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REPORT ON KEROSENE SHALE AND COAL
SEAMS IN THE PARISH OF PREOLENNA.

[One Map.]

*Government Geologist's Office,
Launceston, 15th July, 1903.*

SIR,

As instructed by you, I proceeded on the 16th March to the sections held by the North West Coal and Shale Co., N.L., between the Flowerdale and Jessie rivers, and the country surrounding these.

The discovery of coal on these leases closely related to kerosene shale and cannel was reported upon by the Assistant Government Geologist (Mr. Geo. A. Waller) in November, 1901, and the present report should be read in conjunction with his. Since then, Mr. Austin L. B. Brain was engaged by the company to explore the property, and after tracing and mapping the various exposures, reported that in his opinion a considerable tonnage is assured, and that if the sections were near to the coast or a railway he would not hesitate to recommend the commencement of work on a fairly extensive scale. It is, in fact, recognised on all hands that the coal is excellent, but that its distance from the sea constitutes a drawback. The principal object of my visit was to see whether this difficulty could be minimised, and whether any likelihood exists of the seam being found nearer the coast.

Geology.—The geological system in which the coal seams occur is the Permo-Carboniferous. Mr. Austin Brain gave me a portion of a fossil frond of the plant *glossopteris*, which he found in the 20-inch seam of oil shale, and which is quite conclusive as to the reference of these beds to the Lower Coal Measures in Tasmania. The sandstones which enclose the seams rest upon brown mudstones containing marine fossils, viz., *Fenestella*, *Spirifera*, *Aviculopecten*, *Pachydomus*, &c. These mudstones are known in Tasmania

as the Lower Marine beds of this system, and below them coal has not been found. Intercalated in the sandstones, and overlying bluish, soft, micaceous sandstone, in Fossil Creek is a yellowish, pebbly grit, with marine fossils. This has been thought to be equivalent to the Upper Marines, which alternate with and overlie the coal at the Don. This is possible, and suggests the further idea whether some coal seams at Preolenna, which have been found at a still higher horizon, may not belong to the Upper Mesozoic coals. There is, however, no decisive evidence on this point.

Between the coal outcrops and the Flowerdale River on the west there is a lofty range crowned with diabase (dolerite), the common intrusive igneous rock of our coal-fields. Coal may also be found on the western side of the ridge, but it is highly improbable that the seams pass below it. The sandstone beds, there is hardly any doubt, will be found disrupted by this intrusion. If the seams were continuous, they would pass 1400 feet below the summit of the range. An east and west line across the leases is practically a traverse across a north and south range which lies between the Flowerdale and Jessie rivers.

If we take the north and south track from the Calder River to the Arthur, which, between the 6 and 9-mile pegs passes through the coal leases, as a kind of datum or reference line, we see that the main line of outcrop runs east of and, roughly, parallel to the track on the fall to the Jessie, the seams dipping from 10° to 20° to the west. Northwards, at the 7-mile, the Permo-Carboniferous beds are concealed by a thin capping of Tertiary olivine-basalt, and this capping extends westwards over a considerable area of country, producing fertile chocolate soil, and nourishing timber of gigantic size. Taking the mean of various aneroid readings, the elevation here is 1550 feet above sea-level; at the VIII.-mile 1325 feet; at the VI.-mile 1380 feet; at the V.-mile 1190 feet; at the IV.-mile 690 feet; at the Inglis River about 200 feet; at the Calder River 170 feet. If the basaltic covering north of the VII.-mile could be stripped, and I do not think it is very thick anywhere, the sandstones and mudstones of the Permo-Carboniferous would be laid bare everywhere. Any coal seams west of the Arthur Track at the VII.-mile are hidden by the basalt, and the creeks form the only present indicators of the occurrence of coal.

The entire thickness of the beds in which the various seams are located appears to be about 800 feet, but the main seams are restricted to a band of sandstone from 80

to 100 feet thick. The development of the strata may be represented thus, in descending order:—

7. Basalt	Of Tertiary age. Superficial covering at the 7-mile and to the north
6. Diabase	Of Upper Mesozoic age. Forms crest of high range between Flowerdale and Jessie rivers
5. Sandstones with coal seams	Of Permo-Carboniferous age. The seams are referred to as Upper Coal (at Coal and Main creeks). Thickness approximately 500 feet
4. Fossiliferous grits and mudstones	Contain marine fossils, 8 chains west of Arthur track in Fossil Creek. Of Permo-Carboniferous age: probably intercalated Upper Marines. Thickness about 80 feet
3. Yellow sandstones and clays with the main seams of coal and shale	Thickness approximately 250 feet. The seams discovered so far occur in about 80 to 100 feet of these beds=Lower Coal Measures of Tasmania
2. Fossiliferous mudstones	Permo-Carboniferous Lower Marines. Thickness about 150 feet
1. Non-fossiliferous mudstones	Permo-Carboniferous Lower Marines. Thickness, down to the Jessie River, 200 feet or more

