GENERAL OBSERVATIONS REGARDING THE CLASSIFICATION OF THE UPPER PALÆOZOIC AND MESOZOIC ROCKS OF TASMANIA, TOGETHER WITH A FULL DESCRIPTION OF ALL THE KNOWN TASMANIAN COAL PLANTS, INCLUDING A CONSIDERABLE NUMBER OF NEW SPECIES.

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Carboniferous System (Up. Pal.)

By common consent the name given to this system, in Europe especially, applies to a vast series of rocks, well represented in every division of the globe, composed principally of alternating beds of sandstone, shale, fireclay, ironstone, coal, and limestone. In Europe and America the beds of the system pass insensibly into the underlying Devonian, although its principal members are most markedly distinguished from the latter by its peculiarly rich and characteristic vegetable deposits. It is to this profusion of vegetable remains that the system owes its name. Although in Europe the upper limits of the Carboniferous system can, with some degree of satisfaction, be separated from the lower limits of the succeeding system, known as the Permian, or Dyas, which according to artificial classification is deemed to close the Palæozoic age, it is not as yet always possible in other countries, especially in Australasia, to find special stratigraphic or organic characters, whereby the divisions between the two periods can even be most distantly approximated. The two systems for the purposes of this paper are therefore grouped as one under the term *Carboniferous system.*

The difficulties of any attempt to define the equivalents of the Carboniferous and Permian systems in Australasia may perhaps be unfelt or overlooked to a great extent by many Palæontologists, whose observations are often based upon collections made in the field by other hands, but it is otherwise with the field geologist, who must needs correlate locally stratigraphy with palæontology, and therefore cannot so easily ignore the evidences of the former when dealing with the latter. The field worker, therefore, finds much greater difficulty than the Palæontologist, as such, in any attempt to break into minor systematic sub-divisions, the various formations of any local group which seem to run insensibly into each other. Divisions of systems are, at the best, artificial and imaginary as regards the whole succession of rocks on the earth's surface—a fact which is too often overlooked—and they are only of local value where the breaks or limits of characteristic life and stratigraphical connection can be seen to coincide.

Conclusions from Palæontology, based upon the association of typical organisms with typical rocks in one part of the earths surface, certainly form a strong presumption in favour of their application in a distant part of the earth where such combined associations seem to harmonise, and no doubt in a large measure this holds good, but they are also apt, by force of preconception, to mislead the Palæontologist where the evidences of Stratigraphy are obscure or in conflict. Nothing has so strongly demonstrated the value of Jukes' cautions as a field geologist, in the consideration of such matters, as the discovery of the existence in Australia of a land flora of European Mesozoic aspect, interstratified with a marine fauna of a distinctly marked European Palæozoic facies. It is not without advantage that mistakes were made by Palæontologists over this question, for it has profitably warned us that, in all such matters, we are too apt to crystalise opinion; to fall back upon an old locally useful generalisation, rather than be at the trouble to readjust the true relations of fresh facts and fresh combinations in areas far removed from the centre where the first generalisation was formed, and where, probably, it still holds good. Much unnecessary warmth of controversy between able and well-informed authorities might have been obviated hitherto if questions regarding centres of origin had received due attention in a broad and philosophical spirit when discussing the new facts and relations in Stratigraphy and Palæontology, which at first sight seemed to be evidences of "conflicting testimonies of the rocks." It cannot be too frequently asserted that the associated facts of stratigraphic and organic relation in one part of the world can never be severed or successfully subordinated by generalisations or deductions, however skilfully made, from dissimiliarly associated facts or relation in another distant part of the world; and it is this conviction, enforced by the difficulties of local experience in the investigation of Tasmanian geology, extending now over a period of 15 years, which induces me to concur with Mr. Jukes (p. 22, "Sketch of the Physical Structure of Australia, 1850") in the statement that, before we can rest satisfied with "existing classification of the rocks of Carboniferous, Permian, or Mesozoic age, we must study more thoroughly many questions, such as the original centre of production of the animals (or plants), and the time necessary for their migration and general spreading over the globe. Whether they might not have become extinct at the spot where they first began to exist before they could spread in vast numbers over the opposite hemisphere."

"Questions like these have yet to be answered before we can determine whether or no strict synchronism (or homotaxial relation for that matter) can be deduced from the fact of the fossils in opposite hemispheres being representative of, or even, if it turns out so, identical with each other. At all events, we must not trust too implicitly to single or isolated facts. We must get the series of formations in each case and compare them with each other, and endeavour to trace out some common starting point of time before we shall be able to draw clear geological horizons, establish definite chronological epochs common to the whole earth."

With these observations of so thoughtful a geologist as the late Mr. Jukes I am still in complete accord, notwithstanding the valuable contributions made to our knowledge since that time by the combined labours of men of such genius and skill as McCoy, De Koninck, Ettingshausen, Müeller, Feistmantel, Tenison-Woods, Tate, R. Etheridge, jun., and many more.

