

REPORT ON COAL NEAR GEORGE TOWN, AND  
SLATE NEAR BADGER HEAD.

[Two Maps.]

*Government Geologist's Office,  
2nd December, 1904.*

SIR,

As instructed, I visited the slate outcrops west of Badger Head on the 2nd October; and the coal mine on Hackett's Reward sections, near George Town, on the 30th September and 20th October. I took the opportunity of observing the geology of the country between these two localities.

GEOLOGY.

The present course of the Tamar below Swan Bay is geologically modern, the old river, in early Tertiary times, having followed a north and north-east course from Windermere and along east of Tippagory; though a stream, apparently from Beaconsfield, emptied itself into the sea by the present channel before the latter was choked by a flow of basalt.

At that time the rocky bar of diabasic greenstone country, extending across where Whirlpool Reach now is, had not been cut through; and it formed an effectual obstacle to the flow of the river in that direction. The valley of the Tamar was then the outlet to the great lake or estuary, the waters of which covered the country behind Launceston for hundreds of square miles. The land, which was several hundred feet higher than it is to-day, began to subside slowly, and eruptions of basalt lava filled up the valley in some places, and flowed out to sea.

The coast line came further in, and marine and estuary sand was spread over the country on each side of the mouth of the present Tamar.

The modern river would appear, with the changes in the surface, to have succeeded in cutting its way through the Whirlpool Reach bar, which has been open ever since. The land rose again, but not sufficiently to bring the lower reaches of the old stream valleys (*e.g.*, the Ophir lead at Beaconsfield) up to sea-level again, though the higher parts were raised two or three hundred feet. Accordingly, the

ground on the West Head Range, on the Wentworth estate, and on the Badger Head Promontory, is seen to-day carrying a superficial covering of sea-sand.

There would appear to have been, however, a river channel occupying the present mouth of the Tamar, and the line of this is probably marked by the strip of basaltic rock still preserved from Beauty Point northwards. It is interesting to trace the course of this basalt, as it probably masks a deposit of early Tertiary drift. I have traced it all along the east side of the Ilfracombe township reserve, and it appears again north of Clarence Point, evidently stretching across the river to the Salt Pan Point. Garden Island is basaltic, as also is the shore of Pipeclay Bay. Here Barnard's quarry has been cut in the basalt on the river bank. It extends under George Town, as is proved by several wells, 5 to 20 feet, sunk by the residents. It runs out to sea just north of the northerly white tower, where it junctions with the diabase (trap) ridge, which is prolonged in one direction to Low Head, and in the other direction (south-east) to the Buffalo\* (500 feet above sea-level), the Sugar Loaf (650 feet), Mount George (850 feet), Mt. Dismal, Tippagory, and Mt. Direction.

The opposite head of the River (West Head), four miles to the west, is also a bold headland of diabase, about half a mile in width, with peaks ranging in height from 250 feet to 400 feet above sea-level. The promontory is timbered, and forms part of the Wentworth estate, now owned by Mr. C. Macpherson. A southerly extension of this rock occurs in the Stock-yard Hills west of Kelso. The basaltic fringe is seen along the coast line at intervals, from Kelso round to Shoal Bay, where the West Head trap comes in. Basaltic reefs run into the sea at the points of each bay, the intervening beach being sand. The coast line is fringed with sand dunes, behind which are sandy and marshy plains. At one time, no doubt, the basaltic sheet was continuous across this part of the valley of the Tamar. It has been cut through by the river, and gradually wasted in late Tertiary and present times. Whether it is now only a comparatively thin covering, or is thick enough to extend to the bottom of the present river, will be ascertained by boring, which is now being carried out by the Launceston Marine Board. Opposite George Town there

\* This hill derives its name from H.M.S. *Buffalo*, which carried Lieut.-Governor Paterson and party from Sydney to take possession of Port Dalrymple. This was done by landing at Outer Cove (George Town), 11 Nov., 1804.

is a channel varying from 80 to 120 feet deep, but I have not been able to ascertain whether the bottom consists of basalt, diabase, or sedimentary beds.

