

REPORT ON THE COUNTRY BETWEEN MOLE CREEK  
AND THE MOUNT DUNDAS SILVER FIELD, AND ON  
THE DISCOVERY OF COAL AT BARN BLUFF.

Geological Surveyor's Office, Launceston, 13th June, 1893.

SIR,

I HAVE the honour to forward to you a fuller account than was contained in my *interim* report of 11th April last, of the country lying between the terminus of the Chudleigh branch of the Western Railway at Mole Creek and the Dundas Silver-field, and more especially of the discoveries of coal and other minerals near Barn Bluff and East Mount Pelion. In going from Mole Creek to Dundas my route did not at all closely follow that of the proposed Mole Creek to Zeehan Railway, but was near enough to the latter to enable me to form some idea of the probable nature of the country traversed by it with respect to containing useful minerals.

The railway route has been surveyed more or less completely from Mole Creek to a point on the north side of Mount Pelion, and from the other end, from Zeehan to a point near Mount Tyndall: between these terminals it has only been very cursorily explored. From Mole Creek to Liena it traverses much the same line of country as the existing road does, but crosses the Mersey considerably higher up, just below the junction of the Fisher River. It then follows the west side of the Mersey Valley to a saddle near Lake Ayr, where it crosses the watershed and comes into the head of the Forth River Valley, round which it runs to Mount Pelion.

Round Chudleigh and Mole Creek there is much limestone, belonging to the Silurian or even an older system, which continues through Circular Ponds to Liena. The Barren Tier, on the divide between the Mole Creek Valley and that of the Mersey, seems to be largely made up of ancient sandstones and conglomerates, probably of the same age as the limestone: the close resemblance of the rocks of this district to those of the Beaconsfield goldfield impressed me very considerably, and I regard it as very likely to be found mineral-bearing. I was informed that a little gold and tin ore had been found in the Mersey River, but was not able to ascertain by whom or when. At Liena I observed numerous stones of granite, schist, and quartzite in the gravels of the river bed, together with much diabase greenstone and vesicular basalt. The granite is seen *in situ* on the top of Gad's Hill less than half a mile from the point where the track up its steep northern face comes out on the plateau, and I was informed that it could be traced westward across the Forth to Middlesex. In close proximity to the granite on the top of Gad's Hill there is also a belt of old metamorphic sandstone, and as useful minerals are very commonly found along the contacts of granite with old sedimentary rocks, I should recommend this line of country to the close attention of prospectors. My route from Liena did not follow the railway track, but went over Gad's Hill and the flat-topped range lying between the Mersey and Forth Valleys, crossing the Emu, Hermit, and Mackenzie Plains. For about 10 miles south of Gad's Hill the plateau is mainly composed of scoriaceous basalt, often containing zeolites (especially chabazite), forming a layer of no great depth in all probability. I noticed fragments of limestone and diabase greenstone enclosed in some of the pieces of basalt, indicating that these older rocks occur in the vicinity below the latter. On the plateau the covering of basalt has been in parts entirely removed, and accordingly we come upon patches of quartzite and metamorphic sandstone, and some diabase greenstone: in one place I noticed some much waterworn quartz and quartzite gravel, and in another a rather nice-looking piece of lode quartz. These all serve to show that the basalt has covered a patch of rather likely mineral country, and it is possible that prospecting along the edges of the Forth and Mersey Valleys would discover the outlets of old watercourses that have been covered by the basalt, and these might contain gold and tin. The Forth Valley, as far as can be seen from the plateau, appears to be all composed in this neighborhood of old quartzites, schists, sandstones, and slates, country which is always likely for minerals. The southern part of the plateau is pretty free from the tertiary basalt, but is mainly composed of the older diabase greenstone, an old, probably mesozoic, basalt. This seems to form a thick layer lying upon the old quartzites and schists, which are seen below it in the valley of the Forth, and also occur, I was informed, in the Mersey Valley. The plateau terminates to the south in Mounts Pillinger and Oakley, both steep escarpments of columnar greenstone. By coming over the top of the range as I did, one does not traverse the parts of the district most likely for minerals, which lie in the river valleys below the cappings of volcanic rocks.