It does not follow that because Glossopteris and other fossil genera of Mesozoic facies have been demonstrated (by W. B. Clark, Daintree, Feistmantel, and other authorites) to have their beginning in Australasia in the Palæozoic age, that these alone are to be regarded as having made their appearance in Australasian rocks anterior to their appearance in India and Europe. From evidences available there is a presumption that other typical genera may also have appeared in Australasian rocks anterior to the period, in which they or their congeners make their appearance in the rocks of countries widely separated from Australia; and hence we cannot as yet confidently accept classifications recently proposed by some authors who divide with too much artificial precision many closely related formations in Australasia whose stratigraphic relationships are still too obscure or uncertain to warrant the finer subdivisions of the Palæontologist. Palæontology divorced from facts of local Stratigraphy s unsatisfactory. Huxley forcibly observes ("Lay Sermons," p. 234) "There seems, then, no escape from the admission that neither Physical Geology nor Palæontology possesses any method by which the absolute synchronism of two strata can be demonstrated. All that Geology can prove is *local order of succession*." It cannot be overlooked also that the materials upon which the Palæontologist works are often deceptive and unsatisfactory. There is not the connection between essential parts of classification nor the means of frequent verification, as in the study of living plants and animals, which also has its difficulties, and hence it too frequently happens that a great number of the generic and specific creations of Palæontologists are of necessity artificial, as they are formed upon trivial characters which, on fuller knowledge regarding fruit and other essentials, may to a large extent prove to be individual variation rather than distinctly specific. Professor W. C. Williamson, in his opening address to the Geological Section of the British Association at Southport, in 1883, has strongly commented upon dangers to true and natural classification from this source. In his remarks, under the section FERNS, he states (see p. 524, "Nature," Sept., 1883) "The older taxonomic of Palæozoic Fern-life is with few exceptions, of little scientific value. Hooker and others have uttered in vain wise protests against the system that has been pursued. Small fragments have had generic and specific names assigned to them with supreme indifference to the study of morphological variability amongst living types. The undifferentiated tip of a terminal pinnule has had its special name, whilst the more developed structures, forming the lower part of the frond, have supplied two or three species. Then the distinct forms of the fertile fonds may have furnished additional ones whilst a further cause of confusion is seen in the wide difference existing between a young half-developed seedling and the same plant at an advanced stage of growth."

Since these observations were written Professor F. W. Hutton has contributed a most interesting article bearing upon subject ("Geological Nomenclature," pp. 59-61, *Geol. Mag.*, 1885) in which he very ably supports similar ideas. He states that it is quite impossible to squeeze the rock systems of other regions into those found in the European. They will not fit, and he therefore justly contends that all designations of sub-divisions of systems in Europe, as well as elsewhere, should have a local application only, and that in tabular or other comparisons the several local sub-divisions of a great system or era, such as the Palæozoic, should simply be treated as independent local groupings of the local sequence, against, or between which, may be approximately related the equivalent or complementary systems of distant regions. The necessity for these distinctions, although recognised by Dr. Geikie (pp. 634 636, "Text Book of Geology"), is not sufficiently appreciated by him as regards the world-wide application of European sub-divisions of great systems. For he still believes that regional names (European statedly), whatever may have been their origin, are upon the whole best adapted for general use; and accordingly he cites Cambrian, Silurian, Devonian, Permian, and Jurassic as types of this class of divisional names as having been adopted all over the globe.

Undoubtedly, so far as the three first-named systems are concerned, his remarks are perfectly true, but as regards the two latter there are difficulties in the way of their being adopted in Australasia. Professor Hutton again aptly observes (*Geol. Mag.*, Feb., 1885, p. 60). "We can always speak of the 'Palæozoic' or the 'Mesozoic' rocks of a country with all the accuracy required when using such terms, while we cannot always do the same with sufficient accuracy when referring to rocks belonging to the shorter periods or epochs. For example," he goes on to say, "I can speak of the Mesozoic rocks of New Zealand because the term is wide and makes no pretension to accuracy, but I cannot speak of Jurassic or Cretaceous rocks of New Zealand with any approach to accuracy, although our present immethodical nomenclature often compels me to do so."

These difficulties have also been pointed out by W. T. Blanford, F.R.S. (in "Classification of Sedimentary Strata," pp. 318-9, *Geol Mag.*, July, 1884). He expressly states that, "so far as the Geology of India has been studied, it appears doubtful whether the sedimentary formations of that country can be accurately classified by means of the European sub-divisions. The difficulty, it is true, is partly due to the paucity of fossils in Indian rocks, but partly also to the circumstance that *the breaks in the sequence do not correspond with those especially remarkable in Europe.*" He elsewhere remarks that the same objection applies to other parts of the world.

If the stratigraphic breaks in India do not harmonise with those of Europe, what likelihood is there in finding corresponding breaks in the rocks of Australasia? I have, therefore, advanced good reasons for the course adopted by me hereafter in refraining to refer local rocks to sub-divisions of the Mesozoic Period, and also for merging the Carboniferous and Permian locally into one group, in harmony with the known facts of stratigraphy.