The country between George Town and the ranges is covered with late Tertiary and recent sands: as these rest on underlying diabase, they collect the drainage of the mountains, and are water-logged in wet weather. The geological conditions of George Town are such as to ensure a supply of good fresh water in fair quantity.

None of the Permo-Carboniferous mudstones or Mesozoic sandstones have been seen on the western side of the ranges, but the former appear to exist on the east side of Mt. George, on Hacket's Reward Section.

Tongues of Tertiary sands and clays run up from the Tamar into the flat between Tippagory and Mt. George to a height of about 300 feet; and it is towards the head of one of these that Hacket's coal seams occur.

#### MOUNT GEORGE COAL.

Mr. Hacket applied for a reward section in November, 1888, having discovered coal on the Musk Vale estate, and a lease was granted to him in March, 1889; the area on the chart being now 318 acres—1830-87M—and about 5 miles from George Town by the road. By a short cut across the range, the distance is reduced to 4 miles. From the shore of the Tamar, opposite Middle Island, it is not more than  $2\frac{1}{2}$  miles. The easiest way of approach from George Town is by the Lefroy road to the 4-mile Gate, then a mile north to Quinn's farm. Five or six hundred yards further north is the log fence which is the southern boundary of the Reward Claim; and 150 yards further is the elbow in the west side line of the claim. On the creek inside this boundary are the different works which have been carried out on some coal exposures.

About a quarter of a mile up, Hacket's shaft was sunk 10 or 12 feet, about 15 feet above an outcrop in the creek, where a 2 or 3 inch seam is exposed in soft sandstone, dipping slightly to the south-west; a small 10-foot hole has been excavated in the bed of the creek.

On the west side of the creek Grubb's shaft was sunk, 10 years ago, to a depth of 32 feet; and the seam was intersected, showing a maximum thickness of 11 or 12 inches, I am told, and thickening towards the west. Some pieces of coal up to 14 inches thick have been found in the creek; and I am informed that one block, weighing 1 cwt., was sent to the Melbourne Exhibition. I had a small

shaft, 10 feet deep, unwatered while I was there, to see where some alleged fossils came from, but without success. I was shown a site, 15 feet beyond Hacket's shaft, where a bore was put down to 70 feet about two years ago; but a core drill was not used, and nothing decisive was obtained.

About 25 feet west of the creek, and 30 feet above it, a new shaft has been sunk (10 feet north of Grubb's shaft) to a depth of 44 feet, the first 28 feet of which consisted of soft yellowish sandstone. A 6-inch seam of coal was then struck, dipping north at an angle of 28 degrees, and thinning out at the north end of the shaft. Below this is a foot of pebbly sandstone or wash, and then another seam of coal 4 to 6 inches, thickening at the north end, where it unites with a 7-inch seam dipping south-west. A foot of sandstone underlies this, and then a 2-inch seam, also dipping south-west, rests upon a dark tenacious clay, which continues to the bottom of the shaft. The false bedding shown by the opposed inclinations of the seams, the wash, the looseness of the sandstones, the character of the clay, combine in indicating that the coal and its enclosing strata belong to the Tamar series of Tertiary deposits. The character of the coal confirms this conclusion. It is a light coal, retaining a slightly woody structure, brown to black in hue, moist when freshly broken, not at all sulphurous, and when burnt emitting fumes with a characteristic odour. Its specific gravity is about 1.3, somewhat low for mature coal, the density of which is somewhat nearer 1.4.

Several analyses have been made, the earliest of which appear to have been those by Professor Mica Smith, of Ballarat, and Mr. W. F. Ward, Government Analyst, Hobart. These are as follows:—

	Moisture.	Fixed carbon.	Gases, &c.	Sulphur.	Ash.
Prof. Mica Smith	10.06	52.40	33.42	—	4.12
W. F. Ward ...	6.60	49.00	35.50	0.90	8.00

Last year the claim was inspected by Mr. W. H. Baker, B.Sc., who assayed samples with the following results:—

Moisture.	Fixed carbon.	Gases, &c.	Sulphur.	Ash.
14.50	54.05	26.80	0.00	4.65

On my first visit I brought away samples which were assayed by Mr. Ward, Government Analyst, as follows:—

Moisture.	Fixed carbon.	Gases, &c.	Sulphur.	Ash
15.00	39.70	36.90	0.00	8.40

Mr. Ward reports that "The coal does not coke. Composition, manner of burning and smell on heating, &c., with traces of woody structure appear to show this to be long rather to the brown coals. On the other hand, the sample may have been considerably altered by weathering."

