REPORT ON THE COALFIELD OF LLANDAFF, THE DENISON AND DOUGLAS RIVERS, ON DEPOSITS OF TIN ORE ON SCHOUTEN MAIN, AND ON OUTCROPS OF QUARTZ NEAR BUCKLAND.

Government Geologist's Office,
Launceston, 19*th October,* 1901.

SIR,

I HAVE the honour to report that, pursuant to your instructions, I proceeded to the East Coast on the 20th May, to examine the coal measures north of Swansea, and some tin deposits at the neck of the promontory named Freycinet's Peninsula, known as Schouten Main. My inspection lasted till the 14th June, when I went to Buckland to inspect some quartz country in that neighbourhood.

Swansea is situate in the north-east corner of Oyster Bay, which is here eight to ten miles across, and the eastern side of which is formed by the bold promontory of Freycinet's Peninsula, 12 miles long in a north and south direction. Viewed from Swansea, the granite peaks of the peninsula form a picturesque panorama. One of these, Mount Freycinet, rises 2014 feet from the sea. On the eastern side of the peninsula, Mount Mayson, overhanging Wineglass Bay, is 1670 feet high.

The head of the bay is formed by a fine fringe of sand called the Nine-Mile Beach, which sweeps eastward in a gentle curve as far as Point Bagot. Opposite that point, at Buckley's and eastward, a little round Hepburn's Point, diabase appears, and then gives place to the granite of the peninsula. At the back of the sand-dunes of the Nine-Mile Beach, and north of King Bay, at the mouth of the Swan River, a tongue of diabase rock runs north between the river and the Moulting Lagoon, connecting with Lyne's Sugar Loaf and the diabase on the coastal range further north. Recent sands and gravels extend up the valley of the Moulting Lagoon as far as the surveyed township of Llandaff. They also extend a good way up the Mere-

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dith River. Mr. Jno. Meredith showed me the river shingle at Cambria, which forms a good deal of the land there, and marks the course of the former river-bed. Old charred gum timber has been found there, 15 feet below the surface. The deposit is geologically recent, and rests on hard mud, pipeclay, &c. There are signs here of a recent or present rising movement of the land.

It is not always easy to distinguish between the recent deposits and the Tertiary clays which overspread the flat country in the valley of the Swan. These clays are of middle to Upper Tertiary age, and are highly ferruginous, containing beds of impure limonite or argillaceous oxide of iron. The habit of the mineral is largely concretionary, and it is sometimes pretty dense and solid. On the Cambria estate Mr. E. Meredith took me to a spot where lumps of rather pure iron oxide are to be found, but I take them to belong to the same deposit. Sometimes the ore is cellular, clay having been removed from it by weathering or water. The mineral in its purest form is not available in quantity sufficient for exploitation; in its impure forms the percentage of iron is too low. Iron ore—hematite—is also found elsewhere in this part of the Island in seams in the Mesozoic sandstone, often at the contact of the latter with diabase. An example of this may be seen at Kelvedon, on the road south of the Horse-shoe Bridge over the 30-acre rivulet. About 40 feet from the contact of intrusive diabase with Mesozoic sandstone a vein of hematite occurs in the latter. Numerous parallel instances are to be found. There is no use in looking for precious metals in the iron at these contacts. A piece of the ferruginous contact rock at Little Swanport was given to me by Mr. Mitchelmore, but on assay at the Government laboratories it was not found to contain any economic mineral. On the other hand, iron ore gossanous veins are met with in the granite area intersecting that rock, and these require examining individually to see whether some of them are not the upper parts of tin-bearing lodes. Thus there are three distinct modes of occurrence of iron ore in the district. The largest quantity is certainly in the Tertiary clay deposits, and some of it is of a quality which would lend itself to fluxing other ores in smelting operations, but at present, in this part of the Island, it has no economic value.

The form of Oyster Bay illustrates the eroding force of the waves on a large scale. We must believe that the surviving fringe of diabase on the E. side of the bay at Hepburn's Point, on the S.W. end of the peninsula, and on Schouten Island, was once continuous with the sea-front of the same rock on the Swansea side of the bay. The fragmentary deposits of Mesozoic sandstone (freestone) associated with the diabase, indicate that it, too, extended across the bay to Kelvedon. It follows, accordingly, that the present Oyster Bay has been scooped out of the coal measures, sandstones, and diabase, the eroding process being, perhaps, assisted in its initial stage by the weakness of the strata along the contact line of the diabase with granite on the eastern shore of the bay. The excavating process has extended to a depth of 12 fathoms, on the average. Cole's Bay is 6 to 14 fathoms deep. Off Rocky Hills the average depth is 17 fathoms, and the water is so clear that Mr. Edward Cotton tells me he can generally see the kelp anywhere on the bottom on a fine day, that is, judging by the colour of the water. Towards the head of the bay the water shoals, and the jetty at Swansea, nearly a quarter of a mile long, does not project into more than a couple of fathoms of water at low-tide. The present depth of the bay does not represent the sum total of erosion since the coal period, for it has probably been reduced by deposition in Tertiary times of sediments which have since been denuded as the land has risen again. The Tertiary deposits in the lower part of the valleys of the Swan and Apsley illustrate the depression and subsequent elevation of the land during that period observed frequently elsewhere in Tasmania. These deposits cover up the older formations on the flat land, and speculations as to whether coal measures exist below them have no very precise data to go upon, for, in the first place, we do not know how much denudation has taken place, and, in the second place, we are not quite certain whether the Tertiary and recent sands and clays rest naturally upon a floor of diabasic greenstone, or upon Mesozoic sandstone. The reply to the latter question depends upon the view taken of the general geology of the district, and this, again, involves a consideration of the oft-debated and never satisfactorily-settled question of the relations of the diabase to the coal measures sandstones. The conclusions drawn will be found to have far-reaching consequences, for they will affect the interpretation of coal measures geology and the search for coal in other parts of the State.

Coal measures are not seen in the immediate vicinity of Swansea, but seven miles north a patch of Mesozoic sandstone occurs on both banks of the Swan River, half a mile above Cranbrook. This is bounded on the west by beds lower in the series, terminating in fossiliferous beds of Permo-carboniferous limestone. At the bridge over the Swan the river-bed is diabase, and this continues up the river a few hundred yards, when a stretch of bank comes in occupied for two hundred yards by white and red clays, with nodular, concretionary iron ore (limonite). Another hundred yards up the river is yellow sandstone. The clay may be considered as marking the contact of the intrusive diabase with the freestone. Two or three miles north-west of the river is a sandstone quarry, the stone of which is used for bridge-making, but is not very durable. The yellow flaggy sandstone lies nearly horizontally in the river-banks. It may dip a little to the south. A seam of coal is exposed in the river-bed, crossing the stream N.W.–S.E. About six inches of this was exposed above the water's edge, but I was told it approaches 3 feet in thickness. It would be more accessible when the river waters are lower. It is overlaid by dark clod. I took a sample from the seam in the bank, but the quality has not proved to be at all good. When analysed by Mr. W. F. Ward, Government Analyst, it was shown to consist of—

	Per cent.	
Fixed Carbon	19·20	
Ash	64·10	No coke formed.
Gases, &c.	9·70	
Moisture	7·00	
	100·00	

The poor quality is, very likely, due to surface deterioration. By going from the river about 100 feet S.E., and sinking 10 or 15 feet in the bottom of a dry gully which runs parallel with the river, the seam would be struck. This coal is in the N.W. corner of block 1-198, John Amos, owned by Mr. A. J. Amos, of Cranbrook.

North and north-east of the above, the diabase continues to Lyne's Sugar Loaf, into the Parishes of Bicheno and Douglas, rising into and forming the crest of a mountain-range roughly parallel with the coast. This range is fringed with sandstone beds, containing our Upper Coal Measures, and an important part of my examination was to ascertain whether these sandstones, as is alleged, pass into the mountains under the diabase capping, or whether they simply flank the range and are cut off by a central core of eruptive rock.

Before discussing the several occurrences of coal, it will be well to consider this matter of the diabase. In the first place, the order of the rocks of the district may be illustrated by the following table :—

RECENT.	Superficial sands and gravels, sand-dunes.
TERTIARY.	Palæogene clays and ferruginous sands, with fossil leaves. Impure concretionary iron ore at Riversdale, Cambria, Swan River; consolidated sand-bluffs on Schouten Main.
CRETACEOUS ?	Diabase or dolerite in intrusive masses and sheets, penetrating the Coal Measure sandstones, and crowning the mountain ranges.
JURA.	Soft green-and-yellow felspathic sandstones, enclosing seams of coal, and containing the fossil fern *Thinnfeldia odontopteroides* (Morris).
TRIAS.	White, hard quarrying sandstones.
PERMO-CARBONIFEROUS.	Marine fossiliferous mudstones and sandstones west of Glen Gala. Grits and conglomerates near Isaac's Point.
DEVONIAN.	Granite of Freycinet's Peninsula, Bicheno, and Seymour.
SILURIAN.	Micaceous sandstone at Bluestone Bay. Slate near Isaac's Point.

Now Courlands Pt. (for Sm)
Isaacs Pt. (Dg).

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Although I give equivalent European systems in the above table, it must not be supposed that the formations can be correlated with the identical ones in Europe. It is with the Gondwana formation in India, and not with Europe, that our Permo-Carboniferous and Mesozoic systems are to be compared. That large system of fresh-water beds, with some marine representatives, is spread widely over India, and the continent, of which the beds form the remains, extended at one time to Australia and Tasmania. Our Mesozoic sandstones, with their coal measures, then formed an integral part of the Gondwana-land which sank beneath the Indian Ocean prior to the Tertiary period.

The eruptive rock is known by the various names of ironstone, greenstone, bluestone, trap, and basalt. The first four names are vague field terms. The last is an attempt to be precise, but is hopelessly incorrect. It is a holocrystalline rock, consisting of plagioclase felspar, augite, and titanic iron, is structurally diabasic, and would be called dolerite in England and diabase in Europe and America. Its structure is that of a rock which was formed at a moderate depth below the surface, and where-ever it is now found at surface we must assume it to have been exposed by denudation. It may, therefore, have consolidated at first both as intrusive masses of indefinite size and shapes, and as sills or sheets thrust between the bedding-planes of overlying rocks. In the latter case, we may regard the superincumbent rocks as having been denuded. I am aware that the argument derived from its crystalline texture must not be pushed to an extreme. Thus, Messrs. Newton & Teall, in writing on the basaltic formations of Franz Josef Land,* state :—"Unfortunately there is no petrographical character by which sills can be in all cases distinguished from lavas in the Brito-Arctic province. The sills are usually coarser in grain, columnar, holocrystalline, and ophitic in structure; but none of these characters can be relied upon as distinctive."

M. Lacroix, in describing the ophitic diabase of the Pyrenees,† divides it into two categories, in one of which it is shown by its contact phenomena to be an intrusive rock, and, in the other, an effusive product with tuffs and volcanic

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* Quart. Jour., Geol. Soc., 1897, p. 489.

† Le Gabbro du Pallet et ses modifications, 1899, p. 29.

ejectamenta. Yet, he says, holocrystalline varieties occur in the flows of the volcanic type, and scarcely differ in structure from that of the normal type of intrusive diabases, "making any petrographical distinction which we might be tempted to draw between the two extremely fragile."

But other facts besides its structure must be taken into account. The two facts which make against the idea of the rock being a contemporaneous lava flow are—

1. Its uniformity of composition through very thick masses (and without lines of demarcation, such as would be produced by successive floods of lava), a uniformity persistent through Palæozoic and Mesozoic rocks, which is a singular thing if the eruptive rock is regarded as contemporaneous with the strata of two great divisions of the geological record.
2. The alteration produced on the adjoining rocks where it invades them.

The proofs of intrusion are more decisive and abundant to the south of Swansea than to the north, where the stratification of the sandstone is less disturbed. In several parts of the district flinty rock, resembling hornstone or chert, is found. It varies in colour from grey to green and black. It has a conchoidal splintery fracture, with sharp corners and edges. The thin edge is translucent. It weathers with a brown crust. It should not be called chert, which is a rock of organic origin. This rock is adinole, or shale metamorphosed by contact with diabase. The shale substance has been converted into a mixture of albite, felspar, and quartz. This kind of stone is plentiful at Kelvedon, six miles S. of Swansea, on Mr. Edward Cotton's estate. It is so splintery that it easily injures the fingers if broken and handled incautiously. The aboriginals used split chips of this stone for cutting purposes, and worked flakes are still to be picked up on the grassy headlands on the coast-line. In the roadside section south of the Horseshoe Bridge, near Kelvedon, decayed prismatic diabase, with concentric weathering, is seen tilting up beds of quartzose sandstone. Between the diabase and sandstone are four feet of clay, and a vein or seam of this black adinole. On Mr. Cotton's property, west of the lagoon, the sandstone is changed into a typical white

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quartzite, and is associated with flinty adinole. This indurated sandstone and quartzite area comprises five acres of flat land, the quartzite proper appearing to run N.E. as a narrow strip. On the southern edge diabase comes in, and its intrusive nature is further shown by a curious development of marl in the 30-acre rivulet. On the section south of the creek a good deal of silicified wood and loose chalcedonic quartz may be picked up.

Further south on the coast road at Ravensdale the diabase appears tilting the sandstone where the bridge crosses the rivulet near Mr. Salier's homestead. I caught sight of it as the coach passed over the bridge in stormy weather, and did not feel sure about it till Mr. Salier told me such was the case.

On Slate Hill, west of Swansea, dark adinole is frequent. On Boomer's Hill, between Glen Gala and Apsley, Mr. Amos took me to where some surface pieces of yellowish resinous-looking adinole represented the alteration of shales or sandstone.

At Glen Albyn, in Marshall's Creek, 6½ miles west of Bicheno, and about 300 feet above sea-level, some seams of hard stony coal are exposed in compact sandstone with a rudely columnar jointing. Both the sandstone and coal have evidently been indurated in the vicinity of the diabasic rock.