The Carboniferous System in Tasmania, as thus defined, is marked, stratigraphically and organically, in its lower limits by an important break, so far as its relation with the uppermost members of the clay-slates of Lower Palæozoic age can be ascertained. Whether the Upper Devonian of Europe can in Tasmania be separated from the continuous Upper Palæozoic rocks, and the Lower Devonian from the Upper Silurian slates is a matter which has yet to be decided.

Mr. Gould considered that the soft clay-slates of Fingal immediately and unconformably overlying similar clay-slates, but presenting special characters, and similarly related to the lower members of the carboniferous marine beds above, were the highest members of the Lower Palæozoic rocks known to him. No fossils, however, were found in them by him, and he classed them as the uppermost members of the Silurian age, provisionally as follows. (See p. 29, "Proceedings Royal Society of Tasmania, 1866.")

1. Fingal Beds......Clay-slates, sand-stones, and grits.

2. Eldon Valley	Mudstones and Clay-slates.	Calymene, Orthis, Cardiola, etc.	Thin quartz reefs not abundant.

3. Gordon Beds	Limestones Slates Limestones Conglomerates Quartzose Sandstone

It is singular that in a piece of the uppermost clay-slates sent to me some years ago, I discovered a very well preserved species of *Anodonta*, on breaking up the specimen, also fragmentary impressions of the bark of some forms of vegetation. The species of Anodonta (which I shall for reference sake here call *A. Gouldii*, in honour of Mr. Charles Gould, who, perhaps, more than other person, contributed to our knowledge of the earlier rocks of Tasmania) is almost identical with the well known *Anodonta Jukesii*, one of the most characteristic fossils, if not the only fresh-water lammelibranch of the Lower Devonian rocks of Ireland.

The organisms, therefore, point clearly to a fresh-water origin, and the stratigraphical break above and below, also falls exactly into the position of Devonian rocks, as defined by Jukes in the following terms (p. 491, "Text Book"):—

"All rocks which were formed after the uppermost of those which can be called Silurian, and before the lowest of any which can be called Carboniferous, may be classed as Devonian rocks, and looked upon as records of Devonian time." The Upper Fingal clay and arenacious slates exactly fit into this definition, and the fresh-water organisms, *A. Gouldii*, and the vegetable impression strongly incline me to regard these slates as Devonian.

Here stratigraphy and palæontology are in harmony. The evidences collected by me from various parts of the island, respecting the sequence of the Carboniferous rocks of Tasmania, are so numerous that it would be beyond the purposes of this sketch to attempt to cite them in detail.

The characteristic rocks of the Carboniferous System in Australia and Tasmania consist primarily of thin regular bands of siliceous conglomerates, blue slaty shales, limestones, argillo-calcareous and argillo-arenaceous rocks of a yellow or white appearance, with intercalated bands near its uppermost limits, composed of fine greyish laminated shales, bituminous shales and thin coal seams. The members are, for the most part, extremely rich in fossils, of which the following is a list of the more typical forms:—

PLANTAE, *Glossopteris Browniana*, Brong; *Gangamopteris spathulata*, McCoy; *Tasmanites punctatus*, Newton; *Noeggerathiopsis spathulata*, Dana; *Vertebraria australis*, M'Coy; *Cordaites* sp.; *Schizoneura*, sp.; Silicified trunks of Conifers in profusion, etc.

CRUSTACEA, *Cythere Tasmanica*, mihi.

POLYZOA, *Fenestella internata*, Lonsdale; *T. plebeia*, M'Coy; *Protoretepora ampla*, Lonsdale; *Stenopora Tasmaniensis*.

BRACHIOPODA.—*Leptæna*, sp.; *Orthis Mitchelini*, L'Eveillé; *Orthotetes crenistria*, Phillips; *Productus brachythyærus*, G. Sowerby; *P. cora*, D'Orbigny; *P. fimbriatus*, J. *de* C. Sowerby; *P. fragilis*, Dana; *P. murchisonianus*, De Koninck; *P. punctatus*, Martin; *P. pustulosus*, Phillip; *P. scrabiculus*, Martin; *P. semireticulatus* (?), Martin; *P. subquadratus*, Morris; *P. undatus*, Defrance; *Rhynconella pleurodon*; *Strophalosia Clarkei*, De Koninck; *S. Jukesii*, Etheridge, Jun.; *Spirifera convoluta*, Phill.; *S. crassicostata*, Jukes; *S. Darwinii*, Morris; *S. glabra*, Martin; *S. lata*, M'Coy; *S. oviformis*, M'Coy; *S. Stokesii*, King; *S. Strezeleckii*, De Koninck; *S. Tasmaniensis*, Morris; *S. trigonalis* (?), Martin; *S. vespertilio*, G. Sowerby; *Terebratula sacculus*, Martin.