The chief interest is centred in the No. 3 formation, the series of sandstones in which workable seams have been discovered. Among these seams, the most important is that of the kerosene shale, or, as it has also been called, cannel coal. A very complete monograph on the kerosene shale deposits of New South Wales has recently been written by Mr. J. E. Carne, Assistant Government Geologist in that State. In this, the applicability of these terms to various deposits are discussed. Objections have been urged against the use of the word shale, because, to the eye, the structure is not always shaly; and to kerosene, because it is not certain that this is precisely the oil produced by its distillation. Kerosene shale is, however, a well understood trade term. Notwithstanding this, the classification of this class of coal is not free from confusion. Kerosene shale passes into bituminous or oil shale, in which the proportion of mineral-matter increases. Thus, oil shales, with 7 or 8 per cent. fixed carbon and 20 to 30 per cent. volatile hydro-

carbons, will have 60 per cent. to 70 per cent. of ash. In kerosene shale there will be 60 per cent. to 80 per cent. of volatile hydro-carbons, and from 6 to 20 per cent. fixed carbon, which, of course, leaves only a small proportion of ash. This is the coal known as brown cannel, boghead, or torbanite. The highest Joadja Creek shale contained nearly 89 per cent. volatile hydro-carbons. In cannel coal the fixed and hydro-carbons are present in nearly equal proportions, though there does not appear to be any hard and fast limit; thus, there may be 30 per cent. vol. hydro-carbon and 36 per cent. fixed carbon, up to 50 per cent. hydro-carbon and 49 per cent. fixed carbon. From a study of the numerous analyses available, it is apparent that, as a family of coal, cannel, kerosene shale, and oil shale belong to one great group.

Preolenna Seams.—The shale seam is exposed at about the 8 $\frac{3}{4}$ -mile, cropping out on the eastern face of the hill, about 200 feet below the track on the fall to the Jessie River. A 20-inch seam is shown lying upon dark-green micaceous sandstone, and overlaid by white sandstone of a quartzose nature. Its apparent dip is 10° into the hill. A short tunnel has been driven on it 13 feet in a south-westerly direction; as the true dip of the beds is north-westerly, the dip of the seam will be found to exceed the observed 10°. The upper portion of the seam (5 inches) consists of first-class kerosene shale, equal to the best quality export shale of New South Wales. The remaining 15 inches consist of coal averaging 43 per cent. of volatile hydro-carbon, with 51 per cent. of fixed carbon. The lower part of this remainder is splint-like in appearance, but is fatter than Scotch splint, which is a hard slaty kind of cannel, sometimes, however, included in the long flame dry division of the bituminous coals.

Across the small valley to the north, about three chains distant, a 20-inch seam of the kerosene shale is exposed in the face of the cliff between sandstone roof and floor. It dips in the same direction as the seam in the tunnel, but is about 50 feet lower down, whereas, if it is a continuation of the same seam, it ought to be 34 feet higher, assuming no faulting or undulation to exist. It is therefore possible that a second seam of shale exists 84 feet below the tunnel seam. This could easily be verified by trenching down the face of the hill below the tunnel. If it is not found, a fault may be suspected. In appearance the shale in this opposite cliff closely resembles that of the upper shale in the tunnel. It has the same colour, pitchy lustre, conchoidal fracture,

and the characteristic toughness and sectility. It behaves similarly on the fire. The analysis shows it to be essentially identical—an excellent kerosene shale. The samples which I took from both of these seams were analysed by Mr. W. F. Ward, Government Analyst, with the following results:—

	Fixed Carbon.	Gases &c., lost at red heat.	Ash.	Moisture.	Coke or residue.
Kerosene shale from tunnel seam	21	76.2	2.3	0.5	Rather tender
Kerosene shale from cliff outcrop	23.2	71.6	4.1	1.1	Fairly firm

Mr. Austin L. B. Brain had samples from the tunnel seam assayed in the New South Wales Government Laboratory (Mr. J. C. H. Mingaye), as follows:—

	Fixed Carbon.	Volatile hydro-carbon.	Ash.	Moisture.
Kerosene shale 6"...	28.51	67.32	2.92	1.25
Bright coal 9"	51.46	42.45	4.82	1.27
Splint(?) coal 5" ...	50.61	43.40	5.07	0.92

From the assay results from my samples it would appear that the shale is improving in quality as it gets under cover. The 14-inch part of the seam has not the physical appearance of cannel, but is nevertheless very rich in gas. Its near approach in constitution to the poorer class of cannels makes it difficult to classify; I do not know that I can specify it more precisely than as being a long-flame coal, rich in gas. Its flame is long and smoky, a character which it shares with splint and cannel.