The bores put down with the diamond-drill at sundry points along this coast prove the intrusiveness of the diabase no less decisively, for some of them, after passing down several hundred feet in sandstone, have bottomed upon the igneous rock. Thus, No. 3 bore at Seymour went through 241 feet 5¾ inches sandstone and shale, and then penetrated 5 feet 8 inches into diabase. The bore at Back River, Prosser's Plains, went down 436 feet 9 inches in sandstone and shale, and 3 feet into diabase. A bore at Spring Bay descended through 117 feet of sandstone to the diabase. This is in harmony with what has happened in other parts of the State, where boring for coal has been carried on. At Jerusalem, in 1891, the drill went through 337 feet 0½ inches sandstone, and then 6 feet 10 inches into diabase. At Langloh Park, in 1892, sandstone and coal were bored through 115 feet 6 inches, and then the diabase was pierced for 5 feet 2 inches. No. 2 bore there went through 339 feet 5 inches sandstone, and penetrated

2 feet into diabase. On the flank of Mount Wellington a bore at the Cascades went 509 to 519 feet through the Permo-Carboniferous marine mudstones, and then 100 feet into diabase.

Numerous dykes of diabase everywhere traverse the Permo-Carboniferous and Mesozoic sandstones, proving the eruptive rock to be younger than those strata. It follows that the boring operations which disclose its existence below the latter show that it exists there as an intrusive mass. It has invaded the sandstones, and cannot be described as a superfical flow contemporaneous with them. If we now also see it in other positions overlying the sedimentary strata, we must assume that the beds below which it was thrust have been removed.

The occurrence of massive bodies of this rock at greatly differing levels adds to the difficulty of interpretation. At Swansea and along the coast line to the south diabase (dolerite) forms the shore. It is, consequently, at sea-level. But, at Kelvedon, side by side with the diabase, sandstones and shales exist at sea-level and descend below it. On the sea-bank, near the boathouse, a shaft was sunk about the year 1852 some 86 feet, the bottom reaching 75 feet below sea-level. The strata first passed through were light-coloured shales, and at bottom a soft argillaceous shale with some carbonaceous markings came in. The shales go out to sea, and are seen at low-water. Just north of them a band of black flinty adinole also runs seaward. The appearance of the dark shale in shaft indicates metamorphism to some extent, induced, doubtless, by proximity to diabase. A little distance north of this the eruptive rock borders the sea, and also south towards the Rocky Hills. West of the Kelvedon paddocks it rises from the sandstone into a hill range. North of the homestead is a conical hill, 250 feet high, consisting of felspathic sandstone, which extends halfway up. The upper part is diabase. This is the highest horizon of the sandstone to be seen about here. The plain at the base shows some marl in fragments in the drain ; and in the flat at the back of the farm, as also in the well behind the house, all is sandstone. West of the homestead is a field, with a slightly arched surface, all brown felspathic sandstone strewn with fossil wood. This continues up to the base of the diabase hills, which rise steeply from the plain, with

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the appearance of an eruptive contact, to between 500 and 800 feet high. Do the sandstones pass beneath the diabase? The absence of sandstone cliffs along the fringe of these hills and of heavy diabase detritus is against the theory of the sandstone passing into the range. The juxtaposition of both classes of rock at sea-level strongly suggests faulting which has thrown one up or down.

There are indications of coal in the strata on the sea-shore, but the Kelvedon patch of coal measure sandstone is otherwise surrounded by intrusive diabase, and bears, in many places, such evident signs of the influence of that rock, that I do not think it a very favourable spot for boring operations. It is true the sandstone beds have not been much disturbed as regards position, but the large quantity of quartzite and dark adinole betokens injurious igneous intrusions.

If the fact be thoroughly realised that the diabase is younger than the coal measure sandstones, and has intruded into them, then the diabase capping on the sandstone of the coast range further north must be explained in a way which will not contradict this fact. On this hypothesis the capping was not originally a cap, but an intrusive sheet. The difficulty is to understand how such a thick mass could be forced between sedimentary strata without distorting them enormously, and of this we see no sign.

Passing from Glen Gala to Llandaff, the road up to the summit of the pass, about 500 feet above sea-level, is on diabase country, which runs down south to the Moulting Lagoon, and northwards through Lyne's Sugar Loaf to the coastal tier. In the road-cutting on the pass, the rock is decomposed and weathered to a yellow clay, with nodular lumps. Descending the pass on the N.E. side, a gap in the country is seen opposite Quinn's, which marks the contact of the diabase with the Mesozoic sandstone. A shaft was put down in sandstone some years ago without any result. It is difficult, now, to get any precise information as to this shaft, but report says it went down alongside a wall of igneous rock. It is called Williams' Shaft. The sandstone runs from here north along the side of the range to the north of Llandaff. It descends into the head of the Llandaff valley, called Comb End, and forms the Llandaff basin, in which, however, some apparently intrusive exposures of diabase occur. On the south side of the road is the diabase rock-mass, which extends south to the Moulting Lagoon. Mr. Jas. Lyne's homestead "Apsley," is situate on the fringe of this diabase, and overlooks on the E. the Tertiary and recent deposits which cover the ground between the north end of the Moulting Lagoon and Fosbrooke's land, west of Llandaff. Inside the western boundary of the surveyed township is some diabase, forming low hills and knolls, but the rest of the area is sandstone. For over a couple of miles N. of Llandaff this freestone, as it is called locally, extends up the mountain to a height of about 800 feet, and contains the coal seams which I had to inspect. At about that height the mountains are crowned with diabase, the *débris* of which, in the form of huge blocks and parts of broken columns, strews the hillside profusely. This talus conceals the sandstone, excepting where cliffs of it are exposed in the banks of creeks. Thus, under a heavy overburden of diabase detritus, unsuspected sandstone strata often show themselves. This detritus is so heavy and the fallen blocks are often so enormous, that I doubt whether the fragments have rolled any distance down the slope. At the Douglas River, on similar ground, I noticed a broken column 40 feet long and 15 feet thick lying prostrate, and altogether the size of the *débris* forbids the idea of any great transport. I am inclined to think that this is an indication of the igneous sheet having once extended over the most wasted sandstones, and that its fragments have settled down gradually to where we now see them.

The igneous rock itself consolidated after all our well-known lode systems had been found; consequently, no ores except those of iron have been discovered in it. Occasionally a zeolitic mineral, scolecite (a hydrous silicate of alumina and lime), bluish-white in colour and stellate in habit, has formed in the joints of the rock.

Llandaff Coal.

This has been found both on the flat, at the base of the range, and up on the hillside, to a height of 650 feet above the sea. The quality is very variable, some of the coal containing only 35 to 43 per cent. fixed carbon, while what may be taken as being a cleaner variety goes up to 53 per cent., which compares well with the average of Mount Nicholas—46 per cent. to 50 per cent. It is a sub-bituminous coal, with a bedded structure, some of the layers being dull, others bright black. It burns readily, with a yellow flame, emits much smoke and great heat. Some of it forms coke in the assay. Whether, on a large scale, it could be called a coking coal, requires bulk tests to show. The mere fact of a coal coking, too, is not sufficient, for the coke formed may be poor and unusable either for railway or metallurgical purposes. This is too often lost sight of.

Pike's Shaft.—On Crown land leased to Hume, outside the north boundary of the Llandaff township block, there is a seam of dense dull shaly coal, which, though it agglomerates somewhat on the grate, does not form a coke. It has been analysed by Mr. W. F. Ward, with the following result:—

	Per cent.
Fixed carbon...........	35·4
Ash	34·4
Gases, &c................	26·4
Moisture	3·8
Sulphur..................	—*
	100·00

No coke formed.

The quantity of ash is hostile to the caking property. The water in the creek prevented my seeing the full thickness of the seam, but I was told it is three feet. A small shaft has been sunk on the flat above the creek bank, and has bottomed on the seam. Further work was suspended, owing to water. The strata are the soft felspathic sandstones of the Upper Measures. Near here would be an excellent place for using the diamond-drill. The strata are, apparently, undisturbed, and lie nearly horizontal, and may be expected to enclose more than one coal seam. The bore, too, may show whether the edge of the range is not a line of fault, which is, to say the least, probable.

Pike's Creek.—The slope of the hill up to this seam is covered with detritus from the diabase above, and this

*Not determined.

conceals the sandstone bedrock. No solid diabase is seen below the 700-foot line. The seam is about 300 feet above the plains, and cliffs of sandstone are there massively exposed in the creek. A 3-foot seam of fair-looking coal crops out on the east bank of the gully, and can be traced right across. A short tunnel, 13 feet, has been driven on at N. 130° E. The dip is 2° to S.E., and the section exposed, in descending order, is as follows:—

	ft.	in.
Yellowish sandstone roof.		
Coal	1	1
Parting	0	2
Coal	0	5
Parting	0	0½
Coal	1	7
Clay floor.		
White sandstone.		

The thickness of the partings is inconstant; the lower one is thinning out. There is about 2 feet 6 inches of fair coal; some of the 3-feet seems as if it had suffered deterioration from atmospheric influences. The quality of the samples which I took has proved to be excellent. The Government Analyst's assay is—

	Per cent.
Fixed carbon	50·20
Ash	12·00
Gases, &c.	34·70
Moisture	2·40
Sulphur	0·70
	100·00

The rocks in the gully choke the entrance at present, and the seam would have to be worked a little to the west. There would not be much difficulty in running out a horizontal tramway to where a self-actor could be constructed, to convey the coal to the plain below. But it is, I fear, too much to hope that the seam would be profitable, unless a thicker one can be discovered close by, and the two worked in conjunction. The approximate distance to Cole's Bay has been surveyed by Mr. A. T. Mayson as 19 miles 10 chains, of which 3 miles 72 chains would be by branch tramway to the main line required to run the output of the entire district to a safe shipping port.

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Gully into Steep Creek.—In an adjacent ravine, higher up the mountain, about 500 feet above sea-level, a seam is exposed as follows :—

Coal............	6 inches
Clay band ...	9 „
Coal............	9 „
Band	1 ft. 5 inches
Coal............	3 ft. 3 inches

with a clay parting.

The coal floor has not been bottomed. The seam was worked at one time for Mr. Cahill, and some coal from it sent to Adelaide. It lies flat, dipping a little to the S.E. The coal exposed is of fair quality, burns freely, and has good heating powers. The Government Analyst's assay is as follows :—

	Per cent.	
Fixed Carbon	48·30	
Ash	24·50	Readily powdered coke
Gases, &c............	25·60	
Moisture	1·60	
	100·00	

It will be noted that the proportion of ash is high.

Steep Creek.—This creek exposes numerous seams and outcrops of coal at varying elevations from 200 to 650 feet above sea-level. Among these are :—

(1.) At 200 feet ...	Coal outcrop, not proved.
(2.) At 450 feet ...	Seam of brittle coal, 3 ft.
(3.) At 500 feet ...	Coal outcrop not proved.
(4.) At 520 feet ...	Seam of coal 3ft. 6in., known as A 1.
(5.) At 580 feet ...	Coal outcrop worked by Mr. J. R. Cahill.
(6.) Branch gully ..	Ditto.
(7.) At 610 feet ...	Coal outcrop on south bank.
(8.) At 620 feet ...	Coal outcrop.
(9.) At 650 feet ...	Coal formation, broken.

The seam known as A1, and the highest seam, are the two most important outcrops.

The A1 seam was first worked on the south bank, in about two feet of coal, the upper seven inches being of inferior quality. Coal from the lower 17 inches was analysed in Launceston, May 9, 1898, by Mr. Austin Allom, as follows:—Fixed Carbon, 56·20; Volatile Matter (gas), 27·00; Ash, 12·80; Water, 4·00 –per cent. Sample was a bright bituminous coal, free-burning, with very white ash. The Morning Star Company (formed 25th Feb., 1898), meeting with difficulty in working on this side of the creek, after driving a tunnel over 20 feet, put in a longer drive on the opposite side in a seam from 3 ft. 2 in. to 3 ft. 6 in. thick, of which 18 inches is stony. The dip is very slight to the south. A small shaft (12 or 13 feet deep), called Ramsay's shaft, has been sunk outside for no apparent purpose; it has not bottomed on any coal. I found the good-quality coal from this seam to burn well and throw out a good heat. All these outcrops, I notice, have large proportions of inferior coal, some unusable, but in a great measure this is probably due to atmospheric influences, and, further in, some of this sort of coal will doubtless be replaced by coal of superior quality. This does not apply to brittle and stony coal, but to the perished, earthy kind which has become soaked and spoiled by exposure.

The samples which I took from the A1 seam have been assayed by the Government Analyst, who reports as follows:—

	Per cent.	
Fixed Carbon..................	57·30	
Ash...............................	5·80	Rather tender coke.
Gases, &c.	31·90	
Moisture	4·30	
Sulphur	0·70	
	100·00	

This is a good result, the ash being particularly low for Tasmanian coals. The high situation of the seam is a drawback, but the ground is open and would enable work to be carried on with less difficulty than at some of the other outcrops. The thickness of coal exposed at present is not sufficient to admit of profitable working, but if the drill can be got some distance up the hill, it would test the ground, and show whether more workable seams exist.

The highest outcrop which I saw on Steep Creek was at 650 feet above sea-level, and this did not expose the full thickness of the seam, as the coal is still going down in the floor. A face of about 12 feet is exposed in descending order, as follows:—

	ft.	in.
Carbonaceous formation of shale and bands	6	0
Band	0	4
Coal	0	3
Band	0	2
Coal and shale	0	8
Band	0	6
Coal and hard shale	2	10
Band	?	
Coal	2	6
False floor, coal going down.		

Most of this coal is brittle, and inferior to the good coal in seam A1. The samples which I took were analysed in the Government Laboratories, with the following result:—

	Per cent.	
Fixed Carbon	42·9	
Ash	28·8	Rather powdery coke.
Gases, &c.	25·2	
Moisture	3·1	
	100·0	

Going down the hill, I observed an outcrop of 17 inches of good soft coal in Mosquito Gully, several hundred feet lower than the highest seam, and some more in the creek still lower down, near the Green Lawn boundary. The drill could be got up here without difficulty. I saw some loose adinole stone in Mosquito Gully, showing the diabase to be intrusive.