MOLLUSCA, proper—*Allorisma curvatum*, Morris; *Aviculopecten Fittoni*, Morris; *A. Hardyi*, De Koninck; *A. Illawarensis*, Morris; *A. limæformis*, Morris; *A. ptychotis*, M'Coy; *A. squamuliferus*, Morris; *A. Tasmaniensis*, M'Coy (m.s.); *A. tesselatus*, Phillips; *Cardiamorpha striatella* (?), De Koninck; *Edmondia striatocostata*, M'Coy; *Eurydesma sacculus*, M'Coy; *Modiolo crassissima* (?), M'Coy; *Modiolopsis*, sp; *Notomya*, sp; *Orthonata compressa*, Morris; *Pachydomus carinatus*, Morris; *P. globosus*, J. de C. Sowerby; *P. ovalis*, M'Coy; *P pusillus (?)*, M'Coy; *Pterinea macroptera*, Morris; *Pteronites latus*, M'Coy; *Sanguinolites Etheridgei*, De Koninck; *Tellinomya Clarkei*, De Koninck; *Bellerophon convolutus*, De Koninck; *Capulus*, sp.; *Euomphalus catillus*, Martin; *E. Bigsbyi*, De Koninck; *E. minimus (?)*, M'Coy; *Pleurotomaria*, *Morrisiana* M'Coy; *P. Woodsii*, Johnston; *Connularia* sp.; *Theca lanceolata*, Morris; *Cameroceras Phillipsii* (?), De Koninck; *Goniatites micromphalus*, Morris.

To these might be added many more examples now awaiting determination in my collection. In the greater number of cases it will be observed that the species are identical with those given in similar formations in New South Wales, where owing to the energy of the late Rev. W. B. Clarke, and to the skill of De Koninck, the fossils of that country have been worked out more fully and systematically.

As regards New South Wales, De Koninck tablulates 316 species of fossils, as follows :—

	Genera.	Species.
Upper Silurian	43	62
Devonian	38	74
Carboniferous	73	180
Total	154	316

Of the fauna, 81 species at least are common to the Palæozoic formations of Europe, while many of the typical plants of the Carboniferous coal measures of Australasia are at least generically identical with those found in India in rocks of supposed Mesozoic age.

The various members of the Carboniferous System in Tasmania, are more or less horizontally disposed, although greatly dislocated by more recent intrusions of greenstone and secular upheaval, and subsequently subjected to great long continued denudation. The varying altitudes at which apparently the same members are found, together with the valleys of erosion so common throughout the country, show the vastness of the dynamical agencies which have operated upon them since their deposition.

Generally its members are so intimately associated with the older and newer diabasic greenstones that they cannot very well be considered apart in any attempt to describe them. It will be observed from the Geological sketch, recently prepared by Mr. Sprent and myself, that the diabasic greenstones form the elevated plateaus and mountains, as well as the principal minor dividing ranges throughout a great part of the Midland, Northern, Eastern, and South-Eastern parts of the island, and that they may be said to be comparatively, if not wholly, absent from the extreme western part, where the older Silurian and Metamorphic rocks prevail with their associated granites and porphyries.

The great central greenstone plateau of the Lake Country, in its Northern part especially, preserves a general rugged or undulating level of about 4,000 feet altitude, and its higher bosses and peaks, and its valleys do not vary much more than 1,000 feet above or below this uniform level. From the Picton to Gad's Hill, a distance northerly of over 100 miles its westerly limit may be roughly traced, forming a bold and widely undulating margin relative to the western country, whose immediate general upland surface ranges between 2,000 and 3,000 feet above sea level. This margin is markedly broken by the elevated outlying spur forming the Eldon Range near Lake St. Clair. From Gad's Hill in a south-easterly direction to the Table Mountain, a distance of not less than 90 miles, its similarly indented margin presents a still bolder character as it approaches and contrasts with the lower fertile plains and valleys of the Meander and South Esk, which seldom exceeds an altitude from 600 to 700 feet above sea level. At the great Northern and Southern water divide, in the neighbourhood of the Table Mountain, it suddenly recedes and contracts, forming a large bight in the direction of the Upper Derwent tributaries, notably the rivers Nive and Ouse, from which its level tends to fall, and its marginal boundaries, though frequently rising into high mountain ridges towards Mount Wellington, no longer maintains the uniform boldness of outline which characterises it in its northerly aspect.

With the exception of Ben Lomond, which attains an altitude of 5,010 feet, the remaining isolated or ramifying greenstone dividing ranges, distributed throughout the basin of the Tamar, Derwent, and Coal River, and along the broken or deeply indented coast line of the East, are tame in character when compared with the elevated far-extending tiers of the Great Central Plateau.

Nearly everywhere along and against this plateau, and the greenstone crests of Ben Lomond, Mount Dromedary, Mount Nicholas, Eldon Range, Mount Gell, Grass Tree Hill, Constitution Hill, and most of the more elevated South-Eastern dividing ranges, the various members of the Carboniferous and Mesozoic rocks are seen to repose invariably almost in an horizontal position, or, at most, with a very slight dip towards or away from them. This general character is best appreciated by following the dark-grey color bands of the Upper Palæozoic and Mesozoic rocks as described in the sketch map referred to.