Descending from the plateau to Lake Ayr, we come upon rocks of the coal measures series, mostly sandstones, conglomerates, and fossiliferous shales and mudstones. These are first seen about 250 feet below the plateau, and the capping of greenstone is probably quite this thickness as a rule. There appears to be a quite extensive development of the coal measures from here west and south, for they are seen on the lower slopes of East Mount Pelion, Mount Oakley, the north end of the Du Cane Range, Mount Pelion, Mount Ossa, and the Eldon Range, and Mr. T. B. Moore has also found traces of them as far west as Mount Sedgwick. Messrs. Gould and J. R. Scott's maps also show them to be found on the south side of the Eldon Range, and eastward nearly to Lake St. Clair. At Coal Hill, about six miles west of Lake St. Clair, a seam of coal was discovered many years ago, but I have not been able to learn any particulars of its size or quality. It may be mentioned also that coal measures are found along the north face of the Western Tiers: in fact the great central greenstone plateau in the middle of the island of Tasmania may be said to be almost everywhere fringed with coal measures strata. Two explanations of this are possible, viz., that the sandstones were deposited against the faces of cliffs of older greenstone rock, and secondly that they have been covered by immense flows of igneous matter. In my reports on the Oyster Bay coal-field, and on the Ben Lomond District, I have already discussed the question of the relation of the greenstones to the coal measures at some length, and have only now to say that the evidence presented by the splendid sections at the head of the River Forth, is to my mind conclusive as to the greater antiquity of the latter. The tops of Barn Bluff, Mount Pelion, and East Mount Pelion, all consist of masses of columnar greenstone resting on horizontal, undisturbed, marine beds, and all round the head of the Forth Valley, on every mountain side we can see the horizontal coal measures strata up to a fairly uniform level, above which is the greenstone covering. It is perfectly clear that the volcanic rock has been one continuous sheet, and that the present mountains have been carved from it by erosive agencies. This is a very important conclusion, for it means that in all probability the coal measures extend right under the Eldon and Du Cane Ranges, and under the Central Plateau, and that this wild and barren district may be the great coal-field of the colony. My interpretation of this much disputed chapter of Tasmanian geology, shortly stated, is this: During the permo-carboniferous and early mesozoic periods, the central and south-eastern portions of what is now our colony were gradually covered to a very considerable thickness with strata of sand, mud, and carbonaceous matter, that now constitute our coal measures. Then came a period of very violent volcanic activity, during which the strata were fractured, faulted to various elevations, pierced by very numerous intrusive dykes, and finally overwhelmed beneath immense doleritic outflows. Erosive agencies have since cut deeply into the great covering sheet revealing the underlying strata, the older granitic and Silurian formations, the coal measures, and the dykes and pipes by which the molten matter issued, the latter being the roots as it were of the great lava capping. On the Central Plateau, Ben Lomond, and the Fingal Tier, we probably have still remnants of this once general covering, under which lie the older rocks; if we could lift off the crust of lava we should find these beneath, but doubtless much broken by greenstone dykes, should valuable coal seams be found therefore in the Eldon and Du Cane Ranges it is probable that they could be followed right underneath the mountains.

Besides the old discovery at Coal Hill above mentioned, coal has also been found at Barn Bluff and East Mount Pelion, and no doubt other discoveries will be made when the country is further prospected. There is some reason to think that it will be more profitable to search for coal in the Eldon and Du Cane Ranges than further north, for the coal basin appears to be deepening going to the south and south-east, and it is usually in the deepest parts of the basin that the coal is purest and in the largest seams. The southerly dip of the basin is well seen on the west side of the Oakley Range, the quartzite bottom rising more and more going northwards, and the layer of coal measures strata between it and the overlying greenstone getting thinner and thinner until it disappears. Cradle Mountain, too, seems to be all quartzite and old rocks, the coal measures strata dying out in this direction. Between Cradle Mountain and Mount Pelion there are large beds of quartzite conglomerate, composed of much waterworn pebbles, lying upon the bedrock of strata of quartzite on edge, but going southward these are gradually replaced by shales, sandstones, mudstones, and shell deposits, such as would naturally occur further away from the shore. On the spur between Barn Bluff and Cradle Mountain a seam of coal has been found lying almost directly on the conglomerate, at a height of probably not more than 100 feet above the quartzite bedrock, but on East Mount Pelion, ten miles further south-east, the coal lies 750 to 800 feet above the older formation. It may prove that these two seams do not belong to the same horizon, but if they do, as is most likely, this fact would show a decided deepening of the coal basin going southwards. Unfortunately through a misunderstanding as to the date of my reaching East Pelion, Mr. Will, the leader of the prospecting party that discovered the coal, did not meet me there as arranged, and I was therefore unable to see this seam. He tells me that it is a bituminous coal, 20 inches thick, but of poor quality. It corresponds almost exactly in elevation with the seams at Barn Bluff, viz.:—about 3400 feet above sea level. Round the lower slopes of East Pelion and Mount Pelion, the strata are of marine origin, sandstones, conglomerates, mudstones, shales, and limestones, full of characteristic permo-carboniferous fossils; *Fenestellae*, *Spiriferæ*, *Producti*, *Aviculopectenes*, and *Stenoporaes*, being most common. At Barn Bluff the coal rests, as has been said, almost directly upon the conglomerate, but is overlaid with similar marine strata for about 900 feet in thickness, the altitude of the highest seen in ascending Barn Bluff being 4300 feet above sea level. The thickness of the lava capping on this mountain is close on 700 feet, its summit being 4925 feet above sea level as nearly as I could determine it. The coal seam is enclosed in a band of black micaceous shale, in which I saw fragments of a large *Glossopteris* (probably *Ovata*) and a *Noeggerathiopsis*. This shale and its contained fossils are exactly similar to, and occur under exactly the same conditions as the patch of fossiliferous shale found by me near Mallana Station, on the Strahan to Zeehan Railway line, described in my report on the West Coast Silver Fields of 25th November, 1890, which is likewise overlaid by marine strata. The Barn Bluff coal, therefore, belongs to the lower coal measures of this colony, to which series also belong the Mersey and Don coal field, the Port Adventure coal, and that at Port Cygnet.

