XIII.—*Report on the Geological Relations of some of the Coal-Seams of Van Diemen's Land,—their probable Extent,—and relative Economic Value; made to His Excellency Sir H. E. F. Young. By* Alfred R. C. Selwyn, *Government Geologist, Victoria.*

The Districts visited and partially examined were :—

1st. The Valley of the Derwent from Bridgewater to about seven miles above New Norfolk, including a few observations in the immediate vicinity of Hobart Town and New Town.

2nd. From Risdon Ferry over Grass-tree Hill to Richmond; thence to Spring Bay on the east coast by the Brushy and Prosser's Plains.

3rd. The immediate vicinity of Spring Bay and the Township of Triabunna, where various trials for coal have been made in the Township and on the estate of Captain Vicary.

4th. The country extending from Bicheno, Waubs Harbour, to Falmouth on the east coast, including the Douglas River and a small portion of the upper part of the Valley of the Apsley, near the Township of Llandaff.

5th. From Falmouth over St. Mary's Pass to Fingal, Avoca, and Cleveland, on the Hobart Town and Launceston Road.

6th. The Coal-works on the Rivers Don and Mersey executed by the Mersey Coal Company and others.

1.—THE VALLEY OF THE DERWENT.

On the north bank of the Derwent, seven miles above New Norfolk, a seam twenty to twenty-two inches thick of a

PLATE . I .

Fig I

VERTICAL SECTION *shewing the succession of the beds in the Valley of the* DERWENT

Fig II

SECTION from RISDON on the DERWENT over GRASSTREE HILL to RICHMOND

Length 12 miles

a a a Sandstone *b b* Clay Stone Rock. *c* Probable Position of Fossiliferous Limestone. *d d d* Hard Black Basalt and Crystalline Greenstone. *e e e* Beds of Coal at Richmond, very poor slaty Anthracite.

Fig III.

SECTION *From near the residence of* S. Cruttenden *Esq*
PROSSERS PLAINS *to the* BACK RIVER

PLATE II

Scale 40 ft to 1 inch

A SHAFT 245 feet

I

Clay and soil 5 feet
Yellow freestone with impressions of fossil Plants
Blue and grey freestone with bands of shale
Grey Sandstone
with shale bands, 15 feet
Coal 1 foot
Gritty black shale
Hard brown clod with impressions of large fern leaves
Hard white freestone with streaks of Coaly matter

C SHAFT 134 feet

III

Soil
Yellow and brown Shale, nodular with impressions of fern leaves
Brown Sandstone
Coal 8 inches
Alternating beds of hard grey sandstone and beds of blue and black shale
Coal 5 feet
Under the coal are beds of blue and black shale then blue Sandstone very hard and compact then black shale and left off in Freestone at 134 feet

B SHAFT 70 feet

II

Soil and clay 5 6 feet
Soft friable yellow sandstone with impressions of plants
Yellow and brown shales with numerous impressions of fern leaves
Grey sandstone nodular gritty friable
Coal 8 inches
Black clod 5 feet
Thick bedded Freestone
with bands of blue shale
Coal 5 feet

D SHAFT 100 feet

IV

Alternating beds of white gritty
quartzose sandstone with beds
of black and blue shale
Bored 100 feet from bottom of the Coal, chiefly through Sandstone left off in an argillo arenaceous and slightly calcareous (perhaps Limestone) shale

V

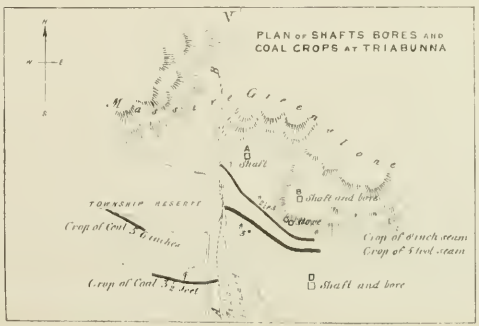
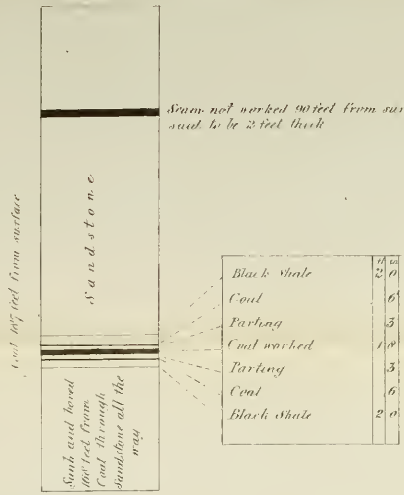