On my last visit I selected samples from which Mr. J. D. Millen, A.S.T.S., has kindly made an assay for me, as follows:—

Moisture.	Fixed carbon.	Gases, &c.	Sulphur.	Ash.
15.83	35.49	33.09	0.02	15.57

Mr. Millen reports "Sp. g. 1.32, coke nil, absolutely non-coking; ash, yellowish-grey. This sample, from its physical properties and the result of its analysis, may be classed among the lignites, a little more highly mineralised than the ordinary."

Mr. Millen's analysis shows more ash than in the other assays, but this is attributable to the sample chosen being a large block more likely to contain more variations in quality and to be more representative of bulk than some of the others; moreover, variations in ash contents are highly characteristic of lignitic seams.

The substance appears to me to be a rather superior brown coal, intermediate between lignite and true coal. Brilliant black, jet-like veins run through it, which are very misleading to those who are not well acquainted with the various classes of coal.

The fuel ratio, or ratio between the volatile hydrocarbon and fixed carbon, obtained by dividing the per cent. of the latter by the per cent. of the former, is 1.38, taking the average of all the assays made. The fuel ratio of a coal, however, while it indicates its usefulness for given purposes, does not indicate its fuel value, which is affected by the proportions of ash and water. The moisture in this coal is very considerable when freshly raised, and even when air-dried for a month retains a proportion which is characteristic of brown coal and lignite, and sufficient to impair its heating properties materially; for it must be borne in mind that each per cent. of moisture means 20 lbs. less fuel in each ton of coal.

The seams found so far are not of sufficient size to be workable, and even if thicker seams are struck in the lignitic strata; I doubt whether profitable use could be made of them. The coal would have to be wet-pressed and moulded into briquettes for the market; there would be

a considerable loss of weight during this process, and when ready to put upon the market, for use in specially-arranged grates (with narrow spaces between the fire bars to keep imperfectly consumed pieces from falling through) the coal would not compete with the other Tasmanian coals. Mr. H. C. Jenkins, late Victorian Government Metallurgist, was of opinion that the Victorian brown coal briquettes, wet-pressed and steam-dried, could not be made under 13s. 6d. a ton; and if slowly air-dried, an article suitable for domestic purposes might be produced at 10s. a ton, having a calorific power about one-half that of Newcastle coal.

In Germany, the Rhenish brown coal-beds, near Cologne, average nearly 100 feet in thickness, and the coal at the Bruhl works has a composition of, moisture 46.6 per cent., fixed carbon 28.9 per cent., volatile matter 24.4 per cent., ash 2.1 per cent.; the mining cost is only 7½d. per ton, and the manufactured briquette costs 5 or 6 shillings per ton. The coal is first crushed or disintegrated, then dried by means of tubular revolving boilers, then crushed and screened and put into steam-presses, which turn out briquettes for household and industrial purposes.

If this industry is ever contemplated in Tasmania, Victorian conditions would approximate to those upon which calculations should be based. In the meantime, however, we have no seams of brown coal at all comparable in thickness with those which exist in Victoria.

The Musk Vale seams occur in the sands at the horizon where these repose on the clay strata, and will, of course, appear in the bed or banks of the creek wherever these cut through the beds at that horizon. By going lower down the creek they could be driven upon, but such work would be unwarranted by their present thickness. The creek descends 100 feet before reaching flatter country at the southern boundary fence. A bore or two put down along the creek and one at this fence would prove the nature and thickness of the clay formation, which may possibly descend to a considerable depth. On the other hand, the basin here does not appear to be very wide, and this would point to the thickness of the clay not being excessive. As long as work is confined to the Tertiary sands and clays, only brown coal or lignite can be expected. What the rock underneath these is can only be ascertained by boring. If not wasted away, it will be Mesozoic or coal-measure sandstone; if that has been removed by denudation, it will be Permo-Carboniferous mudstone; and if that too has been denuded, it will be the diabase or trap rock of the

hill to the west. Consequently, boring with a view of seeing whether the coal measures exist below the Tertiary beds must necessarily be speculative. But it may well be that those interested in this exposure of coal will not care to relinquish work definitely before satisfying themselves that the seams of true coal are not present in the underlying strata.