In my opinion it would seem probable that the greater part of the greenstone rocks were erupted prior to the deposition even of the lower members of the Carboniferous mudstones, and at a time when, from secular causes, the older rocks of the South-Eastern and Central parts of the island, after long subærial exposure, were slowly being submerged below the level of the Upper Palæozoic sea. So far as existing evidences show, it seems to me that this depression must have occurred towards the close of the Devonian, or at the commencement of the Carboniferous, period. Strzelecki, who was the first observer who graphically described these rocks, thought that the main masses of greenstone forming the Western and such mountain chains as Mount Wellington and Ben Lomond, were erupted subsequent to the deposition of the

Mesozoic rocks, and that the former were intruded through the latter and formed vast sheets, which, as overspreading caps, protected them in a large measure from the great denudation which undoubtedly occurred subsequently and of which there is the most abundant evidence throughout the plains and valleys lying within the limits of the Upper Palæozoic and Mesozoic Systems.

Dr. Milligan and Chas. Gould also followed Strzelecki in this opinion, as all of these writers in their ideal sections picture the sedimentary formations as dipping continuously under the elevated greenstone mountains and tiers, against which they have already been described as abutting more or less horizontally. Jukes, however, was doubtful of this relationship, and discussed the probability of certain greenstone masses being of older date than the sedimentary rocks. In the latter case we would have to assume that the narrow lineal strips of Carboniferous sedimentary rocks, as also the overlying coal measures, with their denuded and precipitous faces, flanking the main greenstone tiers and mountain ranges are, with the wasted members of the lower valleys and plains, only the mere remnant of a once greatly extended sedimentary formation, which, by long-continued action of subærial erosive agencies, were cut and wasted away in the formation of later deposits, and whatever elevation and dislocation has taken place locally subsequent to their deposition the earlier eruptive greenstone upon which they flank or rest may also have been similarly affected by them. The consequences of this assumption would therefore lead one to infer that the vertical faces at the higher levels abutting against the greenstone slopes are mainly the result of denudation rather than dislocation. No doubt, repeated general elevation movements in later times may account for some of the examples. At any rate, the greater elevation would intensify the erosive agencies. This assumption, although seriously affecting our prospects as regards the extension of our coal seams beneath the tiers in various parts of the island, has been demonstrated to be perfectly true so far as the greenstone and sedimentary rocks on the flanks of Mount Wellington are concerned. A section at the Cascades on the flank of Mount Wellington was practically tested by the Government during the previous year for the purpose of determining whether the Lower Coal measures as represented in the Mersey Basin, existed beneath the fossiliferous marine mudstones and limestones which occur at the place named, and which appear to dip gently in the direction of Mount Wellington. After the diamond-drill penetrated through 600 feet of alternating layers of calcareous mudstones and limestones, without discovering the existence of the lower coal measures, it pierced immediately some feet into the massive diabasic greenstone, similar in character to that forming the cap of Mount Wellington. It is further of significance that the absence of any appearance of change of the mudstones at point of contact, and the porphyritic and coarse crystalisation of the upper surface of the greenstone as compared with that where the greatest depth was reached indicate that the mass of greenstone was not a later lateral thrust along the plane of the bedding of the mudstone, but in all probability the mudstones were originally deposited against and upon the greenstones of Mount Wellington soon after their eruption.

In various places along the Coast line of the Lower Derwent, as I have already shown, many natural sections occur where the fossiliferous mudstones, unaltered at point of contact, without doubt, repose quietly in horizontal beds, which naturally fill up the uneven surface of the underlying older greenstone I have already exhibited a sketch of a very fine section, which continually shows this relation for several miles between Blackman's Bay and Passage Point. One section in particular not only shows in an unmistakable manner that the fossiliferous mudstones are more recent than the main mass of the older greenstone upon which they rest, but that both are older than a minor dyke or sheet of greenstone of a somewhat similar character to the older. This intrusive greenstone, after bursting vertically through the older greenstone and the lower beds of sedimentary limestone, suddenly bends back and forms a sheet about seven feet thick, running parallel and intercalated between the stratified planes of the marine mudstones and limestones. At Constitution Hill and Lovely Banks, towards the central part of the island, there are also two or three fine sections in the cuttings of the Main Road, clearly showing the Mesozoic sedimentary rocks reposing upon the older greenstone. On the other hand a splendid section at the head of Spring Hill as clearly shows that a massive greenstone (not basalt) has been erupted later than the carbonaceous sandstones of Mesozoic age, as the greenstone mass forming the ridge at this place can be seen to have intruded through the former, dislocating the sedimentary rocks, and spreading over them in great massive caps. It is clear therefore that there are greenstones anterior to the lowest members of the Carboniferous System, and similar intrusive rocks of later date than certain of the members belonging to the Mesozoic Coal Measures.

I am however, at present, if anything, inclined to the opinion that the massive greenstones occupying the more elevated mountain ranges as well as the greater part of the dividing ranges within the system, have all been erupted prior to the deposit even of lower members of the Carboniferous System, and that only certain minor ridges, like that at Spring Hill, represent diabasic greenstones of a later date. There is little difficulty in distinguishing these Upper Palaeozoic and Mesozoic greenstones from the sheets of basalt, which, with their associated tufts, so frequently overspread the Tertiary lignites and leaf beds, and which probably mark the close of the Tertiary Palæogene period in Tasmania.

