid by a dolerite floe, as shown in the following section:—



1. Quartz porphyries: Pullwool Peak; 2. Brockley Coal-mine; 3. Dyke; 4. Ayers's (Lee's) Coal-mine; 5. Dolerite floe; 6. Harper Hills; 7. Wairiri Valley, which may either belong to the contemporaneous volcanic series of the coal measures (metaphyses), or to the more recent doleritic one of the Harper Hills, but most probably is of the former age.

This rock appears to have altered the constitution of the coal where exposed, and it is quite probable that coal of the same character may extend some distance to the dip, but the nature of the country will make it necessary to work this by shafts or very long tunnels, since it dips towards the Wairiri Flats, a series of hills, however, intervening between the outcrop and the flat, the rocks of which overlie the coal measures. It is evident that no estimate can be formed of the extent of altered coal in this direction, beyond this: that it may occur for 120 chains along the strike, and extend to the dip indefinitely, but how far actual work can alone show.

In Washpen Creek, on the north-western side of Pullwool Peak previously referred to, altered coals again occur striking north and south and standing vertical, but at a short distance from the creek the measures are dipping to the west at gradually decreasing angles, although they are very shortly overlaid by the terrace gravels of the Hororata and Rakaia Rivers, which are continuous in the flat country until the Rakaia Gorge is reached.

Dr. Hector, in reporting on this district (Geological Report 1870–71, page 47), says of Washpen Creek: "Under the sandstone ironstone beds appear, and in that part of the stream opposite Redwood (Rochwood) Station the same ironstone strata are seen to form the floor of the valley, interbedded with coarse quartzose grits, finely laminated shales, and ten well defined, but thin seams of coal, the thickest being only 2 feet 9 inches."

At the Rakaia Gorge, Dr. Von Haast reports the occurrence of two thin seams of anthracite 2 feet 2 inches, and 2 feet 4 inches thick respectively, besides which there two thick seams of an altered brown coal of good quality, as may be seen by the accompanying analyses by Mr. Skey of samples, which I collected. They have, however, a high percentage of water, notwithstanding the fact that the proportion of fixed carbon to hydro-carbon is large, and the coal does not stand the weather as well as that from Brockley, although it is superior to the average coals of the Malvern Hills. These seams, which are about 10 feet thick each, are arranged at a rather steep syncline, the axis of which strikes about north-east, in the direction of the Brockley and Rochwood seams, and it is quite possible that the coals may be continuous below the flat in this direction, flanking the Four Peak Range to the south-east, but this can only be proved by boring.

Mr. Gerard, the proprietor of these Rakaia seams, has, I understand, expressed his intention, in event of a railway being constructed through the Wairiri Valley, of laying down a tramway to connect his coal with it, a work of some magnitude, since twelve to fourteen miles would have to be constructed.

About six miles from this point, in the valley of the Acheron River, a seam of anthracite, owned by Mr. Murchison, occurs. This seam, which is 4 feet thick, is of first rate quality, being the best which has been found in the district. A previous analysis of a sample collected by Dr. Hector in 1869 gave 88·91 per cent. of fixed carbon, or an evaporative power of 11·5; but the sample which I brought has a large percentage of ash, and so does not give as good returns to analysis. This seam, which has previously been reported on both by Dr. Hector and Dr. Von Haast, is striking north and south and dipping west at an angle of about 30°, and is a parallel belt to the Rakaia syncline, the same remarks applying to the country between the two points as I have already made concerning that lying between the Rakaia and Brockley, but here the length along the strike is limited by Mount Hutt on the one side and the High Peak Ranges on the other. Coal is reported to occur for two miles further up the Acheron, but Dr. Hector reports (Geological Report, 1870–71, page 49) that it is of inferior quality.

To summarize the results of my trip, it appears that four classes of coal occur in the district, as follows:—

1. *Anthracites.*—Of these the best seam is undoubtedly that at the Acheron, which is 4 feet thick, and also of the best quality, having an evaporative power of from 8·5 to 11·5. Besides this there are thin seams in the Brockley Mine, and also in Ayers's (Lee's) Mine, as well as at Rakaia, which might be worked in conjunction with other seams of coal.