I went over the hill to the north-west for about a mile. The crest of the hill consists of diabase; but on its western slope, and in the valley between this and the range further west, apparently Tertiary again comes in. In this area is a shaft sunk in these sandstones to a depth of 100 feet, by a George Town association about twelve years ago, on a false scent for gold. The stone passed through was a yellowish, coarse, loosely-compacted sandstone, with pebbles and fragments of carbonised wood.

Further north-west is quite a high face exposed on the hillside, of similar sandstone, and beyond and above it to the west is a diabase knoll or crag at the top of the hill. This was mentioned to me as an instance of a sandstone occurring beneath the diabase, but as this variety of sandstone is more modern than the eruptive rock it cannot support that theory.

The Tippagory and Mt. Dismal country is well worth exploring for indications of coal, for it is quite possible that some part of the coal measures, into which the eruptive rock of the country (diabase) was intruded, has escaped denudation, and seams may still be found.

#### SLATE NEAR BADGER HEAD.

The country on the west side of the mouth of the Tamar is low-lying, consisting of a wide expanse of sandy and marshy plain, very little above the level of the sea. This level country is bisected by the West Head Range and the Stockyard Hills, which consist of diabase, and form elevations corresponding with the Low Head, Buffalo, and Mt. George intrusions of similar rock on the east side of the river.

Sand dunes border the frontage of these plains on the sea. Some proportion of the sand on the plains may be wind blown, but the bulk appears to be a marine deposit of recent or late Tertiary age. What the bed-rock below the sand is, is a matter for conjecture; but it is quite possible that coal-measure sandstone exists in depth.

Aulich's farm is just on the foothills of the Asbestos Range, near where Saltwater Creek (the drainage outlet

for the plain) flows into Bass Straits. This Asbestos Range is here a complex of hills about 4 miles wide, terminating seawards in Badger Head, and continuing landward, in a south-easterly direction, for many miles; 7 miles from the coast it borders the serpentine and asbestos country at Anderson's Creek, whence its name, though it contains no asbestos itself. It is heavily timbered, and consists of quartz and micaceous schists, with clay slates mostly in its western parts. The strike of the schists is about N. 20° W., and their dip north-east. The appearance of the rocks indicates intense metamorphism. From the direction of the dip it may be taken that they underly the Beaconsfield auriferous series, and are almost certainly pre-Silurian. A belt of serpentine, about 1 mile wide, separates this range from the Beaconsfield system of strata, which hides the boundary between the two from observation. My journey this time was simply a traverse of the chain on its sea face. The Badger Head promontory is covered with bush, but a little further east the top of the sea cliffs is heathy.

All that I could do on this occasion was to notice any outcrops of stone along the line of traverse. The rock has rather an unfavourable appearance for mineral. The quartz, which occurs in it as veins, lenticles, or sheets, is white and non-pyritiferous—a bad sign. The creeks too do not bring down gold-bearing sand. Copper pyrites has been found along the coast at different times, but in very small quantities. Discoveries in 1876 and 1877 led to mines being started in 1878 near Little Badger Head, but no workable deposit was disclosed. I visited the site of the old copper mine within half-a-mile south of Little Badger Head, where a shaft (70 feet, I believe) has been sunk in slate, and a formation tested, consisting, according to the waste outside the mine, of iron pyrites and calcite. I understand a little good copper was found, but I could see no ore at surface. Another claim, nearer Badger Head, was also worked at the time, and some prospecting done inland; but nothing resulted, and after the short-lived incursion of prospectors the place was abandoned to its pristine solitude. The quartz noticeable in the country rock is in blows, intricate veinings, and lamellar sheets, and not in defined reefs. But this great uninhabited tract has not been traversed sufficiently to enable any positive opinion of its mineral value to be formed.

