PAPERS AND PROCEEDINGS

OF

THE ROYAL SOCIETY

OF

VAN DIEMEN'S LAND.

VOL. I.

TASMANIA:

SOLD BY

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HENRY DOWLING, BOOKSELLER, LAUNCESTON;

1851.

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OF

THE ROYAL SOCIETY

OF Tasmania

VAN DIEMEN'S LAND.

VOL. I. PART I.

MAY, 1849.

Van Diemen's Land:

JAMES BARNARD, GOVERNMENT PRINTER, HOBART TOWN.

1849.

REPORTS

ON

THE COAL BASINS

OF

VAN DIEMEN'S LAND.

BY

JOSEPH MILLIGAN, ESQ.

SECRETARY OF THE ROYAL SOCIETY OF VAN DIEMEN'S LAND.

COMMUNICATED BY HIS EXCELLENCY THE LIEUTENANT-GOVERNOR TO THE ROYAL SOCIETY OF VAN DIEMEN'S LAND; AND READ AT THEIR MONTHLY MEETINGS.

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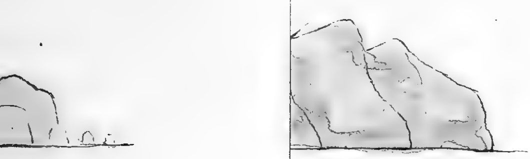

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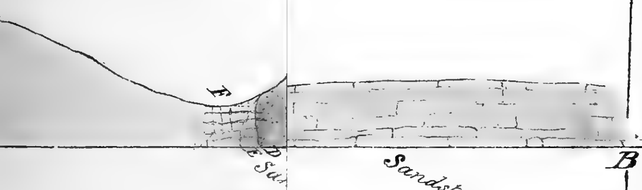

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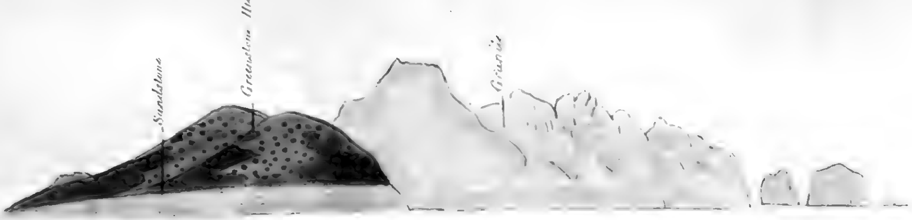
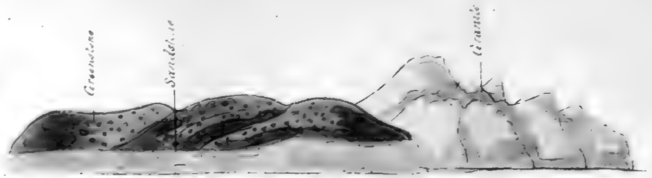


SCHOUTEN'S ISLAND Bearing N.N.E.
distant 4 Miles



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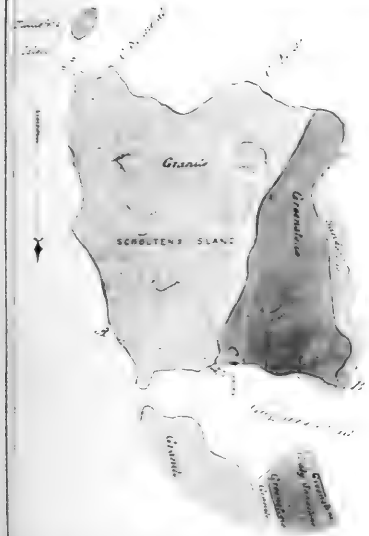
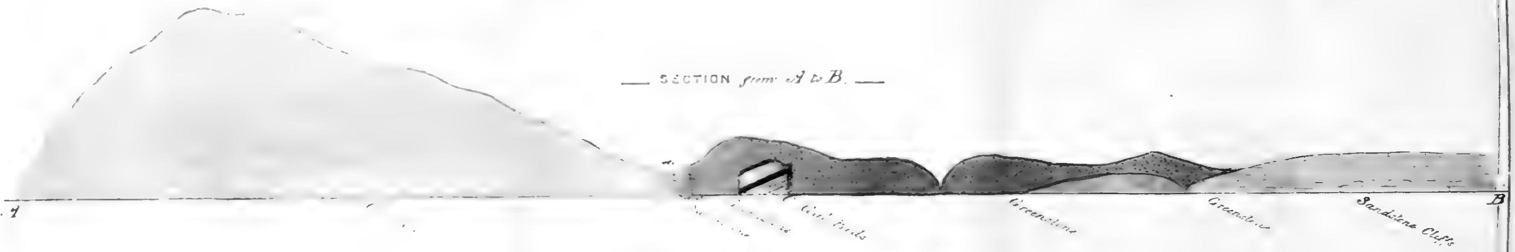


SCALE of 2 Miles to 1 inch



SECTION from A to B.

Vertical Scale 100 feet to 1 inch
Horizontal D° 3 inches to 1 mile

No. I.

SCHOUTEN ISLAND.

Hobart Town, 15th August, 1848.

Sir,

Having now visited, and examined with all the care and precision of which circumstances would admit, several of the Coal Basins of the Island, I have the honor to report my observations upon them to be submitted to His Excellency the Lieutenant-Governor. And I have first to notice that at Schouten Island.

This coal is situated on the northern shore of the Schouten Island, in Geographe Strait, about $\frac{3}{4}$ of a mile west from the anchorage laid down in the charts.

Vessels may anchor within 250 or 300 yards of the coal; and being then much nearer to the inner than to the outer end of the strait, they are sheltered from the long heavy roll of the external ocean.

The only quarter from which mischief need be at all apprehended is that of Swansea, bearing about N.W., the direction of the prevalent wind, in which there is an open "fetch" of several miles across Oyster Bay. Notwithstanding this, it would not be necessary for vessels to shift their anchorage unless during the very heaviest gales, when they might run under cover of the point on the opposite side of the strait, or bring up nearer the whalers' anchorage, in either of which places the shelter would be complete.

It does not appear that any great difficulty would be experienced in constructing an open pier with a platform of plank, along which the coal might in ordinary weather be conveyed upon a tramway on wooden rails, and delivered at the termination into a barge, lighter, or larger vessel of moderate tonnage, in smooth water, and beyond the swell setting upon the beach.

In moderate weather a boat can land without danger or difficultty within a few yards of the coal seam ; and in the finer part of the year, when easterly winds prevail, boats might thus with great ease and expedition be loaded at the beach.

The whole eastern side of the Schouten Island, to the extent of about $\frac{2}{3}$rds of its area, is of massive granite, rising into high, rugged, and picturesque hills.

The remaining third of the surface of the Island consists of greenstone eminences ; lofty and barren enough for the most part, but still more undulating and rounded in their outline, and more prolific of vegetation and timber trees, than the granite section, which, except in deep ravines, and around the base of the hills, supports only, and at long intervals, a scanty show of scrubby and stunted plants.

On the more gentle slopes of the greenstone hills, and their varied undulations, there is besides a forest of gum trees (*Eucalyptus* of various species), many stately specimens of Oyster Bay pine (*Callitris Australis*), with a good deal of grass and other herbage fit for sheep and cattle.

With a view to the maintenance of a number of men to work the coal, it is worth noticing, that from 200 to 300 sheep have at one time run and improved in condition upon the Island.

The greenstone is generally prismatic or schistose in structure ; but sometimes it is massive, very compact, and of a deep dark-bluish colour, with a flat conchoidal fracture and ringing sound, like that of clinkstone when struck with a hammer.

Flanking the greenstone, and girding the coast, with slight intermission, from the point forming the southern side of the entrance to Geographe Strait, out of Oyster Bay, round to about the south-west point of the Island, is sandstone rising into vertical cliffs of considerable height,—whence, however, it dips at once under the greenstone, and does not any where present itself in the central parts of the Island.

From the western entrance point of the strait, a curved beach of shingle and sand extends to the situation where the coal is; and there is within the bend a long shallow lagoon full of reeds and bulrushes, the roots of which abound in starch. This lagoon is banked out by a ridge of large rounded pebbles and sand, thrown up at a time when the elevation of the land must have been less by several feet than it is at present.

Immediately behind this, the land, which at the time of my visit was rank and green with herbage, swells easily up into rounded greenstone hills.

Where the coal has been found, schistose sandstone and shaly clays show themselves along a steep sloping bank for about 160 yards, at either extremity of which space the greenstone hems it in, down to the shingle and sand on one side, and to the water's edge on the other.

This eruptive rock seems to have been poured from some central point of the Island, or more probably from a nearly meridional line of extrusion, which may be traced along the western side of the Schouten main-land, forming an irregular and occasionally interrupted line of undulating grassy hills, with low dark head-lands, which determine the limits of that side of Oyster Bay, and of the extensive inland waters at the head of Swanport, as far as the mouth of the River Apsley. However this may be, the greenstone appears to repose (at the point I have mentioned, and which is marked on the Plan and Section with the letter C) upon the coal-measures, which dip to the S.E. at an angle of 12° or 13°, and range to the S.W. and W.S.W.

The point of greenstone (D), which juts into the sea to the eastward of the coal, partially at least overlies schistose clay with vegetable impressions,—which clay stretches under and supports the coal-seams and associated beds.

To the eastward of the greenstone point (D), sandstone (E) recurs for a short space, but having suffered upheaval; for it is inclined at an angle of about 30°, with numerous veins and seams of a ferruginous nature traversing its substance. High on the bank it becomes soft, laminated, carbonaceous, and of course dark in colour,—the same which is associated with the coal at (C),—and probably indicates the extension of the seams from the opposite side of the greenstone point to the flattish valley (F) within.

There is, however, no natural exposition of the strata absolutely to determine the question of the continuity or presence even of the seams: nor could it be ascertained whether, if coal actually exists at F, it is situated at a depth from the surface at which it may be found practicable to work it.

Where this upthrow of sandstone occurs, there is seen at low water-mark a highly inclined slaty clay, and immediately adjoining it massive granite *in situ*.

This clay-slate is probably of the transition era, as the beds of sandstone would appear to rest upon it unconformably; and it displays much of the cuboid structure, and possesses the ferruginous septa so common in the old metalliferous rocks.

Recurring to the coal in the spot (C) where I have indicated it as being accessible by water almost to the outcrop of the seams, I have to state that I found there the remains of considerable workings.

This enabled me to see that the strata immediately over and under the coal are of white fire-clay, and replete with vegetable impressions, which fire-clay is succeeded on either hand by soft carbonaceous sandstone and shales.

There are two seams of coal diagonally intersecting the face of the hill: the upper is a thin one of worthless stony anthracite, about 40 feet up the bank: the lower seam is a valuable one; it measures throughout 6 to $6\frac{1}{2}$ feet, and consists in its upper part of a subordinate layer of anthracite of a porous and coke-like character, with several layers in succession of bituminous coal, separated only by two or three very thin bands of shale and hardened and altered clays, and having a few inches of hard black shale under all. From a seam of such magnitude and quality it is reasonable to expect, after making fair allowance for waste, that at least four feet of good coal for domestic or other purposes might be realized.

It is usual to include under the name of anthracite all non-bituminous coal.

There are two sorts, however: one is light, porous, and hard, with great tenacity; the other is slaty, dull, earthy, and heavy.

The former burns freely, has great heating powers, and yields its caloric rapidly.

The latter ignites only at a high temperature, burns slowly, and radiates the heat which it is capable of producing through a longer period of time, and is of course a less efficient heating agent.

It will be convenient to distinguish these two sorts of anthracite by the terms *earthy* and *coke-like*, differing as they do so widely in their qualities and value.

As a general rule, bodies in burning heat in proportion to the carbon which they contain; but combustion may be retarded by the presence of earthy matter, and one coal, though containing as compared with another less carbon, may yet have greater heating power, in consequence of its containing bitumen, and its combustion being more rapid and complete.

It appears certain, for instance, that the Schouten coal taken in the aggregate, from its containing so considerable a proportion of bitumen in the lower part of its seam, and so large an amount of carbon in the upper portion of it, possesses heating powers far superior to the coal from Port Arthur, which probably contains a much larger proportion of carbon in a given weight.

Earthy anthracite in a state of combustion is not only less powerful in emitting heat, but, in consequence of the extreme difficulty with which it ignites, a great deal of time, and already realized caloric, are wasted by its introduction into furnaces in an unprepared state. It only burns after attaining a high temperature; and until it reaches this point it absorbs heat, and reduces the temperature around it.

An owner of steam machinery here informs me, that he considers the value of the Sydney bituminous coal, from the greater intensity and manageableness of its heating powers, as three to one compared with Port Arthur coal.

The customary articles of fuel rank as heating agents in the following order:—

Perfectly dry Wood.
Pit Coal.
Coke.
Wood Charcoal.
The Oils, &c.

In the preparatory roasting of metallic ores for reduction, slow combustion is desirable, as some of them are fusible and easily run, involving surrounding objects, and impeding the general process of expulsion of sulphur.

The inferior coal of the subordinate slaty layers would be adequate to this purpose; while mixed portions of the bituminous and carbonaceous qualities would answer well for the subsequent processes of reduction, where a full and effective heat is required to be at once applied.

More than 3 feet of the Schouten seam are bituminous, emitting black smoke, and yielding a white flame, and a powerful heat.

This would suit well for domestic purposes, and for the preparation of illuminating gas. With these objects in view, the best of it might therefore be set apart in working it out.

The inferior and mixed qualities would, as I have said, be adequate to all the necessities of smelting furnaces; while the coal taken generally from the seams, after rejecting a few inches of stony and earthy anthracite at the very top, and two narrow bands of hard tenacious stony matter at and a little below the middle of it, with a few inches of the slaty matter beneath, would be found I think quite equal to the requirements of Steam Navigation on long voyages, where it is essential that the highest and most expeditious heating power should be comprised in the smallest possible compass.

The situation in which this coal occurs could scarcely be more favourable for shipment; and the position of the beds falling about one foot in 5½ or 6, as they run diagonally down the slope of a moderately steep bank capped with greenstone, offers every facility for carrying into the seam drifts and shafts, wherever they may be needed, for riddance of water, for air-courses, &c.

It is not probable that water would be troublesome in working this coal, at least from the sea level to the crop of the seam.

The country behind undulates a good deal, and is, therefore, naturally well drained. On the other hand, the thick bed of hard clay with vegetable impressions immediately over the coal is apt to flake off and descend in large irregular masses, and does not on that account form a good roof.

It would, therefore, in mining be requisite to prop strongly with timber, and to leave ample solid pillars of coal. At the same time, I observe, that it is only in those portions of the galleries in which the coal has been worked completely out that the roof has fallen in; and that where the roof is well arched in the anthracite and shale in the upper part of the seam, no separation whatever has occurred. By adopting this practice throughout, timber might therefore, to a great extent, be dispensed with.

With reference to the insufficiency, however, of these clayey beds as a roof, it is right to state that the passages have all been left open to the action of air and moisture, which could not but lead, in the nature of things, to partial disintegration and detachment of masses from both roof and sides.

The old workings are of the following nature and extent:—

One main drift begun a little above high water-mark, and nearly 6 feet × 6 feet, has been carried in the direction (S.S.W. and W.S.W.) or range of the seam more than 100 yards.

From this two branch galleries have been worked towards the crop, so as to communicate round a massive square pillar.

A narrow air-course had been carried thence to the surface of the bank.

The main drift has a slight rise inwards, so that when the floor is clear from obstruction, water finds its way to the beach at the entrance. There is a tramway along the bottom upon which trucks have been used to convey away the coal. Water stood nearly a foot deep in a great part of the drift at the time I inspected it, in consequence of its being dammed in by rubbish fallen from the roof and sides. There was a continual dripping from the roof in some parts of the drift; and at its termination the drops fell so thick that it was difficult to maintain a light.

The drift ended abruptly, and apparently in massive clay, having its surface worn and smoothed by the perpetual flow of water over it.

To me, in the imperfect light which I could command, it looked like a fault or shift of the strata; and I was disposed to consider the coal-seam as suddenly broken off at or near that point by the greenstone.

On this assumption, I calculated that no greater amount than 25,000 or 30,000 tons could be realized by working out the seam to its crop; and that a similar or somewhat larger quantity might be drawn from workings to the dip by the employment of a steam engine, &c.

Having since referred to some of the persons formerly working the Schouten coal, I am assured that the appearance of a fault or shift at the end of the main gallery was deceptious, and that the coal-seam was perfect where the workings were relinquished; a fact which gives a very different aspect to the extent and value of the colliery.

There is a second drift 30 yards to the westward, and about 15 feet higher up the bank—of course nearer the crop of the seam.

This drift proceeds horizontally in the same direction as the former for about 50 yards. The second drift is free from water, but portions of the roof and walls have fallen in at many points.

The inclination of the seam appears to be a little greater at this level. Other openings have been made and abandoned, and they are now filled up with rubbish.

There is a thin seam of hard earthy anthracite about 35 feet above the 6-feet seam of coal, overlaid with shale, slaty clays, and soft carbonaceous sandstone.

With regard to the probable amount of coal to be obtained at the Schouten Island, I venture to give an opinion with diffidence. The coal-seams partially show themselves variously disrupted and dislocated in the cliffs of the sandstone skirting the south-west shore of the Island, at a distance of about two miles from the old workings. But the surface of the country is very broken, indicating a disturbance in that direction so great, as to render it unsafe to calculate with any degree of confidence without actual sections by boring at different points in the course of the crop.

Assuming the superficial contents of the Island at 16 square miles, and that the coal originally extended over the third part of it,—that part which I now state to be occupied by greenstone,—and supposing that, after rejecting $\frac{1}{16}$th of this for loss by denudation, &c., an area of two-fifths (say two square miles) were found productive of coal, of which it might be possible to mine out one-fourth part, then about 3,000,000 tons would be realized from a seam yielding four feet of coal.

But this calculation hinges altogether upon the question, whether coal may be found to extend at an available depth under the trappean rocks into the central valley between the granite and greenstone hills. It will be safer, therefore, to presume that the seam under notice is continued with greater or less regularity to the point where it is seen in broken and disjointed masses in the cliffs on the south-west side of the Island,—a direct distance which I have roundly computed at two miles,— and that it may be found practicable to push works underground half the distance, realizing 4 feet of coal along one mile at least through a breast of 500 feet or thereabouts.

This would give a product of 10,560,000 cubic feet, which, deducting one-fourth for loss in various ways, would yield, at 20 feet to the ton, nearly 400,000 tons of coal, and this by *working to the crop only.*

It is obvious that by working to the dip of the seam, and using powerful and expensive steam machinery, a much larger additional quantity might be obtained.

The great thickness of this seam of coal, and its isolated position upon the corner of a small Island, claim for it the relation of a very small part of a large basin to its *whole.*

It seems more than probable that the expanse of waters in Oyster Bay occupy the place of a system of coal, shale, and soft sandstones, which once constituted a large coal field, of which one small remnant presents itself on Schouten Island, and others at or near Little Swanport and Rocky Hills, and at intervals along the base of the hills at the extremity of Great Swanport.

Prosecuting this view of the subject, I traversed in various directions the Schouten peninsula and main-land as far as the head of Moulting Bay, near the mouth of the Apsley River, and then crossed towards the Douglas River.

On the Schouten peninsula in Geographe Strait, immediately opposite to the coal-mines on the Schouten Island, there is a nook in which the carbonaceous, schistose, and clayey sandstones with vegetable impressions, which accompany the Schouten seams, crop out; but the strata are concealed on every side but one by masses of trap rocks, and almost immediately plunge into the sea, dipping to south east at an angle of about 30° or 35°.

The whole eastern side of the Schouten peninsula, like that of the Schouten Island, is of granite, varying from coarsely crystallised and porphyritic to very fine and even grained, and from white felspathic granite to that of a bright pink or red colour, every where forming mountain masses.

A legend which the Aborigines of Van Diemen's Land have retained, concerning one of the granite mountains near Wine-glass Bay, induced me to ascend it. I was repaid for the labour by the discovery of a greenstone vein running nearly north and south along its ridge almost to the summit: there was no greenstone visible in mass within a mile or more of the locality.

Sandstone forms a small low island in a bay not far from the bar entrance to Great Swanport; and a few miles farther north it is upheaved into hills of several hundred feet of elevation, on the Schouten main-land between the granite on the east coast and the greenstone on the Swanport side, extending to about the head of Moulting Bay.

At the township of Llandaff, from which to the east coast the country is but slightly elevated, sandstone again appears.

There is also scattered over a great part of that flat neighbourhood, in the shape of fragments of silicified wood, strong evidence of the presence of coal strata: there is evidence, too, of the long-continued operation of currents of water in the smoothly-rounded surfaces of these naturally very hard spicular and splintery fragments. The district through which the Apsley runs undulates but very slightly, and the river is consequently tortuous and sluggish: there is occasionally to be seen, disposed singly or in groups upon these plains, tall bare druidicallooking blocks of greenstone, attesting, like the pebbles and rounded fragments of fossil wood already mentioned, the action of a long-continued denuding force; a force which, no doubt, materially contributed to determine the present physical characters of surface and soil, &c.

It may have been that this district, immediately preceding the last considerable rise of the land, (when it is probable the numerous lagoons lying along the eastern coast of Van Diemen's Land, of Cape Barren, and of Flinders' Island were formed,) lay under water, and was subjected to the operation of furious tides setting to and from the ocean and Oyster Bay,—a period when the high peaks of the Schouten main could only have formed the summits of a chain of small islands and craggy islets.

To the westward of the comparatively level country of the Apsley, there is a range of hills along the base of which coal crops out at several points.

I regret that circumstances prevented me from visiting the localities. In the direction of Wabbs' Boat Harbour there is near the sea-coast a granitic strip of country; and a few miles to the northward of it carboniferous sandstone shows out in great force. There is contained in it innumerable thin seams and irregular patches of a lustrous jet-black coal, with fossil trees in abundance, having this peculiarity, that many of the stumps of trees which are there to be seen imbedded are partly silicious and partly anthracitic, with their roots spreading out on every side in the beds of sandstone, which but slightly decline from the horizontal.

Learning that coal had been picked up in the mouth of a creek emptying itself into one of several lagoons inside the sand-hills which bound the long open beach there, I carefully examined the rivulet,—tracing up its windings for about two miles,—when I discovered a seam of bituminous coal, of about 20 inches thick, reposing upon a series of shales and slaty clay, and overlaid by a bed of unconsolidated gravel and boulders of greenstone.

This coal ignites readily, and yields a steady clear flame, without splitting and flying.

I traced the creek for about half a mile further, where it ran over solid greenstone rock through a narrow gorge between two hills, so as to exhibit on either bank considerable sections of its columnar and prismatic structure.

I still found pieces of coal which had been floated down in the stream; and, of course, concluded that coal existed *in situ* at a yet higher level, on the further side of this ridge of greenstone; but I was unable at the time to follow out the investigation.

One side of the valley through which this rivulet runs is deeply covered with a gravelly alluvium, containing numberless fragments of coal, from the size of a pea to that of a foot square; while the gravel on the opposite side, and which overlies the seam of coal, is free from any mixture of the sort.

It is not unlikely that this seam, if prosecuted, may expand, or lead to more productive beds, or that it may prove to be continuous or closely associated with beds which are said to crop out between high and low watermark on the sea-beach adjoining, and in the banks of the Douglas River, which is not more than two or three miles distant.

I looked for a considerable seam in the Douglas River, but failed in detecting it. In the gravelly beds along the banks, and in the eddies at the channel, were numerous loose fragments of bituminous coal, varying in appearance from dull schistose and greyish black to bright, glistening, and jet-like,—a coal which burns readily with a clear bright flame. The seam in the Douglas is said to be eight or nine feet thick.

The river, it is to be regretted, has a bar entrance, against which a deep heavy surf rolls even in the finest weather, rendering it not only dangerous but impracticable for shipping, or even boats; but the distance is only seven or eight miles, and nearly upon a level the greater part of the way to Wabbs' Boat Harbour, and there small coasting vessels can in ordinary weather come alongside a wharf to load.

In reporting upon, and recommending, the coal at the Schouten Island as adapted for almost any purpose to which English coal may be applied, and stating what I considered to be difficulties and drawbacks connected with mining operations there, I have omitted to notice the probable cost of production of the mineral.

One of the miners formerly employed, and having a beneficial interest in the workings, at the Schouten Island has informed me, that he could afford to deliver coal at the water's edge there from 4*s.* to 5*s.* the ton.

If the cost of production, including all minor and incidental expences, be taken at 7*s.* instead of 5*s.*, and 7*s.* more be added for freight to Hobart Town, with an allowance of 1*s.* per ton as a royalty, the entire outlay upon the article, when brought into market here, would be 15*s.* per ton.

Port Arthur coal—a very inferior article—is sold, I believe, on the wharf at Tasman's Peninsula at 8*s.* 6*d.*; and the price in Hobart Town has recently been 16*s.* per ton.

Sydney coal averages in the Hobart Town market 25*s.* to 30*s.* the ton.

As the Schouten coal is, for every purpose, very superior to that of Port Arthur, and some parts of the seam are fit for any purpose to which Sydney coal may be applied, it appears that the ordinary state of the market prices relatively to them is such as to afford a fair prospect of profit upon the article brought from the Schouten Island to Hobart Town, independently of any quantity productively consumed on the spot in smelting ores, or sold there to a Steam Navigation Company, or otherwise.

I am glad to have it in my power to present a Report so favourable of the character and extent of the coal, and of the natural facilities which exist for obtaining it. I trust it may prove satisfactory to His Excellency.

I propose shortly to prepare and forward Reports of my observations upon the Coal-fields at Southport and Recherche Bay, and at Richmond and Jerusalem, for the information of the Lieutenant-Governor; and I trust to have it in my power, before taking leave of the subject, to lay before His Excellency the results of experiments on the combustible constituents of these coals, and their comparative calorific powers.

I have the the honor to be,

Sir,

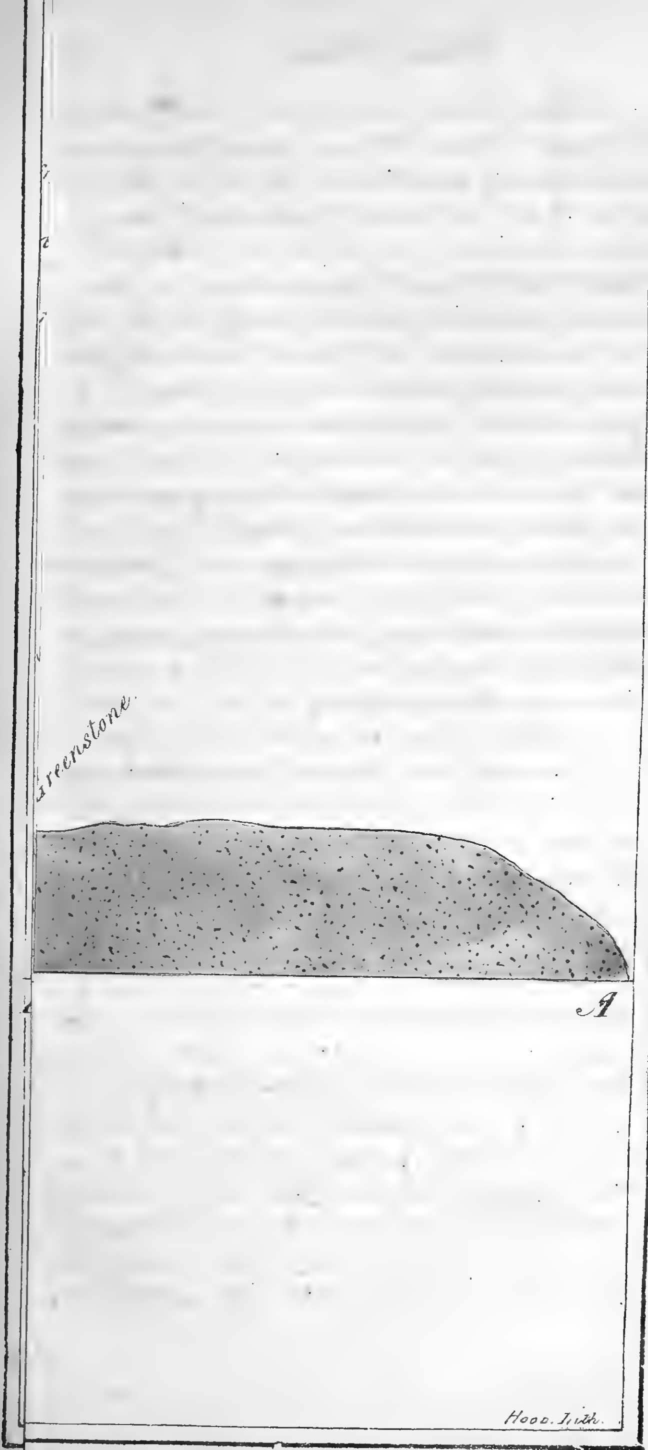
Your very obedient Servant,

JOSEPH MILLIGAN.

The Honourable

The Colonial Secretary,

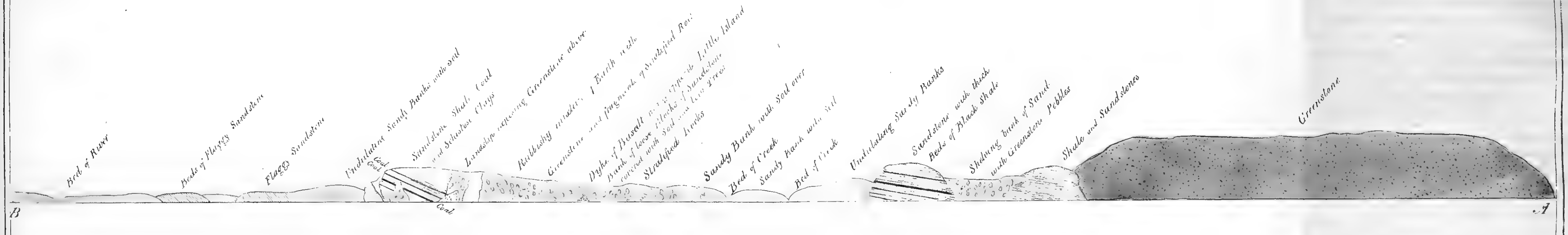
&c. &c.


Greenstone.
A
Hood. Lith.

SECTION *of the line of Coast from the* WHALE'S HEAD *A to the River and Point beyond at B*

— the line S.E. and N.W. is actually a curved line —

— and forms the Eastern side of SOUTH CAPE BAY. —



Horizontal Scale — 4 Inches to One Mile — 5 10 20 30 40 50 Chains

Vertical — 500 Feet to one Inch — 100 500 1000 Feet

No. II.

WHALE'S HEAD AND SOUTH CAPE.

Hobart Town, 18*th September*, 1848.

SIR,

I HAVE the honor to report, for the information of His Excellency the Lieutenant-Governor, the results of my examination as to the coal between the Whale's Head and the South Cape.

It seems probable that this coal deposit extended originally in the direction of Recherche Bay towards Southport.

In the section of the sandstone cliffs, immediately adjoining the station at Southport, there is a seam of black carbonaceous shale overlying beds of schistose clay and sandstone, and overlaid by yellowish white sandstone.

The dip of these beds is S.W., at an angle of 15°.

About three-quarters of a mile to the west of the Station the sandstone is underlaid by massive beds of a bluish clay, having in it numerous, but rudely defined, impressions and traces of vegetable matter.

In the sandstone, immediately over these clayey beds, I found fragments of coarsely silicified wood, and of wood fossilized by iron and silex together.

Imbedded deep in the clay rock itself I met with a large rounded boulder of well-characterised granite, having its felspar of a yellowish colour, and it smica black. I am not aware of any granite formation existing in the vicinity, nor did I see any more of it imbedded.

As it is probable that the clay and sandstone rocks, which alternate with shale,—all rather fine and even in their composition,—and which apparently pass in the upper series of beds into coal, have been deposited in the waters of an estuary, it becomes a curious question, in what manner a large rounded mass of granite could arrive in such a position: the transporting power and agency of glaciers, or—and which is more probable—of icebergs, may possibly be considered necessary to explain the phenomenon.

To the massive clayey stratum succeeds sandstone, which, a little lower in the series, is again replaced by compact beds of hard tenacious clayey rock with impressions as before. Sections of each are visible along the north-east side of the harbour, in the direction of the crop of the strata.

A shaft was sunk a few years ago by the Government in the line of dip of the strata, and about half a mile from the Southport Station, where the black shale is exposed. Some beds of shaly matter were penetrated, but coal was not obtained.

The direct distance, and nearly in the line of dip of these beds, to the northern port in Recherche Bay, does not exceed six miles: at Recherche the rocks are of sandstone and shale, and dip still to the same quarter. It may, therefore, be presumed that they are continuous, or that they have at one time been so, though they now undulate and vary from the intrusion of trap-rocks.

On the eastern side of this part of Recherche the beach is almost exclusively composed of fragments of fossil-wood, resulting from the disintegration of the yellow arenaceous beds overlying the carboniferous sandstone.

The remains of two shafts, and of a nearly horizontal drift, which were excavated by a company a few years ago in search of coal, are there.

The shafts, at the time of my visit, were full of water, and water stood so deep in the low-roofed drift-way, that I could not conveniently enter it, so as to examine the coal; but I found scattered around small fragments of coal, of *anthracitic* character.

The coal-beds at Recherche Bay, besides being inferior in quality, have the additional disadvantage of dipping under water, almost from the moment they are touched; and must necessarily be worked, if at all, at great comparative cost,—circumstances likely long to postpone further mining operations there.

Pity it is that Recherche Bay—one of the finest and most capacious harbours in the Island—offers, except to the ship-builder, scarcely any inducement to permanent occupation. Few places in the Island are possessed of picturesque beauty in the same degree. Its quiet bright waters, and its sinuous shores, sloping upwards into densely wooded hills, which only terminate in the distance in lofty peaks and ranges of bold and rugged mountains, present combinations of the natural elements of beauty but rarely met with.

Sullivan's Point, at the north side of the entrance to Recherche Bay, is composed of greenstone; the point of land standing out between the northern and southern ports in Recherche Bay is of greenstone; the extensive promontory known as the Whale Head consists of greenstone. The surf-beaten line of coast round the southern half of South Bruni Island is also greenstone; and there can be little doubt that the islets, rocks, and reefs studded in the intervening space—the Acteons, the Black Reef, the Blind Reef, and the sunken rock of the *George III.*, &c., are constituted of the same hard and durable material.

It seems but little out of place to record *en passant* the danger to boats proceeding, even in moderate weather, in the close vicinity of the last-named rocks. The pilots and other experienced persons say, that the sea, after remaining still and smooth some minutes, will often rise in a sudden tumultuous wave, overwhelming every thing in its way. By an unexpected surge of this description, a boat, with constables and crew, from Southport was instantaneously swamped near the Black Reef a few years ago.

At the southern extremity of the south portion of Recherche Bay is Cockle Creek, which, from being extremely narrow at the entrance, expands immediately behind a line of low sand-hills into shallow flats, with green rushy borders.

These flats are succeeded about a mile to the westward by extensive levels of low marshy ground, closely covered with a sward of *Junceæ*, *Cyperaceæ*, and a sprinkling of coarse grasses.

This valley trends first to the southward, and then, as it expands, it stretches to the north of west. It is bounded to the north by greenstone hills, rising into the high land of the interior; and on the opposite side by the elevated ground forming the Whale's Head.

The western termination of the valley, sparsely timbered with *Banksia*, stunted *Eucalypti*, and shrubby *Myrtaceæ*, consists of a series of sandy and ferny ridges, with narrow intervening flats and small lagoons, which, a little more to the north, end in a countless succession of tiny rills running in deep channels, every where shaded by dense but not heavy forests of the gum, myrtle, and sassafras trees, intermingled with *Melaleucæ*, the elegant *Anopterus*, and straggling *Cenarrhenes*, and their almost invariable and rich accompaniment, the arborescent ferns.

To these sand-hills succeeds a natural embankment of greenstone,—a prolongation, seemingly, of the eruptive masses of the main-land into the Whale's Head promontory.

The locality now referred to is about north west from the most southern projection of the Whale's Head, and distant from it in a direct line three and a half or four miles.

The greenstone here forms, at an elevation of some 400 feet, a capping of unascertained depth over stratified masses of shales, sandstones, and schistose clays, with coal, which present to seaward vertical sections from 200 to 250 feet in height.

There is a small island of igneous rock close to the main, and almost accessible from it at low water, a little to the south or S.S.E. of the cliffs I refer to: it is connected by a narrow dyke with the greenstone overlying the carboniferous rocks.

Another dyke stands directly across the strand, like a dark wall, and juts out into deep water, barring further progress in that direction, except by scaling its almost perpendicular side of 20 or 25 feet.

The line of coast, and the dip of the carboniferous strata, are nearly parallel, that is, south east; and the inclination of the beds is about 12°.

The following is the long order of succession of these beds, as nearly as I could obtain it, during a season of very tempestuous weather, and in an exposed situation.

There are several seams of coal; the principal one, called a 4-feet seam, proceeding from beneath upwards, consists of

Black shale	12 inches.
Coal	18 ditto.
Hard anthracite	3 ditto.
Brown clay, soft and plastic	2 ditto.

Hard anthracite	2 inches.
Coal	6 ditto.
Black shale	8 ditto.

The coal which it yields is highly carbonaceous; much of it has a porous coke-like aspect, and it contains iron pyrites to such an extent, that it is disagreeable and inconvenient to breathe the fumes of sulphurous acid gas extricated during its combustion, even when at the distance of some feet from the fire, and in the open air: it is therefore a coal inadmissible for domestic purposes.

A low and nearly horizontal drift was carried into this seam by the Southport Coal Company some years ago; and the roof and sides are still perfect from the entrance inwards.

The coal is not very difficult of ignition: it burns without flame, yielding a strong heat. It has been approved, it is said, for furnaces, or rather for blacksmiths' forge-work,—a thing not unlikely, as it partakes a good deal of the nature of coke, which, next to wood-charcoal, is our most valuable heating fuel.

From a careful examination on the spot, it did not appear to me that the seam would yield more than two feet of useful coal.

This, taken together with the fact of its being destitute of bitumen, and placed in a situation to preclude the possibility of shipment, except after land carriage to Recherche Bay—a distance of six miles—must, for an indefinite period, shut it out of consideration as an article of statistical value to the Colony.

No vessel or boat could, even in moderate weather, approach with safety the rocky and iron-bound shores near it.

It is notwithstanding desirable that the situation, relations, and facilities for obtaining this coal, as well as the value of it when acquired, should be known and recorded, in order to guide persons interested in such matters for the future : and hence the minuteness with which I have availed myself of the magnificent natural sections unfolded along the sea-coast.

The rocks associated with this coal follow in ascending sequence thus :—

	ft.	*in.*
Coal and shale, &c.	4	3
Sandy clay, compact and whitish	0	9
Shale, containing ½ inch of shining coal	0	9
Sandstone, soft white	0	2
Ditto mixed with shale	3	0
Ditto, ditto, in seams	5	6
Clay ironstone, in nodules	0	6
Sandstone, white	2	6
Clay, shaly, brown	0	3
Ditto and clayey sandstone	2	0
Coal, with thin shale between	0	10
Shale, black	1	0
Ditto, and shaly clay	1	6
Clayey beds, containing nodules, and seams of clay ironstone	6	0
Shale, brown	0	4
Slaty clay, with clay ironstone	10	0
Coal, black shining	0	6
Shale, black	0	3
Slaty clay	7	0
Shale	0	1
Sandstone	1	6
Ditto mixed with shale	0	1
Ditto, whitish	20	0
Slaty clay	3	0
Sandstone beds, with a few thin seams of laminated clay	130	0
Slaty clay	6	0
Shale, black	1	0

	ft.	in.
Slaty clay	10	0
Shale	1	0
Slaty clay	4	0
Shale	1	0
Total	224	9

Proceeding backwards on the line of crop of the strata, I procured the following descending series, commencing immediately below the 4-feet coal:—

	ft.	in.
Slaty clay and shale	1	6
Sandstone, clayey	15	0
Schistose clay-beds, including 3 seams of shale and one 6-inch seam of coal	50	0

terminating in compact clayey sandstone, which contains some of the impressions of the ferns common in the rocks of our coal fields. I particularly observed the *Pecopteris odondopteroïdes*, as figured by Strzelecki.

Continuing along the sea-shore to the westward, and still nearly in the course of the crop of the strata, I traced the sandstone, with two intervals of sandy beach and low receding sand-banks, for about a mile: the dip varied to E.S.E.; and the sandstone became flaggy at some points, and variously veined and interspersed with ferruginous matter.

A small river, swollen with recent rains, and having a bar on which bursts—as upon the coast every where—a long succession of heavy breakers, stopped further exploration in that direction.

Returning to the coal cliffs, I scaled the precipice where a recent large land-slip made it practicable; and, in doing so, discovered a complete section of the trunk of a small tree coarsely mineralised with silex.

I now remarked, high on the face of the cliffs, in clayey beds separated by sandstone, sections of cylindrical bodies having much the appearance of fossil trees.

In masses detached from these clayey beds, and prostrate near the water's edge, I found numerous impressions and casts of flag-leaves, and of wood partly anthracitic and partly silicious and ferruginous.

Wherever clayey beds alternate with sandstone, they yield a far richer harvest than this does of fossil remains; arguing, generally, conditions of the surface of the dry lands and the circumjacent seas, during the deposition of the finer sediment, at once the most favourable to the support of organized structures, and to their subsequent preservation.

In the direction of the basaltic dyke already mentioned the strata have been much disturbed; and at more points than one prismatic greenstone may be traced from above directly into the sea, overlying sandstone in the intervals.

In the close vicinity of the little island and basaltic dyke referred to, large masses of the stratified rocks occur jumbled up with blocks of basaltic matter; and occasionally both are found blended with *debris* of every kind in the confusion of a gigantic land-slip.

Not the least interesting of the matters which attracted my notice here was the appearance of the clays and clayey shales, &c., altered, in many instances, to a flinty degree of hardness by the action of heat from contact of the igneous rocks adjoining. Interspersed in irregular veins and lumps in interstices of the disintegrating greenstone rock, there presented itself very abundantly a whitish fatty-looking substance—unctuous to the touch, and plastic as putty;—I concluded that it might be akin to *steatite:* onward, however, the same substance occurred of a firmer character and consistency; and ultimately it was found hard and crystalline, and proved to be carbonate of lime.

Such are the mutations constantly occurring in nature. Thus calcareous matter, at first hard and crystalline, by degrees softens and becomes almost milky, under the influence of the never-ending succession of salt spray and aqueous vapour, to be finally swept from a thousand sources into the ocean, to fulfil another term in existence, and to be once more deposited or organised in new forms.

To the south east of the little island, and nearly in the line of dip, I obtained additional sections, exhibiting an immense thickness of carbonaceous deposits, which only in a few insignificant instances, however, reach the condition of coal.

Immediately opposite the little island there has been a land-slip; and adjacent to it there is a cliff which gives the following section from the level of the water :—

	ft.	*in.*
Clayey sandstone, with seams of slaty clay and hard flaggy sandstone	40	0
Shale, comprising 3 or 4 seams of coal one to two inches thick............	8	0
Clayey sandstone	3	0
Shale, black........................	1	0
Clayey sandstone	3	0
Shale, with thin seams of sandstone ..	2	0
Sandstone...........................	2	0
Shale, black	1	0
Sandstone...........................	3	0
Ditto and shale	4	0

The strata are here interrupted; and the banks recede in low undulating sandy hills through which two creeks issue to the sea.

Further on, in the direction of the extreme point of the Whale's Head, the stratified rocks recur dipping to the east, and affording the following section in ascending order :—

	ft.	in.
Clayey sandstone at the sea level.	..	..
Shale, black	1	0
Sandstone, schistose	2	0
Black shale, with seams of slaty clay, and several thin seams of shining coal, one to two inches thick	30	0
Sandstone, carbonaceous and flaggy	6	0
Ditto, yellow and flaggy	5	0
Ditto, carbonaceous, grey	10	0
Ditto, ditto, containing thin seams of shale and clay ironstone	4	0
Ditto, carbonaceous, grey	20	0
Black shale in seams passing into slaty clay	80	0
Iron clay, such as is now being deposited in springs and creeks, involving pebbles, &c.	0	6

The whole surmounted by soil of a mixed clayey and peaty character, containing loose greenstone pebbles.

Certain of the clayey seams in this cliff contain forms constituted of iron pyrites, which may probably turn out to be coprolites.

Exclusive of vegetable impressions, organic remains, in the shape of coprolites, scales, and teeth of fishes, occur in the iron-clay beds of the South Staffordshire coal-field in England; and identical remains are found in the coal measures near Edinburgh.

Reverting to the coal, and the beds associated with it now under notice, I have to observe that the dip varies along the line; but, assuming it to be somewhere about one foot in six on an average, the thickness of the beds, from the point where the undermost shale shows itself to the point where it is cut off by the greenstone, forming the massive promontory of the Whale's Head, must be about

900 feet. Nearly the same thickness of sandstone of a flaggy and ferruginous character is exposed in the sections along the coast travelling in the opposite direction, with the intervention of two open bays, where the banks are low sand-hills covered with sand, where it is to be presumed the beds have consisted originally of clayey and soft schistose material, more liable than the sandstone to be undermined, worn, and washed away by the action of the stormy sea setting on these shores.

The principal seams in the celebrated coal-fields of Northumberland and Durham, in England, are termed the high and low main seams, and are respectively 6 and 6½ feet in thickness, with an interval of 60 fathoms, in which lay 8 subordinate beds, comprising one of 4, and one of 3 feet.

The point at which the high main seam has been explored at the deepest level is about 5 miles from the mouth of the Tyne, where it lies 960 feet from the surface.

At a colliery near Newcastle the low main is, on the other hand, stated to be only 810 feet down. Below it there have been found 7 seams, which are all of a quality approaching the stone coal of the transition rocks.

Most of the coal of Van Diemen's Land yet discovered is of this nature; though it is probable that the rocks with which it is associated belong, relatively to other formations, to an era yielding the best coal in England.

The coal at Tasman's Peninsula is an anthracite; that of Recherche Bay is of the same nature: a seam which crops out in the cliff on the northern side of Adventure Bay yields a coal of the same character; and this coal between the Whale's Head and the South Cape is another instance of the same.

Having recurred to the South Cape coal, I may mention that, about 500 or 600 yards inland from where the 4-feet seam appears in the cliff in South Cape Bay, and in a direction nearly east from it, two shafts have been sunk; but in neither have the projectors carried their operations through the greenstone to the coal, which, at that point, I should reckon to be rather more than 400 feet below the grass, as it is termed.

A fruitless attempt has also been made to sink to the coal upon the marshes between Recherche Bay and the South Cape Bay, but nearest the former; and if I am right in my conjecture, that the seam formerly worked in the northern part of Recherche forms a portion of the South Cape basin, then the shaft begun in these marshes must be at a point where the coal is about its greatest depth from the surface. At the same time, the marshes are but a few feet above high water-mark; and there was, therefore, the advantage of having no elevated ground to penetrate.

It appears scarcely necessary to say more regarding a coal-field which must remain comparatively valueless to the Colony until the coals of better quality, and more easily accessible, of which there is already something known in other parts of the Island, are more or less exhausted.

A Map and Section accompany this Report.

I have the honour to be,

Sir,

Your very obedient Servant,

JOSEPH MILLIGAN.

The Honourable
The Colonial Secretary,
&c. &c.

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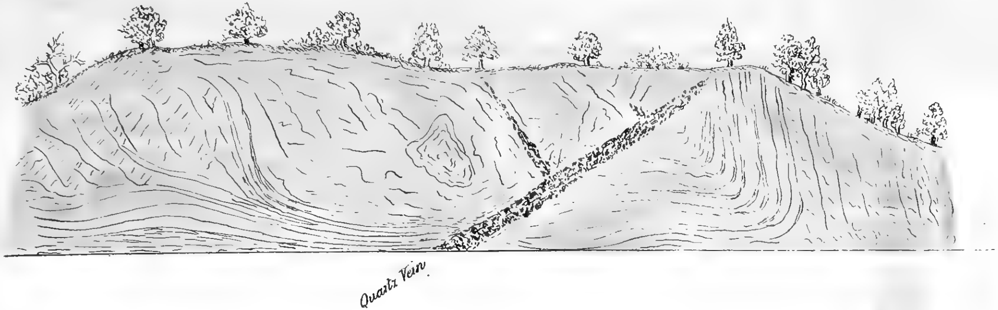
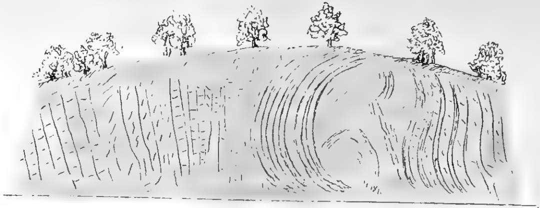
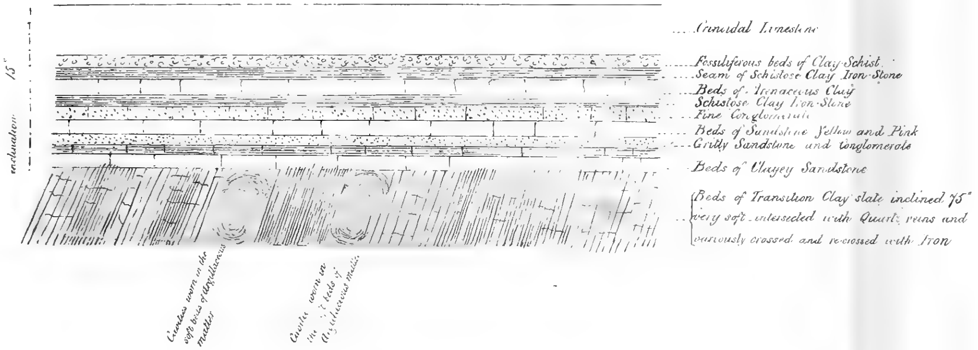


SECTIONS *of Clay-Slate on the road between Fingal and Avoca. — Contorted beds.*

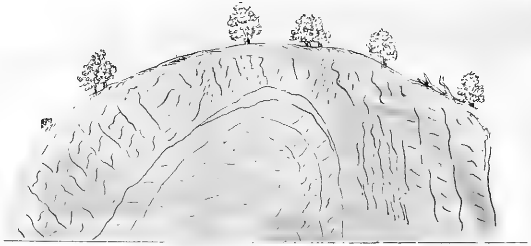


Clay-Slate in contorted wavy beds — road near Fingal



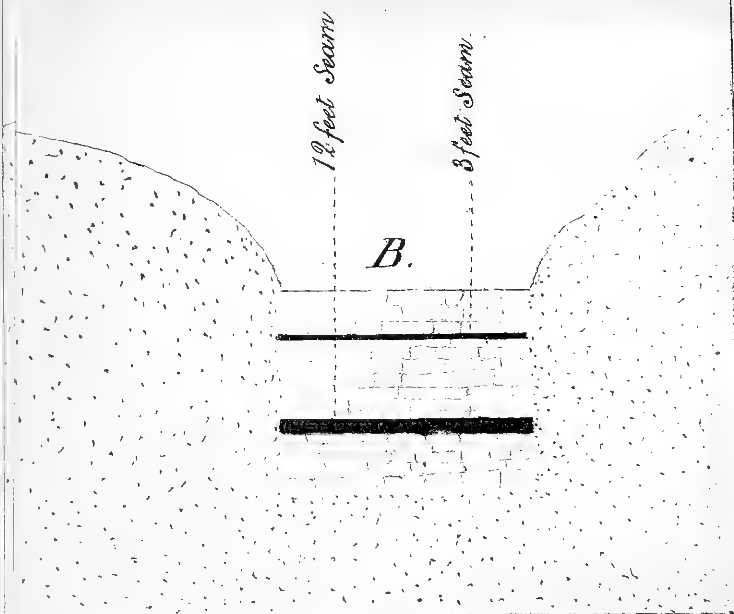
SECTION *showing the overlaying beds from the Vertical Clay-Slate to the fossiliferous Limestone under the Coal Measures*

— Valley of South Esk river — near Fingal —



Beds of Clay-Slate bent — Section — road near Fingal.

Hood. Lith



ys_elevated upon Greenstone.

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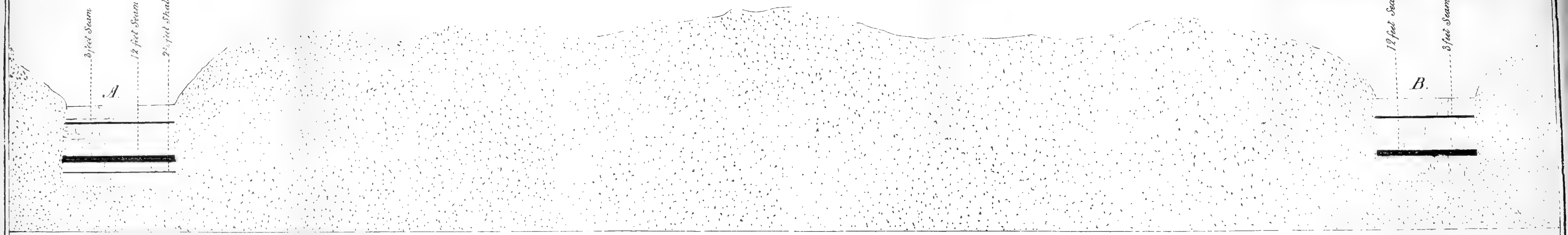
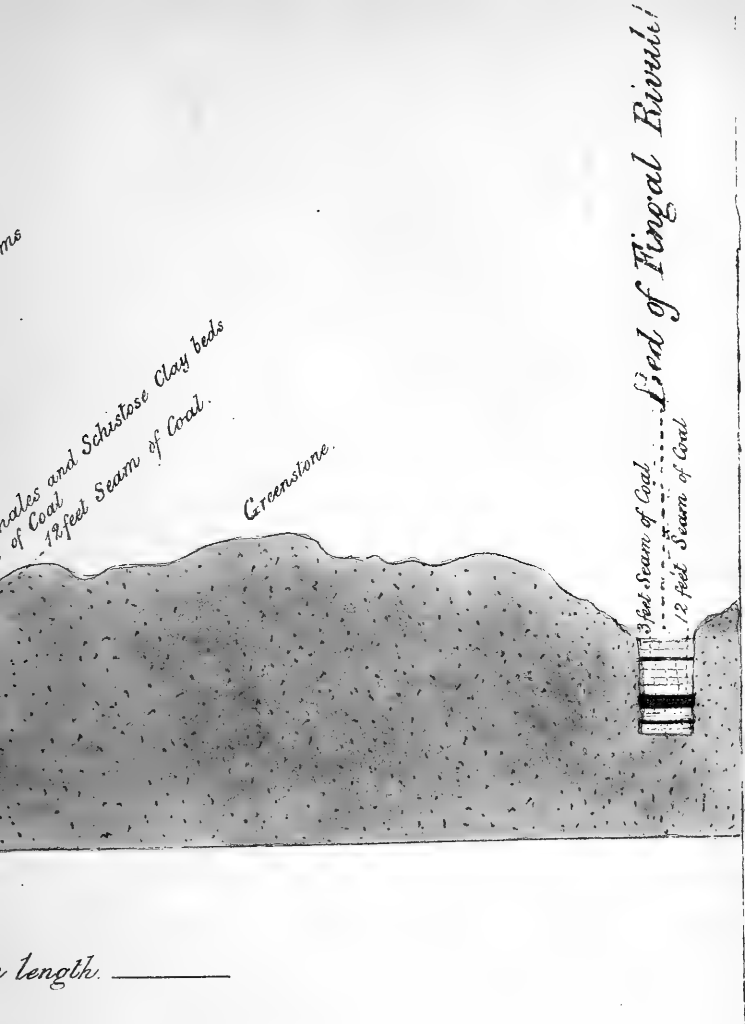


Greenstone

(2½ miles along the line of Direction of Beds _ being nearly North and South.)

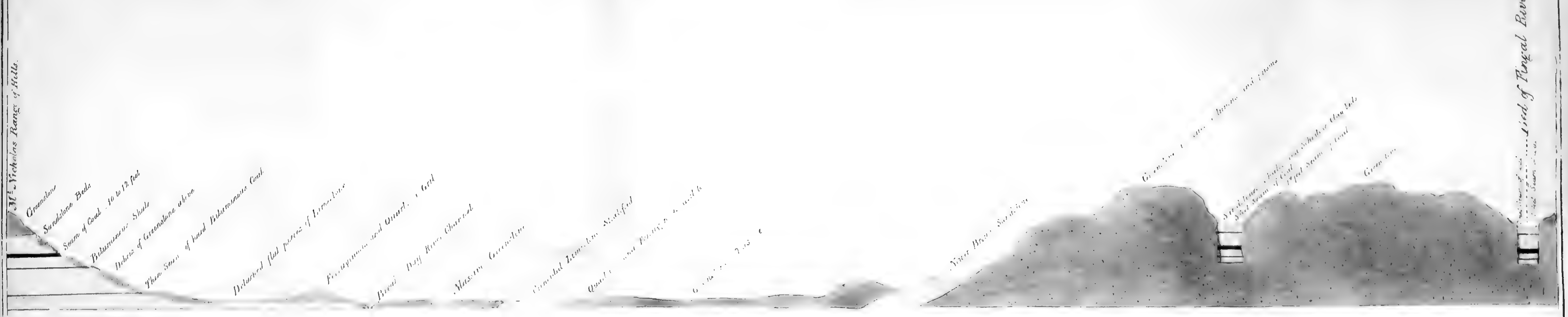
SECTION *from the Coal at* FINGAL *where it crops out in the two creeks at A, to the Fingal Rivulet at B, where the Coal again crops out, amid beds of Sandstone and Shale and Schistose Clays elevated upon Greenstone.*

SCALES
Vertical 400 feet to One Inch — 50 100 200 300 400 800 1200 1600 feet
Horizontal 600 feet to One Inch — 75 150 300 450 600 1200 1800 2400 3000 3600 4200 feet

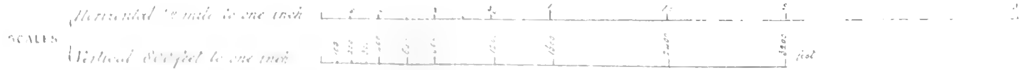


length.

Hood. Lith.



SECTION _ North by East from Mt. NICHOLAS to South by West where the Coal crops out in the FINGAL RIVULET across the Break o Day Valley and the upper portion of the South Esk Valley _ eleven miles in length



No. III.

FINGAL AND EAST COAST.

Hobart Town, 8th November, 1848.

Sir,

In compliance with instructions conveyed to me in your letter of 28th August last, I have examined the Coal Basins in the District of Fingal, and at the Douglas River; and I have now the honor to report thereon, in connection with the geological character of that part of the country generally, for the information of His Excellency the Lieutenant-Governor,—premising only, that the weather proved so extremely unfavourable as to render repeated visits necessary, and seriously to impede, and at times almost to frustrate, every attempt at exploration.

The area falling under observation is bounded on the eastern side by the ocean, from Wabbs' Bay to St. Helen's; on the northern side by the Mount Nicholas range of hills, which extends nearly to the junction of the South Esk and Break-o'-day Rivers; then onward in a westerly direction, by the chain of rounded granite hills which limits the course of the South Esk on that side, nearly to the confluence of the St. Paul's with that river at Avoca; upon the south-west side it is bounded by St. Paul's Plains; and on the south by the extensive flat country stretching from Swanport by the head of Moulting Bay to the Pacific.

About the centre of these limits is a plateau of eruptive rock, having an elevation of 1200 to 1800 feet. It is greenstone. Its surface undulates much, and is deeply intersected and scooped out by a number of rapid torrents.

The Break-o'-day River, the Fingal Rivulet, the St. Paul's River, the Swan and the Apsley Rivers, and the Douglas River, all take their rise within this elevated area of greenstone.

On the flanks and sides of the hills, and occasionally in the deep channels of the mountain streams, the earlier stratified rocks are exposed.

From Avoca to the east coast near Falmouth a good road has been made: in its course there are many deep and interesting sections of the transition clay-slates, of which the *flooring*, so to speak, of the valley of the South Esk is composed.

Greenstone obtains exclusively at and immediately around Avoca, forming low hills which rise from flats, themselves considerably elevated above the lower level of the river channels: on these higher flats, and the rounded eminences springing from them, there occurs at brief intervals a *talus* of diluvial gravel and sand, or sand alone, the origin of which can scarcely be understood without a close study of the stratified and other rocks in the upper portions of the valley.

Taking the Fingal road toward Avoca, the geological observer soon sees, on the opposite bank of the South Esk River, an irregular line of rounded hills of granite, rising a few hundred feet above the level of the stream. This granite continues along the northern bank of the river several miles: it is then replaced with clay-slate, in beds nearly vertical; which are crossed and recrossed in every conceivable way by veins of quartz, and of quartz intermingled with ferruginous matter, from an inch to several feet in thickness.

The Fingal road itself, after leaving Avoca, passes for some miles through thick beds of gravel, containing rounded fragments of granite, clay-slate, quartzose sandstone, quartz pebbles, greenstone, and silicified wood, &c.,—bearing the most indubitable testimony to the character of the agency employed to excavate the valley, and give it its present form.

About seven or eight miles from Avoca the clay-slate succeeds to granite; thence it is continued, with little interruption, to the point of union of the South Esk and Break-o'-day Rivers.

On the northern bank of the South Esk it forms high ridges, which, running in a meridional direction, jut down to the river's margin, exhibiting occasionally, where hard quartzy matter prevails, broad mural lines or bands, which stand out in bold and striking relief from the masses of softer rock to which they pertain.

The clay-slate is rarely exposed in the channel of the river, though it appears at intervals on the immediate bank of the southern side.

It is again entirely lost under the rich alluvial flats forming the expanse of the valley, to re-appear in projecting ridges, which correspond, in their north and south disposition, with those on the northern side of the river.

These ridges, approximating and rising as they retire from the valley, form a massive atlas-like base-work for the support of the overlying and less inclined stratified rocks, and of the elevated plateau of greenstone already mentioned.

The clay-slate is every where highly inclined; and, as is usual in the more micaceous and softer beds of this formation, it is often wavy and much contorted.

In the deep cuttings near the township of Fingal, many singularly beautiful illustrations are to be seen of these tortuosities.

In front of the mansion of James Grant, Esq., of Tullochgorum, there is a picturesque crescent-like vale embosomed in terraced hills of greenstone: along the base of these are several deep recesses in which the clay-slate formation shows itself. It is there constituted of alternating seams of finely laminated argillaceous matter, and of arenaceous and flaggy beds, intermixed and crossed with ferruginous septa. These beds are inclined at an angle of about 75° to the south east; and there rests upon their broken edges a series of kindred beds, dipping to east by north at an angle of not more than 15° from the horizon.

These overlying beds are in the first instance clayey and arenaceous, and, to all appearance, composed of nearly the same material as the vertical beds on which they repose: but, as they recede from direct contact and immediate neighbourhood, they are separated by thin layers of a schistose clay ironstone, by a gritty ferruginous sandstone, and by seams of fine conglomerate; and there is no longer any appearance of the ferruginous septa which obtained in the nether beds. Whatever the agency may have been which determined that semi-crystalline structure, it ceased to operate at or about the period when the transition strata were forced up to an angle of about 60°. Thenceforward the ferruginous matter was diffused in schistose beds of clay.

Pursuing the series of beds upwards in this locality, I found them pass into laminated clayey beds of a yellowish and brownish slate colour, into thick compact beds of clay, and into seams of soft clayey sandstone, having a yellow and brownish yellow tint, which is in many places tastefully striped with red.

Upon two or three eminences immediately behind the village at Fingal, building-stone and flag-stone have been quarried from this section of the group of beds of soft sandstone; and I obtained there a few fossil shells imbedded: but these were rare, or altogether wanting, just as the distance from superincumbent limestone or its place increased.

The superior beds become still thicker and more compact, acquiring somewhat of a columnar structure in the large; but they soon yield again to thinner argillaceous layers of a schistose structure, in which are to be found casts and impressions of *Spirifers*, *Serpulæ*, and *Polypariæ.* These fossiliferous clayey beds merge in limestone of a very hard, compact, and crystalline structure, of a colour varying locally from yellowish and greyish white to pink, and replete with casts and impressions of corals, *Spiriferæ*, *Terebratulæ*, *Pectinides*, and occasionally of *Encrinites.*

The aggregate thickness of the slightly inclined seams between the vertical clay-slates and the limestone appears to be about 200 feet. The limestone has not presented itself to me any where in masses deeper than 40 or 50 feet.

When burnt, it yields an excellent lime; and it is probably identical with the limestone formation which skirts Mount Wellington, cropping out at the Cascades, at Ancanthe, and Tolosa, and upon the road-side in the vicinity of New Norfolk, again to make its appearance upon the Dromedary, on the opposite side of the River Derwent.

On the western bank of a streamlet which flows perennially through the little crescent-shaped valley, described as in front of Tullochgorum House, the limestone has been removed by natural agency from the beds of clay, conglomerate, and clayey sandstone, just where the shells become abundant, and it is replaced with a capping of greenstone. This partial denudation could only have been accomplished by the action of water, and the supervention of greenstone must have occurred subsequently.

At the head of the little vale, and on the opposite side of the streamlet referred to, the same fossiliferous and calcareo-argillaceous strata present themselves, forming the side of a gently shelving hill. Greenstone soon succeeds; but between this and the stratified rocks numerous calcareous springs issue, depositing more or less of lime as they descend. At one place the deposit of calcareous tufa is sufficiently important to have been worked for lime by Mr. Grant. As usual, it varies from very porous, soft, and friable to hard, tenacious, and compact: it is of a dull white colour, and contains numbers of a land shell, appearing not to differ widely from a small *Planorbis* now extant in Van Diemen's Land.

Although the limestone itself does not crop out over the fossiliferous clayey beds, it may fairly be presumed that it exists here between these beds and the greenstone, and that the calcareous springs which issue derive from it their burden of calcareous matter.

In a wild glen, about a mile and a half to the west of this place, there runs a tiny rill or two, which have on either hand perpendicular escarpments, disclosing the whole sequence of beds from the vertical clay-slate to the limestone. These are known as the Cartland Crags: the dip of the seams is to the south east, at a small angle from the horizon.

The character of this gorge is remarkable. On approaching it, the hills on each hand fall back in graceful slopes, rising by degrees into steeper acclivities, which give place further on to precipitous rocks, with a varying amount of *débris*, shelving down like artificial buttresses to the edge of the rapid brook. From the point where the rocks become precipitous, to that where the subdivisions of the brook trickle over the edge of the narrow gullet, at its extremity, may be about 600 yards; the chasm may measure 150 to 200 yards across; and where the channel is lowest its depth may be 220 feet.

The brook itself seems strikingly inadequate to have hollowed out a chasm of such magnitude. But there is no evidence of a sudden reft or of violent displacement; and the beds of rock dip at the same gentle inclination to precisely the same quarter of the compass as the same series of beds do, occurring both east and west from this locality. One is naturally, in looking on such a scene, tempted to account for its formation. In doing so, the simply *possible* must yield to that which is *probable*.

It is possible that the insignificant rill which I have mentioned may have carried down, one day with another, its cubic foot of solid matter for some hundreds of thousands of years, and so have effected the excavation of the chasm above, and the enlargement of the vale below: but it is probable that the valley of the South Esk, if not entirely formed by diluvial denudation, is greatly indebted to such a process for its present form and character. A cataclysm or condition of supernatant fluids, which would admit of a mighty torrent directed along the South Esk valley, would necessitate the existence to a great distance in every direction of many minor collateral and co-operative currents: of these conditions there is, both in the contents and figure of the valley in chief, and in the relative position and aspect of its principal branches, and their subordinate ramifications, the most conclusive evidence.

There can remain, I think then, no reasonable doubt of the nature of the agency from which these lesser communicating valleys first derived their form and direction. I do not mean that it has all been the work of one sudden and stupendous deluge: on the contrary, there exist so many remarkable natural witnesses to the facts of the case, that but one conclusion remains open to us, namely, that it is only after repeated submergencies our present dry land has attained its present altitude; and that this has finally been effected by a long continuance of upheavements, or by a gradual and close succession of elevations, causing a proportionably slow retirement of waters, and an equally protracted process of degradation of strata, by which the hardest rocks, though occasionally disrupted and carried off in masses into the vortex beneath, and transported by accumulated forces from a thousand sources far occasionally from their original situation, have yet ordinarily been minutely broken up, and worn away by continued currents, and the ceaseless set of tides, to be swept down by the same means, in the shape only of mud, of sand, fine gravel, or of larger boulders, according to their nature and position.

The occurrence at frequent intervals of a *talus* of sand and of fine gravel, which I have before noticed, and also of deep and extensive deposits of gravel, composed of boulders and rounded pebbles of almost every size and description, in the lower parts of the valley of the South Esk, have a strong bearing on the question of slow elevation.

The *crinoidal* or *spiriferous* limestone occurs at various elevations in the course of the South Esk and Break-o'-day valleys. At several points along the range of hills which skirt the right of the road from Avoca to Fingal, and about two miles west from the locality last mentioned, it crops out at elevations of 500 to 800 feet, resting upon perpendicular cliffs, 100 feet in height, composed of clayey sandstone, fine fossiliferous conglomerate, compact and schistose clay, &c.; after which the series stretches upwards through more than 100 feet of shales and slaty clays, merging at length in thick beds of carboniferous sandstone, which are in turn overlaid by massive greenstone culminating in hills of 1500 to 1800 feet in elevation. The limestone occurs near the township of Fingal, a little to the southward, only a little above the level of the South Esk, and again upon the Malahide estate, where the road crosses it, at a level but a trifle higher. It crops out on both sides of the valley near the mansion of Mr. Stieglitz of Killymoon, on the level of the plain ; and about three miles higher up it shows out in the channel, and on the banks of the Break-'o-day River, near the residence of Mr. Legge. It is next detected forming low eminences at the foot of a high flat hill a few miles south of St. Patrick's Head, which is locally known as Thompson's Big Hill, and the Elephant Hill. Upon the south-west aspect of this hill the limestone beds form striking vertical escarpments 40 or 50 feet in depth, and certainly not less than 250 feet above the plain, which at that extremity cannot be less than 850 feet above the sea.

Vertical clay-slate is again disclosed in this neighbourhood, and over it a long series of clayey conglomerates and sandstones, &c., terminating as before in the crinoidal limestone.

Whence and however the clay-slate formation, comprising all its long sequence of constituent beds of soft argillaceous schists, compact clayey sandstones, and greywacke, may have been derived, its materials must have been deposited in layers horizontal, or nearly so. They now range from vertical to about 70° or 75°.

The upheaving agent affecting it appears to have been granite ; for every where this eruptive rock is met with in its vicinity more or less abundantly. It is associated with it for several miles along the course of the South Esk from Avoca upwards ; it is associated with it along the course of the St. Paul's River ; and in the interval I found massive schorly granite, supporting clay-slate, at the base of the dome of St. Paul's, and to some height up its side. There also I found limestone, with the intervening fossiliferous clays, &c.,—the whole, as usual, capped with enormous masses of greenstone.

Granite extends from St. Patrick's Head, where it contains much hornblende, to Falmouth, and thence along the coast, with the intervention of clay-slate at two or three points, to Wabbs' Bay, and with scarcely any other interruption to the Schouten Island.

At Long Point, near the Douglas River, clay-slate in vertical beds is supported by granite, which also intersects it in the shape of veins ramifying to extreme minuteness. The same relation presents about seven miles further to the northward.

Every where the beds of clay-slate are discovered in the same vertical or nearly vertical state; and every where they have the same meridional direction.

It appears, then, that the clay-slate was at first elevated by a power having a nearly meridional direction. In some instances this elevation seems only to have caused an inclination of about 60° or 65°; and that upon the broken edges of the clay-slate so disposed the series of clayey sandstones, conglomerate, ferruginous, and clayey schists, &c., extending to the crinoidal limestone, and probably the carboniferous rocks, were deposited during a period of repose as compared with that which had preceded it, that of the subsidence of the material of the transition rocks, and of the eruptive action which threw them into confusion at, or soon after, the period of deposition.

But the strata superposed on the clay-slate, including the whole carboniferous series, have also been tilted up to an angle of about 15°, and by a force, too, whose axis was nearly north and south; and with these beds the clay-slate took, of course, a further inclination.

The disposition of the clay-slate series, though generally vertical, or nearly, is subject to irregularities which bespeak a kind and amount of disturbance which can scarcely be estimated by any action of which we possess subsequent examples: I refer to the singular contortions exposed in its bed, where deep cuttings have been made between Fingal and Tullochgorum, on the Avoca road; and to those who may have the opportunity of visiting the localities, I may instance the many magnificent natural sections occurring along the coast of Bass's Straits, at intervals from the Forth River to Circular Head, but more especially a few miles west from Emu Bay.

The very considerable difference of level apparent between the various points at which the limestone crops out in the South Esk Valley, and in that of the Break-o'-day River, seems to be referable to inequality in the intensity of the upheaving force exerted on particular points during the period of disturbance which immediately succeeded the deposition of the carboniferous strata, and which in many instances produced the disruption of the coal beds, and led to the almost entire disappearance of the coal; while in other cases the coal appears to have been almost as thoroughly destroyed by the direct action of the eruptive masses upon its constituents and qualities. Anthracite is very generally believed to have acquired its comparatively incombustible character through the close contiguity and torrefying action of igneous rocks.

The sandstone which is associated directly with the bituminous coal occurs in massive beds, alternating with an extremely fine yellowish white clay of a schistose structure, in seams varying from a few inches to as many feet in thickness, and more or less abundantly marked with rude casts and impressions of leaves, &c. of plants. Seams of shale of a bluish or black colour, which is also occasionally somewhat bituminous, and upon partial decomposition appears one mass of decomposed vegetable matter, occur in this group from time to time.

The coal sandstone itself is of a greyish white colour, fine-grained, homogeneous, and rather soft, with some impressions of ferns, &c. The dip and range of the beds vary at almost every point where they are disclosed throughout the tract of country under notice. We have seen that the transition clay-slates and the crinoidal limestone beds occur at many different elevations, and that the former are waved and contorted in the most fantastic manner; but scarcely less extensive, though less obvious, are the disturbances throughout the coal-measures.

During the deposition of the transition group, there has been here, as in other parts of the world, a continuous and violent activity of the central masses, giving to the structure of the micaceous and clayey schists above a character which could alone be derived from the mobility of a troubled ocean of molten matter beneath. After the consolidation or partial consolidation of this group, the upheaving action, ordinarily restrained perhaps, seems at times to have broken all bounds, and periodically to have thrown the then solidified crust of the earth into unimaginable disorder. The vertical clay-slates are witnesses to its great violence.

The displacements of the palæozoic group, and the varying dip and direction of the coal-measures, with their numerous faults and dislocations, the eruptive dykes which intersect them, and the enormous masses of greenstone which weigh them down, all bear testimony that if the volcanic agency generally slumbered, it woke at times into throes of terrific fury. Most of the highest hills and mountain ranges of Van Diemen's Land probably at that period obtained the position and elevation which they now bear relatively to the dry land generally.

The eruptive forces did not, however, exhaust themselves upon and immediately after the deposit of the coal group. On the contrary, the newer overlying sandstone, which is nowhere quite conformable with the beds of the true coal series, have also undergone considerable disturbance. We often find re-imbedded in them thin layers and unconnected masses of carbonaceous matter, which had been disrupted and torn from the nether strata.

The fact that over and upon almost every greenstone hill in the district there are found fragments of fossil wood, and of clay schists and shales full of markings of vegetable organisms, is one which would argue that the transporting and disrupting agency of a great body of water continued to operate upon the various rock strata long subsequent to the deposition of the newer sandstone, and the extrusion and cooling down of the greenstone; and that water was the last agent employed to give form to the surface of the dry land: a work most probably followed and consummated by a grand, gradual, and progressive upheavement of the whole mass of this and the neighbouring islands.

The sandstone which overlies the coal contains many impressions of large strap-shaped leaves; and the thin layers of schist which alternate with it are often replete with impressions of ferns, &c. It has generally a brownish yellowish and somewhat mottled or streaked appearance: it is usually coarser in grain, less compact in structure, and is associated with thinner seams of clay-schists, than the lower carboniferous sandstone.

The thickness of both formations varies greatly in different districts, and at various points of the same district. The composition and character of the beds vary also, just as we now find along the course and sinuosities of our sea-shore,—in one locality, a coarse pebbly strand or beach of large boulders,—in another, at no great distance, a fine gravel or sand, which, after passing a neighbouring rocky point, may be replaced with the finer mud or clay of a deep bay, in the soft bottom and luxuriant marine vegetation of which myriads of *Testaceæ*, adapted to the use of man, and easily within his reach, find shelter and sustenance.

These quiet corners are, moreover, the receptacles into which the never-ceasing eddies of the ocean throw more or less of the remains of its varied contents. It is in such clayey beds in the ancient sandstone strata that organic fossil remains are most abundant.

The newer brown sandstone, between which and the palæozoic limestone the coal group is situated, occurs at various localities and elevations in the tract of country under consideration. Upon the east coast it forms a rocky bar to the mouth of the Douglas River, and stretches, after an interval of a few hundred yards, for a mile to the southward of that point, rising into cliffs of 10 and 12 feet in height, and stretching in long flat shelving beds, between high and low water-mark, into the sea.

A few miles up the Douglas River it rises into steep hills, with perpendicular escarpments towards the river of 150 feet and upwards, dipping to south west, south south west, and south, generally at angles of about 15°; but having evidently been subjected, with the beds below, to considerable disturbance.

Along the chain of greenstone hills bounding the flat country through which the Apsley River meanders, before it is lost in the marshes at the head of Moulting Bay, near Swanport, this sandstone is elevated to 300 feet above the sea level, varying in dip round the inflexion of almost every hill, and stretching about the township of Llandaff, and at one or two other points into the plains below, as far as the Apsley itself.

In the valley of St. Paul's I found it forming high cliffs, overlying the true coal sandstone near Mount Henry, on the south side of that valley, and not far from where the road crosses the tier or range of greenstone hills separating the valley from Swanport.

In the valley of the South Esk it is scarcely to be met with, from the confluence of that river with the St. Paul's at Avoca to its junction with the Break-o'-day beyond Fingal. Nearly opposite this latter point it does, however, make its appearance upon the southern side of the valley; and soon after it is found opposite to Killymoon, the residence of Mr. Stieglitz, rising several hundred feet into the bosom of an amphitheatre of greenstone hills, at the very point of which crinoidal limestone and a superjacent ferruginous grit crop out in the floor of the valley, arguing the probability of a considerable displacement in the intervening carboniferous group of beds.

Greenstone obtains exclusively from this locality to a point nearly opposite Mr. Legge's farm, where the brown sandstone is found extending continuously from an elevation of several hundred feet to the level of the plain, characterised, as usual, by its structure, colour, and contents of fossil wood, casts of plants in anthracite, and thin and very limited seams of lignite, and jet-like but incombustible coal, &c.

The same beds rise to a nearly equal elevation due south from Mr. Groom's residence, at the north-eastern extremity of Break-o'-day Valley; and still, as before, cut off and capped by towering masses of eruptive rock.

Upon the flat-topped hill called Thompson's Big Hill, or the Elephant Hill, a short way south from St. Patrick's Head, and about three miles east from Mr. Groom's house, this overlying sandstone is raised to a height of 800 to 900 feet, upon which, as usual, there rests a cap of greenstone some 300 or 400 feet in thickness. The sandstone dips here to the north; and the limestone, which crops out about 250 feet above the plain, forming bold cliffs, in which a vertical thickness of 40 or 50 feet of its fossil beds is apparent, dips in toward the hill.

Several hundred feet of the brown sandstone are traceable in the successive escarpments which present at different elevations along the face of this hill; but there are many intervals where the edges of the strata are deeply covered, and concealed from view, with *débris* from above.

Immediately over the limestone here there are beds of a green sandstone, and a conglomerate more or less ferruginous. These are succeeded by one of those long intervals where the rocks are hidden under a mass of detached fragments of greenstone, stratified rocks, and soil, and just where we ought to look for indications of the true coal group.

The coal-measures must be remarkably scant, if they have not altogether thinned out and disappeared at this point,—a question which can only be determined by a closer examination of every accessible portion of the hill. Between this hill and Mount St. Patrick the strata coming to the surface are clay-slate, with overlying beds of ferruginous grit; and they do not attain an elevation of more than 1000 or 1100 feet above the sea.