In the head of the Forth Valley we find quartzite, schistose quartzite, and mica schists underlying the coal measures, and apparently extending a long way down the Forth River. Cradle Mountain and the country on the north side of the head of the Fury River, as seen from Barn Bluff, also appear to be

formed of quartzite, and this formation is met with all the way to near the east side of Mount Reid, where softer schists come in. Bands of conglomerate, metamorphic sandstone, mica schist, and other varieties of metamorphic sedimentary deposits occur in the quartzite pretty frequently. Mount Murchison, as far as I could judge from a distance, consists of this same rock; a later conglomerate is, however, seen lying on the schists to the south of this mountain, and may compose a good deal of it. At the Granite Tor a large intrusive mass of granite has been thrust through the quartzite formation, and sends off dykes into it: one of these was seen on the divide between the Bluff and Fury Rivers, some miles before reaching the main mass, and doubtless there are many others. Traces of tin ore have been already got in this vicinity, and I have little doubt that here as elsewhere in the colony the granite will be found tin-bearing. This granitic mass, and more especially its contacts with the quartzite formation, are well worth prospecting. Very few minerals have yet been found in the quartzite itself, but there are not wanting indications of its containing metalliferous ores: some veins have been discovered near East Mount Pelion which will be described later on, and on the south-eastern side of Mount Pelion there is a rather nice-looking quartz lode, containing pyrites, but no gold has yet been found in this. One great drawback to prospecting through this region is that there is hardly any alluvial ground in which traces of gold and tin might be concentrated and so lead to the discovery of the parent lodes. The watercourses nearly all run on the bed rock, and have not yet accumulated much gravel in the portions where I saw them. The reason of this is that the shape of the surface is due to the universal presence, in quite recent times, geologically speaking, of large glaciers in all this part of the country. I have discussed this subject in a paper communicated to the Royal Society of Tasmania at some length, describing the evidences of glaciation, and shall therefore now only mention the fact that clear proof of extensive ice action has been obtained, and point out that it is owing to this cause that the bed rock has been swept so bare, and that the expected alluvial deposits have not been formed in the creeks. Prospectors will therefore have to depend mainly on discovering the actual outcrops of the lodes themselves by traversing the hill slopes, without the assistance of broken away debris scattered over the surface. This will no doubt render the progress of discovery of lodes slower than it would be under more favorable conditions, but I have little doubt that mineral discoveries will in time be made throughout all this region.

The proposed route of the Chudleigh to Zeehan Railway, after leaving Mount Pelion, skirts the slopes of the Du Cane Range, Mount Ossa, and the Eldon Range, so as to avoid as much as possible the deep and impracticable ravines in which run the Canning and Murchison Rivers and their tributaries, and then runs along the watershed between the King and Murchison Rivers, and round the north end of Mount Tyndall and south side of Mount Dundas. The country to be passed through is very rugged, and it seems to me very doubtful if a practicable route can be got at all: it would certainly be a long and expensive line. If payable coal seams are found in these ranges, however, it would be in the best possible position for tapping the fields, as it would run just along or below the base of the coal measures. Should important mineral discoveries be made in the quartzite formation and round Granite Tor, however, the proposed line would be most likely both a long way from them and high above them, and long tramways with uphill traction would require to be made to connect with it. Another route suggested itself to me when passing through the country, which seems to be quite as practicable as the proposed one, and considerably shorter; also at a much lower level, an important consideration in this often snow-clad part of the country. It would be of next to no service to the coal fields, but would command the quartzite country. This route would be down the valley of the Fury and Mackintosh Rivers to the Murchison Valley, up this, and round the south side of Mount Murchison, whence it might go either north of Mount Reid to join the Waratah-Zeehan line, or south of Mount Dundas as already surveyed. There are several deep gorges running into the Barn Bluff and Cradle Mountain Range, both from the Forth Valley and from that of the Fury, and looking down from Barn Bluff it seemed practicable to get from the one valley into the other with quite a short tunnel at an altitude of not more than 3000 feet. The route would run down the west side of the River Forth, cross it in the low country, and run through the Sheffield district to join the Western line near Railton. I know very little of this latter part of the country personally, but several persons who know it well have assured me that they believe a practicable route could be got. The Fury and Mackintosh Gorge would be, without doubt, rough country, and the crossing of the Sophia River Valley might necessitate a long detour, but I do not think it would be any worse than skirting the interminable spurs of the Eldon Range.

Once a railway line is on the low country east of Mount Reid it does not appear that there would be much difficulty in connecting it with the Waratah to Zeehan line on the north by going through the big valley separating Mount Reid and Mount Murchison, or on the south side with the line surveyed from Zeehan to Mount Tyndall, and with a northward extension of the Mount Lyell railway. The development of what is likely to prove an extensive tract of mineral country will greatly depend on the route taken by the railway, and this should be kept in view in selecting the latter. As the interests of the coal bearing portion conflict with those of the probable metalliferous part, the country ought to be much more thoroughly explored and prospected before any route is decided on.

The coal already found at Barn Bluff could be taken out by any of the proposed routes, or by a line running along the high country between Cradle Mountain and the Waratah Plateau; a line down the west side of the River Forth to Devonport would, however, be by far the shortest way of getting it to market, the distance in a straight line being only 45 miles, or say 80 miles by railway at most. Going to Devonport by way of Mole Creek and the Mersey Valley, it would have to be carried not less than 100 miles, and to Launceston about 114 miles. Should a seam of cannel coal, of the same quality as that at Barn Bluff, but not less than two feet in thickness, be discovered anywhere along the slopes of the Du Cane and Eldon Ranges, the distance it would have to be carried would be by no means prohibitive, and even a seam of good bituminous coal could probably be profitably worked. The best outlet for this coal, however, would most likely be by means of an extension of the Strahan—Mt. Lyell Railway.