A few hundred yards south of the old copper mine a creek of clear and sparkling water descends from the high

land. Cliffs of schist and slate rock continue to face the sea going westward, and dangerous reefs at their base run out into the water. Within half-a-mile south of the creek above mentioned are some occurrences of slate which have attracted attention, and have been thought to possess characteristics which would make them useful in an economical sense.

The first exposure is a small headland, from 30 to 40 feet high, running north-west in the direction of the planes of the slate of which it is composed. It sinks, going inland, to a low neck about 20 feet high, and then rises to upwards of 100 feet. An excavation has been made in the side of the neck, at a place where the rock is decayed and soft, presumably with the intention of cross-cutting into the hill and reaching the harder slate further in; but this piece of work was hardly advisable, involving far too great an expenditure for a pure trial.

For trial purposes, viz., to get out a bulk parcel for a practical test of quality and market value, a cut into the headland would be sufficient. The slate there can be broken down quite easily. The laminations are nearly vertical, dipping only a little to the north-east; if the dip had been in the opposite direction, working would have been still easier. Large blocks can be brought down without difficulty, using blasting powder in preference to the nitroglycerine compounds, which shatter and break up the rock unnecessarily. The blocks would then be wedged, and split to a reduced size, and afterwards split with chisels until slates of the desired thinness were obtained. The usual course is then to dress and square these, and finally sort them according to quality. The bands of rock which are harder than the ordinary, or are otherwise not quite fit for roofing slate, are taken out in blocks, and sent to special works, where they are planed and made suitable for the slab trade, which disposes of them for hearthstones, flooring, cisterns, tombstones, &c. This is a trade which is developing rapidly elsewhere.

The slate at this headland splits freely into thin laminae, and a good deal of it could be trimmed to roofing sizes. The quality, however, is nothing like that of Welsh slate. The rock is less metamorphosed, being a dark graphitic clay slate, not so hard as the slate of commerce, and more susceptible to the influence of the weather. No doubt it could be used commercially to some extent, but it could not possibly compete with the imported article in respect of durability.

Where exposed, it is free from curls, cramps, and wavy and double cleavage, and there are no disturbing intrusions of igneous rock at this place. To work it on any scale, it would be necessary to go up the hill south-westerly, and start open cuts into the slope, about 100 feet long and 30 feet high, with an inclined tramway from top to bottom. It is premature, however, to consider eventual operations, as the first thing is to place a small parcel or two on the market, as a trial.

A little distance further west, I was shown an occurrence of slate-like rock in the sea cliff; but, though fissile, the rock does not cleave truly. It is actually an argillaceous and micaceous schist, freely traversed by veins of quartz carrying a little copper pyrites. The amount of quartz in it is irregular, and in some parts would not interfere with its use for slate-making; but it is not an ideal rock for that purpose.

During my visit to the country, on both sides of the Tamar I was the recipient of information and kind attention from Mr. Jas. Hacket, Mr. S. J. Richards, Messrs. C. and J. Stephenson, and Mr. C. Macpherson, which I desire to acknowledge.

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

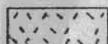
W. H. TWELVETREES,  
*Government Geologist.*

W. A. PRETYMAN, *Esq.*,  
*Acting-Secretary for Mines, Hobart.*

MAP OF  
COUNTRY WEST OF RIVER TAMAR

Scale 40 20 0 40 80 120 160 Chains

M. H. Twidestree  
Government Geologist  
2<sup>nd</sup> December 1904

-  Basalt (Tertiary)
-  Diabase (Mesozoic)
-  Slate and Schists (Pre-Silurian)
-  Sands (Tertiary and Recent)