St. Patrick's Head is stated by Strzelecki to be of syenitic granite. Time, and the state of the weather, did not permit of my ascending it; but St. Mary's Pass and hills adjoining are of hornblendic granite, which gradually passes through a porphyritic granite with hornblende into ordinary micaceous granite in the direction of Falmouth, and down the East Coast.

I have stated that hills of granite and transition schists prevail upon the northern margin of the South Esk, from near Avoca to its junction with the Break-o'-day River; and that the Mount Nicholas range, which stretches easterly from their confluence, hemming in the Break-o'-day Valley on the northern side, is of greenstone: but the newer sandstone and the coal-measures obtain along its side and base; and to the eastward it is cut off by high hills of vertical clay-slate, upon which are elevated portions of the palæozoic limestone group.

The bituminous coal of the South Esk and the Break-o'-day Valleys occurs in rather soft grey sandstone, alternating with thick beds of schistose clay and shales, and crops out in many situations where impetuous brooks and rills, swollen by winter rains, have worn deep channels in the sides and hollows of the hills.

The seams are numerous, and, as usual, vary much in quality.

The first locality in which I had the opportunity of examining this coal was in the immediate vicinity of the township of Fingal, and nearly E.S.E. from it. There it presents itself in the two upper branches of an insignificant creek, in a sinuosity of the greenstone hills, about two and a half miles from the verge of the township, and 500 or 600 feet above the level of the plain. Malahide, the residence of the late Mr. Talbot, bears nearly north west from this coal, and may be distant from it about three miles. Three seams of coal have been laid bare in these two creeks.

The main seam, which is the middle one, measures 12 feet in thickness, and it crops out in both creeks. In both it has been more or less disrupted, and swept away by the water. In the most easterly of the two, the coal has been at one time on fire; and the combustion has extended more than 20 yards along the seam between the two creeks. Such has been the intensity of this fire, that the greyish white sandstone immediately around has been converted by oxidation of the iron contained into red sandstone; and, mixed with fragments of greenstone, it has been in many instances fused into a highly vesicular and light scoriaceous cinder. The coal has not, however, been entirely burnt out where ignited; but it has been reduced at some points to a thickness of only two feet; and it varies from two to four feet in depth in the same extent laterally along the course of the seam. The interspaces are filled up with fragments of red sandstone, baked clay, cinders, ashes, and rubbish.

As this fire must have happened long before the occupation of the Island by Europeans, and the Aborigines knew nothing of the combustible properties of this mineral, it is to be presumed that the coal caught from a bush-fire or from lightning in the course of some very arid summer, when the creek was dried up. This fact is not unimportant as a *primâ facie* proof of the quality of the coal.

The distance between the out-crops of the 12-feet seam in the two creeks mentioned does not exceed 90 yards. The dip of the bed from creek to creek is about one in 25; but even in this space it undulates, and varies in direction from east to E.N.E.

This seam yields a very hard and compact body of coal, having a structure somewhat slaty. Its colour is greyish black, and its lustre is rather dull, but it is intermixed with layers of a resplendent shining black: it is greasy to the touch, and scarcely soils the fingers: its fracture is flat, and flat conchoidal; its cross fracture is semi-splintery and uneven: iron pyrites is sparingly disseminated in it: when ignited, it burns, emitting jets of a clear white and yellowish white light, with a strong heat, and leaves a white slaty cinder, which, on continued exposure to the combustion of a common fire, is resolved into light white ashes.

In this seam there are two or three ribbons of a whitish clay, but not exceeding an inch in thickness. There is a bed of grey sandstone over the coal, and a schistose clay, having impressions of ferns, &c. under it.

The uppermost seam, of the three yet discovered at this locality, presents itself about 200 yards higher up the most easterly of the two creeks, and probably about 200 feet in vertical altitude above the main seam. It is $3\frac{3}{12}$ feet thick: there is 18 inches of schistose clay, succeeded by sandstone, over it; and there is black shale, succeeded by clay and thin sandstone, under it. The seam contains, at six inches from the bottom, nine inches of shale; and the rest of it, though very carbonaceous, cubical in structure, and bituminous, is not a superior coal.

The lower seam of the three shows itself at about 50 feet of vertical depth below the main seam. It is $2\frac{9}{12}$ feet thick, and dips to E.N.E. at about 1 in 20. The greater part of it is mixed up with black shale and schistose clay to such a degree as to render it valueless. This clay is replete with impressions of ill-defined leaves, &c. of plants.

The aggregate thickness of the beds of sandstone, shales, and clay, exposed between the culminating heaps of greenstone above and the solid masses beneath, may be about 400 feet.

It appears that, at the upheaval of the greenstone plateau first mentioned, the eruptive rock forced its way laterally at some points between the carboniferous sandstone and the crinoidal limestone, carrying the former up with it, and spreading in overlying masses in the valley below: that it at length burst through the stratified rocks above, and overflowed them to the depth of several hundred feet; its molten matter acquiring, in the process of slow cooling, the semi-crystalline structure now presented by its aggregated masses of columns, cones, and prisms.

A line carried nearly south from the outcrops of the coal mentioned will, at a distance of about two miles, intersect the mountain torrent known as the Fingal Rivulet, where sandstone forms for some space the channel in which the stream flows. The course of the rivulet, before emerging on the lower grounds near the Fingal Township, is through a deep winding and zigzag ravine, having precipitous or highly inclined banks of greenstone. Where the banks are vertical, or nearly so, the greenstone is columnar and massive: where the inclination is considerable, the banks often rise to several hundred feet, formed of an accumulation of angular fragments of rock, resting upon and against one another in such manner that the removal or displacement of one sets a long string of them in motion. These highly inclined planes of angular pieces of rock are destitute of soil and grass, and for the most part bare of timber.

It is in this situation—in the middle of immense masses of greenstone above and below—that the carboniferous sandstone shows itself to the thickness of many hundred feet in the bed and banks of the stream.

In the sandstone there are two seams of coal, 200 or 300 feet apart, and respectively measuring three and twelve feet in thickness. The dip is to N.E. and E.N.E. The quality of the coal is highly bituminous in both; and, together, they appear to represent the two uppermost of the three seams already described.

The upper seam is of a better quality than where it last appeared. The character of the coal here, as at the former locality, refer it to the variety known in various portions of England and Scotland under the name of parrot, cannel, or splent coal.

The newer sandstone, which overlies, and not quite conformably, the coal-measures, crops out in great force at many points along the line of greenstone hills which skirt the southern side of the South Esk and Break-o'-

day Valleys, from Fingal eastward to St. Patrick's Head. Upon close examination of that range, I failed in detecting coal *in situ*, except only in trivial and imperfect seams, and of the worthless anthracite description so characteristic of this sandstone.

In some of the water-courses detached fragments of good quality presented, but still in connection with the newer sandstone, with its imbedded contents of silicified wood, its casts and impressions of large strap-shaped leaves, &c.

It would appear, therefore, that coal, if it exists at all along the southern side of the valley, is only to be found there at a level under that of the plain, unless it may be at some point where a very circumscribed upheaving action may have thrown up a portion of the inferior strata and the coal with it.

Upon the flat-topped hill, two or three miles south from St. Patrick's Head, the newer sandstone, elevated to nearly 900 feet above the plain, contains, with much coarsely opalised wood and impressions of vegetation, numerous thin, limited, and irregular seams of anthracitic coal and lignite: the latter is in some instances divisible into laminæ of extreme thinness, which are possessed of no small degree of elasticity.

The northern boundary of the Break-o'-day Valley is formed by the Mount Nicholas range of greenstone hills, which run nearly east and west, and attain an elevation of about 2000 feet above the sea. At intervals along the summit of this range the greenstone culminates in lofty bare cones and needle-like points, which in some few cases overtop the forest trees. These cones, as on the opposite side of the valley, are composed of a congeries of columns and prisms of smaller dimensions: they are, from time to time, seen broken, disjointed, and scattered on the tops of the hills, along the sides of the ravines, and in the deepest channels of the streams,—indices at once of the perturbing, denuding, and disintegrating agencies to which, during indefinite periods of time, the country has been subjected.

There runs along the Mount Nicholas range, about 300 feet from its summit, the slightly undulating outline of a wooded terrace-like level, which has its counterpart on the opposite side of the valley, stretching on one hand toward Fingal, and on the other along the flat-topped hill south of St. Patrick's Head. This line indicates, to my apprehension, the elevation which the newer sandstone has attained, though itself for the most part undiscoverable beneath the mass of decomposed greenstone and other *débris* accumulated upon it.

It is worthy of remark that, at an elevation considerably above the present altitude of the newer sandstone, fragments of fossil wood and of hardened clay-schists, more or less rich in impressions of plants, are profusely scattered over the greenstone on both sides of the valley, and indeed throughout the district; indicating, probably, the existence at one period of coal strata, and the fossiliferous beds overlying them at a level relatively much higher than now obtains. One stray fragment of clay-schist which I picked up on Mount Nicholas displays a very distinct impression of an *Equisetum* or *Asterophyllite:* it may prove to be the *Asterophyllitis equisetiformis* (?), which is well known in the European coal-measures.

In almost every deep water-course worn down the side of Mount Nicholas, traces of coal and the coal strata are discernible. All the coal there is bituminous, and the number of seams hitherto discovered is six or seven.

That which, from its excellent quality and great thickness, claims attention first, crops out in the bed of a creek upon the estate of F. L. Stieglitz, Esq., of Killymoon, upwards of 500 feet above the level of the plains. The seam measures from 11 to 12 feet in thickness, with some subordinate layers of clay included. The quality of the mineral is that of cannel or splent coal: it is hard and compact, with a dull greyish-black lustre, plentifully interveined with a splendent, shining black, bituminous, and jet-like matter: its fracture is flat and flat conchoidal: it ignites very readily, and burns without fusing, giving out long jets of bright white flame: it yields a powerful heat, and leaves a white slaty cinder, which ultimately passes into light flocculent ashes.

The seam dips to W.S.W. and W. by S., at the rate of 1 in 17 or 18.

The coal occurs in massive beds of soft greyish-white sandstone, which alternate with clay-schist, replete with impressions of leaves, &c. of plants. Under the seam there is schistose clay, succeeded by a few inches of a very hard coal, which merges in black shale, resting again upon clay-schist with vegetable impressions.

The following is the measurement of the different members composing the seam; viz.—

	ft.	*in.*
Coal	4	0
Schistose clay	0	4
Coal	0	8
Clay	0	1
Coal	4	0
Clay with impressions	0	3
Coal	0	4
Schistose clay	0	7
Coal	1	6
Under which there is clay and shale	2	0
Coal	0	2
Clay-schist and shale, &c.		

making a total of 10 feet 6 inches of coal, exclusive of 15 inches of clay and shale with which it is intermingled.

About 100 feet lower in the series of beds, and in the course of the same creek, there crops out a 20-inch seam of black shaly coal of inferior quality. Another seam crops out about 100 feet above the level of the plain in the same creek; but it is very thin, and extremely hard, and, though bituminous, is of no value. The series of beds in this creek consists of greyish sandstone and schistose clays, with shale and coal, and it extends to a vertical thickness of about 700 feet.

About a quarter of a mile to the westward there is a creek, in the course of which, at a point bearing west by south or west from the outcrop of the main seam just described, and at a level 180 or 200 feet lower, there occurs a seam of coal 8½ feet in thickness. This seam yields a coal of a slaty structure and varying quality, though it is bituminous throughout.

Notwithstanding the difference between the thickness of this and that of the main seam referred to, and the want of correspondence in their line of dip, I incline to think that, when fairly opened into, they will prove to be the same, and that the difference in level has been caused by some partial displacement or local undulation of the strata.

In the bed of a creek about two miles east from that in which the main seam occurs, I found, under several hundred feet of massive sandstone, five seams of coal, varying in thickness from 15 inches to 4 feet, and of quality as various, but all more or less bituminous.

These beds are far apart in the formation, and when worked, it must be as separate seams, and, of course, at comparatively great cost. They are thin compared with Stieglitz's main seam; and, being only two miles nearer the coast upon a distance of twelve, they scarcely demand further notice at present. They are upon, or adjoin, the property of Mr. Legge.

The distance from the sea of the 12-feet seam of Mount Nicholas, where it crops out, is about 12 miles by the road; and it would be, at least, the like distance by any road formed with a gradual and easy descent to the sea-shore near Falmouth.

The nearest tolerable anchorage and place of shipment is George's River on one hand, and Long Point on the other.

George's River is distant, in a direct line from the Mount Nicholas crop of coal, 9 or 10 miles; but a practicable tram-road could scarcely be formed between the two points of less than twice this measurement. The distance to Long Point, along an easily inclined plane, would be about 18 miles.

The Island of St. Helen's, three or four miles from the shore, opposite St. Helen's Point, is said to afford shelter and safe anchorage in all weather to vessels of any burden; and the basin inside the heads at George's River is described as being capacious and secure, and as affording the utmost natural facilities to vessels receiving and discharging cargo. The entrance to the river has been reported to be narrow; and the depth of water is variously stated at from 8 to 11 feet over the bar.

I have seen the report of a project for constructing a pier or breakwater off the granitic point on which a store now stands, a little south from the township of Falmouth; but I am inclined to doubt whether, unless at an outlay to which the funds at the command of the Colonial Government must be altogether inadequate, any work could be constructed there of a character to withstand, in a position so exposed, the unbroken roll of the vast Pacific during heavy gales.

A proposal has also been made to run out a stone pier from near the granitic point which covers to the southward the mouth of Henderson's Lagoons, near Falmouth, and at same time to divert the waters of the Scamander River through these lagoons into the harbour thus formed, so as to keep the entrance clear.

This scheme is, upon the whole, the more feasible of the two; and, if carried out, would be more likely to endure, and answer to some extent the end in view. Besides, it would possess this great advantage over George's River and Long Point—that it would afford a secure place of shipment for coal and other produce of the district along a road already formed, and only about half the distance which must be traversed to reach either of those places.

The work, nevertheless, from the numerous subordinate undertakings involved with and essential to it, would entail in the execution a very serious expenditure of labour, time, and capital.

I have stated that the rock formation extending from the coast at Falmouth to St. Mary's Pass, at the eastern boundary of the Break-o'-day Plains, is of granite and syenitic granite. At St. Mary's Pass, an elevation of upwards of 1000 feet, granite is replaced with transition clay-slate standing on edge,—which then stretches to the northward in long winding ridges of a still higher elevation, hemming in the greenstone range of Mount Nicholas, with its basement of carboniferous and fossiliferous strata.

The transition rocks show themselves again upon the coast, at the mouth of the Scamander River, in immediate apposition with massive granite, and alternating in the shape of regular compact seams of a hard sandstone-like greywacke, and of much contorted beds of a dark carbonaceous clay-slate, varying to whet-slate and alum shale.

The estuary of the Scamander, which is tortuous, and of considerable width for some miles inland, is bounded at every turn of its course by hills consisting of arenaceous and clayey beds and schists of the transition era. These clay-slate hills, separated near the coast by steep ravines of great depth, converge and rise in altitude in a west and west south west direction, until they merge in the high land which skirts and supports Mount Nicholas.

Where the eruptive rock of Mount Nicholas abuts at its eastern extreme upon the transition hills, there is upon the latter, at an elevation of 1600 or 1700 feet above the sea, palæozoic rocks abounding in *Spiriferæ*, &c., which relatively ought to underlie the coal series; suggesting the probability of these fossiliferous strata having been deposited during a period of repose preceding the elevation of the clay-slate into hills, and when as yet the schistose beds were far from having attained their present nearly vertical condition.

High lands must have existed in the neighbourhood at the time of the deposition of the older palæozoic and carboniferous rocks, from which the material of these, both mineral and vegetable, was obtained. The inclination of 12° to 15°, generally characteristic of these rocks, must have been acquired during the ultimate upheaval of the clay-slate to its existing level. The elevation and alterations in dip of the clay-slate itself appear to have been effected in every instance through the instrumentality of granite. The partial upheavals and displacements in the palæozoic and carboniferous measures are, without doubt, attributable chiefly to the agency of greenstone.

The continuous valley of the Break-o'-day and South Esk owes its origin and form quite as much to aqueous denudation as to the process of elevation around.

The coal-beds on the northern side of the Break-o'-day dip generally to the westward and southward: on the southern side, near and opposite to Fingal, they dip to N.E., E.N.E., and east, indicating something like an anticlinal axis along which the coal-measures have been ruthlessly swept away. The exposure of the inferior beds of crinoidal limestone and ferruginous grit through the valley in the course of such a line favours this opinion; but additional and closer observations are required to establish the fact.

It is likely that the deposition of vegetable matter, of which the magnificent coal seams of this district are formed, extended over a large area; and that they were variously disrupted and carried off by currents of water, as has been stated, consequent upon and superadded to the effect of igneous agency at the time of the greenstone irruption. It is not unlikely that this basin may have originally extended to the upper valley of the South Esk, and even to the littoral side of the hills near George's River,—as it certainly appears to have done by the higher valley of the St. Paul's River, and the head of Swanport to the sea, at the mouth of the Douglas River.

Fragments of bituminous coal have been picked up in the channels of various rivulets descending into the valley of the St. Paul's. I have seen several seams of coal, more or less bituminous, along the range of hills to the west and northward of the extensive flat country through which the River Apsley winds before it is absorbed in the marshy ground on the borders of Moulting Bay. A thick seam of the finest bituminous coal is exposed in the Douglas River, and also, it is said, in a creek a few miles more to the northward. The indications of its existence near Long Point are very unequivocal; and, lastly, the thick seam of coal at the Schouten Island is to a certain extent bituminous.

Putting together these facts, it is scarcely possible to resist the conclusion that, at the period of deposition of the coal, a field of kindred quality, and more or less regular and continuous (dependent on the then existing character and local differences of level of the solid surface), extended over an area in this district equal to about 400 or 500 square miles. How much of this large deposit has been suffered to outlive the turmoil, disruption, and destruction incident to the development of volcanic forces, and the wear and tear of tides and receding floods of water, can only be determined, even approximately, by a close and connected examination of the associated strata, wherever sections of them are available for the purpose.

In the mean time, no reasonable doubt can be entertained that, for all practical purposes of the present day, an inexhaustible supply of good coal exists at Mount Nicholas and Fingal. Whether it may be profitable to send it to market, or practicable to consume it productively in manufactures or otherwise on the spot, is for capitalists and speculators to consider, and probably for unforeseen circumstances at length to decide.

The surface of the tract of country which I have designated a plateau of greenstone is so much broken by abrupt water-courses, and so thickly covered with scrubby underwood, as to be almost impervious in many places, especially toward the coast, and in the immediate vicinity of the Douglas River, rendering exploration there at once toilsome, and a matter of extreme difficulty.

Before noticing particularly the coal at the Douglas River, I have to observe, that from the eruptive plateau which I have described there runs a spur of greenstone hills down toward the head of Swanport, between the Swan River and the Apsley. From this spur to the ocean, in an eastern direction, in every water-course along the foot of the hills, the sandstone which overlies the coal strata crops out, more or less inclined, and dipping at various points to north west, west, south west, and even to south south east.

It is often thickly dotted with patches of carbonaceous matter, and interstratified with layers of lignite and anthracitic coal. Of both, several seams, two or three feet in thickness, present themselves, surrounded with beds of clay and flaggy sandstone, upon the estate of Mr. John Lyne. Upon Mr. Meredith's farm, between the township of Llandaff and the East Coast, a seam of strong combustible coal, of bright dark colour and cubical structure, shows itself to the thickness of 30 inches in the bank and bed of a creek, where it is overlaid by loose gravel, and reposes on whitish schistose clay; conveying the impression that the upper portion of the seam has been accidentally removed, and that by tracing it back under the loose bank it may be recovered in its original magnitude.

A gentleman residing in the neighbourhood undertook, at my request, to lay this seam open; but he reports that he has failed in obtaining any increase of thickness. Should a thick seam of good coal exist there, as I am still inclined to conclude, it must be very valuable; for the locality is within five or six miles of Wabbs' Bay, and the land carriage, trifling in amount, would be through a perfectly level country.

Several months ago I discovered, resting on a site of clay-schists and shales, the remnant of a seam of good bituminous coal, over which lay a thick bed of diluvial gravel, intermixed with large greenstone boulders. This was about two miles southerly from the Douglas River, about the same distance inland, and certainly not more than six miles from Wabbs' Harbour. No doubt a closer scrutiny of the locality, with the devotion of a sufficient amount of time to the work, would detect the seam where it is of workable thickness. It measured only 20 inches where I saw it.

From the Douglas River to Wabbs' Harbour there is an open beach of five or six miles, backed up by low sandy ridges, within which are several lagoons. About two miles inland the flat sandy country gives place to greenstone hills.

Wabbs' Harbour is a narrow gullet, gorge, or channel, having a length of 250 or 300 yards, by a width of 70 to 100 yards: it is formed by a small island of granite, placed directly off a projecting and low promontory or point of the same rock, from which the coast on either hand retires to a considerable depth.

To the southward of this point the shore is unintermittingly granitic and iron-bound. To the north of it, at two miles distance, is Diamond Island; and Wabbs' Bay, having a sandy beach, lies between. Cattle vessels from the Straits frequently put in here, it is said, for water. Granite rocks line the coast from opposite this Island to the commencement of the long sandy beach extending to the Douglas River.

About a mile or a mile and a quarter from the Douglas, the newer yellowish-brown sandstone walls in the beach, with a continuation of slightly inclined and wavy beds, forming a cliff 8 to 10 feet in height. Under it are occasionally seen beds of a more compact whitish-grey sandstone, with which it is not quite conformable. In the overlying sandstone there occur numerous thin and irregular seams and masses of anthracitic coal and lignite. There is also in it a great abundance of fossil wood, partly mineralised with silex, and partly converted into very hard incombustible anthracitic coal: but the most striking feature is, that several stumps of trees occur fossilised there in a nearly vertical position, with the ramifications of their roots still attached, and spreading naturally around.

A few hundred yards from the Douglas River the sandstone is replaced by low sand-hills; but it re-appears at the mouth of the river, where it forms the bar to its entrance, so shallow as to render the channel impracticable even for boats in fine weather.

The sandstone which looks out at the mouth of the Douglas dips slightly to N.N.E. and N.E., and almost immediately gives place to low sand-hills, which bound an open beach as far as Long Point. The long swell of the Pacific falls in heavy surf all along the seven-mile beach which I have described. A cattle vessel from Port Phillip, stranded here a few years ago, was notwithstanding got off again, after discharging her cargo.

Long Point is formed of massive granite, with clay-slate in vertical beds, which have a nearly meridional direction. The granite forms the exterior projecting point of the promontory, opposing an effectual barrier to the sea. The clay-slate varies from laminated schist to rhomboidal and prismatic: it is curiously penetrated by granitic and quartz veins; and passes through a granular greywacke-like structure at various points, and by a nice gradation into quartzose gritstone, and even into granite itself.

There is a little bay, formed by a slight curvature in the sandy beach and the projection of the rocky point, where small vessels find anchorage and shelter from every wind, except south and south east. The holding ground is said to be good. In the event of its blowing hard from the exposed quarter, vessels may easily run round, and anchor in comparatively quiet water, and under shelter, on the northern side of Long Point.

Small craft receive and discharge cargo at Long Point, within a few yards of the rocks: larger vessels could anchor further out.

In estimating the character and value of an anchorage where the shelter is not complete, it is of importance to consider whether the exposed point be that of the prevalent winds: and certainly this is not the case at Long Point; for a heavy gale from the south east is scarcely experienced on an average oftener than once in twelve months.

The beach inside Long Point is strewn with rounded fragments of a fine bituminous coal; warranting the supposition that a seam of some magnitude has been exposed, and more or less broken up, under the sea along the line of coast in the direction of the Douglas River, and at no great depth from the surface.

From the Douglas River to Long Point a narrow strip of low ground extends, between the sand-banks which skirt the coast and the greenstone hills inland. This is superficially composed of the newer sandstone, sections of which may be seen, to the perpendicular depth of upwards of 100 feet, in the creek which empties itself on the northern side of Long Point.

The course of the Douglas River itself, for six or seven miles from its mouth, is through this newer overlying sandstone. Its dip, which is rarely more than 15° from the horizon, inclines along the banks of the Douglas to south west, south, and south south east,—generally to south west. The average course of the Douglas for the first few miles is from the west: it afterwards runs from north west and north. In ascending the river channel, therefore, the traveller necessarily proceeds almost in the direction of the stratification.

The Douglas is every where commanded by heights of greenstone, the points and spurs of which run down almost to the river's brink at many places. The channel of the river is, indeed, not unfrequently much encumbered, and nearly choked up by immense blocks of eruptive rock, which have at some time been detached from the neighbouring hills.

Some of these greenstone hills, like the greenstone ridges bordering the Break-o'-day and South Esk valleys, are remarkable for the number and enormous size of the cones and needle-like columns which are scattered, or, as it were, stuck up along their summits. One of these immense needles, visible at a great distance, stands upon the shoulder of a high greenstone ridge, about four miles from the mouth of the Douglas River, and has obtained the name of Nicholas's Cap. Its vicinity is remarkable for the number and magnitude of inferior cones, which stand or lie, as it were, at random in every direction around—huge black isolated masses, near which the tallest and largest forest trees seem to dwindle into walking-sticks.

This ridge descends on the western side by a succession of steep terraces, in the course of which many of the dislocated and giant masses of eruptive rock are met with, apparently on a journey to the river below; and opposite to this point it is that the first upthrow of the inferior strata, which has brought the coal-measures to the surface, has taken place.

When the coal is first met with, the extent of upthrow appears limited, though the dip of the beds continues moderate, being yet not more than 1 in 10. The coal at this point crops out on both sides of the river, and in its bed. Its dip is to S.S.E., and south by east. The seam rests upon schistose clay, and has a solid roof of greyish-white sandstone over it. The dislocation which has elevated the coal here does not appear to extend laterally beyond a few yards.

The coal is of the finest quality. Fragments were broken off at random from all parts of the seam, to the amount of about a bushel, and thrown together upon a few dry sticks, and within half an hour there was a mass of fire and flame fit to roast an ox.

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 the mass with a wild ruddy flame and strong glare, yielding, in detached pieces exposed to red heat, long piping jets of bright white flame.

There is a well-defined line of demarcation along the line of fault, which nearly agrees with the direction of the dip; and the newer sandstone is seen side by side with the coal itself, instead of resting, as it ordinarily does, upon intervening sandstones and shales.

About a quarter of a mile further up the river this coal-seam is again thrown up, exposing a breast full 8 feet thick, obliquely traversing the bed of the river, and dipping to the north at the rate of 1 in 13.

As before, the seam rests upon a bed of schistose clay, and is covered with a compact bed of greyish-white sandstone. The seam contains three thin layers of clay; altogether, less than six inches for rejection.

The compact greyish-white sandstone is almost immediately, and not quite conformably, overlaid by undulating beds of a brownish-yellow sandstone, in which are enclosed detached masses of bituminous coal, and nodules of a pyritous clay ironstone. Between the grey and brownish sandstones there is an irregular seam of the same clay ironstone, a few inches thick.

The sandstone rises into cliffs of 100 and 150 feet perpendicular on either side: it is traversed in lines from north west to south east, within the next mile and a half, by two or three dikes of basalt, from a few inches to as many feet in width, variously veined and intermingled with calcareous spar; and it exhibits within the same space several centres of elevation, from which the beds dip to every side.

I have roughly estimated the direct distance of this crop of coal from the mouth of the Douglas River at four miles; and that a road sweeping under the shoulder of the hill on which Nicholas's Cap is placed, and thence diagonally to Long Point, might reach the shipping place within about six miles. The elevation at which the coal exists I consider to be 150 to 200 feet,—an amount which would be highly advantageous to traffic, were it regularly distributed along a line of half a dozen miles.

Of the quality of the coal no more need be said than that it is first-rate, and will be found fully equal to any or all of the purposes to which the best English coal is applied. With respect to the quantity available, I should say, that though the beds undulate, and are evidently much dislocated and broken up, the supply is, as compared with any demand likely to be created in these colonies in our time, inexhaustible; and it is not to be forgotten that the strata along the coast, from Long Point, across the mouth of the Douglas River, to nearly opposite Diamond Island, give every indication of the existence of seams of coal at an accessible depth, which, if realised, would be in a position still more convenient for shipment.

This Report is accompanied with a coloured map, and a few sections of the coal and associated beds.

I have the honor to be,

Sir,

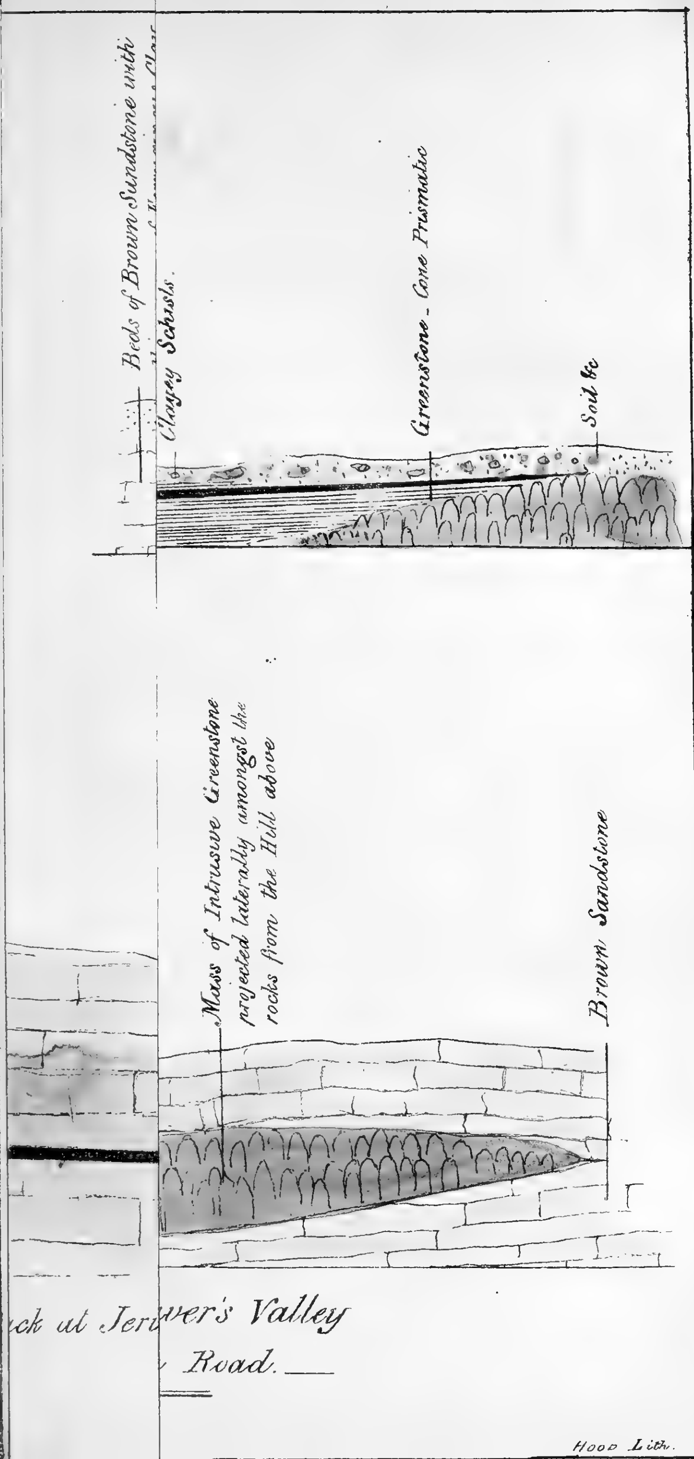
Your most obedient Servant,

JOSEPH MILLIGAN.

The Honourable

The Colonial Secretary,

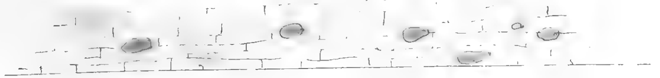
&c. &c.

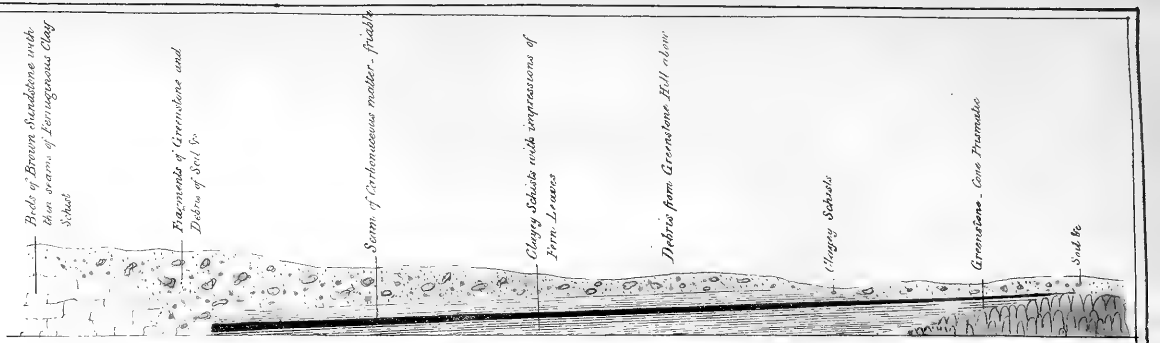


ck at Jer ver's Valley
Road. —

SECTION *Brewer's Valley _ Jerusalem Road* _ SCALE *1 inch to 30 feet.*

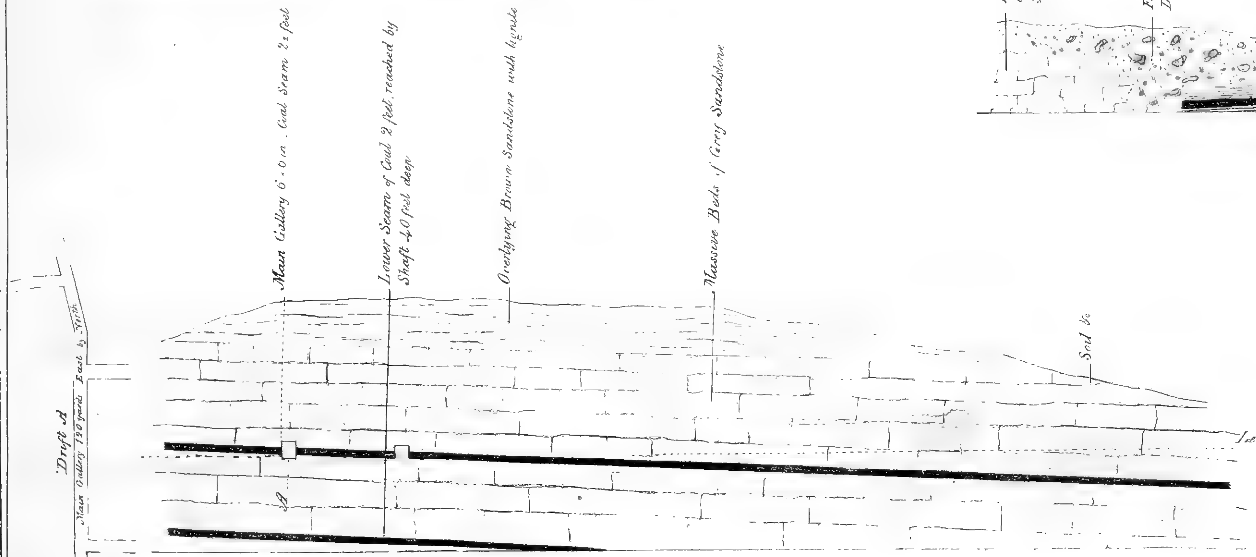
Brown Sandstone Beds containing flattened oval and spherical bodies with Coprolites





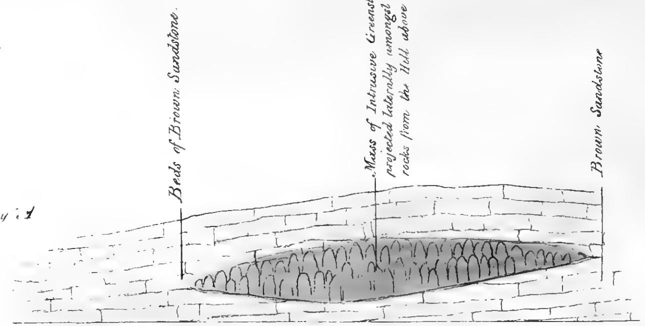
SECTION _ *Jerusalem Road _ Brewer's Valley.*

SCALE _ *One Inch to 30 feet.*



SECTION *showing 2 seams of Bituminous Coal each 2 feet thick at Jerusalem.*

SCALES { *Horizontal _ 1 inch = 50 yards*
Vertical _ 1 inch = 50 feet



SECTION _ *Brewer's Valley*

_ *Jerusalem Road.* _

Hooo Lith.

No. IV.

RICHMOND AND JERUSALEM.

Hobart Town, 13*th February*, 1849.

Sir,

After having revisited Richmond and Jerusalem, and examined the coal of these localities, in accordance with the wishes of His Excellency the Lieutenant-Governor, I have the honor to transmit the following observations on the same, to be laid before His Excellency.

The Richmond coal crops out in the western bank of the Coal River, amid a series of beds of greyish sandstone. The situation is upon the estate of a deceased Mr. Butcher, about one mile from a point in the estuary of the river, where vessels of 20 tons burthen used to load, and nearly the same distance from the Hobart Town road, where it passes through the township of Richmond.

The coal has been worked by a drift carried from the water's edge into the steep face of the river's bank, obliquely to the line of dip; but the works have long been abandoned, in consequence of their having been inundated from the river during a flood.

The dip of the beds is to west south west, and at the rate of about one foot in three or four.

An attempt has been made to win the coal by sinking a shaft a few yards from the margin of the river;

but, from failure of means or of enterprise on the part of the projector, it has fallen short of success. This is not to be much regretted, however; for the coal proves to be an anthracite, only superior to that from Port Arthur in this, that it does not split and fly about to the extent that the latter does when first heated.

The crop of the seam exhibits only a few inches of soft carbonaceous matter, of a dull black colour; but it appears to have yielded about two feet of a consumable commodity, when fairly opened into. In common with the coal from Port Arthur, and other non-bituminous coals, this has the property of great durability as a fuel; burning without flame, and emitting but little smoke. The mineral, when newly broken, has a shining lustre, and a greyish-black colour, and is compact; but it does not stand weather well, frittering down into a gritty powder.

The Coal River crosses the edges of the strata in which this coal rests, and exposes several seams of carbonaceous matter. Toward the dip, these have the ordinary aspect of beds of carbonaceous shale; but, in the direction of the crop of the seams, they have acquired a flinty degree of hardness, so as in some cases to strike fire with steel. The sandstone in that neighbourhood is also much hardened.

On proceeding about 150 yards the cause of this becomes obvious: for there a dike of basalt crosses the river, fairly intersecting the coal strata, and connecting the low rounded eminences of eruptive rock on the opposite sides of the stream.

The coal-beds are cut off in a similar way in the direction of their dip, and at about the same distance from the abandoned pit or gallery. Between the two points where the eruptive rock crosses the river, it forms a bend; and directly opposed to this bend of the river there is a curved ridge of greenstone, between which and the bend the coal-beds are situated, embracing an area of probably not more than 7000 or 8000 square yards,—a space which, it is obvious, would yield from a seam of two feet in thickness a very insignificant amount of coal, could even the whole be realized: but it is certain this would not be the case; and it is probable that the expence of working would be unusually heavy, from the rapid descent of the strata, and the necessity which would arise for the use of machinery.

It is not unlikely that the coal might be recovered by sinking in the valley to the west of the ridge of eruptive rock, if indeed it may not be found to pass under it; but in either case it must, if at all, be worked at a cost far beyond that which the prospect of returns would justify.

The Richmond coal possesses for domestic purposes alone a slight recommendation over that of Port Arthur: it is in no respect better qualified for use in steam navigation or otherwise, where a fuel capable of high and expeditious heating powers is requisite.

On the southern side of the dike of eruptive rock, which I have said crosses the coal strata toward the crop, the sandstone and shales re-appear; and some abortive attempts have been made in that vicinity to regain the coal.

To the eastward, the country rises by a succession of gently rounded greenstone eminences into the continuous chain of lofty hills which on that side give limits to the valley of the Coal River, and stretch, with trifling interruption at Prosser's Plains, to the ocean near Spring Bay; exhibiting on the central flat or table land about Brushy Plains, and elsewhere, traces of the upper sandstone carried up with it at the time of its elevation.

On the flanks of the hills near Black Charlie's Opening the upper sandstone exists; and it is quarried for building purposes by Mr. Morrison on his estate in that vicinity. Between Parson's Pass and Richmond, and on many of the greenstone hills in the direction of Campania, fragments of fossil-wood abound; indicating, in language not to be mistaken, the existence at one time in these localities of the upper or brown sandstone,—the matrix in which it is invariably found.

In the immediate vicinity of the limited coal-seam which I have described, on the opposite side of the river, and just at its head, there is a low hill cut through which displays a series of undulating and unconformable overlying beds of soft brown sandstone, alternating with nodular ferruginous clays and shales containing lignites, ill consolidated: all of these exhibit impressions (but rather imperfect) of leaves and other vegetable matter. As usual, the forms of leaves of ferns and of strap-shaped leaves predominate: fossil wood also abounds.

It is observable elsewhere that, where dikes of eruptive rock traverse the sandstone strata, veins of calcareous spar prevail: such is also the case here; and not merely in the eruptive mass itself, but in the sedimentary rock through which it has been forced.

On the western side of that portion of the valley of the Coal River extending from Richmond to the sea, there runs a chain of hills which have attained an altitude of 400 to 500 feet. These hills consist of a compact yellowish sandstone, into which the brown overlying sandstone already mentioned appears to pass. The beds composing these hills dip to the westward; and they present on their eastern exposure an irregular line of escarpments, in which at a high level many curiously hollowed and deep recesses occur, looking as if the roll of an open sea, rather than wind and weather, had effected their excavation. But the most curious and interesting phenomenon connected with these hills and caverns is, that the sandstone is saliferous; and that common salt oozes and effloresces from roof, sides, and floor of many of the excavations. On the floor there is often a thick layer of sand, with an encrustation of salt between it and the solid rock.

The beds of this sandstone vary from massive to flaggy; and in the upper part of the series it is generally rather hard. It contains thin beds of conglomerate and clay-schist, with layers of clayey *amygdoli*, and some singular impressions and forms. The most common looks like the impress of a straight and broad-toed diminutive shoe with its heel detached, or the tip of a broad spatula narrowed toward the end which is cut across. This form occurs from half an inch to three inches in length, with a proportionate width.

The newer red sandstone which prevails so extensively over the coal measures in England, and for which this appears to be the equivalent here, is highly saliferous. In Worcester and Cheshire it yields, as is well known, salt springs and many thick beds of rock salt. The beds known in England as the "Red Marl Group" attain a thickness of more than 2000 feet.

The saliferous yellow sandstone, which near Richmond reaches an elevation not exceeding 500 feet, may be seen on the banks of the Coal River, two or three miles east from Jerusalem, forming a magnificent façade of 800 to 1000 feet, exhibiting its characteristic caverns with their encrustations of salt and its thin layers of clayey breccia and schist, with the same curious spatula-looking forms and impressions which abound in the Richmond hills.

The same sandstone presents itself again with all its characteristic features about 4 or 5 miles south from

Jerusalem on the eastern side of the Coal River, forming high flat-topped hills, which are separated by deep and rather precipitous cross valleys.

In the hard sandstone, which flanks and caps some of the hills on the eastern side of the valley in which the village of Jerusalem stands, the same characteristic features obtain ; and there, in beds immediately adjoining, they are succeeded by impressions of *Pecopteris* (*Gleichenites*) *odontopteroides* and *Australis*, as figured by Strzelecki, and indicative of the proximity of the coal-measures.

The saliferous sandstone in which the shallow lagoons occur known as the Salt-pans, near Ross, is likely to prove identical with that which I have been describing.

In the earlier times of the Colony, settlers collected salt for domestic use in the caverns along the line of the Richmond hills ; and, up to a comparatively recent date, persons in the neighbourhood of Ross were in the habit of scraping together the thick saline efflorescence which from time to time in the summer season coated the dried-up floor of the Salt-pans.

Upon the whole, it seems fair to infer from the analogies of the formation, that it may in course of time be found to contain, as in England, thick deposits of salt in a compact and crystallized state.

Proceeding from Richmond to Jerusalem, with the Coal River on the right, there runs, at a distance of one to three miles, along the left a continuous chain of greenstone hills, which are only partially interrupted about Gunning's Sugar-loaf and Native Corners.

The floor of the valley consists for the most part of the overlying yellow sandstone: but at many points the greenstone has penetrated from below or been laterally projected from the hills, forming a series of rounded eminences in the very heart of the low ground. Many of these rises are covered with sandstone ; and the sandstone is seen skirting the sides of many of the hills.

Nearly opposite to Gunning's Sugar-loaf (the *Tittarah* of the Aborigines), masses and nodules of a ferruginous clay abound: a mile or two nearer to Richmond, the sandstone has been converted, probably by heat and the proximity of igneous rocks, into a very hard compact silicious-looking grey rock, with a conchoidal and semi-splintery fracture.

It is said that pieces of coal have been picked up about the Native Corners; and a person named Blinkworth, residing on his own small property five miles south of Jerusalem, says that a seam of coal exists in a bend of the Coal River opposite to his house. About a quarter of a mile nearer to Jerusalem a seam of carbonaceous matter, of a greyish-black colour, and friable granular structure, crops out in the bank through which the road has been carried.

From Richmond to Gunning's Sugar-loaf the surface of the country rises slightly and evenly: from that to Blinkworth's the undulations are numerous, and the ascent is considerable: from Blinkworth's to the summit of the high ground which overlooks the village of Jerusalem, at a distance of one to two miles, there is an acclivity progressively increasing in steepness through several hundred feet.

The greater part of this ascent has been cut along the sides of the hills on the west side of the Coal River valley, which is there very narrow, and the road is good.

The cuttings along the road-side exhibit interesting sections of the upper brown sandstone near the point where it is superposed on the true carboniferous and greyish-white sandstone. In the brown sandstone there occur many seams of lignite and imperfectly mineralised coal, which show themselves in the form of a streak or layer of soft culm-like matter more or less intermixed with clay, and in not a few instances containing impressions of leaves, &c. These carbonaceous seams are numerous, and alternate with a long series of beds of schistose clays and flaggy sandstones, the whole of which, with some exceptional undulations arising from the partial action of subjacent and intrusive greenstone, dip to about south south west and south west.

About a mile or $1\frac{1}{4}$ miles beyond Blinkworth's greenstone is seen, irregularly prismatic and columnar, sustaining a succession of beds of clayey schists, in which there is a seam of ill-compacted lignite of a few inches in thickness, increasing in the course of the dip to about 20 inches.

About two miles from Blinkworth's there is a point in the bank where greenstone may be seen completely intruded between beds of sandstone, displaying all its usual irregularity of prismatic structure, with the sedimentary rocks lying above, below, and around it, at various but not great inclinations.

From this locality to Blinkworth's there occur, imbedded abundantly in these sedimentary deposits, flattened spheroidal or oval bodies from a few inches to 20 inches in diameter, composed of dark-brown clay, which owe their forms probably to vegetable or animal organisation of the era of their formation. Smaller bodies similarly imbedded, and somewhat cylindrical and pyriform in shape, and more compact in structure, resemble coprolites. Other forms exist too, the origin of which I am also inclined to refer to organised bodies.

The vale of Jerusalem is situated upon the Wallabee Rivulet, a tributary of the Coal River: it is an irregular oblong basin of about 4 miles by 2 at its greatest width, and shelves away on every side into hills of 250 to 500 feet above the village. These hills are composed almost exclusively of greenstone to the west and north; but to the eastward sandstone not unfrequently mounts up their sides to their very summits, and over them.

From the highest point of the Richmond road, where it begins to descend toward the township of Jerusalem, the beds, which are there exposed to a depth of only a few feet by the cuttings along the way-side, dip slightly but regularly to the north west and north north west,—that is, towards the middle of the vale.

From the eastern side the overlying yellow sandstone already mentioned dips also (but more abruptly) to the centre of the vale,—that is, about south west.

From the north-east extremity of the vale, where the Coal-mine creek emerges from a deep ravine to join the Wallabee rivulet, the sandstone also dips pretty regularly to the south west and south south west,—that is, towards the lower portion of the vale.

The junction of the Coal-mine creek with the Wallabee rivulet takes place about two miles north from the centre of the township; and the seam of coal for which Jerusalem is remarkable is situated about half a mile further in a north-north-east direction, under a cliff of sandstone intersected by the rill of water which has taken its name from the circumstance of coal having been worked there.

The seam measures from 2 to $2\frac{2}{12}$ feet in thickness, and has a soft dark-grey sandstone above and beneath it, which passes downwards into a greyish white, and upwards, at a height of about 40 feet, into the unconformable and undulating beds of brown sandstone so abundant in the district.

This coal has been mined by a horizontal gallery of 6 feet $\times$ 6 feet running about north east by east, the roof of which is partly supported with timber now fast decaying and giving way under the effects of damp, and the heavy superincumbent weight of large detached flakes of the soft grey sandstone above. The length of the main gallery is about 120 yards: at 50 or 60 yards from the mouth there is a branch-gallery to the right, along which the coal has been worked towards the dip of the seam: about 40 yards further there is another branch-passage driven in the same direction. In both these subordinate galleries water now stands to some depth: about 10 or 12 yards from the extreme end of the main gallery a short working has been effected to the left.

The coal seam thins out, and is lost rather abruptly, about 10 yards from the termination of the main gallery, in fine dark grey sandstone, which is there harder than elsewhere: the seam is also lost in the working to the left; in the second working, on the right, it also thins out to a very inconsiderable thickness, and is lost in the water now accumulated on the floor there.

It is becoming daily more difficult to traverse these passages, from the frequent falling in of sandstone and the lining of timber from the roof and sides.

The loss of this seam has been stated by practical miners to be the result of a fault or dislocation of the strata; but it looks more like the natural thinning out of the edge of a basin.

About 20 yards in the course of the dip, along the foot of the steep bank, there remains the closed entrance of another drift, which was never pushed, I believe, to any extent. By the side of this entrance the coal again crops out, affording a good opportunity of determining the inclination of the beds.

The coal seam, and the massive grey sandstone in which it reposes, dip at about 1 in 17 or 18 to south west or south south west: but the brown sandstone, which overlies the whole, though its general inclination is the same, undulates, and varies from point to point in a way to indicate considerable disturbance during the period of its deposition.

The Coal-mine creek, which formerly ran close along the base of the cliff, has been diverted so as to prevent any casual ingress of water, such as inundated the works at Richmond.

Following the dried up water-course downward, the seam is soon lost, partly from its inclination being more rapid than the fall in the creek, and partly from the *débris* of the cliffs having covered it deeply over.

A shaft has been sunk upon the bank by the margin of the stream, in the direction of the dip, and about 250 yards distant, but without recovering the coal. It is probable that the failure may have arisen from the excavation not having been carried deep enough. The sinking ought to have exceeded 50 feet to have intersected the same seam, on the supposition that the inclination continued the same. Down the channel of the creek, for nearly half a mile, the brown sandstone shows out, forming a steep bank of 10 or 12 feet over the grey sandstone, and contains thin carbonaceous seams, with fragments of fossil-wood.

About 750 or 800 yards down the creek, a spot is pointed out where a well had been sunk in its bed to the depth of 10 or 12 feet; and it is reported that at the bottom a thin seam of good coal was found resting upon slate.

Proceeding next in the direction of the crop of the beds, at the distance of only 50 or 60 yards from the mouth of the main gallery, I passed to a dike of eruptive rock, which there crosses the stream in a mass at least 50 yards in width. As usual, this greenstone dike is largely veined with crystallised carbonate of lime. The brown overlying sandstone soon re-appears beyond it, and is succeeded by beds of clay and shale. Imbedded in these, there is a seam of bituminous coal, said to increase downwards to 4 feet in thickness. It crops out about 200 yards from the workings on the opposite side of the dike of erupted rock, and under the western bank (which is private property) of the Coal-mine creek.

At a bend of the same creek, a little higher up, the greyish-white sandstone again emerges under the brown in massive beds; and there is partly imbedded in its substance the stump of a fossil tree placed vertically, with many of its roots still attached, and diverging on every side,—apparently in the position in which such a tree might have grown.

The bed of the creek contains all along great quantities of fossil wood; the residuum from the decomposition and removal of the brown sandstone, and of the uppermost beds of the greyish white.

In the greyish-white sandstone, near its junction with the brown, there occurs masses, rounded by attrition, from the size of a marble to that of a cannon-ball, consisting of its own material much hardened, or of the material of the lower sandstone.

Nodules of clay ironstone and ferruginous clays occur abundantly about the line of junction of these formations.

The brown sandstone, with the massive beds of grey more or less disclosed under it, occurs at every degree of elevation in the immediate neighbourhood: it is found at one time in the bottom of the ravines, and at another mantling round the shoulders and flanks of the greenstone hills, several hundred feet up. In these last situations it is more than probable that the coal seams, which the grey sandstone undoubtedly contains, or traces of them, may yet be discovered by a close and continuous search. Boring would, however, be the most expeditious and certain mode of determining the point.

About a quarter of a mile from the coal-mine the creek receives a slender tributary from a gorge in greenstone hills to the eastward; and about 150 yards up this streamlet a dark grey band of carbonaceous matter under brown sandstone beds, and immediately over grey sandstone, indicates the probability of coal within. The remains of a low and imperfectly formed horizontal driftway are visible, from the inside of which it is said a sinking has been effected, but no good coal is visible. It is alleged notwithstanding that the 2-feet seam of coal, worked as I have described near the dike of greenstone, was struck here. Of the dip of this seam I could only judge by that of the ill-compacted brownish-yellow sandstone, which barely allowed the beds of massive grey to be recognized under it: it appeared to be about south.

In describing the workings formerly carried on in the 2-feet seam at the lower part of the creek, I have omitted to state that, close to the entrance into the main gallery, a well, now nearly full of water, remains almost the only evidence of a shaft which at one time was sunk there to the depth of 40 feet. It is said that in this operation a second seam of two feet thick was cut through, and that its quality was quite equal to that of the upper 2-feet seam.

The colour of the Jerusalem coal varies from greyish and dull black to shining jetty black: its structure is slaty, with a tendency to cuboidal, and its cross fracture flat or irregularly angular, which is nearly the description given of it by the Count Strzelecki.

After having examined the thick seam of cannel coal at Fingal and Mount Nicholas, and the rich bituminous seam at the Douglas River, I am of opinion that the Jerusalem coal yields only in quality, if at all, to that from the Douglas River, and that chiefly in *caking* property.

The Jerusalem coal ignites with extreme facility, and burns with a bright clear flame, leaving an inconsiderable proportion of light white ashes. As regards the economical applicability of the coal at Jerusalem, it will be found fully adequate to the propulsion of steam vessels on long voyages, or to any other purpose for which the best description of this mineral fuel is required.

As to the quantity which may be obtained, sufficient data have not been accumulated on which to found a safe calculation: but enough has been ascertained of the ramifications of the carboniferous system of the district, and of the quality of the mineral which it yields, to justify me in recommending that a still more exact and systematic examination be made in the neighbourhood of Jerusalem, and in the upper valley of the Coal River, wheresoever the lower strata are exposed.

The coal, wherever it has been touched there, appears to be of excellent quality. Two seams at least of a workable thickness have been discovered within 80 feet of the brown sandstone formation; and the irregularity of dip frequently brings the lower beds near to the surface. Then the distance from a place of shipment is not so great as to render the inland transport of coal an insuperable, or even a very serious obstacle. The distance from Jerusalem to the harbour below Richmond would be 16 miles or upwards: but were a tram-road once laid down, it would be of small moment whether the space to be travelled over amounted to 16 miles or only to 6; besides, it is to be borne in mind that, whether such tramway be conducted to Richmond or to the Derwent, a great advantage would be derived from having to send loaded trucks down hill, and from having only to draw up empty ones.

In conclusion I have to repeat, that my last examination of the country immediately about the vale of Jerusalem, and downward into the valley of the Coal River, has impressed me most favourably so far as the amount and quality of coal existing thereabouts is concerned; and that it seems most desirable to have an extensive series of deep perforations made, with boring rods, in situations naturally the most favourable, in order both that the limits of the beds already discovered may, if possible, be determined, and that it may be ascertained whether thicker and richer beds of the mineral are not to be found at a level still lower.

So soon as I shall have constructed the few sections for the preparation of which I have procured data, I shall have the honour to forward them, with this Report, for the perusal of His Excellency the Lieutenant-Governor.

I have the honour to be,

Sir,

Your very obedient servant,

JOSEPH MILLIGAN.

The Honourable

The Colonial Secretary,

&c. &c.

PAPERS AND PROCEEDINGS

OF

THE ROYAL SOCIETY

OF

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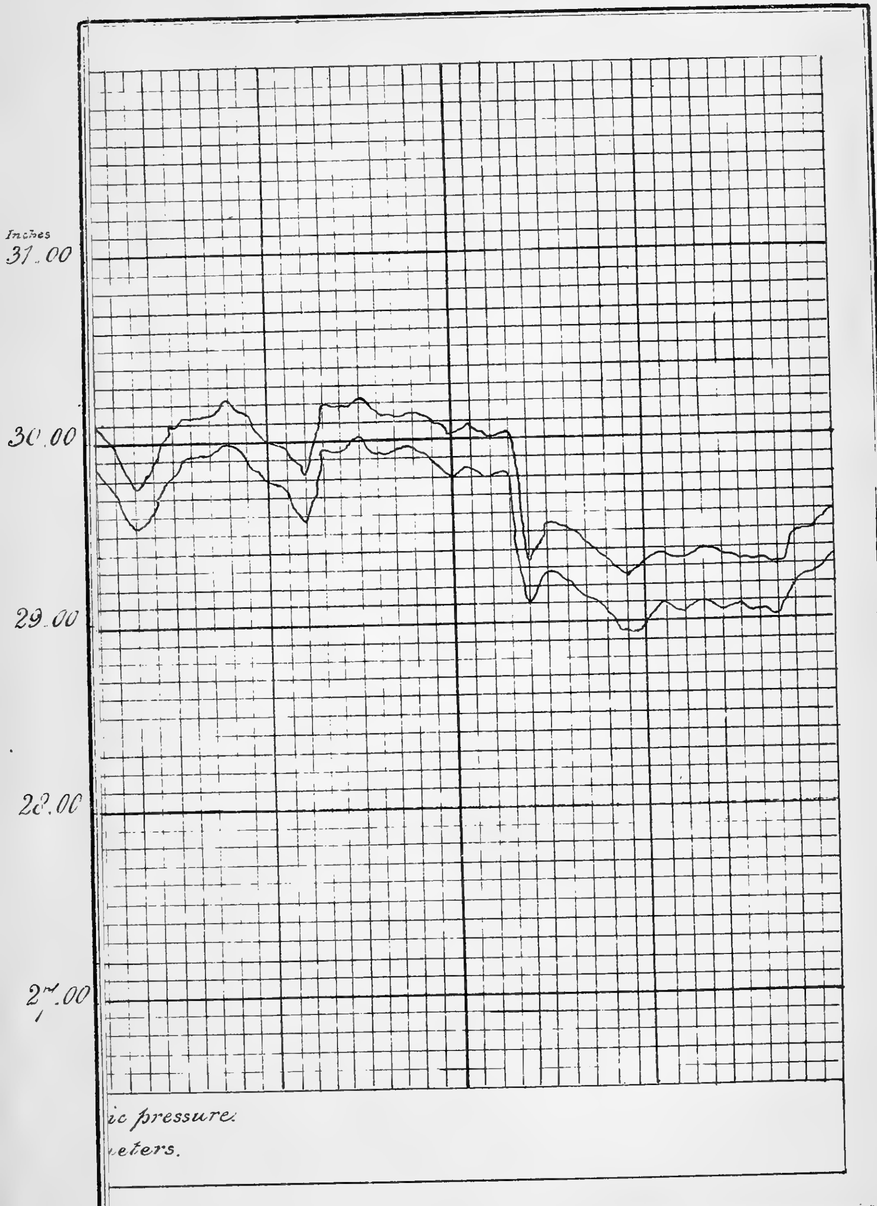
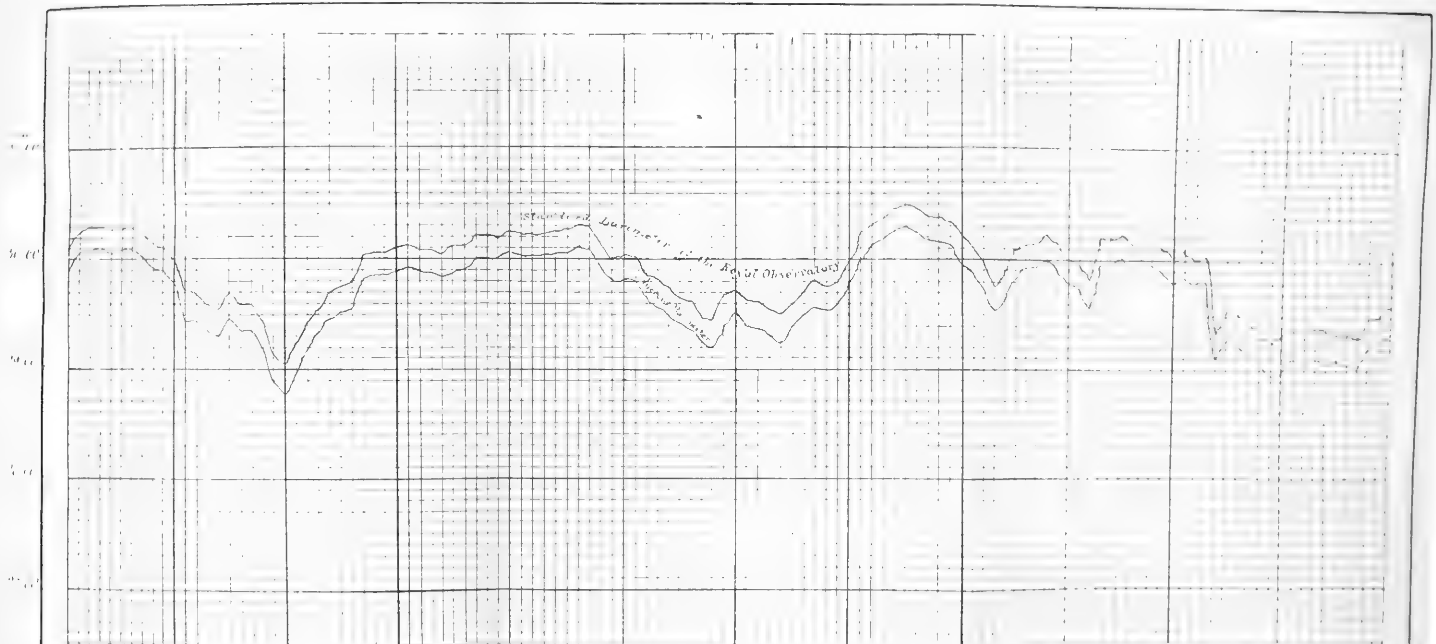
…ial and Aneroid Barometers



T. Browne. Lith.

Diagram representing the Comparative Observations of the Standard Mercurial and Aneroid Barometers



Each horizontal line represents one tenth of an inch variation in the Atmospheric pressure
Each vertical line represents one comparative observation of the two Barometers

V.

On the Aneroid Barometer. By Lieut. KAY, R.N., F.R.S., *Director of the Royal Observatory, Hobart Town.* [*Read 11th July,* 1849.]

THIS elegant little philosophical instrument is of very modern invention, having been first introduced to public notice at a meeting of the British Association, held at Swansea, in September, 1848. It may fairly be considered a matter of congratulation to find that one has so soon reached these shores; and as the proprietor, Dr. Kenworthy, has been so good as to entrust it to my care, with a request that I would make any practical experiments which I might consider necessary for testing its powers, I have deemed it of sufficient importance to bring the results before the notice of the Royal Society of Tasmania. Its portability and accuracy in denoting the changes in atmospheric pressure under ordinary limits, and the apparent simplicity of the principle on which it is constructed, appear to render it peculiarly applicable to the wants of those persons who may desire to possess a convenient house or marine barometer at a moderate cost, without being liable to the derangement in transit, which is so peculiarly the objection to the mercurial barometer: on this account it will prove valuable to the surveyor, the traveller, and perhaps also to the man of scientific observation. Before proceeding to relate the results of such experiments as I have been enabled to make, it may be desirable to glance slightly at the principles on which it is constructed, as far as I have been able to gather from the account of the instrument given in the transactions of the British Association at its first introduction.

The mechanical arrangement consists of a cylindrical chamber of copper about $2\frac{3}{4}$ inches in diameter and $\frac{5}{16}$ of an inch deep, partially exhausted of air, and hermetically sealed: the surface of this chamber is of very thin metal, corrugated or in folds; and with every variation of the atmosphere this surface rises or falls. The movement of the surface is communicated by a strong stud fixed in its centre, which acts upon a main lever attached to it, and the movement is continued by a system of levers, from which a chain connected with a spiral spring changes the motion from vertical to horizontal, the spring being fixed to an axis, on which is placed the steel hand or index indicating the changes on the dial plate: thus, the chamber is a substitute for the Torricellian tube, and its surface for that of the column of mercury. It is therefore obvious that the difficulty in first adjusting this instrument consists in the delicate manipulation necessary to arrange the movement of the levers and surface of the cylinder in connection with the quantity of air to be withdrawn from the chamber, and can only be accurately done in conjunction with some authentic mercurial barometer, which alone furnishes the true weight of a column of the atmosphere at any moment. Here it is that I conceive the principle of the instrument to be objectionable, and particularly so when employed in the mensuration of heights, on account of the variation which different altitudes on the earth's surface would cause in the density of the air contained in the chamber; because the density of air is affected not only by changes of temperature, but by changes in the weight of the incumbent atmosphere.

The comparisons which have been made with the mercurial standard barometer of the Royal Observatory are annexed in the form of a diagram, as more readily conveying the results to the eye than in a tabular form. The mean index error of the Aneroid deduced from 120 comparisons is + ·22 of an inch, the Aneroid being always in defect of the Observatory standard, and it appears to be a constant quantity *in this particular instrument* on all pressures between 29·50 inches and 30·50 inches; whilst on such comparative observations as have been obtained on pressures below 29·50 inches this index error increases to ·28 inches and ·30 inches, and evidently goes on increasing as pressure diminishes. I attribute this constantly increasing error in low pressures to a change in the density of the air, produced by a diminution in the weight of the incumbent atmosphere; and it is but rational to infer that it acts with greater force on pressures of 27. 26. and 25. inches. The error which this defect in principle introduces when employing the instrument for the mensuration of heights is therefore evident.

The greatest test to which I have subjected the instrument was on the occasion of making the ascent of Mount Wellington. From the moment of quitting the town, the Aneroid commenced indicating a diminution in the atmospheric pressure, the steel index gradually moving down towards the low numbers on the dial-plate. On arriving at Mr. Degraves's establishment it stood, corrected for index error, at 29·32 inches; and by the comparative observations which were made at the Observatory, it assigns 391 feet as the height above the level of the sea. Pursuing our path up to the Springs it continued to fall rapidly, and its mean indication during our stay there was 26·88 inches; and as a remarkable instance of its accuracy in *relative* changes, it continued to fall slightly during our stay at the Springs, a change which upon returning to the Observatory I found had taken place there also. The comparative observations with the Aneroid and Observatory standard barometer give 2·730 feet as the height of the Springs above the level of the sea. On a former occasion I had measured the same spot with two very excellent mountain barometers belonging to H.M.S. *Fly*, and they gave a mean result of 2,506 feet. The great difference in the two results must therefore be attributed to the imperfections of principle in the Aneroid before-mentioned, and which appear insuperable in the present state of the instrument. Leaving the Springs, we continued to ascend the mountain, until the Aneroid indicated 25·87 inches (about 3,500 feet), at which height it ceased to act, and the index became perfectly stationary; it remained so during the remaining portion of the ascent: and when we reached the highest part of the mountain (which I had previously ascertained to be 4,190 feet), the index steadily pointed to 25·87 inches, although we had in the meantime ascended at least 500 feet more. It now became interesting to ascertain the cause of its having ceased to act; and we were much gratified to find on our descent that on arriving just below the spot where it had previously become stationary, the index began to move towards the higher numbers, and continued to do so steadily as we increased our distance from the summit. It was therefore evident that we had been in an atmosphere more rarified than the gas contained in the cylinder, and that, in consequence, its corrugated surface was dilated to its full extent, and ceased to exercise any influence upon the levers and index of the dial-plate. It was not until we had increased the weight of the incumbent atmosphere by our descent that the index would move; and from that time its indications were the same as they had been during the ascent. On reaching the Springs it showed 26·90 inches, the same as it had done previously; and I found afterwards that the Observatory barometer had returned at that time to the same reading which it had in the morning at the time of our ascent.

In conclusion, I think that the result of the comparison with the Royal Observatory standard barometer warrants me in recommending the Aneroid as a useful instrument for all the ordinary purposes to which a barometer is applied, or where scientific results are not required. As a convenient and portable weather-glass it is valuable, as it may alike lay on the drawing-room table, or be carried in the coat-pocket without risk of injury; and its indications *within the ordinary ranges of the atmospheric pressure on the earth's surface* will be seen on reference to the diagram to be most accurate. As a strictly scientific instrument, to be employed in the mensuration of heights, it is faulty, and, as far as I have been able to judge, from the reasons already given: but it is well known how difficult a problem it has ever been, even with the mercurial barometer, to make allowance for the expansion of air and mercury with due exactness under all the varieties of temperature and pressure to which an instrument is subjected when employed in such investigations.

VI.

Account of the Analysis, by DR. MOTHERWELL, *of certain Woods of Tasmania, with a view to determine the amount of Potash contained. By His Excellency* SIR WILLIAM THOMAS DENISON, F.R.S., *&c. &c.* [*Read 10th January,* 1849.]

IN a number of the Farmer's Magazine, published, I think, in 1846, there appeared an article on the cultivation of the hop. The writer went very carefully into the subject, giving an account of the various analyses he had made of the plant, bine, leaves, and flower, showing from the elements of which these various portions of the plant were composed, the amount of inorganic matter withdrawn from the ground by every crop. From these analyses it appeared that a large amount of potash was withdrawn annually in the flowers of the hop alone, supposing the leaves and bine to be returned to the ground, as would of course be the case.

It occurred to me that it would be desirable to ascertain the amount of wood ashes which it might be necessary to mix with a compost for hops, in order to restore to the ground the proper quantity of potash; and for this purpose I requested Dr. Motherwell to make some experiments in order to ascertain the relative amount of potash in some of the woods of the Colony. Dr. Motherwell very kindly complied with my request; and after carefully experimenting upon some of the most common woods of the Colony, transmitted to me the accompanying paper, containing not only the results, but also the detailed statement of the mode in which the experiments were conducted. By this it would appear that the she-oak and the white gum, particularly the former, are the trees which contain the most potash.

While, however, these experiments are conclusive as far as they go, it would be very desirable that some attempts should be made on a large scale to ascertain the amount of the ordinary potash of commerce which can be extracted from the ashes of the different woods by lixiviation and evaporation in the ordinary manner. The operation is very simple, and the apparatus required may be cheaply and easily procured. The timber is heaped together in large stacks, and burnt; the ashes are then collected and placed in wooden cisterns, having a plug at the bottom of one of the sides, under a false bottom (a cask would answer the purpose); a moderate quantity of water is then poured on the mass of ashes, and some quick lime stirred in. After standing a few hours so as to take up the soluble matter, the clear liquor is drawn off, evaporated to dryness in iron pots, and finally fused at a red heat into compact masses, which are grey on the outside and pink-coloured within.

The best Canadian potashes, which are sent home in casks weighing about five hundred weight, contain on an average 60 per cent. of pure potassa, and the price is, I believe, about £1 4*s*. per cwt.

In Dr. Ure's Dictionary of Arts and Manufactures, from which the above statement of the mode of manufacturing the potash is extracted, I find a table giving the amount of potassa contained in various woods and vegetables, from which it appears that

1000 parts of	Pine	yield 0.45	of Potassa.
	Poplar	0.75	
	Beechwood	1.45	
	Oak	1.53	
	Boxwood	2.26	
	Willow	2.85	
	Elm and Maple	3.90	
	Wheat Straw	3.90	
	Oak Bark	4.20	
	Thistles	5.00	
	Small Rushes	5.08	
	Barley Straw	5.80	
	Dry Beech Bark	6.00	
	Fern	6.26	
	Large Rush	7.22	

From the experiments made by Dr. Motherwell, it would appear that the woods of this country, especially that of the she-oak and the white gum, yield a very large quantity of potash, as compared with the elm and the maple, the most productive woods of the American forests. These latter produce 3.9 parts of pure potassa to 1000 parts of wood; whereas the she-oak and white gum produce 5 parts of potassa to 1000 parts of wood. If, then, it can answer in America, where labour is much dearer than it is here, to prepare potash from the ashes of timber containing a much smaller amount of that substance than the woods of this Colony, it is reasonable to suppose that the manufacture might be attempted here with success. Should it be found to pay only a portion of the cost of clearing the dead wood from the pastures of the Colony, a very great advantage would be gained; for it is not too much to say, that in some places one-third of the land is rendered valueless for pasture by the amount of dead wood scattered over it, throwing out of consideration the chance of casual injury to sheep, loss of wool, &c. The simplicity of the operation is one great point in its favour. Did it require a large outlay of capital, or any peculiar skill or dexterity in the manipulation, it might perhaps admit of a doubt whether the probable returns would be such as to justify the undertaking; but all that is required in the way of apparatus is an iron pot or boiler, a cask or two with a false bottom, and cock to draw off the lixivium, and a few casks to pack the potash in when produced. The outlay, then, will be trifling; and if the return is not large in amount, yet if it prove sufficient to pay the cost of labour expended, the contingent benefit to the land will yield an ample profit to the owner or occupier.

In cases where the land, if cleared of trees, would be available for the purpose of agriculture, the value of the potash produced might be sufficient to make the expense of clearing and grubbing the land so as to prepare it to receive a crop a wise outlay, which, without such a return, would be but a piece of extravagance. It is true that the removal

ERRATA.—Page 91, line 16.—For *Acacia affinis*, read *Acacia mollissima*.
,, line 17.—For *Acacia mollissima*, read *Acacia dealbata*.

of the potash, which would otherwise be restored to the soil in the ashes of the timber burnt upon it, may lessen its fertility; but not to an extent likely to prove injurious to good land. I have directed some experiments to be made on a large scale at the convict stations, and shall notify the results of these to the Society; and I may at the same time state that I shall be always glad to receive any suggestions, and to carry out any experiments, the object of which may be the development of the resources of the Colony.

Analysis of Seven Varieties of Wood, by DR. MOTHERWELL, *with his Remarks, &c., 26th June,* 1847.

No.	DIFFERENT SPECIES OF WOOD.	Quantity Parts.	Loss by drying.	Produce of Ashes.	Point of Saturation.	Nitrate produced.
			Per Cent.	Per Cent.		Per Cent.
1	Casuarina quadrivalvis, (she-oak) ...	100	25	3	½ fluid oz. to 1½ ashes.	¾
2	Acacia affinis, (black wattle)	100	30	2	¼ per ounce.	½
3	———mollissima, (silver wattle) ...	100	30	2	¼ "	½
4	Eucalyptus resinifera (white gum tree)	100	30	3	¼ "	½
5	———— piperita, (red gum tree)..	100	25	2	¼ "	not completed.
6	———— robusta, (stringy bark tree)	100	20	1½	¼ "	
7	Banksia integrifolia, (honeysuckle) ..	100	25	1	¼ "	

N.B.—The half of the above nitrates will be the net potash, viz.....................			
	1	¼	⅛ ℔ cent.
	2	¼	"
	3	¼	"
	4	¼	1-16th ℔ cent.

Remarks.

The nitric acid used for saturation is of the specific gravity of 1360, (equal to 64 per cent. of dry acid, according to Ure's table); consequently, ¼ of an ounce is equal to 3 drachms, which takes up very nearly the same quantity of potassa (say 3 drachms), making together 6 drachms of nitrate of potash for every 100 ounces of wood consumed where the saturating power has been equal, as in 2, 3, 4, 5, 6, 7; but in No. 1 the alkali is in larger proportion, $1\frac{1}{2}$ ounces having required $\frac{1}{2}$ fluid ounce of nitric acid to saturate, or 6 drachms of dry acid, making the produce 12 drachms nitrate potash.

		lb. oz.		*oz.*		*dr.*		
No. 1.	She-oak reduced to ashes	12 8,	or	200,	produce	30	nitrate, or	$\frac{3}{4}$ per cent.
No. 2.	Black wattle „	12 8	„	200	„	24	„	$\frac{1}{2}$ „
No. 3.	Silver wattle „	12 8	„	200	„	24	„	$\frac{1}{2}$ „
No. 4.	White gum tree „	12 8	„	200	„	26	„	$\frac{1}{8}$ 2-16
No. 5.	Red gum „	12 8	„	200	Alkali not tried.			
No. 6.	Honeysuckle „	6 4	„	100				
No. 7.	Stringy bark] „	12 8	„	200				

Nos. 1 and 4 contain the most alkali.

Manipulation.

1. Cut the wood in small pieces to facilitate the drying; weigh a decimal portion, and dry by a slow but regular heat; when perfectly dry, re-weigh and mark down the loss by the evaporation of the fluids; make up the loss, so as to have 100 parts net; if 6 lbs. 4 ozs. is weighed, it is equal to 100 ounces, or 100 parts.

2. Proceed to destructive distillation by charring; then reduce the carbon to ashes in a free current of atmospheric air to supply the requisite oxygen; take out the residuum, and when cold pass it through a fine hair-sieve to separate any heterogeneous matter, or pieces of carbon not reduced to ashes, which put back into your calcining or charring vessel, and continue the fire until the whole is reduced to ashes; add this to the first quantity, and weigh very carefully to ascertain the quantity of ashes.

3. Proceed to lixiviation by adding boiling water to the ashes in the proportion of 4 parts water to 1 of ashes, which will take up all the soluble salts.

4. Saturate with strong nitric acid as long as any effervescence takes place, or until the test-paper (litmus) turns

slightly to red; ascertain the quantity of acid required for saturation, which is generally $\frac{1}{4}$ of a fluid ounce to 1 ounce of ashes; then proceed to filtration through common canvas, washing with plenty of boiling water to carry off the whole of the alkaline salts; take the insoluble matter from the filtering cloth, dry it, and ascertain the deposition in weight, which will enable you to form an approximate idea of the quantity of alkaline salts or soluble matter contained in the ashes.

5. Having carefully collected all the washings or lixivium together, proceed to evaporation by a slow but regular heat, till the whole of the water is expelled and the nitrates are quite dry; weigh this salt carefully: every 100 parts contain net 48 parts of alkali, which can be proved by proceeding to combustion, when the nitric acid will fly off, and leave the pure potash.

The she-oak and white gum trees contain the most potash, the proportions being nearly $\frac{1}{2}$ lb. to every 100 lbs. of wood consumed, or 10 lbs. per ton.

VII.

On the Manufacture of Potash from Tasmanian Woods. By His Excellency Sir William Thomas Denison. [*Read 15th November,* 1849.]

In a former communication to the Royal Society, I gave an account of some experiments which I had requested Dr. Motherwell to make upon the different timber-trees of the Colony, for the purpose of ascertaining the amount of potash contained in them. The results were, as the members of the Society are aware, sufficiently promising to induce me to institute experiments upon a larger scale, for the purpose of ascertaining whether, by the ordinary process, such as is employed in America, a sufficient quantity of merchantable potash might not be obtained from the timber of this Colony to repay to the owners and occupiers of land a large portion, if not the whole, of the cost of clearing the land.

My late lamented friend, Captain Stanley, had the charge of those experiments; and, had he been spared, I should now have been able to have laid before the Society such positive and definite results, as would have enabled every individual to have formed his own judgment of the profit to be derived from the ash which the timber the natural produce of the land yields, compared with the cost of the labour and apparatus necessary to reduce it to a marketable form. These, however, it is not in my power to give in detail: all that I am able to say is, that the results were so far satisfactory as to indicate the existence of potash, to a greater or less extent, in every species of timber upon which experiments were made, the amount being in a rough way equivalent to one-tenth of the weight of the ash produced;—so that if one tree would produce 20 lbs. of ashes to a ton of wood, and another only 10 lbs., the former would give 2 lbs. of potash to the ton, the latter only 1 lb. The experiments were tried with the wood only of the tree; the results, therefore, were less favourable than they would have been had the smaller branches and leaves of the trees been burned together with the wood and bark.