This discussion as to railway routes may be thought altogether premature, considering that no very valuable mineral discoveries have yet been made in the country traversed, but in view of the fact that

making the Mole Creek to Zeehan line has been so seriously contemplated that a large sum of money has been spent in making surveys, and further, that there is no inducement to prospect this inaccessible part of the country unless it is shown that there is hope of being able to get any minerals that might be found to market, it seemed to me that it was not out of place.

I shall now describe more fully the discoveries of metalliferous veins near East Mount Pelion, and of coal at Barn Bluff.

*Section 1112-91M.*—This is situated on the head of the east branch of the River Forth, just below where it is joined by the branch from Lake Ayr. In the centre of the section, a lode varying from three inches to two feet in size has been opened by a surface cutting; it strikes N. 5° E. and dips to the westward; it consists of quartz, brown oxide of iron, magnetic oxide of iron, black and red zinc blende, and copper and iron pyrites, with occasional specks of galena also. Assays are said to have yielded 6 ounces silver per ton. About three chains west from this, a six-inch wide vein of blende and magnetic and other oxides of iron, with quartz and copper and iron pyrites, runs N. 20° E.; this also contains a little galena. A chain or more further west again, are a number of narrow small veins in the joints of the country rock, composed of the same minerals as before. About a chain from the western boundary, another vein of pretty fair copper pyrites three to six inches thick is seen running N. 35° E. and dipping S.E. What may perhaps be a continuation of this is seen again in the steep rocky gully of the river Forth, about five chains from the north boundary, and five chains from the western one; it consists of 18 inches of altered schist, with quartz, copper pyrites, and a little blende, between well-defined walls. Strike N. 20° E., dip S.E. 70°. The outcrop is about 30 feet above the river, and not more than half a chain from it, and the vein could very easily be tested by a short tunnel from the water's edge. Throughout the section, the country rock is a micaceous schist containing occasional slaty bands; the veins run across the bedding of the country strata, not with them. None of them, however, are well defined lodes, and they look rather like joints in the schists in which mineral sulphides have been deposited. The first and last mentioned are the most promising veins, and a little work should be done on them to find if they show any signs of improvement, but none of them as yet give much hope of being valuable. They serve to show that the rock carries metallic minerals, and it is possible that there is a larger lode somewhere in the vicinity. The section is worth further prospecting.

Another section 1113-91M, has been taken up south of the above property, but nothing has yet been found on it.

*Sections 1149-91M and 1150-91M.*—These blocks of 40 acres and 80 acres respectively, have been taken up by the Mole Creek and Zeehan Mineral Prospecting and Exploration Co., Limited, immediately north of Richard How's section 1112-91M just described. The country changes from schist to quartzite going north, and the 80 acre section seems to be almost all on the quartzite. The beds of country rock run about N. 30° W., and are much contorted in dip; beds of schist often occur interstratified with the quartzite. At the centre of section 1150-91M, a hole about 13 feet deep has been sunk on an outcrop six feet wide or more of quartz heavily impregnated with iron, copper, and arsenical pyrites, and blende, the iron pyrites and blende predominating, though there is also a good deal of copper pyrites. The width of the lode was not visible, nor were its strike and underlay definitely ascertainable, as the walls of the excavation also are partly made up of lode stuff; however, the general course appears to be somewhere near north and south, and the underlay to the westward. The sulphides mostly lie on the hanging wall, forming a vein several inches wide, from which blocks of very solid ore have been taken. Some of this stuff is said to have yielded 14 ounces of silver per ton on assay. The outcrop is oxidised to brown iron oxide and shows stains of green arseniate of iron in places. This lode deserves opening up a little more, so that the width and course of it may be better ascertained, when an effort might be made to trace it along the surface in the hope of coming upon better ore-shoots. It is not a well-defined lode and as much as possible should be ascertained about it by surface trenching before going to the expense of sinking a shaft on it. The ore mixture is not a valuable one at all, unless it should be found to contain silver and gold in payable quantities, the large admixture of blende and arsenical pyrites rendering the copper pyrites valueless. All the veins hitherto found in this district contain copper pyrites, and it seems likely that this mineral and gold will form the valuable portions of any other lodes that may be discovered, rather than galena and silver. The finds made up to the present, however, while showing that the district carries mineral veins and is therefore worth prospecting, are none of them very promising. The lode just described is the largest, and the most likely to lead to something of more consequence.

A peculiar feature presented by the outcrop may be mentioned, namely, the occurrence of an irregular band of more or less waterworn gravel traversing the quartz at a depth down to as much as four or five feet below the surface, in such a way as to separate a block of stone of large size slightly from the underlying solid lode. This is no doubt due to the action of ice, the evidences of glaciation being particularly clear on these very sections and westward from them: the ice has detached the surface block and slightly lifted it, and water and gravel have then got into the crevice.