The original discovery of an 18-inch outcrop of coal was made by Lowrie and Harris in the creek below the track north of the IX.-mile, where it is at about the same level as the shale tunnel, and it has been thought to be the same seam. Against this idea is the occurrence of a 3 ft. 4 in. seam of dirty coal (comprising a few pure coal veins mixed with strong and sandy carbonised shale) 8 feet below it, whereas a 3 ft. 5 in. seam of similar coal is exposed a couple of chains north of the shale tunnel, but 15 or 20 feet above that seam. This makes it doubtful whether the two seams are the same. The analysis of the IX.-mile 18-inch coal is that of the long-flame bituminous class, agreeing closely with the coal of the East Greta District, New South Wales; thus—

	Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke or residue.
Preolenna 9-mile	52.5	41.1	5.5	0.9	Fairly firm
East Greta	52.35	40.45	5.53		

I have seen some of the coke made at the Launceston Gas Works from a sample lot of the Preolenna coal. It is a firm, dark-grey to black, porous coke, well adapted for domestic use, for forges, and other industrial purposes.

Across a gully at the IX.-mile there is a 2-foot seam of black coal dipping into the hill at 15°, about 25 feet above the level of the tunnel seam. Twenty-five feet below it is another seam, 15 inches. Two or three chains further south, and a few feet lower, is a 17-inch seam of inferior sandy coal. Coal from the north fork of Fault Creek was shown by assay to be a good quality gas coal, but, owing to some confusion among the samples, I am not able to locate the outcrop precisely. It belongs, however, to the group which I am describing. Its analysis is—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
52.3	41.7	5	1	Tender

Coal from the Fault Creek itself assayed—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
45.7	43.4	9.7	1.2	Crumbly

There is quite a group of seams around this centre, and until some of them are actually traced to the outcrops further north, it is impossible to connect them individually. In comparing the levels of the respective outcrops, the distance these have been cut back by the ravines must be taken into account, as the greater this is, the lower will the outcrops be. The exposures occur at a dozen points along a line extending for two miles, and are generally in creeks. The concealed line of seam between the creeks could be uncovered without much difficulty, and in this way the identity of certain seams would be established or disproved. If some of these proved to be the same, the variation in class of coal might have an important bearing upon the question of quantities available. From the Cliff section, where the seam appears to be all shale, it is apparent that the quantity in the tunnel seam is liable to variation, having improved in this case to 20 inches. That cannel coal often constitutes only a part of a seam of bituminous coal is well known. J. A. Phillips, in his "Elements of Metallurgy" (p. 48), refers to this fact, as follows:—"Cannel coal occurs in certain districts interstratified with ordinary coal, and often forms, in the Scotch coal-fields, the upper portion of a seam of non-caking coal, or even of a bed of black-band ironstone. It is rich in disposable hydrogen, and is used chiefly in the manufacture of gas, for which purpose it is in

great demand. The cannel coals of Wigan are mined in the immediate vicinity of that town, but thin out in every direction from Wigan as a centre."

In the creek between the shale tunnel and the cliff (Fenestella Creek), two seams are exposed, one apparently the continuation of a 3 ft. 5 in. shaly seam between the creek and the tunnel; the other one, about 6 feet higher up, is about 20 inches thick; a good deal of the latter is impure, but a selected sample assayed well; viz.:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
46·9	45·9	6·5	0·7	Crumbly

The lower seam has about 6 inches of bright laminated coal mixed with impure coal and sandstone. The bright coal ignites with a match, not readily, but burns freely on the fire. Its assay gave the following results:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
44·4	50·3	4·9	0·4	Tender

Between here and the shale tunnel the cliff shows two exposures of a shaly and dirty seam, 3 feet and 3 feet 5 inches thick. The assay of a sample showed it to be worthless at this point:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
18	16·8	61·5	3·7	Powdery

Camp Seams.—About 50 feet below the Arthur Track, at the $7\frac{1}{2}$ -mile, is a small creek known as Camp Creek, where our tents were fixed. Just below the camp is a series of four seams in micaceous sandstone, each separated from the other by 5 or 6 feet. The uppermost of these is 18 inches thick. The coal looks rather dirty where exposed, but is of nice appearance when extracted from below the overburden of soil. We made an excellent fire with it. It is long-flaming, and gives out a good heat. For about 13 inches the coal is dull-black to shining, somewhat laminated, and breaks in large blocks. The remaining 4 or 5 inches consist of rather hard and stony coal. The samples which I forwarded to the Government Laboratories were analysed by Mr. W. F. Ward, as follows:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
44·4	48·3	6·6	0·7	Crumbly

The second seam is 5 feet below the first, but is only 9 inches thick; quality, fair. The third seam is 6 feet below the second, and 20 inches thick. This seam does not con-

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tain proportionately so much bright coal as No. 1, but the coal burns well. The analysis is—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
46.9	44.2	7.1	1.8	Tender

Six feet below this is an unimportant seam, only 4 inches thick.