PLATE III

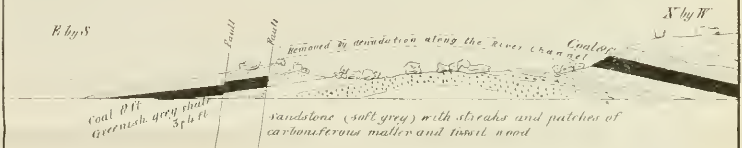
I



II

SECTION OF THICK COAL AS SEEN IN THE DOUGLAS RIVER

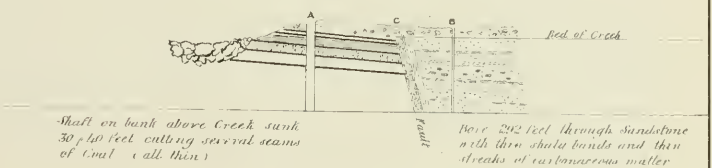
4 MILES FROM THE SEA



III

SECTION SEEN IN THE DENISON RIVULET

NEAR THE COMPANY'S OLD SHAFTS

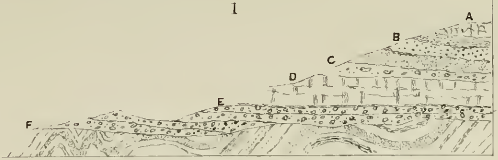


Haslable & Deakin litho

PLATE IV

SECTION OF A HILL BETWEEN ST MARY'S PASS AND FINCAL NEAR MR GROOM'S

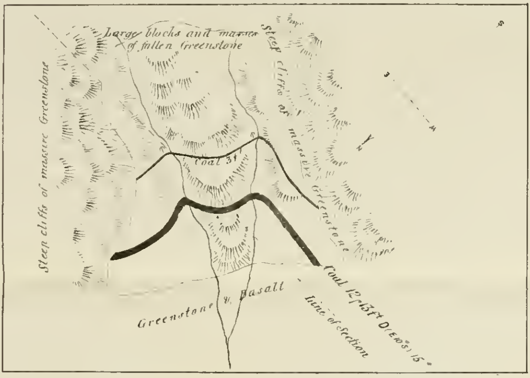
I



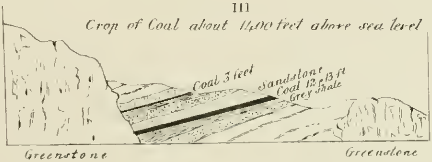
A *Greenstone* B *Yellow Coal Measure Sandstone* .. C *Clayey Conglomerate rock*
D *Limestone replete with fossil Corals Spiriferæ and other Shells* . . .
E *Coarse white quartz conglomerate the pebbles very rounded* . . . .
F *Older upheaved & contorted clay slates & sandstones with Quartz veins* .

PLAN AND SECTION OF THE THICK COAL 2½ MILES S.E. OF FINCAL

II



III



The Coals are seen only in the Creeks the rest of the ground being entirely covered up by fallen blocks of Greenstone.

Hasler & Deakin Lith

PLATE V

Fig 1

SECTION FROM RIVER DON TO WILLIAMS' SHAFT

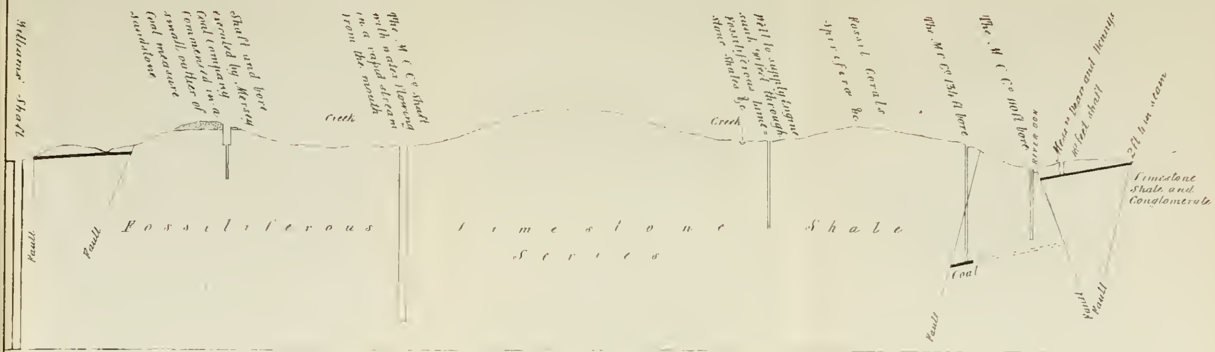
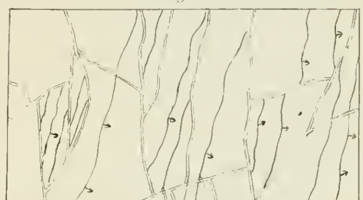


DIAGRAM *representing a faulted piece of Country such as that at the* DON & MERSEY

Fig 2



Red lines Faults *Black lines* Strike of Beds
Limestone Shales & Conglomerate *White* Carboniferous

Marshall & Deakin Lith

hard anthracite coal, of very poor quality and slaty structure, crops out. Immediately underlying it are thin beds of greyish-blue shale, with impressions of fern leaves, &c.; and resting on it is a band of hard, grey, nodular shale, which is again overlaid by thick bedded sandstones (yellow and brown soft freestone), enclosing numerous fragments of roots, stems, and branches of fossilized trees converted into silica or iron, but still presenting the most perfect woody structure.

About two hundred yards higher up the river a solid mass of greenstone presents itself, occupying both banks of the stream for some distance, and apparently completely cutting off the continuity of the coal-measure series in this direction.

I was unable to extend my observations above this point, but I believe that at Hamilton, some ten or twelve miles higher up the river, the coal again crops out in a seam upwards of eight feet* in thickness.

If of good quality and sufficient extent, a seam of this thickness would, I should think, well repay the outlay necessary for the construction of a tramway for transporting it to the shipping-place at New Norfolk,—a distance, I believe, of about eighteen miles.

What the dip and direction of this bed is, I was unable to ascertain. Should it be the same as the small 20-inch seam above described, viz. (W. 20° S.) 10°, and is not cut off by faults, or by greenstones or other igneous rocks, we might expect to find it much nearer New Norfolk in a south-easterly direction, and on the south side of the Derwent.