5 cm

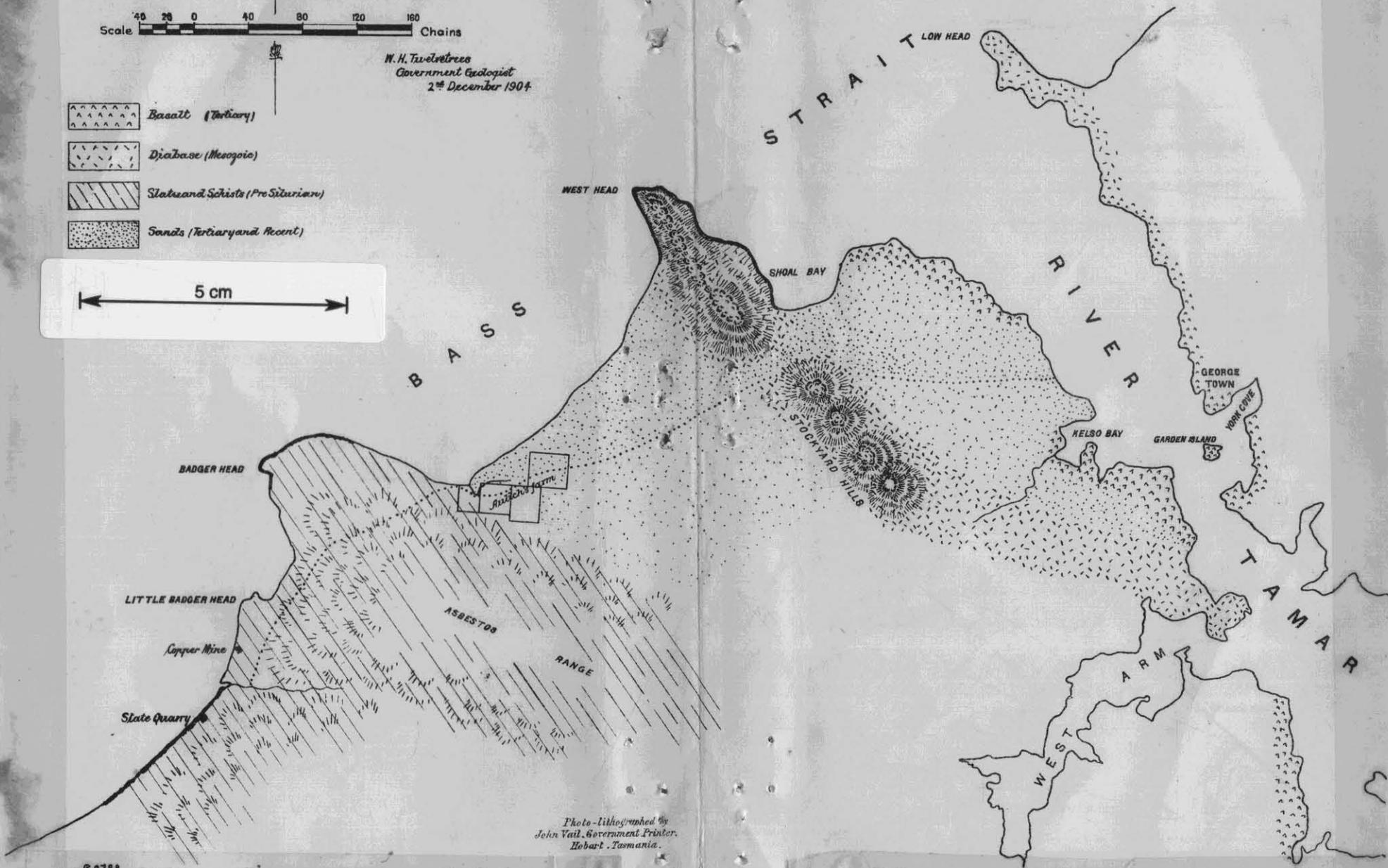


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Hobart, Tasmania.