As the range is so thickly covered with overburden, it is difficult to fix the relations of the different seams to each other. From the differences in position and thickness as well as quality, none of the exposures appear to be outcrops of identical seams. I think, however, there may have been faulting. At between 200 and 300 feet, I noticed a pebbly bed, containing stones of quartz, quartzite, slate and granite. The granite is a fine-grained, red variety similar to some which occurs at the head of

Freycinet's Peninsula, and was doubtless derived from the coastal granite range. The probabilities are in favour of this conglomerate being low in the system, and this would mean that strong faulting has brought the lower beds to view. If this has really happened at Steep Creek, the higher seams may be struck by the diamond-drill on the flats, provided the intrusive diabase does not interfere there.

The hill north of Board's house is sandstone, and coal has been found on the north side of the hill. It probably comes through to the south under the house, and would be found below the gently sloping flat.

If thicker seams are discovered, and there are probably more seams in this system of beds than have been found up to now, there will be no great difficulty in getting the coal away to a safe and deep harbour site in Cole's Bay. A route for a main line of tramway from Denison River to Cole's Bay, with branches coming in near Landaff from Fosbrooke's and Steep Creek has been surveyed by Mr. A. T. Mayson. It runs along level country in a nearly north and south line to Hepburn's Point, Oyster Bay, thence east to Cole's Bay on the west side of the neck of the Peninsula, a total distance of 24 miles from the Upper Denison. From the Steep Creek junction it would be approximately 16 miles 32 chains to the Bay, and would not cost more than £1200, or, at the outside, for a well constructed line, £1500 per mile. The bay is of ample depth, and forms an ideal harbour.

The alternative is to tram the coal to Bicheno, a distance of seven miles only. This would have an apparent advantage in point of cost. The advantage however disappears when examined, for Bicheno Harbour in its present state is unsuited for large vessels, or shipments in all weathers. A breakwater would have to be constructed, extending from Peggy's Point, N.W. into water six or seven fathoms deep, as proposed many years ago. The cost of this, however, would be fully three times the sum of the supposed advantage.

The cost of mining in the range above Llandaff may be assumed at 7*s.* per ton, to which add 1*s.* for conveyance down the hill, and 2*s.* 6*d.* for transport to the port, so that the cost of the coal, f.o.b. the ship, will be about 11*s.* per ton. Taking into consideration the

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quantities likely to be extracted from the comparatively thin seams prevalent in the district, I do not think it would be safe to estimate the cost at less. This would still place the shippers in a fair position with respect to the vendors of, say, Mt. Nicholas coal in Hobart. If thicker seams are discovered, the advantage thereby obtainable is apparent.

As the sandstone strata may or may not pass under the diabase rock, it is impossible to say what the superficial area of these seams may be. The yield however would be approximately 3600 tons per acre from a three-feet seam, and 2400 tons from a two-feet seam, of clean coal of this description. It is possible that the measures pass through the hill to Glen Albyn, a couple of miles to the north, where, however, the coal in Marshall's Creek is brittle and inferior from its proximity to eruptive rock.

I did not see the coal outcrops in Fosbrooke's Gully, deposited under the same conditions as those of Pike's and Steep creeks, from which they are not distant more than a mile W. Two outcrops were reported to me, one at 400 feet above sea-level, another somewhat higher. A tunnel has been driven on the lower seam, which is reported as 2 ft. 9 in. thick, interrupted by two bands of 3 and 6 inches respectively. The Morning Star Company's circular of the 10th May, 1898, gives Mr. Allom's analysis of the coal as under :—

" F.—*Bright bituminous coal.*

Fixed carbon.	Volatile matter (gas).	Ash.	Water.
55·5	33·75	8·5	2·25

free burning, with very white ash."

I recommend a bore (No. 3 on chart) to be put down at the base of the hill at the back of Fosbrooke's land, which will test this part of the field in the same way as I propose for the Llandaff township.

Some fear has been felt on the spot lest coal found in the valley should prove inferior in quality to that cropping out in the ranges. But I do not see any real reason for anticipating this. Coal-mining below sea-level in other parts of the world does not show a decrease of quality attendant upon depth. Coal outcrops may become impoverished by meteoric influences, but the seams resume their normal quality in depth.

Glen Albyn.

I visited Mr. R. Marshall's farm in order to inspect the outcrop at Glen Albyn. The land is on the S. side of the Apsley River at the northern base of the Llandaff range, and five to six miles W. of Bicheno. The flat land through which the Apsley flows is sandstone, which on the south rises into cliffs surmounted by diabase. Coal is exposed in the floor of a creek coming down from the mountain on the south. The principal outcrop is at about 300 feet above sea-level. The sandstone is the usual felspathic variety, but has been indurated locally. The impression left on my mind after examining the seam was an unfavourable one. The coal is hard and stony, apparently metamorphosed by the influence of an eruptive mass. I observed the following section in descending order :—

	ft.	in.
Soil.		
Clay	0	8
Hard stony coal	2	3
Hard stone	0	3
Clay	0	4
Hard coal	0	6
Hard sandstone with columnar jointing	1	9
Clay	0	3
Coal	0	3
Clay	0	2
Hard quartzose sandstone	3	0
Stony coal	1	0
Clay.		

Higher up the creek is a further exposure of the seam, and lower down the favourable felspathic sandstone crops out in the bed. The sandstone occupies the lower part of this range. and has the appearance of passing under the diabase crown to Llandaff, but whether it really does so or not cannot be definitely stated. If it does, the Steep Creek seams ought to be found here also. The strata to the N. and S.E. are cut off by diabase in rather low ground, but the flat at Glen Albyn, Traquhoun, and Blindburn undoubtedly conceals the sandstones of the coal measures. How far they go down can only be proved by boring. The best boring sites are on private property; I should say, on Glen Albyn and Traquhoun. If it could be arranged to put down a bore on the flat

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land while the drill is in the neighbourhood, it would set the question at rest. The diabase to the east of Glen Albyn, between the farm and the coast, is much lower than that on the range, and the question again presents itself, whether the lower exposure of this rock is another and lower sill, or whether faulting has happened. And further, may we expect to find freestone again below the lower horizon of diabase, or does the latter go down indefinitely?

Denison River Coal Field.

At the northern boundary of the township of Bicheno, opposite Diamond Island, the granite country along the shore-line is replaced by the sandstone of the Upper Coal Measures. Incidentally, it may be mentioned that a line drawn northwards across Maclean's Bay from this point 7½ miles would strike granite again at Long Point, the intervening coast-line being sandstone. The line of contact between sandstone and granite is concealed by the waters of the bay. Southwards a narrow strip of granite runs through Bicheno, down Freycinet's Peninsula and Maria Island, and is prolonged to the Hippolyte Rocks.

The coast-line and flat country along Maclean's Bay comprise the sandstones referred to, and these mount up into the coastal range to a height of over 800 feet, when they are surmounted by columnar diabase. Here, too, there are coal seams in the level country at the foot of the hill, and others well up in the range. Some of these seams were worked between 1850 and 1860 by the Douglas River Coal Mining Co., which took up 1800 acres of land, which extended as far north as the Denison Rivulet. The old shafts on the Denison River, about 100 feet above sea-level, are not now accessible, but authentic reports state that two seams of coal were cut and worked for a little time—a 4-feet seam, at the 92-feet level, consisting of two parts, 2ft. 7 in. and 1 ft. 5 in., and a 5-feet seam at the 165-feet level. The carriage to Bicheno (four miles) was found too costly for profitable working of these "inner mines," consequently, after raising about 800 tons of coal, the owners removed to the Lagoon country, within three miles of the port, to which they laid a wooden tramway. The bottom seam of the inner mines yielded good-quality coal. The company, in its report, 1850, p. 24, says:—

"It was tried at Mr Walker's establishment in Barrack-street, and Mr. Robert Walker states that with this coal the boiler was heated 40 minutes sooner than had been usual. It was tried in Mr. Davidson's foundry, in the smelting furnace, where the tilt-hammer is worked, for which a strong heat and much flame are essential; and it was considered to be superior in heating power to some English coal which they had been using, and for which they had paid 35*s*. per ton. Messrs. Easby & Robertson gave an equally favourable account of the behaviour of the coal at their establishment, where, after being tried in the forge, it was used to heat the furnace for working their steam-engine."

At the Lagoon or "outer" mines a small seam was passed through at 90 feet, and a 5 to 7 feet seam at 192 feet. A bore from the 192-feet level proved the strata downwards for another 164 feet, being a total depth of 356 feet, but no further seams were met with.

The published descriptions of the bottom seam worked by the company at the outer mines are discrepant. Mr. Selwyn, in his report on some of the coal seams of Van Diemen's Land, 1855, gives the section of this seam as under:—

	ft.	in.
Black shale	2	0
Coal	0	6
Parting	0	3
Coal worked	1	8
Parting	0	3
Coal	0	6
Black shale	2	0
	7	2

Mr. Chas. Gould, in his Report on Coal Fields, 1861, represents the same seam as consisting of—

	ft.	in.
Black shale	2	0
Coal	0	6
Parting	0	3
Coal	0	6
Black shale	2	0
	5	3

Parting 3"
Coal worked 1' 8"

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After realising the nature of the seams as presented by either of the above sections, I do not think surprise need be felt at the company ceasing operations. Mr. Selwyn figures out estimated contents of the 20-inch seam as 800,000 tons of coal per square mile; but any such calculation is superfluous and delusive, for the simple reason that a seam of this size and quality cannot be worked profitably. After the company stopped working there was an irruption of water into the workings from the Lagoon, and this now blocks all ingress.

The idea has been expressed that the seams near the Lagoon are continuations of those cut in the Denison River shafts at the inner mines; but I do not think they are, because the latter are a hundred feet higher than those at the outer mine, and the dip of the country is in opposite directions.

Four shafts were sunk near the offices, and borings were put down all over the flat, but with no result beyond proving the existence of seams. No records of these bores are available, but as no seams were worked, it may be assumed that those met with were not payable.

I proceeded from here to the Denison River, where freestone is seen on Thornbury's farm. Going up the river from Thornbury's, I saw a few exposures of coal in the bed and banks. Only 8 inches of the first of these was above water. I was told the seam is about 4 feet thick, 18 inches of which (at bottom) consists of bright coal, the rest being interrupted by bands. A small tunnel was cut in the north bank about 50 years ago, and a little coal was seen at the entrance. Fifty yards further up the river is a clay bank on the north side, and a 5-inch seam of impure coal above the clay, about 20 feet above water-level, and under 15 feet of soil with boulders. About 200 yards higher up a small tunnel has been driven into an outcrop on the N. bank of the river. About a foot of rotten and inferior coal is now exposed. It may have been a little thicker, as the tunnel is now fallen in, and there appears to be no roof, but only a cover of boulder clay. This may account for the decayed nature of the coal. To the north of this would, I think, be a good site for boring on private land.

The old inner mines of the Douglas River Coal Mining Company are on the Denison River, not a mile from the sea. Three shafts have been sunk, one on the north side, two on the south side of the stream, within a chain of each other. A north and south fault exists near the shafts, owing to which a bore was put down 300 yards distant from one of them without intersecting a seam. I have already alluded to the good bottom seam worked here. Mr. Gould gives its section as:—

	ft.	in.
Gas coal	1	3
Soft band	0	3
Coal	1	4
Black band	0	6
Clean coal	1	0
Band of coal, with stone...	1	0
TOTAL	5	4

The upper seam is so split up with bands that it cannot be considered as payable, and, according to the above section, the lower one is none too profitable. This is about 24 miles from Cole's Bay.

About two miles up the Denison a series of seams was exploited by the Morning Star Company in 1898. The river-bed rises in this distance to 425 feet above sea-level. These seams were already known in Mr. Gould's time, and are familiar to those interested in them as B 1, B 2, and B 3 seams. They are in the same greenish-grey sandstone which encloses the lower seams, and the strata dip in the same direction as at the inner mines, viz., S.W. about 3°.

At a height of about 280 feet above sea-level, and 40 feet above the river on its north bank, is an old shaft, now filled in, which was sunk about 17 feet through a 3-feet formation of broken impure coal, resting on clay floor, and sandstone below. There is no proper roof seen, as the coal is covered with soil. If work is continued here by driving into the hill, it will probably show a solid seam to exist further in.

A few chains higher up the river is seam B1. A drive N. has been put into this for 14 feet, but is now half-full of water. The floor of the seam is a soft grey clay. The coal is 17 inches thick, its appearance clean, alternately dull and lustrous, practically the same coal as in B2, about to be described. Fair samples from this seam

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have been analysed by Mr. W. F. Ward, the Government Analyst, who reports as follows:—

	Per cent.	
Fixed carbon	54·8	
Volatile matter, gas	32·4	Gives a very firm coke.
Moisture	5·6	
Sulphur...............	0·6	
Ash	6·0	
	99·4	

The coal is dense in texture, breaks in large cubical pieces, soils the fingers readily, and is free from pyrites. According to the analysis, it corresponds nearly with the requirements of a gas coal, which ought not to contain more than 5 per cent. ash, ½ per cent. sulphur, should have 35 per cent. to 40 per cent. volatile matter, and give 58 to 60 per cent. of good coke. Tried on the open hearth, the B1 coal gives a good heat, emits a bright yellow flame, and fuses fairly well. In fixed carbon it is a few units higher than Mt. Nicholas coal, and ought to prove an excellent smith's coal, as the proportion of carbon ensures heating power, the sulphur contents and ash are low, and it cokes sufficiently for the forge. It should answer well for steaming purposes, the ash and sulphur being so low, and fixed carbon high, and it does not appear to have enough iron in it to fuse and clinker on the bars.

The Morning Star Company had an analysis of this coal made by Mr. Austin Allom, Launceston, 9th May, 1898, and this corresponds substantially with that made by the Government Analyst, as given above. Mr. Allom's assay was:—

		Per cent.
B 1. Bright bituminous coal—	Fixed carbon	55·15
	Volatile matter (gas)...	33·00
	Ash........................	6·85
	Water......................	5·00
		100·000

Further down the river, at 200 feet above sea-level, is the big seam, called the 3-feet seam or B 2, below the 17-feet shaft mentioned above. A tunnel has been driven into it 60 feet on the north side of the river. The section in descending order is—

Sandstone roof	40 feet
Coal	16 inches
Band or parting	5 ,,
Coal	3 ,,
Band	2 ,,
Coal	5 to 6 inches
Clay parting	1 inch
Coal	3 inches
Hard clay floor level with river.	