* The seam of coal cut through in the vicinity of Hamilton by Mr. Chilton, in the process of sinking a well in his farm-yard, was at a depth of 40 feet; the quality was highly bituminous, and the thickness 4 feet.—J. M.

These are questions, however, which can only be decided by a very minute and connected geological examination of the whole area.

In descending the valley of the Derwent from the first-mentioned thin seam of coal, after passing over the edges of the underlying sandstones for about three quarters of a mile, another thin seam of coal may be detected cropping in the bed of the stream. What the exact thickness of it is I could not ascertain, as where it crops it has been washed away, forming a pool in the river with an overhanging ledge of sandstone rock.

It did not appear to be more than a foot thick, and of similar quality to the one above.

This would be about fifty or sixty feet below the first seam, the beds between being nearly all sandstone.

A little lower down, where the river makes an elbow, and nearly opposite the junction of the Plenty with the Derwent, we again find the bed of the river, and both banks for a considerable distance occupied by a solid mass of hard, dark, augitic, columnar basalt: on the south bank it rises into cliffs some thirty or forty feet high, through which the road has been cut, exposing a good section of the igneous rocks in various forms, and thus again cutting off the continuity of the carboniferous series. From the above point for rather more than four miles down the Derwent to the confluence of the "Back River," there occur constant alternations of greenstone dykes and carboniferous strata, the latter preserving an almost uniform dip about W. 10 to 15 S. 5° to 8°.

This would, supposing the igneous rocks to have been erupted through the carboniferous beds without shifting them, and the succession to be regular, give a total thickness of carboniferous strata between the first-mentioned seam of coal and the Black River of nearly nineteen-hundred feet,

consisting chiefly of sandstones, with a few beds of black and grey shales towards the upper part, but in which no seams of coal occur.

About four hundred yards below the junction of the "Back River" with the Derwent, and nearly opposite the Falls, a considerable fault shows itself in an almost perpendicular cliff on the south bank of the river, where what would appear to be the lowest sandstone of the carboniferous series is brought in contact with a set of beds composed of a very hard, white, compact, and regularly bedded claystone rock, with occasional thin beds or partings of dark blue and grey micaceous and arenaceous shales.

On the weathered faces of these beds numerous large cavities occur, which are often coated with efflorescences of sulphate of magnesia and alum in small crystals. In some places the beds are conglomerate, and contain pebbles of quartz, granite, quartz rock, and a very hard dark siliceous rock.

Up the "Back River," and in the hill opposite the Government Cottage at New Norfolk, where these beds are well exposed in bold, nearly vertical, cliffs, they are distinctly seen passing conformably under the carboniferous sandstone, the whole dipping about (W. 10° S.) 5° to 6°.

The total thickness of beds exposed in this hill cannot be much less than 700 feet, or about 400 feet of clay-rock and 300 feet of sandstone—the latter forming the capping of the hill, and being in all probability the same beds which a mile and a half higher up the river, at the Falls, are thrown against the former by the fault before mentioned.

In following the Hobart Town road from New Norfolk, the only sections exposed for about four miles consist of alternations of basalt, and recent river deposits of sand and gravel resting on the former.

We then come on a small section, 20 or 30 yards in length, where the clay-rock is exposed, the beds still dipping as at New Norfolk (W. 20° S.) about 5°; and, rising apparently conformably from underneath them, we find a series of limestones, shales, and calcareous sandstones, many of the beds being almost entirely composed of fossil shells and corals.

These beds have been worked along the road-side for a considerable distance, and burnt for lime.

In the quarries I found the following fossils, examined and named by Professor M'Coy of the Melbourne University.

Plantæ :—

Pecopteris, fragments of an undetermined species allied to P. odontopteroides.

Bryozoa :—

Fenestella internata.
——— fossula.
Polyparia ampla.
Stenopera Tasmaniensis.

Mollusca :—

Leminula biundata.
Productus brachythyrus.
Spirifer subradiata.
——— duodecimcostata.
——— vespertilio.
——— Darwinii.
Aviculo-Pecten Tasmaniensis.
Sanguinolites, doubtful sp.
Eurydesma cordata.
Plolyschisma (doubtful) fragments,

These fossiliferous beds extend to within about two miles

of Bridgewater, exposing a thickness, I should think, of not less than 200 or 250 feet.

Towards the lower portion of the section the beds are more solid, hard, compact, and crystalline, and much less mixed with arenaceous matter: the organic contents are also somewhat different, numerous large univalves occurring which are not found in the upper beds, and corals being less abundant.

Where last seen these beds pass under thick masses of gravel and superficial detritus, and are nearly horizontal.

At Bridgewater we again come on the white claystone rock of New Norfolk, exposed in large quarries, which have been excavated to obtain material for the formation of the long embankment which here crosses the Derwent.

The beds dip (E. 10° S.)

From this point to Hobart Town, wherever the stratified rocks are exposed, they appear to consist of the soft sandstones and shales of the carboniferous series.

Thus, between New Norfolk and Bridgewater there appears to be an anticlinal axis, the lowest exposed beds of which consist of a series of sandy and calcareous strata, replete with fossils, and which, with the overlying clay-rock, together near eight hundred feet, forms, I believe, in this portion of the Derwent the base of the true Coal-measure series. If coal-beds exist lower, they must be underneath the lime-stones; and, therefore, any attempt to discover them should of course be made where the lowest beds of that series are exposed on the surface.

From all I have seen, however, I believe these fossiliferous limestone beds to constitute the base of the whole carboniferous series of Van Diemen's Land; and, therefore, any attempt to find Coal underneath will always prove fruitless.