*Coal Sections.*—(1298-91M and 1296-91M, each of 320 acres.)—On the south side of Barn Bluff lies a plateau which extends to Mount Pelion, forming the top of the ridge between the Forth and the Bluff and Fury Rivers. This plateau consists mainly of horizontal beds of conglomerate resting on the older stratified quartzites, and the surface shows numerous signs of having been cut to its present shape by comparatively recent glacial action. At the foot of a spur running south-east from Barn Bluff two sections have been taken up for coal, numerous fragments of cannel coal having been found in the low ground at the foot of the spur, mingled with fragments of all the adjacent rocks. This debris is without doubt part of a ground-moraine, left after the ice-masses had melted away. The fragments of cannel coal, as far as yet known, are confined to the two sections taken up, and are probably derived from somewhere in the immediate vicinity. Several holes have been sunk in the moraine debris, in some of

which large fragments of coal were found, while others had none of it. In one a very large flake of coal was struck, and was at first thought to be the seam *in situ*, but on sinking through it fragmentary material was again found underneath, still containing pieces of coal, one large fragment of this standing on its edge immediately beneath the large sheet. The top of the latter was much scored and striated in the characteristic glacial fashion. It has been laid bare for a distance of 35 feet by 20 feet, and has not yet been all uncovered, but is a good deal twisted and fractured. No doubt it has first been laid bare by the ice and then become frozen hard to the latter, after which the slow motion of the glacier has torn it from its bed and carried it away, possibly some considerable distance. The probability is, however, that the parent seam is quite close at hand. With the coal we find numerous fragments of black micaceous shale, containing occasional prints of *Glossopteris* and other Carboniferous ferns, and this same rock is seen in the solid at the foot of a long trench which has been dug up the face of the spur, and in one or two holes near the foot of it. Since my visit I understand that a bore has been made through this shale for a depth of some 40 feet or more without cutting the seam, but there can be little doubt that a few more bores in different places will soon discover it. Seeing that a bed of coal has been found further north in the same black micaceous shale at quite a short distance above the basal conglomerate, and under marine strata, as is the case here also, it is pretty certain that the shale marks the coal horizon, and that bores from the bottom of the marine beds through it to the conglomerate must pass through any seams that exist. On the slopes of the spur the trenching that has been done makes it clear that the seam is not high up, and search should therefore now be confined to the lower ground and be continued principally by boring. The depth of shale passed through in the bore indicates the same deepening of the basin going southwards that has been before referred to, for at the northern outcrop it appears to be much thinner. This outcrop is found on the slopes of a spur connecting Barn Bluff and Cradle Mountain, about two miles N.N.W. of the above workings, and at an elevation between 70 and 80 feet higher. It is nearly 12 inches thick, of bright, brittle, highly bituminous coal, free from bands, and has the black shale for both roof and floor. I am inclined to think that this seam is identical with that yielding the cannel, but it may not be so. As it crops out on the side of a steep slope, a trench deep enough to cut well in to the solid rock down the face of the slope to the conglomerate would give a very valuable section, and would show if there was a second seam.

The large flake of cannel coal and the other fragments obtained show that the seam from which they are derived must be at least from 6 to 12 inches thick, the average thickness of the blocks being about 8 inches. As it is likely that the loose blocks are not the full thickness of the seam there is considerable hope of this proving to be over a foot in thickness, which should be workable, as this sort of coal is much more valuable than ordinary kinds. In appearance it is black, with bright, shining conchoidal fracture, almost like pitch; it is very tough, and burns freely on application of a light. It pretty closely resembles the Joadja shale, or cannel coal, of New South Wales, which is so useful for gas-making purposes, but is brighter and more pitch-like. Like many other cannel coals it contains a good deal of pyrites in thin layers, a detrimental feature for gas-making purposes, which, however, does not by any means prohibit their use.

I have obtained from Mr. Bateman, manager of the Mole Creek and Zeehan Mineral Prospecting and Exploration Company, Limited, who has very kindly put them at my disposal, several analyses and tests of this coal by various analysts, which are now quoted:—

PROXIMATE ANALYSES.

	1.	2.	3.	4.	5.
Water ... ..	0.30	0.4	Trace	None	0.2
Ash ... ..	2.80	4.2	6.05	4.12	4.3
Volatile Hydro-carbons ...	55.00	51.1	54.20	50.86	52.8
Fixed Carbon ... ..	41.90	44.3	39.75	43.69	42.4
Sulphur ... ..	Trace	0.8	Not determined	1.33	0.7
Analyst ...	J. Sharpe, Ballarat.	W. F. Ward, Hobart.	J. C. Newbery, Melbourne.	W. A. Dixon, Sydney.	Average Analysis.

The analysts' remarks on these analyses give a good deal of information; Mr. Ward, Government Analyst, Hobart, in reporting on sample No. 2 says:—"The sulphur is included in the coke and gases" (being thus counted twice and making the sum total of analysis No. 2 come to 100.8 instead of 100); "the coke is firm and lustrous, and the gas would be of great value for enriching that of poorer coal. The specific gravity of the sample is 1.13." Mr. W. A. Dixon, F.I.C., F.C.S., etc., writing from the Technical College Laboratory, Sydney, says of sample No. 4:—"Coal of this quality should be of value for gas-making, but it would be of little use for oil-making, as it would yield more tar than oils, which would be difficult to purify. I am satisfied from its appearance and behaviour when subjected to heat, that it would give rather aromatic hydro-carbons (benzene, naphthalene, etc.) than fatty ones (olefines and paraffines). It is not a cannel (from which oils are not made), and not a shale, from which they are. Its colour both in mass and powder, and its fracture in mass, are different from either, and this difference is emphasized by the coke which

it yields on rapid heating, neither cannel nor shale yielding a *true coke*. There seems to be something considerable extracted by chloroform, which is coloured brownish yellow from the powder. I would be inclined to name the mineral Pitch Coal, as being most expressive of its appearance, and of its difference from highly bituminous coal as that of Stockton or Hetton here, which I consider to be *resin coals*."