The top coal thickens sometimes to 20 inches. The coal below would not be payable to work. The dip of both B 1 and B 2 is identical, about 2 or 3 degrees S.W.; but the difference in level precludes the idea of them being the same seam, though the quality of the coal is similar in each. The samples which I took from B 2 were analysed by the Government Analyst, with result as under :—

	Per cent.	
Fixed carbon	54·0	
Gases, &c.	33·5	
Ash	5·6	Gives a fine coke.
Sulphur	0·6	
Moisture	6·3	
	100·0	

Tests of coal purporting to come from seams B 1 and B 2 were made by the Launceston Gas Company in 1898, and gave highly satisfactory results. Mr. Arthur Green, the manager of that company, reports to the Morning Star Company, under date of 21st April, 1898, as follows :—

"We charged two retorts, each with 2 cwt. 3 qrs. of coal, one retort being charged with coal from No. 1 seam, B claim, and the other from No. 2, B. The charges were left in for six hours, and produced coke as under :—

"No. 1. 2 cwts. 0 qrs. 9 lbs. }
No. 2. 2 cwts. 0 qrs. 0 lbs. } (= 74·18 per cent. coke)."

"The coke from both samples was very similar : it is a good marketable coke, and burns beautifully, giving out a great heat. I have seen nothing like it before from any

Tasmanian coal, and have no doubt that, with proper coke ovens, you will be able to turn out a very excellent and valuable product."

Mr. Green further reports, April 27th, 1898:—

"I have to report that a test has been made at these works of the coal from your 1 and 2 B claims for coke. In this instance the coal was left in the retorts for 12 hours, the result being that a very excellent coke was obtained. The results of the tests made to-day in your presence for gas are as under:—

"Gas made per ton of coal—10,000 cubic feet.
Coke ,, ,, ,, 13 cwts. 3 qrs. 2 lbs. (= 68·84 per cent)."

This is eminently satisfactory, as anything over 60 per cent. clean coke is excellent. From inquiries which I made on the spot, I am satisfied that the coal which was broken out of this mine for the above tests was duly loaded on the railway truck at St. Marys. It is, consequently, strange that a trial of a sample of the B 2 coal at the Thornhill Collieries, Dewsbury, Yorkshire, in March, 1899, proved very unsatisfactory in respect of its coking properties. The sample was taken by Mr. M. J. Griffin, Inspector of Mines, in the presence of Mr. Bedgegood, who informed me it was a fair sample of the coal which would be sent away. I have seen the remaining half of the same, and it is in every way representative of the seam.

It was given to T. L. Ingham, Esq., of Leathley Hall, Otley, Yorkshire, during his visit to Tasmania in 1898, and he handed it over to E. T. Ingham, Esq., of the Thornhill Collieries. The latter gentleman's instructions to his head coke-burner were as follow:—"27th March, 1899.—I send you herewith a sample of coal. Carefully reduce it to pieces no larger than a pea. Place in a wooden box inside one of your best ovens, so that it shall be thoroughly well burnt. Break the sample in half, taking care not to break it up more than necessary, so that you may judge of the fracture and quality, and report to me in writing the number of hours it has been burnt, the conditions generally, and your opinion of the quality of the product. The sample to be returned to this office entire."

The coke-burner's report on the test, 30th March, 1899, is as follows:—"The sample of coal received on 27th March, and the instructions with regard to it have been carried out. The coal was broken up and inserted in an oven working under the best conditions, both with regard to the oven itself and the dry load it contained. It was burnt 68½ hours at a good heat. The condition of the burnt sample is very poor indeed, and such coal as the sample will not make coke under any conditions, as it could not have had a better trial."

Mr. J. L. Ingham reports upon the coke obtained as under:—"30th March, 1899.—I have examined the coke from Tasmania burned by Ainsley. It is very soft and friable, and there does not seem to be any tendency to cake. It is fairly dense in the fracture, but very light in weight; in fact, is not a coking coal at all. It has turned into little round nodules about the size of a pea, which are more or less held together, but which separate fairly easily with rubbing. It is fairly bright in colour. Am I to have it analysed? It hardly seems worth it."

The coke was analysed by Reynolds and Branson, Limited, Leeds, and Mr. F. W. Branson, F.I.C., reports:—

"12th April, 1899.—The following is the analysis of the sample of coke received from you on the 8th inst.:—

	Per cent.
Moisture	7·90
Ash	8·30
Sulphur	0·82
Carbon by difference	82·98
	100·00

Ash and sulphur very fair, but the coke is mechanically very poor, and useless for any metallurgical purposes."

The coke has been returned to Inspector Griffin, and may be inspected at my office. It is a bright nodular variety, apt to crumble.

Mr. E. T. Ingham reports with reference to the whole test as follows:—

"25th April, 1899.—My own opinion is, this coal, the Morning Star B2, will not make a first-class coke by itself, but with the addition of a small percentage of

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bituminous coal, and the two thoroughly mixed together and ground to pieces less than $\frac{1}{8}$ in. diameter, I think it would make good foundry coke. The mechanical condition of the coke is poor, having been pounded up by hand, and it *might* have agglomerated more (which is what we desire) if it had been passed through a disintegrator. The ash is rather high, but the sulphur is fairly low, indeed quite as low as our best blast-furnace coke. Foundry coke should not exceed 7 per cent. sulphur, and ash 6 or 7 per cent., but this latter is not of so much consequence. I send herewith the coke itself, as burnt in my ovens."

The discrepancy between the English and Launceston reports is striking, and calculated to cause uneasiness, but as Mr. Ward's analysis confirms the tests by Mr. Allom and the Gas Company, the difference may be due either to the nature of the respective samples operated upon, or to the treatment. We know very well that when coke is manufactured in quantity, the product is firmer and more coherent than when made on a small scale, as the heat is greater and combustion is more perfect. Then, again, the methods of coking vary according to whether the coal is burned primarily for the production of gas or for coke. In the former case, the coke, a secondary by-product obtained in close vessels, is generally spongy and not so well suited for metallurgical operations.

In the next place, the sample taken was from exposed coal, and the latter may have been lying some time, to the injury of its coking properties. In this connection I may quote J. Arthur Phillips, who, in his "Elements of Metallurgy," page 45, says:—

"It has been asserted on good authority that certain Welsh coals lose their property of caking after a few days' exposure to the air, and M. de Marsilly states that strongly caking coal, which affords an excellent coke when fresh from the pit, yields an imperfect coke after exposure to the atmosphere for six months."

I am inclined to think that the poor results obtained from the English test must have been due to the inherent nature of the sample operated upon.

About 20 feet above B 1 seam there is an outcrop of very inferior coal, which has not been opened upon. It is in the south bank of the river, and presents the following section :—

	ft.	in.
Stone	0	3
White band	0	4
Stone	0	2
Shaly coal	0	4
Band or parting	0	3
Shaly coal	10	0
Band	0	3
Shaly coal	1	8

This does not show anything encouraging, but a few yards higher up the river the B 3 seam is exposed as a broken coal formation under a sandstone bank. A tunnel has been driven into it in the north bank of the river, but it is not now in a safe condition for entering. In the bottom part of the seam is 2 feet 6 inches fair-looking coal, with one parting. It contains 13 per cent. ash, and does not form coke. The seam might be worth following up, as the samples which I took were from near the entrance. The tunnel is stated as 55 feet long. The analysis of my samples by the Government Analyst was :—

	Per cent.
Fixed carbon	53·1
Gases, &c.	28·9
Ash	13·1
Moisture	4·9
	100·0

Sulphur not determined. No coke formed.

A little above the seam just alluded to a small seam, 1 foot to 18 inches, crops out, but no work has been done upon it.

I did not visit any seams higher than these, and do not know whether any exist, but the Upper Sandstone Measures continue for 200 or 300 feet higher before they give place to the diabase crown of the range. The known vertical extent of these sandstones here down to the bottom of the old Douglas River company's shafts is about 700 feet; but the actual horizon is affected by faults.

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In a gully falling into the Denison, below the B 2 workings, I saw a seam of coal 2 feet 4 inches, but not opened upon enough to give an idea of what it really is. In another branch of the gully, at the same level, Mr. Mayson reports a recently-discovered exposure of 30 inches of superior coal; and this may be the same seam.

The general dip of the whole series, both up on the ranges and down at the inner mines, is gentle, and in a south-westerly direction. The only dip in a reverse direction is on the coast at the outer mines. The difference of dip may be due to either of two causes: firstly, it may represent two sides of an anti-clinal; secondly, it may be due to faulting. Minor faults in the area suggest the latter, and, if so, boring to a depth of several hundred feet on the level ground near the sea might pierce the same seams as are found in the hills. The old bores executed by the Douglas River Company were, apparently, not deep enough for this purpose.

Unfortunately, while the quality of some of the Denison coal is so good, the seams which have been discovered so far are not sufficiently thick to put beyond doubt the possibility of their profitable working. Mr. Ingham, of the Thornhill Collieries, in writing about the Denison coal, says:—

"B 2 seam is, practically, only 20 inches thick. I may say that no seam of this thickness is workable, unless of exceptionally good quality, such as our Yorkshire seam—the Better Bed—with which the Low Moor Iron is manufactured, and which makes a magnificent coke, with only ·5 per cent. of sulphur (one-half per cent.) and about 5 per cent. of ash."

I may add, that while such thin seams can only be worked under unusually favourable conditions—low wages, machine-cutting, solid roof and floor, near markets—seams over 8 and 10 feet thick are not required, as their working becomes more difficult.

B 1 and B 2 are the best seams, and these give 17 inches and 16 inches of good coal. The lower part of B 2 does not seem good enough to work; even if it were, it would only give another foot. Of course, systematic boring might disclose more powerful seams in these measures. I think also that, provided the quality of coal is satisfactory, some chance of profitable working is offered by the lower seam of the inner mines, where 3 feet 7 inches of coal was worked with two bands—three inches and six inches respectively. A seam need not be condemned on account of its partings, provided they can be easily separated from the productive part of the seam ; but the whole question of profit and loss will require working out very carefully.

Douglas River Coal Field.

Two and a-half miles north of the Denison the Douglas River flows into Maclean's Bay. The level land along the coast continues to consist of the Mesozoic sandstones, sometimes yellowish-brown, sometimes greenish-grey, but always of the soft felspathic granular nature of the stone of this geological horizon.

On the sea-coast, about half a mile south of the Douglas, some low cliffs or banks, 10 feet high, called the Porches, have been eroded into cavities and pot-holes by the sea. They are formed of beds of yellowish-green felspathic sandstone, with fragmentary layers of clay containing lignite and coal. One of these clayey patches shows a tree-root in a vertical position, with a spread of about a yard wide. I saw no other fossil remains. The dip of the beds is very slight, about 2° to the N.W.

About half a mile further S., at Harmon's Creek, a small shaft has been sunk in sandstone, called Allen's shaft. At 70 feet it is reported to have cut shale. On the beach there are some thin coal seams at sea-level.

I followed the sandstone strata up the range as far as 500 feet above sea-level, and estimated their continuance for another 300 or 400 feet, so that, at least, 800 feet of these measures may be taken as existing above sea-level. The upper part is obscured by the talus of diabase, which forms a heavy overburden, and conceals the junction of the two rocks. The diabase, which rests on the mountain's summit, has an apparent thickness of between 200 and 300 feet. The section afforded by the course of the Douglas river is highly instructive. The stream, in its upper part, flows due south, and in its lower reaches, due east. By this means, the diabase cap of the mountain has been cut through down to the underlying sandstones which form the river-bed and cliffs on its banks. This section indicates that the sandstones are not beds which merely lie against the eastern wall of a ridge of diabase, but really pass underneath the latter, at least as far into the heart of the range as the stream allows them to be observed. At the same time, theory requires us to assume the existence somewhere of central masses of the eruptive rock, and the intrusive sheets, could we follow them, must inevitably lead to these masses. This makes it difficult, in any given locality, to say how far the coal measures may continue below the intrusive sheet before they are cut off by the igneous boss or stock.

A confirmation of the above interpretation is found in the No. 5 bore, put down by Inspector Harrison in 1888, in the sandstone in this range, 2½ miles from the coast, at a height of 500 feet above the sea, and continuing to 145 feet below sea-level, without touching any diabase, although the bore-hole is nearly under the columnar face of St. Nicholas' Cap. If the diabase had formed a central boss here, a bore of this depth and at this place might have been expected to come in contact with its subterranean flank.

Four bores were put down at Seymour in 1888, and as their particulars do not appear to have been published before, or, if published, are out of print, I give them in the appendix to this report. They will be useful as a guide to future work. I have marked their approximate positions on the accompanying chart.

No. 1 bore left off in the hard floor below a foot of coal at 169′ 5½″. The last 20 feet of boring was in shale.
No. 2 bore left off at 308′ 3½″, in mud shale, with pebbles.
No. 3 bore left off at 247′ 1¾″, in eruptive rock, diabase.
No. 4 bore left off at 892′ 3″, in conglomerate, with rotten granite boulders. The last 430 feet of this bore were in the mudstones, limestone, and conglomerate of the Permo-Carboniferous system.

An important feature revealed by the No. 3 bore at Seymour is the existence of the igneous rock intrusive into the Mesozoic sandstone. It shows that an effusive cap theory, pure and simple, is untenable.

For 50 or 60 years back coal has been known to exist in the Douglas River. In 1881–2 some was taken out for trial by Messrs. Gill and party.

At about 300 feet above sea-level pebbles of quartz, quartzite, quartz-porphyry, and granite occur strewn over the slope of the hill. This is identical with the pebble bed already mentioned on the Steep Creek hill, and I have since seen the same formation north of Seymour, near Thompson's Marshes. The absence of diabase pebbles negatives the idea of it being a later marine terrace. At this height the heavy detritus of diabase begins to appear. Descending into the river-bed cliffs of massive square-jointed freestone are seen, dipping slightly to the S.E. In the river-bed, about 250 feet above the sea, a seam of coal, 8 feet thick, is exposed. Its roof is grey felspathic sandstone, and its floor is clay. Dip, 5° to S.E. The coal is shaly, and appears to be of inferior quality. The seam is cut up by numerous clay partings, from 1 to 3 inches thick. Altogether there are about 6 feet of coal, and 2 feet of clay and stone, distributed in a way which makes profitable working problematical. The section of the seam on the south bank is as follows :—

	ft.	in.
Coal	0	9
Band	0	1
Coal	0	9
Band	0	1
Coal	1	6
Parting	0	1
Coal	0	3
Band	0	4
Stony Coal	0	4

Coal under water 3ft. approximately.