The rocks of the Carboniferous System invariably present a very uniform character throughout the southern part of Tasmania. In the Basin of the Mersey there is greater variation, caused by a temporary local elevation and subsequent depression of the floor of an old arm of the Upper Palæozoic sea, between which elevation and depression sedimentary deposits of carbonaceous matter of considerable thickness were formed, derived from a luxuriant land vegetation consisting of Club mosses, from which the spores of *Tasmanites punctatus* were no doubt derived. Ferns and Equisetaceæ were also abundant, as indicated by the remains of Glossopteris Gangamopteris and Schizoneura.

The bituminous Tasmanite shales were deposited in an arm of the sea, not in fresh water, as shown by the abundance of the remains of marine mollusca found in the Tasmanite notably *Aviculopecten squamuliferus, A. Fittoni, Pleurotomaria, Woodsii, Pachydomous, Pterinea lata,* s.p. and several other forms common to the marine beds above and below the Mersey Coal Measures.

Until very recently, I was in doubt whether the marine mudstones and limestones in the neighbourhood of Hobart, and in the South generally, represented the lower marine beds only, or whether they represented in one continuous series the upper and lower marine beds as developed in the Mersey Basin. The possible existence of the Lower Coal Measures underlying the marine mudstones made this a very important question, and it was this consideration which induced the Government to make the test at the Cascades already described, but which demonstrated the fact that no coal existed beneath the mudstones at this point. Before this practical test, little value could be attached to conclusions formed upon the partial evidence of marine fossil organisms alone, because a considerable per-centage of the species of the the marine organisms common to the mudstone series overlying the Mersey Coal Measures was also common to the underlying or lower marine beds, and also to the Tasmanite group. Among the fossils common to these deposits are the well-known forms:—*Spirifera Tasmaniensis, S. Darwinii Terebratula sacculus, Productus brachythyærus, Pterinea lata, Sanguinolites Etheridgei, Pecten Fittoni, P. squamuliferus, P.*

Illawarra, *Pleurotomaria Morrisiana*, *P. Woodsii*, *Tellinomya Clarkei*, *Theca lanceolata*, and many others. With such equivocal information the evidences based upon a few marine organisms taken by themselves were of little value. Some, however, thought that the test of the diamond-drill, showing the absence of coal seams, indicated that the lower marine group alone were represented in the neighbourhood of Hobart. With this view, I was not prepared to concur as may be learned from the following remarks made at the time before the members of this Society :—

"If, therefore, it be allowed that the Mersey and Southern and Eastern coal deposits represent different horizons, the evidences from marine organisms, taken by themselves with our present knowledge, are absolutely valueless, at any rate neutral. It is from an examination of the plant remains, associated with the respective coal measures, that we have any grounds for separating them into different groups, as representing different periods. Thus the prevailing plant remains of the Coal Measures of the Mersey, which are the equivalents of the Stony Creek, Anvil Creek, and other coal seams in New South Wales, are *Glossopteris Browniana;* equisetaceous stalks, broadly and flatly ribbed, allied to the genus *Schizoneura;* a curious orbicular form allied to *Actinopteris;* and numerous impressions of a form closely allied to *Noeggerathiopsis media.* On the other hand, the Midland, Southern, and Eastern coal measures of Tasmania have generally as prevailing forms *Alethopteris Australis, P. odontopteroides*, *Phyllotheca Hookeri*, *Phyllotheca ramosa*, *Sphenopteris alata*, *Zeugophyllites elongatus*, and *Glossopteris linearis*, and, therefore, the beds may, without doubt, as already shown by Feistmantel, Rev. W. B. Clarke, R. Etheridge, junr., and others, be regarded as the equivalents of the Upper Coal Measures of New South Wales. Regarded from an evolutionist's point of view, it is very difficult to recognise any break, stratigraphic, or organic, between the upper and lower mudstone series of Australia, so far as the marine organisms of undoubted Palæozoic facies gave any evidence. If these subdivision were to be classed as Upper Palæozoic, and the Upper Coal Measures, according to various authorities, as Permian, Oolitic, Dias, or Mesozoic, the separation must be doubtful and purely one of local convenience. I am not prepared to concur in regarding the sandy and calcareous fossiliferous rocks occurring in the neighbourhood of Hobart, and in other localities in the South and East, *wholly* as the equivalents of the Lower Marine Beds of New South Wales, for it was not only conceivable but, unfortunately, probable that the Southern Marine beds of Tasmania were formed in situations more remotely removed from the oscillation of the land which produced the conditions favourable to the deposits of the Lower Coal Measures in such places as the Don, Mersey, Stony Creek, and Anvil Creek basins; that while these carbonaceous deposits intercalcating and interrupting the series of marine beds were being formed in situations adjacent to the shores of the old Palæozoic mainland, the marine areas, more remote from the land, still continued to deposit their marine sediments with an uninterrupted chain of marine organic life; and it is quite conceivable, and, indeed, in harmony with existing evidence, that the Southern and Eastern Marine Beds of Tasmania cover in one unbroken series the whole period represented in Australia and in Northern Tasmania by the Lower Marine Beds, Lower Coal Measures, and Upper Marine Beds; and that the final oscillation of land, producing conditions favourable to the deposits of the Upper Coal Measures of Australia and Tasmania, was the only one which extended as far as the South and East of Tasmania."