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# MAP OF COUNTRY EAST OF RIVER TAMAR



W. H. F. ...  
Government Geologist  
2<sup>nd</sup> December 1904

- Basalt (Tertiary)
- Diorase (Mesozoic)
- Slates and Schists (Silurian)
- Sands (Tertiary and Recent)
- Permian-Carboniferous (probable)
- Sands and clays (Lower Tertiary)
- Coal

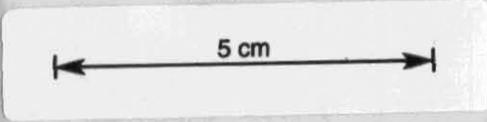
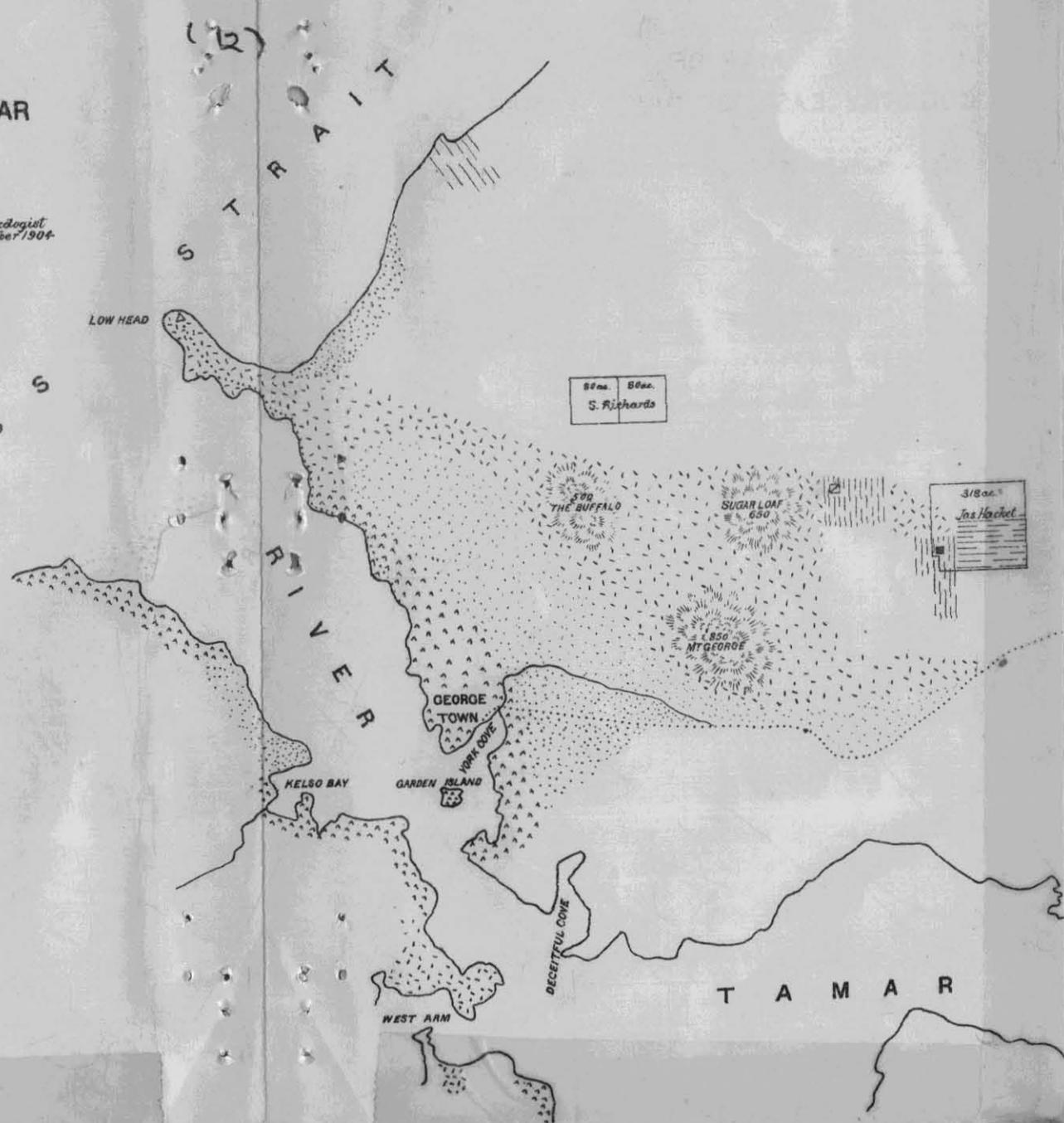


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