These comprise what may be called the Camp seams. They dip north-westerly. A little work on them would soon show whether the partings between them are likely to thin out and give place to coal, or to prove constant. The aggregate thickness of the three seams is 47 inches, and considering the quality of the coal, with favourable transport conditions, the seams should be highly payable. Mr. Waller's sample (3) was taken from the uppermost seam, and the assay, published in his Report, agrees very well with that of my sample as above, viz.:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.
42.2	47.9	8.8	1.1

The Camp seams appear to be about 70 feet higher than the shale tunnel outcrop, and the shale seam ought to exist lower down the creek, but no outcrop of it has been observed. The distance along the outcrop line south-west to the tunnel is about a mile.

Eleven or twelve chains further north-east the uppermost Camp seam crops out in the south fork of the north-eastern creek; at least, it is on the same level, and is a good, bright, solid, long-flaming coal, swelling and tarry on the fire. It is here 13 inches thick, and dips about 20° into the hill. It has a dark, micaceous, soft, sandy roof. The other seams are most likely concealed a little lower down the creek. The analysis of the coal is—

Fixed Carbon.	Gases, &c.	Ash.	Moisture,	Coke.
45.7	42.0	10.7	1.6	Fairly firm

A little further north the upper Camp seam is again exposed in the northern or main fork of the north-eastern creek for a thickness of 16 inches of good, bright coal. Eight feet below this is a 12-inch seam, in which the coal is slaty and altogether of inferior quality, a poor splinty variety. Samples assayed as follows:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
31.4	29.1	38.4	1.1	Powdery

Twenty feet below this is a 19-inch seam, corresponding probably with the third seam at the Camp. Six or eight inches of the lower part of this seam is stony, but there is

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some bituminous coal of fair quality in the upper part, yielding the following results in the Government Laboratories:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture	Coke.
48.2	39.2	11.4	1.2	Tender

Here, again, the shale seam is not known in the creek below, and search ought to be made for it.

Upper Coal Seams.—Below the VII.-mile peg, and 100 to 130 feet above the seams at the Camp, a couple of seams are exposed in a creek, separated apparently by 5 feet of stone. The upper one has about 10 inches of fair coal; the lower one is not exposed for its full thickness, and the coal is dirty and stony. It is the most northerly which I saw in this direction, and its dip would take it below the basalt covering at the VII.-mile. Its position in the Preolenna system of beds is supra-marine, but this of itself is not sufficient to transfer it to the Mesozoic coal system of East Tasmania.

Outcrops of coal occupying high positions in the Preolenna system occur in Main Creek, inside the northern boundary of Section 31, and in Coal Creek, inside the north boundary of Section 29. Mr. Brain says that other outcrops are to be seen on a western tributary of Main Creek and in Pavement Creek, on the west side-line of Section 29. Time did not permit me to visit these. I examined, however, the Main Creek and Coal Creek seams, which are typical of this series.

Main Creek.—This is a long creek traversing the whole of Section 31 from north to south, and flowing into the Flowerdale River. Just inside the north boundary of the section, a seam is exposed in the right bank at the level of the water; nearly a foot of it is visible. The outcrop is washed by the stream, and the samples obtainable were of poor quality. The assay was as follows:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
49.6	22.4	25.9	2.1	Powdery

In the bed of the creek are loose pieces of coal, which indicate the existence of other seams higher up the stream.

Coal Creek.—The second exposure of these higher coals is in Coal Creek, which flows south from the north boundary of the Reward Claim, Section 29, for nearly half a mile before turning west to the Flowerdale River. There are several outcrops in this creek, all of inferior quality. The lowest which I saw was a seam of heavy, poor coal in yellowish-green micaceous sandstone. Some black coal is

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intermixed with the dense, stony variety; the latter is so hard that it rings under the hammer. The assay of samples taken was—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
53.1	21.3	22.9	2.7	Powdery

Fifty feet higher up is another seam of stony coal, veined with a brighter variety. It is rather rotten and friable.