Mr. Ward has also made an ultimate analysis of sample No. 2, with the following results:—

Carbon	...	...	...	...	...	74.0	per cent.
Hydrogen	...	...	...	...	...	7.8	" "
Oxygen and Nitrogen	...	...	...	...	...	12.8	" "
Sulphur	...	...	...	...	...	0.8	" "
Ash	...	...	...	...	...	4.2	" "
Moisture	...	...	...	...	...	0.4	" "
						100.0	per cent.

He remarks:—"The ultimate composition is almost identical with that of 'Grahamite' which is described by Dana as 'an oxygenated and inspissated petroleum found in shrinkage fissures in sandstone,' but the physical characters of the two substances are different."

For comparison with other cannel coals the following table of analyses has been compiled from Dana's "Mineralogy," Newbigging's "Handbook for Gas Engineers and Managers," and Liversidge's "Minerals of New South Wales." As moisture is deducted before making these analyses, the figures above given are re-calculated with the water omitted in the case of the Barn Bluff mineral.

Locality.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Ash.	Sp. Gr.	Coke.	Authority.
Barn Bluff (Tasmania) ...	74.30	7.83	12.85		0.80	4.22	1.13	48.5	W.F. Ward.
Wigan (England) ...	80.07	5.53	8.10	2.12	1.50	2.70	...	...	E. S. Dana
" " ...	79.23	6.08	7.24	1.18	1.43	4.84	1.23	60.33	Newbigging.
Derbyshire, do. ...	74.346	6.285	14.201	0.350	1.318	3.500	1.271	54.75	Do.
Bulwell, Notts., do. ...	78.680	5.872	9.378	0.700	0.690	4.680	1.269	56.64	Do.
Boghead (Scotland) ...	63.930	8.858	4.702	0.962	0.320	21.222	1.218	31.70	Do.
Torban Hill, do. ...	64.02	8.90	5.66	0.55	0.50	20.32	...	...	E. S. Dana.
Murrurundi, N.S.W. ...	66.788	9.712	2.774		0.555	20.171	...	26.403	Liversidge.
Hartley, do. ...	69.484	11.370	6.356		...	12.790	1.052	17.76	Do.
Greta, do. ...	65.610	7.507	9.851		0.924	16.108	1.13	43.816	Do.
Albertite, New Brunswick ...	86.04	8.96	1.97	2.93	Trace	0.10	1.097	...	J. D. Dana.

The next table below given is taken from Liversidge's "Minerals of New South Wales," to compare the Barn Bluff Cannel with others as regards proximate analysis:—

Locality.	Moist're	Volatile Hydrocarbons.	Fixed Carbon.	Ash.	Sulphur.	Specific Gravity.	Analyst.
Joadja Creek, N.S.W. ...	0.44	83.861	8.035	7.075	0.589	1.054	Liversidge
Hartley Vale, do. ...	...	82.50	6.50	11.0	...	...	B. Silliman
Joadja Creek, do. ...	0.04	82.123	7.160	10.340	0.337	1.229	Liversidge
Hartley Vale, do. ...	...	82.24	4.97	12.79	...	1.052	do.
Joadja Creek, do. ...	0.41	77.07	12.13	10.27	0.12	1.098	W. A. Dixon
Joadja Creek, do. ...	1.16	73.364	15.765	9.175	0.536	1.103	Liversidge
Cannel, Mold Flints, England ...	...	72.08	21.91	6.01	...	...	Percy
Murrurundi, N.S.W. ...	1.165	71.882	6.467	19.936	0.549	...	Liversidge
Torbanite, Scotland ...	...	71.17	7.65	21.18	...	1.170	How
Cannel Coal, do. ...	...	69.77	10.45	19.78	...	...	Percy
Torbanite do. ...	0.720	69.695	9.045	20.540	...	1.316	Liversidge
New Caledonia (Hartley's) ...	0.55	64.62	8.71	26.12	...	1.238	do.
Greta, N.S.W. ...	0.48	61.18	25.13	13.21	...	...	do.
Albertite, New Brunswick ...	...	57.490	42.086	0.424	...	1.105	do.
Greta, N.S.W. ...	1.475	53.798	27.946	15.870	0.911	1.130	do.
Cannel Coal, Wigan, England ...	1.464	45.900	45.519	7.117	...	1.259	do.
Barn Bluff, Tasmania... ..	0.2	52.8	42.4	4.3	0.7	1.13	Average of four tests.