The following sketch of the best mode of proceeding may perhaps be of service to those who are inclined to make the experiment, with the view of reducing the cost of clearing ground, and preparing it for cultivation. The timber should be piled in large heaps, and burned in still weather if possible; the ashes, when the heaps are consumed, ought to be sifted; the larger parts, or charcoal, should be returned to the fire, and burned to ashes. These, as soon as the sifting is completed, must be stowed away under cover, until it is desirable to commence the lixiviation.

For this a certain number of casks must be prepared, by having a false bottom placed at a few inches above the real bottom. The false bottom may either be formed of a plank perforated with holes, or an open framework: in either case it must be covered, either with a double thickness of blanket, or five or six inches of clean straw. A cock should be inserted below the false bottom in each cask. These casks will be ranged alongside of each other, and a gutter placed under the cocks, so that the liquor, after having been filtered in these casks, may pass off to a reservoir, from which it will either be pumped or ladled into the boilers for evaporation, or returned to the same, or a fresh set of casks, to be more strongly impregnated with the soluble salts of the ashes. The casks being thus arranged, a quantity of ashes is placed in each, and an equivalent bulk of water is poured in; the quantity of ash being so regulated as to nearly fill the cask when the water has been poured upon it. The water is allowed to remain undisturbed for about 24 hours, when the cocks are opened, and the whole is discharged into the reservoir. Another charge of water is then poured upon the ash; and this, after being allowed to remain in contact with the ash for about three or four hours, is drawn off into the same reservoir. In some instances it may be as well to commence at once to evaporate these two solutions, in order to clear the reservoir for the reception of the liquor of two more washings of the same ash; but in others it may be as well to have a second reservoir for the water of the two last washings, which will never be rich enough in potash to make it worth while to evaporate it. After having been thus washed with four times its bulk of water, the ash, though still containing some potash, may be emptied out of the cask, and thrown away, and a second charge introduced. If the first lixiviation should prove weak, it may be used instead of water for the first washing of the second quantity of ash; but, generally speaking, it will be as well to evaporate the product of the two first washings of the first quantity of ash, and to use the third and fourth washings instead of water for the first and second washings of the second charge of ashes. The process will then go on regularly; the two last washings of each charge being used as the two first of the succeeding charge, and the two first washings of each being removed to the boilers for the purpose of being evaporated.

The arrangements for evaporation are simple enough. A couple of iron pots, or a greater number in proportion to the quantity of ashes to be reduced, will be all the apparatus required. The solution before described will be pumped or ladled into these pots; and a fire being kept up, the water will gradually pass away in steam. It would be as well to keep filling the boiler with fresh solution as fast as the water was evaporated, so that the contents would become more and more concentrated; and at last, when the boiler was nearly full of matter of the consistence of honey, no more of the solution should be added; but the fire might be forced, until the whole of the water being drawn off, the potash itself would enter into fusion, which it would do at a low red heat. During this latter part of the process care must be taken to keep stirring the potash with an iron rod; and when the whole has entered into fusion, the fire may be withdrawn from under the boiler, and the mass allowed to cool; the stirring being still continued in order to granulate the potash, and to secure the escape of all carbonaceous matter, which might injure the marketable quality of the potash by darkening the colour. With reference, too, to this same risk, I may state that the solution should, after being withdrawn from the casks into the reservoir, be allowed to settle for 24 hours at least, in order to deposit any sediment or colouring matter which it may contain; and care should be taken in withdrawing the solution from the reservoir for the purpose of evaporating it, that the sediment should not be disturbed. In some cases, where the solution appears to be very dark-coloured, it may be as well, after evaporating the water till the solution is almost ready to enter into crystalization, to withdraw it from the boiler into some flat troughs or pans, and then allow it to crystalize. If these crystals be then dissolved in a quantity of water, only just sufficient for the purpose, and the solution be allowed to remain undisturbed for 24 hours, it is probable that a large portion of the extraneous matter will be separated and deposited; the liquor being then drawn off with a syphon, and evaporated, the product will be a clean well coloured potash.

When the potash has been fused as before directed, and gradually cooled down, it will be removed from the boiler and packed in casks, well hooped and secured; and it is then fit for exportation.

I will now give a few details, which may serve as elements upon which some idea may be formed of the amount of the return from any given quantity of timber, or any given area of ground. From the experiments made by Captain Stanley, it appeared that the amount of ash from the wood and bark alone varied, according to the description of timber, from 10 to 25 lbs. per ton. In this case the timber was burnt in a reverbatory furnace, with a strong draught, and it is possible that a portion of the ash was carried up the chimney. In some experiments made at one of the convict stations, the proportion of ash was much larger in the same description of wood; but in this case there is reason to think that some extraneous matter may have been included in and weighed with the ash. The proportion of 1 lb. of potash to 10 lbs. of ash is that given in the best works which treat on the subject; and it is corroborated to a certain extent by the experiments made here. What then, in the first place, may be assumed to be the quantity of timber, including branches and leaves, in a heavily wooded district of this Colony? Upon a rough computation I should say from 600 to 1000 tons. If, then, the quantity of ash be taken on an average at 10 lbs. per ton of wood, the weight of ash will be from 6000 to 10,000 lbs., and the quantity of potash from 600 to 1000 lbs. per acre. The value of the potash in the English market is now from £38 to £40 per ton,—deducting £8 for freight and charges, value of casks, &c. The value of the potash on the ground would be 30*s.* per cwt., or 26*s.* 9*d.* per 100 lbs., and the return per acre would amount to from £8 to £16,—an ample return for the cost of manufacture, when it is considered that land which would otherwise be altogether unavailable will at the same time be laid open, and made ready for the plough. I am in hopes that I may be able to give at some future period some more positive statements than the above: but these are sufficiently valuable to warrant their adoption.

VIII.

Remarks upon a Composition to set as a Cement under Water; with Report of DR. MOTHERWELL'S *Experiments on the same. By His Excellency* SIR WILLIAM T. DENISON, F.R.S., &c. [*Read* 10*th January*, 1849.]

IN laying before this meeting the accompanying account of some experiments made, according to my request, by Dr. Motherwell, for the purpose of ascertaining the best proportion of lime and clay to be employed in the manufacture of a cement which might be used under water, it is not my intention to enter into the question of the expense attendant upon such a manufacture, but merely to make known here, as generally as possible, a fact which has been established by frequent experiment, both in England and France,—that it is possible, by a mixture of two materials, both of which are generally diffused throughout the country, to manufacture an article which is fully equal to Roman cement for all purposes, and which would be, in many instances, superior to the cement imported into the Colony; inasmuch as this is often damaged, either from damp or exposure to the air.

The demand for cement is at present trifling, and to attempt a manufactory of it now would of course only lead to loss and disappointment; but a simple apparatus might be contrived which would render its production much easier and cheaper than may be imagined from the accompanying paper, for those who only want to procure a small quantity for some special purpose: while for those who may hereafter manufacture the cement for the market, a more extensive and elaborate apparatus, and one which would allow of the article being furnished at a reasonable rate, will be requisite, and, no doubt, easily found.

DR. MOTHERWELL'S *Report.*

The different experiments were made on graduated proportions of lime and clay, as under:—

5	parts lime with	1	part clay.
....	....	2	....
....	....	3	....
....	....	4	....
....	....	5	....
$7\frac{1}{2}$	....	1	....
10	....	1	....

The proportions which appear to me to answer best after immersion in water for eight days are the two last, and particularly the 10 with 1. In making these experiments, the manipulation is conducted in a way which could not be followed on a larger scale, as the operation would be both too tedious and expensive: I give, however, the exact manipulation, and shall point out the most economical way to proceed on the large scale.

Having neither stone-lime nor chalk, I used shell-lime fresh burnt and slaked. The clay which I used was first well dried, pulverized, and sifted; the clay and lime were then mixed in the proportions mentioned above, and well triturated with pestle and mortar, first in the dry way, and then with a gradual addition of water till made into a stiff paste; the compound was next made into balls and calcined at a strong heat, in a manner similar to the burning of bricks. These balls were then again pulverized and sifted through a fine hair sieve, in order to bring the powder to a degree of fineness equal to that of Roman cement. The composition was at this stage of the process fit for use.

Trial was made of it by mixing with water to the consistence of thin mortar, which was laid to the thickness of a $\frac{1}{4}$ of an inch upon bricks previously wetted, then dried in the air and placed under water.

On examination of cement prepared in this way from 10 parts of lime and 1 part of clay, after being six days under water, the surface appeared coated with a film of vegetable matter deposited from the water.

In the large way, the drying and pulverizing of the clay can be dispensed with in the first instance, as it will only be necessary to ascertain the loss in weight by drying (about $\frac{1}{4}$), in order to arrive at the proper quantity to use in the state in which it is when dug out, so that the bulk applied may correspond to the weight required. The proportion of weight to bulk of lime, after this has been burnt, slaked, and sifted, may be also first ascertained, so as to enable the operator to form his scale in both cases by measure instead of weight. When the clay is brought to the consistence of thick cream with water, it will form a stiff paste by the addition of the lime, which ought to be thoroughly incorporated with it, in one or other of the proportions above mentioned: the paste should be formed into balls the size of a child's head, or thereabouts. It will only be necessary to dry these balls in the sun previous to calcining; and the concluding process of pulverizing and sifting can be done by any mechanical power most at command. The experiment should, however, be made on a small scale at first; that is, with merely a handful of lime, in order to get at the proper quantity of clay to mix with it.

IX.

Observations on the Statistics of Van Diemen's Land for 1848 *: compiled from Official Records in the Colonial Secretary's Office; and published by Order of His Excellency the Lieutenant-Governor. By* JAMES BARNARD, *Esq.* [*Read* 10*th October,* 1849.]

TABLE 1 is a comprehensive summary of the Population of Van Diemen's Land, as ascertained by the Census taken on the 31st December, 1847*; from which it appears, that the number of souls in the Colony on that day was 70,164. Of this aggregate, 47,828, or 68 per cent., were males, and 22,336, or 32 per cent., were females. Taking the sexes together, it will be found by analysis that the free immigrants form 20 per cent., persons born in the Colony 26 per cent., and persons who have emerged into freedom 16½ per cent.,—making the total free population 62½ per cent., exclusive of the troops (3 per cent.), and the scanty remnant of Aborigines.

Of the Convicts, the Ticket-of-leave holders are 8 per cent., those in Government employ 14 per cent., and Pass-holders in service 12½ per cent.,—making in all 34½ per cent. of the entire population.

The increase in numbers upon the Census of 1842 is 11,262, or 19 per cent., for the five years ending in 1847, averaging 3⅘ per cent. annually; and for the 23 years since

* This Census has been already partly illustrated in *Tasmanian Journal*, (vol. 3, part 6, p. 450.)

1824 it has been 456 per cent., or at the average annual rate of nearly 20 per cent., viz.—

Years.	Population.	Aggregate Increase per cent.	Annual Increase per cent.
1824	12,643		
1835	39,563	212 in 11 years.	19
1838	45,846	15 in 3 years.	5
1841	53,000	15 in 3 years.	5
1842	58,902	8 in 1 year.	8
1847	70,164	19 in 5 years.	$3\frac{4}{5}$

By further analysis, to show in detail the relative proportion of the sexes in each class, it will be seen that, of the free immigrants, the males preponderate by only $1\frac{1}{2}$ per cent., of native-born persons on the contrary the females exceed by one-tenth per cent., while of those who have become free by servitude the males exceed the females in the ratio of 3 to 1. The males in all form 36 per cent., and the females 26 per cent., making the difference of 10 per cent. between the sexes among the free population. But the disparity is striking among the Convict class; for of the Ticket-of-leave holders the males are 5 to 1, of the prisoners in Government employ 8 to 1, and of Pass-holders in service also 8 to 1: in other words, the males are $29\frac{1}{2}$ per cent., and the females only 5 per cent.,—making a difference between the sexes of $24\frac{1}{2}$ per cent. in this class of the population.

Table 2 shows the distinction between the Married and the Single Inhabitants of the Colony, without reference to their civil condition. Of the total males, the married form 21 per cent., and those who are unmarried 79 per cent.; and of the total females, the married are 39 per cent., and the unmarried 61 per cent. The Aborigines form 12 married couples, and 3 males and 11 females who are single. The Troops, and the Convicts at Punishment Stations, are excluded from the calculation.

Table 3 is a return, with a similar exception, of the Ages of the inhabitants of the Colony. Of the 64,141 persons enumerated, the proportions may be thus grouped :—

	Per cent. of Population.
Under 2	5½ or 1 in 18
2 and under 7	10½ or 1 in 9
7 and under 14	9 or 1 in 10
14 and under 21	8 or 1 in 12
21 and under 45	56 or 1 in 2
45 and under 60	9 or 1 in 11
60 and upwards	2 or 1 in 51

Of the Aborigines 3 are under fourteen, 27 are between twenty-one and forty-five, 6 are under sixty, and the ages of the two still older cannot be accurately ascertained.

Table 4 is a return of the Religion professed by the people, which may be thus generically classified in denominations :—

	Per cent.
Church of England	69·40
——— Scotland	7·10
——— Rome	15·40
Wesleyans	4·
Other Protestant Dissenters	3·40
Jews and Pagans	0·70

The religion of the troops, and of the Convicts under punishment, was not ascertained by the Census.

The other division of this Table comprises a classified list of the industrial occupations of the people, which are in the following proportions :—

Landed proprietors, bankers, merchants, and professional men	2	per cent.
Shopkeepers	1½	,,
Mechanics	8	,,
Shepherds	1½	,,

Gardeners and farm labourers	16 per cent.
Domestic servants	7 ,,
Military	$3\frac{1}{2}$,,
Convicts at Punishment Stations	$5\frac{1}{2}$,,
Unenumerated	55 ,,

One is struck with the large number excluded from classification, and at first led to think that the grouping must be defective which fails to designate the avocations of more than one-half the population. But it must be borne in mind that all the children under 14 years of age have to be deducted, and also the married females in the majority of cases, which will leave only about 15 per cent. whose occupation is unaccounted for.

Table 5 is a return of the number of Houses in the Colony, more than half of which remain of wood, notwithstanding that such erections have been in numerous instances replaced by substantial buildings of brick and stone. There are 10,187 houses in all, of which $5\frac{3}{4}$ per cent. are unfinished, and $6\frac{1}{2}$ per cent. uninhabited. Taking the population, the number occupying each house would average 7 ; a proportion that will be greatly lessened when the large numbers confined in prisons and barracks are considered. The handsome and spacious buildings in our towns, and scattered through the country, excite the admiration of most visitors to Van Diemen's Land ; and it may not be too much to say, that there is no Colony, of comparative size and population, which excels this in the taste and style of its public buildings. The abundance of excellent stone and other materials, together with the number of well-skilled artizans, have of course greatly contributed to this superiority.

Table 6 relates to the Aborigines of the Colony, who are now located at Oyster Cove. The dwindling down in their numbers from 210 in 1835, to 54 in 1842, and now to 12 men and 23 women, with 8 children, tends to create the painful impression, that this race of our fellow-creatures—the original lords of the soil—have not been duly cared for since their enclosure within the pale of civilized life. So far, however, from there being reason to suppose that there has been any blameable neglect, it is believed that the most humane sympathy and consideration has been constantly evinced on the part of successive Governments; and that whatever was likely to contribute to render the condition of these "sons of nature" happy and comfortable has been freely bestowed: nor has this been confined to physical enjoyments alone—to the bestowal of mere clothing, food, shelter, and amusements. Education, to the extent of which their faculties are susceptible, has been attempted; and of the existing remnant, besides 7 children in the Orphan Schools, there are 5 who can both read and write, and 10 who can read, the remaining 21 being totally uneducated. While withholding assent from M. de Strzelecki's conclusion, that the gradual extinction of the savage races is in fulfilment of any law of Providence, "that the black should disappear before the white," it may be fairly admitted that partial civilization has exercised an influence most unfavourable upon their existence. From their previous habits and modes of life, they are not placed in harmony with their new condition, physically or morally, and have become consequently disqualified from its full share of benefit.

Tables 7 and 8 describe the extent of Emigration to and from Van Diemen's Land during 1848; the arrivals, including 1460 Convicts, numbering 4410, and the departures 3799,—the difference being less than 1 per cent. of the aggregate population. Of those who left the Colony, the proportion of "free" was 63 per cent., of those free by servitude 26 per cent., and of the conditionally pardoned 11 per cent. The emigrants of the last two descriptions were no doubt permanent departures; but, of the "always free," the probability is that theirs were mostly trips of business or pleasure, being so evenly balanced by the arrivals of the same class, and therefore occasioning no actual diminution in the number of "the free." The influx of Convicts, more than one-third of whom were females, was only 2 per cent. upon the whole population.

Table 9 is a comprehensive return of the Convict population. The number in the Colony on 31st December, 1848, was 25,459; of whom 40 per cent. held tickets-of-leave, 48 per cent. were pass-holders, and 12 per cent. were under probation or sentence. Of the whole number, again, 84 per cent. were males, and 16 per cent. females; and the proportion of deaths reported during the year was less than 1 per cent. Of the ticket-of-leave holders, the females comprise $11\frac{1}{4}$ per cent.; of the pass-holders, 18 per cent.; and of those under probation or sentence, also 18 per cent. The number of both sexes who emerged into freedom during the year by the expiration of their sentences was 12 per cent.; of those who received pardons 5 per cent.; and of those to whom tickets-of-leave were granted, 14 per cent. The proportion of Convicts in the population, as before stated, is $34\frac{1}{2}$ per cent.

Table 10 is a return of the Marriages registered in the several districts in 1848; the total number being 799. Of these 72 per cent. were by the Church of England, 8 per cent. by the Church of Scotland, 11 per cent. by the Church of Rome, 2 per cent. each by the Wesleyans and Independents, and 4 per cent. by the Baptists. One Marriage only was performed by the Deputy Registrar. Of these marriages, $\frac{1}{2}$ per cent. of the males and 19 per cent. of the females were under age; 6 per cent. of the males and 16 per cent. of the females had been previously married; and the large proportion of $24\frac{3}{4}$ per cent. of males and 38 per cent. females were unable to write their names.

Tables 11 to 15 form a series of returns from the General Registry of the Births and Deaths in 1848; but their value is somewhat lessened by the apparent neglect of the District of Great Swanport to contribute its quota of information. Of the Births, the males are 858, and the females 795, making a total of 1653,—being 1 in 42 upon the Census. Of the Deaths amongst the free, there are registered 463 males, or 1 in 54, and 310 females, or 1 in 59,—in all 773, or 1 in 56 of the whole; affording a favourable average in comparison with older countries. The deaths of Convicts are recorded in the Comptroller-General's Department; but it is understood that these amount in number to only 244, or 1 in 99, for the same period. This small rate of mortality amongst prisoners is doubtless ascribable to the fact, that the Convict class is composed almost exclusively of persons in the prime of life.

Tables 16 and 17 are returns of the Places of Public Worship existing in Van Diemen's Land in 1848. By No. 16 it appears that there were 53 Churches and Chapels of the Church of England, having 13,200 sittings; the average attendance rather exceeding one-third of the whole accommodation possessed. The pew-rents for the year are stated at £797 13*s.* 1*d.*; and the offertory fund to amount to £759 5*s.* 5*d.* The cost to the Colony for the same period is £9301 12*s.* 7*d.*, and to the British Treasury £5086, or in the respective proportions of 64½ per cent. and 35½ per cent. of the total expense,—showing a remarkable coincidence with the relative number of the free and bond constituting the population.

No. 17 is a similar return for the other Churches and religious bodies, presenting a total of 57 places of public worship, having 12,675 sittings, with an average attendance of 8670; the expense to the Colony being £4806 14*s.* 0*d.* The Church of Rome, in addition, is a charge of £2056 upon the British Treasury; and there is one remark as to this Church which the return suggests. The number of sittings in its 3 chapels are stated to be 580, while the average attendance is given at 1600, or nearly as 3 to 1 of the accommodation afforded. The Jews are included in this enumeration, having 2 places of worship, 268 sittings, and an average attendance of 90. Neither this body nor the Independents are borne upon the public funds for the support of their religion.

Table 18 is a comparative return of the various Ministers of Religion, together with their cost of maintenance, showing the proportion of expense borne upon Colonial funds, the amount contributed by the Home Government, and the number who derive their support from other sources. Taking all denominations together, the number employed is 97, inclusive of 26 who are not paid by the State. From the Local Treasury there is expended upon this object £14,032; and by the Home Government £7142: and if to these sums be added £3900 for the 26 dependent upon extraneous sources, averaging them at £150 each, the result will be a total of £25,074, or a cost of 7*s.* 1¾*d.* per head of the whole population, for the support of religion, annually.

Analysis affords the following points of comparison between the several denominations; viz.—

Denominations.	Proportion of Clergymen employed.	Paid by Colony.	Paid by Home Govt.	Supposed to be paid from extraneous sources.	Average of total Cost.	Ratio of Population.	Cost per head of each Denomination.
	per cent.	£	£	£	per cent.		£ s. d.
Church of England......	56½	9081	5086	900	60	69·40	4 6¼
.... Scotland	12	2930	nil.	300	13	7·10	1 8 2
.... Rome	15½	1371	2056	450	15½	15·40	7 11
Wesleyans	7	500	nil.	1050	6	4·	12 1
Baptists	2	150	nil.	300	1½	3·40	12 4*
Independents	6	nil.	nil.	900	4		

* This may not be strictly accurate, as the term used in the Return is "Other Protestant Dissenters," which may include Quakers; but it is believed to be a correct approximation.

Tables 19 to 22 are a series of returns from the Inspector of Schools relating to education in this Colony in 1848. Of private establishments there are 100; 15 of which decline to give any information as to the number of their pupils. The other 85 schools contained 1285 boys, and 1011 girls; and if to these be added the numbers probably under instruction at the 15 referred to, taking the average of the whole of the others as a guide for the calculation, the total number may be estimated at 2668 children of both sexes, the boys exceeding the girls by about 25 per cent. There were 33 schools upon the Penny-a-day System in connection with the Church of England, and 4 of the same belonging to the Church of Rome, comprehending in all 1812 scholars, in the proportion of 82½ per cent. of the former denomination to 17½ per cent. of the latter; the ratio of expense being also 79 and 21 per cent. respectively.—The next table is devoted to particulars of the Board of Education Schools; the total number of children on the books at the same date being 1080. The annual cost of each scholar, according to the average daily attendance, was £3 11*s.* 11¼*d.*—The last return of the group relates to Infant Schools, two of which exist in Hobart Town, having an attendance of 138 children, and one at Launceston attended by 56.

Table 23 details the working of the Queen's Orphan Schools, from which it appears that the orphan children of Convicts are supported entirely at the expense of the British Government, while those of "free persons" are borne upon Colonial funds under the head of Pauperism. The total number in school at the end of 1848 was 460; of whom 396 were the offspring of Convicts, and 64 the children of free parents. Of these, again, 3 boys and 4 girls were children of the Aborigines. The following is a summary of the youth of the Colony under education at schools in 1848:—

	Children of both Sexes.
In private Schools	2668
In Schools under the Penny-a-day system	1812
In Government Schools under Board of Education	1080
In Infant Schools................................	194
In Queen's Orphan Schools	460
Total......................	6214

Considering also the large number, especially girls, receiving domestic instruction, the foregoing total displays an education-power of immense influence upon the destinies of the rising generation; although there must obviously be, after making every allowance, a considerable number of children as yet destitute of all training.

The next group, Nos. 24 to 27, form the Medical Statistics of the Colony. Table 24 is a return of the Insane under confinement at the New Norfolk Lunatic Asylum; the increase of patients, chiefly in the Convict class, being 8 per cent. upon the previous year. Table 25 shows the number of Paupers treated in the various Convict Hospitals during 1848, the expense of whom is defrayed by the Colony; the charge for each being at the rate of 1*s.* per diem. There are 529 in all, of whom 80 per cent. are persons who have been Convicts. Table 26 is a classified list of Diseases treated in the Colonial Hospitals during the same period, the whole number being 3475, and the deaths 166. By analysis of the several classes, we obtain the following results—which are of importance as showing the maladies most prevalent, and those most fatal; the proportion of deaths being greater in an inverse ratio to the number of cases; viz.—

Of 3475 cases of Disease treated,—

Fevers constitute 6 per cent.; the proportion of deaths being 1 in 25

Diseases of the Lungs	10 per cent.	deaths	1 in 7
——— Liver	1 ,,	,,	1 in 5
——— Stomach & Bowels	7 ,,	,,	1 in 10
——— Brain	6 ,,	,,	1 in 9
Dropsies	0·50 ,,	,,	1 in 3
Rheumatic Affections	8 ,,	,,	1 in 143
Abscesses and Ulcers	13 ,,	,,	1 in 73
Venereal Affections	7 ,,	,,	1 in 230
Diseases of the Eyes	16 ,,	,,	nil.
——— Skin	1·20 ,,	,,	1 in 16
Other diseases	16·50 ,,	,,	1 in 16

Table 27, completing this series, is a return of the persons legally qualified to practise Medicine, &c.; they are stated at 67, of whom 7 belong to the Staff and Military, 15 are attached to the Convict Department, and 45 are private practitioners. There are also 7 chemists and druggists in Hobart Town, and 4 in Launceston.

Table 28 details the Imports and Exports for the year 1848: but, before entering into an analysis of this return, it may be as well to advert again to the principle which it is conceived should regulate commercial intercourse with foreign countries.* It was shown, in the paper referred to, that while it was sound policy to encourage native industry, and

* See the principle discussed at length in the *Tasmanian Journal*, vol. 3, part 6, page 446.

foster colonial enterprise, by promoting the consumption of domestic manufactures; yet, at the same time, that it was indispensable that the home-made article should relatively be as good in quality, and cheap in price, as the one imported.

An undue anxiety is usually displayed to maintain an even balance between the imports and exports, and the greatest concern expressed should the former at any time preponderate in amount. The apprehension is altogether groundless; for, in the very nature of things, an adjustment must take place. For instance, although the imports of one year exceed the exports, it by no means follows that they will be consumed during that period. Besides, the ordinary law of supply and demand itself steps in to regulate imports, and to check their excess, by a fall below cost price, which at once provides an effectual remedy, as importations must obviously stop as soon as they cease to be profitable. Imports, then, subject to the restrictions and regulated by the principle pointed out, are highly advantageous to a community by adding so greatly to its sum of comforts.

With these preliminary observations we turn to an examination of the Table, and find that the total imports in 1848 exceed the exports by 17½ per cent. As compared with 1847, we notice a decrease under each head of 18 per cent.; but, compared with 1846, the imports show an increase of nearly 6 per cent., while the exports on the contrary have decreased 16 per cent.

The diminution in the total value of exports for 1848 may be partly accounted for by the fall in the price of wool, ascribable to the political convulsions agitating Europe, estimated to have caused an actual deficiency in value of £60,000 to £70,000 upon the year's clip; and it will be at once apparent how greatly, again, this immense loss must tend to diminish imports.

As an opinion prevails that the commerce of our ports has been somewhat crippled, especially the Sydney trade, by the 15 per cent. *ad valorem* Duties' Act, which came into operation in 1847, it may be useful to trace the history of these duties, and to ascertain their actual effects. In 1840 the exemption in favour of tobacco grown in New South Wales, being found to be injurious to the revenue, was taken away by the Act 4 Vict. No. 28; and the duty of 1*s.* 6*d.* per lb. was imposed, the same as levied upon tobacco grown in foreign countries. This led to reprisals by the Government of New South Wales, who at once fixed a duty upon our exports to that colony. In 1845 it was deemed necessary, in order to support the revenue, to increase the *ad valorem* duties from 5 to 15 per cent. on tea, sugar, and other foreign merchandise; but on this occasion articles the growth, produce, or manufacture of New South Wales (save in respect of tobacco) continued to be specially exempted. The principle, however, of differential duties having been condemned as objectionable, and the state of the revenue not permitting a recurrence to the previous rate of 5 per cent., in the absence of a provision for charging a similar duty upon British goods, they were abolished by the Act 10 Vict. No. 7, which came into operation on the 1st April, 1847, and at once subjected equally the goods, wares, and merchandise of New South Wales to the uniform duty of 15 per cent. *ad valorem.* On the 6th October, 1848, the Act 12 Vict. No. 8 was passed, wholly exempting wool, coal for steam navigation, metallic ores, seeds, manures, and specimens of natural history from duty; and the Customs' laws were still further relaxed by the 13 Vict. No. 8, exempting metallic ores for smelting from wharfage dues.

The subjoined statement of the extent and value of the trade of Van Diemen's Land with New South Wales since 1844 will best explain the working of these duties; viz.*—

PORT OF HOBART TOWN.

	Vessels Inwards.	Tonnage.	Vessels Outwards.	Tonnage.	Value of Imports.	Value of Exports.
					£	£
1845	161	17,994	180	29,124	69,545	60,247
1846	199	21,549	222	28,388	94,625	89,143
1847	236	23,467	251	27,079	†42,841	75,345
1848	265	27,545	285	36,055	†34,906	55,986

PORT OF LAUNCESTON.

	Vessels Inwards.	Tonnage.	Vessels Outwards.	Tonnage.	Value of Imports.	Value of Exports.
					£	£
1845	136	14,942	131	14,780	54,992	74,893
1846	168	18,701	162	17,912	52,614	119,294
1847	184	18,868	179	18,877	47,990	107,441
1848	191	19,012	174	17,295	†22,935	69,457

Looking at the disparity in value between the total imports and exports of the year, no apprehension need be entertained of any monetary derangement occurring so long as so effectual a counterpoise is afforded by British expenditure. The disbursements in 1848, for Commissariat, Convict, Military, and Ordnance services in the Colony, amounted to nearly a quarter of a million sterling!

But to proceed.—Of the total imports, 77½ per cent. are from Great Britain, 18½ per cent. from British Colonies, and

* For these returns I am indebted to the courtesy of Henry D'Arch, Esq., Collector of the port of Hobart Town.

† The number of ships inwards, as well as of the tonnage, show a large progressive increase, while the "*value*" of the imports appears to have diminished considerably. The discrepancy can perhaps be reconciled by supposing that the permission to take the valuation at the port of shipment instead of at the port of entry had been largely and liberally acted upon.

4 per cent. from Foreign countries; and of the total exports, 52 per cent. are to Great Britain, 47½ per cent. to British Colonies, and ½ per cent. to Foreign countries.

The proportion of imports to population averages £8 9*s.* 4*d.* for each soul in the Colony; and of exports, £6 19*s.* 9*d.* for each.

Our exports to Foreign countries are very trifling, and are exceeded by the imports nearly ten times over: the latter comprise in their list tea, coffee, sugar, wine, and tobacco,—articles recognised as indispensable to the comfort and enjoyment of every class in society.

The trade with British Colonies is pursued with vigour and activity, and is a valuable branch of our commerce. If, on the one hand, we import from our neighbours cattle, sheep, and salt meat, we send them, on the other, wheat, flour, and timber to three times the amount; besides interchanging numerous surplus articles most beneficially to all, especially to consumers, by the influence exercised upon prices, which are thus brought to their natural level.

In the trade with Great Britain there is a remarkable steadiness in many staple imports for which we are necessarily dependent; but it is gratifying to notice a decline in just those very articles which the Colony is so well able to produce; *ex. gr.*, boots and shoes—butter and cheese—candles and tallow—casks—hops—soap. Among the exports, copper ore to a small extent forms a fresh item as a re-export; and there is an increase under hides, skins, and leather: but there is a considerable decline in black oil—whalebone—wool—and wheat. Temporary causes may be assigned in explanation as respects these several staple exports with the exception of the one last named; but the signal and complete failure of this has been doubtless occasioned by the ports of Great Britain being now thrown open to the markets of the World, and the consequent reduction in the price of grain below a point to remunerate shippers.

Table 29 is a return of the number and tonnage of vessels that have arrived at and left our ports during the year. The ships inwards show an increase upon 1847 of 5 per cent. in number, and $5\frac{1}{2}$ per cent. in tonnage; and the ships that cleared outwards also show an increase of 11 per cent. in number, and $11\frac{1}{2}$ per cent. in tonnage. Slight as this increase is, it is the more satisfactory viewed in relation to the diminished exports and imports of the year; pointing to the conclusion that the decline is in value only, not in quantity, and that the commerce of the Colony is in an essentially sound and progressive condition.

Table 30 affords most valuable evidence of the increase to the material wealth of the Colony. Twenty-nine vessels of various tonnage, from 20 to 300, have been built in our ports during the past year; and several more ships of still larger burthen are now in progress, giving employment to many hundred mechanics and labourers, and tending to the formation of industrious and moral habits. The whale fisheries appear also by the same return to continue highly productive. A fleet of 29 vessels, of 6081 tons, was employed whaling during 1848; and the value of the produce has increased from £70,000 to £104,000, being an increase of $48\frac{1}{2}$ per cent. upon the previous year.* No one can regard the progress in this branch of commerce with an uninterested eye, fraught as it is with so much consequence to the advancement of the community, creating wealth from the illimitable resources of the Ocean, as well as providing

* Under Table 28 the exports of oil and whalebone are stated to have declined considerably in 1848: the discrepancy may probably be explained by supposing that a great proportion of the oil taken was not exported to London until the early part of the year 1849.

a nursery for a race of hardy seamen to maintain the glory of the British name in the hour of Britain's need!

Tables 31 and 32 complete the series relating to Colonial shipping; showing an addition to the number belonging to our ports of 25 vessels, and 3518 in tonnage, or 14 and 23 per cent. respectively, since last year.

Table 33 is a return of the number of publicans' licences, as well as of those issued to wholesale dealers in wines and spirits: the latter are fewer in number by 6, while an addition of 9 has been made to the retail class. On a former occasion the evils incident to an indiscriminate issue of Licences were touched upon.* It were to be wished that the Legislature had introduced a declaratory clause in their recently amended Act, defining the extent of the magistrates' powers,—as there exists diametrically opposite opinions on the Bench in this particular; some advocating the principle of free trade broadly and unrestrictedly — others merely qualifying it with the two conditions (the only ones imposed, as they say, by the Act of Council), that the applicant shall be of fair character, and his house possess adequate accommodation—while others, again, claim for themselves the right of judging whether the locality is suitable, and of rejecting any house evidently not required by the neighbourhood. Most desirable is it that a question involving such conflicting opinions should be authoritatively set at rest; for the discussion upon the abstract point of the powers of Justices upon every successive application is most inconvenient, and injurious alike to both private and public interests.

Table 34 states the number and character of public-houses, as well as the ratio of population to each, in the several districts. Sixteen per cent. of the houses licensed,

* See *Tasmanian Journal,* vol. 3, part 2, page 449.

the chief part being in Hobart Town, are described as of low character; an evil which loudly demands the attention of the magistracy.

Table 35 is a new, and no doubt useful return, in a commercial point of view, of the stock on hand in our Bonding Warehouses of the several kinds of Spirits and Tobacco at the end of 1848.

Table 36 details the statistics of the Post-office for the past year, by which it appears that there are 51 Post-offices in all, employing 76 persons, and operating over 634 miles of Post-roads. There were sent from Hobart Town, in the course of the year, 195,785 letters, and 222,522 newspapers; and 161,571 letters were received there within the same period. After defraying its whole expenditure, about £600 is yielded to the Revenue from this department.

Table 37 states the number of Stage-coaches running upon the Main and Cross Roads of the Colony, and affords at once evidence of the increased degree of accommodation which the public now enjoy, and of a rapid extension of intercourse within a comparatively limited period.

Table 38 records the fact that there are six newspapers published at Hobart Town, two of which appear once a week, and four twice; and three at Launceston, two of these coming out twice a week, and one, devoted to the advocacy of the Tee-total cause, monthly.

Table 39 develops the affairs of the Banks in Van Diemen's Land at the end of 1848. The assets comprise bullion to the value of £200,000, and bills of exchange to the amount of about one million; while the liabilities do not exceed £60,000 for their notes and bills in circulation, and £340,000 for deposits: in other words, their liabilities are about one-third of their assets. As compared with 1847, there is a decrease in bullion of 10½ per cent., but an addition of 1 per cent. to the bills of exchange; while the notes and bills in circulation are nearly 10 per cent., and the deposits 21½ per cent. less than at the corresponding period of the previous year. The Banks continue to display much caution and steadiness in their operations, amply justifying that confidence in their stability which they have hitherto so well maintained.

Table 40 is a return of the Savings' Banks at the close of the year 1848, three of which now exist in the Colony; the total number of depositors being 2260 (one-half of whom are for smaller sums than £10), and the amount deposited £43,637 12*s.* 2*d.*—with interest allowed at the rate, principally, of 4 per cent. Compared with 1847, the depositors are fewer in number by 13½ per cent., while the deposits show an increase of 12½ per cent. The social and moral welfare of the working classes are so intimately connected with the maintenance of these valuable institutions, that it must prove a source of unalloyed satisfaction to observe the great degree of encouragement which they receive. Besides affording the best incitement to industry and self-restraint, perhaps a more effectual means could scarcely be devised for rescuing a man from the thraldom of the vice of drunkenness. Induce him to invest his first shilling, and you in all probability detach him from the "evil of his ways," and are instrumental in laying the foundation of industrious and prudent habits.

Tables 41 to 48 form a series of returns illustrative of the progress made in agriculture during 1848. By Table 41 an addition is shown of 17½ per cent. in the number of acres broken up and brought into cultivation since the previous year,—a circumstance which, considering the low prices that have ruled for every species of produce, speaks well for the persevering energy of the settlers. There is an increase also of 28 per cent. in the quantity of Crown Land taken up under licences of occupation; and the aggregate rental thence derived has been augmented nearly 23 per cent.

The great extent to which the Crown Lands, formerly lying waste and unproductive, are now leased for the depasturing of flocks, notwithstanding the temporary depression from the low price of wool, attests the productiveness of the labour and capital therein employed; and the wise and successful policy of the measure will be at once evident from the following comparative statement:—

Years.	No. of Lessees.	Acres let.	Rent received. £	s.	d.
1842	41	39,019	658	14	0
1843	79	78,714	991	0	8
1847	490	1,062,989	14,279	0	0
1848	538	1,363,427	17,511	11	3

It is understood that applications have been since received at the Survey Office for the occupation of nearly a million of acres in the "new country,"—thus still further developing the resources of the Colony. By the table quoted, it also appears that Van Diemen's Land is estimated to contain $14\frac{1}{2}$ millions of acres, of which only about one-fifth has been granted or sold to settlers; and of this quantity, again, only 171,540 acres, or less than 1-20th, are in cultivation.

Table 42 records the sales made of Crown Land during the year. There were 51 Country Allotments sold, in area 1544*a.* 3*r.* 36*p.*, and producing, at the average of 24*s.* $3\frac{1}{2}$*d.* per acre, £1877 3*s.* 9*d.*; and the number of Town and Suburban Allotments sold was 133, in quantity 629*a.* 1*r.* $16\frac{3}{4}$*p.*, yielding, upon the average of £5 4*s.* $1\frac{1}{2}$*d.* per acre, the sum of £3276 14*s.* 6*d.*

Table 43 details the number of acres in crop, and the nature of each crop, for the several districts of the Island, on the 31st December, 1848. The following comparison with 1847 will show the increase or decrease in the various productions of the soil during one year; viz.—

	Increase per cent.		Decrease per cent.
Wheat	1	....	,,
Barley	19	....	,,
Oats	59	....	,,
Peas	,,	....	4
Beans	6	....	,,
Potatoes	0·50	....	,,
Turnips	15	....	,,
Tares	42	....	,,
English Grasses	26	....	,,

The average yield of produce per acre, taking the mean of the several Districts, appears to be as under; viz.—

Wheat	17 bushels.
Barley	23½ ,,
Oats	25 ,,
Peas	19 ,,
Beans	13 ,,
Potatoes	4½ tons.
Turnips	4½ ,,
Tares	7 bushels.
English Grasses	1¼ tons.

Table 44 gives the quantity of Live Stock in the Colony, arranged in Districts, on 31st December, 1848; viz.—

			Increase since 1847.	Decrease since 1847.
Horses	17,196	....	6 per cent.	....
Horned Cattle	85,485	....	4 ,,	....
Sheep	1,752,963	....	,,	.... 4 per cent.
Goats	2,902	....	2 ,,	....
Pigs	29,967	....	(now first published).	

Table 45 sets out the average prices that have ruled for agricultural produce throughout the Colony, showing a considerable decline from those of former years.

Table 46 is a return of the contract prices for wheat, flour, meat, and vegetables, supplied to the Commissariat here and at Launceston during 1848, giving the averages as under:—

Wheat	4*s*. 2*d*. per bushel of 60 lbs.
Flour	£10 8*s*. 8*d*. per ton.
Fresh Meat	$2\frac{1}{2}$*d*. per lb.
Vegetables	5*s*. 7*d*. per 100 lbs.

Table 47 states the number of cattle and sheep imported from Port Phillip and Port Albert during 1848, being 4284 of the former, and 39,673 of the latter. Taking the average prices realised at sales by public auction, this imported stock cost the colony upwards of £40,000. A sum of £10,000 was paid in freight, however, for their conveyance, to the obvious benefit and encouragement of the colonial shipping. Impolitic as are discriminating duties, and injurious, as putting restrictions upon commerce, it is contended by some, that, in the instance of foreign cattle and sheep, the high rate of 15 per cent. duty has been actually productive of advantage in affording a measure of protection to our stockowners, who complain that they cannot enter into competition with their transmarine neighbours from their comparatively limited range of pasture, and the much less favourable terms upon which they hold their licences of occupation. It is by no means suggested that this inequality should be redressed by the assimilation of the rent of our Crown Lands to the merely *nominal* sum paid in the other Colonies: such a course would be attended with positive injustice to those settlers who have bought and paid large sums for their land; besides depriving the Colony of the fair revenue derived from the leasing these waste lands, which are evidently not rated too high, considering their limited extent, and the competition which exists to obtain them.

Table 48 is a return by the Inspectors of Stock of the number of sheep and cattle slaughtered for food during the year in our two chief towns.

Table 49 shows the average daily wages paid to the most useful classes of mechanics in 1848. As compared with 1847, those paid to bricklayers, carpenters, and plasterers have fallen,—those to masons are stationary,—while the wages of joiners, painters and plumbers, and quarrymen, have slightly advanced.

Table 50 is a list of the principal manufactories and trades now in operation in the Colony. In the previous year there were enumerated 20, while the present return mentions 39. Some curious and significant particulars are gathered by comparing the two years. Agricultural implement makers show a decline from 76 to 47,* candle-makers from 15 to 10, fellmongers from 29 to 17, tanners from 44 to 40; several have remained stationary. The principal increase has been in shipwrights and boat-builders (from 16 to 51), sailmakers from 4 to 6, mast and block makers from 2 to 3; well agreeing with the increased activity in ship-building in all its branches. Two soap-boilers, it is satisfactory to notice, make their appearance for the first time in this list of trades.

Table 51 is a return of the net revenue of Van Diemen's Land collected in 1848, which is stated to be £129,545 5*s.* 5*d.* The amount of Customs is £77,151 16*s.* 6*d.*,—of which

* Such a fluctuation seems too capricious to be accurate. We must therefore suppose a mistake of nomenclature to have occurred, and that some of the missing numbers have been probably returned as "blacksmiths" or "wheelwrights."

£27,624 8*s.*, or 35 per cent., was raised at the port of Launceston; leaving £49,527 8*s.* 6*d.*, or 65 per cent. for Hobart Town. Compared with 1847, there is a falling off in this branch of the revenue at the latter port of 10 per cent., but an increase of about 3 per cent. at Launceston; making the actual deficiency 7 per cent. upon the year. The Post-office collections, including the Commissariat postage (a fixed sum of £1500), have increased nearly 9 per cent. The sums received for Licences, and as Fees, exhibit just such slight variations as are incidental to the fluctuations of business: the former head, collectively, shows an increase of 5 per cent., while the latter has decreased in about the same proportion. The Fines and Fees taken by the Police Magistrates have declined full 20 per cent.; a rather satisfactory evidence, it may be supposed, of improvement in public morals. Some small additional items of revenue appear in this year's receipt, partly counterbalanced by the transfer of the proceeds of the Ferries to the Commissioners, and by the reduction of one-sixth in the charge for quit-rents. The total decrease in revenue as compared with 1847 is £20,928 16*s.* 4*d.*: but as in that year was included £12,500 in aid of Police and Gaols due to 1846, the decrease may be stated at £8428 16*s.* 4*d.* The actual net revenue for 1848, excluding arrears for 1847 received in that year, but including receipts not paid until 1849, appears by a Council paper to be £130,492 0*s.* 6*d.*

Table 52 shows the corresponding appropriation of the Revenue for 1848. The total sum expended is £136,193, being a reduction upon 1847 of £6304 19*s.* 3*d.*; but in the last-named year there were paid off Loans to Banks of upwards of £15,000. Of the whole expenditure, the Civil Establishments form 19½ per cent., the Police nearly 25 per cent., the Public Works 13 per cent., the Judicial nearly 15 per cent., the Ecclesiastical 10 per cent., Schools 4 per cent., Pauperism 3 per cent.; the residue being expended upon various Miscellaneous Services. During 1847 and 1848 the revenue has been increased, on the one hand, by the grant for Police and Gaols from the Home Government; and the expenditure has been also increased by the return of loans to Banks and the payment of outstanding claims. The actual expenditure for 1848, excluding the arrears of 1847, but including payments made in 1849, appears to be, by the same official document, £137,136 13*s.* 8*d.*

Table 53 is an account of the Land Revenue, and of the charges borne upon it, for 1848. Deducting the balances from each side of the statement, the amount realised from this source during the year is £23,719 4*s.* 2*d.*; and the sum expended £10,224 10*s.* 10*d.*, which includes a loan of £3000 to the Bridgewater Commissioners, leaving a surplus of £13,494 13*s.* 4*d.* The balance of Land Revenue on 1st January, 1848, was £10,800 11*s.* 1*d.*; and on 31st December, £24,295 4*s.* 5*d.*

Table 54 is a return of Pensions chargeable upon the Colonial Revenue, and calls for no particular comment.

Table 55 is a summary of the Civil Process of the Supreme Court during 1848, and exhibits a considerable increase of business upon the year under most of its heads. If the number of lawsuits be a test of prosperity, as has been recently alleged by a high judicial authority, this increase should be a source of general congratulation; but it is the opinion of others, founded upon experience, that litigation flourishes most during the transition from high prices, high profits, and high wages, to a period of comparative depression. Compared with 1847, there were 103 more summonses issued, and 131 more actions brought, but only 3 more actions tried. Of undefended cases there was an increase of 27. The writs of execution, taking both sorts together, are the same in number as in the previous year; there being 5 more of *fi. fa.* and 5 fewer of *ca. sa.* The warrants of attorney and cognovits, taken together, have increased 15 per cent. One equity suit has been decided, and 2 more commenced, within the year.

Table 56 is a similar record of the business of the Court of Requests, showing an increase upon the year of 20 per cent. in the summonses issued, and of actions brought, and 15 per cent. of actions tried. The writs of *fi. fa.* have also increased 28 per cent., and those of *ca. sa.* are 1 more in number than in 1847. The large total number of 1789 actions were brought, and 1089 tried, during the year.

Table 57 details particulars of the Insolvencies that have occurred during 1848. They are 94 in number; being an increase of 28 per cent. as compared with 1847: but in another point of comparison presenting a favourable result. The scheduled liabilities in 1847 were more than doubled by those of 1848; but the scheduled assets are also augmented in a still greater proportion: for whereas in the former year they would pay 10*s.* in the pound, in 1848 they were equivalent to 15*s.* in the pound. The loss sustained by creditors in 1847 from 74 insolvencies would be nearly £20,000, and in 1848, from 94 insolvencies, not quite £23,000; that is, of course, supposing the respective values to be realised as set down in the schedules. There were 5 insolvencies superseded in the course of the year.

Tables 58 and 59 are returns of Criminal Trials before the Supreme Court in 1848, the total number being 228. Of these 80 were acquittals, and 148 convictions; and of the persons tried, 28 came free to the Colony, and 200 were transported hither. Of the 28 free to the Colony, 19 were acquitted, and 9 convicted; and of those who were, or had been, Convicts, 61 were acquitted, and 139 convicted. The crimes against the person comprise 28 per cent., and those against property 72 per cent., of the whole. As compared with 1847, the convictions for crimes against the person are fewer by 8, but show an increase of 14 in crimes against property.

Table 60 is a similar return of Trials at the Quarter Sessions for the same period, the total number being 194. Of these 74 were acquittals, and 120 convictions; and of the persons tried 20 came free to the Colony, and 174 were transported hither. Of the 20 free to the Colony, 7 were acquitted, and 13 convicted; and of those who were, or had been, Convicts, 67 were acquitted, and 107 convicted. As compared with 1847, the convictions have increased 60 per cent.

Table 61 is a return relative to the Conservancy of the Peace in 1848. There were 248 unpaid magistrates in the commission, comprising

	Per cent.
Naval and Military Officers	26
Surgeons	10
Barristers..	2
Clergymen	4
Civil Officers	8
Merchants	8
Other gentlemen..................................	42

The Police force consisted of a Chief Police Magistrate, 8 Police and 10 Assistant Police Magistrates, with 26 Police Clerks, and 506 Constables.

Table 62 furnishes particulars of the Gaols* of Van Diemen's Land on 31st December, 1848. They were 8 in number, with 14 gaolers and turnkeys, and 40 javelin-men; the expence for the year being £3891 9*s.* 4*d.* The gaols will hold 151 prisoners in separate cells, but will contain 717 when more than one sleeps in a cell. There were

* These are exclusive, of course, of the Barracks and other places for the reception and coercion of British Convicts.

117 males and 11 females in confinement in the month of September, of which 48 per cent. were for misdemeanors, and 52 per cent. for felonies. The instances of punishment within the walls of the Prisons during the year were 30. During the same period 334 cases of sickness occurred in the Gaols, 28 being the greatest number of sick at one time; but there were no deaths.

Tables 63 to 67 form the Police and Magisterial Statistics of the Territory for 1848. The aggregate total of persons, free and bond, taken before magistrates during the year, comprise the almost incredible number of 21,057,* or 30 per cent. of the entire population! Two-thirds of these, or 20 per cent., were bond, and one-third, or 10 per cent., were free. Drunkenness is, as usual, the most conspicuous offence, numbering 5255 cases, or 25 per cent. of the whole amount. These again are subdivisible in the proportion of 44 per cent. bond, and 56 per cent. free—to their shame be it recorded!

Analysis of the several offences, as grouped in the Tables 63 and 67, set down in a descending scale from the one of most frequent occurrence, affords the following results:—

	Per cent.
Drunkenness	25
Misdemeanors	14
Penal Convictions under Colonial and English Statutes	$11\frac{1}{2}$
Felony and Larceny	9
Absence without Leave	8
Absconding	4
Disobedience of orders	3

* Surely the number 21,057 entered as "persons" in this Return ought to have been stated as *cases*. Everyday experience and observation bears witness to the fact, that individuals charged with drunkenness, disorderly conduct, and offences arising out of these, appear again and again in our Police Courts within a comparatively short time.

	Per cent.
Assaults	3
Cases under examination	2
Neglect of duty	$1\frac{1}{2}$
Insolence	$1\frac{1}{2}$
Insubordination	$0\frac{1}{2}$
Idleness	$0\frac{1}{2}$
Sureties of Peace for good behaviour	$0\frac{1}{2}$
Various other offences	15

By Table 65 it appears that the 14,022 Convicts, who were brought before magistrates, bear the proportion of 61·60 per cent. to the total number of that class; and that, further analysed, they constituted 49·72 of the Ticket-of-leave holders, 84·52 of the Pass-holders, and 7·93 of those on probation or under sentence. This return is altogether exclusive of Tasman's Peninsula, and Norfolk and Maria Islands, as well as of cases before Visiting Magistrates, who report direct to the Comptroller-General.

By Table 66 it likewise appears that the 7035 free persons charged with offences before magistrates form 15·20 per cent. of the entire free population—65 per cent. of those free by servitude or otherwise, and 35 per cent of those who arrived free or were native-born, including the Military. Further analysis shows that there were 38·39 per cent. of the former of these divisions, and 7·24 of the latter; or, excluding Military and children under 14 years of age, 15·92 per cent.

Table 67, completing this series, details the offences and civil condition of the persons brought before Magistrates, excluding Tasman's Peninsula, and Norfolk and Maria Islands. This return shows that, of the whole number taken before Magistrates, 18 per cent. were females; in the proportion of $12\frac{1}{2}$ per cent. bond, and $5\frac{1}{2}$ per cent. free.

Table 68 is a subsidiary return of the average number of

Convicts, duly classified, in the territory of Van Diemen's Land during 1848; also of the actual number of each class on 1st December of that year; as obtained from the Comptroller-General's office:—

	Males.		Females.
On probation or under sentence..........	1118	....	1115
Pass-holders	8130	....	1588
Ticket-of-leave holders	8217	....	1141
On Tasman's Peninsula	1963	....	,,
At Maria Island	554	....	,,
At Norfolk Island	661	....	,,
Totals...........	20,643	....	3844
	3,844		
Total number of Convicts in Colony....	24,487		

This Table differs from a foregoing account of the Convict population, in that it includes Norfolk Island, Tasman's Peninsula, and Maria Island.

By Table 69 it appears that the extreme penalty of the law was carried into effect upon 16 criminals in Van Diemen's Land, and upon 1 at Norfolk Island, during 1848. Fifteen of those who suffered were Convicts, and 2 were free persons. In 1847 the total number of executions was 6.

Table 70 is a return of the Civil Establishment in Van Diemen's Land during 1848, grouped into classes of persons "educated" and "not required to be educated." The former division comprehends 128 officers and magistrates, &c., 68 chaplains and schoolmasters, 19 medical men, and 79 clerks: the latter, 42 tradesmen and seamen, and 111 other free persons. The total number employed by the Colonial Government is 447.

Table 71 is a similar return for the Convict Establishment. The total number of free persons employed in 1848 was 576, comprising 141 officers, superintendents, magistrates, &c., 54 chaplains, catechists, and schoolmasters, 29 medical men, and 51 clerks, in the class of educated persons; and 83 tradesmen and seamen, and 218 other free persons, in the uneducated class. The expenditure in 1848 for pay of officers, and food and clothing for Convicts, was £152,800 4*s.* 8*d.*; and £91,777 2*s.* 4*d.* was expended in pay of Military Guard and Staff Officers, including rations—together about a quarter of a million sterling. The estimated consumption in 1849 for Convict purposes of articles the produce of the Colony, deducting the quantities grown at stations, is valued at £37,222 7*s.* 0*d.*

Table 72 is a return from the Port Officer of the Light-houses of Van Diemen's Land, which are six in number; viz., Kent's Group, Brune Island, and Low Heads, exhibiting a revolving light; Goose Island, and Iron Pot Island, having a fixed light; and Swan Island, with its revolving flash. The maintenance of these Light-houses cost, in 1848, £2066 13*s.* 9*d.*, averaging £344 8*s.* 11½*d.* each. The amount of Light Dues received during the year was £1359 5*s.* 4*d.*, or 65¾ per cent. of their expence.

Table 73 is a return from the Port Officer of the Steam Vessels employed in 1848, being 4 in number. Two of these, the *Derwent* (35 h. p.) and *Kangaroo*, (32 h. p.) are employed by the Convict Department,—the *Native Youth* (20 h. p.) is used as a passage boat on the Derwent,—and the *Gipsy* (2 engines of 32 h. p.) is similarly used on the Tamar, although not so stated in the return.

Table 74 is a valuable register of Meteorological facts, illustrative of the climate of Van Diemen's Land, by Lieut. Kay, R.N., of the Observatory. The atmospheric pressure and temperature for the year are first given, being the monthly barometrical and thermometrical observations. The maximum pressure was 30·402 inches in June, and the minimum 28·596 inches in September, giving a barometrical range upon the year of 1·806 inch. The highest monthly mean was 30·004 in July, and the lowest 29·041 in June; the difference being ·963 inch. The mean pressure of the year was 29·739 inches.—The maximum temperature occurred in December, when the thermometer stood at 86°·6; and the minimum in July, when it fell to 31°·3, giving a range in the course of the year of 55°·3. The highest mean temperature for any month was 60°·2 in January; the lowest mean 42°·8 for July; the difference between them being 17°·4. The mean temperature for the whole year was 52°·3,—that for 1847 being 53°·2,—and for 1846, 53°·1.

The next Table gives the quantity of rain which fell monthly during 1848, as denoted by the Self-registering Rain Gauge at the Observatory; the total being 23·67 inches for the year. A general impression prevails that this Island has a dry climate, and is deficient in moisture; and it may therefore create not a little surprise to state that Count Strzelecki gives the annual fall of rain in New South Wales and Van Diemen's Land as actually greater than in England.* A most interesting conclusion is arrived at by Lieut. Kay, based upon a cycle of 7 years, that the seasons in this Colony are alternately wet and dry. In this last year April was the driest month, and May the wettest; the quantities which fell being 0·54 and 4·34 inches respectively. By comparison, it seems that much more rain falls annually on the northern parts of the Island than at Hobart Town, where Mount Wellington attracts much of the rain that would otherwise be precipitated below.

The popular opinion that the winds prevail from the north west are amply confirmed by the next Table; and it

* Strzelecki's N. S. W. and V. D. L., p. 194.

is remarked by Lieut. Kay that the westerly winds embrace 6-10ths of all that blow during the year.

Table 75 is an abstract of Meteorological observations registered at Launceston during 1848. The maximum pressure in the course of the year was in May 30·897 inches; the minimum in November 29·025, giving a barometrical range of 1·872 inch. The mean pressure for the year will be found to be 30·364.—The maximum temperature occurred in January and February, when the thermometer stood at 88°· ; and the minimum in July, when it fell to 27°·5, giving a range in the course of the year of 60°·5. The mean temperature for the whole year will be found to be 51°·1.—The quantity of rain which fell at Launceston during the year was 35·415 inches, being 11·745 more than fell at Hobart Town, corroborating the well-known fact that rain falls in varying quantities at points not far distant from one another. For instance, in London, deduced from 40 years' observation, the quantity which falls annually is 20·686; while at Kendal, in Lancashire, upon a series of observations extending over 25 years, the annual fall is 53·944 inches. In Paris, again, upon 15 years' observation, the annual fall is 18·649 inches; while at Viviers, upon 40 years' observation, the quantity which falls is 33·977.

Tables 76 to 79, completing the volume, contain minute statistics of the several Church Establishments, and also of the Wesleyan and Independent Congregations, showing the local distribution, and names, of their clergy and ministers; but as these returns are merely supplementary to Nos. 16 to 18, which have already passed under notice, further remark upon them is here unnecessary.

X.

On the Introduction of Salmon from the Rivers of Scotland into Tasmania. By the late Capt. C. E. STANLEY, R.E. [*Read* 12*th September,* 1849, *by* MR. HULL.]

MR. JAMES BURNETT, when recently on leave of absence in England, visited Mr. Young, the manager of the Duke of Sutherland's Salmon Fisheries in Sutherlandshire, for the purpose of consulting him on the practicability of introducing Salmon and Trout into Van Diemen's Land.

Mr. Young is a practical man, well acquainted with the habits of this valuable fish, and has made numberless experiments with a view to ascertain their mode of breeding, and the kind of waters in which they thrive best. Mr. Burnett gave him every particular respecting the length of a voyage to this Colony, and the changes of temperature to be undergone; and described to him the Tasmanian Rivers, more especially the Derwent, above New Norfolk.

Mr. Young was of opinion, that by taking the young fish (termed *Smolt*), when they are ready to proceed to the sea, and placing them in a large tank, there would be every chance, with ordinary care, of bringing them out here alive, were the voyage protracted even beyond the usual period of four months; and, once here, and placed in a river like the Derwent, where they would have access to the sea, he would have no doubt of success. He informed Mr. Burnett that he would be ready, at the proper season, to supply the young fish, to superintend their transport to London, and the construction of suitable boxes or tanks in which to convey them hither; and that he would, in every way in his power, assist in bringing to a successful issue an object so desirable as the introduction of Salmon or Trout, or both, into this part of the world. He further added, that he would see the Duke of Sutherland on the subject, and that he could confidently reckon upon the Duke's co-operation.

Before entering into an examination of the mode suggested as the most promising for transporting the Salmon from its native streams to the rivers of this country, it may be well to consider, somewhat in detail, the habits and manner of breeding of the fish, as upon the degree of care and attention paid to these points, in carrying out the experiment, must mainly depend the amount of success with which it is attended.

The breeding and growth of the Salmon, long the subject of very close observation and experiment, have given rise to much curious and eager discussion. Of the various opinions held, the principal difference appears to be in the age at which it was believed the fish went down to the sea for the first time, and, consequently, as to the rapidity of growth during the first year of its existence.

The generally received opinion has been, that spawn, deposited in September or October, was not hatched until the following spring; and that when hatched, the young fish, in the course of a month or two, became Smolts, and went down to the sea that same year.

Mr. Young states that, after numerous and very carefully conducted experiments, he has arrived at a different conclusion; and the views which he takes, and the history he gives of the fish, agree, I think, with those of most persons who have lately paid attention to the subject.

According to Mr. Young, Salmon ascend the rivers in Scotland, and commence spawning operations about September: from the middle of November to the middle of December is the principal spawning season, after which the numbers gradually decrease. He says that the male and female fish unite in selecting a spot in the stream, and together excavate the ground from that spot to a sufficient depth for the reception of the spawn, the depth varying from 9 to 18 inches; that the female deposits therein part of her *ova*, which the male immediately impregnates with the milt; and that the fish continue to enlarge the bed, and at same time cover the seed already deposited with the gravel from the bed thus extended. It appears that the length of time between the deposition and hatching of the *ova* depends entirely on the temperature of the water—varying from 90 to 100 days.

When first hatched, the fish average about $\frac{3}{4}$ of an inch in length, and have a kind of conical bag attached to the belly, which provides them with sustenance during the first five weeks of their existence. After that period, the contents of the bag being exhausted, the fry have to find their own food: they gradually assume more of the natural outline of the grown fish, and improve very fast; so that at the end of two months we have a perfect fish, marked with transverse bars, and furnished with distinct fins. From these bars alone arose many arguments against these fry being the young of the Salmon,—for it was said that the fishes so marked were *Parrs*, and that the young of Salmon are enveloped in their silvery coating when hatched, and so continue through all their after ages. Mr. Young and others have now, I think, very clearly proved that, when the fish is about 11 months old, new scales and silver coating begin to appear, the transverse bars look more and more dimly through this scaly covering, and the young fish have fairly entered upon another wonderful and interesting change, which advances rapidly towards perfection. At the end of 12 months the fish are completely enveloped in their silver coating, aud the transverse bars have entirely disappeared: they are now "Smolts," and fully prepared to leave the stream of their nativity and proceed to the Ocean.

It has not, I believe, been much questioned that these Smolts are young Salmon; but it has been alleged that they are the first hatched of the fry of the same year, and that the fish with the transverse bars are Parrs. Should any one still doubt the identity of the Parr and the Smolt, he has only to scrape away the silvery coating of outer scales, when the *transverse* bars will again be distinctly brought into view. The average length of the Smolt appears to be about 5 inches. The season at which they descend the rivers depends entirely upon the time at which they have been spawned, and this chiefly upon temperature; the greatest numbers descend in April and May, a period which corresponds with the principal spawning time, November and December.

Smolts, descending the rivers in April and May, have been caught, marked, and returned to their native element; and in the course of June and July the same fishes have been recaptured on their return from the sea—beautiful *Grilses,* weighing from 3 to 8 pounds: the difference in weight being regulated by the length of their sojourn in the salt water. This experiment has been repeated by different persons, in different rivers and in different years, and always with the same result. The Grilses, on their return to the rivers, commence spawning in the same manner as the Salmon, only earlier; and in the next spring they again descend to the sea, to return, after an absence of generally about eight weeks, as perfect Salmon. The Salmon, after spawning, go down to the sea again for the same period, and return greatly increased both in size and weight.

The Duke of Atholl, who has taken a very deep interest in endeavouring to trace out and ascertain the history and habits of the Salmon, caused zinc tickets, marked and numbered, to be affixed to all the spawned salmon he could catch, and a register to be kept of the weights of the fishes so marked, and of the dates. Amongst many others, a spawned salmon was taken in March, 1845, which weighed 10 pounds: in the space of five weeks and three days the same salmon, with the Duke's ticket attached to it, was caught returning from the sea, and it then weighed 21 pounds and a quarter.*

Such is a sketch of the early life and history of the Salmon, from the period of its being hatched to the time of its returning to its native river as a full grown fish. The question as to the mode of bringing them out here, most likely to succeed, remains to be determined.

Mr. Young, who has so cheerfully promised his assistance to Mr. Burnett in procuring fish or spawn, and putting it on board a ship bound for the Colony, suggests two methods;—one is to bring out the spawn, and the other to bring young fish.

With regard to the first of these propositions, there would be no difficulty in making the experiment, but there is much doubt of its succeeding;—in the first place, the spawn takes 90 to 140 days in which to be hatched in its own rivers, the time being in proportion to the temperature of the water: now, the temperature of the water in the rivers during the winter would be very low, which of course could not be the case in any water or gravel in which the spawn might be placed for transport hither. On the contrary, the temperature would necessarily be high during the voyage, and so expedite the hatching; and the delicate young fish, if produced on board, would have no chance of living.

* The full grown Salmon weighs from 20 to 40 pounds and upwards. Yarrell mentions a female Salmon brought to Mr. Grove, Fishmonger, of Bond-street, in 1821, which weighed 83 pounds.

There is, however, another and a fatal objection to this plan, namely, that the spawn must be placed in a *running stream* of fresh water; if placed in stagnant water, it dies: there would, therefore, be no chance of its proving productive upon arrival here, were it conveyed out even within 90 days.

It will be seen by Mr. Young's letter appended, that he considers it practicable to bring out the fish alive by securing them in the state of Smolt descending to the sea, and placing them in a large tank filled with sea water, which might be made to pass gently but steadily through it, and so be changed every day. The Salmon would thus be kept only some two or three months longer in the salt water than they would otherwise naturally be. On arrival here they might be turned into the Derwent, somewhere about Bridgewater; or at any place where they would meet the fresh water, so as to induce them to ascend the river.

Once in the river, there would, I think, be every chance of the experiment proving successful. The enemies they would have to contend with would not be so numerous here as at home; their greatest and most destructive enemy there being the Trout, which devours immense quantities of the small fry of the Salmon.

In the upper part of the Derwent there would be no fish to prey upon them, and in the sea they would find no more than at home. The main obstacle to this plan is the motion of the vessel, from which injury might be apprehended to the fish: but this might be corrected, perhaps, by having the tanks hung like a cabin lamp, so as always to preserve their perpendicularity, or nearly. It is certainly very desirable that no expedient should be left untried which offers a fair chance of accomplishing an object so desirable as that of the introduction into the many fine rivers of this beautiful and fertile country, of a fish so valuable as is the Salmon of our native land: and I am glad to have it in my power to add, that

Lieutenant Governor Sir William Denison, taking the same view of the subject, has written to the Secretary of State to allow of tanks, constructed for the purpose, and supplied with Salmon fry or smolt, taken at the right season, being placed on board some of the Convict vessels, and brought out under the immediate care and supervision of the Surgeon-Superintendent.

" *Invershin, Bonar Bridge,*
23rd October, 1848.

" Sir,

" I have just received your note of the 20th instant, regarding the introduction of Salmon into Australia. It would be a grand undertaking, and perfectly practicable, if it could be accomplished during the time between extracting the eggs and their hatching ; but, unless that could be done, I fear the delicate state of the new-hatched fish could not endure the fatigues of a long voyage.

" I may mention that the period from the deposition of the egg to the bursting of the shell varies from 100 to 140 days, according to the temperature of the water, and after being at liberty their food is entirely derived from the conical bag attached to their abdomen ; therefore, during that time I see no difficulty in their transfer : but at the expiration of that, and when the provision-bag is consumed, they are delicate until accustomed to the food they have then to provide.

" If after considering these matters you resolve to try the experiment, I shall be most happy to give all the information I can * * * * * *.

" I remain, &c.,

" A. YOUNG.

" James L. Burnett, Esq."

" *Invershin, Bonar Bridge,*
23rd December, 1848.

" Dear Sir,

" I hope you have now got back to London, and are preparing to carry Salmon Smolts to Australia. The more I think of the subject, I am the more convinced of its practicability ; and as the food of the salmon is not select or confined to one kind, it will be the easier to feed them by the way. I fear to drag them after the vessel would not be so certain of success as boxes erected on deck. The fast motion of the ship would be liable to create too much of a cross current, and thereby dash the fish against the vessel in which they are conveyed; but if boxes or tanks were erected, about 18 feet long by 4 feet deep and broad, and regularly and slowly supplied with water from the sea, they might be very safely carried. I would feed the boxes very slowly from a cistern placed on their top, and allow this water to escape in the same proportion by a small hole near the bottom of the boxes; so that, when the cisterns above are filled with water, they will keep up a supply for hours. The boxes will also require a glass light on the top, so as to allow the fish to feed; and also a way, near where the water runs into the boxes, for putting in their food. The boxes would require to be made and placed in water some time previous to the fish being put in, so that the tar would be all extracted from the wood; and the wood well filled with water, so that when the fish are placed in them they will have the water pure, and without any injurious mixture. * * * * *.

"I remain, &c.,

"A. YOUNG.

"James L. Burnett, Esq."

"*Invershin, 25th January,* 1849.

"Dear Sir,

"I have received yours of the 21st January, and hope you will get a suitable vessel, so that you can with safety carry out the young Salmon; but, in case you should not succeed in getting it in every respect fitted for their safety, I would not advise you to proceed with it at all: for, were you to make an ill-prepared half-job of it, and not succeed, it would deter yourself or others from the attempt again for a long time, (for assuredly it will at some time be done successfully). I would therefore be more anxious for you delaying it for the present (unless you can be fully prepared), than that you should fail to do what some one else might: for I see the thing is quite practicable,—either to take the *ova* in December, or the young fish in the latter end of April or the 1st of May. Both the seed and young fish can be got later or earlier than that time, but then is the time they are easiest got.

"If you succeed in getting a suitable ship, you had better get the boxes made at London, as a much smaller box would convey them there than would be required for the long voyage. And if you succeed in getting all things prepared, try and get a stock of cattle's livers for food; they can be salted, and boiled as they are required—boiled to such a degree that they will break small with the hand; get likewise coarse flour bread, also broken small: and put them into the box among the water—only small quantities at once, as fish subsist long on little food; and it is not expected you are to have them killing fat when you arrive, but only taken there alive for the sake of breeding.

"In the event of your not getting them taken out with you this year, you can perhaps arrange matters so as they can be taken afterwards. I shall at all times be ready to assist in sending the finny tribe to any quarter where they have not yet reached; and I do not see why the world should not be supplied with such a prolific* and useful race. * * * * *

"Believe me, &c.,

"A. YOUNG.

"James L. Burnett, Esq."

* *Cuvier* states that 27,850 eggs have been counted in one female weighing *twenty* pounds.

XI.

Meteorological Tables for the Years 1847 *and* 1848*; made at the Royal Observatory, Hobart Town. Lat.* 42° 52′ *S., Long.* 9*h.* 50*m. E. By* LIEUT.* KAY, R.N., F.R.S., *Director of the Observatory.*

1847.

Atmospheric Pressure and Temperature.

1847.	Barometer during the Month.		Fah. Thermometer during the Month.		Mean for the whole Month.	
	Max.	Min.	Max.	Min.	Barometer.	Therm.
	Inch.	Inch.	°	°	Inch.	°
January	30·117	29·109	88·2	46·0	29·690	61·8
February	30·190	29·146	87·9	48·1	29·828	60·9
March	30·240	28·917	86·8	43·0	29·772	57·9
April	30·323	29·065	73·6	38·8	29·816	53·2
May	30·467	29·057	64·0	34·2	29·836	47·6
June	30·160	28·864	53·4	33·2	29·643	43·1
July	30·050	28·510	55·0	33·0	29·493	43·9
August	30·270	29·211	65·0	36·0	29·773	47·9
September	30·499	29·343	70·4	36·2	29·897	51·4
October	30·262	29·276	77·1	38·3	29·853	52·5
November	30·089	29·031	83·0	41·6	29·631	54·9
December	30·384	28·972	100·0	42·5	29·725	62·9
During the Year	30·499	28·510	100°	33·0	29·746	53°2

NOTE.—The mean pressure and temperature for the whole month are deduced from hourly observations, day and night, throughout the year, except on Sundays.

The mean temperature of the air for the year 1847 is below the average of previous years, principally caused by unusually cold weather in the month of November, during which time a very severe epidemic† was raging throughout the Colony. The Isothermal line passing through the

* Now Commander Kay. † Influenza.

latitude of Hobart Town is about 57° ; and it will be found to be the temperature of all deep wells in the vicinity.

The cistern of the Standard Barometer of the Royal Observatory is 107 feet above the level of the sea, causing a depression in the mercurial column of about 0° 1.

Quantity of Rain which fell in 1847, *as denoted by the Self-registering Rain Gauge at the Observatory.*

	Inches.
January	0·12
February	0·13
March	2·64
April	1·83
May	1·46
June	0·64
July	1·82
August	0·60
September	0·40
October	1·74
November	2·23
December	0·41
Total Quantity	14·02

It is worthy of remark, that the results of six years' observation with a Self-registering Rain Gauge show alternate wet and dry seasons, viz.—

	Inches.	
In 1842	22·84	was the quantity of rain registered.
1843	13·20	
1844	24·00	
1845	15·89	
1846	22·58	
1847	14·02	
	18·75	mean yearly average.

There can be little doubt that the position of the Observatory, with a lofty mountain on its windward side (the westerly winds prevailing through so large a portion of the year), and a large river on the other, is unfavourable for a very correct register of the rain; and observations on the northern parts of the Island show that much more falls annually there than at Hobart Town, where Mount Wellington absorbs much of the moisture which would otherwise be precipitated.

The average of the Observatory Register will therefore, probably, be below the average quantity which falls in other parts of the Colony, except the eastern coast.*

Number of Hours in each Month, in the Year 1847, *on which the Wind blew from the following Quarters.*

MONTH.	N.	S.	E.	W.	N.W.	S.W.	N.E.	S.E.	Calm.	Total No. of Hours.
January......	9	6	14	15	281	18	52	291	58	744
February ...	8	2	9	8	231	28	6	330	50	672
March	3	5	3	10	296	72	36	242	77	744
April	14	6	4	6	419	29	50	127	65	720
May	12	23	1	6	560	24	40	40	38	744
June	8	8	0	3	555	40	10	24	72	720
July	3	19	0	4	590	29	12	23	64	744
August	16	0	0	5	642	9	8	15	49	744
September...	40	6	0	7	468	45	23	72	59	720
October	11	24	8	5	366	63	27	168	72	744
November ...	28	16	3	19	387	68	30	128	32	711†
December ...	73	36	1	9	193	36	47	260	68	723‡
										8730
Hours lost. Instrument out of order..................										30
365 days = Total number hours										8760

* This must be a mistake—it is on the *western* side of Van Diemen's Land that the greatest proportion of rain falls; there the face of the country is generally densely timbered, and the mountain ranges are continued down almost to the water's edge, affording prominent points of attraction for the heavy clouds which come up with our prevalent westerly winds from the Great Southern and Indian Ocean.—J. M.

† Register lost for 9 hours. ‡ Register lost for 21 hours.

General Remarks upon the Weather during the Year 1847.

There were fourteen days in the year on which the hot wind from N. to N.W. blew, viz.—

7th January.
13th Ditto.
13th February.
21st Ditto. { This day Thermometer was 100° in shade—and at midnight it was 73°.
27th Ditto.
16th March.
1st September.
7th Ditto.
17th Ditto.
9th October.
18th Ditto.
13th November.
8th December. { This day Thermometer was 103° in the shade—and a black bulb Thermometer exposed to the sun was 156°5.
28th Ditto.

The most intense hot winds were on the 21st February and the 8th of December. On the former day the sky was cloudless, but covered with a haze of a smoke-like appearance, through which the sun shone with a lurid glare; the air at the same time being extremely oppressive and sultry, and the wind in blasts as from a heated furnace. The evaporation was enormous; and a Thermometer, with its bulb kept moistened with pure water, showed 67°, with the surrounding air at 100°. The hot wind of 8th December was equally intense in its character.

The most brilliant Auroras ever seen in this Colony were also visible during 1847, on the following nights :—

24th September,
23rd October,
24th Ditto,
25th October,
20th December,

causing most violent perturbations in the Magnetic Instruments; and a brilliant Aurora was visible in England at the same time, and caused a similar Magnetic disturbance. The month of November, which followed the most brilliant of these phenomena, was unusually severe, with cold S.W. winds, and frequent snow on Mount Wellington. Great sickness prevailed throughout the Colony.

Prevailing Winds.

The sea-breeze generally commences to blow regularly in the month of October, setting in about noon, and increasing in strength until 5 P.M., after which it usually dies away gradually. Sometimes, when the morning has been very hot, the sea-breeze sets in earlier. In April it ceases to blow regularly.

The greatest amount of calm throughout the year is from the hour of 9 P.M. to 4 A.M.; and in the summer months a land wind from the N.W. springs up usually about 10 P.M., and blows a moderate breeze throughout the night: but, with few exceptions, it gives way to the sea-breeze between 8 A.M. and noon.

During the winter months the westerly winds are paramount; the gales commence at north and N.N.W., gradually veering round to the westward: when they get to the south of west, thick rainy weather sets in for some time, and the gale settles at about S.S.W. The sky then partially clears; but frequent heavy squalls of rain and sleet pass over for some hours, with clear intervals of sunshine; after which the wind goes back to its old N.W. quarter, and the weather becomes settled.

A north-east wind, if it continues to blow for a few hours, invariably brings rain. Thunder and lightning are not frequent, but occur occasionally after a hot wind, with the usual heavy rain attendant upon thunder-storms. They always approach from the leeward.

Perhaps one of the most remarkable states of the atmospheric pressure occurred in the month of July. At 1 P.M., on the 23rd of that month, the Barometer stood at $28^{in.}510$, the lowest registered at the Observatory since its establishment in 1840; the weather at the same time being beautifully clear and fine, and remaining so for some days. Accounts received afterwards from the neighbouring Colonies showed that floods of rain had occurred at that time; and on the northern side of this Island a large quantity fell also: but there was none in the neighbourhood of Hobart Town.

1848.

Atmospheric Pressure and Temperature for the Year.

1848.	Barometer during the Month.		Fah. Thermometer during the Month.		Mean for the whole Month.	
	Max.	Min.	Max.	Min.	Barometer.	Therm.
	Inch.	*Inch.*	°	°	*Inch.*	°
January.........	30·166	28·952	82·7	43·0	29·737	60·2
February	30·276	29·477	81·0	42·7	29·950	59·3
March	30·212	29·218	81·0	47·3	29·743	59·6
April	30·373	29·173	77·2	39·6	29·790	56·9
May	30·184	29·180	67·0	34·2	29·740	49·1
June	30·402	29·392	59·0	34·7	29·941	45·8
July	30·370	29·407	54·3	31·3	30·004	42·8
August	30·297	28·760	57·8	35·3	29·722	45·3
September......	30·242	28·596	72·0	36·2	29·549	48·6
October	30·226	29·051	72·0	39·0	29·698	50·4
November	29·938	28·938	74·7	40·0	29·442	53 3
December	30·110	28·869	86·6	39·8	29·550	56·7
During the Year	30·402	28·596	86·°6	31·3	29·739	52·°3

The mean pressure and temperature for the whole month are deduced from hourly observations, day and night (except on Sundays), down to the 1st of October; after which date they are deduced from observations taken at five periods in the twenty-four hours; viz.—the hours 2 and 6 A.M., and 2, 6, and 10 P.M.

The cistern of the standard barometer of the Royal Observatory is 107 feet above the level of the mean tide, causing a depression in the mercurial column of about 0·1 inch.