Further 50 feet up the creek I saw a water-hole sunk in a seam of coal, said to be 18 inches thick, but not visible owing to water. The coal on the bank looked rather dense and stony, but bright occasionally. The assay shows a large proportion of mineral matter:—

Fixed Carbon.	Gases, &c.	Ash.	Moisture.	Coke.
40.0	12.4	46.3	1.3	Powdery

The analyses of these upper coals correspond with those of many of the Mesozoic coals on the East Coast, and, taken by themselves, they would indicate the seams as belonging to that series. In the absence of any evidence from fossil plants, however, I hesitate to express a positive opinion. The seams may be worth testing at some future time. The strata in this part of the field may possibly be found to contain some better seams and better quality coal. The nearer, however, the outcrops approach to the western intrusive ridge, the more restricted the working area will be, the more likely are faults to be met with, and in all probability the poorer the quality of the coal. The outcrops on Coal Creek are nearly half a mile west of the Arthur Track, so that between the creek and the track there is a fair working area if any further seams exist in the interval.

For the present, however, the best policy will be to concentrate attention on the seams east of the track. In this part of the property two classes of coal have been shown to exist, viz.—(1) kerosene shale, and (2) long-flaming bituminous coal.

The upper part of the seam in the tunnel for 6 inches is kerosene shale, and up to 20 inches in the cliff seam on the opposite side of the valley. Kerosene shale yields products used for various purposes, such as kerosene, naphtha, and gasoline, benzine for cleaning purposes, machine-oil, axle-grease, &c., but is chiefly used for gas-enrichment. Mr. Carne states that the exports from New South Wales are mostly in connection with the latter. Lower grade shale for enrichment of water-gas is being retorted at Torbane (2 miles from the railway), and crude oil supplied to the

Australian Gas Light Co. at a contract rate of 1,000,000 gals. annually. According to Mr. Brain, the Gas Light Co. is using 10 per cent. of poor quality shale for getting rid of the naphthalene in the pipes. The high class shale of export quality (60 to 70 per cent. volatile hydro-carbon) has a wonderful effect, even when used only in small proportions, in increasing the illuminating intensity of coal gas. Shale of not sufficiently high grade for export yields, by retorting, kerosene and other oils. The determination of the oil values of a shale can only be made by those versed in the manufacture, and after suitable trials.

The Launceston Gas Company tested the illuminating power of the gas yielded by the Preolenna shale, which proved to be about double that of Greta coal. The result extended beyond the limit of the photometer scale used, and was estimated as approximately 40 candle-power per Gas Referees' burner.

This shale contains about 20 per cent. more volatile hydro-carbons than the famous drift cannel (?) of Barn Bluff, which it closely resembles in appearance, but which, in composition, agrees with some of the second variety of coal at Preolenna.

The present price of New South Wales export shale delivered to wharf in Sydney is £2 5s. per ton for 65 to 70 per cent. volatile hydro-carbons, so that it can be readily seen that the Preolenna shale would command a good price f.o.b. at a N.W. Coast port.

The long-flaming bituminous coal, which occupies 14 inches of the seam at the tunnel, and is shown in the Camp Creek and other seams, is not easy to classify, as it is not physically a cannel, though chemically it approaches the nature of poor cannels, the proportion of hydro-carbons to fixed carbons corresponding nearly with some Scotch cannels. It is of first-class quality for making gas, and is also excellent for steam generating. In both respects it is superior to any other coal found in Tasmania, and for gas-making purposes surpasses the coal which is imported here from New South Wales. The test applied to it in Sydney shows 1 lb. of it to evaporate 13·9 lbs. of water into steam, as compared with 13·4 to 13·8 lbs. in the case of Greta coal.

The Launceston Gas Company subjected about 2 cwts. of this coal to tests for coke and gas, and these gave very satisfactory results, as may be seen by the subjoined copy of Report from Arthur Green, Esq., Secretary of the company.

"Dec. 6, 1902.—I have the pleasure now of reporting upon two samples of coal received, said to have been

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obtained from newly discovered seams in the vicinity of Wynyard, on the North-West Coast. The first sample, a very superior bituminous coal, was tested in the retort-house for coke only, with the following results:—159 lbs. of coal yielded 62·89 per cent. of good, clean, hard, marketable coke, superior in quality to any yet obtained in these works from any other Tasmanian coal, and I think it would have been better still if the charge had remained longer in the retort. The second sample was tested fully for gas and coke, and the average of three very careful tests gave the following very satisfactory results:—Volatile matter 47·19 per cent., coke 52·81 per cent. The coal yielded 12,030 cubic feet of gas per ton, and 1183 lbs. of excellent coke. I am very pleased to be able to report that, not only was the quantity of gas per ton of coal greater than from any other test of coal, either Tasmanian or Newcastle (N.S.W.), made at these works, but the quality also was superior. Tested by the jet photometer (Kirkham and Sugg's patent), the illuminating power of the gas was twenty candles per gas referee's burner, and I have no hesitation in saying that if coal can be supplied in quantity equal to the samples submitted for tests, I should prefer it as a gas coal to any we have yet received from New South Wales."