On the north side there was a tunnel in the same seam, but it was full of water at the time of my visit.

Half a mile further up the river there is an important outcrop, of what I consider the same seam, only its dip is in the contrary direction, viz., N.W. 5°, so that there must be an anticline. This is about four miles from the mouth of the river, and forms a large crescent across the bed of the stream, which is here about 40 feet wide. The situation is well within the range, with St. Nicholas' Cap on the N.E. The river comes down from the north between lofty sandstone cliffs. The section presented on the W. side is as follows :—

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	ft.	in.
Roof of sandstone.		
Coal, dull, black	3	6
Clay parting	0	5
Coal, dull	1	5
Parting	0	1
Coal, dense, somewhat flinty	2	0
Clay and sandstone (under water).		

In the above seam there is 4 ft. 11 in. of fair coal. The rest is inclined to be stony. The 3 ft. 6 in. at top form the best portion. Samples which I took from the upper part have been analysed by the Government Analyst, who reports :—

	Per cent.	
Fixed carbon	52·00	Yields a powdery coke.
Gases, &c.	27·10	
Ash	16·40	Sulphur not determined.
Moisture	4·50	
	100·00	

In 1881 a sample was assayed for Mr. A. J. Taylor by Mr. E. W. Woodgate, who gave the following report :—

"Sept. 29, 1881. I have examined the sample of coal received from you, and find it to be of a very good quality, and could be used for most purposes : also, after retorting for gas, it leaves a good solid coke. The majority of Tasmanian coals that I have examined do not coke properly. It is very free from sulphur, as the following analysis shows :—

	Per cent.	
Moisture	5·50	Volatile matter.
Volatile hydro-carbon	29·20	
Fixed carbon	48·10	Coke.
Ash : mineral matter	17·20	
Sulphur	0·05	
	100·05"	

The two reports are somewhat conflicting as regards the coking, but this is probably due to differences in the sample. This can easily arise, as the seam varies in quality in different parts. The coal is high in ash. The late Sir H. T. De la Beche assayed some coal from the Douglas River, probably from this seam, and obtained 14·5 per cent. ash therefrom, reporting on same :—"Good quality, like Newcastle, but large quantity of ash." Newcastle coal (in England) contains only from 1 to 6 per cent. ash, and has from 55 to 70 per cent. fixed carbon.

Mr. Hy. Rosales reported on this coal to Mr. F. M. Gill, Nov. 10, 1882 :—"The quality of the coal is bituminous, and it burns in an open fire with a fairly bright flame, leaving a black cinder, partly coke."

Dr. Milligan (Pro. Roy. Soc. 1849, p. 65) visited this seam, and writing of the lower outcrop, says :—

"The coal is of a deep black colour: its structure is cubical, but a few inches near the bottom of the seam incline to slaty with a flat conchoidal fracture. Its lustre is bright, rich, and splendent, like that of resin or jet, and it is easily frangible: it ignites readily, fuses to some extent, gives out dense volumes of black smoke, and burns, in a mass, with a wild ruddy flame and strong glare, yielding in detached pieces exposed to red heat, long piping jets of bright white flame."

The seam could be worked from a little lower down the river, and the basin cleared of stones, which now dam back the waters. The tramway would run on the north side of the river. Seymour is distant, probably, 6 miles by a tram route, but the harbour question would have to be considered first. The distance from the Douglas River seam to Cole's Bay being about 28 miles, we may perhaps consider this field as outside the area which that harbour would serve. If a few of the seams near Seymour were worked by a strong syndicate and the port made practicable to some extent, the produce of the Douglas River seams would find its way to Seymour without much difficulty. The harbour question, however, is one which I cannot touch upon.

The upper seam in the Douglas is one of the thickest met with in this range, and should be opened out and tested so as to give a fair idea of what the average quality of the coal is likely to be. The small drive into it has been abandoned nearly 10 years, and the weathered exposures are unsafe *criteria.* I would not advise any arrangement for working on a large scale until more work has been done. If small shipments can be effected at Seymour, the seam is well worth trying, but the coal, as now exposed, does not seem suited for anything more than domestic and forge use. It is not an ideal coal for steaming. It has too little fixed carbon: its proportion of ash is none too low, and it gives out a good deal of smoke. Still, I dare say it could be used for that purpose.

Coal Creek (D.)—About two miles up the Douglas River a creek flows into it from the south. A mile up this creek there is a two-feet seam of coaly clod resting on a clay floor, and with a roof of massive sandstone. The exposure is in the creek bed, half concealed under broken prismatic columns of diabase. Hence, I could not get at it properly, or ascertain really whether any coal exists. What I saw was wet and soft, and filled up with talus. This was about 300 feet above sea-level.

Lower down the creek, the bed of which is choked with diabase boulders, a seam of coal crosses it, and is exposed by a short tunnel, 8 feet in length, on the west side of the gully. I was told this tunnel was driven by Cooper Bros. over 15 years ago. The seam contains 2 feet 8 inches of coal and about 8 inches of partings. Its section is as follows:—

	ft.	in.
Sandstone roof.		
Shale, with some coal		2
White clay band		1 to 3
Coal		6
Hard grey clay band		1
Coal		9
Hard dark band		2
Coal		17
Floor, clod and shale.		
	3	4

The bands are variable, the 1-inch parting cutting out at one place, where it is replaced by good coal. Some of this coal is dark, with lustrous layers, burns freely, and cokes well. Mr. W. F. Ward's analysis is :—

	Per cent.	
Fixed carbon ...	50·8	
Ash	12·3	Yields firm coke.
Gases, &c.	30·9	
Moisture	5·5	
Sulphur	0·5	
	100·00	

It is to be regretted that this seam is too thin for profitable working. The dull portions of the seam show a rather dirty coal, and this will not make a clean coke. The seam and the sandstone have a dip of about 5° from the horizontal to S. 10° E. The coal is only a few feet lower than the lower outcrop in the Douglas River; it dips in the same direction, and it may be the same seam. The roof is the usual grey felspathic sandstone, somewhat micaceous and pebbly, with imprints of fossil leaves and wood.

Descending the gully several exposures of impure carbonaceous material are seen, none of which are of any good for working, but which serve to show that conditions were favourable for the formation of coal deposits.

Only seven or eight feet below the above seam about 2 feet of stony carbonaceous clay are seen. Nearly 100 feet lower down, a similar dark stony clay is exposed below a 1-foot clay band. If there is any coal here it is likely to be above the clay. In fact, on the E. bank, it is seen above the clay, but ill-exposed. It looks as if it might be the black clod bottom of a seam. Here huge columns of diabase cover the stream, which trickles through underneath, hidden from sight.

Some 10 feet lower down a flat earthy seam is exposed in the bed of the creek, but it is too stony to be of any value. A bandicooting description of a tunnel has been driven in the west bank, but does not seem to have turned out any coal; moreover, the overburden in this place is too heavy for any seam to be properly cut into without driving some distance. A few yards still lower down is another flat seam 5 or 6 inches thick, but stony, and of no good.

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The banks of the creek are steep and inconvenient for economical working, but there are no insurmountable difficulties if a really good seam were discovered. Nothing at present shown in the gully will pay to work. It will be remembered that the seams dip east of south, and I recommend, as the best way of ascertaining whether they improve, and of testing the country generally, that a bore be put down about a mile or so to the south-east, as far up Harman's Creek as can be conveniently got with the drill. There is a ti-tree marsh at the head of that creek, and there, or below there, are spots well suited for the drill. The ground rises gently from the sea for 200 to 300 feet, and the creek has water all the year round.

In the back country, a seam of coal has been recently discovered, about a couple of miles north of Lyne's Sugar Loaf, 7 miles inland; but the discoverers had left the district, and it could not be visited.

In concluding this part of the Report, I may draw attention to the proofs of a coal-field occupying the country, from Llandaff to the Douglas, for about 11 miles by an average of two miles. It extends as a fringe to the north of Seymour. The measures have every appearance of passing, at least, some distance under the mountain ranges. Even if a core or ridge of diabase should be found to occupy the centre of the mountains, the ravines cut by the rivers show that the coal measure sandstones run a good way under the igneous sheet which proceeded from the core. If, therefore, the seams are found profitable, I do not think fears of them being cut off by the eruptive rock need be entertained for a long time to come.

The Douglas River end of the field contains seams of coal as thick as 7 feet, of which, perhaps, 4 to 5 feet could be worked, but more development work is requisite before a definite opinion can be expressed, especially as the coal tested contains much ash, and only yields coke in a thin unprofitable seam on the South Creek.

The Denison field has a better coal in its outcrops in the ranges, B2 yielding a fine coke, but, unfortunately, in a seam which would not give more than 2 ft. 4 in. workable coal at the most. More work here, too, is required on the B3 seam, 2 ft. 6 in. of which is fair looking, but not a coking coal. The lower seam of the inner mines, 3 ft. 7 in., is the one which would appear to offer most inducement at present, but I have no evidence of the nature of its coal.

Going south towards the Upper Apsley, the diabase capping of the hills sinks, and the country seems more under the influence of eruptive rock.

South of the Apsley, on the Glen Albyn flat, the sandstone appears to continue beneath the igneous cap, but whether it really does so cannot be stated. It re-appears at Steep and Board's Creeks, Fosbrooke's Gully, &c., above Llandaff, on the south side of the range. The coal seams on the Llandaff side contain coal of variable quality, but mostly yielding a fair coke. There is a good deal of brittle, stony, and otherwise impure coal, which detracts from the working value of the seams. Thus, of the 3 feet 6 inch seam, one of the most important of all, I should estimate not much more than 2 feet as marketable, and in the top seam, measuring 12 feet and upwards, perhaps not more than 3 feet is fit for sending away Until the outcrops are opened out more, it is unsafe to say how far they would justify a large outlay. The output must be large in order to support the cost of a tramway to the port. None of the outcrops which I saw would do this if worked singly, but two or three, worked in conjunction, might yield a profit. I think there is a likelihood of piercing the same or additional seams at the foot of the hills, where they will be nearer to the port of shipment, and may possibly prove of superior quality, through being farther away from the eruptive rock. Consequently, I have advised the bores referred to above. The Comb End part of this valley has never had a trial, and deserves attention, though the measures are more likely to be found disturbed than at the Llandaff end.

The bores about to be put down will test the ground, about which so much uncertainty has been felt in the past, and I regard this work as one to which the residents on the East Coast are unquestionably entitled.

SCHOUTEN MAIN.

This tinfield is reached by following the Nine-mile Beach from Swansea, round the head of Oyster Bay. The beach, backed by sand-dunes, forms a fine level stretch suitable for driving or riding at low-water. The rock on the west side of the Bay, at Shaw's Bluff, south of the Meredith River, is diabase, which re-appears on the east side at Hepburn's Point and Buckley's homestead, and joins the granite half a mile east of the point. Dr. Milligan also mentions a greenstone vein, running nearly N. and S. along the ridge of one of the granite mountains, near Wineglass Bay.

Schouten Main is the name used for that part of the mainland which is at the head of Freycinet's Peninsula, and consists of granite, with the exception of some Silurian metamorphic sandstone on the crest and east slope of the hill overlooking Bluestone Bay and the diabase which I have mentioned. There is also some Tertiary sandstone between Buckley's and Gill's. The granite is variable in character, being sometimes the even-grained pink biotite (dark mica) granite of Mount Cameron; sometimes the coarse grey pseudo-porphyritic granite of the Blue Tier; sometimes a fine red-grained variety, like that occurring in the pebble-beds of the Mesozoic sandstones. At one place it merges into a quartzless variety, containing augite (augite syenite), called locally "green granite" (at Charlie's Creek.) In all its numerous modifications it is, geologically, one and the same, a part of the huge mountain mass of Devonian age, which forms the bulk of Freycinet's Peninsula.

Prospectors at one time or another have gone through the Peninsula searching for tin, gold, and coal, and on Schouten Main it is estimated that as much as 150 tons alluvial tin ore have been won. This tin, it is conjectured, must have been shed from reefs, and these reefs or lodes have been diligently sought for, though it must be said that no great amount of money has been expended in the search. It is, of course, quite possible that large lodes exist in the granite, and have eluded discovery hitherto; but my observations led me to refer the alluvial ore to two sources, which would be quite efficient distributors. These are—

1. Small quartz veins enclosing coarse tin.
2. Greisenised bands of granite containing small quantities of ore.

In the course of ages the degradation of the granite would account for the release of more tin than has been recovered, without the aid of any large reefs. These large reefs, I believe, are visionary.

I inspected Gill's sections, comprising two 80-acre blocks and a prospecting area of 370 acres, west of Bluestone Bay. A large flat west of the sections yielded a good deal of the alluvial tin referred to above. Another flat is just on the boundary-line between the two sections. The alluvial tin there was found 25 years ago, and was worked first by Messrs. Gill, Mayson, Gemmell, Glover, and Jack. The wash on the 80-acre block is from 1 to 2 feet deep, and has given from 3 ozs. to ½ lb. to the dish, a ton of ore having been once extracted from a space of three square yards. The tin is mostly ruby and resin, rarely black, and the crystals are not much rounded. The quality is good, some of it having gone as high as 75 per cent. The last return was 72·2 per cent. The two Koglins and party worked on these flats in 1875–7. It is considered they left all the wash which returned only one or two ounces per dish; and those who have watched the history of the work here believe that there is as much tin still in the drift as has come out of it. The flat between the two sections ought to yield something, provided water could be got to give pressure enough for a nozzle. This should be looked into.

I may mention as a matter of scientific interest, that the wash here adds one more to the list of localities where buttons of volcanic glass (obsidian) have been found. Some were discovered by Mr. Bingham in the tin-wash, 3 or 4 feet deep.