Quantity of Rain which fell in 1848, *as denoted by the Self-registering Rain Gauge at the Observatory.*

	Inches.
January	1·03
February	0·80
March	1·16
April	1·54
May	4·34
June	1·08
July	2·49
August	2·66
September	1·91
October	1·61
November	3·83
December	2·22
TOTAL	23·67

The results for 1848 tend to confirm the alternation of wet and dry seasons, which has been previously remarked, viz.—

	Inches.
1842	22·84
1843	18·20
1844	24·00
1845	15·89
1846	22·58
1847	14·02
1848	23·67

The unfavourable position of the Observatory for a correct register of the *absolute* quantity of rain which falls in any year has been noticed in the Meteorological Tables of 1847. Relatively, one year with another, there cannot be any doubt of the accuracy of the register, as the reservoir which receives the rain is emptied every morning at 9 o'clock, and by a self-acting syphon besides, whenever the quantity which falls exceeds ·25 of an inch. The effect of evaporation is therefore inappreciable, as the pencil of the register marks the quantity as it falls. The area of the funnel which collects the rain is 200 square inches; and as the reservoir contains 50 cubic inches each time it is full 0·25 of an inch of rain has fallen on that area.

Number of Hours each Month, from 1st January to the 1st October, on which the Wind blew from the following Quarters.

MONTH.	N.	S.	E.	W.	N.W.	S.W.	N.E.	S.E.	Calm.	Number of Hours.
January......	31	13	3	6	256	67	46	248	67	737
February ...	16	48	7	9	113	115	40	264	84	696
March	54	16	2	18	418	26	37	110	34	715
April	58	11	3	21	413	38	11	54	36	645
May	85	28	2	6	380	101	30	75	37	744
June	32	18	0	3	479	101	11	32	44	720
July	31	46	0	2	445	127	19	28	46	744
August	32	43	0	5	354	126	35	84	59	738
September...	53	22	3	5	343	59	70	118	42	715
October	Hourly observations discontinued.									
November ...										
December ...										
										6454
Hours lost (instrument undergoing repair)										122
274 days = total number of hours										6576

General Remarks upon the Weather during 1848.

The hot winds during 1848 were rare, and of a moderate character, occurring on January 3rd, February 12th, March

30th, and April 5th: that on February 12th was the most marked, the thermometer being 91 degrees in the shade. None occurred in the latter part of the year.

There was but little rain until the month of May, when upwards of 2 inches fell between the 6th and 7th, and the whole month was wet, more rain having fallen in it than in any other month of the year. June was fine, with but little rain; so was July, with a mean temperature lower than the average. August was wet, but the spring months of September and October were fine. November and December were of a very severe character, having constant gales with wet cold weather: the mean temperatures of November and December were at least 3 degrees below the usual average; and, during the latter month, the thermometer was several times as low as 40 degrees, with snow in quantity on Mount Wellington.

The Aurora Australis was occasionally visible, but not with the brilliancy which was so remarkable in the year 1847: it was the most brilliant in appearance on March 25th. On October 18th and November 17th, when it appears to have been very remarkable in its character in Europe, it was here but indistinctly seen, from the general cloudy state of the weather: it, however, caused very considerable disturbance in the magnetic instruments on those days.

Prevailing Winds.

The general summary given with the Meteorological Tables for the year 1847 contains all that is necessary to be said upon the prevailing winds. It will be perceived that the westerly winds embrace six-tenths of all the winds that blow during the year.

A Table of the Mean Temperature of the Air at the Observatory, by Fahrenheit's Thermometer, from a record of three successive years' hourly observation, day and night, is given, to show the accordance which the results present.

MONTH.	1846.	1847.	1848.	Mean of Three Years.
January	61·7	61·8	60·2	61·2
February	58·9	60·9	59·3	59·7
March	57·9	57·9	59·6	58·5
April	53 3	53·2	56·9	54·5
May	48·2	47·6	49·0	48·3
June	45·7	43·1	45·8	44·9
July	42·8	43·9	42·8	43·2
August	44·3	47·9	45·3	45·8
September	49·5	51·4	48·6	49·8
October	53·8	52·5	50·4*	52·2
November	58·7	54·9	53·3*	55·6
December	62·8	62·9	56·7*	60·8
Mean temperature for the whole year	53·1	53·2	52·3	

* Cold, Spring and Summer.

JOSEPH H. KAY, LIEUT. R.N.,
Director of the Observatory.

H.M. Observatory, Ross' Bank,
Hobart Town, May 1849.

Proceedings.

16th August, 1848.—First monthly evening meeting; His Excellency Sir W. T. Denison, F.R.S., President, in the chair.

Twelve gentlemen ballotted for and duly elected Fellows of the Society.

Colonel H. Despard, C.B., 99th Regt., and Ronald C. Gunn, Esq., admitted Fellows of the Society upon Rules xviii. and xvii. respectively.

Forty-four volumes of books and pamphlets presented to the Society by Sir William Denison.

Three volumes presented by Capt. Stanley, R.E.

One volume, Dr. Ure's Dictionary of Arts, Mines, and Manufactures, by Mr. Milligan.

The Secretary read a paper on the Coal of Schouten Island and its associated rocks, illustrated with views and diagrams.

Specimens of Coal from Schouten Island, from Jericho, Jerusalem, Richmond, South Cape, and Tasman's Peninsula, were upon the table.

In the course of discussion, His Excellency the President expressed a wish that the Secretary would visit and report upon the Coal which occurs on the estate of F. L. Stieglitz, Esq., at Break-o'-day; and promised to lay before the Society at an early day an account of some experiments undertaken to determine the amount of alkali contained in the timbers and other vegetable products of the Colony.

Dr. Lillie exhibited specimens of the *Sphæria Gunnii* from Franklin Village, and of recent *Terebratulæ* obtained on the coasts of Tasmania. The Rev. gentleman remarked on the frequent occurrence of hard ferruginous nodules in the overlying sandstones about Ross, which he regards as the result of the decomposition of organic bodies of a low order. Dr. Lillie also related the failure in his hands of *guano* from Bass's Straits as a manure: it was applied by him over 5 acres of land in the shape of top-dressing to a corn crop. Sir William Denison had also largely experimented with *guano* from the same locality, and with the same marked want of success. The failure is attributed to the immediate setting in and long continuance of dry weather.

Members of the Society invited to institute a set of experiments upon the relative strength and durability of Tasmanian timbers, and to determine their specific gravities.

The meeting considered that experiments should be made to determine the capabilities of the indigenous grasses of the Island for improvement by cultivation,—their relative power of withstanding the aridity of our summer months, and the ravages of the *grub* and *caterpillar*, *&c.*

A sample of the white resin of the Oyster Bay Pine (*Callitris Australis*, Brown) lay on the table. The Secretary stated that this tree has only been met with along a comparatively limited and narrow strip of land bordering the sea on the eastern coast of Tasmania, and upon Flinders' and Cape Barren Islands in Bass's Straits; that about Swanport and the shores of Oyster Bay it forms a tree, always handsome and picturesque, and sometimes 120 feet in height, affording useful but not large timber, fit for all the ordinary purposes of the house carpenter and joiner in a country district.

18TH SEPTEMBER, 1848.—The monthly meeting appointed for the second Wednesday of the month held by postponement this evening; His Excellency Sir W. T. Denison, President, in the chair.

James Grant, Esq., of Tullochgorum, and Dr. Nixon, Lord Bishop of Tasmania, elected Fellows of the Society.

Twenty volumes of books and pamphlets presented to the Society's Library by J. E. Bicheno, Esq.

The Secretary read a paper on the geological structure of the country between Southport and South Cape Bay, and submitted a plan with sections of the coast near the Whale's Head, illustrated with specimens of the coal, shales, clay-schists, sandstones, and trap-rock prevalent there.

Attention was directed to specimens on the table of Anthracite from Adventure Bay, where it occurs in a seam of inconsiderable thickness, over a compact, hard, and tenacious clayey sandstone, having embedded in it fragments of coarsely mineralised wood and casts of shells, and overlaid by massive beds of schistose clay and a yellowish-white sandstone, all dipping to south-east at an angle of about 14°; the clayey sandstone underneath being apparently identical with that which underlies the carboniferous rocks at Southport.

Mr. Milligan placed before the meeting fossil forms composed of *Iron Pyrites*,—oblong, pyriform, and tuberous, with numerous deep depressions (like the *eyes* in a *potato*, to which the tuber-like form bears a strong similitude); they may prove to be coprolites: they occur in great numbers in the semi-hard, compact, massive, and stratified clay-beds constituting Satellite Island, in D'Entrecasteaux Channel.

The bituminous coal of Break-o'-day, and the practicability of shipping it from George's River or Falmouth, fell under discussion.

Sir W. Denison reported some successful experiments made by Dr. Motherwell, with lime and clay from the coal-beds at Port Arthur, in order to obtain a cheap hydraulic cement for ordinary purposes.

Specimens from the clay-beds which alternate with sandstone, and dip under the greenstone hill in the Domain near Carnelian Bay, and in which have been found very distinct impressions of leaves of an exogenous plant, were placed before the meeting by the Secretary. The clay is white, very pure and equal in composition, and when burned forms pottery-ware of a light cream-yellow colour: the sandstone associated with it yields fragments of opalised wood.

11TH OCTOBER, 1848.—The monthly evening meeting; Capt. Stanley, R.E., in the chair.

The following gentlemen elected Fellows:—

Dr. Dawson, Dep.-Insp.-Gen. of Hospitals, &c.
John Hiddlestone, and } Hobart Town.
Daniel Sutton, Esqs. }

Nine volumes of books were presented by Mr. H. Hull; also a sample of a very fine close-grained white timber, considered by him suitable for wood-engraving purposes, obtained in a defile of Mount Wellington. It seems to be the young wood of *Pittosporum bicolor*, formerly in high estimation amongst the Aborigines of Tasmania, on account of its combined qualities of density, hardness, and tenacity, as the most suitable material of which to make their warlike implement the *waddie*. The tree at full growth, and in situations the most favourable, rarely exceeds 10 or 12 inches in diameter, though it is said to have attained to 18 inches.

Mr. Milligan placed on the table specimens of radiated acicular *Schorl* from the islands in Bass's Straits; and stated that a large area of the country between Hampshire Hills and the House-top Mountain, in the north west of Van Diemen's Land, is composed of granite in which schorl is extensively disseminated.

Specimens of the *fungus* known as "native bread," *Mylitta Australis*, lay upon the table. A member observed that this substance, grated and made into a pudding with milk alone, had been found by him very palatable. Prepared in the same way, and combined with double its weight of rice or sago, it has produced a very superior dish. It has also been eaten with approval in soup, after the manner of *truffle*, to which it is nearly allied. It is said that it has never been found in decidedly sandy soil, that it is invariably near roots or decayed trunks of trees in *alluvium* or rich loam that it occurs, and that there is on the surface no indication by which its existence underneath may be traced by Europeans.

A paper was read by Mr. H. Hull descriptive of a gigantic tree of the Gum tribe, "occurring in a gorge on the declivity of the Mount Wellington range near Tolosa, about six miles from Hobart Town." Mr. Hull describes it as a blue gum (*Eucalyptus globulus*), and says "it stands close to the side of one of the small rivulets that issue from the mountain, and is surrounded with dense forest and underwood. * * * It was measured with a tape, and found to be 28 yards in circumference at the ground (more than 9 yards in diameter), and 26 yards in circumference at the height of six feet. The tree appeared sound except at one part, where the bark had opened, and showed a line of decayed wood. The full height of the tree is estimated to be 330 feet."

8TH NOVEMBER, 1848.—Monthly evening meeting; J. E. Bicheno, Esq., F.R.S., in the chair.

The following gentlemen ballotted for and elected Fellows of the Society:—

G. Courtenay, Esq., Port Arthur
John Dobson, Esq., Hobart Town
Lieut. Harrison, R.N., ditto
J. H. Hull, Esq., ditto
William Richardson, Esq., Colonial Surgeon, ditto
Thomas Smart, Esq., Assistant Colonial Surgeon, ditto
E. S. P. Bedford, Esq., admitted on Rule XVII., ditto.

Two hundred specimens of minerals, with catalogue, from Germany, and two boxes of mineral specimens from the Adelaide mines, presented by Lieut. Harrison.

Samuel Moses, Esq., presented two large calligraphic portraits,—one of Her Majesty the Queen, Patroness of the Society; and the other of His late Royal Highness the Duke of Sussex, robed as Grand Master, &c.

Two young mice, having each a remarkable oblong white spot on the forehead, taken in clearing out a cellar in Government House, submitted for examination,—consigned to a member to be carefully reared and re-examined.

A paper was read by James Barnard, Esq., on the *larvæ* of a moth closely resembling, in the writer's opinion, the *Hepialus humuli* (Fab. Harr. English Insects, iv.) or Ghost-moth of England, —on its habit of concealing itself deep in the ground during the day, and rambling at night,—on its unsparing destructiveness to English grasses,—and on the best mode of obviating its ravages, and of getting entirely rid of the insect. Rolling, except at dawn in the morning or twilight in the evening, even with a very heavy roller, would seem to be inoperative from the great depth at which the caterpillar lies during daylight, and the fact of its commonly attacking old and well-consolidated grass lands. Irrigation seems to be the only effectual remedy, unless where the soil can be turned up with the plough or spade.

A pencil drawing of the *Caterpillar* by Mrs. Barnard was laid on the table; and the following is Mr. Barnard's description of it:—"This caterpillar is fully 2 inches long, and of proportionate thickness; the head is horny, of a glossy dark-brown colour, with a triangular scale on the apex: its body is olive-green, with a black stripe down the back, and minute dark glittering dots on each segment along both sides of the dorsal line: the legs, six in number, are yellow; and the pro-legs, of which there are eight, (making fourteen in all), are yellowish white."

Mr. Milligan read a portion of a report on the Coal of Fingal, Mount Nicholas, and the East Coast.

15th December, 1848.—Monthly evening meeting; His Excellency Sir W. T. Denison, President, in the chair.

The Rev. R. R. Davies, of Longford, admitted on Rule xvii.

The following gentlemen were ballotted for and elected Fellows:—

The Right Rev. Bishop Willson
The Venerable Archdeacon Marriott
Thomas Boot, of Hobart Town
J. L. Fitzgerald, „
William Seccombe, „
A. M. Milligan, of Launceston
Edwin Tooth, of Bagdad—Esquires.

A copy of the Tasmanian Journal, complete to this date, presented by Ronald C. Gunn, Esq.

Three volumes, Life of Wm. Allen, presented by G. W. Walker, Esq.

Four *crania* of Aborigines of New Zealand, presented by Captain Stanley.

Joseph Allport, Esq., drew attention to a sample of coal upon the table from the estate of Mr. Vicary, at Spring Bay; it crops out there in a thin seam on the margin of a rill of water close to the sea. The coal is splendent, of a greyish-black colour, and very friable.

Mr. Milligan concluded his report on the *Coal* of the upper valley of the South Esk—of the Break-o'-day—the St. Paul's, the Apsley, and the Douglas Rivers,—with reference more especially to the seams at Fingal, Mount Nicholas, and the East Coast. Upon the table were plans and sections of the country, and specimens of *coal* and the various rocks associated with it from these localities; also of granite and transition clay-slates from the mouth of the Scamander River; of *syenitic granite*, from St. Mary's Pass; and of *granite*, *clay-slates*, and *greenstone*, along the coast from Falmouth to the *embouchure* of the Douglas River.

Thanks of the Society voted to Mr. Milligan for his papers on the coal fields of the colony, and to the various persons who made donations.

10TH JANUARY, 1849.—Monthly evening meeting; His Excellency Sir W. T. Denison, F.R.S., President, in the chair.

The Rev. T. J. Ewing, of New Town, admitted on Rule XVII.

Francis Loughnan, Esq., ballotted for and elected into the Society.

Buffon's Natural History, in 15 vols., presented by Mr. Barnard.

The *cranium* of a Porpoise of the neighbouring seas by Mr. Calder.

A box of specimens of rocks and minerals, collected at Macquarie Harbour, by Mr. Milligan in 1846, presented by Sir Wm. Denison.

Captain Stanley presented a sample of *Iron-sand* from Cape Farewell, New Zealand.

Mr. Hull, a piece of Sandal-wood from Swan River.

Mr. Milligan, a few good specimens of the *Sphæriæ Gunnii*, from Franklin Village, near Launceston.

A letter from Dr. Nicholson, of Sydney, expressing interest in the objects and success of the Society, and proposing an interchange of the exclusive natural productions of these countries, with a list of *Mammalia* and *birds* more particularly wanted by the Sydney Museum, read by Capt. Stanley.

Sir William Denison read a paper detailing experiments made by Dr. Motherwell on some of the woods of Tasmania, with a view to determine the quantity of *Potash* contained, with observations on the possibility of this alkali becoming an article of export from the colony, or its being made available for the purposes of the scientific agriculturist.

His Excellency the President also read a paper on the preparation of a composition of *Lime and Clay* to set strongly as a hydraulic cement.

Thanks of the Society voted for donations and for papers read.

14TH FEBRUARY, 1849.—Monthly evening meeting; Joseph Hone, Esq., occupied the chair, in the absence of the President and Vice-Presidents.

William Archer, Esq., of Cheshunt, elected a Fellow.

A collection of *Algæ*, made at Kent's Group, Bass's Straits, received from J. E. Bicheno, Esq.

Mr. Hone presented a large piece of fossil wood of Tasmania; specimens of the Lyre Bird (*Menura superba*, Davies), and Nankin Bird (*Nycticorax Caledonicus*, Less.), of Port Phillip.

Two *crania* of Aborigines of Tasmania presented by Dr. Officer.

Mr. F. W. Newman presented a collection of dried specimens of Plants of New South Wales; also the *cranium* of a Porpoise, labelled *Phocena delphinus;* also 3 war spears from the Fegee Islands.

Sixteen volumes of books presented from Mr. Westcott, of Argyle-street.

Mr. Milligan presented a copy of Cuvier's Animal Kingdom, by Dr. MacMurtree; and 220 specimens, in duplicate, of the rock formations and minerals prevalent in the north west of Van Diemen's Land and in Bass's Straits.

The Secretary reported the acquisition by the Society of a complete articulated human Skeleton; a human *cranium*, with the component bones separated; the *cranium* of an aboriginal native of Port Phillip; and of certain Books, &c.

Mr. Milligan read a Report upon the Coal at Richmond and Jerusalem, and the geological features of the district.

Thanks of the Society voted for donations, and for the paper read by the Secretary.

14th March, 1849.—Monthly evening meeting; J. E. Bicheno, Esq., F.R.S., Vice-President, in the chair.

Morton Allport, Esq., elected a Fellow of the Society.

A volume of Statistics of Van Diemen's Land from 1824 to 1848, presented by Mr. Hull.

The Secretary placed on the table a collection of *Corals* from the equinoctial isles of the Pacific; also specimens of compact oxide of *Manganese*, from a range of hills adjacent to the "Frenchman's Cap," on the western side of Tasmania,—of the beautifully distinct and well-established fossil *Casuarina*, occurring on the south-east coast of Flinders' Island, nearly opposite to Vansittart Island,—and of *Iron Mica*, delicately foliated and flexible, from the granitic district between St. Valentine's Peak and the House-top Mountain on the north coast.

Mr. H. Hull read a paper on the Statistics of Van Diemen's Land for 1848, wherein the history and progress of the colony is traced from 1803, and its condition at various intervening periods, compared with its position at the close of 1848.

Mr. Hull says—"The colony was established 46 years ago, viz., in 1803, by the arrival of a ship from Port Phillip with convicts and a guard of soldiers. For 7 or 8 years it consisted solely of convicts and soldiers—a mere convict station—then termed 'the Camp;' now the wide, well-built, regular, populous, and wealthy city of Hobart! The first book kept to record official business in the Colony is now in the Colonial Secretary's office: in it appear the Garrison Orders of the Commandant—instructions to the first free settlers to keep in their houses after dark—an account of the arrest of a free settler for being in the streets at night—the parole and countersign—an account of the extraordinary detention by force of Governor Bligh, &c. No Church existed then, and Divine Worship was performed, in compliance with a Garrison Order, in the verandah of the original Government House. It is said that all the other records from 1803 to 1810 were destroyed. In 1817 the Colony, then 14 years old, comprised 3289 inhabitants, of whom ⅓ were convicts and soldiers, and 104 *ci-devant* convicts originally settled at Norfolk Island, whence they were removed to this Colony by Government, and located upon small grants of 30 to 100 acres each. In 1817 the farm-stock consisted of 420 horses, 28,800 cattle, and 182,000 sheep; 7815 acres of land were under cultivation in wheat, which then sold for 8*s.* per bushel. The daily wages of mechanics were 8*s.* to 15*s.*, with board and lodging. The Customs of the Colony amounted to £5000, and the total value of the exports to £11,000 in 1817. Seven years after, at the departure of Colonel Sorell, the population was 8944, of whom half were free; the revenue amounted to £32,000, and the imports to £62,000. Thirty-three ships arrived and 35 sailed in 1824. One vessel then belonged to the Port; and there were in the Colony 9 post-offices and 4 churches. But bushranging was rife, and in that year 16 men perished by the hands of the executioner. In 1825, 6 and 7, the first three years of Colonel—now Sir George—Arthur's long administration, 22, 53, and 56 criminals were executed, respectively. An efficient system of prison discipline was then established, and several important colonial works undertaken, to which the New Wharves, the Bridgewater Causeway, and Grass Tree Hill road bear witness. In 1837, when Sir John Franklin arrived, the population was 42,000, of which 17,593 were convicts; and 32,000 acres of land were under cultivation in wheat alone. The price of wheat then was 7*s.* the bushel. Twenty-four new churches had been built during the preceding 12 years. The imports were upwards of half a million sterling in value, and the exports within £20,000 of the same amount: 344 vessels arrived at and 363 sailed from the Ports of Hobart Town and Launceston; 65 vessels belonged to these Ports. There were then 33 post-offices. The revenue of the Colony was £154,000, and the expenditure £137,000. *Seven* criminals expiated their offences on the scaffold. Eleven* years have since elapsed. * * * * *."

Mr. Bicheno read an interesting paper upon the Potato,—its history and culture,—the potato disease,—and the influence and effects of the *Tuber*, used as an exclusive or principal article of diet,

* Mr. Barnard's paper in the present number affords data for carrying down the comparison to the latest date to which tables are published.

upon national character; and upon the condition of a people, moral, social, and physical, as exemplified so strikingly in Ireland.

Mr. Bicheno exhibited in his powerful microscope a section of the tuber,—its diseased leaf,—and the *Aphis vastator*, to which the evil has been attributed.

11TH APRIL, 1849.—Monthly evening meeting; the President and Vice-Presidents absent; Joseph Hone, Esq., in the chair.

Two books on Botany presented by Mr. Hone.

One book, Journal of Botany of Sir William Hooker, presented by the Rev. T. J. Ewing.

The Secretary placed on the table, for the Museum, Eggs of the following Tasmanian Birds:—Black Swan (*Cygnus atratus*), Cape Barren Goose (*Cereopsis Novæ Hollandiæ*, Lath.), Tern or Redbill of Bass's Straits (*Thalasseus poliocercus*), Kite (*Milvus affinis*, Gould), Gull (*Larus Pacificus*), Little Tern (*Sternella nereis*, Gould), Shag or Cormorant (*Phalacrocorax leucogaster*, Gould).

The *Carapace* and one of the prehensile legs of a gigantic decapod *brachyurous crustacean* (Crab), cast ashore at Maria Island, presented by Captain Denison, 52nd Regiment, A.D.C.

The Secretary read a note from John Lyne, Esq., of the Apsley district, reporting the discovery of additional seams of Coal near the Douglas River.

A note from Mr. Butcher, of Richmond, read, accompanying specimens before the meeting of a massive, compact, and chalk-like clay occurring in thick beds upon his property.

A note read from Mr. Newman, Superintendent of the Society's Gardens, referring to choice samples upon the table of the following varieties of Wheat grown by him this season; namely—

Farmer's Friend, said to yield		70 lbs.	per bushel	in England.
Golden Drop (late in ripening)		70 lbs.	„	„
Mother of Plenty	(ditto)	65 lbs.	„	„
Chidham ...	...	65 lbs.	„	„
White Kent ...	...	65 lbs.	„	„
James's Essex	...	64 lbs.	„	„

9TH MAY, 1849.—Monthly evening meeting; His Excellency Sir W. T. Denison, F.R.S., President, in the chair.

Henry D'Arch, Esq., Coll. Customs, Hobart Town, Henry White, Esq., Hobart Town, and William Franks, Esq., A.P.M. Fingal, elected Fellows of the Society.

Five volumes of Books presented by Messrs. H. & C. Best.

One volume on Timber Trees by Mr. Milligan.

A section of the butt of a small tree, from the Myal Scrubs, in the Liverpool Range, New South Wales, apparently an *Acacia*, and probably the *Acacia pendula*, presented, together with a spirit preparation, in a large glass jar, of a Fish (not named), by Captain Denison.

Sir Wm. Denison placed on the table a specimen of ore—compact Oxide of Iron, feebly magnetic—from Long Bay, in D'Entrecasteaux Channel, where it is said to occur in a *seam* or *bed* 2 feet thick.

The Secretary drew attention to a pulley or sheave of a block, turned from the timber of a small and slow-growing indigenous tree of Tasmania, the *Notelia ligustrina* (Vent.); its extreme hardness and great density peculiarly adapt it for such purposes.

Mr. Morton Allport presented a large collection of dried skins of Birds of Tasmania.

Thanks voted for the various donations.

The Secretary submitted a longitudinal section of the trunk of a comparatively rare arborescent Fern (*Alsophila Australis*, Brown), from "the Peaks" of Flinders' Island. It was formerly only known as existing on Phillip's Island, Macquarie Harbour. Mr. Allport has seen it on "the Bishop and Clerk" Mountain, at Maria Island; Mr. Ronald Gunn has lately found it in the neighbourhood of Mount Direction, near the road from Launceston to George Town; and Mr. Milligan recently discovered it on the East Coast in a ravine near the Douglas River. The pith in the uppermost part of the column of a young and vigorous *Alsophila* is soft and succulent, and, as compared with that from the common Tasmanian Fern Tree (*Cibotium Billardieri*, Brown), is devoid of astringency, and has a bland, sweetish taste. The pith of both tree ferns were formerly eaten in a half roasted state by the Aborigines, but that from the *Alsophila* was preferred. Their maxim was, that the pith of the *Cibotium* must be eaten along with the flesh of kangaroo, &c., while that from the *Alsophila* was considered so good that it might be partaken of alone.

Mr. Milligan stated that, in crossing from Oatlands to Swan Port, he had observed highly inclined beds of *spiriferous* and *crinoidal* Limestone dipping to north-east, and passing upwards into a bluish and *siliceous* slaty rock—into *breccia—grit-stone*—and finally into *sandstone.* The situation of the out-crop is about 20 or 21 miles from Oatlands, in a direction nearly E.S.E. along the usual cart-track, upon Mr. Stanfield's property.

Mr. Milligan read the following note from the Rev. T. J. Ewing, of New Town, on the occurrence of some unprecedentedly large specimens of the *Swamp Gum* (*Eucalyptus Sp.*)—

"*New Town Parsonage,* 19*th March,* 1849.

"My Dear Sir,—I went last week to see a very large tree, or rather two very large ones, that I had heard of since 1841, but which were not re-discovered until Monday last. As they are two of the largest—if not *the* largest—trees ever measured, I have determined to send you an account of them, in order that a record may be preserved in any future publication of the Royal Society. They are within three quarters of a mile of each other, on a small stream, tributary to the North-west Bay River, pretty far up on the ridge which separates its waters from those of Brown's River. They are easily reached from the Huon foot-path, and are in a beautiful vale of sassafras and tree-ferns, and not in an inaccessible gully like most of our gigantic trees. I have never before seen the tree-ferns growing in such luxuriance, bending over the stream like enormous cornucopias. The fire has never reached them, as they and the forest around them plainly show; and every here and there you are puzzled on seeing a sassafras tree with a root on either side,—one in particular forming a natural arch, underneath which you can walk. And it was some time before I could tell how it was ever possible for the tree to have grown there, until on looking further I perceived that the sassafras must have originally sprung from seed lodged in the bark of some swamp gum that had fallen across the brook; and, as it grew, it gradually sent out roots along the trunk until they met *terra firma.* The trunk having in the course of ages decayed, has left the sassafras tree in the odd position in which we now see it. I say so much before I give you the measurement. I am sure the whole scene would amply repay you for the trouble of a ride; in addition to the giants below, there are, I feel confident, within a mile, at least a hundred trees of 40 feet in circumference. One, about forty yards from the biggest, was 60 feet at four feet from the ground, and at a hundred and thirty must have been fully 40 feet in circumference; it was without buttresses, but went up one solid massive column, without the least symptom of decay. A silver wattle was 120 feet high, and 6 feet round. In fact, we named it the *Vale of Giants,* for puny indeed did men appear alongside these vegetable wonders. The largest we measured was, at three feet from the ground, 102 feet in circumference, and at the ground 130 feet. We had no means of estimating its height, so dense was the neighbouring forest,—above which, however, it towered in majestic grandeur. This noble swamp gum is still growing, and shows no signs of decay; it should be held sacred as the *largest* growing tree. The largest oak on record is the Cowthorpe, in Yorkshire, which is 48 feet in circumference at three feet from the ground. Some hollow pollard oaks are larger, such as the Winfarthing, in Norfolk, which is 70 feet at the ground. The second tree, also a swamp gum, is prostrate. It measures, from the root to the first branch, 220 feet, and the top measures 64—in all 284 feet, without including the small top, decayed and gone, which would carry it much beyond 300 feet. The circumference at the base is 36 feet, and at the first branch 12 feet, giving an average of 24 feet. This would allow for the solid bole 10,120 feet of timber, without including any of the branches. Altogether, as green timber, it must have weighed more than 400 tons. The oak that gave the most timber was the Gelonos oak, in Monmouthshire, which, with its branches, turned out 2426 feet, but the body alone only 450 feet. * * * *.—Believe me, yours very truly,

"THOMAS J. EWING.

"Joseph Milligan, Esq."

His Excellency the President mentioned his having strongly recommended to the Right Hon. the Secretary of State for the Colonies, and to the Lord Commissioners of the Admiralty, the timber of our Blue Gum (*Eucalyptus globulus*). Plank can be obtained from it in lengths surpassing those of any other timber-tree; and it may be sent home and sold at 8*d*. per foot, while oak plank (to which it is not inferior in quality) of the largest obtainable lengths costs 2*s*. 6*d*. per foot.

The Secretary reported having visited and examined the Coal Seams on the East Coast referred to at last meeting in a note from Mr. Lyne. At least *four* additional seams have been discovered, alternating with which are beds of shale, bluish slate, and clay schist, with several seams of *clay iron-stone*, varying from 3 to 11 inches in thickness, and rich in impressions of ferns, strap-shaped leaves, jointed stems resembling calamites, &c. Specimens of these fossils on the table.

The Secretary read the following note from the Rev. T. J. Ewing:—

"*Wednesday Morning.*

"MY DEAR SIR,—I am much obliged for the Report of the Royal Society. I see that towards the end we are exhorted to throw our individual facts into a common centre. I therefore take this opportunity of mentioning that, on Saturday, 24th March, I saw a large flock of one of our rarest birds—namely, the *Acanthylis caudacuta*, or Spine-tailed Swift. It is beautifully figured by Swainson, in his second series of Zoological Illustrations, under the name of *Chætura macroptera*. Gould also has given us an excellent plate. It is about twice the size of the English swift, and its flight is literally *swift as an arrow;* and it was this circumstance which first attracted my attention. It resembled most that of one of the *Procellàridæ*, called by sailors the *Whale Bird*, seen in great numbers between this and the Cape of Good Hope. This flock, consisting of about two hundred, continued playing over New Town for about two hours,—at one time soaring to an immense height without any apparent motion of the wing, and the next minute almost brushing your face in their rapid whirls. When thus low they used their wings very quickly.

"I have never had sight of these birds but twice before during my long residence. Once Mr. Bagot, when A.D.C., brought me one which he had shot at Richmond; and at another time an old pupil of mine shot one from a flock at Sandy Bay, which he described as actually darkening the air like a thick cloud. In both instances they were at a great height. I gave these birds to Commodore Berard when here; but I hope that some sporting member of the Royal Society may have seen and shot for your Museum some of the March flock.

"I would also record an instance of a colony of Snakes which a friend of mine killed in a small field in one day, near Brown's River. He despatched no less than *twelve.* Nine of them had young ones in them, ranging from *four* to *six*, so that he must have slaughtered upwards of sixty of these reptiles in this small spot.—Believe me, yours very truly,

"Thomas J. Ewing.

"Joseph Milligan, Esq."

Joseph Allport, Esq., mentioned that, about two months ago, there was accidentally discovered in this neighbourhood, clustered under the bark of a *Banksia quadrivalvis* (she-oak tree), a family of *sixteen* bats.

The room was heated with a magnificent fire of Coal from Mount Nicholas, on the estate of F. L. Von Stieglitz.

In the ante-room was a fire of Coal from Schouten Island.

13th June, 1849.—Monthly evening meeting; His Excellency Sir W. T. Denison, F.R.S., President, in the chair.

The following gentlemen elected Fellows:—

Elisha Hathaway, Esq., U.S.C., Hobart Town
R. V. Legge, Esq., of Cullenswood
Andrew Crombie, Esq., of Hobart Town
Geo. A. Makeig, Esq., „
Nigel Gresley, Esq., „
I. W. H. Walch, Esq., „
Robert Hepburn, Esq., St. Paul's Plains
Robert Carnes, Esq., M.D., New Town.

The Rev. J. B. Windsor and Joseph Henry Kay, Esq., Lt. R.N., F.R.S. and Director of the Royal Observatory, Hobart Town, admitted on Rule xvii.

Captain Stanley presented for the Society's Botanical Gardens a packet of Seeds, and for the Museum a box of choice Shells collected by the naturalists of H.M.S. *Rattlesnake* on the islands and coasts of Torres' Straits.

Mr. H. Hull presented samples from Mount Wellington of the red and white varieties of the timber of the *Myrtle-tree of Tasmania* (*Fagus Cunninghami*); also a specimen of *Pyritous conglomerate* from the shaft at Procter's Quarry, where *pyritous schists* and *flaggy* and *clayey sandstones* prevail; also a specimen of raw silk produced here. A book also presented by Mr. Hull.

A book presented from Mr. Westcott.

Specimens of *Hippocampus*, *Syngnathus*, and *Ostracion* (Sp.?), presented by Mr. Bicheno.

The skin of a small fish, a species of *Balistes* (?), from South Port, presented by P. S. Tomlins, Esq., A.P.M.

The Secretary read a Journal of Sir John Franklin's Expedition to Macquarie Harbour, referring to the country lying between *Hamilton* and *Mount Fatigue.*

The soil, climate, and natural productions of that district—its adaptation to pastoral purposes—and the wholesale death of the forest trees over extensive tracts of surface, were discussed. Mr. Milligan attributes the destruction of the trees to *fire*, which, sweeping like a hurricane through the forests, often consumes every leaf and bud and twig at a season when the gigantic plants are replete with sap and in the full vigour of vegetation, and, operating as a mephitic agent, destroys by producing a sort of vegetable *asphyxia;* the white and bleached appearance and dreary and desolate character of these forests being the result of after years of exposure to sun, wind, and rain, and other atmospheric influences.

Sir Wm. Denison stated that the instruments used by Count Strzelecki, and since purchased by Government, have been found very faulty—a fact which may account for some obvious errors in the elevations recorded by that gentleman.

The apartment was heated with a noble fire made of Coal brought for experiment from the rich bituminous seams in the Douglas River, on the East Coast of Tasmania.

11th July, 1849.—Monthly evening meeting; His Excellency Sir W. T. Denison, President, in the chair.

M. C. Friend, Esq., R.N., F.R.S., and Peter Fraser, Esq., Cor. M. Geol. Soc. L., Colonial Treasurer, admitted on Rule xvii.

James Ludovic Burnett, Esq., admitted on Rule xvi.

Lieut. Akers, R.E., admitted on Rule xviii.

A. Impie, Esq., and Thomas Read, Esq., of Hobart Town, ballotted for and elected Fellows.

The Secretary reported the receipt of several *fasciculi* of Proceedings of the Zoological Society of London in continuation.

Lieut. Clarke, R.E., presented for the Museum an extensive series of specimens of the Timbers of New Zealand, labelled with native names; also samples of *Scoriæ* and other rocks used as building stone, and two recently discovered *Helices* from the same country: also a packet of Seeds from New Zealand for the Society's Gardens.

J. E. Bicheno, Esq., presented a well-executed cast of *Pentacrinus Briareus.*

A cast of portion of a lower jaw of *Diprotodon Australis* (Owen) presented from Dr. Nicholson, of Sydney, through Capt. Stanley.

A specimen of the Orange Cowrie of Tahiti (*Cypræa aurantium*) presented by Mrs. John Kerr.

Mr. Joseph Ring presented two *crania* of Aborigines of New Zealand, with several warlike implements, articles of dress, and ornaments worn by the natives; also a few Shells from the South Sea Islands.

Mr. Milligan presented the skull of a Tasmanian Wombat (*Phascolomys vombatus*); also a *Coralline* of tall growth (a few inches to 2 feet) and gracefully tapering form, allied to *Antennulariæ*, dredged up in D'Entrecasteaux Channel, upon the inner shore of North Brune Island.

C. S. Henty, Esq., of Launceston, presented four fresh specimens of *Trigonia Margaritacea* and six perfect *Terebratulæ*, dredged up by him at George Town.

Wm. Archer, Esq., of Cheshunt, sent a collection of Seeds of Tasmanian Plants for the Society's Gardens.

A case of Plants and Seeds of Plants indigenous to Australia received from the Botanic Gardens at Sydney, through Sir William Denison.

Joseph Bonney, Esq., of Perth, sent a parcel of Bulbs for the Society's Gardens.

A case of Australian Plants received from E. M. Bowman, Esq., Sydney.

Four cases of choice Fruit Trees from Wm. Macarthur, Esq., of Camden, Sydney.

Lieut. Joseph Henry Kay, R.N., F.R.S., Director of the Observatory, Hobart Town, read a paper on the new portable Barometer, the Aneroid —its principle, construction, and applications; and submitted a diagram of its behaviour as compared with the action of the standard barometer at the Observatory during 120 consecutive observations: with an account of its action during a journey to the summit of Mount Wellington.

A discussion followed on the derivation of the word *Aneroid.* It seems to be formed from the old Greek word *Narŏs*, or *Nērŏs, humidus* fluid, with the privative *a* prefixed. *Narōn* appears to have been the name of a river (Narenta ?) on the borders of Illyria; and *Nĕro* is stated to be the modern Greek word for *water*. *Aneroid barometer* would thus signify that which the instrument actually is—a barometer without a fluid.

A paper by Lieutenant-Governor Sir William Denison, on the nature and construction of Docks—*dry, wet,* and *floating*—was read, illustrated by a series of elaborately-finished diagrams, which were placed upon the table by His Excellency.

8th August, 1849.—Monthly evening meeting; the President and Vice-Presidents absent; Dr. Nixon, Lord Bishop of Tasmania, in the chair.

Edward Macdowell and Alban C. Stonor, Esqrs., elected Fellows of the Society.

The Secretary reported receipt of several *fasciculi* of Proceedings of the Zoological Society of London, with the Report read at the Annual General Meeting held in April, 1848.

A copy of Downer's Nautical Ephemeris received from Mr. Pratt, of Hobart Town.

Henry D'Arch, Esq., presented some good specimens of *Sphæria Robertsii* from New Zealand; a cloak as worn by aboriginal females of New Zealand; an ornamented calabash from Whydah, western coast of Africa; a necklace worn by Blacks at Fernando Po: with specimens of *Madreporite* from Devonshire, and of *Ammonites* and *Belemnites* from the *Lias* at Whitby in Yorkshire, England.

Mr. Makeig presented specimens of native *Sulphate of Alum*, from caverns in the clay-rock formation near Bridgewater, and of *Iron Pyrites*, curiously fluted, said to be from York Town, near the mouth of the Tamar River.

Mr. Barnard presented a fish preserved in spirits (*Clinus despicillatus ?* Rich., 3rd vol. Zool. Journal, June, 1839), caught in the estuary of the Derwent.

John Kerr, Esq., M.L.C., presented a collection of Coins of the old Roman Emperors—of Medals struck to commemorate great events in British history, and in honour of military and naval commanders, statesmen, &c.—with Medals of the Numismatic Society of Paris, finely executed in bronze, &c.

A small Rat, resembling in its long, slender, and acuminated muzzle, and somewhat in its general appearance, and carnivorous character and habits, the *Mus nasutus* (Waterh. Proc. Zool. Soc. Lond. Feb. 1837), as figured by Darwin, forwarded for examination by Captain Stanley: this animal, being a regular purloiner of provisions from a party of workmen employed high up the side of Mount Wellington, was caught there in a trap.

12TH SEPTEMBER, 1849.—Monthly meeting; His Excellency Sir W. T. Denison, President, in the chair.

The following gentlemen elected Fellows of the Society:—

Abraham Hort, Esq., Holebrook-place
William Henty, Esq., Launceston
Chester Eardley-Wilmot, Esq., A.D.C.

Dr. Agnew, of Hobart Town, and James Grant, Esq., of Launceston, admitted on Rule XVII.

Last number of the Tasmanian Journal presented by Ronald C. Gunn, Esq.

A packet of Seeds, &c. received from John Montagu, Esq., Secretary to Government, Cape of Good Hope, for the Society's Botanical Gardens.

A case of Fruit Trees received from Mr. Fry, of Launceston, in return for scions forwarded to him from the Royal Society's Gardens.

A case of Bulbs and *Cacti* received from the Botanical Gardens at Mauritius.

A molar tooth of *Diprotodon Australis*, obtained near Mount Macedon, Port Phillip, by the late Dr. Hobson, forwarded by R. C. Gunn, Esq., lay upon the table.

A stuffed specimen of the *Phaps elegans* (brush bronze-winged pigeon), and of a male *Biziura lobata* (musk duck of the colony), presented from Robert Power, Esq., Surveyor-General.

A female specimen of *Biziura lobata* presented by J. E. Bicheno, Esq.

Major Ainsworth presented a fine stuffed specimen of *Aquila fucosa*, standing upon a black opossum, in a large glazed case.

William Watchorn, Esq., presented dried specimens of *Phyllopterix* (Swainson), and of other *Hippocampi*,—of *Callorynchus Australis*, *Pristis*, &c. &c.

Specimens of small *Crustaceans* and *Arachnidæ*, preserved in spirits, and of Oriental Bezoars, presented from Mr. A. M. Milligan, of Launceston.

Fragments of a layer of inner bark of *Melaleuca squarrosa*, or swamp tea-tree, resembling a leaf of papyrus, and a *Glycera* (?), preserved in spirits, received from P. S. Tomlins, Esq., A.P.M., South Port.

A specimen of the *Menura superba*, stuffed and set up, presented by Mr. Alfred Douglas.

Specimens of *Galena* from the estate of Abraham Walker, Esq., of Norfolk Plains, placed on the table by the Secretary. The ore is found in nodules in a highly siliceous limestone, underlying a slaty clay-rock and clayey breccia, beneath a hill of greenstone on the margin of the "Western Lagoons."

A paper prepared by the late Captain Stanley, R.E., upon the history, habits, and mode of breeding of the Salmon, and upon the means by which this valuable fish may be introduced into the Tasmanian rivers, read by Mr. H. Hull. Sir W. Denison said he had addressed Earl Grey, requesting that facilities might be afforded on board vessels coming to the colony under contract to Government.

His Excellency the President read a paper, condensed from a Report by him to the Admiralty, upon various methods in use at the shipping ports of Great Britain for expediting the loading of vessels with coal, &c. from the ends of jetties and wharves, &c.

10th October, 1849.—Monthly meeting; Joseph Hone, Esq., in the chair.

Major Last, of the 99th Regiment, admitted on Rule xviii.

The Secretary reported the purchase of Gould's Birds of Australia by the Society, and that the first number of the Mammals had been obtained.

A copy of the Statistical Tables of Tasmania for 1848, published by authority, received.

A pamphlet on Harbours of Refuge, by the Right Hon. Earl of Lovelace, and emanating from the Institution of Civil Engineers, presented by Sir William Denison.

Seven volumes of Books presented from the library of the late Captain Stanley.

Dried specimens of Pines of Tasmania presented from R. C. Gunn, Esq.

Specimens of *Casarca tadornoïdes*, or chesnut sheldrake, and of *Lobivanellus lobatus*, the wattled peewit or spur-winged plover of Tasmania, shot near Oatlands, stated by Gould to be found exclusively in New South Wales, presented by Henry Anstey, Esq., of Anstey Barton, through Mr. Bicheno.

A *Pagurus* (?), soldier or hermit crab, in spirits, (resembling *Pagurus deformis*, as figured), together with its shell, presented by Arthur Perry, Esq.

A *Petromyzon*, or river lamprey of Tasmania, in spirits, presented by Dr. Officer. It has four teeth, or bony plates like teeth, opposed to two long sharp teeth set upon its piston-like tongue. It has also along the neck a very distensible pouch or bag directly under its single nostril, which is situated centrally on the upper flat part of the head, a little in advance of the eyes, over which the general dermoid tegument is extended in a thin layer.

Lieut. Clarke, R.E., presented from Mr. Strange, of Sydney, one hundred marine, fresh-water, and terrestrial Shells, (amongst the first a fine *Trochus imperialis*), the produce of Sydney and New Zealand.

Lieutenant Akers, R.E., presented a bucket made of *gutta percha*.

Mr. H. Hull presented a preparation in spirits of the *marsupium* of a *Dasyurus viverrinus*, having four *fœtus* attached ; also the *cranium* of a *Dasyurus maculatus*.

Mr. Watchorn presented some pieces of shell of the egg of the *Moa dinornis*, having the striated, short, rough lines, or depressions, characterising the specimens sent to England by Mr. Mantel.

The Secretary placed on the table a sample of bituminous Coal from the estate of Mr. Chilton, at High Plains, about two miles north of Hamilton. It occurs in a seam 4½ feet in thickness, and was discovered in excavating a well for water in the farm-yard. The superposed rocks consist of 30 feet of soft brownish sand-stone, 2 or 3 feet of a laminated yellowish-white clay, and 2 to 3 feet of blue shale. There is immediately under the coal a few feet of blue shale and slaty clay, which disintegrate rapidly on exposure. The sand-stones and shales associated with the coal show themselves under the greenstone on the same side of the Clyde near the bridge at Hamilton, and again at various points in the direction of New Norfolk as far down as the residence of Mr. Spode.

Mr. Milligan placed on the table fragments from a silicified tree imbedded in the sand-stone over this coal, and remarked that fossilised wood is very abundant in the superior beds.

Mr. Milligan also produced several fine amianthus-like specimens from the fossil tree on Mr. Barker's estate at Macquarie Plains. This tree has been removed from the igneous rock in which it held a vertical position. It was found to be destitute of roots, and—like the innumerable specimens of a similar character involved in the sand-stones over our coal measures—probably existed in a mineralized state previous to its being thrown into the position it held amongst the trap. Its perpendicularity was probably the result of a concurrence of merely mechanical forces operating in a lava stream. The matrix is an amorphous and vesicular basalt.

Specimens of a tufaceous limestone, occurring in detached nodules through the soil in a valley upon Mr. Chilton's estate, and regularly burnt by the proprietor for lime, were also placed before the meeting.

A paper of considerable length, forming a running commentary upon the Statistical Tables published of the Colony for 1848, was read by James Barnard, Esq.

Thanks were voted for the numerous donations, and to Mr. Barnard for his paper.

14th November, 1849.—Monthly meeting; His Excellency Sir W. T. Denison, F.R.S., President, in the chair.

Sir George Grey, K.C.B., Governor-in-Chief of New Zealand, elected an honorary member of the Society.

The following gentlemen elected Fellows:—

Andrew Sinclair, Esq., M.D., Colonial Secretary, New Zealand.

Lieutenant-Colonel Daniel Bolton, R.E., Commanding Royal Engineers, Auckland.

Walter Mantel, Esq., Wellington, New Zealand.

J. Swainson, Esq., the Hutt, New Zealand.

Captain Joseph Greenwood, 31st Regiment, Major Brigade, Auckland, New Zealand.

Henry Cotton, Esq., Hobart Town.

Henry Anstey, Esq., of Anstey Barton.

Rev. R. K. Ewing, Launceston.

Mr. Bicheno presented a variety of cones of the pine tribe; also a specimen of *Mylitta Australis*, remarkable for having a tolerably regular stem, for the unusual softness and succulency of its substance, and for having involved in it a piece of the root of a fern.

Mr. Bonney, of Perth, forwarded to the Society's Gardens a parcel of seeds from South Australia.

Mr. Lewis, of Collins-street, presented specimens of rocks and minerals brought by him from the Burra Burra and other mines at South Australia.

Specimens of rocks and minerals collected in South Australia and New Zealand, by Mr. Rhodda, were presented.

Specimens of the delicate *Janthina fragilis*, picked up by Mr. Calder at Eagle Hawk Neck, were presented.

A specimen of soft micaceous grit, from Break-o-'day Plains, forwarded by F. L. Stieglitz, Esq., submitted for examination.

Mr. John Abbott placed upon the table a sample of *Iron Sand* from Long Bay.

Mr. Milligan submitted a portion of the compact part of a long bone imperfectly mineralized, but without process or articular surface, from which to deduce its probable origin or connections; it is said to have been found on one of the Hunter Islands, in Bass's Straits: the structure of the bone is almost as dense as that of ivory.

Mr. Milligan also submitted fragments of the timber of *Eucalyptus globulus*, blue gum, and of plank of the wood of *Acacia melanoxylon*, the lightwood, and more correctly blackwood of the colonists, perforated through and through by the *Teredo navalis*—both specimens from D'Entrecasteaux Channel: the first from the interval between high and low water on the shore; the last from the bottom of a large boat some years used on the river. Considered desirable to be ascertained whether the Huon pine or other of our colonial timbers suffer in the same way.

Mr. Milligan also submitted two species of *Syngnathus*, both apparently distinct from those already in the Society's Museum.

A sample of coal from the Lagoon Rivulet, about five miles from Wabbs' Harbour, on the east coast, where the seam crops out $6\frac{8}{12}$ feet in thickness, and of a highly bituminous caking quality, lay upon the table. This coal has been found by experiment to yield a good coke. In the upper portion of the Lagoon Rivulet, an *upthrow* has exposed a long series of seams of *coal*, *shale*, and *clay-ironstone*, with thin beds of sand-stone, containing impressions of ferns and strap-shaped leaves, &c.

Mr. H. Hull presented a copy of Lindley's Elements of Botany.

Tables compiled by order of His Excellency the Lieutenant-Governor, exhibiting the comparative stature and weight of children of the following three classes in the community, at ages not exceeding 18, were laid upon the table; namely,—

Children of the higher classes in the community.

———————— free persons (working class).

———————— convicts (Orphan School).

The Secretary read a paper communicated by William Porden Kay, Esq., Director of Public Works, on the construction and cost of the Causeway and Bridge across the Derwent at Bridgewater.

His Excellency Sir W. Denison read a paper on the manufacture of marketable potash, from the ashes of timber burnt off in the process of clearing new land for the plough, in Tasmania.

12TH DECEMBER, 1849.—Monthly meeting; Joseph Hone, Esq., the senior member of council present, in the chair.

The following gentlemen were ballotted for and elected Fellows:—

Thomas J. Knight, Esq., Hobart Town.

Joseph White, Esq. „

Lieutenant Robert Lynd, Barrack-master, Auckland, New Zealand.

Henry D'Arch, Esq., presented for the Museum 48 coins and medals of ancient Greece and Rome, from the collection of Captain W. H. Smyth, R.N., F.R.S., author of *Travels in the Sicilies*, &c.

Major Walch presented 80 coins and medals of various ages and countries.

J. S. Hampton, Esq., presented two specimens of roughly polished marble, from the crinoidal limestone at Maria Island.

Mrs. Kerr sent a comb as originally worn by the inhabitants of the Feejee Islands.

Samuel Moses, Esq., presented shells from the South Sea Islands; a section of the stem of a *Xanthorrhœa,* and of the trunk of a small *Acacia*, labelled "raspberry jamwood," from Western Australia.

J. E. Bicheno, Esq., presented (having been sent by H. Anstey, Esq., of Anstey Barton), the skin of a small rodent, about the size of a large mole; together with the skin of the smaller cuckoo of Tasmania, *Cuculus inornatus* (Vig. and Horsf.)

The rodent sent by Mr. Bicheno measured, from the tip of the snout to extremity of tail, 10¾ *inches; the tail alone measured* 4¼ *inches. Its body is closely covered with a fine short fur of a light slate colour, tipped with brownish-white, interspersed with fine silky hairs of brownish black one inch in length, tipped with white about* ⅛ *inch. The crown* *of the head darker. The belly of a lighter shade, without long hairs. Ears broad and bare. Four toes on the forefeet, the two middle ones longest, with rudimentary thumb ; the fore legs short. Five claws on the hind feet, the three middle toes longest. Dental formula ; rodent teeth* 2-2, *molar* 4-4, *with a long interval between. Tongue very large. Not marsupial. The entrance to the* meatus urinarius, *&c. curiously defended and half concealed by a thin pendent flap or purse-like appendage covered with short hairs. The tail four-sided, very sparingly clothed with short hair, and compressed laterally at the tip, so as to form a slightly flattened fan-like termination.*

L. Nathan, Esq., of London, sent per *Rattler*, for the Society's Gardens, a case of choice exotic plants, of which few have survived the voyage.

Mr. Moses has placed on the reservoir in the Society's Gardens a canoe, with outrigger and paddles, picked up by his ship *Prince Regent*, in latitude south 1° 25′, and in longitude east 171° 45′, where it was computed to be 200 miles from land. There was on board the canoe when found three inhabitants of Henderville's Island, whence they had been drifted in a gale ; a fact having an obvious bearing upon the mode by which the Oceanic Islands have been originally peopled.

E. S. P. Bedford, Esq., presented to the Library 3 volumes on Natural History, by Swainson.

Mr. Westcott presented 8 volumes of Proceedings of Zoological Society of London.

Woodville's Medical Botany, 4 vols. 4to., presented by Mr. Milligan.

Mr. Turnbull, of New Norfolk, sent for examination a specimen of native sulphate of magnesia, crystalized, in an aggregated acicular mass, from caverns in the clay rocks in the neighbourhood of the Dromedary Mountain.

Specimens of superior pottery-ware, manufactured in Hobart Town, of clay from the Domain and from Richmond, were exhibited.

A series of fossil shells, from tertiary and post-tertiary deposits in the islands of Bass's Straits, and on the northern and western coasts of Tasmania, were submitted by Mr. Milligan. The Secretary read extracts from a letter of R. C. Gunn, Esq., mentioning the occurrence of a fossil *Haliotis*, species of *Cidaris*, &c. in a recent formation near Melbourne, about 200 feet above the present level of the sea. The Secretary also placed before the meeting some delicate petrifactions of recent *Gramineæ*, *Musci*, &c. in carbonate of lime, found on the west coast near Cape Grimm.

Extracts from a letter of the Rev. W. B. Clarke, of Sydney, touching the fossil contents of the carboniferous rocks in that neighbourhood, and their probable identity with sandstones, &c. associated with the coal in Tasmania, were read by the Secretary.

Mr. Milligan mentioned that one of the Aborigines of Tasmania reports having often discovered the nest of the *Echidna setosa*, porcupine or ant-eater, of the colony; that on several occasions *one egg* had been found in it, and never more: this *egg* has always been found to contain a *fœtus* or chick, and is said to be round, considerably less than a tennis ball, and without a shell. The mother is said to sit continuously (for a period not ascertained) in the manner of the common fowl over the egg; she does not leave the young for a considerable time after having hatched it; at length, detaching it from the small teat, she moves out hurriedly and at long intervals in quest of food,—the young one becoming, at each successive return, attached to the nipple. The young animal, at first altogether devoid of covering, soon acquires fur, and afterwards quills or spines, which, like the deciduous teeth of children, or feathers of birds in the moulting season, are shed during the summer, to be replaced *seriatim* with a stronger, thicker, and effectual defence of the same sort.

The adult female *Echidnæ* are nursing their young at this season of the year, and therefore rarely met with. About the close of summer individual females have been often found, it is said, surrounded with a numerous suite of admirers of the opposite sex; each like a queen holding amid her admirers her separate state, far removed from the possibility of any "rival near the throne."

The Platypus (*Ornithorhyncus paradoxus*) is said to lay *two* eggs, having the same external membranous covering, but of an oblong shape.

p Esq., M.D.

	Winds.									
		3 o'Clock p.m.								
	.E.	Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
J	2	...	...	28	...	3	...	...	...	...
F	..	1	...	20	...	7	...	...	...	...
M	1	...	...	16	1	10	...	4	...	...
A	..	2	...	19	...	8	1	...	...	...
M	..	10	...	18	...	3	...	...	...	...
J	..	10	...	12	...	8	...	...	...	...
J	..	10	...	15	...	5	...	1	...	...
A	..	8	...	21	...	...	...	1	...	1
S	..	3	...	25	...	2	...	...	...	...
O	..	3	...	20	...	8	...	...	...	...
N	..	1	...	26	...	3	...	...	...	...
D	..	3	...	26	...	2	...	...	...	...
F	3	51	...	246*	1	59	1	6	...	1

	Winds.									
		3 o'Clock p.m.								
	E.	Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
J		...	...	23	...	8	...	...	...	...
F		1	...	15	...	13	...	...	...	...
M		3	...	21	...	5	...	2	...	...
A		3	...	19	3	...	...	...	...	...
M		6	...	14	...	9	...	2	...	...
J		9	...	9	...	11	...	1	...	...
J		5	...	9	...	6	1	10	...	...
A		3	...	12	...	3	...	11	1	1
S		2	...	11	4	8	...	4	1	...
O		...	...	23	1	4	...	3	...	...
N		1	2	14	5	5	1	2	...	...
D		1	1	22	...	5	2	...	...	...
I		34	3	192	18	77	4	35	2	1

ie point of junction, have thence a course from and through
n.—J.M.

Abstract of Meteorological Observations made at Launceston for the Years 1847 *and* 1848. By W. R. Pugh, Esq., M.D.

Dr. Pugh's house stands 142 feet above the sea level.—*Strzelecki*, page 46.

1847.	9 o'Clock a.m.		3 o'Clock p.m.		External Thermometer.				Extreme Range of Temperature.		Evaporation, in Inches.	Fall of Rain, in Inches.	Winds.																	
	Barometer.	Thermometer, attached.	Barometer.	Thermometer, attached.	9 o'Clock a.m.		3 o'Clock p.m.						9 o'Clock a.m.									3 o'Clock p.m.								
	Mean.	Mean.	Mean.	Mean.	Dry.	Wet.	Dry.	Wet.	Max.	Min.			Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	Calm	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
January......	29·868	66°	29·843	70°5	67°5	61°.	75°.	65°·	85°	45°	2·170	1·086	8	...	19	...	2	...	...	...	2	...	...	28	...	3	...	...	...	...
February ...	30·010	67·	29·912	69·5	68·5	61·5	75·	65·5	87·5	43·	1·930	·066	16	...	4	...	8	...	...	...	...	1	...	20	...	7	...	...	...	...
March	29·849	62·5	29·818	65·	61·	56·5	66·	60·5	78·	41·	1·380	4·494	11	...	11	...	7	...	1	...	1	...	...	16	1	10	...	4	...	...
April	29·998	55·5	29·953	59·	57·	51·	59·5	55 5	67·	36·	·580	3·462	14	...	9	...	7	...	...	...	...	2	...	19	...	8	1	...	...	...
May	30·029	48·5	30·015	51·	45·5	44·	51·5	48·5	62·	32·	·460	2·673	14	...	14	...	3	...	...	...	...	10	...	18	...	3	...	...	...	...
June	29 764	41·	29·738	46·	40·	38·	46·	44·	55·	27·	·170	5·106	23	...	6	...	1	...	...	...	...	10	...	12	...	8	...	...	...	...
July	29·672	45·5	29 600	48·	40·	38·5	47·5	45·	54·	30·	·170	5·622	22	...	8	...	1	...	...	...	...	10	...	15	...	5	...	1	...	...
August	29·925	47·	29 899	51·9	44·	42·3	52·	48·7	56·	34·	·390	2·472	18	...	13	...	...	...	...	...	...	8	...	21	...	...	...	1	...	1
September...	30·158	52·5	30·095	57·1	52·3	49·	57·3	51·9	63·	32·	·770	1 228	16	...	13	...	1	...	...	...	...	3	...	25	...	2	...	...	...	...
October......	30 017	56·5	30·002	61·7	56 4	51·7	61·9	55·	74·	40·	1·140	2 214	12	...	14	...	5	...	...	...	...	3	...	20	...	8	...	...	...	...
November...	29·866	54·5	29·822	57·4	60·9	56·7	65·8	60·	74·	40·	1·760	1·974	14	...	15	...	1	...	...	...	...	1	...	26	...	3	...	...	...	...
December ...	29·915	59·	29·882	61·	63 8	60·7	78 2	65 9	90·	42·	2·140	1·198	19	...	12	...	...	...	...	...	...	3	...	26	...	2	...	...	...	...
For the Year	29·925	54·88	29·885	58·4	54·74	50·9	61·3	55·46	90·	27·	13·060	31 595	187	...	138*	...	36	...	1	...	3	51	...	246*	1	59	1	6	...	1

1848.	9 o'Clock a.m.		3 o'Clock p.m.		External Thermometer.				Extreme Range of Temperature.		Evaporation, in Inches.	Fall of Rain, in Inches.	Winds.																	
	Barometer.	Thermometer, attached.	Barometer.	Thermometer, attached.	9 o'Clock a.m.		3 o'Clock p.m.						9 o'Clock a.m.									3 o'Clock p.m.								
	Mean.	Mean.	Mean.	Mean.	Dry.	Wet.	Dry.	Wet.	Max.	Min.			Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	Calm	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
January......	29·908	59°	29 867	61°7	66°6	60°2	73°5	65°6	88°	47°	2·200	2·340	8	...	14	...	9	...	...	...	...	...	...	23	...	8	...	...	...	...
February ...	30 090	57·7	30·031	61·5	63 9	58·2	73·1	64·1	88·	45·	1·830	·727	14	...	3	...	12	...	...	...	...	1	...	15	...	13	...	...	...	...
March	29·959	55·9	29·905	57·9	61·3	57·9	67·	67·8	74·	45·	1·270	2·211	13	...	13	...	4	...	1	...	...	3	...	21	...	5	...	2	...	...
April	30·012	52 8	29·976	54·9	56·6	53·6	62·4	56 8	69·	34·	·920	·852	10	...	16	1	3	...	...	...	...	3	...	19	8	...	...	...	...	...
May	29·877	47·5	29·874	49·5	47·6	45·5	53·2	49·6	63·	33·	·440	5·127	16	...	6	1	4	1	3	...	...	6	...	14	...	9	...	2	...	...
June	30 096	44·5	30 014	46·5	42·5	40·8	49 8	47·1	55·	30·	·270	2·268	20	...	6	...	4	...	...	...	...	9	...	9	...	11	...	1	...	...
July	30·153	43·4	30·113	45·1	41·9	39·5	48·2	45·	52·	27 5	·420	2·790	17	...	5	...	5	...	2	1	1	5	...	9	...	6	1	10	...	...
August	29·922	43·7	28·886	46·4	42·5	40·8	50·9	46·6	56·	30·	·500	3·288	23	...	7	...	1	...	...	...	...	3	...	12	...	3	...	11	1	1
September...	29·753	47·2	29·729	49·1	49 3	46·1	53·5	49·	68·	32·	·810	4·039	13	2	9	1	1	1	3	...	...	2	...	11	4	8	...	4	1	...
October......	29 857	50 9	29·819	53·1	55·7	51·2	59·	54·	68·	37·	1·130	4·284	20	...	7	...	1	...	3	...	...	...	...	23	1	4	...	3	...	...
November ...	29·618	51·8	29·594	54·	56·5	51·9	59 7	54·4	71·	36·	1·390	4·508	7	1	18	1	...	...	1	2	...	1	2	14	5	5	1	2	...	...
December ...	29·778	54·2	29·748	56·6	60 3	54·3	64·9	57·5	76·	41·	1·610	2·681	4	3	16	1	6	...	1	...	...	1	1	22	...	5	2	...	...	...
For the Year	29·918	50 71	29·799	53·	53·73	50·	59 6	51 79	88·	27·5	12·790	35 415	165	6	120	5	50	2	14	3	1	34	3	192	18	77	4	35	2	1

* The valley of the Tamar River, hemmed in on either side by high ridges, runs N.W. and S.E. as far as Launceston; its tributaries, the North and South Esk Rivers, flowing in channels nearly east and west, at the point of junction, have thence a course from and through the flat open country to the southward,—a state of the surface which obviously determines our prevalent westerly winds into N.W. and S.W. at Launceston.—J.M.

Miscellanea.

Remarks on the 'Observations sur l'Ornithorhynque,' par M. Jules Verraux. By Prof. Owen, F.R.S.

[*Annals and Magazine of Natural History, No. XI., Nov.* 1848.]

One of the admirable characteristics of the National Museum of Zoology in France is the staff of "Naturalistes Voyageurs" attached to the Jardin des Plantes. These gentlemen, after receiving the requisite zoological acquirements, are sent to various parts of the world to collect animals and plants for the museum at the expense of the government.* Their preparatory pursuits eminently fit them for observing the living phenomena of rare animals in their native environment, and the names of several of these collectors have obtained high and deserved repute in the records of zoological science: those of Diard, Duvaucel, Delalande, will readily suggest themselves; and to these we may add that of the enterprising nephew of Delalande, M. Jules Verraux, who, after having spent some years in Australasia, has recently returned to Paris with rich collections for the Jardin des Plantes.

During a sojourn of fifteen months in Tasmania, M. Verraux devoted much time and pains to studying the habits of the *Ornithorhynchi* in their native rivers, and has published the general results in the 'Revue Zoologique' for May of the present year. His observations are the more valuable as they appear to have been made without the knowledge of any of the recent steps that had been taken towards a resolution of the mystery of the generation and development of the paradoxical mammal; and I propose, therefore, to notice them here in connection with the actual state of our knowledge of those points prior to the publication of M. Verraux's remarks.

He found the *Ornithorhynchi* most abundant in the river of New Norfolk†, Tasmania; but succeeded in killing some individuals at a considerable altitude on Mount Wellington.

His description of their burrows accords with that given by Mr. George Bennett‡: those excavated in clayey soils, though they have numerous outlets—one always below or level with the surface of the stream—contain only a single nest, placed at the extremity furthest from the water, and spacious enough to hold three or four of these animals: the nest is composed of reeds and other aquatic plants, and is thick enough to defend the animal from the damp.

The *Ornithorhynchus* is an excellent burrower. M. Verraux saw

* In the year 1835 there were eight of these officers engaged in travelling in Hindostan, Madagascar, the Cape, Nubia, &c., at an expense to the government in that year of 25,000 fr.

† River Derwent.—J. M. ‡ Trans. Zool. Soc. vol. i. 1834.

one dig a hole of more than two feet deep, in a very hard gravelly soil, in less than ten minutes: during this operation the webs that extend beyond the nails when the animal swims are retracted, and the nails are exposed; and from its attitude and action it would be taken for a mole rather than a swimmer. As it burrows it uses its tail, like a beaver, to beat the earth and consolidate the sides of the burrow.

The *Ornithorhynchi* are chiefly, but not exclusively, nocturnal; they are most vivacious by night, swimming then with the velocity of fishes, and moving about on land with remarkable agility: but the female, when she has young ones in the nest, will leave them during the noon-tide heats and swim about.

With regard to the generative economy of the *Ornithorhynchus* I may premise, that examination of the ovarium and of the ova, both ovarian and uterine, had led me to the conclusion "that they were, like the Marsupialia, ovo-viviparous; and I conjectured that the utero-gestation would be more prolonged, and the allantois and umbilical vessels probably more developed.* But the period of gestation remained to be determined, and the decisive proof of ovo-viviparity, by the discovery of the fœtus *in utero* and the examination of its membranes, was a desideratum. This M. Verraux appears not to have supplied, but he says: "The number of *Ornithorhynchi* which I have possessed has perfectly demonstrated to me that this animal does not lay eggs, as has been supposed, but that it is ovo-viviparous. The ovaria, which form part of my collections, sufficiently prove this." *Ib.* p. 130. No doubt, had M. Verraux obtained the decisive proof above referred to, viz. the impregnated uterus, he would have mentioned it.† He does not specify his physiological deductions from the ovaria, but they were probably those which led me to the same conclusion in my memoir in the Philosophical Transactions for 1834. In that memoir I had stated that "the season of copulation was probably at the latter end of September or beginning of October:" but this point also remained to be determined by observation, together with the manner of the coitus. The latter is thus described by M. Verraux:—"Pendant le mois de septembre je parvins à découvrir que l'accouplement avait lieu dans l'eau. Caché soigneusement sous un cabane fabriquée exprès, et au fond de laquelle il me fallait rester des nuits entières sans oser me mouvoir, car l'Ornithorhynque est d'un naturel excessivement méfiant, je pus suivre tous leurs mouvements. Le mâle, après avoir poursuivi sa femelle plus d'une heure, finissait toujours par l'amener au milieu des roseaux. Là, se cramponant solidement à l'aide de son bec, il tenait fortement la peau du cou, tandis que les éperons s'appliquaient sur la partie postérieure. La femelle, tout en se débattant énergiquement, nageait et poussait des

* Phil. Trans. 1834, p. 564. Art. *Monotremata,* Cyclopædia of Anatomy.

† It is to the absence of this proof that Dr. Carpenter appears to refer, where he remarks, in his excellent 'Principles of Human Physiology,' 1842, p. 40, "No *positive* evidence has yet been obtained that its young are born alive." The minute size of the ovarian ovum, and consequently of the vitellus; the presence of small ova with a delicate chorion and without chalazæ or shell, in the uterine portion of the oviduct; the absence of any shell-forming portion of the oviduct,—all are elements of a body of *positive* evidence in favour of the ovo-viviparity of the *Ornithorhynchus,* which needs only the discovery of the fœtus *in utero* for decisive confirmation.

cris plaintifs qui offrait quelques rapports avec ceux d'un petit cochon, et qui allaient toujours augmentant: l'accouplement durait cinq ou six minutes, ensuite les deux animaux jouaient ensemble pendant plus d'une heure." *Ib.* p. 130.

We have seen that M. Verraux draws his conclusions from the ovaria of the female, that she is ovo-viviparous. The period of gestation has yet to be determined. I have calculated it at about six weeks, judging from the size of the uterine ova in a female killed December 8th in the Murrumbidgee river, and from that of young ones found in the nest in the banks of the same river two months afterwards. M. Verraux, alluding to the habit of the female to quit her burrow during the heat of the day, says that this occurs—"lorsqu'elles ont des petits, c'est-à-dire depuis novembre jusqu'en janvier," *ib.* p. 132: meaning, that she has young ones in her nest at that time. He states that "a gentleman in Tasmania, Dr. Casey, had discovered (but the date is not given) two nests of the *Ornithorhynchus*, one with a single young one, the other with two; they were naked, but vigorous in proportion to their size. Their beak did not at all recall the form of that of the adult, but was short, broad and thick, and could embrace in that state the mammary areola concealed by the hairs of the mother." This accords with the description and figures of the beak of the young *Ornithorhynchus* given in my memoir on the young *Ornithorhynchus* in the 1st vol. of the Zoological Transactions; where it is also shown, that "the tongue, which in the adult is lodged far back in the mouth, advances in the young animal close to the end of the lower mandible; all the increase of the jaws beyond the tip of the tongue, which in the adult gives rise to a form of the mouth so ill-calculated for suction or application to a flattened surface, is peculiar to that period, and consequently forms no argument against the fitness of the animal to receive the mammary secretion at an earlier stage of existence. The disproportionate breadth of the tongue is plainly indicative of the importance of the organ to the young animal both in receiving and swallowing its food. The mandibles are surrounded at their base by a thin fold of integument, which extends the angle of the mouth from the base of the lower jaw to equal the breadth of the base of the upper one, and must increase the facility for receiving the milk ejected from the mammary areola of the mother." The arrangement of the muscles for compressing the mammary glands I had described in a previous memoir. (Phil. Trans. 1832, p. 517).

M. Verraux adds:—"The young ones, while suckling, continually rub or triturate the mother's belly with their fore-feet, and sometimes with their hind-feet." "At the end of fifteen to twenty days the new-born are covered with a silky hair, and are able to swim." (Revue Zool. p. 132).

And he likewise describes another mode in which the young obtain their lacteal nourishment:—"I redoubled my attention and care, and by dint of perseverance, having at my disposition (always on the banks of the New Norfolk)* a pretty considerable number of adults and young, I saw the latter accompany their mothers, with which they played, especially when they were too far from the bank to take their

* River Derwent.

nourishment. I distinguished very well that, when they wished to procure it, they profited by the moment when the mother was amongst the aquatic plants, near the land, and where there was no current. The female having her back exposed, one can easily conceive that on the exercise of a strong pressure the milk would float to a little distance, and that the young might suck it up with facility; this it does, turning about so as to lose as little as possible. The manœuvre is the more easy to be distinguished, since one can see the beak move with rapidity. I cannot better compare the greasy liquid of the female than to the iridescent colours produced by the solar rays upon stagnant water. I have witnessed the same fact repeated daily and nightly. I have also remarked that the young, when it was fatigued, climbed upon the mother's back, who brought it to land, where it caressed her."*

With regard to the anomalous weapon of the hind-legs of the male *Ornithorhynchus*, the evidence of its function was summed up in my article *Monotremata* as follows:—"An objection to the theory of the spur and gland being a defensive apparatus is their absence in the female. Since then this apparatus forms a sexual character, it may be presumed that its function is connected with that of generation. Whether the spur be a weapon for combat among the males,—or, like the *spiculum amoris* of the snail, be used to excite the female, the injected secretion being an additional stimulus,—or whether the spur be mechanically useful in retaining the female during the coitus,—are conjectures which must be verified or disproved by actual observation."†

M. Verraux states:—"Quant aux crochets qui arment les membres postérieures du mâle, et qui, chez la femelle, sont rudimentaires, ils n'ont d'autre destination, d'après moi, que de maintenir la femelle pendant l'acte de copulation."—"Les expériences souvent réitérées à diverses époques m'ont attesté que ces crochets n'avaient rien de nuisible. J'ai même observé qu'en tracassant l'animal, jamais il ne cherchait à s'en servir comme moyen de défense," *ib.* p. 133. This precisely accords with what Mr. G. Bennett has recorded in the Zoological Transactions, vol. i. p. 236.

* "J'examinai aussi avec le plus grand soin la structure des mandibules du jeune, et la trouvant conforme à mes idées je compris parfaitement comment il pouvait obtenir sa nourriture. Je redoublais d'attention et de soin, à force de persévérance, ayant à ma portée (toujours sur les rives de New Norfolk)‡ un nombre assez considérables d'adultes et de jeunes; je vis ces derniers accompagner leurs mères avec laquelle ils jouaient, surtout lorsqu'ils étaient trop éloignés du bord pour prendre leur nourriture. Je distinguai très-bien que lorsqu'ils voulaient se la procurer, ils profitaient du moment où la mère se trouvait parmi les herbes aquatiques, à peu de distance de la terre, là où il n'y a aucun courant. La femelle ayant tout le dos découvert, l'on conçoit aisément qu'une fois la pressure fortement exercée, le lait surnageait à peu de distance, et que le jeune pouvait le humer" (suck it up) "avec facilité; chose qu'il fait en tournoyant afin d'en perdre le moins possible. Cette manœuvre est d'autant plus facile à distinguer, qu'on voit le bec se mouvoir avec célérité. Je ne peux mieux comparer le liquide graisseux de la femelle, qu'aux couleurs irisées produites par les rayons solaires sur l'eau croupie. J'ai vu le même fait se répéter tous les jours et toutes les nuits. J'ai remarqué aussi, que le jeune, lorsqu'il était fatigué, grimpait sur le dos de la mère, qui se dirigeait sur la terre, où il la caressait."—*Revue Zoologique*, 1848, p. 131, *note*.

† Cyclopædia of Anatomy, vol. iii. p. 407. ‡ River Derwent.

Upon the whole then, M. Verraux's evidence goes to confirm the ovo-viviparous theory of the *Ornithorhynchus*, determines the season and mode of coitus, agrees with the calculations previously made as to the period of gestation, establishes the function of the mammary glands, and describes two modes by which the young acquire the lacteal secretion: it also demonstrates one use of the perforated spurs of the male, though that of the secretion which they emit is still conjectural. The chief points then that remain to be determined by actual observation are—

1st. The precise period of utero-gestation.

2nd. The nature of the membranes or other structures developed for the support of the fœtus during gestation, and the order of their appearance.

3rd. The exact size, condition, and powers of the young at the time of birth.

4th. The period during which the young takes the lacteal nourishment.

5th. The age at which the animal attains its full size.

The most important desideratum for the physiologist is the impregnated uterus of the *Ornithorhynchus* at different periods. Such specimens are indispensable for the determination of the second point. It would seem that they might be obtained without any very great difficulty at New Norfolk river: it would require only to take or kill a female *Ornithorhynchus* at the latter part of September, and repeat the capture of other females during each week of the months of October and November, or in December if the specimen taken at the end of November was still pregnant. The hinder half of each of such specimens, with the female organs, or simply the impregnated uterus, should be preserved in strong colourless spirits; and if this should meet the eye of my esteemed correspondent Mr. Ronald Gunn, or of Dr. Casey, I would earnestly solicit their kind co-operation in transmitting such specimens to me at the Royal College of Surgeons, London.

On a New Species of Apteryx. By John Gould, Esq., F.R.S. etc.

[*Pro. Zool. Soc. Lond., June* 8, 1847.]

We have abundant evidence that at some former period New Zealand, and probably the Polynesian Islands, have been inhabited by a remarkable group of Birds, of which the *Dinornis*, so ably described by Professor Owen, formed a part, and of which the genus *Apteryx* is the only form at present known to exist: this form, so different from all others, has been, and will ever be, regarded with great interest, as the sole remnant of a race of which every other genus is believed to be extinct. Hitherto a single species only of this genus has been recorded: I have therefore no ordinary degree of pleasure in introducing to the notice of this Meeting a second, and if possible a still more extraordinary one than that previously described; and as I reported to the meeting held on the 13th of April, I have intelligence of the existence of a third and much larger species than either of them.

The bird I am now about to describe has just arrived from New Zealand by way of Sydney, but unaccompanied by any information as to the locality in which it was procured, or any particulars of its habits and economy.

It appears to be fully adult, and is about the same size as the *Apteryx Australis*, from which it is rendered conspicuously different by the irregular transverse barring of the entire plumage, which, with its extreme density and hair-like appearance, more closely resembles the covering of a mammal than that of a bird; it also differs in having a shorter, more slender, and more curved bill, and in the structure of the feathers, which are much broader throughout, especially at the tip, and of a loose, decomposed, and hair-like texture. I propose to characterise this new species under the name of *Apteryx Owenii*, feeling assured that it can only be considered as a just compliment to Professor Owen, who has so ably investigated the group to which I believe it pertains.

APTERYX OWENII. *Ap. corpus superius fusco et fulvo transversim radiatum; plumis singulis, ad basim argenteo-fuscis, in medio saturatius fuscis, deinde fasciâ semilunari transversâ fulvâ, cui macula succedit informis nigra, ad apicem fulvis. Corpus inferius superiore pallidius, pluma enim quæque inferioris corporis tribus radiis fulvis, superioris tantum duobus ornatur; fulvis quoque color inferiore longius quam superiore corpore in apicibus plumarum extendit.*

Face, head, and neck dull yellowish brown; throat somewhat paler; all the upper surface transversely rayed with blackish brown and fulvous; each individual feather being silvery brown at the base, darker brown in the middle, then crossed by a lunate mark of fulvous, to which succeeds an irregular mark of black, and terminated with fulvous; under surface paler than the upper, caused by each feather being crossed by three rays of fulvous instead of two, and more largely tipped with that colour; the feathers of the thighs resemble those of the back; bill dull yellowish horn-colour; feet and claws fleshy-brown.

Total length from the tip of the bill to the extremity of the body, 18 inches; bill, from the gape to the tip, $3\frac{5}{8}$; bill, $\frac{7}{8}$ broad at the gape; tarsi, $2\frac{1}{4}$; middle toe and nail, $2\frac{1}{2}$.

Hab. New Zealand.