The gas-yield from the best N.S.W. coal used here is about 11,000 cubic feet per ton, but generally works out in practice at 10,500 cubic feet. The Preolenna coal, with a yield of 12,030 cubic feet, is distinctly superior.

I may add that the Greta gas coals, which contain the highest proportion of volatile hydro-carbons of any of that class of N.S.W. coal, yield from 40 to 42 per cent., while the Preolenna coal ranges from 42 to 48 per cent. volatile matter.

The Government Analyst's assays of my samples show the ash-percentage to range between 4·9 and 7·1, or an average of 6 per cent. only. This compares favourably with our other Tasmanian coals, and takes a good stand with those of New South Wales.

This is a coal, the like of which is not seen in any Tasmanian colliery, and if it can be got to market at a reasonable cost, a large demand for it is assured. It is a high-class coal of the bituminous class, called bituminous not because such coals really contain bitumen, but to indicate the high proportions of gaseous elements entering into their composition. Mr. Ward reports that all the samples gave a yellow and very smoky flame. Some of the varieties seem related to cannels, but superior in coking qualities. It may be mentioned that the Wigan and Newcastle (Eng.) cannels

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give coke of fair quality, while coke from Scotch cannel is not so valuable, and a good deal of it has no value as a fuel.

The produce of the 20-inch seams will be approximately 2000 tons per acre of coal worked out, and the cost, if the seam is followed on the dip, and it continues regularly without faults, may be put down at about 8s. per ton at tunnel mouth. If work on a large scale is carried on, it may be advisable to sink a shaft, and work to the rise. It should be remembered, with respect to the shale, that shale-mining is usually more costly than ordinary coal-mining, owing to the flying of splinters from the tough shale, especially when the roof is hard and heavy. Mining rates at Genowlan, near Capertee, N.S.W., are given by Mr. Carne as 5s. 3d. per ton for 30-inch seams, to 13s. 9d. for 15-inch.

No sign of faulting is seen in the country, but faults in our coal fields are of constant occurrence, and the ordinary fault would not be visible at surface. These breaks are more likely to be met with nearer to the intrusive rock on the west. Quite apart from faulting, I may add that kerosene shale has a habit of passing into cannel, or even bituminous, coal in the same seam, and it is very hazardous to estimate its continuation as shale beyond the visible limit.

The distance to the Camp Creek from Wynyard by the present route is 17 miles, viz., about 9 $\frac{3}{4}$ miles to the turn-off from the Calder Road, and thence 7 $\frac{1}{4}$ miles along the Arthur Track; and these figures give some idea of the length of line required for a tramway, though I was told by Mr. Lowrie that he saw a possible route of not more than 13 to 14 miles. The present track, on leaving the Calder Road, plunges 500 feet down into the valley of the Calder, which is only about 170 feet above sea-level. After passing the Calder it again rises 500 feet, and then descends to the Inglis, 200 feet above the sea, whence it rises, with occasional undulations, to 1400 feet above sea-level at the IX.-mile. If the natural valleys were followed instead of the hill crests, the grade would be much easier.

If a permanent workable seam consisting entirely of kerosene shale were discovered, the question of erecting retorts at the mine might be considered. As it is, the best policy is that of conveying both shale and coal to a market.

Unfortunately, the distance from Wynyard is too great to pay for the construction of a tramway under present conditions for coal transport exclusively; but sooner or later, with the increased settlement which is now going on so rapidly in that part of the Island, a public tramway or railway into the Flowerdale District will be made, which will reduce the distance between the coal and the coast by fully

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one-half. The transport question would then be brought within the range of profitable discussion, and this valuable coal thrown open to market. The private trams of the shale mines in New South Wales are from $1\frac{1}{2}$ to $4\frac{1}{2}$ miles; the private railway from Joadja Mine to Mittagong was 18 miles.

Without waiting, however, for the development of the district, there is work which might be done towards locating the seams on their probable extension northwards, for every mile gained in that direction means so much saved in eventual transport cost.

That the coal seams do extend further north is next to certain, from the discoveries recorded of loose pieces on the coast. In 1869 Mr. Thos. Stephens, M.A., exhibited to the Royal Society of Tasmania a pebble of kerosene shale found near the mouth of the River Inglis, and Mr. R. Quiggin also tells me that pieces of shale are found on the beach at Seabrook Creek and at the mouth of the Inglis, down which river fragments are continually borne in flood-times. He states, too, that pieces are found at the junction of the Inglis and Calder.