The country-rock is a pink to white or grey granite, with a little dark mica in it. In the granite is a greisenised zone, running through both sections in a north-westerly direction. Within this zone are bands of rock, from which the felspar has mostly disappeared, leaving a quartz-mica rock slightly chloritised by the decomposition of the

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original dark mica, which has given place to silvery muscovite. The rock in this form is a tin granite, such as characterises the large stanniferous formations at the Blue Tier (formerly called quartz-porphyry), and is identical with the tin-bearing stone of the Anchor, Liberator, and Australian mines. There are five parallel exposures or outcrops in a belt of 700 or 800 feet wide.

No. 1 has been worked upon by a long trench and a shaft about 15 feet deep. The stanniferous band of country is here 50 to 60 feet wide, carrying thin greisen veins. The boundary of the belt on each side is dark mica granite. The shaft sunk N.W. of this trench is in the tin granite formation, which is intersected by vertical quartz veins. The jointing of the formation is in the direction of the extension of the zone, N. 30° W. The samples which I took from the stone in the shaft did not yield any tin when assayed by the Government Analyst, but in September, 1899, the Government assay showed traces of tin and copper in stone from the bottom of the shaft; also 3 per cent. tin from a bunch of ore in the trench; and from a leader below, 1·6 per cent. metallic tin. There is an increase of pyrites towards the bottom of the shaft, and the latter is to be sunk a few feet further, to see whether the improved mineralisation means anything.

On the northern section, to the N.E. of the works just alluded to, a cut has been made into tin granite (greenish mica-quartz rock), called No. 4 lode. This greisen is exposed at surface about 1 ft. wide, and goes down in a series of bands. In the side of the cut a dab of rich tin ore was met with, and I was told that a little had also been found in the bottom. Mr. J. S. MacArthur (Glasgow) reports the assay of the good ore from here as 6·31 per cent. tin. I picked up a piece from the pile at surface, which Mr. W. F. Ward, Government Analyst, has assayed. It yielded 4·6 per cent. metallic tin. This, however, must not be taken as a representative sample. It only shows what can be found sporadically. Further samples which I took from the pile were assayed by Mr. Ward and yielded 1·2 per cent. metallic tin. This little pile contains the remainder of the patch of ore, but I could find no tin in the face. As tree roots penetrate the formation to nearly the bottom of the cut, care should be taken in sampling not to include the soft material between the joints. This cutting will be advanced a little further under the cover to see whether the tin found in the bottom continues.

No 5, higher up the hill, towards the north boundary of section, is an outcrop consisting of granite with bands of greisen. This appears to be on the strike of a long tourmaline joint further south. It is on a small knoll of granite boulders. No tin is visible in the stone, and none was obtained therefrom by assay. This line of stone has been traced a few chains north and south.

Still higher up the hill a greisen vein occurs in granite, composed of coarsely crystalline quartz, large flakes of muscovite, lithia mica, and tourmaline. A width of 18 inches is exposed, but a shot or two would uncover the whole for better examination. The samples which I brought away, however, on assay in the Government laboratories, returned no tin. The vein runs in a northerly direction in pink granite, with very little dark mica in it.

Still ascending the hill to the Pimple, 600 feet above sea-level, the crest is reached on Section 4779-93M, 37 acres, A. Dilger, where, overlooking the sea, the Swansea Prospecting Association has opened a hole about 7 feet deep, in soft granite rock veined with quartz and greisen. The felspars are becoming chloritised, and a little tourmaline is visible, enclosed in the mica. This is on the strike of the Gill outcrops. The samples which I took from here, upon assay, did not return any tin.

S.E. of Gill's south section is an area of dark brown metamorphic sandstone of nearly a square mile in extent, overhanging Bluestone Bay. As nuggets of gold have been picked up on the slope above the mine, it has been surmised that the sandstone formation may have been the source. These nuggets are sometimes in crescentic forms ½″ diameter, and in pellets like wheat grains. It is possible that some reef is still undiscovered in this sandstone, for it is a Silurian rock anterior to the granite, which has impregnated it with mica.

Gill's sections are to be further prospected. I think the large tin is likely to have come from quartz veins in the granite, but these ought not to be reckoned upon as a source of supply. The future of the property depends upon whether the greisen zone will pay to work open face, passing the whole of the stone through the battery. No doubt, enriched portions exist here and there, but these will probably be found too limited in extent, and too far apart to be worked profitably. The whole formation will have to be worked as it stands, or be left alone. It would be comparatively easy to put in a cut right across the zone, and find out its extent and limits. Then bulk-sampling must be undertaken, and the average tin contents ascertained. It must be borne in mind that this is a low-grade proposition, and I cannot report more definitely about it until the necessary work is done to provide data for conclusions. I was told that 700 feet of backs could be got in 700 feet of driving-in from the sea coast, if a convenient place for starting a tunnel could be found on the shore-line. Without endorsing the precise height, I have no doubt the figure is not far out, but I do not believe that underground mining will pay in this ground, unless a strong lode be discovered.

I am not at all sure as to the water supply, but some could be got by damming the large flat to the W., once it is worked, and a machinery site could be selected below, about a mile from the present workings. For working on a large scale the water question will form a difficulty. Cole's Bay is 2½ miles south in a direct line.

Bernacchi's Gold Quartz Reef.—From Gill's sections I walked two miles north along the granite range overlooking the sea to Bernacchi's reef, on the sea coast, E. of Fresh Water Lagoon. This was discovered about 23 years ago, when a trial crushing of half a ton in Melbourne is reported variously as returning 13 dwts. and 17 dwts. gold per ton. From the source of information I have reason to believe the former figure is the more reliable. Mr. C. J. Ramsay, of the Morning Star Company, reported, 10th May, 1898, having got out a ton of stone for a trial crushing, but I believe it was not treated. Samples which I took, and which have been assayed by the Government Analyst, yielded only a minute trace of gold ; but a battery test is the only fair way of arriving at an idea of the value of the stone.

The reef crops out at sea-level, where a short drive on its course has been put into the cliff. It is a solid reef of laminated quartz, 12 inches to 14 inches wide, white, and mottled green. A two-inch selvage occurs on the foot-

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wall, another on the hanging-wall. The dip or underlie is 75° to the S.W. The country-rock is coarse dark-mica granite, pink in tint. On the footwall side of the lode there is a narrow band of dark, slate-like, granitic wall-rock, gradually altering to normal country granite a few yards away from the lode.

I saw no pyrites in the stone. I am afraid the reef is one of those which carry no payable mineral at the outcrop. Next to no work has been done on it, and it is in an awkward position for working.

On the saddle of the hill to the S., I observed water-worn pebbles of dark sedimentary rock scattered over the surface of the ground. I can only surmise that these have been derived from slate country to the N. Further south a well-defined hard elvan crosses the granite hill. This is a dyke of typical elvan or granite porphyry, rich in potash mica (muscovite). The rock is a compact, fine-grained admixture of quartz, mica, and felspar, with porphyritic crystals and nests of crystals of quartz and felspar. It contains no mineral.

Jack's Reef.—This is a veiny quartz reef in granite country, between Gill's and Buckley's, on Crown land. It was opened upon six years ago by a 7-feet cut, exposing a vertical face. The exposed width is 11 feet. It has not been tested hitherto for gold or tin. The samples which I took have been assayed by the Government Analyst, and returned a minute trace of gold—no tin.

The Boulder.—About a quarter mile further W. is an isolated boulder of quartz, which has excited much interest and curiosity in the district. It is a block of clean quartz, lying in a clayey, pebbly, and quartz wash. The valley is 250 feet above sea-level, and is apparently eroded in cemented Tertiary sand, bluffs of which are exposed in massive beds, 20 feet thick, a little distance to the west of the boulder. The boulder itself is 6 feet × 5 feet × 4 feet is a little smoothed by the action of water, and is composed of dense pinkish quartz, with here and there excessively finely divided pyrites. The ground around it has been excavated, and this shows that it is not *in sitû*, but where it has come from can only be conjectured. It has most probably been derived from some reef in granite,

Basal Pm ?J.

or or basal Pm

or grey-billy type material from R/Sd dolerite contact.

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country, judging by the rather peculiar appearance of the quartz. It may have been imbedded in the wash while the latter was being deposited. This view removes all difficulty as to its transport, for though the sand bluffs are now 250 to 300 feet above the sea, they were at sea-level at that time, and the granite peaks of the Peninsula would still be high above the deposit. Some stones of slate and sandstone are found in the wash or in the surface soil, but these have no particular bearing on the question.

It was found 25 years ago by Mr. Gemmell, and half a ton of it was assayed in Ballarat, for 9 dwts. gold per ton. A trial like this is more satisfactory than the assay of the few samples taken by myself, which the Government Analyst reports did not contain any gold. As it is an individual boulder only, its occurrence is not important, unless it can be identified with its parent reef, which is probably not far off. The configuration of the country at the time it was deposited was different from what it is now; hence search for the reef on the hillside immediately above the boulder may be quite fruitless.

Some iron ore not far from Buckley's is of doubtful origin; that is, whether it be veinstone, or merely concretionary, like so much of the ironstone at the head of the bay. An assay of it by the Government Analyst showed that its contents in precious metals were *nil*.

Schouten Main Mining and Dredging Co.'s Claim.

I visited these properties comprising 4 dredging leases, of 39 acres each, and a mining lease of 20 acres, as follows:—D.C. 235, 39a. 3r. 9p.; D.C. 236, 39a. 3r. 9p.; D.C. 208, 39a. 3r. 29p.; D.C. 209, 38a. 2r. 31p.; 93M. 4387, 20a.

These are on the Saltwater Creek, on Schouten Main. There is a connection by track both to Buckley's, at Hepburn's Point, 2½ miles, and to Cole's Bay, 1½ miles, originally called Meredith's Fishery Bay.

The lower part of the claim is a flat, through which the small Saltwater Creek meanders sluggishly, the ground being full of nearly dead water. The banks of the creek show wash under 2 feet of soil. The part of the flat taken in by the claim is 5 chains on each side of the creek, which in this part of its course flows W. The plain is bounded N. and S. by low granite hills, strewn with sea-sand. In the western portion of this flat four holes have been put down to a depth of 10 feet, the first 4 or 5 feet being in sand, the rest in a wash of small gravel. As far as I could learn, the drift in this part of the property did not show much tin: on the other hand, the holes did not go down to bedrock, on account of the water. The wash has been invaded by the sea, and what tin there is is much finer than in the upper part of the property.

Where the creek changes its course from N.—S, there is a small shallow lagoon, in which a dozen bores have been put down 15 to 20 feet, bottoming on soft granite. I was told that the same quality of wash was met with as that shown in the tin-bearing shafts further north.

Going up the creek from the lagoon northwards, the valley between the hills contracts, and the drift channel north of the camp on the 20-acre section does not exceed a chain in width. Still further north it pinches to about half a chain, widening out again finally to about 4 chains.

For about a mile up the creek from the lagoon a series of 30 holes and small shafts have been sunk to test the ground, which, on the whole, has been well prospected, the intention evidently having been to find out what it is really worth. The first hole is a chain east of the lagoon. It is down 6 feet in sea-sand, and shows a little gravel in the bottom. No. 2 shaft, a little further north, is 12 feet down, with an 8-feet borehole in the bottom. A sand and-quartz wash was touched at 3 feet below the soil. No. 3 shaft, to the north, is down about 20 feet in sea sand of granitic nature, and has bottomed on granite. Prospects from this sand, assayed by the Government Analyst, yielded 44 grains metallic tin per dish = 0·042 per cent = about $\frac{1}{10}$ oz. per dish, or $\frac{1}{2}$ lb. to the cubic yard. No. 4 shaft has been sunk 20 feet, and has not bottomed. The wash is here about 3 chains wide, and the gutter seems to be close to the hillside on the west, which rises steeply. No. 5 shaft is sunk 12 feet, and has not reached bed-rock. This shaft is near the camp. The wash appears to improve going north. The prospects taken were assayed in the Government Laboratories, and returned 113 grains metallic tin per dish = 0·107 per cent. = say nearly $\frac{1}{4}$ oz. per dish, or $1\frac{1}{4}$ lbs. to the cubic yard. A shaft N. of the

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camp bottomed at 10 feet, where the channel of wash is not more than a chain wide.

Further north a trench has been cut down to the bed-rock a couple of feet in wash, here one chain wide, contracting to half a chain, and of good tin-bearing quality. The prospects washed yielded, on assay by the Government Analyst, 596 grains metallic tin per dish = 0·57 per cent. = say, $1\frac{1}{3}$ ozs. per dish, or $6\frac{2}{3}$ lbs. to the cubic yard.

The granite hills come, here, close together, with not more than $1\frac{1}{2}$ chains of alluvial between them. This, then, widens out to three chains, and acquires a stripping or overburden of seven or eight feet. An outcrop of quartz occurs here, running W. of N., and its course, parallel with the new direction of the creek, is marked by loose fragments of quartz. Prospecting holes have been put down, one in seven feet of wash, said to be worth half an ounce to the dish, and another through six feet of stripping into four feet of wash, estimated at 4 ozs. to the dish. The expanding alluvial ground has here formed a kind of basin, an ideal position for dredging. Some former prospectors worked in this part of the ground, but no record of their success or otherwise is available. The ground now pinches to almost nothing, and this seems to me the only place where there might be any difficulty in passing the dredge. This part of the claim may be taken as consisting of 10 to 12 feet of stripping and two to three feet of wash, as proved by a line of bores across the valley. The tin gets heavier as the head of the valley is approached.

Further N., where the ground is about two chains wide, shaft No. 7 has been sunk 12 feet, with four feet of wash at bottom, very wet. The prospects taken here, assayed by the Government Analyst, returned 408 grains metal ic tin per dish = 0·39 per cent. = say, $\frac{9}{10}$ oz. per dish = $4\frac{1}{2}$ lbs. to the cubic yard. The width of the alluvial pinches again.

At the northern end of the claims the stripping is six feet, and overlies four feet of wash, which contains a few stones of quartz. The creek forks at this place, and the ground is between three and four chains wide, and the prospects taken (No. 8) were the best of any. The results of assay by the Government Analyst are 778 grains metallic tin per dish = 0·74 per cent. = over $1\frac{3}{4}$ ozs. per

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dish, or nearly 9 lbs. to the cubic yard. This situation is, of course, the nearest to the assumed source of the tin, and the yield is, consequently, rather exceptional.