The suggestion that the marine beds in the neighbourhood of Hobart cover in one unbroken series, the whole period represented elsewhere by the Lower Marine Beds the Lower Coal Measure, and the Upper Marino Beds, has since been amply confirmed by my discovery of the Cythere and Gangamopteris beds at Porter Hill, near Hobart. The beds at this place. unmistakably show a gradual transition upwards, without stratigraphical break of any kind, from the common limestones restricted to marine organisms to fine sandy shales where the marine organisms have altogether disappeared with the exception of a minute ostracod. These upper beds are replete with plant remains of ferns, chiefly belonging to the genus Gangamopteris. The fossiliferous marine limestones and mudstones replete with the common forms belonging to the genera Stenopora. Protoretepora, Fenestella, Spirifera, Strophalosia, Terebratula, etc., are followed by thin passage beds of alternating soft dark-brown sandstones, and friable shales where most of the common lower forms disappear with the exception of *Spirifera Tasmaniensis* and *S. Darwinii.*

In these shales a species of *Cythere* swarms in the greatest number, together with species belonging to the genera *Modiolopsis, Tellinomya,* and *Theca.* In the same beds, also, the plant remains referred to begin to make their appearance, and in the uppermost shales the plant remains and an occasional *Cythere,* together with the articulated spines, probably of a species of *Ichthyodorulites,* alone are to be found. There is little doubt, therefore, that these upper beds are the equivalents of the Tasmanite stage or of the Upper Marine Beds of the Mersey.

The finest sections of the Marine Beds of the system are exposed at Maria Island, although anyone may get a very full acquaintance of all the known characteristic fossils and rocks, in the many exposed sections along the Huon Road, One Tree Point, and Shot Tower, in the vicinity of Hobart.

Generally, then, we may consider that the Carboniferous Marine Beds formed the sediment or floor of a strait or frith of the ancient Upper Palæozoic sea. So far as I can read existing evidences, it would seem most probable that, during this period, Tasmania was represented by three principal islands, and several detached groups of smaller islets. The largest of the former probably represented a narrow and irregular strip of land running obliquely and continuously North and South between the extremes of the granite headlands of the Hummock Island in the North East, to the bold schistose rocks towards South Cape. Towards the centre of the present land limits of Tasmania, and scarcely separate from the narrow strip of land to the West, what now forms the great inland greenstone plateau of the Lake Country probably formed an elevated island mass of considerable extent. Towards the North East and East the granites and metamorphic portion of the Furneaux Group, Portland, Ringarooma, Schoutens, together with the massive greenstone in the neighbourhood, Fingal, Swansea, Tasman and Forester's Peninsula, South Bruni, must have formed a somewhat irregular detached chain where not broken by the minor or isolated masses which must have formed rocky islands, such as Ben Lomond, Mount Victoria, Tower Hill, Mount Nicholas, Eastern Tier, Black Tier, Mount Dromedary, Grass Tree Hill, Constitution Hill. The interspaces of the shallow elongate basin, now forming the major part of cultivated settlements, was occupied by the Upper Palæozoic sea, which would seem to have formed a comparatively broad strait between the the easterly detached chain of islets, and the two principal islands to the West, which were themselves divided by a very linear strip of water. It is hazardous to assume what may have been the altitude of the island masses relatively to this old sea level. But there is some ground for the opinion that the great central greenstone island, especially in its northerly limits, rose abruptly from the old sea level, and presented a bold escarpment of from two or three thousand feet altitude. The sediments of this old sea forming the greater part of our Carboniferous rocks, are now often found flanking the mountain-tiers, as at Mount Wellington, at altitudes of from 2,000 to 2,500 above the existing sea level. With the overlying Mesozoic Coal Measures, they everywhere give evidence of having been frequently disturbed by forces of upheaval or depression, and their members have been vastly denuded throughout the limits of the basin, whose limits have been thus roughly sketched.

MESOZOIC ROCKS.

The Mesozoic Period has been aptly termed the "Age of Cycads," because of the abundance of plants of this type of the Mesozoic age. With the exception of the Mersey Coal Measures, it has now generally been admitted that the various coal seams, and associated shales, and variegated sandstones overlying the Upper Marine Beds of Carboniferous age in Tasmania, belonging to the Mesozoic Period. These rocks are mainly distributed throughout the Midland and South-eastern parts of the island, although the existence of coal at a great height, near the Eldon Range, on Coal Hill, with remains of the variegated sandstones flanking all the great western tiers, associated with the Carboniferous rocks, indicate that the numbers of the Mesozoic rocks were probably at one time conterminous with those of the Carboniferous rocks,

With the exception already named, therefore, the dark-grey shading of the sketch map, and perhaps a considerable portion concealed under the Launceston Tertiary's Basin colored yellow, make up the whole area within which the several basins of the Mesozoic rocks occur.