A little below the confluence of the Jessie and Inglis rivers is flat land occupied by B. F. Reilly's lot, known as Lett's Garden. I am informed that quite a quantity of pieces of coal and shale accumulates here. Of course, it is just possible that fragments have been carried down four or five miles from the creeks on the company's leases; but equally possible that some nearer outcrop has furnished them. From a hurried glance at its geology, it would appear as if the country there consists of the conglomerate at the base of the Coal Measures; but in view of the abundance of drift-coal, it certainly deserves a closer examination.

The most important block of country for exploration is the area comprised between the Inglis, Reeve's Creek, Cooper's Creek, and the Flowerdale. The country all round appears to belong to the basal conglomerates and pebbly sandstones, but Mr. Brain reports that on the higher ground a little further north-west these are overlaid by mudstones, in their turn succeeded by sandstones, resembling in appearance those associated with the seams on the company's leases. If seams could be found here, they would be within 10 miles of Wynyard down the valley of the Inglis. The country is of a nature which renders examination a matter of time, and the work can be best done in summer. If this succession of strata be established, it would be

advisable to use the diamond or calyx drill to test the beds for seams.

Before undertaking any serious work on the coal leases in the shape of driving tunnels into the hill, the country above the shale tunnel and the Camp Creek must be tested with the drill, with the double object of proving the freedom of those seams from faults and of seeing whether other and better seams exist, which have not come to surface, or the outcrop of which is hidden under an overburden. The camp seam would be intersected by a bore at the Arthur Track, not more than 400 feet deep, and the shale tunnel seam, which appears to lie flatter, ought to be reached at about the same depth; but if its angle increases to the same pitch as the other seams, as is likely, a bore of 500 feet would be requisite. I would not recommend more than two bores to be put down on these leases at present, and those just mentioned will fulfil the desired purpose.

The country between the Jessie and Flowerdale rivers is eminently coal country. I saw no signs of metallic mineral deposits. I was told that the Flowerdale basin is considered copper-bearing, and the Inglis basin gold-bearing; no reefs, however, exist in the latter, or if they do, they are concealed below the Permo-Carboniferous sediments. A little creek which I saw on the south side of the Inglis, a few hundred feet above the river, has given a little gold associated with small water-worn zircons. The wash contains stones of quartzite, schist, and sandstone, and appears to head from a hill of Permo-Carboniferous conglomerate; it carries also a little red granite. The proximate source of the gold and zircons is, I think, the conglomerate; the original source of the gold would be veins in the older rocks; the zircons have probably come from granitic or syenitic rock, or some ancient gneiss. Creeks containing zircon sand are common in this part of the Island. The Shekleton deposit of zircon and corundum bearing sand near Jacobs' Boat Harbour is a well-known instance. The rare mineral, pyrochlore, which is found with the Shekleton zircons, is connected in Scandinavia and Russia with nepheline syenites, and these may come to light eventually on this coast. Zirconia is being used for making the glow-body in the Nernst lamp. A parcel of the Shekleton zircons was exported to England, but the result was unsatisfactory, probably owing to the less refractory and more easily obtained thorium and cerium metals coming into use for the mantles of incandescent gas lamps. A few of the stones have been found large enough for cutting, but the bulk of them are far too small.

16/17

Further south, across the Arthur River, the country changes to the older schists, and the Sisters' Range across the Flowerdale on the western horizon with its quartzites, &c., also belongs to the Cambro-Silurian. This portion of the Island has been very imperfectly explored for minerals, but being on the strike of a large part of the West Coast metalliferous zone, it highly deserves attention. A useful piece of work would be an examination of the coast-line from Burnie to the Montagu, noting exactly the northern terminations of the strata which are prolonged from the mineral-bearing belts known to exist further south. The present visit was limited in its scope to the coal country, which there is every reason to believe is destined eventually to become an area of economic importance.

I have the honour to be,
Sir,
Your obedient Servant,

W. H. TWELVETREES.

W. H. WALLACE, *Esq.*,
Secretary for Mines, Hobart.

APPENDIX.

Since writing this Report, some further tests have been applied in the Government Laboratories by Mr. W. F. Ward.

An analysis was made of a somewhat better sample of coal from the 18-inch seam in Coal Creek, as follows :—

Fixed Carbon.	Gases.	Ash.	Moisture
47·6	14·5	34·6	3·3

and also of an exposure of friable coal about 50 feet lower down the same creek, viz. :—

Fixed Carbon.	Gases.	Ash.	Moisture.
55·7	29·2	12·3	2·8

These results approximate in character to many obtained from East Coast coals, and make it probable that this upper series at Preolenna is of Mesozoic age.

Determinations of sulphur in the kerosene shale have also been made, from which it appears that from 1 to 1·1 per cent. of that element is present.