The diagram, Pl. I. fig. 1, shows the probable sequence

of beds as exposed in the valley of the Derwent, from seven miles above to the same distance below New Norfolk. In many parts the series is much broken by faults, probably often repeating the beds, and by intrusions of large masses of igneous rock, basalts and greenstones of different ages. On this account it is almost impossible to estimate correctly the thickness of the whole series of strata, from the first Coal, seven miles above New Norfolk, to the lowest exposed bed of limestone, the same distance below the above Township.

2. — RISDON TO RICHMOND AND PROSSER'S PLAINS.

From the mouth of the Valley of Risdon over Grass-tree Hill to within three miles and a half of Richmond the section exposed is precisely similar to that seen in the hill opposite New Norfolk. Thence to the Village of Richmond the strata occur as represented in the Diagram, Pl. I., fig. 2.

The three seams of Coal (*e e e*) are seen cropping in the south bank of the river, about three quarters of a mile below the village.

All three are anthracite, of poor quality and very slaty structure, dipping (W. 15° S.) 15°, and apparently cut off on all sides and within a few yards by eruptive greenstones.

A shaft now abandoned and full of water has been sunk about twenty yards from the margin of the river, in which the lowest and the thickest seam has been cut at a depth of about 35 feet.

On the crop in the river this seam is apparently 2 to 3 feet thick; but from the poor quality of the coal, the high angle at which the seams are dipping, and the fact above alluded to of their being cut off on all sides within a very short distance, none of these seams would, I imagine, be worked to advantage.

For more ample details of the geological features of this District than I am able to give, and its relation to the Coals found at Jerusalem, which I was unable to visit, I can hardly do better than draw attention to the able Report on these Districts by Dr. Joseph Milligan, published in the "Papers and Proceedings of the Royal Society of Van Diemen's Land," Vol. I. Part I. ; May, 1849. At Prosser's Plains in the Back River, a branch of Prosser's River, and about five miles from the residence of T. Cruttenden, Esq., two seams of Coal occur, together about 4 feet thick, dipping (S. 15° W.) to (W. 20° S.) from 35° to 50°, and passing under a flat of about 2000 acres.

These Coals are bituminous, though not of first-rate quality ; they ignite freely, and burn with a bright flame, but are of rather slaty structure, and contain a large percentage of earthy and incombustible matter. On three sides of the flat the carboniferous beds are cut off by high ridges of massive greenstone ; but on the fourth side towards the plain, and in the direction of the dip, no eruptive rocks occur.

In this direction the above seams of Coal, and perhaps others, might be found at no great depth over a considerable area : the distance, eight or ten miles, from the nearest shipping-place in Prosser's Bay, and the great expense attendant on the construction of the necessary road, appears the chief difficulty in the way of their being worked to advantage. The greater part of the ground is, I believe, the property of the Crown.

The very high angle at which the seams are dipping where exposed in the Back River is probably only local ; and they would most likely be found to flatten at a short distance on the dip, in conformity with the overlying sandstones to the S.W., as shown in Diagram, Pl. I, fig. 3.

From Prosser's Plains to the Bay, the road follows the course of the river through a narrow defile, crossing and recrossing the river several times in a few miles.

With the exception of one point about eight miles from Spring Bay, where the fossiliferous limestone crops out, the entire distance is occupied by massive crystalline greenstones, rising on either hand into high ridges and abrupt escarpments. This extends to the N.E. corner of Prosser's Bay, where we again come on the coarse, gritty, yellow, and white sandstones of the carboniferous series; and these extend uninterruptedly to the Township of Triabunna on the north-east side of Spring Bay.

3.—SPRING BAY AND THE TOWNSHIP OF TRIABUNNA.

The vertical sections, Pl. II., figs. 1, 2, 3, 4, are drawn from data furnished by Mr. Vicary.

The works are all abandoned for the present, and the shafts full of water. I was, therefore, unable to examine any of them.

As I had no map of the locality, the plan is merely a sketch of the surface, in which I have attempted to show the position of the different workings, and the general relation of the beds as seen on the surface.

The shaft marked D was the first work executed, and was sunk with the intention of cutting the $3\frac{1}{2}$-foot seam of coal, which is seen cropping below high-water mark on the west bank of the estuary, and which but for the existence of the fault A B, of which the parties do not seem to have been aware, would have been successful. Owing to this circumstance, however, they sank and bored two-hundred feet in beds immediately underneath the crop of the coal, and which are exposed to view on the surface to the south along the

shores of the estuary,—thus wasting both time and money.

In the several bores and shafts A B C D, a thickness of nearly four-hundred feet of coal-measures has been proved, in which only one seam of coal of a workable thickness exists.

This seam could however, I think, be worked over an area of at least 300 acres: this, taking the seam at 3 feet, and the cubic foot of coal at 56 lbs., would give something like 900,000 tons of Coal. The seam is said to be 5 feet, but it has never been cut except with boring rods at B and C on the plan.

The largest workable area would probably be on the west bank of the estuary, where no works have hitherto been executed, the land being a Government Township Reserve.

In the area above described no shaft would, I think, require to be carried more than 200 feet in order to obtain Coal. I was unable to obtain specimens from which the quality of the Coal could be judged; but Captain Vicary states that it is an excellent bituminous Coal, ignites freely, and burns with a bright flame. Such being the case, and considering the proximity to the shipping-place, some additional outlay in this locality would, I think, be desirable, and would, if properly expended, in all probability result in the discovery of a workable Coal-field.

4.—THE DOUGLAS RIVER.