2. *Altered Brown Coals in which the percentage of water is not high*, amongst which the thick seam in Ayers's (Lee's) Mine and Brockley 6 feet seam may be classed.—They are of good quality, burning freely and not being affected by the weather, but the sample from Mr. Ayers's mine is the best. These correspond with the better class of pitch coals.

3. *Altered Brown Coals with high percentage of water*, including the large seams of coal at the Rakaia Gorge.—These coals have a lower evaporative power than the foregoing, and do not stand the weather so well. They are, however, of better quality than the ordinary brown coals.

4. *Brown Coals*, which are largely represented in the Malvern Hills, but are not found amongst the seams which I have examined.—They have a high percentage of water and hydro-carbons, and a far lower evaporative power than any of these.

The extent of these altered coals is not assured, as I have previously pointed out, and without the knowledge which can be obtained by means of boring no estimate of quantity can be made. The estimate given of the quantity of coal in the Brockley Mine is, however, only a small proportion of what probably occurs in the district, and the coal in Mr. Ayers's seam, adjoining it, is of yet better quality.

The following analyses have been made by Mr. Skey of the samples of coal which I collected:—

1. *Anthracites,—*

	Acheron.	Ayers's thin seam.
Fixed carbon...	65·80	52·01
Hydro-carbon	5·38	3·69
Water	4·57	4·89
Ash	24·25	39·41
	100 00	100·00

Evaporative power: Acheron, 8·50; Ayers, 6·76.

2. *Altered Brown Coals in which percentage of water is not high,—*

	Brockley, per Mr. Cox.	Brockley, per Mr. McMillan.	Ayers's thick seam.
Fixed carbon	49·99	53·29	62·21
Hydro-carbon	35·42	33·04	18·99
Water	11·79	12·65	5·20
Ash	2·80	2·02	13·60
	100·00	100·00	100·00

Evaporative power: Brockley (Cox), 6·49; Brockley (McMillan), 6·77; Ayers's thick seam, 8·08.

3. *Altered Brown Coals with high percentage of water,—*

	Rakaia Mine.		Rakaia Mine. Upper Seam.	Outcrop of Coal in Cliff on Rakaia River.	
				No. 1, Lower Seam.	No. 2, Upper Seam.
Fixed Carbon ...	46·06	46·70	44·43	45·30	35·30
Hydro-carbon ...	28·80	24·99	26·08	25·95	27·42
Water ...	18·18	18·42	19·53	26·15	18·28
Ash ...	6·86	9·89	9·96	2·60	19·00
	100·00	100·00	100·00	100·00	100·00

Evaporative power: Rakaia Mine (1), 5·98; Rakaia Mine (2), 6·07; Rakaia Mine, upper seam, 5·77; lower seam on cliff, which has been worked to small extent, 5·88; upper seam on cliff, also worked to small extent, 4·59.

It will be of interest to reproduce here a report by the Railway Department on the comparative work done by Westport, Shag Point, and Brockley coals, from which it will be seen that the tonnage per train-mile for 1lb. of coal consumed, which is the best test of the comparative value of the coals, is as follows: Westport, 8·22; Brockley, 5·63; Shag Point, 3·74. The evaporative powers of the different coals being: Westport, 8·2; Brockley, 6·5; Shag Point, 5·4.

I have, &c.,

The Director of the Geological Survey. S. Herbert Cox.

Hurunui–Bluff Section (New Zealand Railways).

Comparative Statement of Brockley, Shag Point, and Westport Coals used on Locomotives.

Date.	Eng. No.	Class.	Mileage.	Coal consumed.	Rate per ton.	Value.	Average consumption per mile.	Cost in pence per Engine-mile.	Cost in pence per Ton-mile.	Average tonnage per Train-mile.
					Brockley.					
1881. April 18 to April 30	84	J.	1,093	cwt. 400	£ s. d. 1 2 0	£ s. d. 22 0 0	lb. 41·00	4·83	·025	230·82
					Shag Point.					
1880. Sept. 20 to Oct. 16	84	J.	2,167	1,070	0 13 0	34 15 6	55·30	3·85	·022	207·11
					Westport.					
1881. April 11 to April 30	86	J.	1,649	420	1 4 0	25 16 0	29·20	3.75	·020	240·10

By Authority: George Didsbury, Government Printer, Wellington.—1882.