These analyses show that our cannel coal is higher in carbon and lower in hydrogen than the very rich ones of Torban Hill in Scotland, and Joadja Creek in New South Wales, but lower in carbon and higher in hydrogen than many good English cannels. The proximate analysis also shows a similar relation, the volatile portion being higher than that of the Wigan cannel and lower than that of Boghead or Joadja Creek mineral. The practical tests that have been made bear out the position assigned to the coal by analysis, showing it to be better for gas manufacture than the average English cannels, but not quite so good as the best Scotch and New South Wales ones. It has been tested at the Launceston and Melbourne Gas Works and by Mr. Wm. Leggate of East Devonport, with results as follows:—

Mr. T. S. Cleminshaw, A.M.I.C.E., Engineer of the Launceston Gas Company, reports:—"In re sample of cannel coal supplied, I have tested it for quantity and quality of gas, with the following results:—

Quantity (average of 4 tests)—11,200 cubic feet per ton

Quality (average of 3 tests)—50·40 candles, corrected for barometer and thermometer.

The test was made with Sugg's No. 2 cannel burner, as the gas was far too rich to burn in ordinary one. The residue was non-coking and valueless for fuel purposes, being similar to cannel coke of the richer sorts of cannel,—volume, 55·5 per cent. The sample when broken exhibited signs of being an out-crop specimen, and water was visible internally. The tarry vapours, from their appearance, indicate the presence of oil. There was a distinct smell of sulphur in the hot coke."

Mr Leggate's test was a comparatively rough one, but agrees fairly well with Mr. Cleminshaw's, the yield of gas per ton being returned as 12,607 cubic feet of an illuminating power equal to 47 standard candles.

Mr John Wynne, C.E., engineer of the Melbourne Metropolitan Gas Company, reports as the result of a test of half a ton of the cannel, that it gave an average yield of 15,486 cubic feet per ton of an illuminating power equal to 29·44 candles. As Mr Wynne's test was made on a much larger quantity of material than the preceding two, it is likely to be the most correct. The quantity of gas being much greater, and the illuminating power much less than in the Tasmanian tests, it is probable that the retorting was done at a much higher temperature in the Melbourne trial. In order to reduce tests of coal for gas-making purposes to a common standard by means of which their relative value may be estimated, it is usual to calculate what number of pounds of sperm would give the same illuminating effect as one ton of coal. The standard sperm candle burns at the rate of 120 grains an hour, while the standard gas-burner consumes 5 cubic feet of gas per hour. Calculating from these data we find that one ton of Barn Bluff cannel gives a yield of gas equivalent in illuminating power to 2031·53lbs. of sperm, according to Mr. Leggate, 1935·36lbs. according to Mr. Cleminshaw, and 1563·11lbs. according to Mr Wynne; the mean result being 1,843·33lbs. of sperm. Even the lowest of these is a very good result, for I find in Newbigging's Handbook for Gas Engineers and Managers, that out of 140 determinations there recorded of various cannels there are only two whose value is over 2,000lbs. of sperm, and only 11 between 2,000 and 1,500lbs., while there are 43 whose values lie between 1,500 and 1,000lbs., and 84 under 1,000lbs. of sperm. Taking the mean result (1 ton = 1,843·33lbs. sperm) of the above three trials of Barn Bluff cannel, it would stand third in Newbigging's list, being only exceeded by the New South Wales cannel (=2,126lbs. of sperm) and by the Boghead cannel of Scotland (=2,073lbs. of sperm). Taking Mr. Wynne's result, it would stand ninth in the list. The following table gives particulars of some of the richest known cannels; the first three being taken from Liversidge's Minerals of New South Wales, and the remainder from Newbigging's Handbook, the local results being also added for comparison:—

Locality, etc.	Gas per ton Cubic feet.	Coke per ton Lbs.	Ash in Coke Per cent.	Illuminating Power Standard Candles.	Value of Gas per ton of Coal in pounds of Sperm.
Grahamite, W. Virginia ...	15,000	1056	4·6	28·70	1476
Albertite, Nova-Scotia ...	14,784	806	0·95	49·55	2511·6
Hartley Cannel, N.S.W. ...	13,716	424	62·86	131·00	6160·4
Cannel, N.S. Wales ...	15,300	818	71·0	38·43	2126·
Boghead, Scotland ...	15,750	817	68·21	38·39	2073·
Wigan 4ft., England ...	17,300	920	7·77	30·07	1783·56
Dykehead, Scotland ...	13,126	1109	15·50	38·71	1742·08
Chapleside, Scotland ...	13,265	973	18·89	35·86	1630·22
Kirkness " ...	13,825	1034	24·90	32·13	1522·96
Inchgall " ...	13,520	1026	25·80	32·72	1518·42
Lesmahago " ...	12,420	1060	13·20	34·26	1458·88
Bromley, England ...	15,865	913	29·73	28·66	1559·83
Barn Bluff, Tasmania ...	11,200	—	—	50·40	1935·36
(Cleminshaw)					
" " " ...	12,607	1030·4	21·65	47·00	2031·53
(Leggate)					
" " " ...	15,486	—	—	29·44	1563·11
(Wynne)					

The results therefore show that the Barn Bluff mineral is one of the very best known cannel coals for gas-making purposes in the whole world, and when we consider that the pieces tested have been lying on the surface of the ground exposed to the weather for centuries, or buried not more than eight feet deep in loose soil, there is reason to expect that even better results will be got when the seam is mined from solid country, as nearly all kinds of coal suffer deterioration by exposure to the weather.