Remark.—In this species the wing is even more rudimentary than in the *Apteryx Australis*.

ON THE SPECIES OF THE GENUS PLACENTA OF RETZIUS. BY J. E. GRAY, ESQ., F.R.S. ETC. ETC.

[*Pro. Zool. Soc. Lond.*, 11*th July*, 1848.]

LAMARCK describes three species of this genus, depending on the general outline and the waved or flat form of the shell, characters which are liable to considerable variations, as may be found on the mere inspection of any large number of specimens.

I have observed that the hinge forms a more permanent character, and affords the means of dividing the species into two sections, and furnishes characters which separate them from each other. In both subgenera the right valve is the flattest, and bears the ridges of the hinge.

Sect. I. *Placuna*, sp. Lamk.=*Ephippium*, Chemn.; *Placenta B*, Schum. *Shell purplish, subopake; hinge-ridges rapidly diverging from one another at about the angle of* 45 *degrees. Muscular scar under the centre of the hinge. The ridges of nearly equal length.*

1. *Placenta Sella.*—Shell flexuous, outline rather rhombic, being straight in front and rather notched behind; the ridges of the hinge not longer than they are separate from each other at the base.

Anomia Sella, Gmelin, S.N. 3345, 1788.

Placuna Sella, Lamk. Hist. N. 2.

Ephippium anglicanum maximum, Chemn. C. viii. t. 79, f. 714. cop. E.M. t. 174. f. 1.

Placenta Ephippium, Retz. 1788.

Inhab. China, India.

B. Shell nearly flat, subquadrangular.

Inhab. Australia. Brit. Mus.

2. *Placenta papyracea; Placuna papyracea*, Lamk. Hist. N. 2= *Ephippium parvum*, Chemn. Conch. viii. t. 79. f. 719. cop. E. M. t. 174. f. 2.

3. *Placenta Lincolnii.*—Shell flat, outline suborbicular, rounder before and behind; ridges of the hinge elongate, longer than they are separate from each other at the base.

Inhab. Australia; Mr. W. Davison. British Museum.

I wish to name this species after my excellent friend Mr. Abraham Lincoln, who kindly presented me with the specimen here described, and who is well known for his fondness for conchology, and the liberality with which he allows persons to use his extensive collection.

Sect. II. *Placenta; Placenta*, Schum. *Shell semi-transparent, flat, outline suborbicular; ridges of the hinge very gradually diverging from each other, the hinder ridge much the longest. Muscular scar rather in front of the middle of the hinge.*

1. *Placenta orbicularis*, Retz.; *Placuna placenta*, Lamk. Hist. N. 3; *Anomia placenta*, Linn. S.N. 1154; Chemn. Conch. viii. t. 79. f. 176. cop. E. M. t. 173. f. 2.

Shell colourless, semi-transparent; when young, pale purplish.

Inhab. China. N.W. Coast of Australia; *Earl of Derby*. Port Essington.

The shells vary a little in the inequality of the hinge-ridges, but the hinder is always the longest.

I may remark that Chemnitz gives the best character for the species, and has observed the character furnished by the hinge, which has been overlooked by Lamarck, and, as far as I am aware, by all recent authors.

Remarks on the Origin of Plants, and the Physical and Geographical Distribution of Species. By the Rev. Dr. Fleming.

[*Botanical Society of Edinburgh, June* 14, 1849.]

The author stated that it had been assumed as a first principle, connected with an extensive series of speculations in botany and geology, that *species* had sprung from *single centres*, and that the individuals had "radiated from one point to greater or lesser distances around it," according to Dr. J. Hooker; or that all the individuals of a species could be traced "from a single progenitor, or from two, according as the sexes might be united or distinct;" and hence the origin of the phrase, "specific centres." In opposition to this view, it was stated that the history of the human race, traced to their origin in a single pair, did not furnish an analogical argument of any value; while the dependence of the carnivorous animals on the herbivorous kinds, and the latter, along with man himself, on plants, gave good grounds to conclude that *many individuals*, of grasses for example, were requisite in the first instance, and were brought forth *abundantly*. These considerations rendered the assumption of "specific centres" extremely *improbable;* but the occurrence of similar species, in localities remote from one another, and even in opposite hemispheres, over which, by no conceivable process, could dispersion from a single plant be reconciled with the phenomena, did, in the opinion of the author, furnish a *demonstration* of its absurdity. Dr. Hooker, while admitting the identity of the species of opposite hemispheres, acknowledging about thirty antarctic forms as identical with European plants, even after careful comparison and with the ablest coadjutors, is inclined to consider the identity, not as indicating a multitude of progenitors of a species, but as an anomaly, the explanation of which must be sought for "*in some natural cause.*" Professor E. Forbes disposes of the anomaly in a more summary manner, by an *assertion*, that "species of opposite hemispheres, placed under similar conditions, are *representative*, not identical." If this opinion be correct, then form and structure are vastly inferior in value, in the determination of species, to *latitude*, a conclusion not lkely to be adopted. The author concluded by recommending the abolition of the term "specific centres of distribution," as involving an erroneous hypothesis, and the substitution of the phrase "*patches of distribution.*"

Dr. Fleming exhibited a specimen of *Xanthorrhœa hastilis*, which had been sent by Assistant-Commissary Neill from St. George's Sound, together with some implements manufactured by the aborigines, by means of the gum exuded from the bases of the leaves of this plant.

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XII.

On the Potato as an Article of National Diet, and the Potato Disease in connexion with Distress in Ireland. By J. E. Bicheno, Esq., F.R.S., F.L.S., &c. [*Read 14th March*, 1849.]

For some time past political evils have been but a small element in determining the condition of Ireland. The one great evil has been the almost exclusive cultivation and adoption of the potato as an article of national diet, with a rapid increase of population upon this low and degenerate food. The fearful calamities which have been witnessed of late years in Ireland had long been foreseen by the physiologist and economist as the inevitable results of such a national diet and system of cultivation, and have stamped the potato as the worst species of food for a people. As an adjunct to other and better food, the potato is beyond all praise; but as the chief article of consumption, and sole dependence of the inhabitants of any country, it becomes politically and economically a curse.

The scourge of famine and pestilence which swept Ireland during the years 1845-6-7-8, while it roused England and the British public to the most gigantic efforts at relief, awakened the warmest sympathies of the civilized world, and drew from countries and people alien in race and religion, and in political and social institutions,—from Europe, Asia, Africa, and America—from the Christian, the Moslem, and the Hindoo,—large and repeated contributions in aid. It was, perhaps, the first instance of the treasury of the world being poured into the lap of one unhappy land, to succour the necessities and mitigate the sufferings of its starving and plague-smitten inhabitants.

But nothing could stay the march of famine and pestilence: the means of relief afforded in 1845-6 seemed rather to increase than allay distress. All sense of self-reliance seemed to be lost; and the gentry, converting the world's benevolence to private emolument, were known to have placed their tenants on the roll of relief to obtain their rents: while, in 1846-7, the tenantry, before putting in their crops, said they would wait till it should be seen what Government would do—expecting that their labour in tilling their own ground would have been taken as relief work, and that their crops would have been literally planted for them. The failure of the crop in 1846-7 was followed by an entire change in the mode of relief,—the burden was thrown upon local funds administered by local functionaries; and the British Government, declining to take the initiative in any case, played the part of an able, willing, and munificent auxiliary to those who would help themselves.

In 1847-8, the crop again failed; but famine and pestilence had now swept away the people by millions, and the remainder were more easily dealt with.

It is to be hoped that a visitation of Providence so signal and protracted may yet be rendered a blessing to Ireland, by inculcating and graving deeply on the minds of its people how great and urgent the necessity is that, in future, they should seek their subsistence as a nation in some other article of food besides the potato.

The native country of the potato, *Solanum tuberosum*, is tolerably well ascertained to be the cold regions of the Cordilleras, in South America. Darwin, in his "Naturalist's Voyage," chap. 13, page 285, speaks of the potato being indigenous, as a littoral plant, on the *Chonos Archipelago*— "Having run up the coast, we anchored near the northern end of the Chonos Archipelago, in Low's Harbour, where we remained a week. The islands were here, as in Chiloe, composed of a stratified, soft, littoral deposit; and the vegetation was, in consequence, beautifully luxuriant. The woods came down to the sea-beach just in the manner of an evergreen shrubbery over a gravel walk. We also enjoyed from the anchorage a splendid view of four great snowy cones of the Cordillera, including '*el famoso Corcovado.*' The range itself had in this latitude so little height, that few parts of it appeared above the tops of the neighbouring islets. We found here a party of five men from Caylen, '*el fin de Christiandad,*' who had most adventurously crossed in their miserable boat-canoe for the purpose of fishing the open space of sea which separates Chonos from Chiloe. These islands will, in all probability, in a short time become peopled like those adjoining the coast of Chiloe.

"The wild potato grows on these islands in great abundance, on the sandy shelly soil near the sea-beach. The tallest plant was four feet in height. The tubers were generally small, but I found one of an oval shape two inches in diameter. They resembled in every respect, and had the same smell as, English potatoes; but when boiled they shrunk much, and were watery and insipid, without any bitter taste. They are undoubtedly here indigenous; they grow as far south, according to Mr. Low, as lat. 50°, and are called Aquinas by the wild Indians of that part. The Chilotan Indians have a different name for them. Professor Henslow, who has examined the dried specimens which I brought home, says that they are the same with those described by Mr. Sabine; * but that they form a

* Horticultural Transactions, vol. 5, page 249.—Mr. Caldcleugh sent home two tubers, which, being well manured, even the first season produced numerous potatoes, and an abundance of leaves. See Humboldt's interesting discussion on this plant, which, it appears, was unknown in Mexico,—in Polit. Essay on New Spain, book 4, chap. 9.

variety which, by some botanists, has been considered as specifically distinct. It is remarkable that the same plant should be found on the sterile mountains of central Chile, where a drop of rain does not fall for more than six months, and within the damp forests of those southern islands."

The localities in which *Statice, Armeria* and some other plants are found are apparently as dissimilar; and the distribution we may suppose to be dependent upon physical condition—it may be of moisture—of the atmosphere, and of the soil around, closely approximating to identity in such cases.

The first American settlers, sent out by Sir Walter Raleigh in 1584, found the potato in Virginia; and probably carried it to England with them on their return in 1586 with Sir Francis Drake. Mr. Thomas Harriot, who in 1579 took the degree of B. A. at St. Mary's Hall, Oxford, and was mathematical tutor to Sir Walter Raleigh, accompanied Sir R. Grenville to Virginia in 1585; in his "brief and true Report of the new found land of Virginia, of the commodities there found and to be reared, &c.," published in 1588, mentioned the potato under the *Indian* name *Openawk,* as having the roots round, and "hanging together as if fixed on ropes," and as "good for food, either boiled or roasted."

Gerarde grew the potato in his garden at Holborn in 1590, and published his herbal in 1597, giving a figure and description of the plant, recommending it as a conserve to be eaten "sopped in wine."*

* Gerarde, in his "Second Booke of the Historie of Plants," chap. 334, and pages 780 and 781, says of the sweet potato, or as he terms it "*Battata Hispanorum*"—"These rootes may serve as a ground or foundation whereon the cunning confectioner or sugar baker may worke and frame many comfortable and delicate conserves and restorative sweetmeats.

"They are used to be eaten rosted in the ashes; some, when they be so rosted infuse them, and sop them in wine: and others, to give them the greater grace in eating, do boile them with prunes and so eate them; and likewise

But some years before the introduction of the present root into England, another bearing a resemblance to it had been brought into the gardens—the *Convolvulus Battata*—(*Battatas edulis*) or sweet potato as we now call it, an inhabitant of a warmer climate, and very inferior in farinaceous matter. Spain received this from her Colonies on the eastern shores of Central America 40 years before the former, which belonged to the western side, and was called by the Spaniards *Batata:* its resemblance to the *Solanum tuberosum* led doubtless to the employment of our word potato as a name for both.

The sweet potato is the potato of Shakspeare, who, in his *Merry Wives of Windsor,* makes Falstaff call upon "the sky to rain potatoes," as a provocative to love; and in *Troilus and Cressida* there is a similar allusion to its virtues. In a cookery book of 1596, "the Good Huswife's Jewel," there is this recipe—"Take 2 quinces, 2 or three burr roots, and a potato, put them in a quart of wine, and let them boil till they be tender, draw them through a strainer, and put the yolks of 8 eggs, and the brains of 3 or 4 cock sparrows, and then you have a tarte that is courage to a man," &c., all which applies to the sweet potato.

America has contributed to the common stock of comforts

others dress them (being first rosted) with oile, vineger and salt, every man according to his own taste and liking; notwithstanding however they be dressed, they strengthen, nourish, and comfort the bodie, &c."

Of our potato, which he terms "Battata Virginiana, and Pappus," he says at pages 781 and 782:—"The roote is thicke, fat, and tuberous; not much "differing either in shape, colour or taste from the common potatoes, saving "that the rootes hereof are not so great nor long; some of them round as a "ball, some ovall or egge fashion, some longer and others shorter: which "knobbie rootes are fastened unto the stalkes with an infinite number of "threddie strings."

He adds—"The temperature and vertues are referred unto the common "potatoes; being likewise a foode as also a meate for pleasure equall in "goodnesse and wholesomenesse unto the same, being either rosted in the "embers or boiled and eaten with oile, vineger and pepper, or dressed any "other way by the hand of some cunning in cookerie."

belonging to civilized life four most useful and agreeable articles—the potato, tobacco, maize, and the turkey; and also, it is said, two most serious pests, the potato blight and the apple blight, both pertaining to the genus *Aphis,* or plant-louse—a genus not more remarkable for its extreme fecundity than for the singular fact disclosed by the researches of entomologists, that one sexual congress is sufficient to propagate numerous generations of *Aphides.* The ravages of the apple blight seem to have been first noticed in a nursery in Sloane-street, London, into which apple trees from North America were imported in 1787.

History would scarcely have suffered any material incident in the account of a battle to have perished; yet the name of him to whom we are indebted for the potato,—which has spread over the globe from Hammerfest, in Lapland, about 71° north latitude, to Van Diemen's Land, 40° south, and become an indispensable article of diet for all the races of men,—has found no record.*

Even Spain and Portugal, countries the least disposed to improvement, have at length adopted the potato as an article of subsistence; for, though they were the earliest to introduce it from their colonies, they have been the last to cultivate it. I quote from a friend's letter just received:—

"I spent six months in Portugal, which country is quiet enough (no small matter in these times); the Government insolvent and powerless, and the law of no force beyond the neighbourhood of the large towns: and yet the interior thriving after its fashion, as if to show us how little govern-

* Sir George Simpson mentions having found potatoes in a lodge of Pend d'oreille Indians, not far from the sources of the *Columbia* river, and nearly in the line of the Rocky Mountains.—"In one of their lodges we were surprised to find several baskets of potatoes; and, in answer to our inquiries on the subject, we were shown two patches of ground where they had been produced; the seed and implements having been supplied from Fort Colville."—Vol. I, page 144,—*Journey round the World.*

ment is required. I made two trips on horseback from Lisbon to Oporto, deviating a good deal from the high road, and spending some time in the country, and found the people with an appearance of comfort I hardly expected. Perhaps comfort is too strong a phrase, at least it must not be understood in the English sense. The country has advanced a good deal since I went there fifteen years ago; much more land is under cultivation, so that instead of *importing* they *export* grain. The potato has been introduced since my last visit, and is now a great part of the staple food of the people. I believe that Spain also has been improving, and even faster than Portugal, notwithstanding," &c. &c.

To Sir Walter Raleigh, under whose auspices the first but fruitless settlement in Virginia was planted, is attributed the introduction of the potato into Ireland. Sir Walter's intrepid spirit, and his love of enterprize, induced Elizabeth to reward him with a grant of 50,000 acres of land in Cork and Waterford, which he afterwards forfeited by getting into disgrace with his capricious Queen: his estate was subsequently divided between three noble families, which survive to the present day—*Cork*, *Burlington*, and *Devonshire*,—yielding an ample competence to each. Youghal, Bandon, Dungarvon, and Lismore are the centres from which the potato has been disseminated throughout Ireland.

In the opinion of some, all or most of the evils which have fallen so heavily from time to time on the mass of the population in Ireland are attributable to the cultivation of the potato, and to its general and almost exclusive consumption as an article of food; while others look upon its introduction among the greatest boons bestowed by Providence upon the exigencies of man. It seems certain that the potato, when relied upon as the sole subsistence of a community, exposes it to more casualties than probably any other cultivated plant which forms a national diet. I am not aware of any other instance in which a root has become the staple and almost the only food of a nation; neither the yam nor sweet potato are used to this extent. The *tapioca* plant, which yields a very important article of food in the tropical parts of America, and the *arum*, employed as a common diet in the South Sea Islands, are by no means the sole diet; they have in America beef, besides flesh of the guanaco and ostrich, several varieties of deer, bear's flesh, &c.; and in the Isles of the South Sea, they have the yam, the banana, the *arum*, and bread-fruit, with the flesh of the pig superadded.

The single vegetable which sustains, without doubt, the largest number of human beings is the rice plant; the myriad labouring classes of India and China are thus supported: and although rice is much less subject to failure than the potato, yet the main dependence for food being upon a single article, causes the countries in which it prevails to be exposed to the most fearful visitations of famine and pestilence. As a proof of the wide range of excess and of failure of crop to which the potato is subject, it may be mentioned that, in years of scarcity, it has been known to be ten times as dear as in seasons of plenty; whereas the range of wheat does not exceed two, or at most three, times its average rate in modern cultivation. The failure of the potato crop has been more frequent of late than in former years. Within the last twenty years, the following may be taken as years of partial or wide-spread failure:—1831, 1835, 1836, 1837, and 1839. The potato disease, which had appeared in North America in 1844, showed itself in Ireland in 1845, increased in 1846, was of milder type in 1847, and returned with greater virulence in 1848. The causes thereof are several. Population has increased, and consumption has been proportionally augmented; it has been necessary, in consequence, oftener to repeat the crop in the same ground, and the soil has become exhausted of the peculiar elements essential to the reproduction of the plant. The extraordinary success with which its cultivation is attended in fresh virgin soil, such as a new colony affords, sufficiently attests this point. The poverty of the people of Ireland has increased with their numbers, while their means of cultivating to the best advantage has diminished in an opposite ratio: again, this pressure upon the poorer and most numerous class of cultivators has tempted them to rear inferior varieties of the plant—such as the "lumper," the "ox-noble," and other cattle potatoes.

I think that the frequent repetition of these years of scarcity and famine serve to point to a still different cause of failure: one having even a more general influence, as affecting more intimately and vitally the plant itself—one which scarcely appears to have been noticed, except by some of the more distinguished horticulturists—one which we more especially have it in our power to assist in obviating, and to which, therefore, I would particularly draw the attention of members of this Society. It is now pretty well established as a law in cultivation, that there is a point beyond which it cannot be carried without occasioning the plant or flower to produce monsters, or to become unhealthy and die off. This is particularly the case in plants propagated by offsets, grafts, or from the roots. Where a new progeny is produced from seed, the cause of failure is not so apparent; the cereal plants, which have been cultivated for thousands of years, seem to possess the same fecundity as ever. Nations living on *rice*, and which has been their diet beyond all record,—India and China for instance,—are not subject to loss of crop, and their staple article of food, so frequently as the Irish. The gardener knows full well that, in the case of apples, the old sorts—such as the golden pippin, the nonsuch, the pearmain—have disappeared; and there is very little doubt that the theory of the late Mr. Knight, of Downton, President of the Horticultural Society, was well founded—namely, that propagation by graft is only the perpetuation of the individual. All apples increased by this method after a time die away; and so in the case of pinks and tulips, and all tubers, they die off. Early varieties of the dahlia even are not to be prolonged—partly, no doubt, because the gardener finds his advantage in raising new sorts; but partly, also, because old varieties disappear from the operation of natural laws. It is a fact well known that the American blight, so destructive to apple trees, attacks old sorts, and that some varieties are free from them. Reasoning upon analogy, there can be little doubt that, to continue to grow good healthy potatoes, we should be prudent in resorting to seed from time to time. I know that it may be objected that the vine has been propagated from cuttings for thousands of years, yet shows no deterioration: it is a sufficient answer for me, that in most plants the rule seems to be otherwise,—and this may be an exception.

Many plants are selected by the florist and horticulturist because of their sporting tendencies. The potato is a plant of versatile disposition—how else could it be believed that the "ox-noble" is the same species as the "ash-leaved kidney?"

Now, it seems very desirable that in this new country some new varieties of potatoes should be raised from seed; and it ought not to be left in the hands of the market-gardener, whose interests, however obviously they may lead him to cultivate a favourite sort, whose excellence is well known and acknowledged, are just as plainly opposed to the great loss of time, attention, and labour involved during several years spent in bringing the tuber to a sufficient size, in ascertaining its value, and establishing for it a character and reputation. In the case of such new produce, it must be indubitably established that *it is* from seed—a cardinal point not to be entrusted to any one who is to make money by it. The experiment should, therefore, be undertaken by gentlemen who look for no recompense, and whose sole object is to confer a benefit on their country and their fellow-man. Still, more especially, does it appear to me to fall within the province of this Society to conduct such an experiment: we have a virgin and not ungenerous soil—our climate is most favourable to the plant—we have every means and appliance at command; and I am very confident that there lacks not amongst us a disposition animated by the highest motives.

I now produce to the meeting sections of the *leaf*, and of the *tuber*, of the potato affected by disease as it exists in Ireland, and also of the insects to which the mischief is attributed, for examination through my microscope under a high magnifying power. I am sceptical as to the disease originating with the *Aphis;* it seems to me more likely that the insect is the effect, than the cause. Disease and decay have two concomitants, fungi and insects, one or both. In England the notion is, that this *Aphis* (a species well known to the gardener) is brought by the east wind. It is a notorious fact, that winds from this point of the compass are unfavourable to the health of plants. They predispose, therefore, to blight; and hence the notion that east winds carry the disease.

When the elm trees in St. James's Park and the neighbourhood of London were observed to be dying, about twenty-five years ago, without any other apparent cause than that they were infested with a grub which groped its way under the bark, the Government appointed several scientific gentlemen to investigate the matter. They came to the conclusion that the unhealthy condition of the trees prepared a *nidus* for the insect, and that the real cause of the malady was the dense population, the consequent increase of coal fires and smoke, and deterioration of the air, by which it was rendered less fit for vegetable respiration. Whether the newly planted trees have become acclimatized I know not.

The aphides of the potato may similarly be regarded as the *result* of a diseased condition of the plant; and I have no fear that the health of new plants, raised from seed in a new colony, would be readily affected by them.

XIII.

On Docks—Dry, Wet, and Floating. By His Excellency Sir William T. Denison, F.R.S., F.G.S., &c. [*Read 11th July,* 1849.]

Thinking it desirable that the Papers of the Royal Society should not be merely a record of new facts or observations upon matters connected with the progress of the arts, but that they should also contain such of the results of the experience of the members as may be likely to prove of practical use to the community, I have embodied in the present paper some general observations on the subject of the construction of dry docks, which will serve as an introduction to the detailed drawings and descriptions of some floating docks with which I was furnished some years ago by some friends in America, and which I now present to the Royal Society.

The term dock may be considered as a generic term, embracing all enclosed spaces for the reception of shipping. I say *enclosed spaces,* for although an area similar to that now in process of construction on the new ground in the rear of the Franklin Wharf will practically have all the advantages of a dock, yet as it is open to the sea, and as the tide will flow in and out uninterruptedly, it will be properly termed a tidal basin.

Docks, then, are enclosed spaces for the reception of shipping; and it is usual to classify them under the two heads of wet and dry docks.

The first of these is generally a large area where ships are always kept afloat. The second is not in general larger than is necessary to receive one, or at most two vessels; and arrangements are made to allow all the water to be withdrawn from the dock, so as to leave the vessels dry to enable shipwrights to work upon them, and to execute all the necessary repairs.

The wet dock presents but few features of interest to the inhabitants of Hobart Town. Our harbour is, in fact, for all practical purposes, a large wet dock capable of containing any number of vessels. The rise and fall of the tide is too small to affect to any extent the arrangements which may be made on the wharf for the convenience of loading or discharging cargoes, and there is always depth of water sufficient alongside the wharf to float the largest vessels.

At Launceston, however, it may be desirable eventually to enclose an area in which vessels may always be kept afloat. The tide in the Tamar rises from 10 to 12 feet, and vessels alongside the wharf are aground at low water, and are liable, therefore, occasionally to receive some damage.

I propose, however, to limit myself at present to the subject of dry docks.

The object of these being to facilitate the repairs of vessels, it stands to reason that in a port which, like Hobart Town, is visited by upwards of 92,000 tons of shipping annually—where the vessels belonging to the port are increasing daily—where ship-building is carried to an extent seldom seen in a colony, and where the cheapness and quality of the materials used, and the comparative cheapness of labour, will, in all probability, lead to a still greater extension of this trade,—it would be advisable to offer every possible facility for the repair of the shipping trading in these seas.

Hundreds of vessels are employed in the trade of these colonies—hundreds of vessels belonging to different nations are employed in the whale fishery; and it is not too much to expect that, whenever any accident might render repair necessary, many of these vessels would resort to this port,—which is easy of access, where the climate is good, where provisions and stores are cheap,—could we offer to them the necessary facilities for the execution of the repairs of which they might stand in need.

As, therefore, the interests of the Colony are, I may say, to a certain extent bound up in this question, I have thought that a sketch of the different systems upon which dry docks have been constructed, together with an account of the difficulties attendant upon their construction in different localities, would not prove uninteresting, more especially as introductory to a more minute account of a plan which has been adopted in America, in a locality analogous, as far as regards the rise and fall of the tides, to the harbour at Hobart Town.

Dry docks, for the reception of ships while under repair, may be classed under two heads :—

1st. Those where the space for the dock is excavated out of the solid ground, and made secure by some means from the percolation of the water.

2nd. Those where the receptacle for the ships is itself afloat, being, in fact, a floating chamber, large enough to receive a vessel, with means and appliances for preventing the ingress of water, and of getting rid of it should any leakage take place.

There is also a third class, which, however, can hardly be called a dock, inasmuch as when the vessel is floated into its place, it is afterwards lifted bodily out of the water by means of some mechanical agents.

In considering the construction of those belonging to the first class, one of the first circumstances to be taken into consideration is the rise and fall of the tide, at the point where the dock is to be made. Should the rise of tide be great, (exceeding, in fact, the draught of water of the vessels for whose use the dock is intended), the difficulty of the construction and working of the dock is very much diminished—the foundation being above low water-mark, the whole of the work can be done without incurring the expense of constructing a coffer-dam to keep out the water. As the water ebbs below the floor of the dock, no provision need be made for pumping the water out of it, as it can be allowed to flow out at ebb tide.

Little or no difficulty will be experienced in keeping the apron in front of the entrance clear for the opening of the gates, as it will be exposed at every tide.

The construction, therefore, of a dock in a tidal river, when the rise of the tide exceeds say 20 feet, is the simplest operation of the kind; and I will proceed to give an account of the difficulties which are likely to be met with, and the precautions which must be taken, in order to secure the work as it proceeds.

The first matter to be looked to is the foundation of the proposed dock,—Is it solid enough to sustain the load which it will have to carry without the assistance of piles, or some other artificial support? If solid enough for that purpose, is it pervious to water? On the answer to these questions will depend, in great measure, the cost of the construction.

Should the foundation be, as is often the case in tidal rivers, a mere mud-bank, it will be necessary to provide a solid bearing for the floor of the dock and the side walls, by driving such a number of piles as may be necessary to sustain the whole weight of the dock and of the vessel which may be under repair in it. Upon the piles will the floor of the dock be laid. If the material of which it is constructed be stone or brick, a platform of timber will be required upon the top of the piles. Should the ground, however, be solid, it will be levelled to receive the floor of the dock, which can be built at once upon it.

Whether, however, the ground be hard or soft,—whether it be necessary to use piles or not, there is one most essential precaution to be taken in laying the floor; for want of proper attention to which many accidents and failures have taken place.

The floor, however constructed, should be able to resist the upward pressure of the water. At high water, when the dock is completed, the gates closed, and the docks empty, should there be any means by which the tidal water could make its way under the floor of the dock, a thing not unlikely to happen, there would then be an upward pressure equivalent in pounds weight to the area of the part thus acted upon by the water, multiplied by the height of the water outside above the floor, and this multiplied again by $62\frac{1}{2}$ lbs., the weight of a cubic foot of water.

If we suppose the area of the floor to be $120 \times 30 = 3600$ feet, and the height of the water 20 feet, $3600 \times 20 \times 62\frac{1}{2} =$ 2009 tons.

Provision is made against this pressure when the floor is constructed of stone, by making it in the shape of an inverted arch, and taking particular care that the joints of the masonry are tight.

When the floor is of wood, the beams of which it is made should be near enough together and strong enough to withstand the pressure, and the planks spiked upon them should be carefully caulked.

The weight, too, of the walls should be calculated to withstand the maximum lift which might be exercised by the upward pressure of the water, as well as the pressure of the earth behind them.

The floor and the walls being constructed with all the arrangements which may be desirable, in order to facilitate the work of the shipwrights,—such as steps from bottom to top, slides for timber, altars or steps for the shoring timber to rest against,—the next thing to consider is the mode in which the entrance should be closed. This may be done in two ways,—either by gates, or by a caisson, which is a floating vessel made to fit into grooves in the sides and bottom of the dock entrance, and which can be floated into its place and then sunk so as effectually to close the opening.

The question as to which of the two plans is to be adopted turns upon a variety of considerations. When the opening of the dock is not very wide, and there are means of clearing the apron in front from any collection of mud or sand, gates would probably be the cheapest, and most certainly the easiest mode of closing the entrance; but when the opening is very wide, as in the case in docks which are required to admit steamers of a large class, and where there is the risk of collecting mud and sand to any great extent upon the aprons in front of the gate, which it would be difficult to remove on account of the depth of water over the sill at low water, then a caisson is the cheapest and most effectual mode of keeping out the water. There is an advantage attendant upon a caisson even where the water does ebb nearly away from the apron, inasmuch as it is possible to retain a head of water in the dock, and to let it out by means of sluices through the caisson,—thus creating a scour in front of the dock entrance, which may keep it clear of deposit.

When I stated that, under certain circumstances, gates would prove the cheapest and easiest mode of closing the entrance, I referred principally to those which, turning upon heel posts fitting in a groove in the piers of the dock, meet at an angle, and are supported against the pressure of the water,—partly by the sill against which each leaf rests at the bottom, and partly by each other: the angle at which the leaves of the gate meet render it impossible that they should yield to the water, unless the piers against which the pressure is thrown should give way, or the framing of the gate itself prove too weak. There is, however, a simple kind of gate, composed of three portions, two of which rest in grooves, or against projections in the sides of the piers and against a sill at the bottom; while the third fits in a sort of keystone between them. These are allowed to float away when not required, or to lie on the apron,—are hauled into their proper position by ropes,—and, when once fixed, have the additional support of shores against the piers, as shown in the sketch. This arrangement is cheap in its original construction; but it is clumsy, and requires a good number of hands to work it properly. The objection to the caisson is, that it requires a number of hands to work it, especially if the tide does not ebb sufficiently to allow of the water which sinks it into its place being drawn off, the labour of pumping water out of a caisson is very great.

These are the principal matters which have to be attended to when a dock has to be constructed in a river where the tide ebbs away below the level of the floor. The same difficulties will have to be surmounted by the engineer in constructing a dock where there is little or no rise of tide:

but, as in this case, the whole space intended to be occupied by the dock must be excavated to the necessary depth below the surface of the water in the river and harbour, he will, in addition, have to exercise every precaution to prevent the water of the river making its way into the excavation. A coffer dam, as it is called, must be constructed, steam-engines and pumps provided, to keep the work clear of water; and after every precaution has been taken it may be found that, owing to the porous nature of the soil, or other circumstances connected with its geological character, it may be impracticable to execute the work except by means of a diving bell,—and that at a cost altogether incommensurate with the object to be attained.

At Bermuda, the Ireland Island, where the Government dockyard is placed, is composed of a porous limestone, an aggregation of broken shells and coral sand, the whole being so pervious to water that an excavation at any point carried a foot or two below the level of the sea is filled with salt water in a very short time. By no means, then, but by the diving bell could either the necessary excavations be made, or the masonry of the floors and of the sides of the dock be constructed in such a situation.

A coffer dam is not merely an expensive undertaking, but it requires constant care and attention: it is generally made of two rows of sheet piling, about 5 feet apart—the interval is filled with clay puddle; care must be taken to connect the two rows of piles together by means of strong bolts to as great a depth as the water will allow,—the pressure against the piles by the weight of the clay and its tendency to expand by wet being very great. I have seen a pile, 12 inches square, broken short off by the pressure of about 20 feet of wet clay, the weight of which would not have exceeded 130 pounds to the foot: the effect, therefore, could not be attributed to the weight of the clay, but to the expansion caused by its absorption of water.

Great care must be taken to support the coffer dam against the pressure of the water by a proper system of shores; and this it may be imagined is not a matter of trifling importance, when it is considered that a head of 20 feet of water outside a coffer dam gives a pressure upon every foot of its length of $5\frac{1}{2}$ tons; and this, if the bottom of the pile be considered as fixed, is acting with a leverage of 10 feet to turn it over.

It is usual to place the shores at a distance of about 10 feet apart, in a horizontal direction, and of from 6 or 8 to 4 feet apart in a vertical direction; and even when placed at such short distances, the strain thrown upon them is enormous, calling for every possible precaution and attention on the part of the engineer.

While the coffer dam is in course of construction, care must be taken that the water inside is never allowed to remain at a higher level than that outside, otherwise the whole fabric will be forced outwards. Sluices, therefore, must be provided, by which a free communication may be established between the interior and exterior.

When the coffer dam is completed and the ground prepared, the work will proceed in the same manner as before described. All the precautions which were required in the dock built in the tidal river will be required: indeed, greater care should be taken, because, should any accident happen, it can only be remedied by the adoption of expensive means of shutting out the water and pumping the dock dry; while, in the other case, the repairs can be executed at once.

Having now said all that is necessary upon the subject of the first kind of dock, I will proceed to give a short sketch of the modes in which the floating docks, or those lifting docks mentioned under the third head, are brought into operation, merely as an introduction to the descriptions of those American inventions, drawings of which I now lay before the Society.

The simplest kind of floating dock is a large box capable of containing the vessel requiring repair, with space sufficient to allow the shipwrights to work: into this the ship is floated, the gates are shut, and the water pumped out,—the whole gradually rising till the weight of the dock and the vessel in it is balanced.

It is necessary in this case that the dock should not be placed in deep water, and that it should have either a level bottom or a soft mud to ground upon, as when the water is admitted the whole will of course sink.

The next kind is one in which, in addition to the simple box, there are water-tight chambers sufficient to float the dock itself when the water is allowed to enter it: by admitting water into these chambers, or by pumping it out, the dock may be sunk or raised to the proper draft of water of any vessel which may require repair.

The third class, or those which may be more properly called lifting docks, will in principle include the hauling-up slip,—a contrivance by which vessels, when floated into a frame rolling upon trucks, are hauled up an inclined plane till they are beyond the reach of high tides: but I shall not enter into any of the details of this plan at present. Those to which the term lifting docks is more especially applied consist generally of a series of frames supported from piles, or piers by chains, which chains may be acted upon by various descriptions of mechanical force,—such as hydraulic rams, or steam engines working wheels, round which the chains are wound, &c.

The objections to the floating docks are the difficulties which are encountered in repairing them. Should any accident happen to the floor, the only mode by which it can be repaired is by hauling the dock upon *ways* laid on a sloping beach till the shipwrights can get at the floor; and this would involve a large expenditure of labour and material.

The saving, however, in the first cost of construction would amply repay any outlay of the kind; and the objection does not apply with so much force to the lifting dock, which can at all times be repaired with ease and expedition.

I will now proceed to describe, shortly, the sketches and drawings which I lay before the Society.

The first is a floating dock, invented by Mr. Gilbert:—it is constructed entirely of timber, appears very simple, and is capable, as far as its principle is concerned, of being extended to take in vessels of any size. The side chambers, or camels if they may be so called, serve to support the dock when the gate is opened, and the dock filled for the admission of the vessel: a steam engine and pumps will be necessary in order to pump the water from these chambers, and from the dock itself. Mr. Gilbert's own description will give all the necessary details of the construction and mode of operation of this dock.

The second set of drawings consist of five, which are explanatory of all the details of Messrs. Skull and Martin's floating dry dock, which is, in fact, a lifting dock, in which the vessel, after being floated on to a cradle, supported partly by air-tight chests or tanks, and partly by framing attached to the floor on which the cradle rests, is lifted by means of pinions working into racks upon this framing,—the moving power being a steam engine, which turns a set of working shafts connected with the pinions.

In the drawings a large turn-table is shown, the object of which is to enable the cradle, with the vessel upon it, to be removed from the dock and transferred upon a railway to any part of the yard connected with the dock, which might thus be used for the repair of several vessels.

The third set of drawings comprises three, which give the details of another lifting dock. In this, which is of a less elaborate construction than that of Messrs. Skull and

Martin's, the immediate moving power consists of two large hydraulic presses, the pumps of which are worked by a steam engine, and which act through the intervention of connecting rods and chains upon a series of trussed frames, upon which the vessel is supposed to rest.

In the plans of the two lifting docks a good deal of ingenuity has been displayed; and I have no doubt that, under certain circumstances, an adaptation of some methods of lifting a vessel clear of the water analogous to these may be advisable.

In the circumstances, however, in which this colony is placed, I should hesitate in advising an attempt to carry out an elaborate system, which would require the perfect adaptation of the different parts of the machinery to each other to ensure success.

I should very much prefer the simple construction shown in the first sketch of a floating dock, where no skill is required beyond what the talents of the ship-carpenter can supply, and where materials of the best quality in the timber of our forests can be cheaply and easily procured.

XIV.

On the Modes of Shipping Coal practised at various Ports in England. By His Excellency SIR W. T. DENISON, F.R.S., &c. &c. [*Read 12th September,* 1849.]

HAVING visited in the year 1846, by direction of the Lords Commissioners of the Admiralty, the following Coal Shipping Ports in the North of England, viz., Newcastle, and North and South Shields, on the Tyne; Sunderland, on the Wear;

and Stockton and Middleboro', on the Tees; and having carefully examined the various contrivances at each of these places for facilitating the shipment of coal,—the following extracts from a Report which I made to the Admiralty on that occasion may not be unacceptable to the Society :—

The machinery in use at these different ports may be classed under three heads :—

1st. That of spouts or shoots, which have been in use for a long time, and is the simplest. Here the coal is delivered into a sort of box, the bottom of which is inclined at such an angle as will just cause the coal to slide upon it. The lower end of this box or spout is closed by a sliding door. To this box, which is a fixture, being connected with the framing supporting the tramway upon which the coal waggons run, is attached a moveable shoot or spout, for the purpose of directing the fall of the coal when the sliding door is withdrawn to the proper point on board the vessels.

The fixed box is filled from above, the coal waggons being emptied into it through a trap in the road between the rails : it contains sometimes as much as 10 or 12 tons.

The objection made in the trade to these spouts is, that they break up the coal into small particles and dust : they are, in consequence, only used for shipping the small coal and slack.

2nd. That of lever drops, which is a plan in common use both in the Tyne and the Wear.

In this the waggon, as in the former case, runs upon a platform, supported at some distance above the level of the wharf. Double lines of rails, with *turn-tables*, from distance to distance are laid upon this platform, in order that the lines of empty and loaded waggons may not interfere with each other, and that the latter may be easily brought to the points from which they are to be discharged into the vessel. At these points a stage is made to project toward the river, and a long lever, composed of two arms, far enough apart to allow of a coal waggon passing between them, and yet strongly connected by cross bracing, turns upon a centre or axis near the level of the wharf, at the foot of the stage: from the end of the lever is suspended a stage, which, when the lever is raised, is on the same level as the projecting stage of the platform; and to allow the waggon to run upon it without any difficulty, rails are laid on it to correspond with those of the platform.

The lever is kept in contact with the projecting stage by a counterpoise, to which two flat ropes are attached; which, passing over a drum on a shaft above the upper platform, are connected with the cross bracing at the head of the lever. This counterpoise is heavy enough to counterbalance the empty waggon, lever, &c., but light enough to yield when the loaded waggon is on the platform.

A powerful *brake* is fixed upon a large wheel upon the shaft which carries the drums, or on one which gears with it; and by means of this brake the descent of the loaded waggon or the ascent of the empty one is regulated. The mode of action is as follows:—

The waggon is run off the line of rails parallel to the wharf by means of a turn-table, and is pushed on to the hanging-stage by two men, and then wedged in its place: one of these men now attends to the brake, while another stands on the hanging-stage and accompanies the waggon. As soon as the waggon is fairly fixed on the platform the brake is slackened, and the weight of coal in the waggon (amounting to 53 hundred weight, or a Newcastle chaldron), causes the lever to turn upon its axis and descend, carrying with it the stage, the waggon and the men, the counterpoise being regulated to prevent any accelerated motion.

As soon as the hanging-stage or platform carrying the waggon is near the level of the deck, the brake is tightened and the whole remains fixed; while the man who accompanies the waggon loosens a *catch* which fastens the bottom of the waggon, and the whole of the coal is at once discharged into the hold of the vessel.

As soon as the waggon is empty the brake is again slackened, and the counterpoise coming into action brings back the lever and the empty waggon into its original position, and the latter is then run off to the line of rail appropriated for the empty waggon. In some instances the levers are nearly 60 feet long, in order that the waggons may be carried far enough out to *plum* the hatch of a vessel at that distance from the shore, for they are frequently obliged to remain at some distance from the wharf line for want of water in the river to keep them afloat.

By means of this contrivance from 60 to 80 tons can be put on board a vessel in one hour; and it has this advantage over the spout, that the waggon can always be brought down within a foot or so of the deck of a ship, so that the coal has no greater distance to fall than from the deck to the hold,—and there is, therefore, much less risk of breakage.

There are several modifications of the principle upon which this drop is made; the difference consists principally in the arrangements of the counterpoise. In one of these modifications the lever has its centre of motion in the middle of its length, or thereabouts; while the counterpoise is a fixed weight at the end of the arm.

3rd. That of vertical drops. This plan coincides with the second, in so far as a counterpoise is used to bring back the empty waggons,—but it differs from it in that there is no lever; the waggon is run out upon a platform supported by counterpoises, the motion of which is governed by a break-wheel. The platform and waggon descend together vertically,—one end of the platform working in two cast-iron guides, which are attached to the standards of the fixed stage or tramway. Provision is made by means of blocks and tackles for lifting the platform clear of the shrouds and rigging of the vessels when they are brought alongside of the wharf. This drop has of course no great amount of projection beyond the line of the wharf or front part of the fixed stage; it is principally in use at Middleboro', where there is a dock for the reception of the colliers, and where by means of this drop two men can load about 120 tons per hour.

These are the various systems now in use at the before-mentioned ports for shipping coal on board colliers, and by which an enormous amount of coal is shipped with very little delay or inconvenience. It is evident that, both in England and in this Colony, the charge for freight will form the largest item in the cost of coal; any arrangement, therefore, by which a vessel can be loaded rapidly will go to diminish this head of expense. The saving of a single day in loading a vessel on the east coast will be equivalent to a reduction of 8 or 9 per cent. at least in the freight,—throwing altogether out of consideration the diminution of risk to a vessel lying alongside a wharf in an exposed situation.

I have not given any sketches of the different kinds of machinery employed, not having brought out the drawings with me; but I have sent to England for them, and when they arrive I shall be happy to lay them before the Society. In the meantime I shall be willing to give any information which may be necessary to enable any competent person either to make a model of the machine, or such a drawing as may be sufficient to guide a contractor in forming an estimate of the cost.

XV.

On the Construction of the Bridge and Causeway across the River Derwent at Bridgewater, in Tasmania. By WM. PORDEN KAY, *Esq., Director of Public Works, &c.* [*Read* 14*th November*, 1849.]

THE bridge lately constructed for the purpose of connecting the end of the Bridgewater Causeway with the opposite or northern bank of the River Derwent forms part of the main line of road of communication between Hobart Town and Launceston. For several years the project of carrying a causeway and bridge across the river at this place had been a favourite one with the public; and in pursuance of that object the former work was commenced—and, indeed, nearly completed—by Colonel Arthur, when Lieutenant-Governor of this Colony.

With respect to the bridge itself, various plans had from time to time been proposed as being desirable to carry out; but much hesitation was shown to commence a work which, from the nature of the bed of the river, was, in the opinion of many, deemed to be one of much difficulty in execution, and some uncertainty in its accomplishment. The impediment also which, it was stated, would be caused to the navigation of the river by the erection of a bridge was another point of much importance, requiring consideration to be dealt with successfully.

These difficulties, however, have, I believe, been all satisfactorily met in the present work, which, although not laying claim to any architectural beauty of design, may be deemed a structure of high utility and advantage to the Colony, and likely to answer its purpose of public convenience for many years to come.

The bottom of the river across its whole width is composed of mud, varying from 5 to 15 feet deep, and under it is a bed of soft clay of unascertained thickness.

The depth of water in the channel, or deepest part of the river, is from 20 to 25 feet.

The rate of the current in the summer time, when the stream is lowest, is not more than from $1\frac{1}{2}$ to 2 knots per hour; and in times of a flood it rarely exceeds 4 knots.

From the above data it will be seen that no difficulty was to be anticipated in driving piles of any required length: the points upon which any doubt existed were, whether they could be so driven and secured together as mutually to assist each other in rendering the whole structure stable, and made sufficiently secure for carrying the superstructure and for resisting the pressure of the current in times of flood,—for it had long been contended that piles, when driven into so soft a stratum as the river's bed, would not be found to be equal to the required purposes.

Consequently, the contractors bound themselves to drive piles which, at the last or trial strokes, should not be depressed at each stroke more than 1 inch. This condition, however, was not fulfilled, and, apparently, could not be—no pile being driven which did not exhibit at the last stroke a depression of 3 or 4 inches.

The piles, which were from 65 to 90 feet long, could therefore have been driven with ease much further into the bed of the river had their length permitted; and they were not so firmly fixed immediately after driving but that they could be readily made to move or shift in their places from side to side. But it was found, after the duration of a month or so, that they became much firmer and stiffer, the clay bed in which they were placed adhering closer to them,—it having in the first instance been disturbed by the process of driving. In nearly all instances the depth of driving was 40 feet, and in some as much as 50 feet.

The supports of the bridge consist of 20 piers 8 feet broad, composed of 12 piles each in a double row, 10 of which carry the platform and 2 are for the purposes of fender-piles—the intervals form 22 bays of 32 feet span each; of an abutment of 25 feet long on the southern end adjoining the causeway of 25 piles: and of a pier carrying the moving parts, or rolling bridge, of 100 feet long, consisting of 98 piles.

The total number of piles driven is 363. The roadway is borne on longitudinal beams, 5 in breadth, carried from end to end by the heading pieces secured on the piles, and strengthened by a system of strutting between the several bays or openings.

At the third bay, from the northern shore, which has been made 35 feet in the clear opening, the navigation of the river is secured by the adoption of a moveable platform, or rolling bridge, which is readily removed, whenever occasion requires, to allow a vessel to pass through. It opens in the following manner:—

On the pier provided for the purpose are fixed a series of large flange wheels carried on strong timber framing; upon these the moveable part of the bridge is run in or out, iron rails being fixed on the under side of the longitudinal beams, which traverse upon the wheels as they turn.

The space which is thus occupied by the rolling bridge, when run in, is filled up when it is run out, or across the opening, by platforms upon wheels working laterally on railways at each side, right and left. The breadth of the roadway through these moving parts is considerably narrowed, being only 12 feet, and admitting but of one vehicle to pass at a time.

The method adopted for moving this bridge is by powerful crab-winches, working in toothed rails fixed on the framing under the bridge. They are worked by men standing on the bridge, who move along with it.

The lateral platforms are also moved by crab-winches fixed on the framing below, and working moveable toothed racks, which draw the platforms apart.

The rolling bridge is formed by large timber trusses placed on either side, and further strengthened or stiffened by suspension chains from a centre tower, or framing, erected on the bridge for the purpose.

A double row of fender-piles is driven (in addition to those already described as belonging to the bridge) at this opening, extending up and down the stream for a distance of 175 feet, upon which is placed a stage, which answers the purpose of a towing path for vessels while passing through the opening. The present amount of traffic on the river by boats passing is very trifling. A steam-boat once a day, and two or three small craft which occasionally pass, are all the vessels which require the bridge to be opened. No inconvenience or hindrance is felt by the steam-boat in going through, her passage being quite uninterrupted.

It may not be out of place to mention that some piles, which were driven 18 or 20 years ago for the jetty of the ferry on the north shore, showed no symptoms of the ravages of the worm (*Teredo navalis*), which is generally so destructive to timber works constructed in salt water; there is, therefore, every reason to hope that the bridge may escape injury from such a cause.

The extreme length of the causeway across the mud flats on the southern shores of the river is 2350 feet, and it averages in breadth 70 feet.

The length of the bridge from the end of the causeway to the northern shore is 960 feet, with a breadth of roadway of 24 feet.

The height of the roadway above the highest high-water level is 9 feet, while the greatest variation in the level of the tide is about 5 feet.

The whole work extending to a length to 3310 feet, or nearly three-quarters of a mile, is, I believe, the largest ever attempted in the Australian Colonies; a work which could not have been accomplished in this Colony but for the abundance of labour at the disposal of the Government, and which has been made available throughout the works from their commencement. From the slight records that have been kept of the actual cost and duration of the works at the construction of the causeway I am only able to gather the following particulars:—

It was commenced in 1830, and finished in 1839, at an average expenditure of £4500 per annum.

The solid contents of the material of the causeway filled into the river cannot be computed at less than 560,000 cubic yards, which, for the quarrying, moving, and placing, have cost 1*s.* 5½*d.* per cubic yard.

The cost of the bridge, completed, has been £7580, which, added to the former amount, makes a total expenditure of £52,780.

XVI.

On the Export and Consumption of Wattle Bark, and the Process of Tanning, &c. By J. MITCHELL, Esq., D.A.C.G. [*Read 12th June*, 1850.]

THE gradual decline which the following Table exhibits in the exportation of mimosa bark would seem to evince either an exhaustion of the supply, want of remuneration in the trade, or apathy on the part of the Colonists towards what may be looked upon as one of the most genuine of all colonial products. It is gratifying, however, to know that abundance of this article remains; and that, although exportation has diminished, colonial consumption has increased,—while the export itself still offers a fair prospect of gain to those who will devote an ordinary share of attention to its preparation.

The Table is taken from the Returns of the Board of Trade, which will be found published in the Sydney Gazette when relating to colonial produce; and by it there appears to have been exported from New South Wales—in which, it is presumed, Van Diemen's Land is included—in the year

1845	1710 tons.
1846	956
1847	408
1848	201

and to the 30th November only in 1849, 238 tons; thus showing a decrease of about one-half in each succeeding year until the last, when improvement seems to commence.

The value of sound bark in Van Diemen's Land at present ranges from £2 to £3 10*s*., according to dryness, or the year's strip. Its last quoted price in England was from £10 to £11 15*s*. The freight and charges may be estimated at about £4 10*s*., thus leaving £3 or so as the profit per ton to the exporter. Bark is admitted into England duty free.

Sufficient care does not appear to be taken in drying it, for it is frequently found to be damaged, and buyers are, consequently, cautious in making their purchases.

There is, however, another form in which the mimosa bark may still yield remuneration to exporters, viz., as an extract. This was tried several years ago; but, like the export in its natural state, it fell off, and to a much greater extent. As much as £80, it is said, has been given in New South Wales for a ton made from nine tons of the bark; but imperfect preparation and, what is much worse, adulteration have so lessened it in estimation, that its price has dwindled to £20 in New South Wales, and it is, consequently, seldom if ever made now. But when we remember the enormous outlay and venture attending the acquisition of whale oil, it surely seems desirable to attempt the renewal of an export nearly equal in value, attended with comparatively little expenditure; for the cost of boiling pots and a few casks from one whale ship would furnish the greater part of the material of an extract manufactory.

The bark to form extract is ground, macerated for 48 hours, and the infusion evaporated by boiling to the required strength.

It may be mentioned that an objection has been taken to our bark, which tells in price, though there is no real deterioration in quality,—it is said to turn the leather red, while the oak bark gives it a pale buff; but as colour is of no great importance in leather, it is unfortunate that we should suffer by what may be called a mere fancy of the trade.

There is inducement to redeem the character of the extract in the estimation of our shippers and manufacturers, as it is likely to be much more extensively used than heretofore. The article on tanning in the Penny Cyclopœdia contains a notice of at least one successful attempt to shorten the process by the use of extract; and it cannot be believed that this time-saving age will long submit to the tedious method hitherto followed, when it is known that hides have been tanned in a few hours; while from six months to two years is taken in the usual way.

The principle is now well understood by the intelligent tanner; yet, though every one knows that bark is used in tanning, few ordinary persons are so fully aware of the manner in which the transmutation takes place in the hide but that a brief explanation may render the subject more clear to them.

There is a chemical affinity, or attraction of combination, between tannin or the astringent principle of bark and all kinds of gelatin. This may be shown by pouring a small quantity of the extract into a solution of glue or other gelatinous substance; the two (the tannin and glue) combine and form a compound, leaving the water which held them in solution free.

The skins of animals being composed of gelatin attract the tannin from the bark, or rather its infusion, when they are placed together in the pits; but as the structure of the skins is extremely complicated and minutely cellular, the tannin is required to penetrate each cell, and combine with its sides, or fill it, before the skins are completely tanned. A single infusion will not carry a sufficiency of the tanning principle to effect this, and hence arises the tediousness of the process; for the water of the first infusion, after penetrating the cells and depositing its tannin, must be displaced by another and stronger infusion. As the outside cells also are the first to attract the tannin, they consequently form a barrier to the inner ones, which complete and long saturation alone overcomes. If a hide be taken from the pit before it is completely tanned and cut through, a white streak in the centre will mark the line of cells beyond which the tannin has failed to penetrate.

The great desideratum, therefore, is, a means of forcing a continuous stream of extract through the hide without destroying or injuring the texture. A variety of plans have been tried to effect this,—some with partial success, others with complete failure ; a few will be found mentioned in the article already alluded to, and by the saving of time effected with some of them considerable profits have been made : but there is generally some defect,—the hide is either too much stretched, imperfectly tanned at the edges, or marked by the apparatus used. The rolling between cylinders after emersion seems, however, to have obviated all these ; and no doubt this discovery will be improved upon.

It was thought that by placing hides in a strong chamber from which the air could be exhausted, and sudden injections of extract made, that the water might be drawn from the hides in this way after each injection, and the process repeated any number of times required ; but if this plan were tried, capillary attraction alone would prevent its success. Many have succeded in tanning a single hide quickly ; but any invention, to be of value, must be capable of being applied to hundreds at a time before it can compete with the present mode,—by which, in some of the large tanneries, thousands are turned from the pits at once.

It is singular that an art known from the earliest ages should have remained until the present day without any material improvement. Were Simon, the tanner, to appear among us he would find his craft much as he left it; but even he may be looked upon as a modern comparatively, for remains of leathern articles are found in the oldest ruins of Egypt and Assyria: indeed, the art may have been practised long ere human records existed, and seems to have immediately followed the earliest use of skins by the first of the human race.

XVII.

On a Specimen of Pristis cirrhatus, *by* J. E. Bicheno, Esq., F.R.S., &c. [*Read 12th June*, 1850.]

New Town, 8th June, 1850.

Dear Sir,—Last week an old fisherman brought me a fine specimen of a saw-fish, caught in the Derwent. It turned out to be the *Pristis cirrhatus*,—a rare and curious species, confined to the Australian seas, and first described by Dr. Latham in the year 1793, in the 2nd volume of the Linnæan Transactions, page 281, plates 26 and 27, with this specific character — *Pristis rostro cirrato spinis longioribus; brevioribus intermediis.—Habitat in Novâ Hollandiâ—In hac specie,* he says, *rostrum spinis circiter* 20 *acutis, modicè incurvis, muritum; brevioribus* 3—6 *interjectis ad latera subtus utrinque cirrus elongatus flexilis.*

The subject from which Latham described was a male fish, having a total length of about 40 inches.

The fish brought to me was a female, and measured full 5 feet from the extremity of the snout to the end of the tail. The larger of the spines, set along each side of its snout, were strong, bony, trenchant, and pointed; the smaller intermediate spines varied in number from one to three in each space, and wherever the number was three the middle one was the longest and stoutest: but there was no regularity in the number. Besides these there was underneath a series of minute spines in a partially developed state, projecting at right angles with the line of the former series standing singly, pointing slightly backwards, each being a little in advance of the larger spines along the edges. The larger spines were stiff and straight, without flexibility in their sockets; the smaller yielded slightly to the pressure of the finger in the backward direction. About the middle of the snout, from orifices on the under side, sprung two *Cirrhi,* like those of the sturgeon, about 3 or 4 inches in length, fleshy, pliant, and about the size of large whipcord.

The skin of the female *Pristis* resembled that of the dog-fish in colour and texture. The reproductive organs were in a favourable state for examination; for there was found in her two young ones,—the largest 8 inches and the smallest 6 inches in length,—together with 12 eggs, the largest being about the size of a pullet's egg,—a tolerable proof of the species being ovo-viviparous. The young ones appeared nearly ready for extrusion. The story of the young of some congenerous fishes taking refuge inside the mother is a fable.

The spines on the snouts of these young ones, although standing at right angles with the edges, are easily laid back close along the sides of this weapon, so as to offer no resistance to its passage through any channel where the head would pass.

The superior advancement of one of the two young ones, and the gradations in the eggs (which had all the appearance of having been impregnated), were very consistent with the notion of the whole brood being a series, the completion of whose gestation would be acomplished at intervals, as in the case of birds. It has been observed that in the highest cartilaginous fishes, of which this is one, there is in their mode of reproduction an approach toward the type of this process in the superior *Vertebrata;* and that the fertilization of the ova, whilst yet within the ovary, takes place by actual congress of the sexes. The condition of the ova and of the young in this case seems to warrant such a conclusion. I have to express my regret that the opportunity of making the examination with reference to this important point, which the specimen would have afforded, did not fall into the hands of some more experienced physiologist.

I have the honour to be,

Yours faithfully and truly,

J. E. BICHENO.

JOSEPH MILLIGAN, *Esq.*,
Sec. Roy. Soc. V. D. Land.

XVIII.

On Timber Trees of New Zealand. By Capt. COLLINSON, R. E., *with Notes by* WM. SWAINSON, *Esq.*, F.R.S., &c. [*Read* 10*th July*, 1850.]

1. *Totara.*—(New Zealand Yew, *Podocarpus Totara*). This is a soft close-grained wood of a red-brown colour, with shades of yellow occasionally, something like a light cedar; has a short fibre, and breaks easily; dries light,

and shrinks a good deal both laterally and endwise. It is almost the only wood used by the natives for the palisading of their pahs, and for their canoes, on account of its durability. I have seen stakes of an old pah, which had been by all accounts about twenty years in the ground, and they were sound. When worm-eaten it is said to be most durable. It is difficult to paint, on account of a greasy matter in it, which is probably the cause of its durability. It is not useful in carpentry, on account of its want of strength, except for sleepers and boards; but it is useful in joinery on account of its easy working. *Totara* splits easily into shingles and laths.

It grows all over New Zealand, both on flat and hilly ground, but is more luxuriant on moist flats. It averages about 3 feet in diameter and 70 feet in height. It is not so plentiful as white pine, except in particular localities. Logs of it have been found 5000 feet above the sea lying on the ground, and also below the level of high water buried 6 feet in the clay. Its leaf is small, narrow and pointed, about $\frac{1}{2}$-inch long and $\frac{1}{8}$-inch broad. The tree grows to a bush at the top: it bears a small orange berry with a black seed on the top of it and ripens in June,—the bark splits off in large flakes. The specimen was got from a large tree in the flat valley of the Hutt, probably about 200 feet above the sea, and was cut in October, 1849.

(*Note by W. Swainson, Esq., F.R.S., &c.*—The *Totara* is the most valuable wood in New Zealand for building, fencing, and furniture; for it is not affected by wet, which rather preserves than injures it. I have seen large trunks that have remained buried in swamps for perhaps two centuries as sound and entire as ever. I believe there are three species: the red-wooded sort is superseded in the barren clay districts by one with a pale yellow wood; and a third is found on the hills, high up the Hutt Valley, which assumes a conic form, is seldom more than 30 feet in height, and not more than $1\frac{1}{2}$ feet through.)

2. *Rimu,* or *Red Pine.*—(Order *Coniferæ, Dacrydium cupressinum).* Is a pine of a red-brown colour, with dark-brown veins; it has a long fibre, and frequently contains resin, but does not burn well. Polishes something like a coarse mahogany; it shrinks laterally in drying. The heart of it is a durable wood. From its strength and quantity it is more used in carpentry than any other wood in the south part of New Zealand, and is good for all descriptions of carpenter's and joiner's work.

It grows, I believe, all over New Zealand, but chiefly south of latitude 39°, replacing the Kauri, which stops about that latitude. It is found both on flat and hilly ground, but most luxuriant on the hills.

It averages 3 feet in diameter and 80 feet in height, growing to a peak with pendulous leaves. On level spaces among the hills there are groves composed almost entirely of small *Rimu* trees, very suitable for spars, being about 2 feet in diameter and 50 feet in height.

It is about as plentiful as white pine. The leaves are something like spruce fir, and hang downwards. The bark is in dark rough flakes. The fruit is a red berry with a black seed on the top, ripe in May.

The specimen was taken from a large tree at Karori, 3 miles from Wellington,—a hilly district, about 600 feet above the sea. It was cut in October, 1849.

(*Note by W. S.*—There is, I consider, a second species, which I have called the weeping pine, *Dacrydium pendulum.* The common *Rimu,* as well as the weeping species, is almost exclusively confined to poor stony or clay soils, which are unfit for agricultural purposes; for not one is found in the rich alluvial lands of the Hutt valley.)

3. *Kahikatea*, or White Pine (*Dacrydium excelsum*).—A pine of a clean white colour, and long close grain ; dries light, and shrinks laterally. It does not last more than three years in the ground.

From its quantity, and easy working, it is much used for inside carpentry and common work; and, from its clean white appearance, is very good for interior work.

It grows, I believe, all over New Zealand, like the red pine, but chiefly in the southern parts. It is found both on flat and hilly districts, but most luxuriant on flat wet ground. It grows in thick groves of long thin clean trees, averaging about 2 feet diameter and 70 feet high, growing to a peak at top; the leaves are like spiked leaflets on soft stems, growing thick and pointing upwards; bark round and in smooth flakes, and dark coloured; fruit a red berry with a black seed on top, ripe in June. The specimen was taken from a large tree in the Hutt, and was cut in October, 1849. There is about half the quantity of white pine that there is of black birch in the south part of New Zealand.

(*Note by W. S.*—I have never seen the true *Dacrydium excelsum* on the hills rising from the Hutt valley, although on the flat alluvial soil of that valley itself it grows to a great size. In this locality it takes the place of the *Rimu*, which is strictly confined to the hills, so that the two species are only found together where the stony poor soil blends with the rich alluvial mould of the valley itself. It was with *Totara*, the commonest tree in the Hutt valley; but both are rapidly disappearing.)

4. *Tawai*, or black birch, is the most plentiful of any wood in the south part of New Zealand. It is of a light brown colour, with light veins, and a tough, close, and knotty grain. It is used frequently for ship-building, both for timbers and planks, and is said to last well; but it has

not been used much for carpentry, owing, I think, to its being more difficult to procure, and harder to saw and work up, than the pines. *Tawai* splits easily into shingles and laths.

It grows chiefly in mountain districts, and invariably in the poorest clay soils, where none of the other forest trees of the alluvial grounds are found. It is a mark of hard clay or gravelly soil. The rich flat grounds are covered with pines and other trees, whilst on the surrounding hills are forests of nothing but black and white birch, extending for miles ; and these forests are almost bare of underwood, which in the pine forests of the richer ground is remarkably thick. It grows like the English beech, and the leaf is something like the leaf of the beech. The bark is black and rough.

The specimen was cut from an average tree from the hills on the east side of the Hutt. The average diameter is about 18 inches, and height 50 feet.

(*Note by W. S.*—There are two distinct species in the Upper Hutt, the black and the white birch, known by the colour of their bark and the different shape of their leaves. A third is found on the mountains, and its lower branches hang on the ground. I have only seen this remarkable kind in the mountain glens of the Wai-nui-ornata.)

5. *Tana* (*Laurus Tana*) is not used in carpentry. It has a light coarse grain, with dark streaks. It burns well.

It grows almost exclusively on the flat alluvial grounds, being a mark of rich soil. It bears a leaf something like that of the willow, and grows like the ash. The fruit is a dark plum with a turpentine flavour, ripe in June.

The specimen was taken from a small tree in the Hutt, and cut in October, 1849.

(I have seen this tree in the Upper Hutt valley grow to an immense size.—*W. S.*)

6. *Rata* (*Metrosideros robusta*) is much used in ship-building for timbers, and by wheelwrights, on account of its toughness and crooked form. It is a dark red wood, like coarse mahogany, strong and tough. It grows chiefly on hills, and is a parasite. The stems grow up other trees, and, gradually uniting, replace the original, and grow to a great size, with ribbed trunks and crooked branches. It is therefore difficult to get a plank out of it. The leaf is like the myrtle leaf; it bears a crimson flower in December. The average size is about 3½ feet, and 50 feet high. The specimen was taken from a 2½-feet tree, at Karori, and cut in October, 1849.

(*Note by W. S.*—This is the most gigantic tree of this part of New Zealand. It is not always a parasite, as I often saw very large individuals with solid stems. Like the *Totara,* it resists wet, and ignites rapidly.)

7. *Kohai* (yellow).—A small tree; the wood brown, close-grained, and very tough and hard. It is used for cogs, and would, I think, be useful for all the purposes for which *Lignum vitæ* is used.

It grows near the water, in sandy soils, and among rocks, and bears a little round leaflet.

Specimen taken from the Hutt; cut in October, 1849.

8. *Matai,* or *Mai.*—A yellow pine, with a smooth clean grain, and a uniform colour—very good for all joiner's work, from its hard texture, and easy and fine working, and from its not shrinking in drying, being almost the only wood in New Zealand that does not. It polishes well to a dark yellow, is as durable as *Totara,* containing the same greasy matter, which makes it difficult to paint. It is much used for joiner's work, but not for carpenter's work, on account of its brittle grain.

It grows best on the hills, but is also found on the flats. It averages 2 feet in diameter and 50 feet high; bark like that of the *Kahiketea;* leaf like that of *Totara*, but smaller; bears a black berry with a stone inside, ripe in May; is as plentiful as *Totara,* but more expensive, being harder.

Specimen from Karori; average tree, cut in October, 1849.

9. *Mairi.*—There are two kinds, the black and the white. The black *Mairi* is a dark-grained wood, very strong and hard. It is used for strong framework; is very durable; but not being plentiful, and being very hard to cut, it is not much used. It grows only on hills, and poor stony soils. The leaf is about 2 inches by $\frac{1}{8}$-inch, dark olive colour, growing in pairs. Bark rough, average size 18 inches and 40 feet high. Specimen cut at Karori in October, 1849.

White Mairi is of a lighter colour, with dark veins. The wood is like ash, and is used for the same purposes, but it is not plentiful. It grows on hills like the last; it bears a large red berry in winter. Leaf long and oval like a laurel, bark light colour and rough. Specimen from Karori; cut in October, 1849.

10. *Rewa-rewa*, or Honeysuckle, *(Knightia excelsa)*, not used in carpentry or joinery, but frequently in fencing, because it splits easily. The wood has a coarse grain, in red and white veins, with cross red veins, giving it a mottled appearance. It grows on the hills, but is not plentiful; has a smooth round bark, with lumps projecting, and a long serrated leaf; seed ripe in November; average about 18 inches and 40 feet high. Specimen from Karori; cut in October, 1849.

(*Note by W. S.*—This is one of the few trees that grows both on poor and rich soils. In the latter it reaches a very superior size, and is at once known in the forest by its close conical manner of growing.)

12. *Miro* (a pine) is a wood something like elm, of a red-yellow colour, short-grained, hard, knotty and durable; not being plentiful, it is not much used.

It grows on hills. The bark is like that of *Kahikatea*, but smoother; the leaves like those of *Totara*, but larger, and grow in regular pairs on the stem. Bears a small red fruit with stone inside, ripe in May. Averages the same size as *Mai*. Specimen from Karori; cut in October, 1849.

13. *Pukatea* is a common tree, both on hilly and flat country, but is not used for carpenter's or joiner's work, having a coarse grain and no strength, and being liable to decay. It is the worst burning wood we have. The leaf is something like that of the *Rata*, but serrated. Specimen from Karori; cut in October, 1849.

(*Note by W. S.*—This is one of the most gigantic trees in the Hutt forest, inferior only to the *Rata*. In the upper valley it is very rare, but in the lower it forms nearly three-fourths of the forest. On the hills it is rare and very small.)

14. *Hinau*—Is a light-coloured wood, something like oak, is supple and tough, and is used for cart-wheels and shafts, and for ships' timbers, but not extensively, being not plentiful, and generally of small size.

It grows chiefly on poor flat lands, or on hilly grounds. The bark is very rough, the leaves are oval and olive-coloured. The sap is used by the natives to make a blue-black dye, and the bark is used in Wellington for tanning; average 18 inches and 20 feet high. Specimen from Karori; cut in October, 1849.

15. *Titoke*, sometimes called by the natives *Topetope*, a light-coloured wood, with a tough and twisted grain, and knotty. It is the wood generally used by wheelwrights in the south part of New Zealand, and is also used for

ships' timbers. It is plentiful on the hills, but difficult to get at.

It is a small tree. The leaf has something the appearance of the oak leaf, being of the same size and colour, and serrated.

(*Note by W. S.*—I have only seen this tree in the alluvial lands of the Hutt valley, where it grows to the thickness of a man's body, but often to twice the size. It is almost superior to the *Rata* in hardness, and generally breaks the axe of the woodman. If left to expand, the stem is very straight, and it is then a beautiful tree.)

16. *Whawako*, common in the low swampy parts of the Hutt forest, where it is much esteemed for fencing, as its split is straight and easy. Its leaf very much resembles that of the olive and the *Tana.*—(Not having seen its flower or seed, I know not its botanical character.—*W. S.*)

17. *Manuka, or Tea Tree.*—This is a very hard dark-coloured wood, used for sheaves of blocks and such purposes; it is common all over New Zealand, and grows either on sandy or hard clay soils; but being generally small, and hard to cut, is very little used, except for firewood and axe-handles. It is a common wood among the natives for spears and paddles. A small species of it covers the ground like privet; the larger species resemble the Scotch fir. The leaf is very small and lanceolate. It bears a little white flower like a small white thorn flower, and is very fragrant when in blossom. It burns very well. The average size is 12 inches and 20 feet high. Specimen from Karori; cut in January, 1850.

(*Note by W. S.*—This name is indiscriminately applied to all the specimens of *Leptospermum*, of which I have discovered six in the vicinity of Port Nicholson; some are very small, whilst others grow to 40 feet high or more. Other species are peculiar to Australia, where it is also called the tea tree. I find it recorded that a tree of *Leptospermum lanigerum*, of Tasmania, (not found in New Zealand, I believe), has been measured 70 feet high by 7 in circumference. This is the broad-leafed swamp tea-tree of the colonists.)

18. *Kauri.*—This specimen was obtained from the north of New Zealand. The tree does not grow in the south.

T. B. COLLINSON, *Capt. R.E.*

Wellington, New Zealand,
February, 1850.

Note.

Hobart Town, March 26, 1850.

I herewith forward to you specimens of the principal forest trees that grow in the southern parts of New Zealand, and a short account of each, to which William Swainson, Esq., F.R.S., of the Hutt Valley, Wellington, has had the kindness to add the botanical names and some notes of his own. I also send specimens of the leaves of most of the trees.

Specimens of each have been placed in a palisade now making round the Soldiers' Barracks at Wellington, for the purpose of testing their durability. Specimens of each will be placed in the Museum of the Royal Sappers and Miners, at Woolwich.

In case any experiments upon the strength of these timbers should be made by the Society, I shall be much obliged to you to forward some account of them to the Commanding Royal Engineer, Auckland, New Zealand, who will be happy to supply you with specimens of the northern trees.

I must inform you that amongst the northern trees is the *Kauri*, the most important tree of New Zealand, and the *Puriri*, called the oak of New Zealand, neither of which is included in the list herewith enclosed.—I am, Sir, your obedient servant,

T. B. COLLINSON, *Capt. R.E.*

The Sec. Roy. Soc. V. D. Land.

XIX.

On Laap, or Lerp, the Cup-like Coverings of Psyllidæ *found on the Leaves of certain* Eucalypti. *By* Thomas Dobson, *Esq., B.A., of the High School, Hobart Town.* [*Read* 11*th September,* 1850.]

The white saccharine substance called "lerp," by the Aborigines, in the north-western parts of Australia Felix, and which has attracted the attention of chemists, under the impression that it is a new species of manna, originates with an insect of the tribe of *Psyllidæ,* and order *Hemiptera.*

According to Latreille, (*Dict. Classique d' Hist. Nat.* art. *Psylla*), only six species of this genus are known, and these are all proper to Europe.

The three species described in this paper are, in all probability, new to entomologists.

The larvæ of several insects avail themselves of their peculiar secretions to form a rude tent-like protection from their enemies and the weather. Those of the *Crioceres* are concealed under an irregular mass, having the appearance of macerated leaves. The *Cassidæ, Coccidæ,* and *Psyllidæ* are hidden under a cloak of white cottony filaments flowing from the articulations of the body. The *Psylla Eucalypti* enjoys a more profuse supply of glutinous pabulum than its European congeners, and is thus enabled to construct a more artificial and effective dwelling. It is, perhaps, owing to the remarkable dryness and mildness of the winter just past that these insects have been obtainable in their various phases of transformation at all times during the last four months. The white conical tents of the larvæ and pupæ may be readily detected on the leaves of the lower branches of the stunted gum-bushes in the Government Domain here; the groups of minute ova are not so obvious, and the perfect insect is seldom seen abroad. It is more often met with in a quiescent state, after it has cast off its pupa skin, and while its wings are yet moist and shrivelled up. Its existence in the present state is either very ephemeral, or it escapes observation by its incessant restlessness, and the peculiar faculty of leaping, to which it owes its generic name.

To the unaided eye the eggs appear like small yellow granules scattered in groups on either side of the leaf, and unprotected by covering. (Fig. 1, plate xviii.)

Under the microscope they are seen to consist of a translucent pyriform membrane inserted into the leaf by a pedicle, and containing an amber-coloured fluid of somewhat darker hue near the neck or fixed extremity. Just before the exclusion of the larva, the egg bursts longitudinally from its free extremity. The body of the larva is nearly transparent, except the eyes and dorsal vessel, and resembles in form that of the subsequent pupa. An early stage of the pupa's growth is shown in fig. 2. A thick uniform cylindrical thread of a transparent viscous fluid issues from the anal aperture, and terminates in a considerable globule.

Finer filaments proceed from between the rings of the abdomen, near the extremity of which are two principal excretory glands. At almost every articulation of the body and limbs the microscope reveals minute globules of this white fluid.

Four lateral tubular cases contain the rudimentary elytra and wings.

Fig. 2 also exhibits the first framework of the conical roof. Portions of the strong central thread have been turned up the back by the bifurcated tail, one extremity of each portion rests on the leaf, the others meet together and form a rough apex to the frame-work over the back of the insect. By turning round its body the finer filaments are passed from rafter to rafter in the inside, until they form an open basket-like covering, and combine into one thin glutinous cup-like sheet. The subsequently secreted fluid oozes out in drops at the base, and hardens and elevates the original roof on the wall formed by these accretions. This occasions the appearance of superposition, and the lateral displacement of the apex observed in most of the specimens of old lerp. (Fig. 3 a.)

When the pupa is about to undergo its final transformation, it escapes from its skin through a fissure down the back, eats its way out of the cone through a round hole, and leaves the skin within.

But when the base is not too firmly attached to the leaf, the pupa creeps out from beneath, and throws off its skin on the leaf. The perfect insect is represented in fig. 4. The antennæ are filiform, and have ten articulations. The two first are much shorter and thicker than the others, and the last is terminated by two hairs. Two elongated parallel tubes compose the "sucker," as it is improperly called, with which the insect pierces the leaf, and procures its juices. The eyes are prominent, globular, and compound. Immediately behind each eye is an *ocellus.* In many individuals a third ocellus appears in the central furrow which divides the head longitudinally, and therein they agree with the general character of the genus according to Latreille, Milne Edwards, &c.; but in others, as in fig. 4, this central ocellus is replaced by two ocelli separated by the furrow. This duality of organ accords well with analogy, and disposes me to believe that what has been hitherto considered a third central ocellus is really a combination of two minute ocelli, whose proximity and oblique position render them incapable of separation by our microscopes.

The wings are much longer than the body, and nearly colourless. The elytra are longer than the wings, almost of the same consistence, and deflexed. The abdomen is of a rich emerald green, and is terminated by two pointed projecting pieces, which play an important part in depositing the eggs and constructing the roof. The feet are furnished with two hooks, and a small membranous bladder. These vesicular appendages, as well as the antennæ, are continually in motion. The insect seems to prefer locomotion by running and leaping to that by flight. The male is somewhat smaller than the female, but presents no prominent difference in other respects. The description given by Dr. Anderson in the Edinburgh New Philosophical Journal for July, 1849, of the form and structure of the small white cones, is sufficiently minute and accurate. The tuft of hairs seen on most specimens consists of portions of the thick central thread which have failed to retain their hold on the surface of the leaf. If Dr. Anderson is correct in stating that the saccharine taste of lerp is confined entirely to these external hairs, there must exist a remarkable difference between the usual excrementitious matter of which these hairs are composed, and that secreted and expelled from between the abdominal rings, &c. In insects which subsist on vegetable juices, the salivary vessels are developed in an extraordinary degree; and whether the fine silky filaments exude from the salivary glands, as in the caterpillar, or are elaborated by a special secretory apparatus, it is quite conceivable that their nature may be very different from that of the excrementitious matter which has been subjected to the action of the various organs composing the intestinal canal. The ants are extremely fond of lerp; and the beautifully marked spider whose dwelling is a gum-leaf folded and laced together by white threads, has generally one or two tenanted cones and a large ball of fluid lerp within its abode.

I have recently met with another species of *Psylla* located on the red-curled leaves at the extremities of fresh young shoots, and protected by a different kind of lerp. The edges of the leaf are turned over so as nearly to meet; and within each of the two grooves thus formed is a series of white opaque shells of an elongated oval shape. (Fig. 3 b.)

They are of a waxy consistence, and tasteless. The lower part is a thin film adhering to the surface of the leaf; the upper is much thicker, and covers the insect enclosed as in a bivalve shell. Overlapping each other like the scales of a fish, the upper valves form two rows down the sides of the leaf. The perfect insect (Fig. 3, nat. size) is about one-half larger than the cone-forming *Psylla*, the head and prothorax are of a bright yellow, the remaining segments of the thorax are dark brown, the abdomen a yellow green, and the elytra yellow, with two elongated dark brown spots at each tip.

When my attention was first directed to this subject, more than four months ago, I found, besides the common white lerp and its occupant, a larger and differently coloured lerp, with its peculiar *Psylla*, surpassing in beauty and structural development the species already described. The eggs of this third species are of a deep black-red colour, sometimes disposed in groups, sometimes isolated, and occasionally on the same leaf as those of the first kind. The colour of the larva is a reddish brown. The first shell-like coverings are little transparent, and in many parts quite opaque and dark brown. Its form is remarkably like to that of one valve of a cockle-shell. (Fig. 5.) The apex or hinge is always well attached to the leaf. As the insect grows, the digestive or secretory functions seem to be more perfectly performed, and the material of the covering become of a rich canary-yellow colour, and very translucent. The shell of yellow lerp varies in diameter from one-third to one-half of an inch. (Fig. 3 c.)

The strong threads all rise from near the point of attachment, which is at the cleft of the heart-shaped base, and arching over meet the leaf.