From the Schouten Island to about three miles north of the Douglas River Company's Jetty at Waub's Harbour, the coast-line is entirely occupied by granite; thence for about six miles along the coast to near Long Point we find the sandstones of the Coal-measure series exposed at intervals, occasionally rising into low cliffs, or forming low shelving

plateaus below high-water mark, backed by steep hillocks of blown sand.

At Long Point granite, with vertical clay slates and sandstones resting against it, is exposed; and thence to St. Patrick's Head and Falmouth, with only one exception, about two miles south of Piccaninni Point, where a very coarse granitic conglomerate, probably the base of the carboniferous series, is exposed on the back, dipping south 5°.

Granite and clay-slate are the only rocks seen in place; the before-mentioned six miles of coast occupied by carboniferous strata varies in width from one to four miles, at which distance inland the country rises into massive greenstone ridges against the steep escarpments, and in the hollows of which the carboniferous beds have in all probability been deposited.

One is irresistibly led to this conclusion from the apparently undisturbed and unaltered condition of the latter, even where they are in closest proximity to the igneous mass. At the southern extremity of the above tract of country are situated the Douglas River Coal Company's works.

The land occupied by the Company extends over about 2100 acres, bounded on the north by the Denison Rivulet.

Over nearly the whole of this area workable seams of Coal will, I think, be found to exist. Numerous shafts and boreholes have been sunk, and in most of them Dr. Milligan states that seams of Coal have been cut. All the shafts were at the period of my visit full of water; I was therefore unable to inspect the seams, nor could I at the time obtain the measurements of the different strata penetrated in the shafts and bores.

The vertical section, Pl. III., fig. 1, is a section of the seam for the purpose of working which the Company are now erecting a 20-horse-power engine.

The central or 20-inch portion of the seam is the only part available for a supply of fuel. This, supposing it to extend only over an area of one square mile, or 640 acres, would at a moderate computation yield about 800,000 tons of Coal; and there is little doubt that this seam, and probably others, exist over a much larger area between the present works and Allen's Point, half a mile south of the Douglas River.

In ascending the Douglas River, after passing over a series of soft grey and brown sandstones, dipping from (E. 20° S.) to (S. E.) 5° to 10°, for about four miles, we come on the crop of a magnificent seam of Coal eight feet thick, with only one six-inch parting, and apparently of first-rate quality; it dips (E. 30° S.) 6°. Now, as in ascending the river from its mouth there appears no evidence of the existence of any great fault or dislocation, but a regular succession from higher into lower beds, the above seam would, in all probability, be found to extend underneath nearly the whole of the flat country from four miles south to at least two miles north of the Douglas, including the land occupied by the Douglas River Coal Company. In the vicinity of Allen's Farm, or about $2\frac{1}{2}$ miles in a south-easterly direction from the crop, supposing the seam continues to dip at the same angle—viz. 6°, or 1 in 9—we might expect to find it at a depth of 1400 feet: apparently, however, the beds flatten considerably in this direction, and at the mouth of the river they are nearly horizontal. This would, of course, throw the coal much nearer the surface.

Prior to any deep sinking being undertaken near the coast, a boring might be made higher up the river, and within half or three quarters of a mile of the crop, which, if carried from 300 to 400 feet, would prove the continuance or otherwise of the seam in the direction of the dip.

That it is permanent over a considerable area, is evidenced

by the fact that about half a mile above the first crop, after passing over a small anticlinal axis, we again come on the Coal in its original thickness dipping up the stream, or nearly north, at an angle of 7°, the intermediate portion of the arch having been denuded with the Coal along the river channel. *Vide* Pl. III., fig. 2.

This seam would, taking the cubic foot at 56 lbs., and not allowing for loss in working, yield about 5,200,000 tons per square mile.

On either bank of the stream the beds are overlaid by large masses of greenstone, which have fallen or been transported from the surrounding high peaks and ridges: this greenstone drift at several points along the course of the river has been cut through to a depth of 30 or 40 feet, and I have no doubt it often attains even a much greater thickness.

It is universally distributed along the flanks of all the higher ranges, extending from the solid greenstone which usually forms their summits nearly to the sea level, and thus almost invariably concealing the actual junction of the latter with the beds of the carboniferous series, which are seldom exposed on the surface except in the river channels, where the overlying drift has been cut through, or on the sea-beach.

Besides the seams already noticed, several other smaller ones occur, associated with beds probably above those sunk through in the Company's works.

The crop of one, if not two, of these is partly exposed in a cutting on the tramway about three quarters of a mile south from the "New Coal Shafts," marked in the accompanying plan.

Again, at three points in the banks of the Denison Rivulet seams of Coal are seen cropping.

The first is situated on a line bearing N. 15° W. from the "Old Coal Shafts," and about 450 yards distant.

The others are about two miles higher up the Rivulet, where all the beds are again overlaid as in the Douglas, by enormous masses of fallen greenstone.

At the first-mentioned point the section Pl. III, fig. 3, is seen.

In the shaft A, commenced on the bank about 35 feet above the level of the Creek, five or six seams of Coal were cut in something less than 50 feet.

Two of these are seen partly exposed in the river bank below the shaft: they dip at a low angle in the direction from A to B, or down the Creek; and at the latter point about 300 yards distant from A, a bore-hole B was commenced for the purpose of further proving these seams. It was, however, carried 290 feet without cutting a single seam, and passed the entire depth through brown and grey sandstone rock.

On examining the strata exposed in the bed of the Creek from A to B, the cause of this is apparent; the vertical strata seen at C indicating the existence and position of an extensive dislocation of the beds.