With regard to Mr. Dixon's contention that this coal is not a true "cannel," it may simply be said, that this is a trade name rather than a scientific one, and from a gas-maker's point of view covers grahamite, albertite, torbanite, and other varieties, which differ very much from one another in composition and origin, but agree in yielding much rich gas. His observation that aromatic hydrocarbons are given off

rather than paraffins and olefines is important, as it indicates that the bye-products of the distillation are likely to be very valuable for the manufacture of aniline colours and other coal-tar derivatives, which are made from the hydrocarbons of the aromatic series, not from the fatty ones. Mr. W. F. Ward has made a test of the quantity of oil that can be got from the coal, and reports:—"Crude oil and tar 92 gallons per ton; this result was obtained by very slow distillation, and is unusually large." No investigation has yet been made, however, by any specialist in the manufacture of coal oils and tar-derivatives, without which the commercial value of the stuff in this respect cannot be estimated.

If used for gas-making alone, without any consideration as to bye-products, the following calculation, which Mr. Cleminshaw has been good enough to send me, shows its approximate market value in Launceston:—"Reckoning the Joadja Creek shale (N.S.W.) as producing 15,000 cubic feet of 50 candle gas (a very low estimate, as results approaching 18,000 feet have been obtained), and costing here 75s. per ton, this gives  $\frac{15,000 \times 50}{75} = 10,000$  candle feet for every shilling of value. Barn Bluff canal

(Tasmanian) producing 11,000ft of 50 candle gas (a high estimate, on a small parcel only) would cost on same lines as above  $\frac{11,000 \times 50}{10,000 \text{ per shilling}} = 55s.$  per ton. I need scarcely remind you that tests on a

small scale should be discounted for a practical result, and should therefore feel inclined to say that the Barn Bluff Canal might be worth 50s. per ton in Works" (i.e. Launceston Gas Works).

Should the seam prove to be one foot or more in thickness, and to extend over any large area of ground it ought to pay for working at this price after access by railway had been established. The following table gives the quantities of coal per acre for seams of different thicknesses, the specific gravity being taken at 1.13:—

Thickness in Inches.	Cubic Feet per Square Yard.	Weight per Sq. Yd., in lbs.	Tons per Acre.
1	$\frac{3}{4}$	52.9	114.3
—	1	70.54	152.4
6	$4\frac{1}{2}$	317.4	685.9
8	6	423.2	914.5
10	$7\frac{1}{2}$	529.1	1143.1
12	9	634.9	1371.8
15	$11\frac{1}{4}$	793.6	1714.7
18	$13\frac{1}{2}$	952.3	2057.6
21	$15\frac{3}{4}$	1111.0	2400.6
24	18	1269.7	2743.5

Immediately round and under Barn Bluff I estimate the area of probable coal-bearing ground at about 1800 acres, which at 900 tons per acre (taking the seam at eight inches thick) would contain 1,620,000 tons of coal. Round Mount Pelion and the Du Cane and Eldon Ranges there would be a very large field, supposing the coal to exist there, as is probable, but even in the immediate vicinity of the canal discovery the quantity likely to be present is so considerable as to make it well worthy of serious consideration whether it could be mined and brought to market at a profit. At the present stage, with the seam actually not yet found in the solid, and with its thickness unknown, we have not the data required to decide this question, but in my opinion there is such reasonable probability of success that further prospecting can be recommended without hesitation. It is now necessary, before going further, to ascertain by borings and trenches the extent of the seam of canal, its thickness, and its average quality, the latter especially, because the canal might gradually merge into an ordinary bituminous coal. The ground, except where covered by glacial drift, is easy to prospect, and by boring, and cutting a series of trenches from the top of the conglomerate beds upwards to the marine measures all round the mountain, it is not likely that much difficulty will be experienced in getting the required information. Should the seam be thus discovered, the working facilities are very good, the strata lying nearly horizontal, and there being every opportunity to get natural drainage by adits. There is plenty of timber for mining purposes in the adjacent ravines, and along the route of the railway.

While prospecting is in progress it would be desirable to have the canal tested very thoroughly on a working scale by some European manufacturer whose speciality is the treatment of coal-tar products, a quantity of not less than 50 tons being sent him for the purpose. We should on receipt of his report be enabled to tell whether it would be possible to get a better price for the stuff in the colonies or in England, it being quite possible that the bye-products of distillation would in Europe more than make up for the lower price for gas-making purposes. It would also show us whether it would be worth saving the tar and oils in local gas-works and exporting them, more or less roughly purified. None of

the great industries which in older and more populous countries are founded on coal-tar have yet taken root in the Australian colonies to any considerable extent, but as time goes on no doubt they will be established. It may here be mentioned, in passing, that we have at Mount Lyell an enormous quantity of pyrites of good quality for the manufacture of sulphuric acid, which is largely used in refining coal-tar, and is indeed next to coal and steam the most indispensable material used in all chemical works.

In concluding this report I have to record my thanks to Mr. Bateman for analyses and papers, and to Mr. T. S. Cleminshaw for much information with respect to Cannel coals.

I have the honour to be,

Sir,

Your obedient Servant,

A. MONTGOMERY, M.A.,

Geological Surveyor.

The Secretary of Mines,  
Hobart.