Around this fixed point the leaf is always more or less dried up and discoloured. A thick tuft of curling hairs rises from the neighbourhood of the apex. The finer striæ, which are disposed parallel to the surface of the leaf, and line the roof, are quite distinct and separate from each other. Around the base is a broad flat band of an open reticulated texture. A white filmy carpet, composed of extremely fine threads crossing in all directions, completes the interior of this beautiful structure. The pupa and perfect insect are twice as large as those which fabricate the white lerp.

The head and thorax are more highly coloured, and the abdomen of a warmer green. (Fig. 6.)

The elytra and wings are diaphanous, but the wing-cases of the pupa, and the elegant symmetrical nervures of the elytra of the perfect insect, are of a bright scarlet colour.

[Under each of these limpet-like coverings there is usually found one or two little drops of a thickish, nearly transparent, and sweet fluid, like honey, deposited there no doubt by the insect after enclosing itself, to become a resource probably in case of protracted imprisonment from any unfavourable state of the season as to temperature, humidity, &c. The insect would appear to be very susceptible to changes of temperature, and perhaps to atmospheric influences generally ; for I have observed that, when a twig having leaves, with the white cones plentifully scattered over them, is brought in and kept for a few hours in a warm apartment, the perfect insects disengage themselves and are seen to flit about in numbers.—J.M.]

On a New Species of Manna from New South Wales. By Thomas Anderson, M.D. F.R.S.E.

(From the *Edinburgh New Philosophical Journal* for July, 1849.)

The saccharine exudations of plants which have been classed under the generic term of Mannas, present, in all instances, a close resemblance in their chemical constitution. Their principal constituents are, gum, sugar, and the peculiar principle called mannite, which derives its name from its source, and has been considered as the characteristic constituent of a manna. All the varieties of manna obtained from European or Asiatic plants which have been examined contain this substance in greater or less abundance; and it appears also to be a common constituent of the fluid exudation of the leaves known by the name of Honey-dew. At least, this is certainly the case under certain circumstances, as it was observed by Langlois* in the honey-dew of the lime, which, during the hot summer of 1842, occurred in such abundance in the neighbourhood of Strasburg, that it fell from the trees in the form of small rain.

About 30 years since, a species of manna was brought to this country from New South Wales, which was obtained from the *Eucalyptus mannifera*, and differed in many of its properties from the European mannas. This substance was examined by Dr. Thomas Thomson†, who ascertained it to contain a species of sugar resembling, and yet different from, mannite. It was afterwards examined by Professor Johnston‡ who confirmed Dr. Thomson's observation, and by analysis obtained for this new species of sugar the formula $C_{12}\,H_{14}\,O_{14}$, which removes it altogether from mannite, and brings it into the class of the true sugars, containing hydrogen and oxygen in the proportion to form water, and further establishes its isomerism with grape-sugar, from which, however, it

* Journal für Practische Chimie, vol. xxix., p. 444.
† Organic Chemistry, Vegetables, p. 642.
‡ Journal für Practische Chimie, vol. xxix., p. 485.

manifestly differs in all its properties. This was the first manna examined which contained no mannite; and I have now to add to the list another, similar in this respect, but differing in every other, and peculiarly remarkable from its possessing a regularly organised structure.

The specimen subjected to analysis I owe to the kindness of Mr. Sheriff Cay, by whose son, Mr. Robert Cay, the substance was originally discovered in the interior of Australia Felix, to the north and north-west of Melbourne. An immense tract of country in this district is entirely occupied by a "scrub," as it is called in Colonial language, consisting of the mallee plant, *Eucalyptus dumosa*, the leaves of which at certain seasons become covered with this species of manna, which is known to the natives by the name of Lerp, the *l* being pronounced like the Italian *gl*. This substance was first observed by Mr. Cay in the latter part of the year 1844, when he explored a considerable district lying between lat. 36° 20' and 37° 10' S., and long. 142° 40' and 144° 20' E., in search of pasturage for sheep. He returned in 1845 to occupy the ground, and in the course of his journey was obliged to leave his party, in pursuit of a native guide who had decamped with a gun. In mentioning this incident, Mr. Cay writes (25th March 1845): "I was rather cold that night, as I had come off after him in my shirt-sleeves; moreover, I had no dinner, but I got plenty of lerp. Lerp is very sweet, and is formed by an insect on the leaves of gum-trees; in size and appearance like a flake of snow, it feels like matted wool, and tastes like the ice on a wedding-cake."

On Mr. Cay's arrival in Scotland in 1847, he gave some further particulars regarding this substance, stating that it was produced in great abundance, and covered large tracts of the scrub-like snow; that it is very nutritive, the natives becoming fat during the season in which it is found, and that he himself had subsisted for a day or two upon it; that it adheres with very little tenacity to the leaves, and is immediately washed off by a shower of rain.

As it appeared from this description that the substance was unknown in this country, Mr. Cay, at his father's request, wrote to his overseer in Australia, who sent over the quantity of lerp which has formed the material for my observations, accompanied by a letter, dated 25th February, 1848, of which the following is an extract:—"The Blacks say the lerp is not in any way produced by an insect, but that it is a spontaneous production of the mallee or gum-scrub when very young, say a foot or eighteen inches high, and that it grows on either side of the leaf; that old mallee, or mallee about eighteen inches high, does not produce lerp. Therefore, this year they have burned as much of the mallee as they could to admit of the young mallee springing up."

The only published notice of this substance I have met with is contained in Westgarth's *Australia Felix*, page 73, where it is mentioned in the following terms:—"Mr. Robinson, the Chief Protector (of the Aborigines), ascertained during his expedition in 1845, to the north-west of Australia Felix, that the natives of the Wimmera prepare a luscious drink from the Laap, a sweet exudation from the mallee (*Eucalyptus dumosa*). This liquor is manufactured in the months of February and March, on which occasions there is commonly a festival, and adjustment of mutual disputes."

The substance to which these observations refer differs very strikingly in its external appearance from all the other species of manna. It consists of numerous small conical cups of the average diameter of one-sixth of an inch, with a more or less distinctly striated structure, and covered externally with a number of white hairs curled in various directions. These hairs are not distributed over the whole external surface of the cup, but are generally attached to the middle portion between its base and apex. The cup itself is generally sharply acuminated, and bears a pretty close resemblance to some of the smaller species of patella. Its interior is pretty smooth, its exterior rough, and its edge perfectly regular and round. The cup and hairs are translucent, except on the edge of the former, which is frequently opaque. No traces of attachment to the leaves of the plant were to be detected, and though fragments of leaves, obviously those of a species of *Eucalyptus*, were found in the substance, none of them had any of the cups attached to them. The cups were not generally isolated, but usually adhered loosely to one another by the edges; and this attachment was always such that the mouths of the cups were in one plane, and there can be little doubt that it was by this surface they were attached to the leaves. The hairs, when examined under the microscope, were found to be distinctly organized. Each hair formed a uniform tube, which, under a high magnifying power, presented a granular structure, with imperfect indications of transverse striæ.

When treated with potash under the microscope, they became very transparent, and lost their granular appearance, and a drop of solution of iodine coloured them uniformly blue; thus indicating starch as one of their constituents. The cup itself is composed entirely of a mass of cells resembling starch-globules, but so closely compacted together, that their characters can only with difficulty be made out. A thin slice, however, when macerated for some time in water, admitted of disintegration; and though most of the cells were broken up, a few could be distinguished in a pretty perfect state, and agreed in their appearance with those of starch. The whole cup is coloured blue by iodine.

The taste of lerp is distinctly saccharine, but this is confined entirely to the hairs; the cup when completely separated presenting only a slight mucilaginous taste.

The chemical examination showed that it differed as remarkably in constitution, as it does in form, from all hitherto examined species of manna. When boiled with alcohol, a large proportion is dissolved; but the solution deposits no mannite on standing, and when evaporated on the water-bath yields a thick syrup, which cannot be brought to crystallise. It is obvious from this fact, that it contains neither mannite nor the sugar obtained by Johnston from the manna of *Eucalyptus mannifera*. The sugar separated from lerp had all the characters of the uncrystallisable sugar obtained from fruits, and entered rapidly into fermentation when mixed with yeast. The residue from which the sugar had been extracted yielded to cold water a small portion of gummy matter, and, when boiled with water, a considerable part of it dissolved; and the filtered solution, on cooling, deposited a large quantity of a white powder, of sparing solubility in cold water. The fluid from which this substance had separated gave, with iodine, a strong reaction of starch.

The substance which deposited from the hot solution when washed with hot water until it no longer gave the reaction of starch was found to agree, in all its characters, with inulin; but in order fully to establish its identity, an analysis was made of the substance dried at 310°, of which the following are the details:—

$$\left\{\begin{array}{lll} 6{\cdot}441 & \text{grains gave} & \\ 10{\cdot}398 & \ldots & \text{of carbonic acid, and} \\ 3{\cdot}652 & \ldots & \text{of water,} \end{array}\right.$$

giving the following results per cent :—

Carbon . . .	43·90
Hydrogen . . .	6·29
Oxygen . . .	49·81
	100·00

which agrees perfectly with the results obtained for inulin from other sources.

The insoluble residue was likewise carefully washed with boiling water, and then constituted a white substance insoluble in water, alcohol, acids, and alkalies, and agreeing in its characters with cellulose. That it actually was this substance was determined by the following analysis of the substance at 212° :—

3·953 grains of cellulose gave
6·334 .... of carbonic acid, and
2·494 .... of water.

Carbon . . .	43·69
Hydrogen . . .	7·00
Oxygen . . .	49·31
	100·00

Traces of nitrogen, and of a waxy or resinous matter, were also detected; but of these, and more especially of the former, the quantity was too minute to admit of determination. When burnt in the air, it left behind 1·13 per cent. of a white ash.

The quantitative analysis of lerp presented some difficulties. These were chiefly experienced in determining the quantity of starch, which I at first attempted to do in the usual manner, by washing it out; but the hairs disintegrated under pressure, and passed in fragments through the cloth, so that I was under the necessity of abandoning this process, and determining it by difference. This was effected in the following manner: The residue, after extraction by alcohol and cold water, and which, of course, contained the starch, inulin, and cellulose, was weighed, and then boiled with water. The insoluble residue of this process, which was cellulose, was washed, dried, and weighed; the inulin which deposited from the boiling solution, on cooling, was likewise washed, dried, and weighed. The difference between the sum of these weights, and that of the whole original residue, was reckoned as starch. This method, which was the best the circumstances admitted of, is not one of very high accuracy; but I believe it to approximate pretty closely to the truth. I think it likely, however, that the starch is rather under, and the inulin overrated, as, owing to the slight solubility of the latter substance, it was impossible to carry the washing very far. The following are the results I obtained:—

Water	15·01
Sugar, with a little resinous matter	49·06
Gum	5·77
Starch	4·29
Inulin	13·80
Cellulose	12·04
	100·00
Ash	1·13

Such being the constitution of this curious substance, the question of its origin becomes of very great difficulty. All the species of manna regarding which we have explicit information appear to be exudations consequent upon the puncture of an insect, and they are composed of substances entirely soluble in water, which may easily be conceived to exude in solution, and gradually dry up in the rays of the sun, as indeed is actually the case with common commercial manna. But in this manna we have present the insoluble cellulose, with starch, which is absolutely insoluble, and inulin, which is sparingly soluble in cold water; and it is very difficult, under any circumstances, to suppose that these substances could have been produced as a consequence of a puncture; and still more so, when it is taken into consideration that the whole substance is possessed of a definite organization. It is true that certain insect punctures are followed by the production of a sort of organised excrescence on some plants; but in every instance these are excrescences in the strictest sense in the word, and are part of the plant upon which they are developed,—but lerp is manifestly an independent substance, the very attachment of which is not distinguishable; and I apprehend that far more distinct evidence than we now possess is required to establish its insect origin. The natives, as has been already mentioned, state that it is not produced by an insect; and though, under any other circumstances, the opinion of a tribe so unintelligent as the New Holland aborigines is not deserving of any attention, it is still of some importance when it tallies with the conclusion to which I think the chemical examination leads us. Entomologists to whom this substance has been shown are of a different opinion ; and Mr. Newport, to whom specimens were sent, has gone so far as to establish, on the strength of it, an entirely new genus of insects, to which he has given the name of *Aspisarcus*, from *aspis*, a shield, and *arcus*, a net.* The consideration of this point, however, must be left to those who are more competent than I am to form an opinion. I have confined myself to determining its constitution, which appears to me altogether at variance with the idea of its being a simple exudation consequent upon the puncture of an insect.

XX.

On the Coal Measures along the Coast between Western Port and Cape Liptrap, in the Colony of Port Phillip. By G. H. WATHEN, *Esq., Mining Engineer.*

HAVING recently returned from an examination of the coast from Western Port to Cape Liptrap, with reference to the future working of coal in that district, I beg to make the following statement of facts for the guidance of those interested in the matter.

It has long been known that coal existed on this coast. More than once operations have been undertaken for mining it ; but these, having been ill-devised and ill-directed, were successively abandoned.

* Professor Balfour, in his Manual of Botany, p. 412, says: "A saccharine substance, mixed with cellular hairs, which arise from a cup-like body, has been sent to this country by Mr. Cay, found upon the leaves of *Eucalyptus dumosa*. It is called Layurp by the natives, and is thought by Mr. Newport to be the produce of an insect of the tribe Coccidæ."—*Editor Phil. Journal.*

The beach along the eastern shores of Western Port Bay presents trap and lava of various kinds, and in different states; in some cases hard and crystalline, in others decomposed or decomposing into soft rich-coloured earths and clays. The banks of the bay are generally low and sandy, but occasionally rise into bluffs from twenty to thirty feet high, formed of decomposed lavas.

The coal measures commence with a well-defined boundary about a quarter of a mile north-west of, or within Griffith's Point, opposite Cape Woolomai, in Phillip Island, at the eastern entrance to Western Port. Griffiths' Point is a bold headland presenting cliffs nearly a hundred feet high next the sea, and forming the termination of a range of wooded hills which run inland nearly east and west. The coal measures are immediately contiguous to the lavas, but whether they run beneath them can only be determined by boring or sinking. The workings carried on some years ago, under the authority of Mr. Cole, were on the shores of the bay between East Head and the mouth of the River Bass, at a spot where a portion or point of the coal measures protrude into the mass of the eruptive rocks; the former having been much broken and disturbed by the latter. In such a place no extended bed of coal could have been expected, nor was such found.

From Griffiths' Point the cliff towards Bass's Straits present a continuous section of the coal measures for a length of eight or ten miles to the River Bourne, known locally as the First River. Here the cliffs are succeeded by a range of sandy hummocks; but the coal measures probably extend beneath the surface, as they re-appear six miles further along the coast at Cape Patterson, where a natural section is displayed both in the low bluffs and on the beach. It is at this spot that the coal itself rises to the surface. Within half a mile of the Cape three seams crop out upon the beach, and are visible at low tide. Being half immersed in sand and water, their exact thickness and dip cannot be readily determined ; but the following may be taken as an approximation to the truth.

	Thickness.	Dip.	
1st or West Seam of Coal	1ft. 8in.	25°	West.
2nd or Middle Seam	3ft. 4in.	20°	,,
3rd or East Seam	1ft. 8in.	20°	East.

Continuing along the coast, the coal measures are again displayed in section between Cape Patterson and Anderson's Inlet, both in the cliffs and on the beach. Opposite the entrance to the Inlet, the cliffs are succeeded by a low sandy flat, forming the entrance to the valley drained by the Screw Creek, which runs into the inlet near its entrance ; but, after crossing the creek, the coal measures again crop out to the surface on the beach, and rise into low bluffs. They appear to continue along the northern shore of Anderson's Inlet to the River Tarwin, which is probably not far from their termination in this direction ; for a few miles beyond, at Cape Liptrap, we find, together with large masses of intrusive greenstone, the underlying formations of mountain limestone and clayslate, the latter probably lying immediately upon the granite ; which at Wilson's Promontory rises through the superior strata into a bold and lofty mountain range, forming the most southerly point of the Australian Continent.

Thus it appears that the coal measures extend almost uninterruptedly along the coast from Griffith's Point, at the east entrance of Western Port, to the River Tarwin, a distance of about thirty miles. They consist of a series of beds, such as in all parts of the world are associated with coal, presenting, however, certain characteristic modifications of their own. The upper strata consist of a hard conglomerate grit, with a thick bed of reddish brown sandstone variegated by veins and patches of redder tint. Beneath are a succession of beds of grey sandstone, hardened clay, black and blue shales, with seams of coal and fire-clay, and a conglomerate of rolled fragments of clayslate cemented together by a silicious paste. Imbedded in this conglomerate are found nodules (not rolled fragments) and irregular beds of a hard crystalline rock: these somewhat resemble in form and location, though not in mineral character, the "balls" and beds of iron-stone in the coal fields of England and Wales. Veins and bunches of lignite, and numerous fragments of fossil wood, are also found embedded in the grey sandstone. This sandstone offers another peculiarity. Portions of the beds near their surfaces have undergone a complete change, and have now a hard and blackened surface and fracture, and a prismatic structure, presenting all the appearance of the influences of igneous agency. It might have been supposed that this change originated in these parts having been in contact with igneous rock; but the fact that the unchanged sandstone lies immediately upon that which has been metamorphosed proves such an hypothesis to be incorrect. This hardened sandstone occurs, not in continuous beds, but in detached patches, which, being better able to resist the erosion of the waves, rise above the level of the contiguous rocks, and present much the appearance of worn street-paving.

The coal measures are much heaved and dislocated by trap dykes and other eruptive rocks, but their average dip appears to be to the west and north-west; and hence at Cape Patterson, the most southerly point in their range, the deeper beds crop out to view.

Cape Patterson, where the coal itself rises to the surface, is rendered wholly inaccessible from the sea by a heavy rolling surf, while it is just midway between two points of shipment, being about fourteen miles from Western Port on one side, and from Anderson's Inlet on the other. But though not visible at the surface, there is good reason to believe that the Cape Patterson coal seams extend with the other carboniferous strata from Griffith's Point to Anderson's Inlet, at either of which places they might be advantageously worked. Indeed, a thin seam of coal has actually been worked at a former period not very far from Griffith's Point; while at Anderson's Inlet three seams of black coaly shale crop out, very similar in character to beds which at Cape Patterson are closely associated with the coal. The actual existence at these points of shipment of the Cape Patterson seams, or of any other and perhaps richer deposits, together with their thickness and depth from the surface, can only be determined by boring.

The first operation, then, for any parties intending to mine for coal should be to cause a deep boring to be made near Griffith's Point, and another at Anderson's Inlet, to prove the actual nature of the successive strata. And when the existence of good seams of coal at either place has been thus proved, their superficial extent might readily be determined by other borings, at certain distance from the first. These borings might be carried on at a moderate expense, and by this mode of proceeding all possibility would be precluded of a lavish and profitless outlay in sinking pits for beds of coal which did not really exist, or were not worth working. In short, the adventurers would reduce their speculation almost to a certainty.

As regards the quality of the coal hitherto found, it will be enough here to say that the thickest or middle seam is of first-rate excellence, well fitted for the forge and for domestic use, and abounding with gas for lighting. It is also very readily worked. The west seam is of an inferior kind, and carries embedded in it a thin band of shale. The fire-clay with which the coal is associated would itself prove of considerable value in the construction of furnaces, smelting works, &c.

It may be necessary to say a few words as to the practicability of using Anderson's Inlet as a place of shipment, which has been questioned by some. It is affirmed by a whaler, who has often visited the place in his boat, and is well acquainted with the whole coast, that the inlet would be accessible to coasting craft under all ordinary circumstances, and that, were it not for want of shelter outside the bar, it would form a better harbour than Port Albert. This statement is confirmed by the map of the Surveyor sent by Government to take soundings in the Inlet, from which it appears that there was then an entrance-way through the bar, five feet deep in the shallowest part at low water.

Should the coal be worked either at Western Port or at Anderson's Inlet, a jetty and railway might easily be constructed, by means of which the coal waggons would carry direct from the mouth of the pit to the spot where the vessels were moored and unload into them. A great saving of expense would thus be effected. If, on the other hand, any workings should be undertaken at Cape Patterson, a road or railway must be constructed for at least twelve or fourteen miles along the coast; and carriage for this distance must in that case be charged upon every ton of coal consumed at Melbourne.

The coal measures extend inland to an unknown distance, but the advantages of working them on the coast are too obvious to need remark.

This is not the place to enter into detailed calculations of the profits which might be expected by a coal-working company; but that they would be ample can scarcely be doubted when coal, after being carried eight hundred miles, is selling at the Wharf at Melbourne for thirty shillings a ton, that price being due to the high rates paid for freight. It is stated on good authority that, if supplied at a moderate price, four hundred tons of coal a week, or 20,800 tons annually, would be consumed at Melbourne for steam engines, foundries, and other works. As regards the probable consumption for domestic purposes, it appears from official returns that there are about 3500 rate-paying families at Melbourne. Assuming that each family uses on the average twelve loads of wood annually, and taking three loads of wood as equivalent to one ton of coal, we should find that each family would consume four tons of coal a year, and that the total consumption for domestic use would be 14,000 tons annually. If we assume that for private purposes coal would supersede wood as fuel only to the amount of two-thirds of the actual consumption, we should still have a total of upwards of 30,000 tons as the annual consumption of Melbourne alone, in its present state of half development.

XXI.

On the Introduction and Naturalization of Petaurus sciureus *in Tasmania. By* R. C. Gunn, Esq., F.L.S. [*Read 25th October,* 1850.]

In the year 1845 I drew the attention of the Tasmanian Society to the interesting fact that the *Petaurus sciureus* (*Desm.*) or Flying Squirrel, of Port Phillip, was becoming naturalized in Van Diemen's Land, as several individuals had been killed in a forest near my house, in the vicinity of Launceston (*Tasmanian Journal,* vol. ii. p. 458.)

Subsequently, in April, 1846, Dr. James Grant, of Launceston, announced to the Tasmanian Society that a specimen of the *Petaurus* had been brought into town from "O'Connor's Sugar-loaf," a hill on the Lake River, about 30 miles south from Launceston (*Tasmanian Journal*, vol. iii. p. 76.)

Since that period, several individuals have been killed at widely-separated stations, indicating both a rapid extension and multiplication of the species,—the last having been killed about four weeks ago (about 1st September, 1850), by Mr. Landale, upon his father's farm, on the Meander River, about 11 miles west from Launceston; which specimen is now in my possession.

No species of *Petaurus* is indigenous to Tasmania; it therefore becomes peculiarly interesting to note *how* and *at what time* the present species was introduced.

It does not appear from all that I can learn, that any living specimens of the *Petaurus sciureus* were imported into Van Diemen's Land prior to 1834; but immediately after the settlement of Port Phillip, in that year, considerable numbers of the flying squirrel were, from their beauty, brought over as pets by the early visitors. Launceston was at that time the principal port connected with the Port Phillip trade, and thither the squirrels were brought in proportionate numbers. I remarked at the time, that most of the individuals so imported, from their extreme nocturnal activity, escaped from confinement almost immediately after arrival; and it would now appear that they at once found food and shelter in the woods adjoining the town, and the climate not proving too severe, they have increased and become dispersed over much of the country around Launceston. It is also probable that some were carried, as pets, some distance into the country before they escaped; but upon this point I cannot speak with certainty.

The *Petaurus sciureus* has, since 1845, been killed in a wild state at Penquite; Mr. Gough's farm, Patterson's Plains; Franklin Village; Mr. Pitcher's, on the Westbury

Road; O'Connor's Sugar Loaf, Lake River; Mrs. Barnes's, Trevallyn; Dr. Landale's farm, Meander River; and behind the Church at Whirlpool Reach, River Tamar. Many more may have been killed without having come to my knowledge.

From the preceding facts, I infer that the *Petaurus sciureus* may now be considered as fairly established in Van Diemen's Land, and that it will ultimately increase in numbers, and spread over all those parts of the island favourable to its existence.

XXII.

METEOROLOGICAL TABLES *for the Year* 1849; *Royal Observatory, Hobart Town. By* J. H. KAY, *Esq., F.R.S., Commander R.N., Director of the Observatory.*

Latitude.................................... 42° 52′ South.

Longitude .... 9^h 50^m East.

Atmospheric Pressure and Temperature for the Year.

1849.	*Barometer taken at five periods every 24 hours during the Month*		*Temperature during the month, by Self-registering Thermometer. Fahrenheit's Scale.*		*Mean from Observations of the Month.*	
	MAXIMUM.	MINIMUM.	MAXIMUM.	MINIMUM.	BAROMETER.	THERM.
	Inch.	*Inch.*	°	°	*Inch.*	°
January ...	30·150	29·237	105·0	43·0	29·726	59·7
February	30·260	29·296	85·8	40·5	29·783	56·6
March ...	30·170	28·819	75·0	39·0	29·575	54·7
April	30·232	28·941	70·7	37·0	29·771	49·4
May	30·314	29·001	67·7	30·6	29·855	47·6
June	30·520	29·227	56·8	29·4	29·866	44·7
July	30·584	29·109	53·8	32·2	29·878	43·5
August ...	30·275	29·094	66·2	31·0	29·760	46·3
September	30·116	29·000	67·0	34·2	29·631	46·0
October ...	30·366	29·121	79·3	35·8	29·744	51·3
November	30·215	29·054	84·3	38·3	29·716	53·5
December	30·160	29·090	85·0	40·7	29·666	58·4

The Observations from which these results are deduced were taken at five periods in the twenty-four hours; viz.—the hours of 2 and 6 A.M., and 2, 6, and 10 P.M.

	Inches.
Mean Pressure for the year, corrected down to Standard Temperature of 32° Fahrenheit, from observations at 5 hours out of the 24	29·748
Mean Temperature for the year, from observations at 5 hours out of the 24	51°

The cistern of the Standard Barometer of the Royal Observatory is 107 feet above the level of the mean tide, causing a depression in the mercurial column of about 0·1 inch.

Quantity of Rain which fell in the Year 1849, *as denoted by the Self-registering Rain-Gauge at the Observatory.*

	Inches.
January	0·72
February	1·02
March	2·37
April	1·46
May	4·53
June	1·52
July	5·99
August	2·74
September	1·91
October	1·41
November	8·94
December	0·90
TOTAL	33·51

General Remarks upon the Weather during 1849.

There was an intensely hot wind on Saturday, the 27th January, which continued throughout the night, and until the afternoon of Sunday, when the atmosphere was relieved by a violent thunder-storm and heavy rain. During the continuance of this hot wind the Thermometer stood in the shade as high as 105°.

This was the only hot wind of any note throughout the year.

The principal feature in the weather during 1849 was the unusual quantity of rain which fell—considerably more than has yet been registered in any year since the establishment of the Observatory in 1840. It has entirely contradicted the assumption (which the observations of previous years had warranted) of the alternation of wet and dry seasons. The months of May, July, and November were particularly distinguished; and in the latter month alone there were 9 inches of rain—a very unusual monthly quantity for this climate. The mean temperature of November is below the average, owing to the constant wet, cold weather: and at Midsummer—viz., on the 23rd of December—Mount Wellington was completely covered with snow, extending down to the low hills in its vicinity. The weather during the night of the 22nd of December, and morning of the 23rd, was as severe and inclement as during any day in Mid-winter.

XXIII.

On the Construction of Dams, with a View to Irrigation. By Sir W. T. Denison, F.R.S., *&c.* [*Read* 11*th December,* 1850.]

As the subject of Irrigation is one of much importance to the interests of the agriculturists and flockowners of this colony, any information connected with the subject, or with the mode in which it may best be carried out, will be useful. I have therefore thought that a paper on the construction of Dams, which was contributed by me in the "Aide Memoire" of the Corps of Royal Engineers, and which treats of the modes of constructing such works in a rapid, yet substantial manner, of materials easily procured, would not be unacceptable to the Royal Society.

DAM,—a bank or obstruction built across a river or stream for the purpose of raising the level of the water on the upper side of it.

There are many objects for the attainment of which it may be necessary thus to check the course of a stream, and gain a head of water. It may be requisite to turn it for a time into another channel—to inundate the ground in front of part of a military position—to make a portion of the stream unfordable—to secure depth sufficient to enable vessels of a given draught of water to navigate the stream—or to gain a power to be applied to mechanical purposes. The works for the attainment of the first three of these objects belong more particularly to the class which officers may be called upon to execute in the course of a campaign; and the details here given refer entirely to works composed of such materials as may be expected to be within reach of an officer on service.

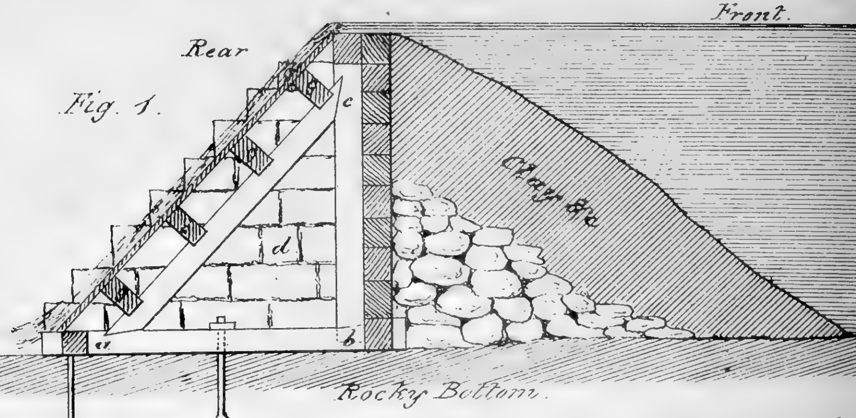
Dams built for the purpose of inland navigation, or for that of securing a water power, may be considered as having a more permanent character, and will be treated of in the second volume of this work.

The first consideration in forming a dam across a stream is the choice of a proper site. This must, of course, be decided with reference to the objects to be attained by the rise of water; but there are a few general rules to which attention should be paid.

In streams liable to sudden floods it would be advisable to carry the dam across the widest part of the stream, so as to allow ample space for the water to flow over, and thus to prevent any sudden and great rise above the dam; or it may even be advisable to carry the dam in an oblique line across the stream. In rivers, where much drift wood is likely to be brought down, the dam should be situated below a bend in the stream where an eddy is formed, by means of which the collection and removal of the timber will be facilitated.

Section of a Dam on a Rocky Soil.

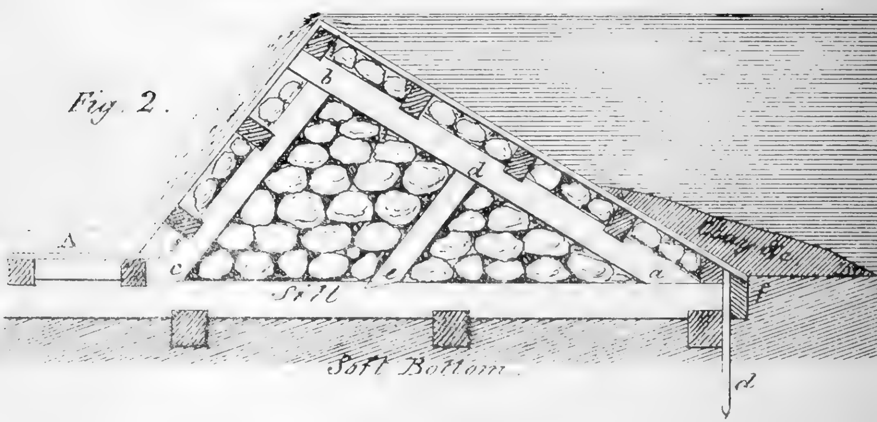
Fig. 1.



d. Rough blocks of Stone to be used if possible
f. g. Planking & cross beams substituted
when d cannot be obtained, the interio
to be filled as in Fig. 2.

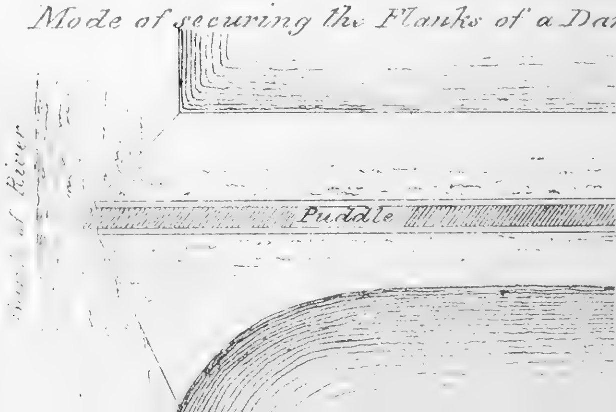
Section of a Dam in a Soft Soil.

Fig. 2.



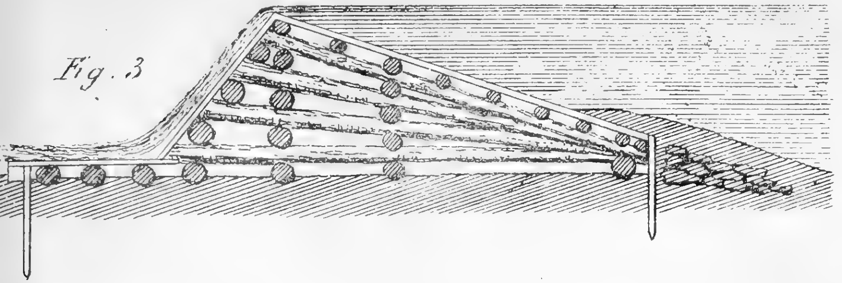
Mode of securing the Flanks of a Dam.

Fig 3.



Section of a Dam on Soft Soil where Timber is plentiful.

Fig. 3



Elevation of the rear of Fig. 3 before being planked.

g. 4.

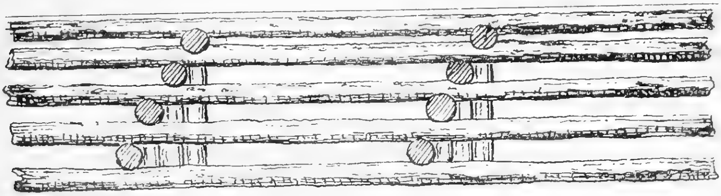


Fig. 5
Plan of Fig. 6.

Figs 5. 6.
ribwork.

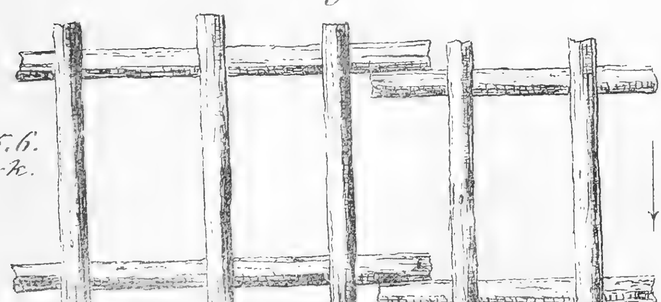


Fig. 6
ansverse Section of Fig 5.

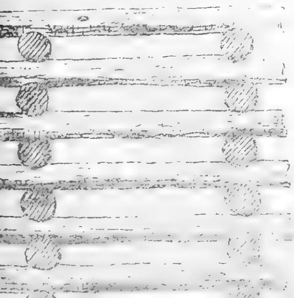
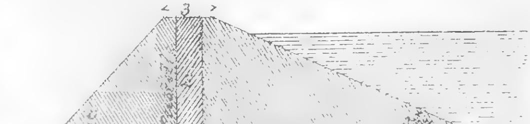


Fig. 7.
Transverse Section of a Puddled Dam.



The banks of the river or stream should be carefully examined with reference to the quality of the soil of which they are composed, and their power of acting as abutments to the dam.

When the site of the dam has been decided upon with reference to the principal objects which it is intended to answer, the necessary levels must be taken, and the height of the structure determined. Upon this will depend, in a great measure, (when materials are plentiful), the plan to be adopted in forming the dam.

In shallow rivers, when the bottom is rock, a dam of the section shown in *(plate* xix.*)* fig. 1 may be easily constructed of 10 or 12 feet in height. The sill (*a b*) is bolted down to the rock with fox-wedge bolts. The standard (*b c*) is mortised into this sill; and a brace (*a c*) is framed into the two, making thus a strong vertical frame. When the dam is high, a second brace may be inserted, and the horizontal distances between the frames diminished; but, in general, 8 or 10 feet may be allowed as a fair distance between these frames from centre to centre. When the frames are securely fixed, a facing of logs, roughly squared on the upper and under sides, is laid in front of them, across the bed of the stream. These should be got as long as possible, and should break joint occasionally against a standard, to which they should be sometimes pinned with a trenail, in order to prevent their moving.

When the water is intended to flow over this dam, the space between the frames in the rear should be filled in with blocks of rough stone, well wedged together, and laid in steps, so as to break the fall of water on the bed of the river in rear. If material of the proper quality cannot be found, or if the time will not allow of its being quarried and placed properly, this space may be filled in with earth and rubble; and logs being notched down upon the back braces of the frame, stout planking should be spiked over these logs, so as to present a smooth surface for the waste water to flow over, and to act as a protection to the stones, earth, &c. below. The front of the dam should also be filled in with earth, rubbish, &c.; and if the surface of the rock is so uneven as to prevent the front logs bearing fairly upon it, brushwood and fascines may be placed in front, so as in some measure to close the spaces between the rocks and the logs.*

When the bed of the river is composed of sand, clay, or material too soft to resist for any length of time the action of the water, the plan shown in figure 2 may be advantageously adopted. This frame is composed of a sill, extending not only the width of the dam, but also of the apron in rear, notched down and pinned to three or more sleepers, which are laid transversely to the stream, and sunk into the bed of the river. Into this sill, the beam (*a b*) is framed at an angle of about 30° with the horizon, and supported in this position by the two struts (*b c*) (*d e*) at an angle of about 60°. These frames are placed at about 8 feet apart, and upon them are notched the horizontal beams which carry the planking with which both the up and down stream sides of the dam are covered.

In order to prevent the water making its way under the dam, a row of plank piling (*d*), about 5 feet long and 4 inches thick, should be driven in front of the upper sleeper, and a line of waling (*f*) upon this row of piling should be well spiked through the piles into the frame. In order to secure the work more completely against leakage, clay should be thrown in front of the sheet piling to a height of one or two feet. An apron (A,) as shown in figures 2, 3, is a neces-

* Occasionally, when the strata cross the bed, and particularly when they crop out against the stream, great additional stability may be obtained by abutting the lower parts of the dam against the basset edges of the rock.

sary addition to every dam constructed across a river when the bed has not sufficient tenacity to resist the action of the water. This may be composed of logs notched upon the sill pieces and covered with plank, or of rough logs notched and pinned down upon the sleepers in close contact with each other: it should extend far enough below the dam to conduct the water away safely, and should have a row of sheet piling in rear, as shown in figure 3.

Where rough timber is plentiful, a dam, as shown in figures 3 and 4, may be easily and quickly constructed thus: two or three rows of rough sleepers are bedded across the stream, and upon these rough logs are notched and pinned at intervals of about five feet in the rear of the dam. Over one of these sleepers another transverse log is notched upon the first row of longitudinal timbers; and if the dam is a large one, perhaps a second transverse timber may be required. The second row of longitudinal timbers is notched upon the second row of transverse timbers, not exactly over the first row, but just so much clear of it as to allow of the end being notched and pinned upon the ground-way or sleeper at the upper side of the dam, close alongside of the first timber. Row after row of timber is thus placed, the dam constantly rising in rear by the thickness of a log for each course, while in front all are brought down and pinned to the ground-way. When the necessary height is obtained, the top row of longitudinal timber may be laid side by side in as close contact as possible, and the spaces made good with small fascines, bark, &c.; or rows of transverse logs may be placed at about three feet apart, and planks spiked to them. The rear of the dam appears, as shown in the sketch figs. 3 and 4, of alternate rows of longitudinal and transverse timbers to which planking is spiked.

Where timber is plentiful, and the river is deep, a dam may be safely constructed to a great height of crib-work, that is, of a series of rough cases formed of whole timbers, notched together at the crossings, as shown in figure 5.

In framing a dam of this description, two logs are laid in a direction transverse to the stream at the same distance apart as is intended for the width of the dam; upon these cross logs are notched at distances of 6 or 8 feet: other transverse timbers are notched upon these, and the dam is carried up in this way until it arrives at its intended height. Sometimes it may be advisable to divide the interior space into smaller compartments, by introducing more transverse timbers; during this, very little impediment has been offered to the stream which flows through the interval between the logs.* When the crib-work is complete, the spaces between the cribs are filled with stone if it can be procured; or if not, with fascines, earth, &c., and a mass of earth and rubbish is thrown into the river in front of the dam, so that by degrees a mass is accumulated sufficient to prevent leakage. This work is carried on simultaneously from both banks, and as the water is checked, so the stream rises above the dam, rushing through the central space left for its passage. The same process may be continued till the dam is completely closed; but as large quantities of earth, &c. would be washed away in attempting to close the opening between the logs in this centre bay, the best plan is to prepare a frame to receive a sort of gate made of logs, which can be dropped down from above, and which will close the opening sufficiently to prevent much waste of material taking place. †

When timber is scarce, fascines and hurdles may be used

* In executing this sort of work, the first logs float on the water, and are gradually sunk by the increasing superstructure.

† Experience has likewise shown, that when the water is deep and even rapid, the front of the dam may in like manner be formed of portions of crib-work, two bays in length, constructed ashore, dropped down into position and arranged on the arc of a circle in plan, beginning from each flank, filling them as soon as properly placed. This, as the body of the dam, must be assisted and supported by slopes of clay, as in figs. 1 and 2.

in the construction of dams. In Holland and Germany they are very commonly employed for this purpose. A course of large fascines is first laid, the length of the fascines being in the direction of the current, and each in as close contact as possible with its neighbours: upon this a second course is laid transversely, strong pickets are driven through these two courses to connect them together, and the heads of these pickets are wattled together so as to make a kind of hurdle-work, which serves to connect the whole more completely into one mass; these layers of fascines are then continued in the same manner, each course being picketed to those below, and the pickets connected at top with hurdle work, until the dam has attained the proper height. Very large rivers, with a great depth of water, have been successfully dammed up and their courses changed by works constructed in this manner. Where the water is deep, gabions loaded with stones, square wicker baskets, filled with stone, &c., have been used to form the foundation of the dam; and upon this a superstructure, as before described, has been raised.

The above are a few of the most simple and of the readiest modes of constructing dams; modifications may of course be made to any extent: two or more of these plans may be combined in the construction of a single dam—as, for instance, the sides of a dam when the water is shallow may be made according to figure 1, and the centre part with cribs, as in figure 5.

The flank of the dam should be secured by being let into the bank and puddled in front, and the earth or rubbish which is thrown in front should be carried up the river against the bank to a greater distance than at other points.

As a general rule, the sides of a dam should be first constructed and the abutments made good;—serious accidents have occurred from a neglect of this precaution.

Should it be decided to raise the water so as to inundate the banks on each side, the embankment to prevent the water thus raised finding its way round the flanks of the dam,—these flanks should be completed before the dam itself is closed. This embankment may be formed of earth; its section may be as in figure 7, about three feet thick at the top, which should be about one foot above the highest water line, the upstream slope at least 2 of base to 1 of height; the down stream 1 of base to 1 of height: in case the soil is light and porous, it will be necessary to excavate a trench in the line of the embankment, about two feet into the ground, and about two feet wide; to puddle this well with clay, and to form a wall of the same through the centre of the embankment, till above the water line, as in figure 7, to render it water-tight. Where a current can act upon it, the base may be protected by stones, and by planks or fascines pinned down parallel to its direction. In all cases ample provision should be made for the passage of the waste water; when it is not allowed to pass over the dam, waste channels should be made, and the passage of the water through these, regulated by sluices, either self-acting (which is the safest plan), or worked by men. Great care must be taken that the action of the water through these sluices does not tear up and wash away the ground below to an extent to endanger the structure. Aprons (constructed as before described) must be laid in rear of the sluices, except when these are fixed upon rock, and must be carried down to a distance proportional to the body of water discharged, and to the fall, also taking into consideration the nature of the soil.*

* Bridges may often be converted into temporary dams by blocking up the archway, taking care that the mass thus formed is sufficient to support the accumulated body of water, which must not be taken for granted with most bridges.

XXIV.

Analysis of Coal *from Van Diemen's Land; with Report. By* Sir H. De La Beche, C.B., F.R.S., &c. &c. [*Read 11th December,* 1850.]

(*Enclosed to* Sir W. Denison *in a Despatch from* Lord Grey.)

Geological Survey of the United Kingdom,
Bastow, Chesterfield, Derbyshire,
27th July, 1850.

Sir,—I have the honour herewith to transmit, for the information of Earl Grey, the Analysis made at the Museum of Practical Geology, London, of specimens of Coal from Van Diemen's Land, forwarded for examination by Sir William Denison.

Though several of the Coals, as far as they are represented by the specimens, do not appear of good quality, nevertheless there are two (from Adventure Bay and Douglas River, East Coast), which so much approximate to good Newcastle Coals, though with a large amount of ash, that it may be very desirable somewhat fully to explore the localities whence these Coals are derived, in order to ascertain their thickness, mode of occurrence, and other circumstances connected with them, and perhaps also with other associated Coal Beds.

When it is considered how little would be known of some of our British Coal Districts if they were situated in distant and little explored regions, from the somewhat rapid views usually taken, and which can be expected from mere general examinations of country, it seems desirable carefully to ascertain the workable value of any Coal that may be discovered in Van Diemen's Land,—so that, while on the one hand thin seams, however good, may not have a false value attached to them; on the other, thick beds, though of inferior quality, should not be neglected, always supposing that their mode of occurrence, and the importance of the Coal as fuel, are such as to justify their being worked.

It may be desirable to add, as regards information to be derived from the analysis of the specimens of Coal usually obtained during the ordinary first exploring of a country, that such specimens are commonly of worse quality than the beds whence they have been derived, when these beds are worked at sufficient depths from the surface of land to secure them from the destructive action of atmospheric influence.

I have, &c.,
(Signed) H. T. DE LA BECHE.

B. Hawes, Esq., &c. &c.

ANALYSIS *of* COAL *from Van Diemen's Land.*

(Referred to in the Report of the Lieutenant-Governor, dated 18th May, 1849.)

LOCALITY OR NAME OF COAL.	MEAN COMPOSITION OF AVERAGE SAMPLES OF COAL.						REMARKS.
	CARBON	HYDROGEN.	ASH.	SULPHUR	NITROGEN.	OXYGEN.	
South Cape	63·33	2·89	29·96	0·98	1·27	1·57	Very large amount of ash, carbon poor, quality indifferent.
Mount Nicholas, Break o' Day	57·38	3·93	27·55	0·90	1·15	9·09	Quality very indifferent, carbon poor.
Fingal	57·21	3·40	29·10	1·32	1·20	7·77	Same quality as last.
Jerusalem	68·17	3·97	19·22	1·12	1·62	5·90	Better quality, approaching Newcastle coal, ash still large.
Douglas River, East Coast	70·44	4·20	14·50	0·70	1·12	9·04	Good quality, like Newcastle, but large quant. of ash.
Tasman's Peninsula ...	65·53	3·34	26·40	1·03	1·89	1·81	Indifferent.
Schouten Island	64·00	3·54	27·17	0·85	0·94	3·50	Indifferent.
Adventure Bay	80·20	3·05	8·67	1·90	1·36	4·82	Best specimen, like good Newcastle, though the ash is also large.
Whale's Head & South Cape	65·85	3·18	21·50	1·14	1·32	7·01	Indifferent, ash large.

N. B.—These Coals all contain a large quantity of ash. The amount of sulphur is not remarkably large in any of them, but still considerable. The coals cannot be considered as being at all first-class coals, but still they may be of much value in a colony so distant from the European Coal Fields as Van Diemen's Land.

Museum of Practical Geology, 26th July, 1850.

(NOTE.—It is possible that a mistake may have been made between the Adventure Bay and the Mount Nicholas Coal. Specimens of each will be sent to England for verification.)

[. R. PUGH, ESQ., M.D.

[4]6.

Winds.													
[o'Clo]ck a.m.					3 o'Clock p.m.								
[S].W.	S.	S.E.	E.	N.E.	Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
5	...	2	...	...	3	1	17	4	4	...	2	...	...
3	...	2	...	...	6	2	12	2	5	...	1	...	...
2	...	1	...	...	5	2	17	2	3	2	...	...	...
...	...	2	...	1	6	2	11	2	3	3	3	...	...
1	...	4	...	...	12	3	10	...	2	...	2	2	...
1	1	5	1	...	10	4	7	...	...	1	5	...	3
...	1	8	1	2	8	2	6	1	...	2	10	2	...
...	...	5	...	...	8	...	17	...	1	...	5	...	...
...	...	4	...	...	3	1	19	...	2	2	3	...	...
...	...	4	...	1	3	...	24	...	...	1	3	...	...
1	...	5	...	1	4	2	17	1	1	...	4	...	1
...	...	1	...	...	6	2	20	1	1	...	1	...	...
13	2	43	2	5	74	21	177	13	22	11	39	4	4

V

Abstract of Meteorological Observations made at Launceston for 1849. By W. R. Pugh, Esq., M.D.

"Dr. Pugh's house stands 142 feet above the sea level."—*Strzelecki*, p. 46.

1849.	9 o'Clock a.m.		3 o'Clock p.m.		External Thermometer: mean.				Extreme Range of Temperature.		Evaporation, in Inches.	Fall of Rain, in Inches.
	Barometer.	Thermometer, attached.	Barometer.	Thermometer, attached.	9 o'Clock a.m.		3 o'Clock p.m.					
	Mean.	Mean.	Mean.	Mean.	Dry.	Wet.	Dry.	Wet.	Max.	Min.		
January......	29·946	...	29·906	...	67°·	59°·8	72°·8	63°·9	90°·	44°·	2·530	·048
February ...	29·940	58·2	29·925	69·1	62·3	56·7	69·1	61·9	85·	45·	1·810	·831
March	29·802	56·2	29·773	62·2	57·8	53·7	62·7	57·3	73·	42·	1·380	3·216
April	29·932	49·6	29·899	58·5	50·9	48·1	57·9	54·3	71·	33·	·950	1·542
May	30·027	44·3	29·991	53·5	45·5	43·2	52·6	50·2	62·	32·	·445	2·562
June	30·000	42·4	29·976	49·4	42·1	40·9	48·8	46·9	55·	29·5	·245	3·489
July	30·012	39·3	29·991	47·7	39·2	37·6	47·	44·6	53·	27·	·275	3·266
August	29·945	43·6	29·897	52·	43·6	41·8	51·4	49·1	58·5	29·	·305	3·903
September...	29·816	48·8	29·745	53·9	50·	47·5	53·3	50·5	62·	33·	·475	2 970
October......	29·911	56·4	29·866	60·9	58·1	53·8	60·4	56·6	69·5	39·	·880	·997
November...	29·893	58·5	29·851	63·9	60·1	55·3	63·9	59·2	76·	41·5	1·025	4·596
December ...	29·835	63·7	29·809	69·3	65 6	60·4	69·3	63 7	82·	43·	1·380	1·296
For the Year	29·922	51·	29·886	58·22	53·52	49·9	59 1	54·85	90·	27·	11·7	28 716

1849.	Winds. 9 o'Clock a.m.									Winds. 3 o'Clock p.m.								
	Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	Calm.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.
January......	6	2	12	4	5	...	2	...	...	3	1	17	4	4	...	2	...	...
February ...	11	6	4	2	3	...	2	...	...	6	2	12	2	5	...	1	...	...
March	7	5	15	1	2	...	1	...	...	5	2	17	2	3	2	...	...	...
April	19	2	6	...	...	...	2	...	1	6	2	11	2	3	3	3	...	...
May	22	1	3	...	1	...	4	...	...	12	3	10	...	2	...	2	2	...
June	15	3	4	...	1	1	5	1	...	10	4	7	...	...	1	5	...	3
July	13	2	4	...	...	1	8	1	2	8	2	6	1	...	2	10	2	...
August	18	...	8	...	...	...	5	...	...	8	...	17	...	1	...	5	...	...
September...	12	2	12	...	...	...	4	...	...	3	1	19	...	2	2	3	...	...
October......	9	1	15	1	...	...	4	...	1	3	...	21	...	...	1	3	...	...
November...	11	1	9	2	1	...	5	...	1	4	2	17	1	1	...	4	...	1
December ...	8	3	17	2	...	...	1	...	...	6	2	20	1	1	...	1	...	...
For the Year	151	28	109	12	13	2	43	2	5	74	21	177	13	22	11	39	4	4

Proceedings.

9TH JANUARY, 1850.—Monthly evening meeting; Joseph Hone, Esq., in the chair.

The following gentlemen were ballotted for and elected Fellows:—

Henry Butler, of Hobart Town; Frank Butler, of Hobart Town; Phineas Moss, of Hobart Town, Esquires.

The Secretary reported that His Excellency Sir W. T. Denison, President of the Society, had forwarded to the Museum a valuable collection of shells from the eastern shores of Central and South America, specimens of metallic minerals from Chile, and of native sulphur from New Zealand.

Major Cotton, Deputy Surveyor-General, sent specimens of transition slate and quartz from the Huon River, nearly opposite Lake Pedder; of greenstone from Mount Picton; and of clayslate and micaceous schist from the Frenchman's Cap mountain; also, the palm-like head of a tree of *Richea Pandanifolia* from a ravine in that neighbourhood, the stem of which measured 40 feet in length.

J. E. Bicheno, Esq., sent a good specimen of *Fungia Patellaris;* a specimen of native sulphate of magnesia of Tasmania; also, a large concretionary mass said to have been taken from the stomach of a sheep. It was remarked that concretions of this description have usually a dirty yellowish green colour, and the figure of a sphere or ball variously flattened, with a diameter of one to two inches only; that they are composed of thin layers of finely subdivided and closely compacted vegetable fibre; that they have been found to affect sheep in almost every district of the Island, and generally without sensible detriment to health or condition; and that they have been known after a season to disappear from flocks all but universally affected by them. It would appear, therefore, that these concretions are not caused by noxious and poisonous herbage peculiar to certain tracts of land, and eaten as food by sheep as had been supposed, but that the *nucleus* around which there is a continual accretion of thin laminæ is the result or residuum of imperfect action on the part of the ruminative and digestive organs—a condition which may in all probability be obviated or removed by the introduction of bitter and aromatic plants; such as parsley, thyme, chiccory, clover, &c., amongst the few comparatively sapless indigenous grasses which constitute the natural pasturage of Van Diemen's Land.

The Reverend R. K. Ewing, of Launceston, forwarded a specimen of curiously fluted and stalactite-looking *Iron Pyrites* from Mr. De Little's Lime Quarry, near York Town, on the Tamar River.

James Barnard, Esq., presented a fragment of calcareous spar, seemingly detached from trap rock, with a specimen of micaceous schist from the estate of B. Berthon, Esq., at the Cross Marsh; also, a fragment of fine Porphyry from the beach at Sandy Bay, having a red jasper-like matrix thickly studded with serrated white points like minute portions of shell or the points of shark's teeth.

Mr. Worley presented a few shells from the Islands to the north and eastward of Australia.

Mr. Loughnan submitted for examination a sample of starch from his manufactory in Campbell-street.

Mr. A. M. Milligan, of Launceston, sent a few scarce coins—gold, silver, and copper.

Samuel Moses, Esq., presented an extensive assortment of coins and medals of ancient and modern times in a good state of preservation; also some beautifully crystallized specimens of blue and green carbonates of copper from Adelaide. Mr. Moses submitted for examination samples of a consignment of ores shipped as *Copper Ore* from the islands called the Chickens, in the Bay of Wangari, New Zealand: it was found to consist of *Iron Pyrites, Iron Glance*, and earthy matter.

John Kerr, Esq., M.L.C., presented a purse of coins of ancient Rome, and of England and Scotland, from the time of Elizabeth and James downwards.

W. Champ, Esq., forwarded from Port Arthur for the Museum, a little spotted fish belonging to the genus *Chironectes*, preserved in spirits, together with specimens of a small *macrourous* crustacean, probably a *Palæmon*. Mr. Champ writes thus respecting the frog fish :—"It was found in the sea at Port Arthur by a person who was with me, and when caught had all the appearance of having four legs, from the position and shape of the fins; the two longest of which, from the sort of elbow in them, and the division into (rays) what resemble fingers, seem to form a connecting link between fins and legs or arms."

Of the crustaceans Mr. Champ says :—"If they should turn out to be young lobsters the fact is worth knowing, quantities of them having within these few days been found in Opossum Bay, at Port Arthur."

Mr. Hull presented specimens of fossil shells from the *spiriferous* Limestone cropping out at Tolosa, of the common *Helix*, or large existing snail shell of Tasmania, the cranium of the *Echidna setosa* —a dried specimen of *Calloryncħus Australis*, and a spirit preparation of a large Tasmanian Lizard, closely resembling that figured by Darwin (Zool. of the Beagle, vol. iii., plate xv.) as *Cyclodus Casuarinæ*, and said by him to resemble the snakes in its mode of progression : there is an opinion commonly prevalent in Van Diemen's Land, and it obtained also amongst the Aborigines of the Island, that this Lizard is venomous.

From Mr. Propsting, of Elizabeth-street, was received a fine stuffed specimen of the Australian Goshawk. (*Astur Approximans*, Vig. and Horsf.)

Mr. Milligan read a paper illustrated with an ample series of specimens, upon the occurrence of *Galena*, with traces of copper in the old siliceous limestone, for some years quarried and burned for lime upon the property of Mr. Abraham Walker, at the western side of Norfolk Plains, and immediately under Dry's Bluff, a portion of the western range of mountains.

Thanks were voted for the donations and paper, and the meeting, after some discussion, broke up.

13TH FEBRUARY.—Monthly evening meeting, Joseph Hone, Esq., in the chair.

The following gentlemen were ballotted for, and duly elected Fellows of the Society:—Gother Mann, Esq., of Sydney; Thomas Arnold, Esq., Inspector of Schools; D.A.C.G. Mitchell, J. Boyd, Esq., F. C. Tribe, Esq., J. C. Jervis, Esq., of Hobart Town. T. J. Lempriere, Esq., A.C.G., was admitted upon Rule XVII.

The Secretary reported that Dr. Pugh, of Launceston, has forwarded his Meteorological Tables for 1849, to be published in the journal of the Society; that a book on "the Earth's Antiquity" has been received from the Dean of Westminster, through J. E. Bicheno, Esq.; that Sir William Denison has sent to the Society's Gardens a case containing *Para Grass*, forwarded from the Botanic Gardens at Kew by Sir William Hooker: and that a box of ores of copper, from the Burra Burra mines, has been presented by Sir William Denison to the Museum. A collection of prepared skins of birds of Tasmania was received from Miss Denison.

Mr. Bicheno sent for examination a fragment of freestone from the High School, having a pale blue colour, which it is said to have acquired from contact with the timber of the Huon pine.

Mr. Phineas Moss presented a few insects collected by himself at South Australia.

Mr. Mort, of Sydney, has forwarded to the Society's Gardens a case of valuable exotics, besides plants indigenous to Australia.

Mr. Mackinnon, of Selma, on the South Esk, presented for the Museum a relic of the celebrated *Flora Macdonald.*

From Mr. A. B. Jones and Mr. Philip Stanley Tomlins were received for examination curious thin saucer-like forms recently found on the sea-beach at the Retreat and South Port respectively: they seemed to be formed of sand mingled with the roe of fish, and fixed in the cake-like shape they possess by the glutinous matter involving the *ova.*

Mr. Sharland, M.L.C., sent for examination fragments of an *obsidian*-looking mineral from his estate north of Hamilton, where it is said to occur in considerable abundance, and massive: it will probably prove a variety of wood opal.

Mr. Douglas, of the Ordnance, presented mineral specimens collected in Kerguelen's Land by the officers of the Erebus and Terror, with some sea shells.

Mrs. J. Kerr, of Fitzroy Crescent, sent a small collection of coins for the Museum. Mr. H. Hull presented two specimens of fossil wood from the Old Beach, where it is said to be plentiful on the surface of the ground.

Mr. Lievesley presented for the Museum a dried fish (not named) from Honolulu, at one of the Sandwich Islands, together with a packet of seeds of a plant met with in the neighbourhood of San Francisco.

A.C.G. Lempriere sent for the library a folio atlas, curiously embellished, having been published so far back as 1715.

Mr. Milligan placed on the table a suite of beautifully distinct impressions and casts of stems and leaves of *ferns*, *strap-shaped leaves*, *calamites*, &c., recently obtained in the soft schistose clays and sandstones interposed between the seams of bituminous coal cut through in the shaft now being sunk near Wabb's Harbour on the East Coast; also read a letter from P. S. Tomlins, Esq., A.P.M., South Port, descriptive of a meteor observed by him there on the morning of the 10th instant.

A letter from Mr. Boot, on the valuable products recently stated in the House of Commons to have been obtained on the large scale from Irish peat, was communicated to the meeting.

Conversations on the subjects before the meeting were maintained till nearly 10 o'clock, when, on the motion of Dr. Officer, seconded by Dr. Turnbull, the thanks of the Society were voted for various donations and communications, and the members separated.

13th March.—The monthly evening meeting, held in the Museum and numerously attended. His Excellency Sir W. T. Denison, President, occupied the chair.

Mr. Thomas Browne, of Macquarie-street, and Mr. Walch, junior, of Elizabeth-street, were ballotted for and duly elected into the Society. The Secretary placed on the table several spirit preparations of fishes from the Estuary of the Derwent, and the bay and waters adjoining; amongst them was a fine specimen of the cuttle-fish tribe, closely resembling the common Calamary (*Loligo Vulgaris*—Lam., *Sepia Loligo*—Linn.), a rough pencil sketch, of the natural size, was exhibited. Dr. Turnbull stated, that on more than one occasion he had caught these *cephalopods* in the estuary between this and Risdon; that they are remarkable for a chameleon-like power of changing colour when captured, and that they emit a very distinct scream at the moment of seizure. It appears that the individual under examination was taken in the bay, fixed by his cup-like suckers to the back of a fish brought up with hook and line.

The Secretary submitted an inflated specimen of *Diodon* or globe-fish, taken by the aborigines near Oyster Cove, in D'Entrecasteaux Channel.

One egg of the ostrich, with two perfect specimens of *Cassis tuberosæ*, were presented from Mrs. Garrett, of Macquarie-street.

Sir William Denison placed before the meeting a specimen of of *Lignite* converted into *jet*, obtained by His Excellency in the bed of the Ouse river. Sir William also submitted a specimen of iron ore, procured in the vicinity of the Mersey river by one of the district surveyors.

A specimen of *Hematite* ore of iron was submitted for examination, having been forwarded from Break-o'-Day Plains by Mr. Groom.

Specimens of *iron pyrites* (yellow variety—*mundick* of miners) from the Lake country were submitted, having been forwarded through Mr. Barnard by Mr. Berthon, whose shepherd had collected them.

Mr. Hull sent some well grown and productive ears of *millet* raised at Tolosa.

Mr. Makeig, of the Treasury Department, presented two ornamented waist belts of aborigines of the Fejee Islands.

The Secretary placed before the meeting a sample of *Manna*, obtained from the *white gum-tree* in the Domain here. A discussion arose as to the season when it appears—the tree on which it is found—and the mode of production; in which Mr. G. W. Walker, Mr. D.A.C.G. Mitchell, Mr. Hone, Major Last, Dr. Agnew and others, joined.

The Secretary submitted a small (probably undescribed) hairy Crab, caught about the level of low-water mark on the rocks near "the Snug" point, in D'Entrecasteaux Channel. It is remarkable for the size and comparative strength of its claws, and for its lurking in a state of perfect concealment under a red membrane-like covering, from which it springs on its unwary prey. It much resembles the *Dromia hirsutissima* of the Cape of Good Hope.

The Secretary presented for the Museum some Baskets manufactured by the Aborigines of Tasmania from the strap-shaped leaves of certain Cyperaceous plants common on the sand-hills by the seashore, and used by them in their wild state for carrying shellfish and other edibles, together with articles of the toilet. Necklaces worn by Tasmanian Aborigines, and ingeniously prepared by them from a small and highly pearlaceous shell (a *turbine*,) common on our coasts, were also added to the Museum by Mr. Milligan.

The Secretary read a note from Mr. Walter Mantel, of New Zealand, expressive of his desire to aid in furthering the views of the Society.

The Secretary reported the presentation to the Society's Gardens, by Captain Goldsmith, of the Rattler, of two cases of valuable Exotic Plants; and that several cases of Tasmanian and Australian Plants had been forwarded by the same vessel to London.

The principle and construction of the Aneroid Barometer became the subject of conversation; in which Sir William Denison, Dr. Turnbull, E. P. Bedford, Esq., Dr. Butler, &c. took part.

Mr. Douglas proposed that measures be taken for bringing under the notice of the British public, at the Grand National Exhibition in London in 1851, the natural productions of this island; instancing, among other objects of interest and economical importance, its highly ornamental cabinet woods and valuable ship timbers—its gums, balsams and drugs, &c.

The meeting, after voting thanks for the various donations, broke up about 10 o'clock.

10TH APRIL.—Monthly evening meeting; Dr. Officer, one of the Vice-Presidents, in the chair.

The following gentlemen were ballotted for and duly elected into the Society:—Messrs. Thos. Dobson, of the High School; Michael Evans, of Macquarie-street; and the Rev. Francis Brownrigg, of St. George's, Hobart Town. Captain Collinson, R.E., was admitted on Rule XVIII.

Letters from His Excellency Sir George Grey; from the Hon. the Civil Secretary to Government, New Zealand; from Lieut. Lynd, Auckland, New Zealand; and from the Royal Asiatic Society of London, were read.

A letter was read from J. E. Bicheno, Esq., stating that His Excellency Sir William Denison had transmitted for presentation to the Society's Library three volumes, forwarded by the Under Secretary to the Government of Bengal, by order of the Hon. the Deputy Governor.

The Secretary reported the presentation by Sir William Denison to the Society's Gardens of a packet of seeds from Calcutta, containing one hundred and eight species: the receipt of one hundred and four species of seeds indigenous to New South Wales, from E. M. Bowman, Esq., of Camden; also the presentation of a case containing thirty-two New Zealand plants, by A. Hort, Esq.

Twenty-four coins, ancient and modern, were received from Sir Henry Atkinson, R.N., for the Museum.

The Secretary read a note from Capt. Greenwood, 31st Regt., Brigade-Major, Auckland, New Zealand, presenting a box of choice shells—marine, fresh water, and terrestrial.

The skin of a squirrel-like animal (*Acrobates Pygmæus* Desm.) of the size of a common mouse, from Port Albert, was received from Mr. H. Best.

A large specimen of prawn, and a fish (not named) were received from Mr. A. B. Jones, having been caught in the bay near his farm.

A note was read from Mr. A. Douglas presenting a case of dried plants indigenous to New South Wales, collected by Mr. Mossman; the egg of an Emu (*Dromiceius Novæ Holland*, Vieillot) from Gipps' Land; two eggs of the black swan (*Cygnus Atratus*) from Port Davey; with some shells, recent and fossil; the latter from Market Harborough, Leicestershire, England.

The Secretary reported the presentation from the Hon. Capt. Keppell, of H.M.S. *Meander*, of about fifty species of rare shells—marine, fresh water, and terrestrial—collected on the Chinese coasts, at Borneo, Labuan, New Ireland, and in the seas adjacent.

The presentation from Capt. Collinson of a number of samples of the timbers of New Zealand, of a size sufficiently large to admit of their density, hardness, and tenacity, as compared with the timbers of Van Diemen's Land, being thoroughly tested, was announced. These specimens of New Zealand timbers were accompanied with dried leaves of several of the trees yielding them, with memoranda by Capt. C., and additional notes by W. Swainson, F.R. and L.S., &c.

A letter was read from Lieut. Lynd giving an account of a New Zealand bird, allied to the Terns, about the size and having much the plumage and general appearance of the common sandpiper of the shores of Tasmania; but remarkable in having its rather long, acuminated bill turned to the right side, and slightly upwards.

A specimen of New Zealand coal, said to have been procured from beds of great thickness on the banks of a magnificent river in the Waikato district, forwarded for examination by Lieut. Lynd, was laid before the meeting: in structure, appearance, and qualities it resembled the jet-like mineral which is found in the bed of the Derwent, and more abundantly in the tertiary strata at Macquarie Harbour; like the latter, the New Zealand mineral is associated with iron Pyrites and with a fossil resin which Lieut. Lynd considers identical with that of the Kauri pine *(Dammara Australis)*. A note from Mr. Lynd, and the following letter* of the Rev. A. G. Purchas on this subject, published in the *New Zealander* newspaper of the 23rd February last, were read.

The Secretary read extracts from an article taken from the Edinburgh New Philosophical Journal for July, 1849, transmitted by D.A.C.G. Mitchell, on the occurrence of a peculiar manna in large quantities upon a scrubby variety of gum-tree *(Eucalyptus Dumosa)* at Port Phillip, known to the aborigines there under the name *Lerp* or *Laap*, and used by them as an article of food.

Mr. Milligan placed before the meeting leaves recently taken from a gum-tree near Oyster Cove, thickly covered with the little white patella-like forms characteristic of this substance.

The lately-invented harpoon gun, of which two specimens have been imported by Messrs. Nathan and Moses, of this city, was exhibited.

The thanks of the Society having been voted for the various donations, the business of the evening terminated.

* *To the Editor of the New Zealander.*

Sir,—Having occasion lately to spend a short time in the Waikato district, I took an opportunity of examining the localities in which coal has been found. A short account of what we saw may perhaps interest your readers.

Coal has been seen in four or five places on the banks of the Waikato River, in the great ridge of hills of which Taupiri is the most remarkable point. We visited three of these places,—two on the south and one on the north bank of the river. That on the north bank has been the longest known. Many years ago a large land-slip took place and uncovered the edge of a coal seam; but it was not until within the last few years that the natives became acquainted with the nature or value of the treasure so disclosed.

The coal brought to Auckland for sale some time ago was from this place; but, being taken from the exposed surface, may be considered as an unfavourable specimen.

At the time of our visit the quantity of clay washed down by the rains was so great that the seam was nearly covered. We succeeded, however, in exposing a few feet, and found the upper seam to be about 22 inches thick, of close, compact texture and brilliant fracture, covered by a good substance of dark brown shale, and bounded below by a much thicker *bed* of the same substance. In this lower bed of shale we were much interested by finding fine specimens of *kauri* gum, interspersed with small quantities of iron *pyrites.* We were unable, from want of time, to examine the lower stratum of coal; but there is every reason to believe that it is of great depth, the shale appearing again about 20 feet further down the side of the hill. The situation of this place is nearly opposite the village of Kupakupa, and is from a quarter to half a mile from the edge of the river. The land belongs to the well-known old chief Te Whero Whero, of the tribe Nga-ti Mahuta.

The second place in which coal was discovered is on the south bank of the Waikato, a little higher up the stream. It is called Papahorohoro, and belongs to chiefs of the Nga-ti Mahuta tribe. The seam of coal was first seen by some natives who were digging for *kauri* gum in a little gulley about half-way up one of the hills that bound the narrow valley through which the river flows. At the time of our first visit, a very small portion of the seam had been removed; but sufficient was visible to lead us to think it worth a careful examination. There was not a pickaxe to be obtained in the whole district—we were, therefore, forced to content ourselves with a mortising axe, some spades and hoes; armed with these, we commenced our labours, and before evening had the satisfaction of uncovering the seam to the extent of about 15 feet in depth, without reaching its lower edge. We also uncovered its upper surface for some distance, and separated about half a ton of coal. I have the pleasure of forwarding to you a specimen of the coal from this place. It is of a compact kind, having a brilliant conchoidal fracture; and, although burning with a brilliant flame, is very durable. A sufficient quantity for trying its quality has been used to-day by Mr. Watson, blacksmith, of High-street, Auckland, and found to be *too good* for smith's purposes; that is, having too much flame. For domestic purposes and as fuel for steam boilers, it is said to be superior to New South Wales coal, being clean, and perfectly free from sulphur. In appearance it closely resembles the cannel coal of England, but differs from it in not being so easily lighted.

The other place visited is a little higher still, on the same side of the river, and, as far as I am aware, was only known to the native chief who was my guide. It has, I believe, no distinguishing name. The seam was exposed by a land-slip, and is very large; but from the hastiness of our visit, it was impossible to make more than a superficial examination. The portion uncovered was probably about 25 feet in width, and from 18 to 20 feet in depth; but the middle of this is now covered by a new slip of earth, with shrubs, toe-toe, &c. growing upon it. Sufficient, however, is visible to show the great extent of the bed.

Both of these mines might be worked with the greatest ease, and, for the present at least, would require no machinery. They are situated at a considerable elevation above the river, thus affording a facility for drainage without the use of pumps. The distance from the river's side is only a few hundred yards, with a gradual slope the whole way.

There is water communication by the river Waikato and the little streamlet of the Awaroa to within three miles of Waiuku, upon the Manukau harbour, and then across the harbour to Onehunga. The portage from the Awaroa to Waiuku is very good even in its present natural state, and with a very little judiciously-employed labour might be made an excellent road.

Trusting that some means may speedily be found of turning this store of fuel to good account, to the advantage of both the natives and our fellow-colonists,

I remain, your very obedient servant,

ARTHUR G. PURCHAS.

22nd February, 1850.

8TH MAY.—Monthly evening meeting, numerously attended; His Excellency Sir William Denison, President of the Society, occupied the chair.

Alfred Denison, Esq., of Sydney, was ballotted for and duly elected a Fellow of the Society. W. R. Pugh, Esq., M.D., of Launceston, has been admitted on Rule XVII. The Secretary presented a copy of Ross's Hobart Town Almanack for 1832 from the Messrs. Best.

Mr. Phineas Moss presented three books, namely, Dr. Drummond's "Letters to a Young Naturalist," "Synopsis of the Contents of the British Museum," and "A Grammar and Vocabulary of the Aboriginal Language of South Australia."

Mr. Milligan presented seven quarterly parts of the "Transactions of the Highland and Agricultural Society of Scotland."

The receipt at the Society's Gardens of two cases from England containing choice *Camellias* and other plants, generally in good condition, was reported; also the receipt of a case from Joseph Bonney, Esq., of Perth, containing eighty plants, chiefly Australian; it was also stated that Mr. Newman had forwarded to the Botanic Garden at Sydney, per H.M.S. *Meander*, a large case of plants and scions, together with two boxes of choice strawberries.

Mr. A. Makeig, of the Treasury, placed on the table a large and elaborately-finished model of Chapman's Patent Drop Machine, by which coal is lowered in the trucks to a ship lying in deep water, and poured into the hold in a way to avoid breakage, at the rate of 2 to 3 tons per minute. The examination of the various details of this beautifully executed and valuable model, and the exhibition of its mode of operation, created general interest and attention.

The Secretary placed on the table a box of geological specimens collected by Mr. James Scott, Surveyor, Launceston, on the northern side of the island, transmitted by him to the Surveyor-General, and by order of Sir William Denison transferred to the Society's Museum. His Excellency the President took the opportunity of stating that orders have been given to observe and collect rock specimens and minerals, and carefully to note their localities and connections, so far as may be practicable, in the progress of the trigonometrical survey, so as to get together data for the preparation of a geological map of the colony.

A sample of New Zealand coal was presented from Mr. Lewis, of Collins-street.

A beautiful impression of *Osteolepis* from the Devonian Rocks, at the Orkneys, north of Scotland, was presented by Henry D'Arch, Esq.

Mr. Milligan placed on the table specimens (male and female) of *brachyurous* Crustaceans (Crabs), from D'Entrecasteaux Channel; one pair belonging to the *Oxyrhynchi* (of Milne Edwards), and the other remarkable for the possession of ciliated antennæ, with a rim having a fine steel-blue tint; specimens from a bed of Lignite, near "Beckford's," on the Tamar River—of the soft argillaceous cliff reposing upon it—and of ferruginised roots, &c.;—also a section (dressed and French-polished) of the stem of the graceful palm-like Richea (*Richea pandanifolia*), found in the dense forests between Lake St. Clair and Macquarie Harbour, where it attains the height of 40 to 50 feet in sheltered positions,—the venation, markings, and rich yellow colouring of which were much admired.

A paper upon the bituminous coal which occurs on the Australian coast, between Western Port and Wilson's Promontory, near Cape Liptrap, by Mr. G. H. Wathen, was read.

Mr. Dobson, of the High School of Hobart Town, submitted some carefully-executed coloured drawings of an insect whose labours in the formation of a small conical domicile or chrysalis on the leaf of the white gum-tree, and its metamorphoses therein, have been recently very closely observed by him in reference to the paper which was read before the Society at last meeting, on the *Laap* or *Lerp* found on the *Eucalyptus Dumosa* over extensive tracts of country in Australia Felix at certain times.

A paper of Captain Collinson's, on New Zealand timbers, was postponed on account of the lateness of the hour. The thanks of the Society were voted for the numerous donations, and in a special manner to Mr. Makeig for his masterly model. The meeting broke up a little before ten o'clock.

12TH JUNE.—Monthly evening meeting; Robert Officer, Esq., one of the Vice-Presidents, in the chair.

Mr. Francis Cotton, of Kelvedon, Swan Port, and Mr. Salier, of Liverpool-street, Hobart Town, were ballotted for and duly elected. The Rev. W. B. Clarke, M.A. F.G.S. of Sydney, and the Rev. Chas. Pleydell N. Wilton, M.A., of Newcastle, N. S. W., both members of the Tasmanian Society, were proposed and admitted on Rule XVII.

Dr. Henry Butler presented to the library of the Society, in the name of the author, Mr. Field, of Isleworth, two volumes on Analogical Philosophy.

Mr. Phineas Moss presented a small volume on Taxidermy, with manuscript notes.

A fragment of compact blue limestone, obtained by one of the Government Surveyors in the bed of the Florentine River, (a tributary of the Derwent, on its western side, and nearly opposite to Marlborough), where it is said to occur over an extensive tract of country, was sent to the meeting by His Excellency Sir W. Denison.

Specimens of clay-ironstone and fossils, from the carboniferous strata at St. Paul's Plains, were received from F. W. Stieglitz, Esq., of Lewis Hill.

Major Last laid on the table specimens of schistose clay, &c., having beautiful impressions of *Glossopteris Browniana*, obtained at "Nobby Island," near the mouth of the Hunter River, New South Wales, during the construction of the breakwater at Newcastle.

G. T. W. B. Boyes, Esq., sent for the museum two old English silver coins, respectively of the reigns of William the Conqueror and of Edward the First. That of William the First belongs to a box containing 6500 pieces or more, accidentally found by four little boys playing marbles in a piece of pasture-land called "Old Litten," near the manor-house of Beaworth, in Hampshire, on the property of Mr. Dunn, of Aylresford, on Sunday, June 30, 1833. This box of treasure was exposed and broken open by the wheel of a heavy waggon cutting deeply into the ground.*

James Barnard, Esq., presented to the museum preparations of a black snake, and of a lizard, of the colony; also autographs of the poets Wordsworth, Southey, Moore, James Montgomery, and Joanna Baillie,—of James, the novelist and historian; Cooper, the American novelist; Dr. Elliotson, Sir Charles Lyell, and M'Culloch, the political economist.

* Ruding's Annals (4to.) of the Coinage of Great Britain, vol. i. page 151.

From Morton Allport, Esq., two drawers full of Tasmanian insects, well preserved, were received; many of them reared from the egg by Mr. A. A fish, probably *(Chironectes)* undescribed, having a remarkable elbow-joint-like conformation of pectoral fins, was presented by Mr. Allport.

C. C. Abbott, Esq., of the 18th Royal Irish, presented to the Museum a handsome collection of heads and horns of the Antelope and Deer tribes frequenting the rocky sides and summits of the lower ranges of the Himmalay Mountains.

P. S. Tomlins, Esq., forwarded to the meeting a spirit preparation of a curious specimen of the *Tunicata.* The animal looks like a free member of the genus *Accidia* on its proper surface; but underneath, and in the spaces between three leathery pendant flaps, there is on one side loose *Branchiæ,* and on the other, covered by a soft membrane, a thin and pellucid shield-like shell. It will probably be found to be a link between this class of animals and the conchiferous *Molluscæ.* The specimen was procured by Mr. Tomlins on the sea-beach at South Port.

H. Hull, Esq., placed on the table some fragments of granite, compact quartz, quartz rock veined with iron, recently collected by him on Ben Lomond; also specimens of the fresh-water muscle *Unio,* from the South Esk; and a good specimen of a hermit or soldier crab, in his usurped shell—a *Fasciolaria.*

Mr. Milligan placed on the table spirit preparations of the diamond snake and whip snake of the colony—the former taken at Circular Head, the latter on Flinder's Island; also specimens of the egg of a member of the shark tribe, known as "Sea Purses:" on examination, one was quite fresh, the yolk and white being distinct, without appearance of vivification. They were taken by a fisherman, according to his own account, from a short squat fish, which he calls a "Nurse," and which he says was afterwards thrown into the water.