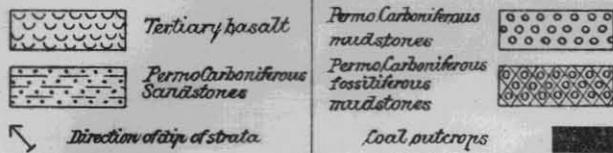
Tests with Thompson's calorimeter showed that the evaporative power of the kerosene shale is 13·8, and that of coal from the top seam in Camp Creek is 14.

W.H.T.

PREOLENNA COAL-FIELD GEOLOGICAL SKETCH MAP

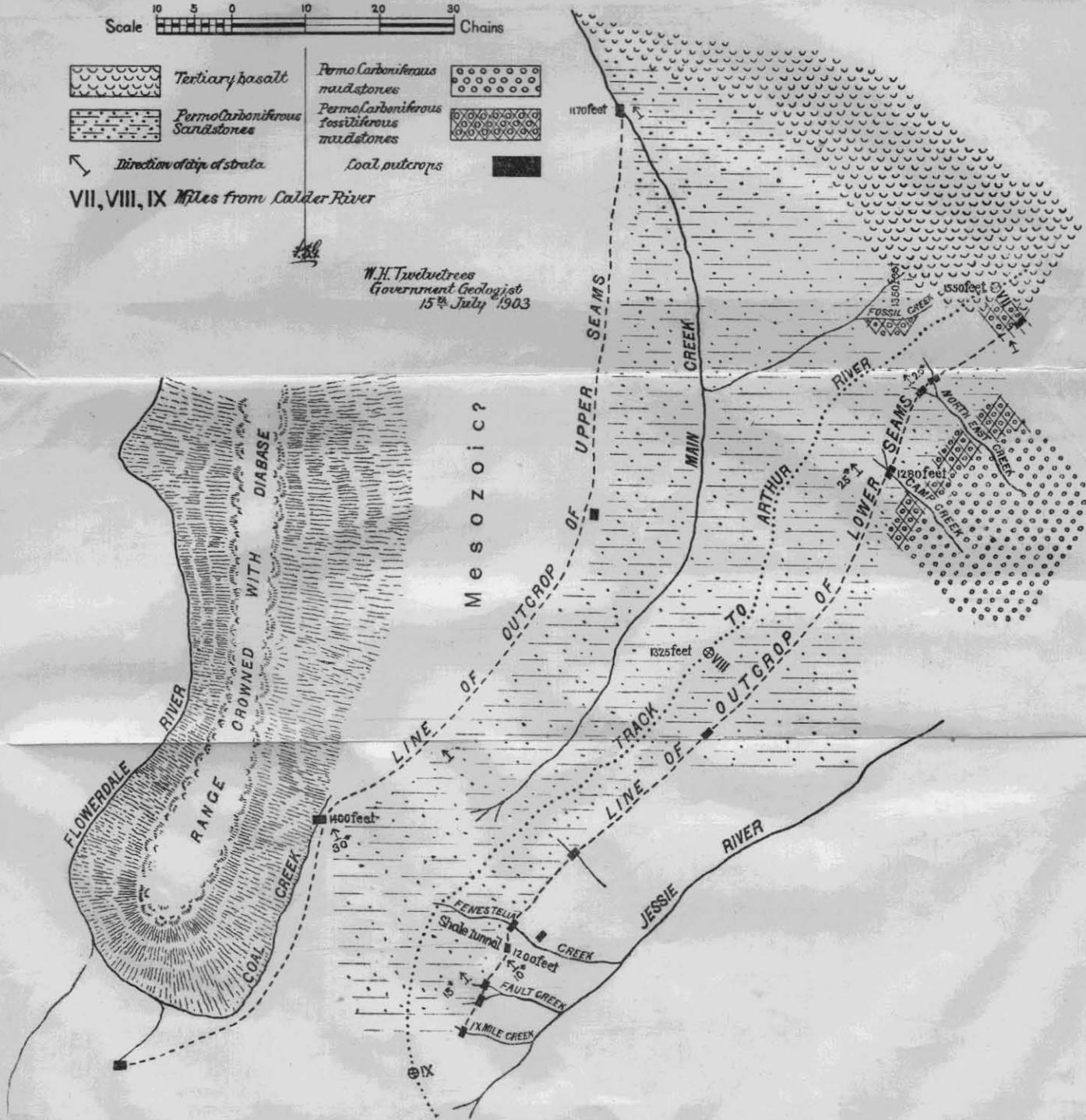
5 cm

Scale 10 5 0 10 20 30 Chains



VII, VIII, IX Miles from Calder River

W.H. Twidwrees
Government Geologist
15th July, 1903



A5782.

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