Whether the sandstones passed through in the bore-hole B are above or below the Coal-seams at A, there is not here sufficient evidence to determine; nor is at all certain what position they occupy relatively to the two seams which have been cut in the "Old Coal Shafts" on the south side of the Creek.

Much more ample details of the general geological features of this district, including the valleys of the Apsley and South Esk, than I am able to furnish, are given in Dr. Milligan's "Report on the Coals of Fingal and the East Coast," pub-

lished in the Transactions of the Royal Society of Van Diemen's Land, Vol. I., Part I.

As I only paid a very hasty visit, and to a limited portion of the valley of the Apsley, I can merely state that all the evidence I saw led me to form a very favourable opinion as regards the existence in it of workable seams of Coal.

The general dip of the carboniferous strata where seen near the Township of Llandaff is in the same direction as at the Douglas River Coal Company's works—viz., E. 10° S.; and they would be nearly on the same geological horizon as the sandstones which are there found overlaying the Coal-seams.

They are, however, not continuous as between the two points; and about one mile from the coast there runs a low ridge forming the watershed between the Denison Rivulet and other Creeks running to the eastward, and the Apsley, which runs south to Moulting Bay.

To the southward and eastward towards the Township of Bicheno this ridge is composed of granite, and to the northward entirely of greenstone,—thus completely separating the carboniferous strata of the Douglas and the Apsley.

About one mile westward from the Township of Bicheno, at the junction of the granite with the greenstone, a low gap occurs in the ridge through which the road from the Apsley to the east coast now passes, and which would afford an easy line for the construction of a tramway for the conveyance to the shipping at Waubs Harbour of any Coals which may eventually be discovered in the valley of the Apsley.

That such do exist has already been shown by Dr. Milligan in the Report before referred to; and it now remains to prove their thickness and extent, which can only be accomplished by a series of borings,—the sites for which should

be selected after a careful examination of the surface, and not merely at random, as is too much the fashion in undertakings of a like nature, thereby often causing a useless expenditure of both capital and labour.

For the present wants of the Colony, however, I should say that the Douglas River District possesses in several respects advantages and facilities for the production of Coal not to be found combined in any other District I have visited in Van Diemen's Land: these are—proximity to the point of shipment,—absence of large masses of intrusive igneous rock in the area to be worked,—and thickness, extent, and number of workable seams.

Supposing, however, only two workable seams to exist,—one 8 feet, and one 1 foot 8 inches,—they would together, after deducting one-fourth for loss in various ways, yield upwards of 5,160,000 ton per square mile.

The great depth (1500 or 1600 feet) at which over some portion of the area the 8-foot seam would, in all probability, have to be worked need not be regarded as an insurmountable obstacle in the way of its being profitably worked.

5.—FALMOUTH TO FINGAL, AVOCA, AND CLEVELAND.

From Falmouth to the top of St. Mary's Pass the formation consists entirely of granite: descending towards the Break-o'-day Valley at an elevation of about 1000 feet, vertical clay-slates first make their appearance; and resting on these are beds of a very coarse quartz conglomerate, principally composed of rounded pebbles of white quartz. These beds would appear here to form the base of the carboniferous series, and are probably part of the same series

as are found cropping on the east coast south of Piccaninni Point.

In a high, flat-topped hill south of St. Mary's Pass the section Pl. IV., fig. 1, presents itself.

Lower down the Break-o'-day Valley, nearly opposite the residence of F. L. Steiglitz, Esq., and at other points, the limestone (D) crops out in the bottom of the valley. In the flanks of the hills on either side, and along the valley of the South Esk, at elevations of from 400 to 500 feet above the level of the valley, several seams of Coal are found cropping.

They occur on the Mount Nicholas range, on the estate of F. L. Steiglitz, Esq., and close to the Township of Fingal. These latter were the only seams I had an opportunity of examining in this neighbourhood.

They are situated about $2\frac{1}{2}$ miles S. 10° E. from the Township, upward of 500 feet above the level of the South Esk, and about 1500 feet above the level of the sea. The seams, two in number, respectively 14 feet and 3 feet thick, are exposed in the upper part of two branches of a small creek which run at this point about 100 yards apart down the steep slope of a hill, cutting through the greenstone debris with which the face of the hill is thickly covered.

The seams are dipping about 10° to 15° into the hill, or from E. 10° S. to about 10° N. Between the uppermost or 3-feet seam, and the thick seam below there are about 100 feet of soft grayish and brown sandstone, and some thick beds of shale. Except in the channels of the two creeks for a few yards, the Coal is no where visible on the surface.

It appears to be of good quality, though of rather slaty structure, and, like most of the Coals in Van Diemen's

Land, contains a very large per-centage of incombustible matter.

On all sides the beds are surrounded and appear to be overlaid or cut off by massive greenstone, as represented in the plan and section, Pl. IV., figs. 2 and 3. What the actual geological relations of the greenstone and the carboniferus beds are, is very difficult to determine; that the latter do not pass conformably underneath them is, I think, certain; and it, therefore, remains to decide whether they are completely cut off and isolated by the greenstone, as represented in the plan and section, Pl. IV., fig. 2,—or whether the latter have been forced to the surface through numerous and distant vents and fissures, and quietly overflowed the already upheaved and denuded edges of the carboniferous beds.

In either of these cases similar appearances would be found on the surface; but a very wide difference would exist as regards the economic value of the several seams of Coal.