On the table lay a fine specimen of *Sagus Ruffia* in fruit, and the large seed vessel of the *Lodoicea Sechellarum.*

Dr. Crooke presented in a phial, from Mr. Weston of Adelaide, a sample of washed gold-dust from the Onkaparinga district, South Australia.

The Secretary reported having forwarded to the Museum at Sydney a quantity of skins of birds of Tasmania—that the Horticultural Society of London had acknowledged a large assortment of indigenous seeds sent to them by the *Marmion*—and that the Society's "Papers and Proceedings" had been acknowledged by the British Museum, the Royal Institution of London, the Australian Subscription Library, &c.

A note from Colonel Bolton, R.E., was read.

The Secretary read a paper from D.A.C.G. Mitchell on Mimosa bark, and the two following notes to Capt. Chalmers of Bagdad; also from Dr. M'Kenzie of Kinellan, near Dingwall, Ross-shire, Scotland, on the introduction of salmon into Tasmania.

"*Kinellan, by Dingwall, 2nd July*, 1841.

"SIR,—In Sir F.'s absence I hasten to reply to your favour of 28th ultimo.

"I could not supply you with young fry, because they would have to be carted 80 miles to the steamer at Inverness; and if they survived this, I fear they might, through neglect, die before the *Queen of Scotland* reached London. If you choose to send down a person to take charge of them with a proper vessel or two, I will supply you with a lot of fry. The expense will not be serious by steamer from Hore's Wharf to Inverness on the 12th. I would have a cart ready for him, to send him to, and bring him back from, the west coast, where the fry are. But you must write me directly. Allow me to suggest a better and simple plan, and I think one that cannot miscarry. We take the roe and melt from a fresh-killed fish—say in September,—rub them together, deposit the roe in a basket of fine gravel in a pool, and in March or April the fry come out in swarms. Why should not you (or some one you can recommend to me) take out a supply of roe thus prepared, plunged in your tank? I am perfectly certain, that if shipped in September or October, and deposited in a river in Australia before March, 99 of the 100 grains of roe will become salmon. Let me hear from you.—Yours truly,

"J. MACKENZIE, M.D.

"Captain Chalmers."

"*Kinellan, by Dingwall, 12th July*, 1841.

"DEAR SIR,—I fear you will hardly get a roe and melt so far advanced by 1st August as to be depended on for impregnation. But by consulting some of the Billingsgate folks you may perhaps succeed; at all events it is worth trying, as the cost will be almost nothing. A common basket, with cover, filled with gravel and roe impregnated, and sunk in your tank, will require no more trouble till you land in Australia, when the basket can be put into a pail and carried to any stream where you wish to try if the thing is to succeed.

"Next year (D.V.) you can have some fry sent south to you in better time if you like; or if you will give me the address of some careful confidential friend, I will send him south two baskets, containing impregnated roe, say in September; one basket to be sunk in water in England to produce live fish for your next year's trip,—and the other to be shipped to your address in Australia, where it is probable you will receive it long before the fry begins to chip the shell.

"All that will be necessary is to direct your friend to keep the basket under water in some *fresh* stream till the ship is ready to sail, when one can be transferred to the ship tank, and the other remain (in a pure running stream if possible) till the fry begin to emerge in March, when a pool can be formed surrounded with a fine net to prevent their straying and being destroyed. Let me hear from you as to this before you start.—Yours faithfully,

"J. Mackenzie, M.D.

"Captain Chalmers."

Dr. Officer expressed doubts whether the temperature of the rivers of Tasmania is sufficiently low in the winter for salmon to thrive in.

Mr. James Burnett remarked, that it has been considered essential to the successful introduction of the fertilised roe, that it should be placed during the passage out in a current of fresh water.

Dr. Butler cited experiments of Professor Owen to show that the roe and milt, taken at the proper season, mixed, and then deposited together in a tub of standing water and kept there, become hatched about the usual time and yield fry in abundance, and that the introduction of the fish may prove much easier than anticipated.

Dr. Officer thought we might yet, perchance, find it most convenient to procure the salmon from California.

The Secretary read a letter from J. E. Bicheno, Esq., F.R.S., &c., on a specimen of saw-fish, *Pristis Cirratus*.

Mr. D.A.C.G. Mitchell gave a short but clear and satisfactory exposition of a new mode of setting up the rigging of vessels, illustrated by a neat model which he placed on the table. The contrivance has a light and elegant appearance, and is considered in an especial manner applicable to merchant vessels, as it is calculated to effect a material saving in manual labour.

After discussions on various matters before the meeting—in which Mr. James Burnett, Drs. Agnew and Butler, Lieut. Smith, Major Last, and others joined,—it was moved by Joseph Hone, Esq., seconded by Dr. Turnbull, and carried, "That the thanks of the Society be given to the persons who have made presentations and furnished papers."

The meeting broke up a little before ten o'clock.

10TH JULY.—Monthly evening meeting; the chair taken at half-past seven by His Excellency Sir W. T. Denison, F.R.S., &c. &c., President. The following gentlemen were elected into the Society:—Thomas Anstey, Esq., of Anstey Barton; Lieut. Walker, R.N., of Launceston.

The Secretary drew attention to a choice collection of *Algæ* made at George Town by the Rev. J. Fereday—to a sample of bituminous coal dredged up in the River Tamar below Whirlpool Reach—and to a specimen of timber possessing a perfume almost equal to that of sandal-wood, a section, apparently, of a small *Acacia* not identified, but said to occur at or near George Town; presented to the Society's Museum by Sir Wm. Denison.

A cabinet of mineral and rock specimens from Europe, arranged and numbered, with a catalogue, presented by John Abbott, Esq..

A sample of coal from the lower seam at the Schouten Island, received from Mr. Whitcomb, lay upon the table.

Lieut. Smith, R.N., presented a collection of mineral specimens of great interest from South Shetland, Kerguelen's Island, Ascension, St. Domingo, Greenland, Cornwall in England, &c.

Mr. Hull presented to the Museum, in the name of James Mackay, Esq., upwards of a hundred curious coins, ancient and modern; together with a few sea shells.

The Secretary reported that two cases of Australian plants and a packet of seeds have been received at the Society's gardens, presented by Sir W. Denison; that a packet containing twenty-five species of Australian seeds has been received from Mr. R. Officer of Port Phillip, through the kindness of Dr. Officer; and that fifty species of seeds have been forwarded to J. Bonney, Esq., of Perth, in exchange for plants and seeds received at sundry times. A specimen of the *Ardea Novæ Hollandiæ*, or heron, commonly called a crane in the colony, was presented by G. T. W. B. Boyes, Esq.; the bird was shot on the banks of the Derwent, near Mr. Boyes's residence, at New Town.

Joseph Allport, Esq., forwarded for the Society's Museum the skin of a Tasmanian eagle, the *Aquila fucosa.*

E. Hathaway, Esq., United States Consul, presented a sample of anthracite from Pennsylvania, of which a fire in the ante-room was made: as a fuel it is remarkable for entire freedom from smoke and flame, and it is of a character so durable that a fire properly made up will last more than twenty-four hours.

A good specimen of goldbeater's skin, with a jar of gold leaf, manufactured by Mr. R. V. Hood from Californian gold with tools made in Hobart Town, was presented to the Society's Museum by Mr. Hood.

Mr. Milligan placed on the table some preparations in spirit of Tasmanian fishes ; also some curious fossil forms recently discovered by him in certain clayey beds under sandstone strata in D'Entrecasteaux Channel; they are in shape *trilobite*, from one to five or six inches in length—in some instances two inches in breadth. The *carapace* and heads are yet desiderata. This fossil from D'Entrecasteaux's Channel approaches closest to the *Calymene* in general appearance of any of the families of the tribe which have been figured ; casts of the stems of *Algæ* and a form like *Orthoceratite* are associated.

The Secretary read a communication from Mr. Edwin Ward Trent, of Park Rope Manufactory, Essex, recommending the introduction of Italian hemp into Van Diemen's Land, as calculated to become a valuable staple, realizing in England £30 to £50 per ton. Mr. Trent states that he has discovered a mode of dressing New Zealand flax at a rate not exceeding 2*s*. per cwt.

The Secretary read the following communication from Francis Cotton, Esq., of Kelvedon, Swan Port, on the habits, &c. of Snakes of Tasmania ; Dr. Agnew, Lieut. Smith, and others adduced facts to corroborate the statements of Mr. Cotton :—

"To Dr. Milligan,

"Respected Friend,—I herewith send my promised account of Snakes, and regret that I cannot, as thou wilt perceive, enrich it with some anecdotes by the writer of the letter which I enclose.

"I have seen much more of snakes in this than in the old country, and have noticed circumstances here which may or may not be common there. For instance, some of our cats seem to have a predilection for the small snakes ; they sometimes bring them up to the house,* play with them, and finish by eating them as they do mice. The fur of the cat seems to protect it against snake bites; for I understand that every effort has been tried, but fruitlessly, to make the snake bite this animal. The opossum enjoys, I apprehend, a similar immunity. Eagles and hawks devour snakes, and have been frequently observed soaring with them in their talons to a considerable height in the air, whence they drop them to the ground in order to kill them ; and when they fail to accomplish this on a first effort they repeat the process, and conclude by eating them.

* Lieut. Smith remarked that he had seen a cat bring a whip snake into the parlour in Capt. Read's house, at New Town.

"Snakes are amphibious. A diamond snake, pursued by one of my sons, took refuge in a shallow water-hole, and upon search being made in order to despatch it the reptile was found coiled up in the gravel at the bottom.*

"Some years ago I lost a shepherd from a bite in the wrist by a black snake, which he was in the act of striking with a short stick. The man walked to the edge of the bay, and washed the wound in salt water; but no attempt was made at excision, on account of the sinews and artery. The man was bit about noon; my son saw him about half-an-hour after, and there being no medical man nearer than 20 miles he sucked the wound, remaining with him till 8 o'clock in the evening, when he left under the impression that the man would recover; but he died about 3 or 4 o'clock next morning, apparently from general paralysis.

"A few months ago my friend Dr. Story saw a snake in the garden of the "Grange" Estate, Great Swan Port, and looked about for a stick to kill it with; on returning he was surprised to find the reptile still in the same place, and that it appeared to be somewhat torpid. The snake was readily dispatched, when it became apparent that it had been killed in the act of swallowing something which, on a closer inspection, proved to be another snake, about four inches of the tail of which protruded from its jaws.

"I visited the "Grange" on the following day, when Dr. Story showed me the snake as he had killed it; after which the half-swallowed snake was withdrawn,—an operation requiring considerable force. We measured the snakes, and found that one, which was of the red or diamond species, was about 31 in. in length; while the other, which was a young black snake, measured 22 in. only. The diamond snake was probably full-grown, being thick in proportion to its length; the black snake was about half the bulk of the other.

"As neither Dr. Story nor myself had before seen snakes in like circumstances, or heard of such having been observed by others, we supposed it to be a discovery that snakes preyed on each other; and also that this might account in some measure for their comparative fewness throughout the island. Of the former supposition I was soon undeceived; for, meeting with Charles Meredith, I related to him what we had witnessed, when he told me that he had *twice* before heard of such occurrences,—one at a sheep station on the Morumbidgee River, New South Wales; the other in the neighbourhood of Port Sorell, where for some time he held the appointment of Assistant Police Magistrate.

"That snakes climb trees with ease is well ascertained, though it seems almost incredible when the tree is upright and the bark smooth, as in the white gum. One of my sons, some years ago, passing a tree of this description without a branch for twelve feet up, saw a black snake fall therefrom to the ground; he killed it, and on cutting it open found in it several young parrots. He then climbed the tree with some difficulty, and found among the

* Mr. Milligan remarked that he had seen a large black snake in the Tamar river, about $1\frac{1}{2}$ miles below Launceston, swimming directly across the wake of a vessel, and where the water was of course brackish, if not quite salt.

branches an empty parrot's nest, the occupants of which had no doubt furnished the snake with a meal.

"About twelve months ago, three of my sons on one of their play afternoons were in the bush, and seeing an opossum hole in a tree (about four feet in thickness, the first branch being about seven feet from the ground), one of them climbed up to see if the hole were occupied, and on looking in saw an opossum moving about, instead of sitting perfectly quiescent as they usually do; he then made a noise, when the animal looked up, and as my son leaned back to break off a stick, jumped out and ran away along the ground, pursued by the children. The opossum soon climbed a small she-oak tree, where he was immediately shot. On going to take him up, a red snake was seen entwined round his neck, the head hidden or buried in the fur. The snake was about 30 inches long, and had two turns or coils round the opossum's neck; it was of course killed.

"Here are instances of two species of snakes climbing trees*—the first evidently on a predatory excursion; the last possibly on the same errand.

"It is not unlikely that other persons may be able to communicate facts similar to those I have detailed; but whether such be the case or not, it seemed to me that the relation might prove interesting to many persons, and perhaps induce others to be more observant of the habits of a class of reptiles justly held in general abhorrence.

"I remain, thy friend,

(Signed) "FRANCIS COTTON.

"Kelvedon, Great Swan Port,
12th of 6th month, 1850."

In connection with this subject the Secretary laid on the table the following statement of experiments made by Dr. Dawson, D.I.G.H., and Staff-Surgeon Huish, in presence of other medical men, in order to test the efficacy of a preparation alleged by Charles Underwood to be an antidote to the poison of Snake bites, on the 13th, 14th, and 19th February, 1850:—

"Two cats and twenty-three dogs, in all twenty-five animals, were bitten by black, brown, and diamond snakes. To fourteen, Underwood applied his preparation, and four of them died. The other eleven were tied up without anything being done to counteract the effect of the bite, and three of them died; or $28\frac{1}{2}$ per cent. died after the application of the antidote, and $27\frac{1}{8}$ per cent. without the antidote.

"Excepting in one case the snakes would not voluntarily bite; the exception was in the case of one of the cats, which died. The methods adopted to make the snakes bite were, first, by confining one

* Dr. Agnew stated that in the vicinity of Sydney he had shot a snake upon the limb of a tree at least 30 feet from the ground.

snake after another in a large wire cage, and throwing dogs, cats, and rabbits in on them: this failing, one snake at a time was allowed to be free on a grassplot, and animals were dragged over it in every way. This, likewise, failing to excite the snakes to attack or bite any animal, Underwood seized the snake behind the head, the mouth was forced open, and if its poison-fang appeared perfect, the tip of the dog's nose or the inside of a dog's ear, where the small blood-vessels are numerous, was placed within the jaws of the snake: in some instances the snake fixed itself; in the others it appeared to be forced by Underwood to bite. In every instance there was the mark of a bite, and when the antidote was used it was immediately applied."

Feb. 12.—A puppy was bitten by a small black snake, no antidote was applied, and the animal lives.

Feb. 12.—A cat was bitten by a large diamond snake at 2h 7m, antidote applied, died at 6h 15m.

Feb. 12.—A cat bitten by a large diamond snake at 2h 10m, no antidote applied, died at 3h 20m.

Feb. 12.—A cat bitten by large black snake at 2h 25m, no antidote applied, died at 2h 35m.

Feb. 12.—Dog bitten by a large black snake at 2h 36m, antidote applied, died at 3h 15m.

Feb. 13.—Dog bitten by a large black snake at 1h 44m, antidote applied, lives.

Feb. 13.—Dog bitten by a large black snake at 1h 46m, antidote applied, died at 6 a.m. on 14th.

Feb. 13.—Pup bitten by a large black snake at 1h 52m, no antidote applied, died at 7 p.m.

Feb. 13.—Dog bitten by a large brown flat snake at 1h 56m, antidote applied, lives.

Feb. 13.—Dog bitten by a large brown flat snake at 1h 58m, antidote applied, alive.

Feb. 13.—Dog bitten by a large brown flat snake at 2h 35m, antidote applied, alive.

Feb. 13.—Dog bitten by a lage diamond snake at 3h. 45m, antidote applied, alive.

Feb. 13.—Dog bitten by a large diamond snake at 3h 50m, antidote applied, alive.

Feb. 13.—Dog bitten by a large diamond snake at 3h 55m, no antidote applied, alive.

Feb. 14.—Dog bitten by a large brown snake at 12h, no antidote applied, alive.

Feb. 14.—Dog bitten by a large brown snake at 12h 1m, antidote applied, died at 7h 30m.

Feb. 14.—Dog bitten by a large orange diamond snake at 12h 10m, no antidote applied, alive.

Feb. 19.—Dog bitten by a large black snake at 11h 53m, antidote applied. All the following animals were alive on the 20th at 6 p.m.

Feb. 19.—Dog bitten by a large black snake at 11h 55m, no antidote applied, alive.

Feb. 19.—Dog bitten by a large black snake at 12h, antidote applied, alive.

Feb. 19.—Dog bitten by a large black snake at 12h 2m, no antidote applied, alive.

Feb. 19.—Dog bitten by a large brown snake at 12h 10m, antidote applied, alive.

Feb. 19.—Dog bitten by a large brown snake at 12h 13m, no antidote applied, alive.

Feb. 19.—Dog bitten by a brown snake (about 2½ feet) at 12h 17m, antidote applied, alive.

Feb. 19.—Dog bitten by a black snake at 12h 19m, no antidote applied, alive.

(Signed) WM. DAWSON,
Deputy Inspector-General of Hospitals.

Results of further Experiments made on the 23rd and 26th Feb., 1850.

Feb. 23.—Pointer dog bitten by a large black snake 12h 15m, antidote applied, alive.

Feb. 23.—Small dog bitten by a large black snake 12h 15m, no antidote, died at 11 a.m. on 25th instant.

Feb. 23.—Dog bitten by a large black snake 12h 30m, antidote applied, alive.

Feb. 23.—Dog bitten by a large black snake 12h 35m, antidote applied, alive.

Feb. 23.—Dog bitten by a large black snake (second time) 24m to 1 p.m., no antidote, alive.

Feb. 23.—Dog bitten by a large black snake, 20m to 1 p.m., no antidote, alive.

Feb. 23.—Dog bitten by a large black snake 5m to 1 p.m., no antidote, died at half-past 10 p.m., 23rd instant.

Feb. 26.—Dog bitten by a large black snake 6m to 12, antidote applied, alive.

Feb. 26.—Black and white spaniel bitten by a black flat snake, 12h 6m, no antidote, died during the night of the 26th.

Feb. 26.—Puppy bitten by a whip snake 12h 15m, antidote applied, unknown. Lost by Underwood on his way home.

Feb. 26.—Dog bitten by a green whip snake 12h 15m, no antidote, alive.

Feb. 26.—Dog bitten by a whip snake 12h 21m, antidote applied, alive.

Feb. 26.—Small black dog bitten by a large black snake 12h 25m, antidote applied, alive.

Feb. 26.—Black dog bitten by a large black snake, 12h 30m, no antidote, alive.

Feb. 26.—Pointer bitten by a large black snake 26m to 1, antidote applied, alive on 26th at 50m to 2, but has lost the use of its limbs.

H. Huish,

Assistant Surgeon to the Forces.

A paper by Capt. Collinson, R.E., upon the timbers and timber trees of New Zealand, was read, which led to animated and interesting conversations; in which Mr. Ronald Gunn, Mr. D'Arch, Lieut. Clarke, Sir William Denison, and other gentlemen joined. Major Last remarked that it is chiefly, if not exclusively, under and above the roots of the *Rata (Metrosideros robusta)* that the plant caterpillar, *Sphœria Robertsia*, is met with.

The thanks of the Society having been unanimously voted to the various persons who had made donations, the President left the chair, and the meeting broke up soon after 10 o'clock.

14th August.—Monthly evening meeting; J. W. Agnew, Esq., M.D., in the chair.

The Rev. David Boyd, of Norfolk Plains, was ballotted for and elected a member.

On the table was a fine stuffed specimen of the bittern of Tasmania (*Botaurus Australis*), presented to the Museum by Alban C. Stonor, Esq., Solicitor-General.

Mr. Ring presented samples of the gold-dust of California in its washed state.

A specimen of crystalized quartz, from Mount Picton, on the western side of the upper portion of the Huon River, was received from Major Cotton.

Dr. Officer presented a stuffed specimen of *Ornithorynchus paradoxus.*

Some choice apple and pear trees have been received from Mr. Fry, of Launceston, in exchange for scions sent to him from the Society's Gardens. A case has been forwarded to England, per *Eliza*, by the Superintendent of the Society's Gardens, containing *coniferæ* of New South Wales and Van Diemen's Land, *Richeæ* and *Treeferns.*

A note from Mr. H. Hull, transmitting to the Museum of the Society twelve small coins of silver, copper, and brass—amongst them a brass farthing of George II., was read.

The Secretary placed on the table for the Museum specimens of fossil woods, upwards of twenty in number, from various parts of Van Diemen's Land and Bass's Straits, duplicates of which have been recently forwarded to the British Museum, and to Mr. Brown, President of the Linnean Society, &c. Mr. Milligan also presented about 60 species of shells of Tasmania,—terrestrial, fresh water, and marine,—several possessed of much delicacy and beauty, and probably undescribed; duplicates of them have been forwarded to the British Museum. Mr. Milligan also presented for the Museum a human *cranium*, apparently aboriginal, and recently ploughed up on new ground near Wabbs' Harbour, in a tolerable state of preservation. It is known that the aboriginal tribes differed in their mode of disposal of the dead; some interred and roughly covered them over in holes and cavities accidentally formed by the upset of a tree or the like; others burnt their bodies to ashes in huge fires; while others, after placing them in hollow trees in a sitting position, surrounded them with loose pieces of dry timber, and so abandoned them.

Mr. Milligan also submitted specimens of granite, containing garnet, from Wabbs' Harbour.

The Secretary read letters from the Horticultural Society at Wellington, New Zealand, expressive of their desire to reciprocate; and from the principal librarian of the British Museum, communicating the intention of the trustees to furnish the Royal Society of Van Diemen's Land with copies of their extensive and valuable catalogues, and thanking this Society for specimens of *Gorgoniæ* sent home by the Secretary—the first of the kind met with in the southern hemisphere. The Secretary read extracts of an interesting letter from J. E. Gray, Esq., F.R.S. of the British Museum, on this and other corallines forwarded. Mr. Gray refers the coralline in question to *Primnoa*, of which he thinks it may form a *subgenus*, if it do not turn out to be an entirely new *genus*.

A communication forwarded through J. E. Bicheno, Esq., from Mr. Frederick Maning, on an unusual optical phenomenon, described by him as having occurred off Maria Island, during his residence near Spring Bay, was read.

The Secretary mentioned his having observed the appearance of luminous rays emanating from the shadow of a person thrown across a field soon after sunrise, at Sandy Bay, on a fine dewy morning. Attention was drawn to a small gun harpoon, neatly executed by D.A.C.G. Mitchell, on a principle suggested, it appears, by Staff

Surgeon Dr. Huish, of this city. The chief difference between this model and the gun harpoons from England is, that the line in this is attached to a nut, which, travelling along the harpoon itself, half enters the muzzle of the gun, into which it nicely fits.

A letter from Mr. Young, of Invershin, Inverness-shire, addressed to James Burnett, Esq., of this city, and recently received, on the introduction of salmon, was read. Mr. Young has had communications with Mr. B. Hawes on the subject, and he now recommends, as ensuring all but absolute success, that full-grown salmon should be sent out in a vessel fitted up for the express purpose, which he terms a *welled smack*. The cost, estimated at about £700 or £800, offers for the present an obstacle scarcely to be overcome; but it is expected that the more practicable and cheaper mode of bringing out spawn or smolt in tanks will be tried, and that the pleasures and profits of salmon fishing may in due course be added to the sports and pastimes as well as industrial resources of the colony.

Discussions followed, and protracted the sitting to ten o'clock, when, after voting the thanks of the Society for the various donations, the members separated.

11TH SEPTEMBER.—Monthly evening meeting; Joseph Hone, Esq., senior member of council present, in the chair.

The following gentlemen were ballotted for and duly elected into the Society:—Hon. R. G. Talbot, of Malahide; George King, Esq., R.N., Port Officer; John Mackinnon, Esq., of Selma; and Richard Cleburne, Esq., Hobart Town.

The Secretary reported the following donations to the Society's Library:—From John Abbott, Esq., a copy of Andrew Bent's Van Diemen's Land Almanack for 1824, said to be the first book printed and published in the colony; from Ronald C. Gunn, Esq., a copy of Sir W. J. Hooker's "Popular Guide to the Royal Botanic Gardens at Kew;" from Alfred Douglass, Esq., of Port Phillip, a treatise on "Mesmerism and Clairvoyance," recently published in Melbourne.

The presentations to the Museum were:—

A fine specimen of fossil wood (*Banksia?*) known as the *Ross fossil*, from J. E. Bicheno, Esq.

A valuable collection of eggs of Tasmanian birds, from Mr. Morton Allport.

A specimen of fibrous *schorl*, locality not named, from Mr. Barnard.

A collection of upwards of 30 marine and fresh water shells, comprising good specimens of the following genera—*Cypræa*, *Hippopus*, *Pinna*, *Pyrula*, *Natica*, *Ovula*, *Conus*, *Mitra*, *Cyclostoma*, and *Ampularia*, from Mr. John Abbott.

Two fragments of copper ore from Sir Henry Atkinson.

Seventy copper coins of ancient Rome, modern Italy, and other countries, from Mr. William Abbott.

A mass of siliceous matter, replete with impressions of Ferns (*Pecopteris Odontopteroides*, as figured by Stizelecki), found at Broad Marsh, from Mr. Walch.

The Secretary reported two cases of plants, forwarded from the Society's Gardens, per *Munford*, to New Zealand, and one case forwarded per *Emma*, to Sydney, containing plants and scions of fruit trees, varieties of willows, strawberries, &c. &c., for Mr. Bowman, of Camden.

The Secretary placed upon the table two marine parasitical Isopodous Crustaceans (*Oniscides?*—Latreille), obtained from the rock-cod and gurnard here; also an imperfect shell of *Nautilus pompilius*, thrown up by the sea on the east coast of Van Diemen's Land—and it was remarked, that as a perfect specimen of the same was obtained at Flinders' Island some years ago amongst a vast number of shells of the paper nautilus (*Argonautus Argo*), cast ashore there at same time, it may fairly be set down as an occasional inhabitant of these seas.

Mr. Milligan also mentioned having recently discovered, in a ravine upon the east coast of the colony, an elegant-looking shrub, ranging from six to twelve feet in height, clothed with long digitate leaves, set opposite, and drooping at their extremities, and having its young shoots more or less hollow and filled with pith, like those of the *Sambucus*. The shrub exhibited neither flower nor fruit. It will, probably, be referred to the *Umbellales* of Lindley, and to the order *Araliaceæ*, a dwarfish member of which (*Panax Gunnii*) Mr. Milligan discovered in 1842 in the dense dark forests near the Franklin River. This new shrub promises to become an acquisition to our arboretums and pleasure-grounds, and ought to be introduced.

Thomas Dobson, Esq., of the High School, read a paper upon three varieties or sub-species of *Psylla*, which he terms *Psylla Eucalypti*,—insects which, in the larva state, have the faculty of elaborating from the juices of the gum-leaves on which they live a glutinous and saccharine fluid, whereof they construct for themselves little conical domiciles, more or less beset externally with filamentous matter, somewhat resembling that characteristic of the *Aphides.* Mr. Dobson placed before the meeting a series of carefully executed coloured drawings illustrative of the subject. Twigs and leaves of *Eucalyptus* were produced bearing myriads of the white cones, which are probably identical with those said to prevail so abundantly at certain seasons in Australia Felix—called Lerp, and eaten by the aborigines, —and which has been noticed in the Edinburgh Philosophical Journal for July, 1849, as a new species of *Manna*, &c.

Mr. Milligan read the following note from the Rev. S. B. Windsor, Warden of the College, Bishopsbourne, giving results, in 1850, from the operation of *budding* rose-trees in 1849.

" *Christ's College, 9th September*, 1850.

" My Dear Sir,—I met with rather a remarkable fact the other day, which you may perhaps feel interested in knowing. Last November I budded several rose trees in the College garden, a good many of which took well and flowered that season: several did not, as I thought, take at all; of these last I cut away some, and left others as they were. To my surprise I find this spring that almost every one of those which I left have taken, and are now shooting healthily into leaf. I have been in the constant habit of budding for nearly twelve years; but never witnessed a like phenomenon. To what would you attribute this? Have any more practical gardeners ever met with it; or is it quite unprecedented; and has the early spring anything to do with producing it? A mild winter, I should say, it has not been. We have had very little rain, but some of the most severe frosts which I ever remember in this country since my arrival.—My dear Sir, faithfully yours,

" S. B. Windsor.

"Joseph Milligan, Esq."

After conversation on various topics before the meeting, thanks were unanimously accorded to Mr. Dobson for his interesting paper, and to the several parties bringing donations. The Chairman vacated his seat, and the meeting broke up about nine o'clock.

9th October.—Monthly evening meeting; the Rev. John Lillie, D.D., a Vice-President of the Society, in the chair.

The following gentlemen were balloted for and elected:—L. C. Stevenson, Esq., John Watson, Esq., of Hobart Town; Francis Evans, Esq., Launceston.

The following presentations were made to the Library:—In the name of Dr. Fitton, forwarded through Dr. Pugh of Launceston, a copy of Sir Henry De la Beche's Address to the Geological Society of London, at the Anniversary Meeting held on 16th February, 1849. *Fasciculi* of Proceedings of the Zoological Society of London, in continuation from May to December, 1848, with the Report read at the Annual Meeting held in April, 1849. Mr. Milligan presented a publication of 1672, entitled the Practice of Physic, in seventeen books, by

Nicholas Culpepper, Physitian and Astrologer,
Abdiah Cole, Doctor of Physic,
William Rowland, Physitian ;

chiefly a translation of the Works of Lazarus Riverius, Counsellor and Physitian to the King of France, &c.

Mr. M. Allport presented to the Museum a collection of eggs of English birds; also a box of eggs of birds of Tasmania, with a list of names.

His Excellency Sir W. Denison sent a specimen of the common *Hippocampus*, and a very fine specimen of the more rare variety named *Phyllopteryx*, by Swainson ; also a sample of bituminous coal obtained by Mr. J. Scott, Surveyor, Launceston, at the Ben Lomond Rivulet, on the western flank of Ben Lomond.

Samples of plumbago *(Graphite)*, obtained in the shaft lately opened on the estate of Creekton, Norfolk Plains, the property of Abraham Walker, Esq., in pursuit of the veins of *Galena* with *copper*, occurring in the limestone and slate there, were presented from Mr. Walker.

The Secretary drew attention to an unusually large crab upon the table—one of two said to have been taken recently by fishermen on the East Coast.

Mr. Milligan also placed upon the table a quantity of the red balsamic exudation of the grass-tree *(Xanthorrhœa Australis)* of Tasmania from Bass' Straits; exhibited its highly combustible qualities, and remarked that, from the very fragrant odour which it yields, it may be found useful in the preparation of pastiles, frankincense, &c.—that it has been used to produce a nankin dye, and that it seems capable of being turned to account as the basis of a varnish. Mr. M. also placed upon the table a cone of *Banksia serratifolia* from Rocky Cape, Bass' Straits,—the only locality in Van Diemen's Land in which it is found ; it forms a picturesque but not lofty tree, prevailing over an area of several miles along the coast upon a meagre soil of sand with peat.

From H. F. Anstey, Esq., were received fine specimens of mountain duck (*Casarca Tadornoides*), and of the native hen (*Tribonyx Mortieri*).

Samuel Moses, Esq., presented a large branched zoophite from the island of Wahoo, one of the Caroline group, having a minutely ramified horny axis, with but a very partial deposit of calcareous matter of a pale bluish white colour, extending from the base or pedicle along the principal branches.

Thomas Dobson, Esq., of the High School, presented a well-finished model in wood of a self-registering tide gauge by himself. A perpendicular to the float, which is enclosed in a wooden box, acting upon a pencil by means of a diagonal moving in a horizontal slide, describes the rise and fall of the water on the surface of a cylinder covered with paper, to which motion is given by a common Dutch clock, and which cylinder may be subdivided to represent hours and minutes of the day and night. Mr. Dobson obligingly promised to furnish to the Society a written exposition of the construction and mode of working the instrument, with a diagram.—[The meeting considered it desirable that tidal observations should be made at the various light-houses maintained by the colony, and at Port Arthur, and other distant points well adapted for obtaining results uninfluenced by long narrow channels, freshes from the mouths of large rivers, &c. It is understood that His Excellency Sir William Denison, President of the Society, is favourable to the scheme.]

From R. W. Fenwick, Esq., P.M., Hamilton, has been received a case containing twenty-five varieties of dahlia from England for the Society's gardens.

Two cases of plants have been forwarded per *John Souchay* to Mauritius for the Botanic garden there; and Capt. Fallenstein is commissioned to procure on return a number of Cape plants, &c. for this Society.

The Secretary read the following extracts from a report made in 1824, after survey of the west coast of Tasmania, by Mr. Hobbs, and now obligingly forwarded by James Gibson, Esq., of Circular Head, for examination :—

"Pieman's River is in latitude 41° 40' 13" S. The mouth of it is totally unfit to approach, even with a boat, from the very heavy swell that immediately runs in upon the bay; and, in fact, all along this coast there is as much sea in fine weather as there is on the east coast in a gale of wind. I was obliged to *carry* a boat into the river. I proceeded up 18 miles before I met anything to impede my progress, when I arrived at numerous falls, and hauled the boat over them: this is as far as any boat can go. The falls are 21 in number.

This river runs from a swampy plain, about Mount Hemskirk. Its banks abound with pine* of the very best quality, also with lightwood† and myrtle.‡ At some distance towards its source is a very high clear hill, from the top of which I had a full view of all the country around. Notwithstanding the dangerous entrance, it still is practicable to get timber there, should it become scarce at Macquarie Harbour. The land about is sterile, but not so much so as all to to the southward of it. Being anxious to know if such land did exist to the northward of this river as has been represented, I sent Carrott, accompanied by two men, to examine the land, and to travel as far as Cape Grim, whilst I proceeded along the coast with the boats.

"Near West Point, on the south side, there is a river in lat. 41° 3', similar to Pieman's River, with a bar, mouth, and an entrance equally dangerous. We carried the boat along the beach into the river, and then went up 15 miles to the Falls.

"The water, like that of Pieman's River, is deep and salt up to the first falls, even at this dry season.

"This river rises from the low country around Mount Norfolk. The timber here consists of very fine stringy bark, gums, &c., with a few lightwood trees. The soil is barren and little fit for any purpose, with exception of a few potatoes; nearly a mile inland there is a light sandy soil, covered with grass."

The Secretary read extracts from the Annals of Natural History, giving an account of a Tasmanian Cowry sent home by R. C. Gunn, Esq., described at a meeting of the Zoological Society of London by J. E. Grey, Esq., F.R.S., which sold for £30. Mr. Milligan exhibited a shell of the same description (but less perfect), obtained by him on the east coast of Flinders' Island.

The Secretary read a note from Mr. Gunn, stating that the *(Petaurus sciureus)* flying squirrel of Port Phillip has become naturalised in Tasmania.

Mr. Milligan mentioned that the London *Times* of 21st May reports the safe arrival there of the two living specimens of *Thylacinus cyanocephalus hyena*, or tiger of Tasmania, sent home last year by Mr. Gunn and Dr. James Grant. It is the first instance of this animal having been imported alive into England or Europe.

The Secretary read a paper by Sir W. Denison, commenting upon the operations of the Annandale Farmers' Club, recently reported in the *Transactions of the Highland Society of Scotland*, from which it appears that an extensive series of experimental observations of great exactness and value have been carried out by practical farmers

* Huon pine (*Dacrydium Franklinii*).

† Lightwood, or blackwood (*Acacia melanoxylon*).

‡ Myrtle (*Fagus Cunninghamii*).

in the south of Scotland, intended to determine the increase of crop (chiefly turnip), derivable from the employment of various manures applied to soils under varying circumstances, as to the feeding of stock. The average results were:—Swedes, 21 tons and 16 cwt., yellow 20 tons 2 cwt., white 22 tons 7 cwt. to the acre; on land of ordinary fertility it was found that early sowing is advantageous—that the most suitable width between the drills is 28 to 30 inches—that the prevalent rule as to distance between the plants is to hoe out 7 to 8 inches, though the success in cases where 13 and 14 inches have been adopted has been such as to warrant a very general trial of the practice. The narrower spaces appear to suit the Swedes, and the wider the white and red turnips. Farm-yard manure is to be principally depended upon, and it should not be applied in quantities under 16 cubic yards to the acre, unless when 2 cwt. of guano or 12 barrels of crushed bones is used, when 13 to 14 cubic yards may answer. Sir William thinks that the Midland Agricultural Society of Van Diemen's Land should follow in the track of the Annandale Club.

Dr. Lillie, Dr. Officer, Capt. Kay, Drs. Agnew and Butler, Mr. Dobson, Mr. Mitchell, and others took part in the discussion.

About ten o'clock, on the motion of Joseph Hone, Esq., seconded by S. Moses, Esq., the thanks of the Society were voted for the various donations, for the paper by Sir W. Denison, and for the other written contributions, and the meeting broke up.

13th November.—Monthly evening meeting; Dr. Officer, a Vice-President, in the chair.

The following gentlemen were ballotted for and duly elected into the Society:—The Rev. George Wright, of Hamilton; R. De Little, Esq., of Launceston; and A. Kissock, Esq., of Hobart Town.

The presentations were as follows:—"Narrative of a Visit to the Mauritius and South Africa," of James Backhouse, from Mr. G. W. Walker: *Curiosities of the British Museum*, 1 folio volume, 1788, from Mr. Westcott; five parts of the Journal of the Agricultural and Horticultural Society of India, transmitted through the Colonial Secretary here by Mr. Grey, Under-Secretary to the Government of India.

A specimen of effloresced *Alum*, from caverns in the argillaceous rocks near Bridgewater, was received from Mr. Bicheno.

Captain Kay, R.N., sent a box of Tasmanian insects, collected in 1843 by M. Verraux, the French naturalist; also a small collection of dried plants, by Mrs. Kay, from various parts of the island.

Mr. G. R. Lewis sent a sample of *Tapa* cloth, manufactured by the inhabitants of Pitcairn's Island, together with a fragment of the copper sheathing of the *Bounty* sloop-of-war.

Mr. Vicary, of Spring Bay, forwarded a large lizard in spirits, commonly considered venomous, resembling *Cyclodus casuarinæ*, of Darwin.

Mr. Milligan placed upon the table a specimen of a nearly allied species obtained under a piece of decayed wood on the shore of D'Entrecasteaux Channel. Mr. M. also presented the carapace of a large turtle of the *Hawk's-bill* kind, cast ashore on the northern coast of Flinders' Island in 1846 during a gale; and stated it to be known to the Aborigines that turtles have been cast ashore at Swan Port, and that they have been seen more than once by Europeans off the Schoutens, on the east coast of Van Diemen's Land.

Mr. Matson, of the Bank of Australasia, presented a basket and netted bag made by the aborigines of Port Phillip, a stuffed specimen of the Koala (*Phascolarctus cinereus*), with skins of a Lyre bird (*Menura superba*), of the Nankin bird (*Nycticorax Caledonicus*), the Porcupine (*Echidna aculeata*), and of the Emu (*Dromiceius Novæ Hollandiæ*), of Port Phillip.

A specimen of anthracite from a thin seam on the estate of Mr. John Abbott, near Three Hut Point, was submitted for examination.

From Mrs. S. H. Atkins, of Storth, Break-o'-Day, was received specimens of the plant caterpillar *Sphæria Robertsii*, of New Zealand.

Two specimens of nodular and jasperous clay-ironstone, from Long Bay, were submitted by D.A.C.G. Mitchell.

Mr. G. A. Makeig, of the Treasury, presented to the Museum a fragment of meteoric iron, a piece of granite from Pompey's Pillar, a specimen of Rock of Gibraltar, crystals of quartz with calcareous spar from the vicinity of Bristol, native copper from the Burra Burra, specimens of cobalt, fossil shells, &c.

Mr. Propsting sent the skin of a large seal, taken a few years ago in Carnelian Bay, for inspection.

The Secretary reported the receipt, at the Society's Gardens, of a case of New Zealand plants from Mr. Hort; of a case of New Zealand plants, per *Munford*, from Capt. Impey, in fine condition; of a case, per *Australasia*, from Mr. Allen, of Stockwell, near London, containing thirty-three plants, well selected; and of a case from W. M'Arthur, Esq., of Camden, containing about sixty Australian and exotic plants, in a good state. These cases are in exchange for plants exported from the Society's Gardens.

The following communication from Francis Cotton, Esq., of Kelvedon, on the two species of pine inhabiting the East Coast, the *Callitris Australis* and the *C. Gunnii*, was read.

" There are two species of *Callitris* in the district of Oyster Bay; one, the *C. Gunnii,* grows to the height of from 4 to 10 feet, on the banks of some of the rivers, and forms a very ornamental shrub for gardens; it bears trimming well, and then grows more dense and bushy, rising up from the ground as a beautiful pyramid. The leaves are of slightly glaucous hue, and to the taste have an aromatic or resinous flavour.

" The other, the *Callitris Pyramidalis,* or Oyster Bay Pine, when standing alone, is also of a handsome pyramidal shape; the leaves have but little of the glaucous hue of the *C. Gunnii,* their flavour is somewhat like that of the rind of an orange, and they have not the subacid of the shrub.

" A few trees have been found 80 feet high, and 2½ feet in diameter; but it is much sought after for timber, and is not usually found now exceeding 60 feet in height, and 18 inches in diameter at the butt.

" The shrub, if carefully taken up with a ball of earth, will bear transplanting well, when under a foot in height; the tree is difficult to transplant, and must be removed when very young,—of the first or second year's growth: the young plant requires protection alike from the frost and hot sun.

" The Oyster Bay Pine is preserved in the district in manner following:—The old trees are burnt down, or fall from some other cause; bush fires partly consume the branches, and cause the cones to open and shed their seeds on the burnt ground, from which young plants spring up. The remains of the old tree and the grasses form a protection to them for two or three years, when they are capable of bearing the vicissitudes of the climate.

" They appear to flourish equally well on the hill tops and sheltered valleys, and are rarely found growing in rich soils, their choice being the hungry white soil of the colony, incumbent on clay.

" The Pine tree is adapted to many useful purposes; the smaller pines are extensively used for rafters to buildings—also for oars, masts, and yards for boats: the larger pines sometimes afford masts and spars for small vessels. The larger trees are sawn into boards for building purposes; they make excellent floors,—and indeed they do well for all the internal fittings of a house, including staircases, sashes, and doors.

" The boards shrink little in drying,—much less, I believe, than any other colonial wood; and they rarely warp while seasoning.

" I have doors, floors, sashes, &c. that have had upwards of twenty years' wear, and, judging from their appearance, the timber must be very durable. Both species of pine furnish a resin which exudes in tears through rents or wounds in the bark of growing trees, from stumps left in the ground—very sparingly, however, from the small shrubby species, and not in great quantity from the tree: it is semi-transparent, brittle, and has a slight resinous taste; dissolved in turpentine it forms a varnish, but sufficient trial has not been made of its value in this respect; it burns readily, with a slow, steady flame.

"For most of these facts I am indebted to my friend Dr. Story,

"FRANCIS COTTON."

Lieut. Clarke, R.E., read a paper by Sir W. T. Denison on the destruction of piles by the *Teredo navalis*, as evidenced in those recently taken up in forming the entrance of the new dock. His Excellency recommended that every opportunity should be seized of making record of any fact proving the liability or non-liability of various timbers we possess to be attacked by this insect. A turbid and unsettled condition of water is thought to retard or even to prevent the operations of the insect; and some appear to consider the Huon pine exempt from its ravages.

After a conversation, in which Dr. Agnew, Lieut. Clarke, Mr. Mitchell, Dr. Officer, and others took part, it was resolved, on the motion of Mr. Hone, seconded by Mr. Hort, that the thanks of the Society be given for the various papers and donations, and the meeting broke up.

11TH DECEMBER.—Monthly evening meeting; His Excellency Sir W. T. Denison, President, in the chair.

The Rev. J. R. Buckland, of the Hutchins School; Francis W. Stieglitz, Esq., of Lewis Hill, St. Paul's; and J. Meyer, Esq., M.D., New Norfolk, were ballotted for and elected.

Captain Tylee, R.E., was admitted on Rule XVIII.

The Secretary reported the presentation to the Museum of the Society, by Peter Fraser, Esq., of a specimen of the spectacled Petrel (*Procellaria conspicillata*), and of the great grey Petrel (*Procellaria hasitata*); of a pouched Lamprey, in spirits, caught in the Clyde, near Bothwell, from W. S. Sharland, Esq., M.L.C.; and a small Lamprey, with an eel-like head, recently taken at the fording-place of the stream at Brown's River, by Morton Allport, Esq. Mr. M. Allport also presented two eggs of the spur-winged plover of Tasmania.

Lieut. Akers, R.E., laid on the table fragments of a silicio-ferruginous conglomerate, from the great bend of the Gordon River, which he has lately visited.

There were upon the table several spirit preparations of fishes from the estuary of the Derwent. A sample of the red oil obtained from the sooty petrel, *Puffinus brevicaudus.* Several teeth of the sperm whale. Two teeth of the Walrus, from Behring's Straits. Eight varieties of wood from Norfolk Island. Several rock specimens from the same place. A collection of casts of fossil shells (*Spiriferæ*) from Eagle Hawk Neck. Specimens of clays and clay rock, with iron pyrites, crystallized in cubes, from Circular Head, and a number of skins of Tasmanian birds, from Mr. Bonney.

The President read a correspondence with the Right Honourable the Secretary of State for the Colonies, and others, on the introduction of salmon into Van Diemen's Land; also a despatch from Earl Grey, with its enclosure—an analysis of the Coal of Tasmania at the Museum of Economic Geology, London, with a report thereon; and another communication on the same subject from Sir H. T. De La Beche, F.R.S., F.G.S., &c., by which it appears that the Geological Society of London will exchange duplicate specimens with the Royal Society of Van Diemen's Land.

Lieut. Clarke, R.E., read a short paper by Sir W. Denison on the formation of dams, with a view to irrigation as peculiarly applicable. and likely to be very valuable to this colony.

The Secretary read the following extracts from a letter of the Rev. W. Colenso to Ronald C. Gunn, Esq., of Launceston, dated Waitangi Hawke's Bay, New Zealand, 4th September, 1850:—

"I have procured two specimens of the ancient, and all but quite extinct, New Zealand Rat, which until just now (and notwithstanding all my endeavours, backed, too, by large rewards) I never saw. It is, without doubt, a true *Mus*, smaller than our English black rat, (*Mus Rattus*), and not unlike it. This little animal once inhabited the plains and *Fagus* forests of New Zealand in countless thousands, and was both the common food and great delicacy of the natives—and already it is all but quite classed among the things which were, I have also a bat, which I believe to belong to the genus *Vespertilio*; at all events widely (generically) distinct from the species mentioned by Gray, in Dieffenbach's New Zealand, vol. ii., p. 296. This little creature I kept alive a whole month, and was not a little amused with its habits.

"Among other novelties, I have discovered another and very distinct species of vegetating caterpillar, of which, however, I have only hitherto detected two specimens. It differs widely in general appearance from *Sphæria Robertsii*. Some fine specimens of *Aseroe*, and of that other nearly-allied genus *Illodictyon*, of which I have a new and very large species, which I call *I. laticostæ*, and which, when fully evolved, forms a living net of nearly 18 inches in girth.

"You enquire after an *Apteryx*. How delighted should I be to succeed in getting you one. Three years ago Owen expressed a similar wish, and I have repeatedly tried, but failed. Yet here they still are in the mountain forests, though, doubtless, fast hastening towards extinction. I saw one in its wild state two years ago in the dense woods of the interior; I saw it clearly, and watched its movements for some time without being at all perceived by the creature. It moved quickly along, much like a hen when running after a fly. On seeing me it quickly dived into the untrodden recesses of the forest. Two living specimens were lately taken by the *Acheron*, steamer, to Sydney, where they died; these were obtained at the Bay of Islands, where also I once got three at one time. Since then I have not been able to obtain another, although I have offered a great price for one. The fact is, the younger natives do not know *how* to take them, and the elder ones having but few wants, and those fully supplied, do not care to do so. Further, they can only be captured by night, and the dog must be well trained to be of service; consequently, any hopes of getting specimens are but faint."

A letter to Mr. Milligan, from the Corresponding Secretary of the Royal Hawaiian Agricultural Society, was read, soliciting an interchange of seeds and other objects in Natural History.

The thanks of the Society were voted for donations and papers, and the meeting broke up about ten o'clock.

Miscellanea.

On the Fossil Botany and Zoology of the Rocks associated with the Coal of Australia. By Frederick M'Coy, M.G.S. and N.H.S.D. &c.

[*Annals and Magazine of Natural History.*]

(Nine Plates.)

The following paper has been drawn up from an examination of specimens collected by the Rev. W. B. Clarke and sent to the Rev. Prof. Sedgwick, who kindly allowed the writer to make this use of them.

The species will be first noticed, and the new forms described, after which some observations will be offered on the relative ages of the Australian coal-fields, from a comparison of their organic remains with each other, and with those of other countries; premising that the extent of our materials enables this to be attempted in a more extended and precise manner than heretofore, and that several of the new forms described are calculated to throw much light on the fossils of our own country.

In this first part of my paper I wish to express my obligations to the Rev. Prof. Henslow and Mr. Babington for the kindness with which they allowed me the use of their herbaria on all occasions when I found it necessary to work out for myself points of structure in recent plants, neglected by botanists and omitted in their works, but which are of the highest importance in the investigation of fossil plants. To the facilities afforded by the former for my examination of the New Holland plants growing in the houses of the Cambridge Botanic Garden, I am mainly indebted for the maturing my views of the affinities of the genus *Phyllotheca*.

PLANTÆ.

Class Acrogens. (*Al. Lycopodales*).

Ord. Marsileaceæ (?).

Vertebraria. (Royle).

This genus has been proposed by Prof. Royle in his 'Illustrations of the Botany of the Himalaya Mountains' for two species of fossil plants from the supposed oolitic coal-field of Burdwan, but without any description or definition. Similar bodies are not uncommon in the shales and clays of the Australian coal-fields; but although the genus is noticed by Unger in his 'Conspectus Floræ Primordialis,' and Mr. Morris has noticed its occurrence in this district, no botanist has as yet given any descriptive account either of the genus or species; and so obscure are the relations to other forms, that doubts have even arisen as to what part of the plant the radiated cylindrical fossils might be supposed to represent, and how its parts should be named. A distinguished botanist has suggested to me that the cylindrical fossil might be considered a stem, the axis being the pith, the radiating divisional lines the medullary rays, and the intervening cuneiform masses the wedges of wood. I have carefully considered this opinion, but find it impossible to adopt it, from the ease with which the transverse fractures take place, and the perfection of the surfaces produced; as it is obvious that such numerous and perfect divisional planes, as we observe at right angles to the axis, would be incompatible with the above view. On the whole, after a careful study of the specimens at my disposal, I feel disposed to view the genus as closely allied to *Sphenophyllum*, in which we have a jointed stem surrounded by verticillate whorls of from six to twelve wedge-shaped leaves with dichotomous veins; and in this light *Vertebraria* becomes intelligible, for I have clearly ascertained the existence of the dichotomous neuration on each of the wedge-shaped divisions of the transverse planes, which will, according to this view, represent the surface of a whorl of verticillate leaves; and we may consider therefore the main difference between *Sphenophyllum* and *Vertebraria* to consist in the greater approximation of the whorls of leaves in the latter, the internodes being so very short that the whorls of leaves are brought in contact, or nearly so. I might therefore provisionally characterize the genus as follows:—

Gen. Char. Stem slender, surrounded by densely aggregated whorls of verticillate, cuneiform leaves, having a dichotomous neuration.

To the above we might add, that the number of leaves in a whorl depends on the species, and that from the whorls being so close as nearly to touch each other, the fossils have the appearance of lengthened cylinders, breaking readily in a horizontal and vertical direction—the former coinciding with the surfaces of the leaves, the latter coinciding with the vertical prolongations of the lines separating the leaves of each whorl—the former producible in indefinite number at distances of about a line from each other, the latter having only a small definite number depending on the number of leaves in a whorl. The leaves themselves are flat, rather thick, dilated at the tip in such proportion that there is no space left between the edges of the adjacent leaves.

It is very possible that together with *Sphenophyllum* these may have been fresh-water aquatic plants allied to the recent *Marsilea*, in which we see a quaternary arrangement of cuneiform leaves with dichotomous veins, but the affinity is not very strong. The Australian species seems distinct from either of those occurring in the Indian beds by the smaller number of leaves in the whorl, which is perfectly constant in all the examples I have seen. I would propose to name and characterize our species as follows:—

Vertebraria australis (M'Coy). Pl. IX. fig. 1.

Sp. Char. Leaves constantly eight in each whorl.

The fragments are of various lengths, but with a pretty uniform diameter of about seven lines. The radiating dichotomous veins are never strongly marked, apparently from the original softness of the texture of the leaf; in many cases we observe between them an obsolete concentric plication, probably from the same cause, and which may explain the nature of certain vertical striæ visible on the perpendicular fracture, crossing the horizontal lines which mark the edges of the leaves.

This species is abundant in the whitish shales and clays of Mulubimba, N. S. Wales.

(*Al. Filices*).

Ord. Gleicheniaceæ.

Gleichenites odontopteroides (Mor.) sp.

Syn. *Pecopteris odontopteroides* (Mor.) in Strzelecki's N. S. Wales.

Having obtained a finely preserved frond of this plant distinctly forked in the manner of *Gleichenia*, I have removed it from *Pecopteris*, in which it was placed by Mr. Morris, and transferred it to the order *Gleicheniaceæ* without hesitation; and taking the verbal characters of Göppert's genus *Gleichenites* — "Frons dichotoma pinnata. Fructificatio hucusque ignota,"—I think there can be no objection to placing it in that genus, although very distinct from his two species *G. artemisiæfolius* and *G. critmifolius*. I might also suggest its relation to the Lias and Keuper genus *Heptacarpus*, with some of the German species of which it generically coincides.

In the sandstone of Clark's Hill, N. S. Wales.

Ord. Neuropterides.

Odontopteris microphylla (M'Coy). Not figured.

Sp. Char. Bipinnate; pinnæ alternate, oblique, narrow, about three lines wide and two inches long; pinnules alternate, oblique, slightly connate at the base, obtusely elliptical, their length only equalling the width of their base; no midrib, secondary neuration indistinct.

The only *Odontopteris* approaching this elegant species by its alternate pinnæ and very short connected pinnules is the *O. Schlotheimii* (Br.), from which it is distinguished by the smaller size, much narrower and more oblique pinnæ, and by the pinnules being proportionally smaller and elliptical instead of broadly rounded. The latter character also separates it from the so-called *Pecopteris Desnoyersii* (Br.) of the 'Oolithe à Fougères' of Mamers, Sarthe.

Common in the fine sandstone of Clark's Hill, N. S. Wales.

Otopteris, Lind. and Hut.

With Messrs. Lindley and Hutton I use this term for those pinnated plants, the leaves of which agree with *Cyclopteris* in their neuration. Some of these forms were originally described by Lindley and Hutton (Fossil Flora) as *Cyclopteris*, under the impression that the rachis was a rhizoma; Brongniart (Prodrome and Hist. des Végétaux Foss.) gives several of them as *Neuropteris*, apparently neglecting the important character of want of midrib. Göppert confounds both the simple and compound fronds in his *Adiantites* (Syst. Fil. Foss. in Nova Acta Acad. Cæs. Leop. Cur. Nat.), and Unger does the same under the head *Cyclopteris* (Chloris Protogæa). I have, however, thought it desirable to use the term for the pinnate species for which it was proposed, and thus retain *Cyclopteris* for the simple, entire fronds, in accordance with the original view of Brongniart.

Otopteris ovata (M'Coy). Pl. IX. fig. 2.

Sp. Char. Frond pinnate; rachis very thick, slightly flexuous; leaflets little longer than wide, ovate, pointed; upper lobe of the base nearly twice the size of the under, the contracted, thickened base set obliquely on the rachis; veins fine, divaricating; very frequently dichotomizing, nearly equal, but fasciculated at the base.

The fasciculation of the nerves at the base resembles that of the *Cyclopteris flabellata.* The regular, short, semi-elliptical form of the leaflets distinguishes this from the other species of the genus. The average length of the leaflets in the examples I have seen is about 8 lines, width 7 lines, width of rachis 1½ line. Occurs in the hard siliceous flags of Arowa, N. S. Wales.

Cyclopteris angustifolia (M'Coy). Pl. IX. fig. 3 & 3 *a.*

Sp. Char. Leaf linear, lanceolate, eight or nine times longer than wide; sides straight, nearly parallel, pointed above, contracted to a lengthened petiole below; nerves equal, those of the middle third of the frond nearly parallel, straight, rather closer than those of the sides, which gradually divaricate towards the margin at a very acute angle; all the nerves dichotomise at irregular intervals, and those of the sides occasionally anastomose and are connected by a few transverse bars.

In this curious plant we have, as it were, a connecting link between the genera *Cyclopteris* and *Glossopteris;* for although the specimen I have drawn only exhibits the middle portion of the frond, yet I have ascertained that the form is precisely that of a narrow *Glossopteris*, being elliptical or pointed at the apex, and tapering gradually to a lengthened petiole at the base, and still further agreeing in the occasional anastomosing of the lateral veins, and their being connected, though rarely, by transverse bars; yet it is impossible to refer it to that genus from the want of the strong, characteristic midrib, the place of which is occupied by numerous dichotomous nerves of nearly the same thickness as those of the sides; I am therefore obliged to refer it to *Cyclopteris* from a consideration of its more important characters, although differing remarkably in form from the other species of the genus as above restricted. The portion figured, of the middle of a frond, measuring 3½ inches in length, and 9 lines wide at the base, only tapers 2 lines. This species seems common in the gray shale of Guntawang, Mudgee, N. S. Wales.

Ord. Sphenopterides.

Sphenopteris lobifolia (Mor.).

Common in dark brown shale, Mulubimba, N. S. Wales.

Sphenopteris alata (Br.) sp.

Of large size in the fine gray sandstone of Mulubimba, N. S. W.

Sphenopteris hastata (M'Coy). Pl. X. figs. 1 & 1 *a.*

Sp. Char. Bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulatodentate, having three obsolete lobes on each side; nerves bipinnate, two branches reaching each lobe of the margin.

The lengthened oval form, slightly indented margin, and simple neuration of the pinnules, fully distinguish this from any published species of the genus. The average length of the pinnæ is about 1½ inch, width 4 lines, average length of leaflets 3 lines.

Not uncommon in the shale of Mulubimba, N. S. Wales.

Sphenopteris germanus (M'Coy). Pl. X. figs. 2 & 2 *a*.

Sp. Char. Bipinnate; pinnæ oblique, alternate elongate, ovate, with a narrow membranous margin; pinnules oval, deeply pinnatifid; lobes very oblique, elliptical, generally three on each side, and the apex of the pinnules three lobed; nerves bipinnate, three branches reaching the margin of each lobe.

It is extremely difficult to distinguish this species from the *Pecopteris Murrayana* of the Yorkshire oolitic coal-fields, with which it is nearly identical in form and neuration. The oval outline of the pinnules is the most obvious character, contrasting with the trigonal, wide-based leaflets of the English plant; this, together with their more oblique setting on the rachis, more oblique, narrow and deeply-cleft lobes, and the decurrent, narrow, alate margin to the straight rachis, will I think be sufficient to distinguish the species.

In the shale of Mulubimba, N. S. Wales.

Sphenopteris plumosa (M'Coy). Pl. X. figs. 3 & 3 *a*.

Sp. Char. Bipinnate; pinnæ curved, elongate, narrow, plumose, with a scarcely alate margin to the rachis; pinnules close, oblique, ovate, pointed, deeply cleft into about four oblique mucronate lobes on each side, exclusive of the largely trilobed apex; nerves strong, much branched, so that about six branches reach the margin of each of the lobes of the lower side, and seven to each of those of the upper margin.

The number of lobes of the leaflets and complexity of the neuration will readily distinguish this species. The average length of the leaflets 5 lines.

Rare in the shale of Mulubimba, N. S. Wales.

Sphenopteris flexuosa (M'Coy). Pl. IX. figs. 4 & 4 *a*.

Sp. Char. Bipinnate; pinnæ very long, with a strongly flexuous naked rachis; pinnules large, moderately oblique, unequal, ovate, sides cut into two very large obtusely rounded lobes on each side; apex trilobed; nerves strong, much branched, seven branches reaching the margin of each lateral lobe, and three going into each of the three lobes of the apex.

This strongly marked species is not sufficiently allied to any published form to render a comparison necessary. The average length of the leaflets is about 8 lines, width 4 lines.

In a brown bed of clay, Mulubimba, N. S. Wales.

Ord. Pecopterides.

Glossopteris Browniana (Br.).

I think I recognise both the Indian and Australian forms of this species (vars. *a.* and *B.* of Brongniart) in nearly equal abundance among the specimens examined, and some of the fronds are of a size far exceeding any hitherto published, some of them being six inches wide, which in the proportion of the small, perfect examples would indicate a frond of more than two feet in length. I believe I have ascertained the rhizoma of this species, which is furnished with ovate, clasping (or at least very convex) subcarinate scales, having a divaricating reticulated neuration, resembling that of the perfect frond, but much less strongly marked; these scales are of large size, some of them being nearly an inch in length, and terminating at the apex in a long flat linear appendage, about one line in width, which occasionally gives off small, lateral, flat, membranous branches nearly at right angles; the whole perfectly resembling (except in size) the rhizomal scales of *Acrostichium*, *Laromanes*, and *Hymenodium*, as figured by M. A. Fée in his beautiful 'Mémoire sur la Fam. des Fougères,' and when combined with the great similarity in form, habit and neuration, would warrant us in presuming a strong affinity to exist between these genera.

Abundant in the soft reddish shales of Jerry's Plains, and also in the black shales and white clay beds of Mulubimba, N. S. W.

Glossopteris linearis (M'Coy). Pl. IX. figs. 5 & 5 *a*.

Sp. Char. Leaves very long, narrow, with nearly parallel sides; midrib very large; secondary veins fine, forming an angle of about 50° with the midrib, anastomosing occasionally from the midrib to the margin.

It is only with the *Glossopteris angustifolia* (Br.) from the Indian coal-fields of Rana-Gunge, near Rajemahl, that this long, parallel-sided frond could be confounded, and it is distinguished easily from that species by the fineness of the neuration, which is as remarkably delicate as that of the other is coarse; the neuration of the *G. angustifolia* is also distinguished by its great obliquity, forming an angle of about 30° with the midrib, while the nerving of the present species is not more oblique than that of the *G. Browniana* or *G. Nilsoniana.* In this species also, from the anastomosing being continued up to the margin, it results that the nerves are little closer at the margin than at the middle of the leaf, while in the *G. angustifolia* the anastomosing is confined to the central portion, and the dichotomising goes on to the margin, where in consequence the neuration is finer and closer than towards the midrib. None of the specimens are perfect at the extremities, the largest being three inches long and seven lines wide at the basal fracture, and diminishing about two lines in that length towards the distal end, being about eight lines wide in the middle. Disconnected fragments show that the base diminishes insensibly to a lengthened petiole, as in the *G. Browniana,* and that the apex is elliptical and pointed.

Very abundant in the gray shale of Wollongong; not uncommon in the hard siliceous schists of Arowa, N. S. Wales.

Pecopteris? tenuifolia (M'Coy). Pl. IX. fig. 6.

Sp. Char. Bipinnatifid (?); pinnules and rachis very slender, each about half a line wide; pinnules very long, oblique, linear, apparently simply united to the rachis by their entire base, one very strong midrib running throughout; secondary nerves unknown.

If this be truly a *Pecopteris*, it is distinct from all others by its very narrow, linear leaflets. The only plant I have seen at all resembling it is the *Zamites obtusifolius* from the shale of the oolitic coal-fields of Blackheath, Richmond, United States, exhibited some weeks since by Mr. Lyell to the Geological Society. The specimens alluded to of this latter plant seem imperfectly preserved, but still show, on some portions of the pinnules, a neuration running parallel with a strong midrib. This great midrib seems to me incompatible with *Zamites*, so that, although I point to the resemblance between the American and Australian plants, I prefer placing the latter provisionally in *Pecopteris*, as I have seen no trace in my imperfectly preserved specimens of a parallel neuration; and even if it should hereafter be found to exist, I conceive it would be necessary to form a new genus, intermediate in form, neuration, and (I think) mode of attachment of the pinnules to the rachis, between *Zamites* and *Pecopteris*, for the reception of those two plants.

One specimen has occurred in the fine sandstone of Clark's Hill, N. S. Wales.

Class Endogens. (*Al. Palmales*).

Ord. Palmaceæ.

Zeugophyllites elongatus (Mor.).

Common in the shales of Mulubimba, N. S. Wales.

Class Exogens. (*Al. Amentales*).

Ord. Casuarinaceæ (?).

Phyllotheca (Br.).

M. Brongniart, in his 'Prodrome,' founds this genus for a single species, the *P. australis*, of which he mentions having a large number of well-preserved specimens, which he describes as "des tiges simples, droites, articulées, entourées de distance en distance par des gaînes appliquées contre cette tige, comme dans les *Equisetum*, mais terminées par de longues feuilles linéaires, qui remplacent les dents courtes des gaînes des Prêles. Ces feuilles sont ou dressées, ou plus souvent étalées, et même réfléchies; elles sont linéaires, aiguës, sans nervure distincte, au moins deux fois plus longues que la gaîne. Les gaînes elles-mêmes présentent de légers sillons longitudinaux, qui disparaissent vers la base, et qui semblent correspondre à l'intervalle des feuilles, comme les sillons des gaînes des *Equisetum* correspondent à l'intervalle des dents. La tige, dans l'espace qui sépare les gaînes, paroît lisse; mais sur des fragmens de tiges un peu plus grosses, qui appartiennent probablement à des individus plus âgés, de la même plante, on voit des stries régulières, presque comme sur les Calamites." While, on the other hand, Messrs. Lindley and Hutton in their 'Fossil Flora (article *Hippurites gigantea*) state, that having examined specimens communicated by Dr. Buckland (from whom also Brongniart received his), they found Brongniart's description inaccurate, and that the leaves, instead of springing from the edge of the sheath, arise immediately from the stem, and having in addition to the whorl of distinct leaves "a sheath originating within them and closely embracing the stem, to which it gives the appearance of the barren shoots of an *Equisetum*, with its whorls of slender branches on the outside of a toothed sheath." Unger, in his 'Chloris Protogæa,' referring both to Brongniart and Lindley and Hutton, defines the plant as "Caulis simplex, rectus, articulatus vaginatusque. Folia verticillata linearia, enervia contracta v. expansa, vaginas articulorum strictas circumdantia." Mr. Morris, I believe the latest writer on this plant, closely follows Brongniart in his observations on its structure.

I have now stated what I believe to be all the published information regarding this very interesting form; and as it has not been hitherto figured, and the published accounts are contradictory among themselves, and none of them as I find strictly applicable to the plant, it may be interesting to detail some of the observations I have been enabled to make on those specimens which have come under my notice.

I find in the whitish clay beds of Mulubimba a profusion of plants having cylindrical jointed stems, the joints surrounded by sheaths, and the free edge of each sheath terminating in a whorl of long, linear leaves. Here we have all the essential characters of *Phyllotheca*, but beyond this there is no agreement with the descriptions of those few botanists who have seen the plant. And here I may be permitted to state, that, from the number of specimens which I have examined with great care, there remains not a doubt on my mind of the accuracy of M. Brongniart's view of the relation of the whorls of leaves to the sheaths: I have traced them distinctly in every instance as arising from the free edge of the sheath, and lying either straight, inclining obliquely outwards, or, as is most commonly the case, completely reflexed, as I have represented in the drawing Pl. 11. fig. 2: and their occurrence in this position may have deceived Messrs. Lindley and Hutton as to their real connexion with the sheaths; for when the long slender leaves are completely reflexed and pressed in a reversed position against the sheaths, broken specimens may easily have their inferior mistaken for their superior extremities; and if when in this position the leaves be supposed to point upwards, they will really have the appearance of originating as an independent whorl of leaves *outside of the base of the sheath*, as described in the 'Fossil Flora.' This double arrangement would be so anomalous, that it is the more important to have the means of ascertaining the true relation of those parts in accordance with Brongniart's original view.

Brongniart describes the stem as smooth, and I find the specimens before me apparently divisible into two groups, one having the stem smooth, the other having it coarsely sulcated longitudinally, as in *Calamites*. All the botanists alluded to agree in describing the stem of *Phyllotheca australis* as simple;—*all the sulcated stems* I have seen are simple, but a number of the smooth or slightly striated stems are distinctly branched, and in a manner quite distinct from *Equisetum*. In *Equisetum*, if we view with most botanists the sheaths as produced by the mere lateral union of the leaves, and thus representing the foliage of other plants, we have the extraordinary character of the branches arising, not as axillary buds originating immediately above and within the base of the leaves, but originating *below* the joints and external to the sheaths. This is not the case with the fossil before us, in which the branches originate directly over the joints, and are therefore within and axillary to the sheaths, which may thus, with their appendages, be considered as true leaves, and having the same relation to the branches as in ordinary plants. This character is of such importance, that the resemblance of *Phyllotheca* to *Equisetum* is proved by it to be of the most trifling nature, and that there can be no real affinity between them. On the other hand, when compared with *Casuarina*, the affinity seems to me to be exceedingly strong, although botanists have not, I believe, hitherto so considered it. The *Casuarinæ* are exogenous weeping trees, with slender cylindrical branches; their shoots regularly jointed, longitudinally sulcated, and surrounded at the joints with toothed sheaths as in *Equisetum;* while the branches originate either in a verticillate or irregular manner immediately above the joints and within the sheaths, showing a perfect agreement with the above-mentioned *Phyllotheca*. But a still more interesting and important proof of the relation of those plants to *Casuarina*, and removing them still farther from *Equisetum*, is to be found in their mode of inflorescence, of which I have fortunately noticed a fragment among the specimens at my disposal. The specimen alluded to is a portion of a branch (see Pl. XI. fig. 1) with the joints more approximate than on other parts of the plant, their length being scarcely equal to their diameter; the sheaths are the exact length of the internodes, and fringed on their upper margin with a dense little whorl of (I think two-celled) anthers, agreeing very closely with *the male flowers* of *Casuarina stricta* and allied species, with which (being in flower at this time in the houses of the Cambridge Botanic Garden) I have been enabled to compare it as advantageously as the state of preservation of the fossil would allow. The fructification of *Equisetum* is entirely different, forming a dilated, club-shaped mass at the end of the branches or at the extremity of a particular stem. The *Phyllotheca australis* is described as having the sheaths closely applied to the stem, the leafy appendages twice the length of the sheaths, without midribs, and having the naked portion of the stem between the sheaths smooth. Of the two species which I have seen this would best agree with the branched one, which however has a midrib, although not a very prominent one. The species which agrees with the definition in being simple-stemmed, differs in having the sheaths very loose or infundibuliform, and so long as to extend the entire way from one joint to the next, so as to leave no bare space of the stem visible; the leaves are very long and have a strong prominent midrib, and the stem when deprived of the sheaths is seen to be always coarsely sulcated. Under these circumstances the obvious course seems to be to modify the definition of the genus so as to include the two species under consideration, and to characterize them as distinct species. If the supposed affinity with *Equisetum* were borne out, I should probably have considered the loose-sheathed, simple-stemmed plant as the fertile shoot, and the branched stems with small tight sheaths as the barren shoots, following the analogy of some of our best-known recent species of *Equisetum;* but having seen that they are constructed in an essentially different manner, we cannot do better than as I have proposed.

I may then briefly characterize the genus and species as follows:—

Phyllotheca.

Gen. Char. Stem slender, jointed, simple or branched; branches springing from above the joints, not arranged in the same plane; surface smooth or longitudinally sulcated; articulations surrounded by sheaths, the free edge of which terminates in long narrow leaves, having a more or less distinct midrib. Inflorescence arranged in whorls near the extremity of certain branches.

I have only to add to the above characters, that the ridges of the sulcated stems do not alternate at the joints in the regular manner of *Calamites*, nor is there any trace of the peculiar tubercles so generally seen in that genus (an additional proof, if such were wanting, that Brongniart's original explanation of those tubercles being connected with the vascular system of the sheath is not the correct one, for here we have enormously developed sheaths and no tubercles). The verticillate whorls of leaves, whenever I have seen them perfectly expanded, seemed always elliptical as in *Annularia*, the leaves of two opposite points of the circumference being considerably longer than the rest. The genus is distinct from *Annularia* by the great development of the sheath or connected base of the leaves, and by the branches being inconstant, and when present, not being arranged in pairs in the same plane.

Phyllotheca australis (Br.).

Sp. Char. Stem simple, smooth or slightly striated; sheaths tight, shorter than the internodes, terminated by narrow leaves, double the length of the sheaths, without distinct midrib. (*Condensed from Br.*)

Phyllotheca ramosa (M'Coy). Pl. XI. figs. 2 & 3.

Sp. Char. Stem branched, smooth, or slightly striated; sheaths half the length of the internodes; leaves thin, linear, flat, twice to three times the length of the sheath, with a very fine indistinct midrib.

This beautiful plant has the branches weeping or hanging downwards as in *Casuarina*, about half the diameter of the stem; they do not arise from every joint, but they do nearly; I am uncertain whether more than one spring from any one joint. Most of the stems are perfectly smooth, being striated only at the articulation (see Pl. XI. fig. 3), while others have a delicate lineation down the internodes; the first I imagine to be stript of their bark, and the latter to retain it; and here again we have another proof of the stronger affinity of our fossil to *Casuarina* than to *Equisetum*, for I find by examining the living *Casuarinæ* that the lineation of the surface goes no deeper than the bark, while the elevated lines on the surface of *Equisetum* are only the edges of strong septa going towards the central hollow, and the flat spaces between those lines are only the superficial coverings of tubular hollow spaces between the aforesaid septa, so that destroy the surface of *Casuarina* and you render the stem smooth—destroy the surface of *Equisetum* and you only increase the coarseness and strength of the sulcation. I may also add (in accordance with this view) that age or size has no connexion with this lineation of the surface, as is suggested by

M. Brongniart in the last few lines of the quotation from his work at the head of this subject, for I find some of the largest stems perfectly smooth and the smallest occasionally striated. The sheaths are rather coarsely striated, and terminate in thin, flattened leaves, the midrib of which is scarcely discernible. In the weeping or downward curved branches the leaves are completely reflexed so as to point upwards, and, according to the position of the stem, are either reflexed, expanded, or lying straight up against the stem. The stems vary from 3 to 7 lines in diameter.

Common in the white soft shale of Mulubimba, N.S.Wales.

Phyllotheca Hookeri (M'Coy). Pl. XI. figs. 4, 5, 6, 7.

Sp. Char. Stem simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose subinfundibuliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, and with a strong, prominent midrib.

This species is easily known from the two former by its great loose sac-like sheath, completely concealing the stem (see Pl. XI. figs. 4 & 5), its long, thick, strongly ribbed leaves (see Pl. XI. fig. 6), and by its stem when stripped of its sheath being coarsely and regularly sulcated, precisely as in the *Calamites Cistii* (see Pl. XI. fig. 7). Although abundant, I have never seen a trace of a branch. Some of the flattened stems attain a width of two inches.

Common in the sandstone of Clark's Hill, in the siliceous schists of Arowa, and in the shales at Mulubimba, N. S. Wales.

ZOOPHYTA.

Stenopora crinita (Lonsd.).

Very abundant, forming globose masses five inches in diameter, with a mammillated surface like that of the *Ceriopora verrucosa* (Gold). In the sandstone of Woollongong, N. S. Wales; also in the sandstone of Darlington; more rare in calcareous beds at Black Head, N. S. Wales.

Stenopora ovata (Lonsd.).

Common in Darlington sandstone, N. S. Wales.

Stenopora Tasmaniensis (Lonsd.).

Not uncommon in the sandstone of Darlington, N. S. Wales.

Fenestella ampla (Lonsd.).

Common in the sandstones of Muree, Bell's Creek, and Loder's Creek, N. S. Wales.

Fenestella fossula (Lonsd.).

Common in the sandstone of Muree, N. S. Wales.

Fenestella internata (Lonsd.).

Common in the sandstone of Bell's Creek and Darlington, N. S. Wales.

Fenestella undulata (Phil.).

Rare in the shale of Dunvegan, N. S. Wales.

Fenestella.

Two species closely resembling the *F. antiqua* (Lonsd.) (the

Devonian variety) and the *F. plebeia* (M'Coy) of the British carb. slate, but not determinable with certainty from their state of preservation: common in the shale of Korinda, N. S. Wales.

Glauconome.

A species most allied to the *G. pluma* (Phil.) of the British carboniferous rocks, and perhaps identical with it, but not in sufficiently good preservation to determine. Common in the shale of Dunvegan, N. S. Wales.

Cladochonus (M'Coy), new genus.

Gen. Char. Polypidom of very thick, straight, slender, calcareous tubes, suddenly dilating at short regular distances into large oblique, cup-shaped terminal chambers, longitudinally striated within; from the point where the dilatation commences, a second slender tube similar to the first is given off at an angle varying with the species, and terminating at the same distance as the former in a similar cup, bent in nearly an opposite direction to the first, and giving rise at its base to a third slender-tube as before. The whole polypidom erect, attached by the base only, which embraces some foreign body.

These singular and beautiful corals have some relation to *Aulopora,* but differ in their curious erect habit, regular, angular mode of branching, slender, equal, stem-like tubes and abruptly dilated terminal cups bent in nearly opposite directions. The *Aulopores* are attached for the most part by one side; the tubes *gradually* expand to the mouths, which all open nearly in one direction; they have no regular distance for branching, and frequently anastomose. The present corals have also much thicker walls to the tubes, the central hollow being proportionally very small. I formerly described some species of this group under the genus *Jania,* being uncertain where to place them; such are the *J. crassa* and *J. bacularia* of the 'Synopsis of the Irish Carb. Limestone Fossils,' which should now be removed to this genus.

Cladochonus tenuicollis (M'Coy). Pl. XI. fig. 8.

Distinguished by the slenderness of the stems. Common in the Dunvegan shale.

Strombodes? Australis (M'Coy). Pl. XI. fig. 9.

I have given the above name provisionally to a species of *Strombodes* from the calcareous shale of Wagamee, N. S. Wales, having the precise form of the *Turbinolia fungites* of British writers. It is certainly without transverse chambers, having the vertical lamellæ twisted about the centre; the lamellæ are about thirty-six in number, all reaching the centre, though grouped in irregular bundles as they approach it. The section is slightly oval, the lamellæ in the direction of the long axis being straight, those of the sides much arched. The external surface is striated longitudinally, the striæ being double the number of the lamellæ.

Turbinolopsis bina (Lonsd.).

Agreeing minutely with Devonshire specimens. Rare in the shale of Dunvegan, N. S. Wales.

Amplexus arundinaceus (Lonsd.).

Common in the gray limestone of Curradulla or Limestone Creek, N. S. Wales.

CRINOIDEA.

Tribrachyocrinus (M'Coy), new genus.

Gen. Char. Cup globose; pelvis (or dorso-central plate) large, saucer-shaped, pentagonal, tripartite; first costals (or first row of perisomic plates) five, one pentagonal, three hexagonal, and one (?) heptagonal; one of the hexagonal costals is truncate above and supports one pentagonal interscapular plate; between these and the heptagonal costal is situated one large, roundish, pentagonal, intercostal plate; in the re-entering angle between this latter and the summit of the heptagonal costal is an obscurely hexagonal plate, analogous to a second costal. Scapulæ (or ray-bearing plates) three, rhomboidal or obscurely pentagonal, upper margin rounded, lower margin pointed; two of those in the re-entering angles between the first costals and one in the angle between the intercostal plate and the second costal. Interscapular plates three, shield-shaped, pentagonal; upper margin broad, straight, truncate, with the two upper lateral angles horizontally extended into short angular processes.