The prospects taken were selected for the purpose of gaining a general idea of the nature of the wash, and not for forming an accurate estimate of the value of the whole deposit. The latter would require systematic sampling from holes sunk regularly in lines across the flat at fixed intervals, and average prospects from fixed horizons in the deposit. Still, they afford some notion of the capabilities of the drift. The average of the places from which my prospects were taken gives 5½ lbs. metallic tin per cubic yard; but I consider it unsafe to include the higher values of 6 lbs. and 9 lbs. to the yard at more than the average of the remainder, which is 2 lbs. metallic tin, or 2·86 lbs. tin ore (at 70 per cent.) per cubic yard. This estimate does not fall far short of that put forward by the promoters, who reckon upon 3 lbs. tin ore per cubic yard. I cannot speak with any certainty about the ground in the lower part of the claim, as the wash there was inaccessible. Taking the ground all through, I should think a width of two chains is a fair average, and the depth is, as may be seen from my remarks, variable from two to 20 feet of sand and wash. The promoters estimate the average as 12 feet. I think this is too high an estimate for the 2 lbs. a yard quality material. The edges of the formation have to be taken into consideration, and not the deepest parts only. The mean thickness of the payable part of the wash can only be ascertained by careful trials.

The proposition is a fair one for a moderate-sized company. The only way of dealing with the ground is by dredging. A bucket-dredge is mentioned in the prospectus, but, from the nature of the flat, I doubt whether a pump will not be found more suitable. Dredging is now carried on in flats, where it would not have been dreamed of some years ago. The proprietors will need the very best expert advice before embarking on the enterprise, for tin-saving is more difficult than gold-saving, and the failures of attempts at dredging in Tasmania hitherto suggest that some general difficulty exists which has not been sufficiently realised. Apart from the quality of the material handled, I think insufficiency in quantity has been the rock on which most of our recent undertakings have struck. With good advice and ordinary care, the tin ought to be extracted from these claims profitably.

Quartz Country at Cutting-grass Marsh, near Buckland.

Cutting-grass Marsh is a marshy flat of 80 or 90 acres, about nine miles N.W. of Buckland, about 900 feet above sea-level. It lies just east of Woodsdale Bluff, called Bluff Hill. The treeless marsh-soil consists of humus and sand-grains resting on sandstone, knolls of which protrude a little from the plain. Hills of the same sandstone surround the marshy ground. There are no fossils to guide in the determination of the horizon of the strata: as the stone is not felspathic, it may belong either to the Lower Mesozoic or the Permo-Carboniferous. In the flat there is an outcrop of cellular iron ore, about three or four feet wide, which can be traced at intervals through the paddock in a direction S.E.—N.W. It has not been opened upon sufficiently to disclose what it really is, but, from the stone occurring in the paddock on the strike, I am inclined to think that it is simply a band of iron oxide in the sandstone, due, probably, to the influence of adjacent igneous rock (diabase). No gold was found in the stone when assayed in the Government laboratories, and the occurrence does not differ essentially from similar outcrops in the Swansea area. It has no value as a carrier of economic ores.

On the north side of the marsh there is a hill range, 300 feet high, on the summit of which is a trench, 10 feet deep, which has been cut down into a band of broken quartz and sandstone, about 10 feet wide, on a face of quartz which appears to be the south wall of a reef. The reef itself has not been cut into nor fully exposed. A few fathoms to the west a shaft has gone down 15 or 20 feet in a broken quartz formation, but it appeared to me a little too far south to catch the reef. The samples of quartz which I took have been assayed by Mr. W. F. Ward, Government Analyst, but returned no gold. The sandstone is a yellow quartzose variety. A few years ago some four or five men worked here for Mr. Goodwin, and gold in small quantities was reported. Since then prospects have been taken repeatedly without results. There are very likely parallel veins in the neighbourhood, as the hill to the north is also strewn with pieces of quartz. The quartz of this occurrence has an unfavourable vitreous appearance, with a tendency to be lumpy, and altogether different from the dull, mottled, massive stone of our gold quartz reefs. A little specular iron is present in the brown oxidised matter. The age of this sandstone is much later than that of the auriferous quartz reefs in the Silurian slates of the State; and the deposition of the quartz was, probably, in infiltration veins, confined to the sandstone strata. I saw some samples of quartz from French's show, three miles east of this. Some of it is radiating, mammillary, and chalcedonic quartz, of a resinous appearance; just the sort of silica which might be expected to be derived by infiltration from the surrounding rock.

Of course, the above reef has not been properly broken into, but I have little faith in it as a gold-producer, as its silica cannot have been directly expelled from the granite, which had already cooled, and even been exposed by denudation before these sandstones existed. The sandstones themselves consist of material derived from the waste of the granite hills. If gold has ever been found in this quartz, it would only be in infinitesimal quantities derived from the sandstones, which had collected it from the waste of older hills.

I have very little doubt that the diabase exists at no great depth below this freestone basin, though the nearest exposure of it which I saw was at Johnny Mac's cutting, between Mr. Jas. Cornish's farm, on the Marsh, and Buckland.

The chart accompanying this Report is a sketch map of the geology of the district. The part referring to the country N. and S. of Swansea and Schouten Main embodies my own observation; the features of the Peninsula and Schouten Island are from the best information which I could gather.

Appendices I. to V. are official Registers of the bores put down at and near Seymour by the Government, in 1888.

Appendix VI. is a tabular statement of analysis of coal referred to in the present Report, and of other Mesozoic

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coals in Tasmania, together with analyses of Newcastle coal, New South Wales and England, for comparison.

I have to tender my best thanks to many gentlemen in the Swansea district for help and information, and to all who formed the Committee for facilitating my examination, especially to Mr. E. O. Cotton, Mr. F. M. Gill, Mr. J. H. Jessen, and Mr. Jas. Lyne, who accompanied me, and Mr. A. Threlkeld Mason, who amassed a great deal of useful information for me.

I have the honour to be,

Sir,

Your obedient servant,

W. H. TWELVETREES,
Government Geologist.

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

Appendix I.

Seymour No. 1 bore, total depth 169 feet 5½ inches.

1888.

	STRATA. ft.	ins.	TOTAL. ft.	ins.
Surface soil and clay	5	2	5	2
Yellow sandstone	3	0	8	2
Green sandstone	3	0	11	2
Iron stone	0	2	11	4
Grey and yellow sandstone ...	8	4	19	8
Dark shale, hard and brittle .	3	1	22	9
Bastard fireclay	1	10	24	7
Coal and black clod	0	4	24	11
Light bastard fireclay	1	1½	26	0½
Coal	1	1½	27	2
Band	0	1	27	3
Coal	0	1	27	4
Band	0	2½	27	6½
Coal	0	1½	27	8
Band	0	0½	27	8½
Coal	0	3	27	11½
Band	0	1	28	0½
Coal	0	0¾	28	1¼
Band	0	0¾	28	2
Coal	0	4	28	6
Band, very dark	0	1½	28	7½
Coal, very brittle	1	11½	30	7
Band	0	3	30	10
White fireclay...	2	2	33	0
Bastard fireclay	5	6	38	6
Coal	0	2	38	8
Bastard fireclay	5	2	43	10
Sandy seam	0	3	44	1
Bastard fireclay	2	2	46	3
Hard blue shale	0	11	47	2
Coal	0	2	47	4
Bastard fireclay	3	1½	50	5½
Black clod	5	2	55	7½
Sandstone and blue post... ...	24	11	80	6½
Hard sandstone	2	0	82	6½
Blue shale	1	1	83	7½
Coal and shale...	1	4½	85	0

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	STRATA. ft.	STRATA. ins.	TOTAL. ft.	TOTAL. ins.
Soft greasy shale...	1	2½	86	2½
Blue shale	2	6	88	8½
Sandstone	3	4	92	0½
Hard sandstone	1	0	93	0½
Blue shale	3	4	96	4½
Coal	0	2	96	6½
Band	0	1	96	7½
Coal and clod...	0	3½	96	11
Black clod...	5	1	102	0
Dark shale...	2	11	104	11
Light shale...	0	10	105	9
Dark sandstone...	1	8	107	5
Sandstone	31	0	138	5
Coal	0	2	138	7
Firm sandstone	5	6½	144	1½
Dark hard stone	0	2	144	3½
Coal	1	5	145	8½
Band	0	1½	145	10
Coal	1	6½	147	4½
Dark grey shale	1	6½	148	11
Sandstone showing coal stains	3	7	152	6
Sandstone	1	6	154	0
Firm blue shale	6	9	160	9
Coal	0	3	161	0
Brown shale	0	5	161	5
Light firm shale	3	4	164	9
Coal	0	2½	164	11½
Black clod and dark stone...	0	7½	165	7
Black shale...	1	5½	167	0½
Light shale	0	6	167	6½
Dark shale	0	5½	168	0
Coal	1	0½	169	0½
Hard floor	0	5	169	5½

Appendix II.

Seymour No. 2 bore, total depth 308 feet 3½ inches.

1888.

	Strata. ft.	Strata. ins.	Total. ft.	Total. ins.
Surface soil and boulders ...	4	6	4	6
Sandstone	31	5	35	11
Hard shale	1	0	36	11
Fine-grained sandstone	3	5	40	4
Hard shale, full of coal marks	0	6	40	10
Fine-grained sandstone	11	1	51	11
Sandstone and conglomerate of hard shale and sandstone	19	8	71	7
Free-boring sandstone	25	10	97	5
Dark shale	3	7	101	0
Coal	0	6	101	6
Band	0	1¾	101	7¾
Coal	0	10	102	5¾
Band	0	1	102	6¾
Coal	0	1½	102	8¼
White parting	0	0⅛	102	8⅜
Coal	0	4⅛	103	0½
Band	0	2½	103	3
Coal	0	2½	103	5½
Coal, with white parting... ...	0	1	103	6½
Coal, with a few thin bands...	0	10½	104	5
White band...	0	1¼	104	6¼
Black band	0	2½	104	8¾
Coal, with thin bands...	0	9½	105	6¼
Coal	1	5	106	11¼
Light band	0	0½	106	11¾
Coal	0	1	107	0¾
Band	0	1	107	1¾
Coal	0	1	107	2¾
Floor	2	8	109	10¾
Firm shale	2	11	112	9¾
Coal	0	2	112	11¾
Brown sandy shale	3	8	116	7¾
Firm, light, sandy shale	4	1¾	120	9½
Sandy shale, full of coal-stains	1	6	122	3½
Coal	0	1	122	4½
Firm light shale	3	8	126	0½
Dark hard shale...	1	0	127	0½

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	STRATA. ft.	ins.	TOTAL. ft.	ins.
Light and dark shale, alternate layers	4	2½	131	3
Sandstone, full of coal-stains .	4	5	135	8
Blue post and sandstone... ...	20	0	155	8
Sandstone	6	2½	161	10½
Blue post	0	8½	162	7
Firm dark sandy shale	1	6	164	1
Coal	0	4	164	5
Sandstone, full of coal-stains .	2	5	166	10
Black shale, showing fern impressions	1	0	167	10
Dark sandstone	1	2	169	0
Black shale	3	0	172	0
Firm sandstone	2	5½	174	5½
Coal	0	1	174	6½
Brown band	0	2	174	8½
Coal	0	1½	174	10
Black shale, with two thin seams of coal	5	6	180	4
Sandstone, full of coal-stains .	1	4	181	8
Very firm grey sandstone ...	2	0	183	8
Clean sandstone	23	11	207	7
White hard sandstone (showing carboniferous matter) .	4	5	212	0
Very hard dark shale	8	6	220	6
Hard dark sandstone, with coal seams	1	6	222	0
Conglomerate, coal, shale, and sandstone...	1	11	223	11
Conglomerate	1	2	225	1
Black shale	2	10	227	11
Dark sandstone	2	0	229	11
Conglomerate	0	4	230	3
Coal	0	1	230	4
Dark sandstone	1	1½	231	5½
Coal	3	0	234	5½
Band of grey parting	0	0¼	234	5¾
Coal	0	9	235	2¾
Soft dark greasy band	0	0¼	235	3
Coal	0	4	235	7
Very firm sandstone	0	10½	236	5½
Dark shale...	1	0	237	5½
Dark sandstone...	2	7½	240	1
Light sandstone, with coal-stains	2	0	242	1

	STRATA. ft.	ins.	TOTAL. ft.	ins.
Blue shale	3	3	245	4
Bastard fireclay	8	1	253	5
Dark shale	2	0	255	5
Coal	0	0½	255	5½
Black shale	0	8	256	1½
Coal, with three bands	1	3	257	4½
Black shale	1	6	258	10½
Light sandy shale...	2	6	261	4½
Black shale	0	10	262	2½
Sandstone	1	0	263	2½
Grey sandstone...	5	7	268	9½
Dark sandstone	1	9	270	6½
Dark shale	0	10	271	4½
Bastard fireclay	0	11	272	3½
Dark sandstone	2	4	274	7½
Coal	0	2	274	9½
Sandstone	2	10	277	7½
Coal	0	2	277	9½
Sandstone	0	8	278	5½
Firm blue sandy shale	5	6	283	11½
Dark shale	1	0	284	11½
Sandstone	0	10	285	9½
Dark shale	1	7	287	4½
Hard coarse sandstone	0	4	287	8½
Blue shale...	2	4	290	0½
Dark shale...	1	2½	291	3
Conglomerate...	1	4	292	7
Very hard light shale	2	10½	295	5½
Mud shale, with pebbles... ...	12	10	308	3½

Appendix III.