From the dip and direction of the Fingal seams, I have little doubt that they are portions of the same, and were once continuous with those which occur on the north side of the Break-o'-day Valley in the flanks of the Mount Nicholas Range,—the intermediate portions being entirely swept away during the formation of the valley of the South Esk and Break-o'-day, and thus exposing the lower beds consisting of clay-rock and fossiliferous limestones which, as before stated, are found cropping at several points from a few miles below Fingal to the entrance of St. Mary's Pass. From Fingal to Avoca and Cleveland on the Hobart Town and Launceston road, the carboniferous beds do not again make their appearance; and the hills which arise from the valley on either side are chiefly composed of the older upheaved

and contorted clay-slates and sandstones: wherever these do not come to the surface, the bottom of the valley seems exclusively occupied by hard dark augitic basalt, often becoming scoriaceous and vesicular.

These basalts are evidently of more recent date than the crystalline greenstones associated with the carboniferous beds. In lithological character they precisely resemble the basalts and lavas which form many of the extensive plains of Victoria. Here also, as there, they form a fine rich agricultural country, openly timbered, rather flat, and covered with a stiff black soil, and I have little doubt are of the same geological age, viz., tertiary or post-tertiary: they have, as in many similar instances in Victoria, evidently flowed in a molten state through the present valley.

I had no opportunity of visiting the diggings near Fingal, but was much struck when passing over the country occupied by the old clay-slates and sandstones with their resemblance to the auriferous rocks of Victoria, and the promising aspect of the very numerous quartz veins which every where traverse them in all directions; and I have little doubt that gold will eventually be found along many portions of the South Esk Valley.

6.—THE COAL-WORKS ON THE MERSEY AND DON.

The principal works which have been executed in searching for Coal in the above Districts are those of the Mersey Coal Company, of Mr. Williams, and of Messrs. Dean and Denny.

The Mersey Coal Company have expended upwards of £14,000; and the works executed are, one shaft between 250 and 300 feet, and numerous bore-holes.

Up to the period of my visit they had not succeeded in

discovering any Coal: since then I have learnt they have cut a seam of Coal in a bore-hole which was then being executed. This bore is situated at the extreme N.W. corner of the Company's property, and about 50 or 60 yards from the East bank of the River Don.

With the exception of, perhaps, over one or two acres in this corner, I do not believe any Coal will be found on the lands occupied by the Company.

In the shaft before mentioned the work was, fortunately for the pockets of the Company, stopped by an enormous influx of water, which the engine could not keep under.

At the period of my visit they proposed erecting another and more powerful engine: this I strongly persuaded them against, as, on examining the debris of the rocks that had been raised from the shaft, I found them to consist of the fossiliferous limestone shales, which in Van Diemen's Land as in New South Wales form the base of the carboniferous system, and under which no Coal is likely to be discovered.

About two to three miles nearly south of the above shaft a bore-hole was being executed by the Company: it had reached a depth of 102 feet, passing the whole distance through grey arenaceous shales.

This I also recommended them to abandon, as it was almost directly on the strike of, and therefore in, the same beds passed through in the shaft.

The whole of the Company's land with the exception above mentioned is, I believe, occupied by these fossiliferous beds, with a few isolated and very thin patches of carboniferous strata resting on them.

Mr. Williams' works are situated near the south-west corner of the Township of Tarleton, and consist of one shaft 270 feet deep.

In this shaft the beds passed through were,—

Blue argillaceous marl or shales with numerous fossil shells, Producti, Spiriferæ, &c.....	70 feet.
Hard grey sandstone and conglomerate rock, fossil shells very scarce.....	200 feet.
Total.....	270 feet.

Here again we have a shaft 270 feet deep sunk entirely through beds beneath the carboniferous series, and in which, of course, no Coal was discovered,—nor, as I told Mr. Williams, would he have the smallest chance of finding Coal were he to sink another thousand yards: he, however, is firmly persuaded to the contrary, and intends, if he can raise funds, and find men to undertake the work of sinking through a quartz conglomerate nearly as hard as cast-iron, to carry the shaft deeper.

About one mile north-west from this shaft Mr. Williams has discovered a seam of Coal cropping in a small water-course; it is about 2 feet thick, and dips (S. 23° E.) 3°.

He had only just commenced opening into it at the period of my visit. I have been informed since that, following it up the hill, or on the rise, it was found to be suddenly cut off and completely thrown out by a fault: in the opposite direction or on the dip it is evidently cut off between the place opened and the deep shaft towards which it dips,—so that there would be only a narrow strip of coal measures let down by faults between the lower fossiliferous beds. See Section Pl. V. fig. 1.

Notwithstanding this, unless the two above-mentioned faults are within a very short distance of each other, run together at an acute angle, and are also crossed at a short distance in the opposite direction by another fault, thus forming a small triangular patch, I think Mr. Williams will be able to raise a considerable quantity of excellent

Coal at a very small expense,—it being very near the surface. On the River Don the Coal is seen cropping in two places, and here Messrs. Dean and Denny's works are situated; the seam is from 2 feet 2 inches to 2 feet 4 inches thick, and the Coal in quality is by far the best I have seen in Van Diemen's Land, the per-centage of incombustible matter being 22 per cent. less than any other. Three shafts have been sunk on this seam; the first was sunk within a few yards of where the seam is seen cropping in the river, and in close proximity to a large fault which completely cuts it off.

In this shaft the Coal was soon, as miners term it, "run out," and the shaft abandoned; another shaft was then sunk about 30 or 40 yards distant from the first, directly on the strike of the seam, and was carried 80 ? feet through fossiliferous grey shales without meeting with any indication of Coal, thus proving the existence between the two shafts of the fault above-mentioned.