The singular Crinoid for which I propose this genus is very differently constructed from any other of the generic groups with which I am acquainted. The cup is not symmetrical in form, like that of other Crinoids, but is, as it were, humped on one side by the interpolation of the large irregular intercostal (marked *h* in the diagram) and the second costal (*i*). The only specimen found is slightly crushed laterally, so as to render this inequality of the sides very remarkable. The arm-bearing plates or scapulæ, which are so generally five in the other genera, are only three in the present animal, forming a strong peculiarity which it shares only with the genus *Triacrinus* of Count Münster (Beiträge zur Petrefactenkunde), a little Crinoid of the Eifel differing in every other respect from the Australian form. The general disposition of the plates is most analogous to that of *Poteriocrinus*, from which it differs in the number of the scapulæ and every point of detail. I am as yet only acquainted with one species of the genus, which it is not possible therefore to characterize specifically: I have dedicated it to the Rev. W. B. Clarke, to whose zeal we owe the specimens described in this paper.

Tribrachyocrinus Clarkii (M'Coy). Pl. XII. fig. 2.

The surface is smooth, with the exception of a few irregular radiating plicæ at the margin of some of the plates, which seem in some cases to overlap each other—an appearance, however, which may be deceptive. Length of the cup 1 inch 7 lines, width about 1½ inch.

From the soft gray shale of Darlington, N. S. Wales.

Actinocrinus.

Fragments of pelvic plate of this genus occur in the Dunvegan shale, and large columns apparently of *Cyathocrinus* are common in the limestone of Wagamee, N. S. Wales, and also in the limestone of Wollamhoola, N. S. Wales.

CRUSTACEA.

(*Entomostraca.*)

Bairdia curtus (M'Coy), Synop. C. L. Foss. Pl. XXIII. fig. 6.

This little creature is perfectly identical with those I have described and figured, from the lower limestone of Kildare, in the 'Synopsis of the Carb. Limestone Fossils of Ireland.'

Mr. Morris, in Count Strzelecki's work, has noticed a *Bairdia* which he says is intermediate between my *B. gracilis* and *B. curtus*, being more slender than the latter; but his figure is greatly more gibbose, so that I am uncertain whether his *B. affinis* be really distinct or not. At any rate there can be no doubt with regard to the present examples, which are from the shale of Dunvegan, N. S. Wales.

Cythere impressa (M'Coy), Synop. C. L. Foss. Pl. XXIII. fig. 16.

This is another species which I have described from the shales at the base of the carboniferous series in Ireland, and from the complexity of its form is, if possible, a still more positive identification than the last; the agreement in outline, central hollow, and its little marginal tubercle, &c. being absolutely perfect, and admitting of no doubt. It is certainly very curious to see those two genera and species of minute Crustaceans occurring together in the shales at the Antipodes just as we see them in our own lower carboniferous beds.

Occurs with the *B. curtus* in the shale of Dunvegan, N. S. Wales.

(*Trilobita.*)

Brachymetopus (M'Coy), new genus.

Gen. Char. Cephalothorax truncato-orbicular; limb narrow, produced backwards into flattened spines; glabella smooth, cylindrical or ovate, about twice as long as wide, not reaching within about its own diameter of the front margin; one pair of small, basal, cephalothoracic furrows, or none. Eyes reniform, in the midst of the cheeks (? smooth); eye-lines unknown. Surface strongly granulated; one tubercle on each side of the anterior end of the glabella, the marginal row and a circle round each eye being larger than the rest. Body-segments unknown. Pygidium nearly resembling the cephalothorax in size and form, rather more pointed, strongly trilobed, and with a thickened prominent margin; axal lobe about as wide as the lateral lobes, of about seventeen narrow segments; lateral segments about seven, divided from their origin, each terminating in a large tubercle at the margin.

The minute Trilobites for which I propose the present genus are very distinct in habit from those of other genera, and as two or three species are now known, it seems desirable to place them together under one name. They are the smallest perfect Trilobites known, from two to three lines being the greatest width they have been seen to attain. The *Phillipsia Maccoyi* of Capt. Portlock's Geol. Report on Londonderry, &c. certainly belongs to this genus, and is at first sight difficult to distinguish specifically from the Australian species. The Irish species alluded to was collected by the writer from the lower carboniferous limestone of Kildare, and sent to Captain Portlock for his monograph of Irish Trilobites, under the impression that it formed the type of a new genus and species; but probably from there being but one specimen it was placed provisionally by that author in his genus *Phillipsia*, from which it differs in its small, short glabella, smooth eyes, want of cephalothoracic furrows, &c. Having now examined numerous specimens of the Australian species, there can be no longer any doubt of the distinctness of the group from *Phillipsia*, from the characters of the cephalothorax, and the pygidium is still more distinct. From those materials I have therefore drawn up the above characters, which it is believed will distinguish them easily from the other generic types. From the general similarity in the structure of the pygidium, I am inclined to refer the fossil which I have named *Phillipsia* (?) *discors* (Synopsis of the Carb. Limestone Foss. of Ireland, pl. 4. fig. 7. p. 161) to the same genus. This is also a very small Trilobite, the length of the pygidium being only three lines; and although referring it provisionally to *Phillipsia*, I suggested in the above work that it should, when better known, form the type of a distinct genus, which, however, it was not possible to frame until now. I have dedicated the present species to Count Strzelecki, whose fine work on the physical features of New South Wales and Van Diemen's Land has so materially advanced our knowledge of that country, and who has recorded the existence of minute Trilobites (undetermined) in the limestone of Yass Plains, which probably belong to this group, if not to this species.

Brachymetopus Strzeleckii (M'Coy). Pl. XII. fig. 1.

Sp. Char. Glabella widest at the base, with one very minute obscurely marked cephalothoracic furrow at the base on each side; all the segments of the pygidium with an irregularly tuberculated ridge along the middle; lateral segments forming large tubercles where they join the thickened limb, opposite each of which is a short slender spine projecting from the margin.

The greater size of the glabella and its being widest at the base will distinguish the head from that of the *P. Maccoyi* (Portk.), and the granulation extending entirely across the segments and the spinose margin will distinguish the pygidium from that of the *P. discors* (M'Coy).

Width one and a half line.

Common in the shale of Dunvegan, N. S. Wales.

Phillipsia.

A species closely resembling the *P. gemmulifera* (Phil. sp.), but not distinctly preserved, occurs in the shale of Dunvegan, N. S. Wales.

MOLLUSCA.

(*Brachiopoda.*)

Atrypa cymbæformis (Mor.).

Very common in the sandstone of Muree, N. S. Wales, and in the impure limestone of Black Head, N. S. Wales.

Atrypa biundata (M'Coy). Pl. XIII. figs. 9 & 9 *a*.

Sp. Char. Longitudinally ovate, gibbose, smooth; front narrow; margin raised in two rounded waves, from which two obsolete rounded ridges extend a short way towards the beak on the ventral valve, and one obscure rounded mesial ridge extends nearly to the beak on the dorsal valve.

This species closely resembles the *A. hastata* (Sow.) of the British Mountain Limestone, and may have been confounded with it; it is, however, perfectly well distinguished by the character of the front margin, which in *A. hastata* is straight and even, but is elevated and bent into a double fold in the Australian species, somewhat as in the less exaggerated varieties of the *Terebratula biplicata* (Sow.) of the oolites (from which it is known by its imperforate beak, &c.); also *both* valves of the *A. hastata* are plano-concave towards the front margin, while the dorsal valve of the present species presents an obtuse mesial convexity. Length 1 inch 1 line, width 10 lines, thickness 7 lines.

Common in the dark limestone of Black Head, N. S. Wales, in the coarse conglomerate of Korinda, N. S. Wales, and in the gray schists of Lewin's Brook, N. S. Wales.

Atrypa Jukesii (M'Coy). Pl. XIII. fig. 8.

Sp. Char. Transversely oval, length two-thirds the width; sides with eight or nine large, acutely angular, simple plaits, extending from the beak to the margin, which they deeply indent; mesial elevation moderate, square, of five slightly angular simple plaits, much smaller than those of the sides.

This species is closely allied to the *A. pleurodon* (Phil.) of the carb. limestone of Britain, and the *A. fallax* (Sow.) of the upper Devonian and lower carboniferous shales of England and Ireland, but is distinguished by the dissimilarity in size and angulation between the mesial and lateral plaits; the mesial plaits are, if anything, a little larger than those of the sides in the British forms alluded to. Length $4\frac{1}{2}$ lines, width 7 lines.

Common in the Dunvegan shale.

I have dedicated this species to my friend Mr. Jukes, who has geologically examined a considerable portion of the country and collected many fossils, which I have not as yet seen.

Spirifera (*Reticularia*) *crebristria* (Mor.).

This species has got a distinct cardinal area, and could not therefore belong either to *Terebratula* or *Athyris*, as suggested by Mr. Morris; it is, in fact, a typical example of that little group of *Spirifers* for which I have suggested the name *Reticularia* in the 'Synop. Carb. Foss.' &c., distinguished by their small size, area and hinge-line as in *Martinia* (M'Coy), (that is, the former shorter than the width, and the latter moderately large), in addition to a reticulated surface and *parallel dental lamellæ.* Is this really distinct from the *Spirifera* (*Ret.*) *microgemma* (Phil.) of the Devonian and lower Irish carboniferous shales? On comparison I scarcely think it is.

Rather rare in the schists of Dunvegan, and in the fine sandstone forming the summit of a hill one mile south of Trevallyn, N. S. Wales.

Spirifera vespertilio (Sow.).

Not uncommon in the impure limestone of Black Head, N. S. Wales, and abundant in the dark calcareous schists of Eagle Hawk's-neck, Van Diemen's Land.

Spirifera calcarata (Sow.).

I cannot in the slightest particular distinguish examples from the sandy shales of Dunvegan, N. S. Wales, from those so abundant in Devonshire and in the lower carboniferous shales and sandstones of Ireland.

Spirifera avicula (Sow.).

Abundant in the sandstones of Korinda, also occasionally in the limestone of Blackhead, N. S. Wales.

Spirifera Darwinii (Mor.).

Common in the sandy schists of Loder's Creek and Barraba; more rare in the arenaceous limestone of Blackhead, N. S. Wales.

Spirifera subradiata (Sow.).

Common in the sandstone of Muree, in the arenaceous limestone of Blackhead, in the schists of Woollongong, and in the fine sandstones of Darlington, N. S. Wales.

Spirifera subradiata (? var. resembling *S. glabra*).

Common in the sandstone of Maitland, and in the arenaceous limestone of Irrawang, N. S. Wales.

Spirifera attenuata (Sow.).

Specimens perfectly undistinguishable from the *larger variety* so abundant in the lower carboniferous shales of Ireland (as at Hook Point, co. Wexford), are common in the arenaceous shales of Dunvegan, N. S. Wales.

Spirifera Tasmaniensis (Mor.).

Common in the hardened schists of Lewin's Brook, N. S. Wales.

Spirifera lata (M'Coy). Pl. XIII. fig. 7.

Sp. Char. Transversely rhomboidal, moderately gibbose, width four times the length; sides flattened, regularly attenuating to the very acute cardinal angles; cardinal area broad, flat; mesial fold wide, defined, angular, smooth; about sixteen to eighteen slightly convex, simple, smooth ribs on each side of the mesial fold, becoming indistinct as they approach the cardinal angles, so as to leave nearly a third of the length of the sides smooth.

This differs from the widest varieties of the *S. disjuncta* (Sow.) by its defined and smooth mesial hollow, extent of the smooth space at the end of the sides, and the smaller number and greater width of the radiating ridges, which are also much less prominent; the smoothness of the mesial fold and width of the cardinal area separate it from the *S. convoluta* (Phil.); and from the *S. Rœmerianus* (Kon.) it is known by its size, greater width, smooth cardinal extremities, and flatter and wider lateral ridges. Length 1 inch 1 line, width 4 inches.

From the hard schists of Lewin's Brook, N. S. Wales.

Spirifera duodecimcostata (M'Coy). Pl. XVII. figs. 2 & 3.

Sp. Char. Transversely oval, or subrhomboidal gibbose; sides rounded; hinge-line shorter than the width of the shell; cardinal area wide, triangular, curved; mesial ridge prominent, deeply divided by a mesial sulcus; mesial hollow wide, deep, defined and showing a mesial ridge corresponding to the mesial sulcus of the ridge of the ventral valve; five or six strong, subangular simple ridges on each side of the mesial fold.

Length of dorsal valve 1 inch 3 lines, width 1 inch 9 lines. Not uncommon in the calcareous grit of Wollongong, and in the sandstone of Muree, N. S. Wales.

Spirifera oviformis (M'Coy). Pl. XIII. figs. 5 & 6.

Sp. Char. Longitudinally ovate, longer than wide; hinge-line much shorter than the width of the shell; sides rounded, gibbose; mesial ridge large, rounded, divided by a deep furrow; mesial hollow very wide, flat, undefined; three or four large, rounded prominent ribs on each side of the mesial fold, rendered obscurely nodulose by the obtuse concentric undulations of growth.

This is one of the very few *Spirifers* in which the length exceeds the width, by which character it may be known from all the varieties of the *S. subradiata.* The figures on the plate are from two different specimens. Length 2 inches 6 lines, width 2 inches 3 lines.

Not uncommon in the sandstone of Barraba, N. S. Wales.

This species and the last belong to the subgenus *Brachythyris* (M'Coy).

Orthis striatula (Schlot.).

On the most careful comparison I find nothing to distinguish the Australian specimens from those so common in the Eifel and lower Irish carboniferous shales.

Abundant in the hard rock of Lewin's Brook, N. S. Wales.

Orthis Australis (M'Coy). Pl. XIII. figs. 4 & 4 *a.*

Sp. Char. Longitudinally obovate, very depressed, uniformly convex, length nearly equalling the width; width greatest towards the front margin, narrowing towards the hinge-line, which slightly exceeds half the width of the shell; sides and front margin nearly straight, slightly convex; surface with very numerous, fine, nearly equal dichotomous striæ radiating from the beak.

This is closely allied to the upper Devonian and lower carboniferous fossil to which Prof. Phillips restricts the name *O. interlineata,* and to the carboniferous *O. Michelini* (Lév.), (*O. filiaria,* Phil.). From the former it is distinguished by its narrow, longitudinally obovate figure, and from the latter by its wider hinge-line and much finer striæ; and from both it differs in the form of its muscular impressions. Length 7 lines, width $7\frac{1}{2}$ lines.

Abundant in the shales of Lewin's Brook, N. S. Wales.

Orthis spinigera (M'Coy). Pl. XIII. fig. 3.

Sp. Char. Longitudinally obovate, gently convex; length of ventral valve two-thirds the width, width greatest near the front margin, narrowing rapidly towards the hinge-line, the length of which is little more than half the width towards the front; cardinal area triangular, flat, half as high as wide; sides of the shell much rounded; front margin without sinus, slightly convex; surface with two or three strong distant imbrications of growth, crossed by numerous small, strong, angular, radiating ridges (about twenty-two at two lines from the beak); they are nearly equal in thickness, but shorter ones are interpolated, chiefly at the concentric imbrications of growth, between each pair of the primary ones as they approach the margin, beyond which, when well preserved, they are produced into slender conical spines; they are about their own diameter apart, the intervening flat spaces being coarsely striated across.

Somewhat allied to the Russian *O. plana* (Pand. sp.), but very distinct by the character of the striation and by the short hinge-line and comparative width of the front. Length of ventral valve 5 lines, width 7 lines; height of cardinal area 2 lines, width of hinge-line 4 lines.

Rare in the shale of Dunvegan, N. S. Wales.

Productus antiquatus (Sow.).

Reticulated rostral portions well preserved and perfectly undistinguishable from the British carboniferous specimens.

Common in the hard schist of Lewin's Brook, N. S. Wales.

Productus brachythærus (Sow.).

Very common in the calcareous grit of Loder's Creek, and also at Korinda, N. S. Wales.

Productus setosus (Phil.).

I find the Australian species undistinguishable when minutely compared with our common British mountain limestone species above-named. In the dark indurated schist of Lewin's Brook, N. S. Wales.

Productus scabriculus (Sow.).

In the calcareous flags and dark limestone of Hull's quarry, Hobart Town: associated with this there is abundance of a flatter species, concentrically wrinkled and with more irregularly placed, blunt, round spines, which may, or may not, be distinct from the *P. fragaria* and *P. caperata* of the upper Devonian and lower Irish carboniferous shales; but from the state of preservation I cannot satisfy myself of the species.

Productus undulatus (M'Coy). Pl. XIII. fig. 2.

Sp. Char. Subquadrangular, one-third wider than long, gibbose, front slightly concave at the margin; sides nearly rectangular, obtusely rounded; beak large, tumid; surface with fine, close, short, undulating transverse wrinkles; a few obscure traces of oblong spines towards the margin.

This species is slightly allied to the *Leptæna lepis* of the Eifel, and the *L. membranacea* and *L. mesoloba* (Phil. Pal. Foss.), but is distinguished from the two first by its gibbose quadrangular form, concave front, and large tumid beak; and from the latter by its want of mesial ridge and spines, and by the fine transverse plication of the surface. Length 7 lines, width 10 lines.

Rare in the sandstone of Loder's Creek, N. S. Wales.

Leptæna ——— ?

A species closely resembling the *L. Hardrensis* (Phil.), but more square in outline, not so wide, and more coarsely striated, is common in the shale of Dunvegan, N. S. Wales; it also resembles the *Chonites Laguesianus* of the Belgian carb. shale and the *Chonites Falklandica* of the Falkland Islands; but as I have not examined either of those latter species, I prefer leaving the determination of the Australian form uncertain.

Orbicula affinis (M'Coy). Pl. XIII. fig. 1.

Sp. Char. Longitudinally ovate, very much depressed; margin slightly undulated; apex acute, excentric towards the right side, one-third of the length from the anterior edge; surface with fine, sharp, irregular concentric plicæ.

This is only to be distinguished from the *Orbicula Davreuxiana*, (Kon.) of the Tournay carb. shale by the fine, sharp, concentric plication of the surface. Length 3 lines, width 2½ lines, height three-fourths of a line.

From the shale of Dunvegan, N. S. Wales.

(*Lamellibranchiata.*)

Pecten squamuliferus (Mor.).

Common in the fine, olive-coloured schists of Wollongong, N. S. Wales.

Pecten ptychotis (M'Coy). Pl. XIV. fig. 2.

Sp. Char. Ovato-orbicular, width very slightly exceeding the length, convex, smooth; ears unequal, posterior one obtuse-angled, undefined, anterior ear narrow, square at its extremity, divided by a deep, acutely angular sinus, from the body of the shell; surface smooth, except the extremity of the anterior ear, which is longitudinally plicated.

It is only by the plication of the extremity of the anterior ear that this can be known from the *P. variabilis* (M'Coy) so abundant in some of the carboniferous shales of Ireland. Length 4 lines, width one-fourth of a line more.

Common in the shale of Dunvegan, N. S. Wales.

Pecten sub-5-lineatus (M'Coy). Pl. XVII. fig. 1.

Sp. Char. Truncato-orbicular, convex, equilateral, beaks tumid; ears large, nearly equal, flattened, the posterior one slightly pointed and separated at the margin from the body of the shell by a deep rounded sinus; anterior ear broad, nearly square, with a slightly convex margin; surface of both ears and body of the shell marked with a few obtuse concentric waves of growth, and radiated with rather coarse narrow rounded ridges, those of the ears being close and equal, while those of the body are rather distant from each other, the interspaces being flat; about twenty-five proceeding directly from the beak to the margin, where they are about two lines apart; between those at a short distance from the beak are interpolated an equal number of rather thinner ones, which again receive nearer the margin two fine striæ between each of them and the adjoining primary ridge.

The striation of this fine species resembles that of the *P. quinquelineatus* (M'Coy, Syn. Carb. L. Foss.); that is to say, near the margin and towards the middle of the shell there are five striæ between each pair of primary ones, the middle or odd one of the five nearly equalling the primary ridges in thickness. The present fossil has, however, much finer striæ than the Irish species alluded to, and the arrangement is much less definite, becoming confused in size and number towards the sides; it is also distinguished by its greater convexity. Length 2 inches 9 lines, width the same.

Rare in the greenish, fine sandy beds of Harper's Hill, N. S. Wales.

Avicula tessellata (Phil.).

I cannot distinguish the specimens occurring in the soft greenish schists of Dunvegan, N. S. Wales, from those in the precisely similar shale at the base of the carboniferous series at Lisnapaste, in the north of Ireland.

Pterinea macroptera (Mor.).

Rare in the white rock of Port Arthur, V. D. Land.

Eurydesma cordata (Mor.).

Common in the arenaceous limestone of Arthur's Hill, N. S. Wales.

Inoceramus Mitchelii (M'Coy). Pl. XIV. fig. 1.

Sp. Char. Longitudinally ovate, one-fifth longer than wide, slightly oblique, inflated; hinge-line oblique, nearly equalling the width of the shell, forming a slightly compressed wing; beaks pointed, prominent, incurved, close to the anterior end; anterior side nearly straight, abruptly subtruncate; surface with numerous strong, concentric, irregular wrinkles of growth.

The hinge margin of this species is much thickened, which removes it from *Posidonia*, while, as in many of the German cretaceous *Inocerami*, it is not possible to observe any traces of the transverse ligamentary pits, nor can we be sure whether those species possessed them or not; meanwhile I shall leave the present species in the same genus as its obvious allies alluded to; and even if future research should prove that ligamentary pits did not exist, we should form a distinct genus for those species, which, like the present and the *I. vetustus* (Sow.) of the mountain limestone, are distinguished from the true semimembranous *Posidoniæ* of the lias and palæozoic shales with which they have been confounded, by their thick shells, general form, and thickened hinge-margin. Length 2 inches 3 lines, width 1 inch 9 lines, thickness about $1\frac{1}{2}$ inches.

Common in the sandstones of Glendon and Wollongong, N. S. Wales.

Dedicated to Sir T. Mitchell, one of the first to make known the existence of fossils in those rocks.

Pleurorhynchus Australis (M'Coy). Pl. XVI. fig. 4.

Sp. Char. Alæform or transversely subtrigonal, gibbose, length nearly two-thirds the width; posterior side forming a compressed narrow wing; anterior face obliquely subtruncate, convex, divided into three nearly equal tumid compartments by two impressed furrows from the beak; body of the shell and posterior side radiated with rather coarse irregular ridges from the beak; anterior face finely striated longitudinally.

This resembles the *P. minax* (Phil.) in the striation of the anterior face being so much finer than that of the middle or posterior parts of the surface; it differs in having the anterior face not only much more finely striated, but divided into three parts by distinct furrows; while from the *Cardium irregulare* and *C. strangulatum* (Kon.), which have the anterior face so divided, but smooth, it is distinguished by this latter character, and also by wanting the mesial strangulation of those species. Length of small specimen 8 lines, width 1 inch.

Not uncommon of larger size in the sandy schists of Wollongong, N. S. Wales.

Allorisma curvatum (Mor.).

Common in the sandstones of Darlington, Wollongong, and Glendon, N. S. Wales.

Orthonota compressa (Mor.).

In the calcareous schists of Harper's Hill, N. S. Wales.

Orthonota costata (Mor.).

Common in the sandstone of Wollongong, N. S. Wales.

Modiola crassissima (M'Coy). Pl. XV. figs. 2 & 3.

Sp. Char. Transversely ovate, very gibbose: beaks small, nearly terminal; anterior side forming a small rounded lobe beneath the beaks, separated from the body of the shell by a strong sinus in the ventral margin, from which a shallow concavity runs towards the beak; posterior side wide; hinge-margin elevated, four-fifths the width of the shell in length, compressed, angulated, posterior end broadly rounded; ventral margin convex; shell very thick; surface with a few concentric waves of growth, and marked towards the posterior inferior angle with a few distant obsolete ridges, extending obliquely from the beaks.

Length 5 lines, width 1 inch 7 lines, height of cardinal angle 11 lines (occasionally $3\frac{1}{2}$ inches wide).

Not uncommon in the schists of Harper's Hill, N. S. Wales.

Pachydomus carinatus (Mor.).

Abundant in the fine sandy schists of Wollongong, N. S. Wales; more rare in the white rock of Port Arthur, V. D. Land.

Pachydomus globosus (Sow. sp.).

Common in the sandstone of Wollongong, N. S. Wales.

Pachydomus gigas (M'Coy). Pl. XVI. fig. 3.

Sp. Char. Transversely oval, length two-thirds of the width, very gibbose, inflated; beaks very large, incurved, placed in about the anterior third of the shell; posterior side obliquely truncated, the angles rounded; posterior slopes compressed, flattened; posterior ridge obtusely rounded, almost disappearing before reaching the posterior inferior angle; anterior side small, narrowed, with a slightly marked sinus between it and the convex ventral margin; surface marked with small concentric cord-like sulci and ridges.

This is distinguished from the *P. globosus* (with which Mr. Morris seems to include it) by its greater width in proportion to the length, by the flattened, compressed sides of the posterior slopes and the more oblique truncation of the posterior end, and the smallness and narrowed appearance of the anterior side, arising from a slight, but always perceptible, sinus between it and the convexity of the ventral margin. The shell is very thin in this species, which makes a near approach to *Leptodomus* (M'Coy) in all its characters. Length 4½ inches, width 6 inches 3 lines (often much larger).

Common in the fine sandstone of Wollongong, N. S. Wales.

Pachydomus sacculus (M'Coy). Pl. XIV. fig. 5.

Sp. Char. Subquadrate or satchel-shaped, length nearly equalling the width, thickness two-thirds the length; gibbose towards the beak, compressed towards the ventral margin; beaks large, nearly central, strongly incurved towards the anterior side; posterior side forming a short, compressed, rectangular wing; anterior side very obliquely truncated; anterior and posterior slopes abruptly rounded, and the angles formed by their junction with the ventral margin equal, broadly rounded and nearly equidistant from the beak; abdominal margin broadly concave, giving the middle of the valves a flattened, slightly hollowed appearance; shell very thick, foliaceous; surface with a few obtuse concentric elevations and numerous irregular concentric lines of growth.

Length 4½ inches, width 4 inches 9 lines. I am uncertain whether the specimen figured is from Black Head or Wollongong, N. S. Wales.

Pachydomus ovalis (M'Coy). Pl. XIV. fig. 4.

Sp. Char. Transversely oval, length five-sixths of the width, compressed, thickness rather more than two-thirds of the length; beaks tumid, nearest the anterior end; anterior and posterior ends oval, rounded, the latter obscurely angulated at end of hinge-line; ventral margin regularly convex; surface marked with thick, unequal, cord-like concentric striæ, lunette deep ovate; ligament external, large.

The anterior and posterior adductor impressions are large and oval; the impression of the retractor of the foot very small, lunate, just over the anterior adductor; pallial impression with a small rounded sinus before joining the posterior adductor. Distinguished from the *P. lævis.* (Sow.) by the coarse concentric lineation of the surface. Length 1 inch 8 lines, width 2 inches.

Very common in the sandstone of Wollongong, N. S. Wales.

Pachydomus ? pusillus (M'Coy). Pl. XVI. figs. 1 & 2.

Sp. Char. Small, ovato-orbicular, width slightly exceeding the length, globose, thickness four-fifths the length; beaks very large, tumid, much incurved into the anterior cordiform space, which is unusually deep; anterior side short, rounded; posterior end rounded; ventral margin very convex; ligament very large, external; muscular impressions large, anterior deep oval, posterior impression shallow, lunate, pallial impression entire; shell thick, surface rough with strong concentric imbricating lines of growth.

This curious little species resembles an *Isocardia;* but from the great size of the external ligament, thick shell and general habit, I have placed it in the present genus, but not without doubt, from its diminutive size and peculiar proportions. Length 10 lines, width 11 lines.

Common in the sandy schists of Wollongong, N. S. Wales.

Cardinia (?) *exilis* (M'Coy). Pl. XV. fig. 1.

Sp. Char. Transversely ovate, compressed, cuneiform, slender, twice as wide as long; dorsal margin convex; beaks small, one-sixth of the width from the anterior end; posterior end attenuated, obtusely pointed; anterior side small, rounded; anterior half of the ventral margin convex, posterior half slightly concave; surface with strong irregular imbricating laminæ of growth and close intervening imbricating striæ.

This reminds us of the *Unio* (*Cardinia*) *acuta* (Sow. sp.) of the European coal-fields; but is distinguished by its greater thickness, more clavate form, and arched dorsal margin. The muscular and pallial impressions correspond with those of the lias species of the genus generally, but the dental impressions are obscure. Length 1 inch 1 line, width 2 inches 2 lines.

From the sandstone of Wollongong, N. S. Wales.

Notomya (M'Coy), new genus.

Gen. Char. Shell transversely ovate, equivalve, inequilateral, compressed, greatest thickness behind the middle of the shell; gaping slightly at both ends; beaks small, compressed; cardinal slope not distinguished from the sides of the shell; shell thick, surface concentrically lineated; ligament external, large. Cast: a wide shallow furrow runs obliquely from the beak about halfway towards the ventral margin; a shallow spoon-shaped hollow extends from the beak to the impression of the posterior adductor muscle, bounded by a low ridge on each side in each valve; traces of a simple cardinal tooth beneath the beak of the right valve; muscular impressions deep, anterior adductor large ovate, not attenuated above; posterior adductor broadly lunate; retractor of the foot small, oval, immediately over the anterior adductor; pallial impression with a small rounded sinus before joining the posterior adductor.

It is with those Muschelkalk *Myacites* of Schlotheim and Bronn' and such like forms, of which M. Agassiz, in his 'Etudes Critiques sur les Mollusques Fossiles,' has composed his genus *Pleuromya*, and with those forming his genus *Gresslya*, that the present fossils have the strongest affinity. They are, however, perfectly distinct from those essentially Jurassic and Triassic types, by the small size of the sinus in the pallial impression. In minor characters it differs from the *Gresslyas* in the small size of the beaks, and the more compressed form of the sides (the greatest thickness in *Gresslya* being always before the beaks, and gradually diminishing towards the posterior end, while the greatest thickness in *Notomya* is *behind* the beaks, depriving them of the characteristic wedge-like form of *Gresslya.*) The present genus is destitute of the cardinal ridge in the right valve, so remarkable in *Gresslya,* having in its place a shallow, attenuated, ovate hollow, bounded by two obscure ridges in each valve, thus approaching *Pleuromya.* The shell also is much thicker than in the above genera, and the impressions of the muscular and pallial scars much deeper and more strongly marked in consequence; the impression of the anterior adductor is pear-shaped, pointed and attenuated above in *Gresslya,* but simply oval in *Notomya.* The *Pleuromyæ* differ in nearly all the same points as *Gresslya* from the present genus (except the cardinal ridge), and differ besides in the elevation or upward curvature of the cardinal line and the convexity of the posterior two-thirds of the ventral margin corresponding with it, those parts being oppositely inclined in *Notomya.* The oblique mesial or post-mesial furrow from the beak in the cast of *Notomya* does not exist in the other two genera, but in *Pleuromya* there exists a somewhat similar furrow, but different in position, arising *in front* of the beaks, and extending directly to the ventral margin close to the anterior end. *Cardinia* (Ag.), which somewhat resembles the present genus, is distinguished by its entire pallial impression and dental characters.

Notomya securiformis (M'Coy). Pl. XV. figs. 5 & 5 *a.*

Sp. Char. Transversely ovate, flattened; length two-thirds the width, thickness rather less than half the length; beaks small, flattened, rather more than one-third the width from the anterior end; anterior end narrowed, rounded; posterior end narrow, subtruncate, nearly square; anterior two-thirds of the ventral margin very convex, a shallow concavity in the posterior third; muscular impressions very large, anterior one deepest, ovate, posterior one shallow, broad, reniform; pallial scar strongly marked, parallel with the ventral margin as far as the anal angle, then a small subangular sinus before joining the adductor impression; retractor impression small, deep, narrow, oval; in the cast the oblique furrow from the beak towards the ventral sinus wide, shallow; remains of a cardinal tooth under the beak of the right valve.

Length 1 inch 6 lines, width 2 inches 2 lines, thickness 11 lines. The figures of this species display most of the generic characters. Sandstone of Wollongong, N. S. Wales.

Notomya clavata (M'Coy). Pl. XV. fig. 4.

Sp. Char. Transversely clavate; length two-thirds the width, evenly convex, greatest thickness towards the posterior half; beaks very small, compressed, rather more than one-fifth the width from the anterior end; anterior end very broad, evenly rounded; anterior third of the ventral margin very convex, middle portion widely concave; posterior end narrowed, obliquely subtruncate, rounded; muscular impression shallow, anterior large ovate, posterior broad lunate; retractor small, broad, oval; oblique longitudinal furrow from the beak deep, narrow above, widening nearly to the marginal concavity; impression of one simple cardinal tooth beneath the beak of the right valve; the long spoon-shaped hollow extending from the beaks to the posterior muscular impressions, and its lateral bounding ridges obscurely marked.

Distinguished from the *N. securiformis* by its broadly rounded anterior side, smaller beaks, thinner shell, and consequently more faintly marked ridges and impressions on the cast, and by the middle of the ventral margin being concave instead of very convex, and the sides evenly convex instead of flattened. Length 1 inch 6 lines, width 2 inches 2 lines. Common in the sandstone of Wollongong, N. S. Wales.

Besides the above, there is a third species of *Notomya* equally common in the sandstone of Loder's Creek, but of which none of the specimens were good enough to figure or describe; it has the strong mesial oblique furrow from the beak of the cast, small sinus in the mantle scar, and other characters of the genus, but differs from the preceding species in its regular oval outline, &c. It might be named *N. ovalis*.

Pullastra? striato-costato (M'Coy). Pl. XIV. fig. 3.

Sp. Char. Transversely oblong, depressed, nearly twice as wide as long, dorsal and ventral margins nearly parallel, anterior and posterior ends elliptically rounded; beaks rather large, one-third of the width from the anterior end; surface with about twelve strong angular ridges parallel with the margin; those ridges are finely striated in the direction of their length.

The striation parallel with the ridging distinguishes this from the *Pullastra bistriata* (Portk.) of the Irish carb. shale; and there being no flat space between the angular ridges, and its less width and straight ventral margin, distinguish it from the *M. scalaris* (Phil.) of Devonshire. Length 2 lines, width 3½ lines. Common in the shale of Dunvegan, N. S. Wales.

Venus? gregaria (M'Coy). Pl. XVI. fig. 5.

Sp. Char. Orbicular, compressed, evenly convex; beaks prominent, slightly nearer the anterior side; lunette deep ovate, smooth; external ligament short, prominent; surface covered with coarse rounded concentric striæ; margin crenulated within.

This pretty little species occurs gregariously in great numbers in some spots in the sandstone of Wollongong, N. S. Wales, principally as hollow casts, which at first sight resemble impressions of the *Atrypa decussata*. Length 4 lines.

(*Gasteropoda.*)

Euomphalus minimus (M'Coy). Pl. XVII. fig. 4.

Sp. Char. Greatest diameter one line; spire depressed, of three small whorls; basal whorl deeper than the spire, rounded, mouth wider than long; umbilicus small, rounded; surface smooth.

Common in the shale of Dunvegan, N. S. Wales.

Pleurotomaria subcancellata (Mor.).

In the fine calcareous sandstone of Loder's Creek, N. S. Wales.

Pleurotomaria Strzeleckiana (Mor.).

Common in the fine calcareous grits of Wollongong, N. S. Wales.

Pleurotomaria Morrisiana (M'Coy). Pl. XVII. fig. 5.

Sp. Char. Acutely conical, width four-fifths of the length; volutions four or five, each having a small double keel below the middle, and a slightly tumid margin to the sutures; no umbilicus; surface with fine close unequal striæ arched backwards from the suture to the keel. Width 4 lines, length scarcely 5 lines.

As the characters of this little species seem to have been already recognized and slightly alluded to by my friend Mr. Morris (in Count Strzelecki's work), I dedicate it to him. It is, as he observes, something like the *P. conica* (Phil.), but smaller and more elongate. Abounds in some parts of the limestone of Black Head, N. S. Wales, and rare in the sandstone of Muree, N. S. Wales.

Platyschisma rotundatum (Mor.).

Abundant in the dark arenaceous limestone of Harper's Hill, N. S. Wales.

Platyschisma oculus (Mor.).

Common in the arenaceous limestone of Harper's Hill.

(*Pteropoda.*)

Theca lanceolata (Mor.).

Abundant in the dark arenaceous limestone of Black Head, N. S. Wales. I observe that, at the longitudinal furrows, the ends of the transverse sulci alternate with each other as in *Conularia*. Those longitudinal furrows are not noticed by Mr. Morris in his description of the genus and above-named species; but they exist, of the same number as in *Conularia*, one coinciding with the principal (? dorsal) ridge, two being placed a little on the (? posterior) side of the lateral angles, and one in the middle of the flat (? anterior) side. It is of importance to notice those obscurely-marked furrows, as bringing more clearly to view the relations of the genus *Theca* with *Conularia*. The transverse sulci are crossed by very minute longitudinal striæ.

Conularia lævigata (Mor.).

Common in the fine gray micaceous sandstone of Black Creek, N. S. Wales, and in the limestone of Harper's Hill, N. S. Wales.

Conularia torta (M'Coy). Pl. XVII. figs. 9 & 10.

Very elongate-conic, diminishing in diameter at the rate of one line in two inches; section oval; lateral longitudinal channels only two (?), placed with a slight obliquity to the long axis of the shell, giving it a twisted appearance, being placed at the sides (or extremities of the short axis) of the oval section at the base, and being at the ends (or extremities of the long axis) of the oval section near the small end; sides very convex, without mesial furrow; transverse sulci coarse (about fifteen in half an inch), continued uninterruptedly across from one side furrow to the opposite.

This extraordinary fossil seems to differ from all known *Conulariæ* in having but two instead of four longitudinal furrows (for although MM. D'Archiac and Verneuil give an oval section of their *C. Brongniartii* showing but two furrows, I suppose this to be erroneous, as it neither agrees with their description nor larger figure).

This is distinctly seen in the small fragment here figured, as well as the uninterrupted passage of the transverse ridges from one oblique sulcus to that on the opposite side, and the undivided nature of the intermediate faces. The larger specimen figured is not so perfect, but shows the slow rate of increase. The transverse sulci are about as numerous as in the *C. lævigata*, but that species has four unequal, divided faces, and is, together with all the described species, so different as not to require a particular comparison. The oblique or twisted direction of the longitudinal sulci above-noticed, I find also to exist in the recent *Creseis spinifera* of the Mediterranean; so that what would otherwise seem an anomalous character of the present fossil tends rather to strengthen the affinity between *Conularia* and the recent *Pteropoda*.

Not uncommon in the sandstone of Muree, N. S. Wales.

Conularia tenuistriata (M'Coy). Pl. XVII. figs 7 and 8.

Sp. Char. Quadrangular, pyramidal, section rhomboidal, tapering at the rate of two lines in one inch; sides unequal, two narrow sides flat or slightly convex, about half the width of the two wide ones, which are slightly concave; a strong longitudinal furrow down each of the lateral angles, and a faintly-marked one in the middle of each of the broad faces; transverse striæ very fine, twenty-seven to twenty-nine in the space of half an inch, passing uninterruptedly, with a slight upward curve, across the broad faces, more nearly straight on the two narrow ones.

This species equals or even exceeds the *Conularia Gerolsteinensis* in the fineness of its transverse striation, while it is distinguished from that and all other species with which I am acquainted by the great disproportion in the width of the sides. One specimen, imperfect at both ends, measuring 1½ inch long, had the long diameter at the base 9 lines, the short diameter at the base 4½ lines; long diameter at smaller end 6½ lines, short diameter at ditto 3 lines.

Not uncommon in the sandstone of Muree, N. S. Wales.

(*Cephalopoda.*)

Bellerophon micromphalus (Mor.).

Common in the impure calcareous beds of Wollongong, N. S. Wales; rare in the sandstone of Muree, N. S. Wales.

Bellerophon interstrialis (M'Coy). Pl. XVII. fig. 6.

Sp. Char. Globose; keel obtuse, rounded; surface with sharp spiral striæ, each pair having two or three finer lines between them, and the whole reticulated by sharp tranverse elevated striæ, which form little tubercles at the intersections.

Closely allied to the Irish carboniferous *B. interlineatus* (Portk.), from which it is known by the strong reticulation of its surface.

Rare in the Dunvegan shale, N. S. Wales. Width 4 lines.

Nautilus.

A species resembling the carboniferous *N. sulcatus*, but too imperfect for specific determination, occurs in the Dunvegan shale, N. S. Wales.

Conclusion.

Having far exceeded the limits I had originally intended for the preceding part of this paper, I find it only possible to give a brief outline of those general topics on which I intended to have dwelt. First, as to what has been already done: geologists are familiar, from the labours of M. de Strzelecki and others, with the fact that there exists a series of stratified deposits, consisting of siliceous and argillaceous slates, limestones and sandstones, stretching at irregular intervals from the Liverpool range of mountains in New South Wales to the extremity of Van Diemen's Land, and forming detached masses, probably at one period continuous; those contain abundant fossil remains of animals referable to the palæozoic period.

Above these we have a series of clays, shales and sandstones, with remains of fossil plants and beds of coal, occupying three great basin-shaped hollows; one in the district about the Hawkesbury River in New South Wales, and called the Newcastle basin, and the two others in Van Diemen's Land, called respectively the South Esk and the Jerusalem basins. The animal beds containing the palæozoic remains are found, with one doubtful exception, to dip constantly under the coal-bearing strata, at every point of observation; for the most part at the same angle as that at which the coal crops out: the exception alluded to is a point near Spring Hill, Van Diemen's Land, where masses of clay containing *Pachydomus globosus* seem to rest on a sandstone containing remains of plants, and which is known to belong to the top of the coal series: Count Strzelecki, who made this observation, doubts its correctness himself, and expressly states that it needs re-examination to establish the fact of those *Pachydomus* clays really existing in this position. Nevertheless the inference has been drawn from this observation, that the Jerusalem coal-basin was much older than that at Newcastle, New South Wales, where the sandstones containing the *Pachydomi* were always seen to dip distinctly under the coal-measures: countenance was apparently given to this supposition by the few plants which were collected from Jerusalem coal-field proving to be all specifically and some generically distinct from those known to exist in the Newcastle basin. When to this we add, that the beds containing the fossil animal remains rest on a siliceous breccia, the age of which is unknown, and that the coal strata are overlaid by variegated sandstone and yellow limestone, supposed from its few organic remains to belong to the pleiocene period, we have I believe stated all that is known on the geological relation of those deposits.

With regard to their palæontology,* we have seven species of plants noticed in M. de Strzelecki's work by Mr. Morris, one of which is identical with a species from the Indian coal-field of Burdwan; and the general resemblance to the oolitic plants of Britain is noticed, as well as the absence of the characteristic forms

* Since the above was printed, I learn from a letter of Mr. Dana's that he is just putting to press his account of the palæontology of this district, which, as Naturalist to the United States Exploring Expedition, he has recently investigated under more favourable circumstances than any of his predecessors; we may soon, therefore, expect from this accomplished naturalist a great addition to our knowledge on this subject.

of the older genuine coal-fields of Europe. In the inferioi strata there are forty-eight species of animal remains noticed, one of which is supposed to be identical with a species of the British mountain limestone; the remainder are all (except two new types) of palæozoic genera; but the absence is remarked of *Nautilus*, the true *Leptænæ* and *Orthidæ*, all of which, however, I have now been able to add.

In the above notice I have given seventeen species of fossil plants from the Mulubimba district, which is a portion of the great Newcastle and Hawkesbury basin, twelve of which are considered new. Those plants belong to ten genera, two of which (*Vertebraria* and *Zeugophyllites*) are only known here and in the supposed oolitic coal-fields of India: one genus (*Gleichenites*) I have provisionally used for the *Pecopteris odontopteroides* of Morris, from the verbal characters given by Göppert for that genus, the species of which are found only in the palæozoic coal; the plant, however, agrees much better with the species of the Keuper genus *Heptacarpus* than with those of the carboniferous *Gleichenites*, and if we look rather to the plants themselves than to the definitions given of the genera, I should certainly place it there: all the other genera (with the exception of *Phyllotheca*, which is confined to the locality) are well known in the oolitic coal deposits of Yorkshire; and one species, the *Sphenopteris germana* (M'Coy), is scarcely to be distinguished from the common *Pecopteris Murrayana* (Br.) of the Scarborough shales. Several of those genera are common both to the carboniferous and oolitic periods, but the most abundant and characteristic plants of the Australian beds belong to a genus (*Glossopteris*) never found in the old coal-fields, but several species of which are, on the other hand, well known in coal-beds of the oolitic age in various parts of the world. I am therefore strongly of opinion, from the evidence of more than double the number of species of plants known before, that the coal deposits of Australia should be referred to the oolitic period; and this opinion derives much additional weight from the negative fact, that among the large quantity of remains of plants which I have examined from this district, not a trace has been observed of any of the characteristic carboniferous genera—not a trace of *Lepidodendron* or any allied plant—not a trace of *Sigillaria*, *Favularia*, *Stigmaria*, or even of true *Calamites*. I might further add, that the list of plants I have given destroys any negative arguments formerly based on the fossil evidence, for considering the Jerusalem coal-basin to be of a different age from the Newcastle one, as I have detected the most characteristic plants of the former abundantly in the latter beds, so that the fossil evidence now would go, with the admitted identity of the walls of the basins and the general analogy of the sections, to prove them all of one age.

In the underlying rocks I have been able to determine 83 species of animal remains, of which 14 are *Zoophyta*, 3 *Crinoidea*, 4 *Crustacea*, 25 *Brachiopoda*, 24 *Lamellibranchiata*, 6 *Gasteropoda*, 4 *Pteropoda*, and 3 *Cephalopoda* (including *Bellerophon*). Of these, 4 genera and 32 species are figured and described as new. Those 83 species belong to 39 genera, all of which (with the exception of the genera *Tribrachyocrinus*, *Pachydomus*, *Notomya*, and *Eurydesma*, —new forms at present only known in Australia) are abundant in the carboniferous rocks of Britain, many of them not being found in any higher series, and several of them not being known in any older deposits, so that the age, even if *we only look to the genera of the fossils*, is clearly limited to the carboniferous period; but when we descend to the critical examination of species, we find so extraordinary and unexpected an amount of agreement between those beds and the similar shales, sandstones and impure limestones forming the base of the carboniferous system in Ireland, that it is impossible not to believe them to be nearly on the same parallel, and there is equal difficulty in imagining them to be either younger or older than those deposits. Of those species no less than eleven are believed to be positively identical, on the most careful comparison of the Australian and Irish specimens, and nine more are so closely allied that it has been found impossible to detect any difference of character, but which, either from imperfect preservation or want of sufficient specimens to display all the characters, have not been specifically identified. With such evidence as I have mentioned, I do not think it improbable that a wide geological interval occurred between the consolidation of the fossiliferous beds which underlie the coal, and the deposition of the coal-measures themselves; that there is no real connexion between them, but that they belong to widely different geological systems, the former referable to the base of the carboniferous system, the latter to the oolitic, and neither showing the slightest tendency to a confusion of type.

EXPLANATION OF PLATES IX TO XVII.

PLATE IX.

Fig. 1. Vertebraria australis (*M'Coy*).
Fig. 2. Otopteris ovata (*M'Coy*).
Fig. 3. Cyclopteris angustifolia (M'Coy).
Fig. 3 *a.* Neuration of ditto magnified.
Fig. 4. Sphenopteris flexuosa (*M'Coy*).
Fig. 4 *a.* Pinnule of ditto magnified to show the neuration.
Fig. 5. Glossopteris linearis (*M'Coy*).
Fig. 5 *a.* Neuration of ditto magnified.
Fig. 6. Pecopteris (?) tenuifolia (*M'Coy*).

PLATE X.

Fig. 1. Sphenopteris hastata (*M'Coy*).
Fig. 1 *a.* Pinnule of ditto magnified.
Fig. 2. Sphenopteris germana (*M'Coy*).
Fig. 2 *a.* Pinnule of ditto magnified.
Fig. 3. Sphenopteris plumosa (*M'Coy*).
Fig. 3 *a.* Pinnule of ditto magnified.

PLATE XI.

Fig. 1. Inflorescence of Phyllotheca.
Fig. 2. Phyllotheca ramosa (*M'Coy*).
Fig. 3. Decorticated stem with scar of branch.
Figs. 4 & 5. Phyllotheca Hookeri (*M'Coy*).
Fig. 6. Magnified part of leaf of ditto to show the midrib.
Fig. 7. Stems of ditto, without their sheath, to show their sulcation.
Fig. 8. Cladochonus tenuicollis (*M'Coy*). Lower figure magnified.
Fig. 9. Strombodes (?) australis (*M'Coy*).

PLATE XII.

Fig. 1 *a.* Brachymetopus Strzeleckii (*M'Coy*): head natural size and magnified.
Fig. 1 *b.* Ditto, pygydium natural size and magnified.
Fig. 2 *a & b.* Tribrachyocrinus Clarkii (*M'Coy*).
Fig. 2 *c.* Plates of ditto expanded.

PLATE XIII.

Fig. 1. Orbicula affinis (*M'Coy*).
Fig. 2. Producta undulata (*M'Coy*).
Fig. 3. Orthis spinigera (*M'Coy*).
Fig. 4. Orthis autralis (*M'Coy*).
Fig. 4 *a*. Ditto, internal cast.
Figs. 5 & 6. Spirifera (Brachythyris) oviformis (*M'Coy*).
Fig. 7. Spirifera lata (*M'Coy*).
Fig. 8. Atrypa Jukesii (*M, Coy*).
Figs. 9 & 9 *a*. Atrypa biundata (*M'Coy*).

PLATE XIV.

Fig. 1. Inoceramus Mitchellii (*M'Coy*).
Fig. 2. Pecten ptychotis (*M'Coy*).
Fig. 3. Pullastra (?) striato-costata (*M'Coy*).
Fig. 4. Pachydomus ovalis (*M'Coy*).
Fig. 5. Pachydomus sacculus (*M'Coy*).

PLATE XV.

Fig. 1. Cardinia (?) exilis (*MCoy*).
Figs. 2 & 3. Modiola crassisima (*M'Coy*).
Fig. 4. Notomya clavata (*M'Coy*).
Figs. 5 & 5 *a*. Notomya securiformis (*M'Coy*).

PLATE XVI.

Fig. 1. Pachydomus (?) pusillus (*M'Coy*): internal cast.
Fig. 2. Ditto, surface.
Fig. 3. Pachydomus gigas (*M'Coy*).
Fig. 4. Pleurorhynchus australis (*M'Coy*).
Fig. 5. Venus (?) gregaria (*M'Coy*).

PLATE XVII.

Fig. 1. Pecten subquinquelineatus (*M'Coy*).
Fig. 2. Spirifera (Brachythyris) duodecimcostata, dorsal valve.
Fig. 3. Ditto, ventral valve.
Fig. 4. Euomphalus minimus (*M'Coy*).
Fig. 5. Pleurotomaria Morrisiana (*M'Coy*).
Fig. 6. Bellerophon interstrialis (*MCoy*).
Fig. 7. Conularia tenuistriata (*M'Coy*).
Fig. 8. Ditto,
Figs. 9 & 10, Conularia torta (*MCoy*).

INDEX.

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Plate IX.

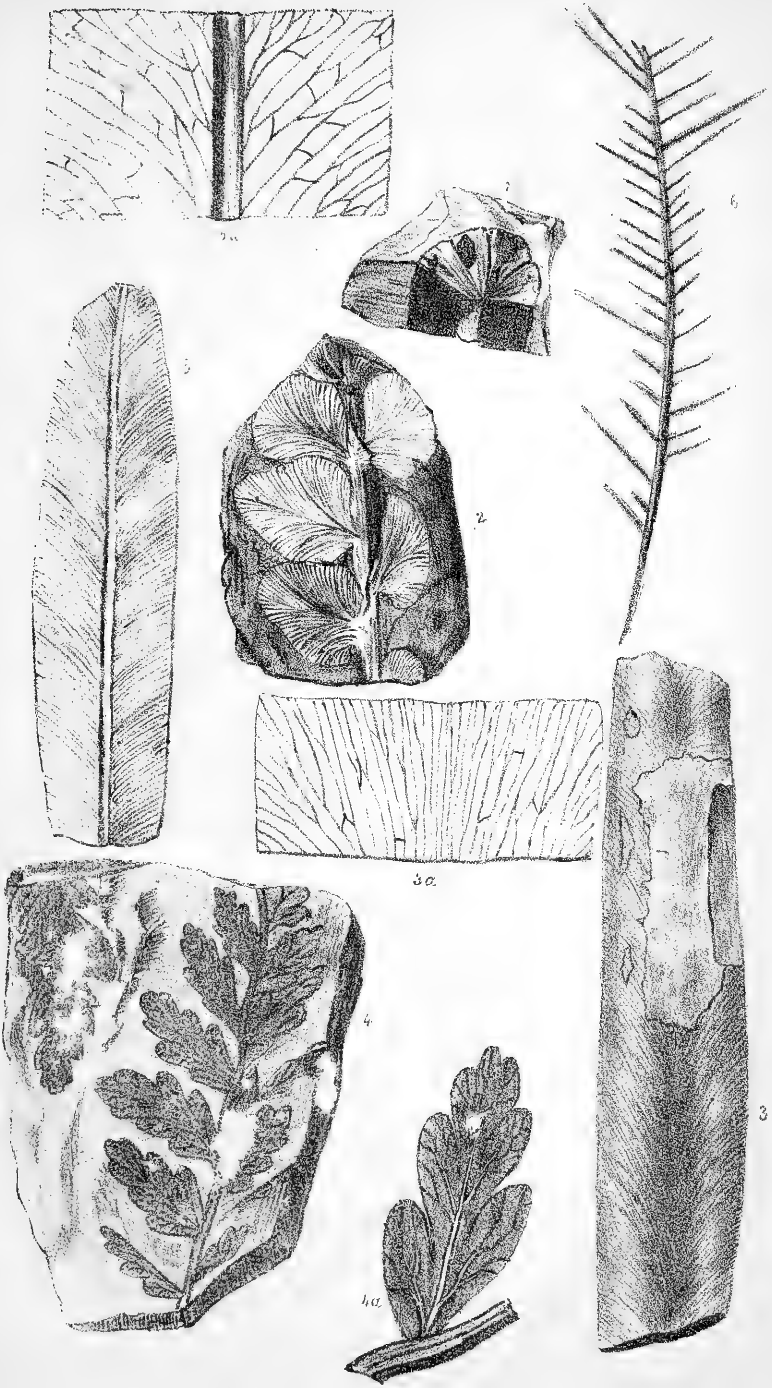
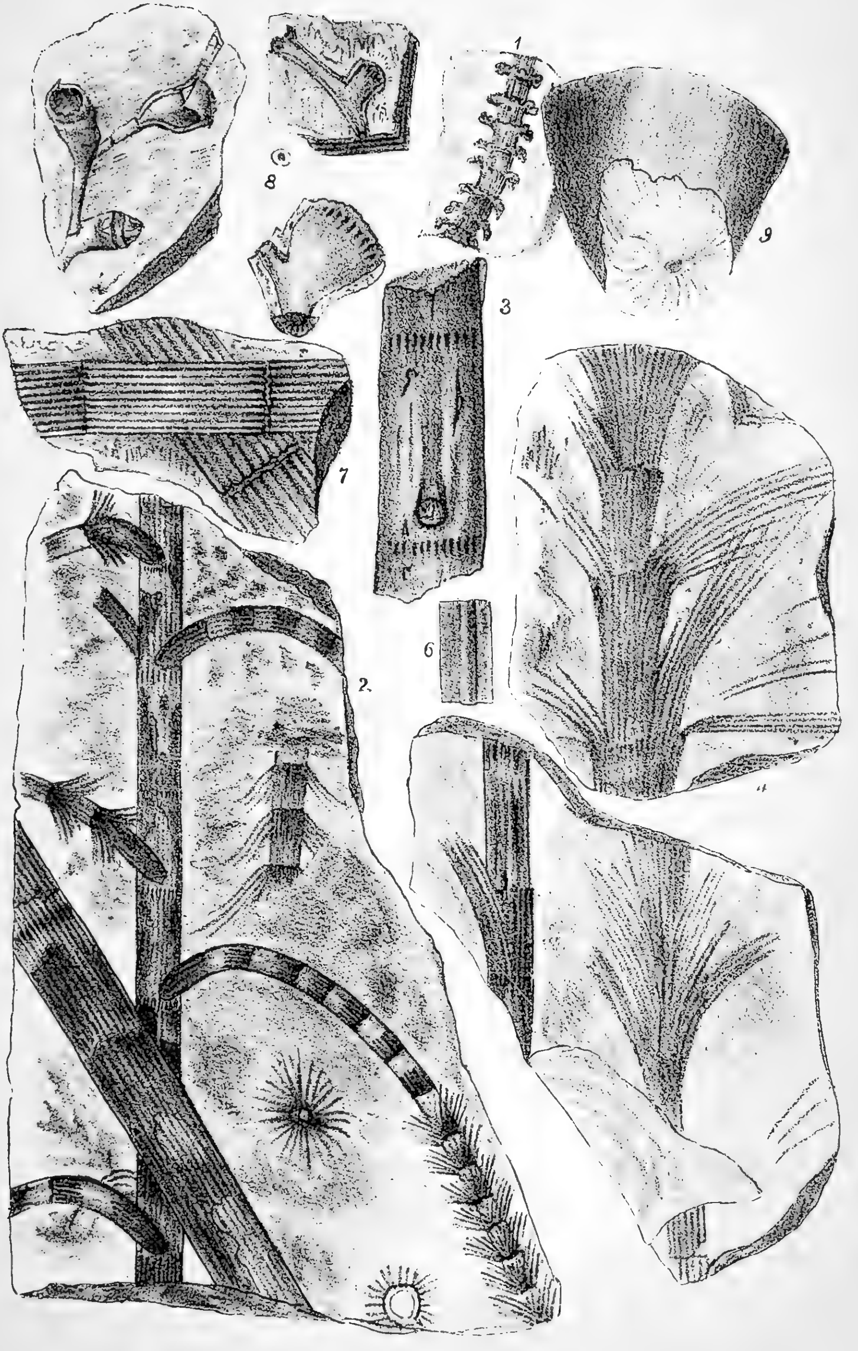
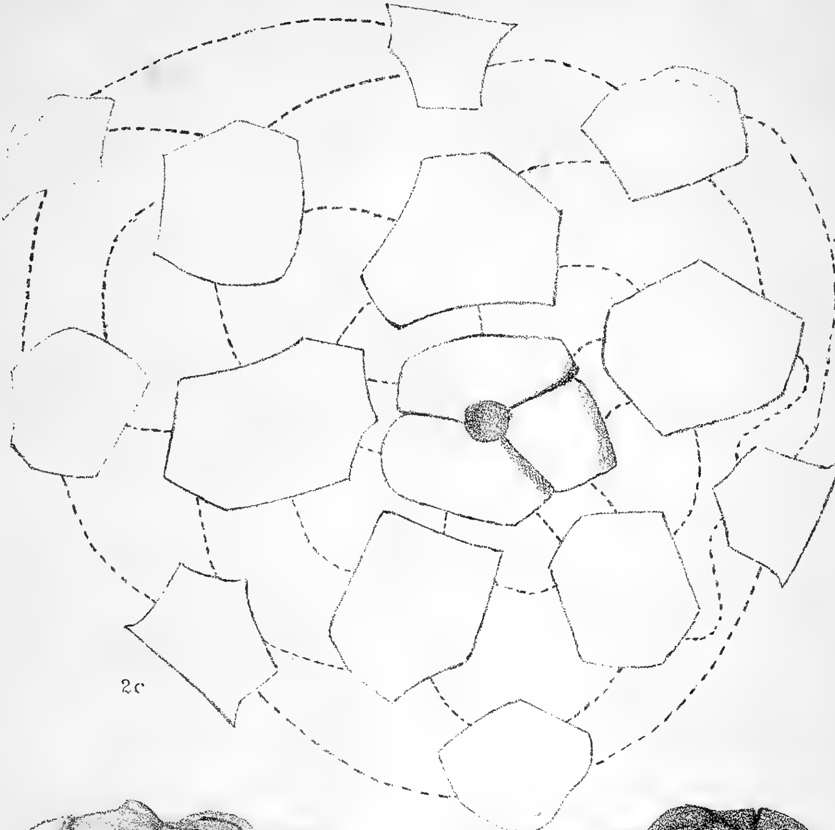


Plate X.

Plate XI





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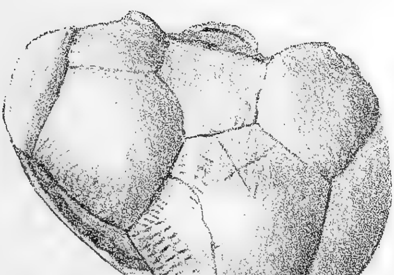

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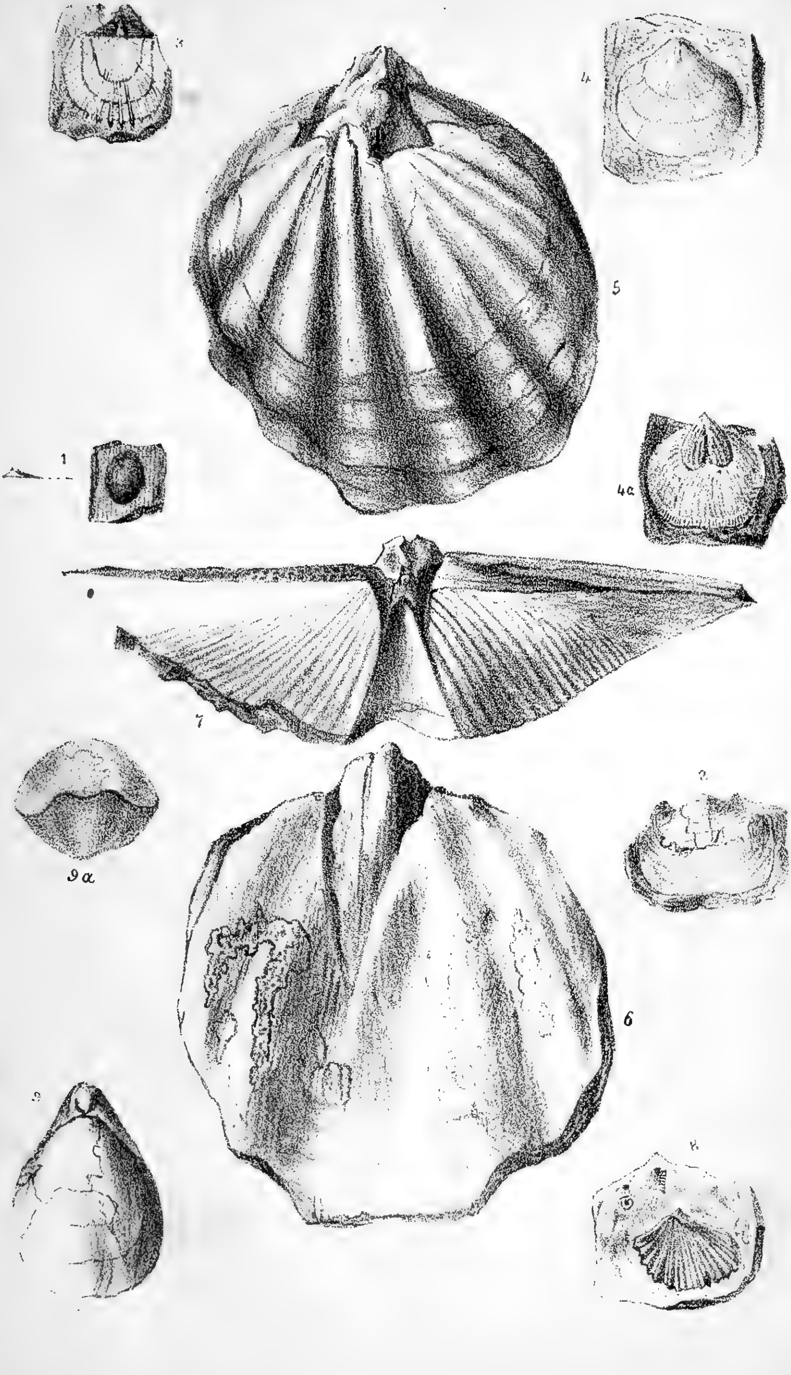

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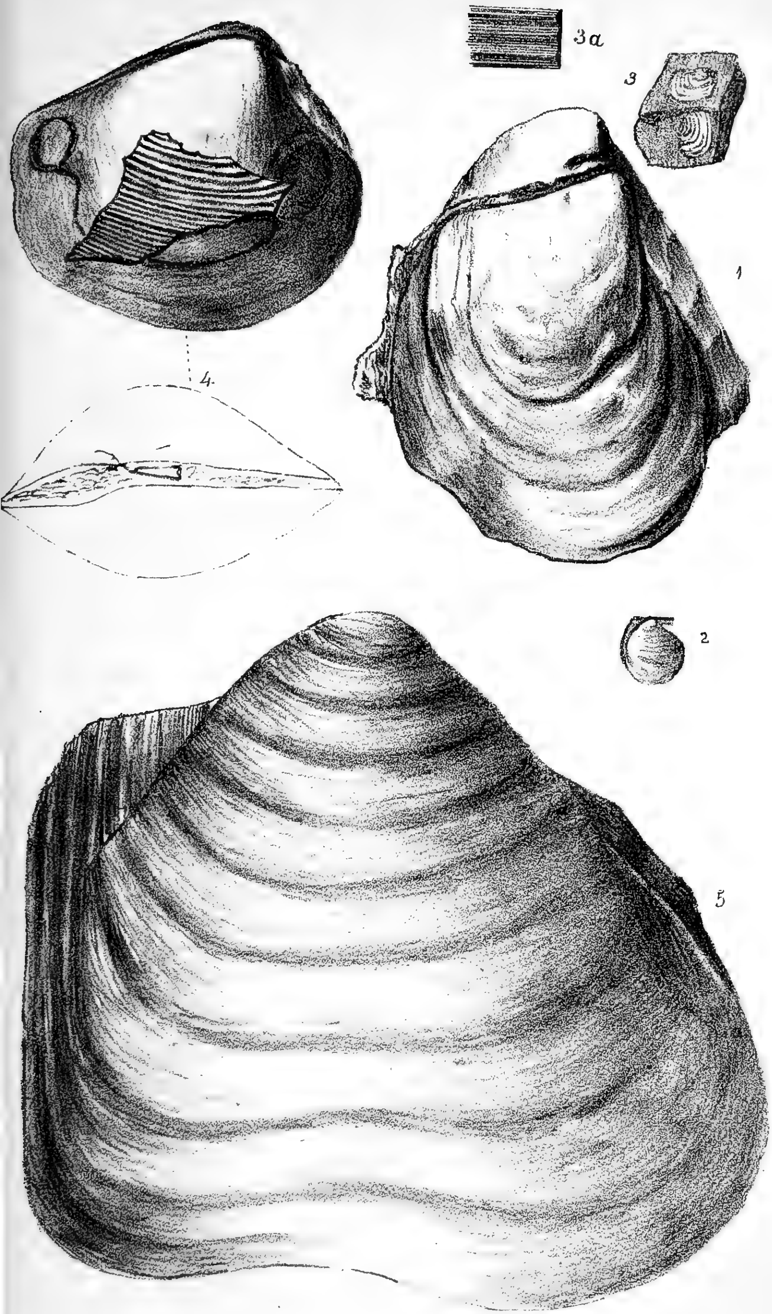

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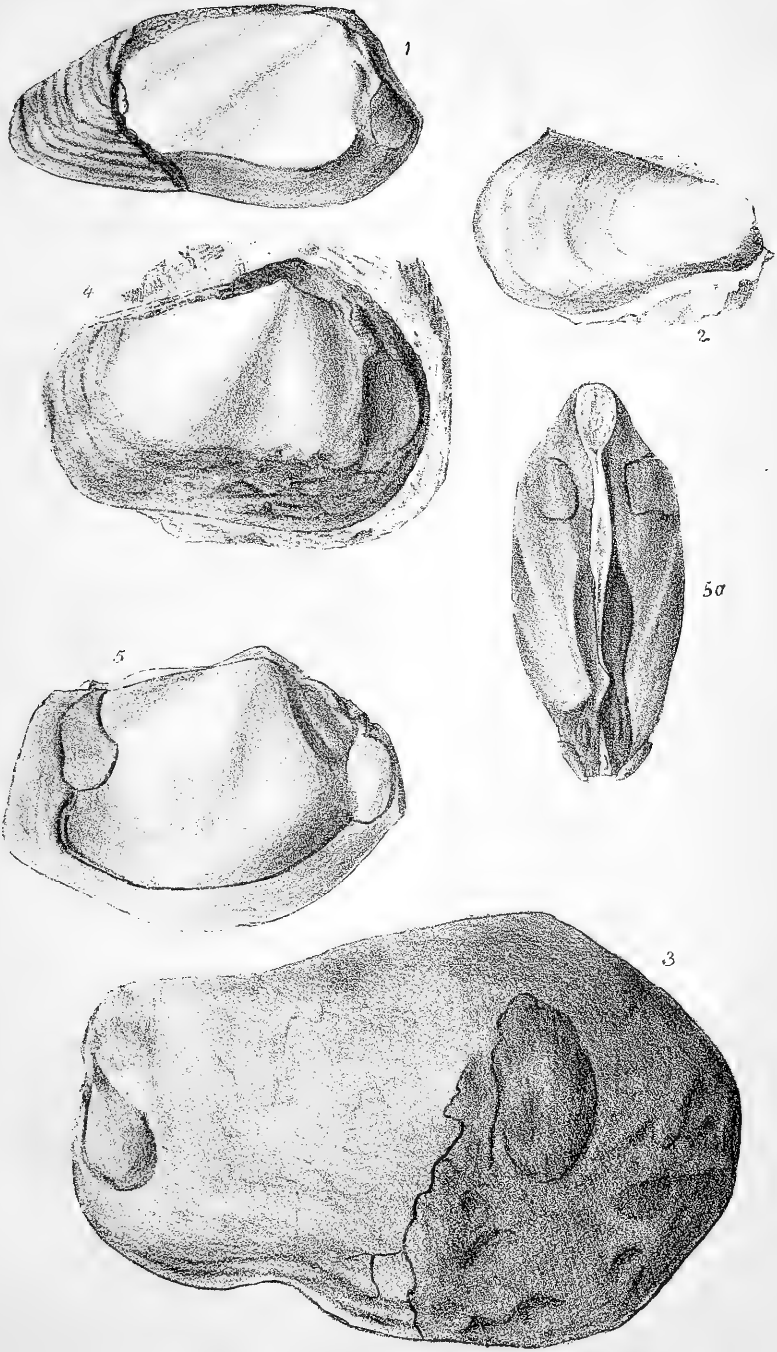
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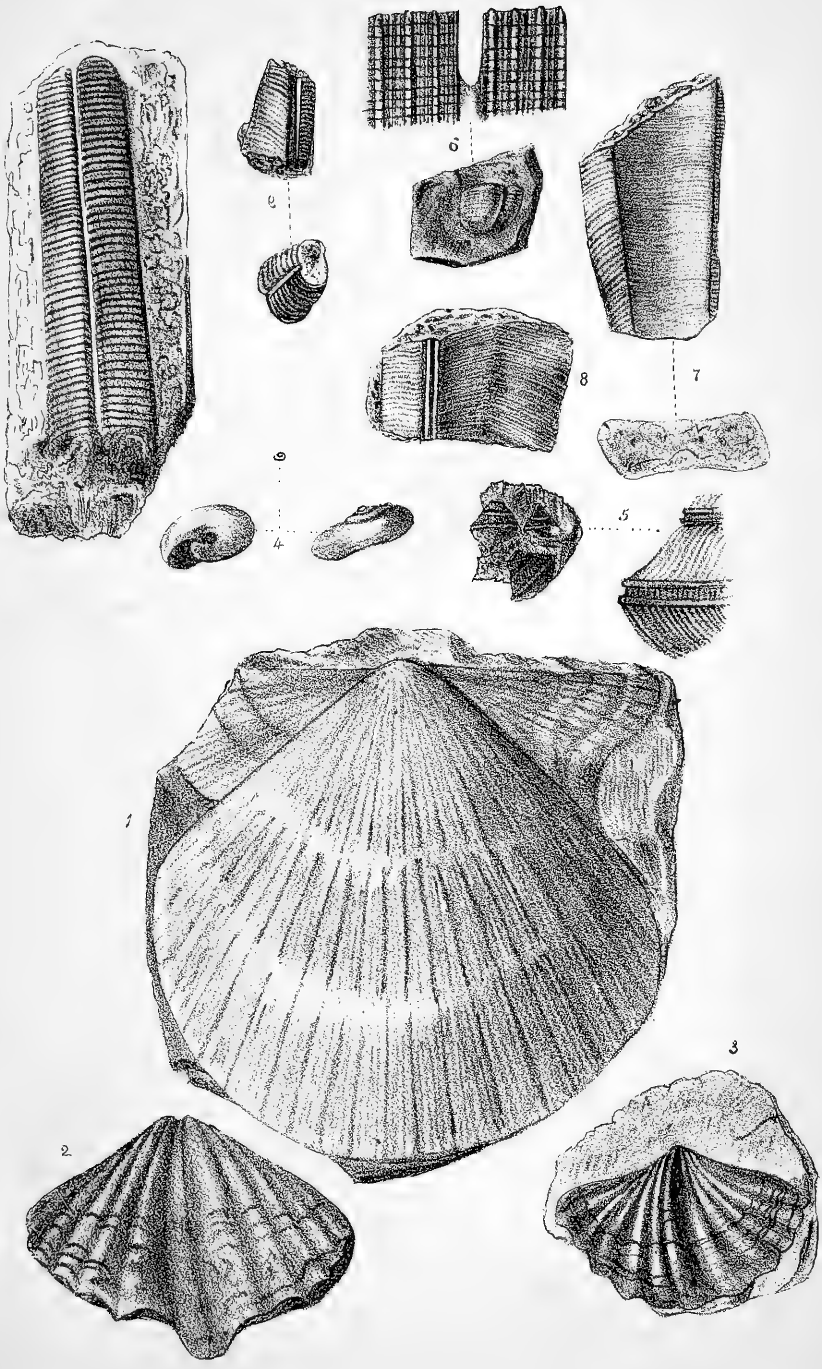
Plate XVI.

T. Browne. Lith.

Plate XVII.

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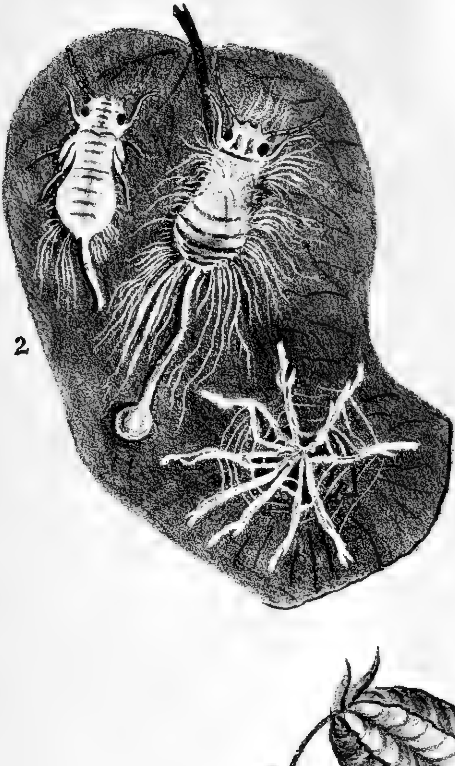
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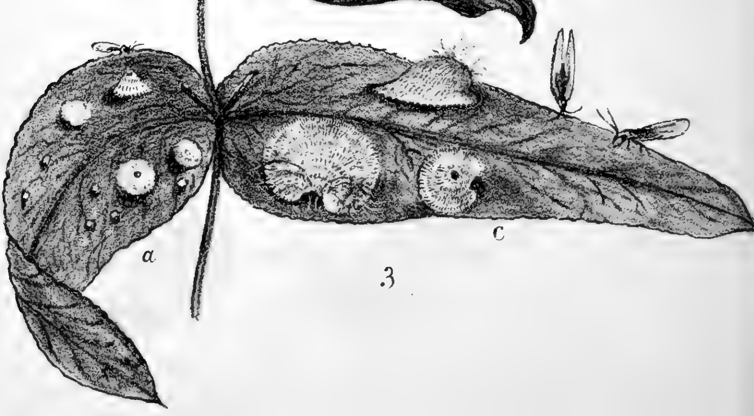

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Plate XVIII.

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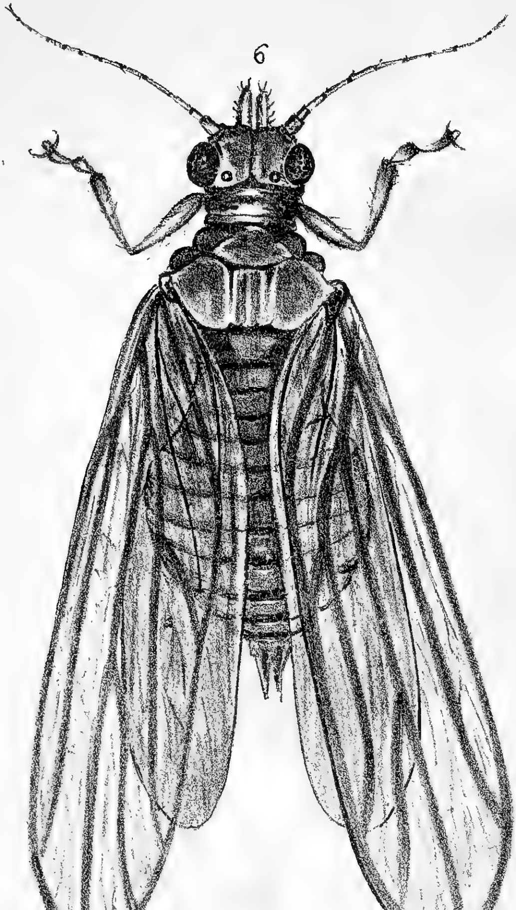

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Bishop, William, D.C.G.*	*Hobart Town.*
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Boot, Thomas	*Hobart Town.*
Booth, C. O'Hara, Captain	*New Town.*
Boyd, James	*Hobart Town.*
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Boyes, G. T. W. B., Colonial Auditor	*New Town.*
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Brownrigg, Rev. Francis	*Patterson's Plains.*
Buckland, Rev. J. R., B.A.	*Hobart Town.*
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Burnett, John, Sheriff of Van Diemen's Land	"

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Friend, M.C., R.N., F.R.S. ... ... *George Town.*
Fry, Rev. H. P., D.D. ... ... *St. George's, Hobart Town.*

Giblin, Thomas ... ... *New Town.*
Gibson, James ... ... *Circular Head.*
Gill, W. H.... ... ... *Hobart Town.*
Grant, James ... ... *Tullochgorum.*
Grant, James ... ... *Launceston.*
Greenwood, Joseph, Capt. 91st Regiment, Major Brigade ... ... *Auckland, New Zealand.*
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Gresley, Nigel, Union Bank ... ... *Hobart Town.*
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Jervis, J. C.	*Hobart Town.*
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Kay, Joseph Henry, Com. R.N., F.R S.	*Royal Observatory, Hobart Town.*
Kay, W. Porden, Director-General of Roads and Public Works	*New Town.*
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Last, Major, 99th Regiment	*Hobart Town.*
La Trobe, Charles Joseph, His Honor, Superintendent, Port Phillip	*Melbourne.*
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Legge, R. V.	*Cullenswood, Break-o'-Day.*
Lempriere, T. J., Assist.-Commissary-General	*Hong Kong.*
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Officer, Dr....	*Hobart Town.*
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Wilmot, C. Eardley-, A.D.C.	„
Wilton, Chas. Pleydell N., Rev., M.A.	*Newcastle, N. S. Wales.*
Windsor, Rev. S. B.	*Bishopsbourne.*
Woolfrey, Rev. W. O.	*Hobart Town.*
Wright, Rev. George	*Hamilton.*

Young, Thomas	*Hobart Town.*

Obituary.

JOHN KERR, Esq., M.L.C., a Member of this Society from its institution, and one of the earliest contributors to the Collection of Coins and Medals in the Museum, a Member of the Legislative Council of V. D. Land for twenty years, died, after a tedious illness, at an advanced age.

CHARLES SWANSTON, Esq., Treasurer, a Member of the Council of this Society, and one of its most steady and zealous supporters from its commencement down to the close of 1849, and many years a Member of the Legislative Council of V. D. Land, died at sea, between Sydney and California, after a short illness.

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