Seymour No. 3 bore, total depth 247 feet 1¾ inches.

	ft.	ins.	ft.	ins.
Surface soil and loam	1	6	1	6
Clay	10	6	12	0
Decomposed sandstone	1	0	13	0
Sandstone	53	3	66	3
Blue shale	4	0	70	3
Sandstone	1	6	71	9
Dark shale	3	1	74	10
Dark and light shales	4	4	79	2
Coal	0	0½	79	2½

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	ft.	ins.	ft.	ins.
Band	0	2¼	79	4¾
Coal	0	5½	79	10¼
Coal and bands	0	3¼	80	1½
Coal	0	4	80	5½
White parting	0	0¼	80	5¾
Coal	0	4¼	80	10
Coal and bands...	0	6¼	81	4¼
Coal	0	5¼	81	9½
White band...	0	1	81	10½
Coal	0	0½	81	11
White band...	0	0½	81	11½
Black band	0	1¼	82	0¾
Coal	0	1	82	1¾
Dark band	0	4¾	82	6½
Coal and white parting	0	1¼	82	7¾
Coal and white parting	0	0½	82	8¼
Coal and white parting	1	8	84	4¼
Band	0	2½	84	6¾
Coal	0	0½	84	7¼
Band	0	0½	84	7¾
Fireclay	0	8	85	3¾
Sandy fireclay	2	10	88	1¾
Bastard fireclay	1	4	89	5¾
Coal	0	2	89	7¾
Fireclay	4	6	94	1¾
Light sandy shale	4	4	98	5¾
Dark sandy shale	0	4	98	9¾
Blue shale	6	9	105	6¾
Dark shale	1	10	107	4¾
Dark stained sandstone	4	1	111	5¾
Clean sandstone	8	2	119	7¾
Sandstone and post	13	4½	133	0¼
Shale	2	11	135	11¼
Light sandstone full of coal seams	0	9	136	8¼
Blue shale	5	4	142	0¼
Black hard shale	1	1	143	1¼
Dark stained sandstone	4	7	147	8¼
Dark and blue shales...	3	1	150	9¼
Hard dark brittle shale... ...	3	1	153	10¼
Dark sandstone	1	5	155	3¼
Clean sandstone	3	5	158	8¼
Clean firm sandstone	10	8	169	4¼
Firm grey sandstone	14	4½	183	8¾
Dark shale...	5	0	188	8¾

	ft.	ins.	ft.	ins.
Sandstone...	0	4½	189	1¼
Coal	0	2	189	3¼
Shale	0	8½	189	11¾
Coal	0	0½	190	0¼
Blue shale	0	6	190	6¼
Sandstone...	0	6	191	0¼
Shale...	1	1	192	1¼
Sandstone	1	6	193	7¼
Shale	0	10	194	5¼
Coal	0	6½	194	11¾
Sandstone	1	5	196	4¾
Dark shale	0	10½	197	3¼
Mottled shale...	0	7	197	10¼
Coal	0	1	197	11¼
Band	0	1	198	0¼
Coal and shale	0	2	198	2¼
Dark shale	0	3	198	5¼
Coal	2	6½	200	11¾
Band	0	3	201	2¾
Black bass	0	2½	201	5¼
Coal	0	3½	201	8¾
Shales, mottled and dark ...	4	2	205	10¾
Fine-grained sandstone, very hard	3	6	209	4¾
Light blue shale, very firm...	2	11	212	3¾
Very hard white shale	0	7	212	10¾
Coal, poor quality...	0	11	213	9¾
Very hard black shale	0	10	214	7¾
Light shale	0	2	215	9¾
Coal	0	5½	216	3¼
Shale	1	4	217	7¼
Coal	0	1	217	8¼
Very hard black shale	0	4	218	0¼
Coal	0	1	218	1¼
Sandy shale...	4	0	222	1¼
Firm sandstone...	3	11	226	0¼
Shale	0	7	226	7¼
Black shale and coal	0	9	227	4¼
Light sandy shale	3	3½	230	7¾
Black shale and coal	0	6	231	1¾
Sandy shale...	1	4	232	5¾
Dark mottled shale	0	6	232	11¾
Dark shale	0	2	233	1¾
Hard grey sandstone...	8	4	241	5¾
Greenstone	5	8	247	1¾

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Appendix IV.

Seymour No. 4 bore; total depth, 892ft. 3in.

1888.	Strata. ft.	Strata. in.	Total. ft.	Total. in.
Surface clay and drift	5	0	5	0
Yellow and grey sandstone	3	4	8	4
Hard black shale	0	4	8	8
Grey sandstone with coal stains	33	1	41	9
Hard dark curly shale	1	3	43	0
Conglomerate	3	8	36	8
Hard dark brittle conglomerate	4	0	50	8
Hard curly shale	0	8	51	4
Sandstone with coal stains	2	10	54	2
Conglomerate	1	7	55	9
Clean sandstone	40	9	96	6
Conglomerate, shale and sandstone	2	3	98	9
Sandstone	11	3	110	0
Blue shale	5	3½	115	3½
Black shale	2	7	117	10½
Blue greasy shale	1	4	119	2½
Sandy shale and bastard fireclay	14	7½	133	10
Sandstone	1	0	134	10
Black shale and coal	1	5½	136	3½
Coal and bands	0	9½	137	1
Fine-grained sandstone	1	2	138	3
Shale and bastard fireclay	4	8	142	11
Coal	0	2	143	1
Brown sandy shale	1	5	144	6
Sandy shale	7	5½	151	11½
Black shale	0	3	152	2½
Coal	0	1	152	3½
Blue shale	5	3	157	6½
Dark shale	1	1	158	7½
Sandstone, coal-stained	7	8	166	3½
Sandstone and post	6	9	173	0½
Sandstone	2	1	175	1½
Grey post	12	8	187	9½
Blue shale	6	1½	193	11
Black clod	0	1	194	0
Coal	0	6	194	6
Black shale	3	8	198	2
Sandstone, coal-stained	0	11	199	1

1888.	Strata. ft.	ins.	Total. ft.	ins.
Blue shale	0	9	199	10
Sandstone	0	11	200	9
Blue shale	2	7	203	4
Sandstone, coal-stained	4	3	207	7
Black shale	2	4	209	11
Dark sandstone	9	0	218	11
Clean sandstone	18	6	237	5
Firm sandy shale	1	6	238	11
Blue shale	1	6	240	5
Shale, with ½ inch of coal	9	6	249	11
Mottled shale and coal seams	1	2	251	1
Brown shale	2	3	253	4
Hard blue shale	1	6	254	10
Conglomerate	5	4½	260	2½
Dark shale	0	5	260	7½
Coal	0	2	260	9½
Conglomerate	2	6	263	3½
Coal	1	5	264	8½
Brown shale	1	8	266	4½
Conglomerate	3	5	269	9½
Black shale and coal	0	3½	270	1
Blue sandy shale	1	9	271	10
Fine-grained sandstone	3	7	275	5
Blue shale	1	4	276	9
Coal	0	0½	276	9½
Dark blue shale	2	8	279	5½
Coal	1	8	281	1½
Coal, showing grey matter	0	1½	281	3
Coal	0	8	281	11
Soft black stone	0	1½	282	0½
White band	0	0½	282	1
Coal, bright	0	2	282	3
Band ½ in., coal ½ in.	0	1	282	4
Dark and blue shale	8	0	290	4
Bastard fireclay	2	0	292	4
Coal	0	0½	292	4½
Dark and blue shale	10	6	302	10½
Grey sandstone, very jointy	5	0	307	10½
White sandstone	3	0	310	10½
Conglomerate, spotted with pyrites	3	6	314	4½
Green sandstone	9	0	323	41½
Pebbles and veins of carbonate of lime	2	3½	325	8
Conglomerate, with pebbles	5	2	330	10
Grey sandstone	5	3	336	1
Shale, coal-stained	0	10	336	11

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1888.	Strata. ft.	ins.	Total. ft.	ins.
Sandstone, coal-stained	4	0	340	11
Conglomerate	1	0	341	11
Firm mud shale, with pebbles, some quartz	12	4½	354	3½
Fireclay	0	5	354	8½
Mud shale, traces of coal	10	4½	365	1
Mud shale, no traces of coal	20	1½	385	2½
Mud shale, minute fossils	77	6½	462	9
Green sandstone, with pebbles	22	10	485	7
Limestone, fossils	9	9	495	4
Rock, like granite	0	10	496	2
Hard limestone, fossils	123	3	619	5
Blue limestone	125	10	745	3
Fine-grained sandstone	42	8½	787	11½
Sandstone shale and conglomerate	16	8½	804	8
Shale and conglomerate	2	3	806	11
Coarse-grained sandstone, few coal markings	9	6	816	5
Very coarse sandstone, patches conglomerate, no coal marks	20	10½	837	3½
Conglomerate and rotten granite boulders	54	11½	892	3

Appendix V.

Seymour No. 5 bore; Douglas River; total depth, 645ft. 1¼in.

1888.	Strata. ft.	Strata. in.	Total. ft.	Total. in.
Surface shaft	44	0	44	0
Sandstone and clay	11	6	55	6
Sandstone and black clod	7	6	63	0
Clod and hard brittle shale	12	0	75	0
Light sandy shale	17	0	92	0
Fine-grained sandstone	4	9	96	9
Coal, inferior quality	0	5	97	2
Light shale	20	7	117	9
Fine-grained sandstone	14	3	132	0
Shale	6	7	138	7
Free-boring sandstone, showing thin coal pipes	33	1	171	8
Dark shale and clod with coal veins	4	0	175	8
Fireclay	3	6	179	2
Sandy shale	6	5	185	7
Sandstone	1	0	186	7
Shale	2	3	188	10
Sandstone, some showing coal stains	49	0	238	4
Coal	0	1½	238	5½
Sandstone, with coal pipes and stains	225	4	463	9½
Sandstone, much cleaner	90	8	554	5½
Coal seam, only 8 inches clean coal	1	6	555	11½
Fine-grained sandstone and sandy shale	57	2	613	1½
Coal	0	4	613	5½
Brown band	0	2	613	7½
Coal	1	1	614	8½
Band	0	2	614	10½
Coal	0	1	614	11½
Parting	0	0¼	614	11¾
Coal	0	2½	615	2¼
White band	0	1	615	3¼
Coal	0	10	616	1¼
White band	0	3	616	4¼
Coal	1	0	617	4¼
Hard sandy shale, showing fern impressions	27	9	645	1¼

4' 2¾"

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Appendix VI.

Analyses of Tasmanian Mesozoic Coal.

	Water.	Volatile Hydro-carbon.	Fixed Carbon.	Ash.	Sulphur.	Analyst.
	Per cent.	Per cent.	Per cnt.	Per cent.	Per cent.	
Mount Nicholas	6·45	36·55	48·57	8·43	...	W. F. Ward
Ditto	3·80	32·20	49·17	14·83	...	Ditto
Ditto	7·6	35·75	50·00	7·25	...	Ditto
Ditto	5·1	33·00	46·00	15·90	0·60	E. W. Woodgate
Fingal	8·0	31·20	42·30	18·50	...	W. F. Ward
Bicheno	3·8	33·90	54·20	8·10	...	—
Sandfly	2·2	24·90	60·00	12·00	0·90	W. F. Ward
Ditto	6·5	25·43	62·59	4·60	0·88	Ditto
Douglas River V.	5·5	29·20	48·10	17·20	0·05	E. W. Woodgate
Ditto	4·5	27·10	52·00	16·40	...	W. F. Ward
Fosbrooke's Gully, Llandaff	2·25	33·75	55·50	8·50	...	A. Allom
Coal Creek D. Douglas River	5·5	30·90	50·80	12·30	0·50	W. F. Ward
Douglas River, Outer Mine	5·7	21·40	49·60	23·30	...	Ditto
" Seam below V	5·5	24·60	49·60	20·30	...	Ditto
Steep Creek A., Llandaff	4·0	27·00	56·20	12·80	...	A. Allom
Pike's Creek, ditto	2·4	34·70	50·20	12·00	...	W. F. Ward
Steep Creek, top seam, ditto	3·1	25·20	42·90	28·80	...	Ditto
" " bottom seam, ditto	4·1	24·60	41·50	29·80	...	Ditto
Steep Creek Tunnel	4·3	31·90	57·30	5·80	...	Ditto
Gully into Steep Creek, Llandaff	1·6	25·60	48·30	24·50	...	Ditto
Pike's Shaft, Hume's Lease, ditto	3·8	26·40	35·40	34·40	...	Ditto
Barber's Creek, Llandaff	3·4	18·80	44·40	33·40	...	Ditto
Ditto	3·0	20·20	49·80	27·00	...	Ditto
Ditto	6·4	23·40	43·60	26·60	...	Ditto
Board's Gully K, Llandaff	2·45	32·73	53·00	11·82	0·76	W. Dods
Glen Gala	7·00	9·70	19·20	64·10	...	W. F. Ward
Newcastle, New South Wales	2·75	34·17	57·22	4·64	1·22	— Dixon
Ne[illegible]nd	28·93	...	71·11	·08	0·88	J. A. Phillips

JOHN VAIL, [illegible]

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SKETCH MAP
SEYMOUR TO SCHOUTEN ISLAND
Scale
40 0 1M 2M 3M Chains
Sands and Clays Tertiary and recent
Diabase (GREENSTONE)
Silurian slate
Coal seams
Existing bores
Proposed bores
W.H. Twelvetrees, Govt. Geol.
October 1901
SEYMOUR
DOCTOR'S CREEK
BLIND CREEK
LINE OF SECTION
RESERVED FOR COAL
DOUGLAS RIVER
HERMAN'S CREEK
LAGOON
DIAMOND ISLAND
PEGGY'S POINT
BICHENO
PROPOSED
HALFMOON BAY
LLANDAFF
ISAAC'S POINT
SWAN RIVER
CYGNET RIVER
BRUSHY RIVER
MT PETER
SALTWATER LAGOON
FRESHWATER LAGOON
SABINA'S PT
MOULTING LAGOON
TRAMWAY
PROPOSED
BLUESTONE BAY
THE THREE SISTERS
BOULDER
D.C. 23
KING BAY
PELICAN PT
GREAT SWANPORT
SLEEPY BAY
RABBIT ISD
COLE'S BAY
RIVER
RYE RIVER
WINEGLASS BAY
SHAG ROCK
HAZARD ISD
SHAW BLUFF
WATERLOO PT
MEREDITH RIVER
SWANSEA
OYSTER BAY
FREYCINET'S PENINSULA
STONY RIVER
WEBBER'S PT
BUXTON'S RIVULET
BUXTON'S PT
SCHOUTEN PASSAGE
BARE HILL
TRUMPETER BAY
SCHOUTEN ISLAND
5 cm