The other two shafts are both on the strike of the seam, close to the banks of the river, and about a quarter of a mile apart.

The one sunk some time since when the Coal was first discovered I could not examine, it being full of water: the Coal was cut in it about 20 feet from the surface, and some six or eight tons raised, which now lies on the bank.

The other shaft, which had just been completed at the period of my visit, I examined, and obtained the following section:—

	Feet.	*Inches.*
Mould	3	6
Yellow Clay	2	6
Grey Sandstone	1	6
Blue Bind or Shale	2	5

	Feet.	*Inches.*	
Coal	0	6	
Blue Fire Clay	0	8	
Clod	4	4	
White Sandstone	0	4	
Coal	2	3	Dip (E. 20°N.) 10°
Total	18	0	

The Mersey Coal Company's bore-hole before mentioned in which they had cut a seam of Coal is situated about 80 or 90 yards north-easterly from the above shaft, and the seam cut is the same as the one in Messrs. Dean and Denny's shaft on the opposite bank of the river: the rise of the ground, the distance, and dip of the seam will hardly explain without another fault the greater depth (134 feet) at which the Coal was cut in the bore-hole. Should a shaft be sunk on the site of this bore, I believe that to the eastward or towards the Company's land the Coal will be found to be again cut off by a fault; as in ascending the hill in the above direction we come on beds of yellow gritty and argillaceous shales full of corals and other fossils of the limestone series. See Section Pl. V., fig. 1. The Coal discovered by Mr. Williams is, I believe, a portion of the same seam.

Wherever this seam has been cut it is of excellent quality; but the very small area over which it appears to extend on the River Don (from 50 to 80 acres) renders it very doubtful whether the large outlay would be repaid which is necessary for the construction of four miles of tramway, the erection of an engine, and other expenses (not much less than £14,000), before the Coals could be shipped.

Taking the area at 70 acres it would give a yield of

105,000 tons of Coal, deducting $\frac{1}{4}$ for loss in various ways. This, taking the value to the producer at ten shillings per ton, would give £52,500 as the nett proceeds of the undertaking.

Such being the case, I should advise that before any great outlay be incurred a series of bores should be executed accurately to prove the workable area of the 2 feet 4 inch seam; and also a bore from the bottom of the present shaft to prove the existence, or otherwise, of other seams underneath the one already discovered.

From the very faulted character of the country on the Don and Mersey, I do not think that a Coal-field of any great extent will ever be discovered: there are, however, a number of narrow bands and patches of various sizes of the Coal-measure series, which have been preserved from denudation with the Coal-seams they contain by being dropped down between lower beds by faults crossing each other in all directions. I have attempted to show this in Section and Diagram Pl. V.

What the thickness or number of seams below the 2 feet 4 inch seam in these narrow bands and patches may be has as yet never been proved, owing to all the deep sinkings and bore-holes having been executed at random, and always unfortunately in the underlying fossiliferous strata.

This, of course, is a very important question to decide, and one which must be determined before the workable value of the Mersey and Don Coal-fields can be accurately estimated. Less than half the money which has already been uselessly expended had the works been executed under proper superintendence, and with due regard to the geological features of the country, would have been amply suf-

ficient to decide both the extent of the several bands and patches of the carboniferous strata, and the number and thickness of the Coal-seams contained in them.

The following information I have recently received from Mr. Dean of the River Mersey:—

"The Mersey Coal Company have commenced boring on my land about 400 yards from the house: they bored 30 feet, and came into a quicksand, which ran in very fast and gave the miners much trouble; they then wished to prove that you were in error; and made an offer to the Company that if they would find them in rations, without wages, they would get the Coal for the Company at the shaft * where the water runs over the top: the men were allowed to leave my land, and are now boring close to the shaft, but have not yet got the Coal."

This, of course, is a most absurd waste of labour, unless some very large faults exist, of which I could see no evidence, close to the shaft in question.

Mr. Dean adds:—

"Mr. Williams is hard at work stripping the Coal, and will have a large quantity to ship in the spring. Mr. Johnston has found the Coal cropping 2½ miles south east from Mr. Williams on crown land; it appears to be the same seam, about 2 feet 2 inches thick, and butts against the yellow Coal."

(This yellow Coal is the Dysodile, or combustible schist, which has been known to exist for some time on the Mersey: the same kind of schist is found near Syracuse, in Sicily.)

"The Mersey Company are now boring close to the Don,

* This shaft is the one before mentioned by me as having been abandoned owing to the great influx of water.

exactly opposite our shaft, trying for a second seam, and have sunk 110 feet through soft sand stone and dark "clod" or argillaceous schale." This bore is about 50 to 80 yards from the one before mentioned in which the Company had cut the Coal at 134 feet, and about the same distance nearer the river, in fact close on the bank,—the Coal on the opposite bank being only 18 feet deep.

Thus a considerable fault must exist, if the information I have received be correct, along the bed of the Don at this point. See Section Pl. V., fig. 1.

I much regret not having received a map of the surveyed and purchased lands on the Don and Mersey,—which I have twice applied for at the Survey Office, Hobart Town,—as I could then have pointed out very nearly the relative position of the different shafts and bores, as well as the ground over which Coal is most likely to be found.

From a few rough experiments on specimens from the various Coal-seams, I have obtained results which places them in the following order as regards quality:—

1. Mersey.
2. Douglas River, 8-feet seam.
3. Douglas River, 20-inch seam.
4. Fingal.
5. Prosser's Plains.