In a general way the existing evidence tends to show that, as the floor of the ancient Upper Palæozoic sea was gradually being elevated above its waters at the close of the Carboniferous period, æolian, atmospheric, and organic agencies immediately began to operate upon it in carving out valleys and river-channels, and in filling its many cup-shaped basins and irregular hollows with lakes and sediments. It is mainly from such waste, and by such agencies, modified by igneous intrusions, that the sediments and materials of the lower rocks of the Mesozoic period were deposited in Tasmania.

So far as my observations go, there is every reason to believe that the larger part of its surface, including that portion of the Upper Palæozoic rock underlying the Tertiary lake deposits (coloured yellow), has been permanently elevated above sea level since the close of the Upper Palæozoic age—that is, since the Upper Marine Beds, with their characteristic spirifers, fenestellæ, stenoporæ, etc., were elevated above the waters of the sea at the close of the Palæozoic Period in Tasmania.

If this be admitted—which can hardly be doubted—it follows that there should be found throughout the area now occupied by Secondary and Tertiary rocks a connected, although, perhaps necessarily, a greatly broken and wasted, representation of all the original rocks of the two great divisions. It is not likely that the fluviatile and subærial agencies, however prolonged or intense, would altogether destroy the older deposits in the formation of the later rocks; and it is reasonable to assume, where there are no sudden breaks, such as occur elsewhere, by the sudden alternation of Marine and Terrestrial formations, that the transition, as even now indicated by the fossil flora, would be very gradual in the limited basins where sediments were deposited, which, probably, were again and again partly re-distributed, as successive formations in gradually lessening areas. Nor can it be reasonably expected, where such separate minor basins are so intimately related to each other, that marked breaks in the chain of organic life, should be apparent, and therefore it would be extremely hazardous to assume that the identity of even one or two species in separate basins was sufficient evidence to mark synchronism between them, especially so where the associated prevailing forms of the one basin differ materially from the other. On the other hand, different conditions, such as soil or altitude, might account for a considerable amount of difference between two widely separate basins, although the evidence in this latter direction would not be quite satisfactory where the two separate basins were only separated by a line from slightly unconformable beds in juxtaposition.

From considerations such as these, and while willing to recognise the fact that all the European subdivisions, may be represented by equivalents in Tasmanian Rocks, I still think it would be altogether unscientific to expect that the many little groups of our Mesozoic rocks, as a whole, will show the faintest correspondenc with the ternary sub-groups (Triassic, Jurassic, Cretaceous), as such. To attempt to make corresponding divisions in Tasmania, with our present knowledge respecting stratigraphy and palæontology, would be purely artificial and altogether misleading. In the meantime, I am of opinion that the stratigraphic and organic characteristics of each separate basin or group of rocks should first be carefully and fully marked and related to each other. Until some satisfactory limits have been determined, I think you will agree with me that it would be rash to refer the various local basins of Mesozoic age under any of the great sub-division groups of Europe. In harmony with these observations and as a practical contribution to the materials necessary to aid in the proper classification and correlation of our Mesozoic rocks, I have prepared a table, showing the distribution of all the Tasmanian plants of the system known to me, in which are included a considerable number of forms not hitherto known as occurring in Tasmanian rocks.

In addition to this, I have prepared a full description of each species, including a considerable number which I believe to be new to science.

Another table prepared for this paper illustrates the views advanced by me regarding the classification of stratified divisions.

TASMANIAN FOSSIL PLANTS OF THE UPPER PALÆOZOIC AND MESOZOIC COAL MEASURES.

DESCRIPTION.	TASMANIA (MESOZOIC).														TAS. UP. PAL.		N.S. WALES			VICTORIA.	
	NEW TOWN.	RICHMOND.	CAMPANIA.	CONSTITUTION HILL.	JERUSALEM.	SPRING BAY.	IMPRESSION BAY.	SEYMOUR.	YORK PLAINS.	FINGAL.	BEN LOMOND.	MT. NICHOLAS, KILLYMOON.	LONGFORD.	SPRING HILL.	PORTER HILL.	MERSEY.	WIANAMATTA BEDS.	UPPER COAL MEASURES.	LOWER COAL MEASURES.	UP. DEVONIAN.	MESOZOIC ROCKS.
EQUISETACEÆ.																					
Phyllotheca Australis, Brong	*	*	*	*	*	*	...	...	*	...	...	...	...	...	...	...	*	*	...	...	*
,, *ramosa*, M'Coy	*	*	*	*	*	...	...	...	*	...	...	...	...	...	...	...	...	*			
,, *Hookeri*, M'Coy	*	*	*	*	*	...	...	...	*	...	...	...	*	...	...	...	...	*			
Vertebraria Australis, M'Coy...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	*				
FILICES.																					
Sphenopteris lobifolia, Morris	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*			
,, *alata*, Brong	*	...	...	...	...	...	*	...	...	...	...	...	...	...	...	...	...	*			
,, *elongata*, Carr	*	*	...	...	...	*	...	...	*	...	...	...	...	*							
,, *plumosa*, Brong	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*			
Trichomanides Ettingshauseni, Johnston	...	...	...	...	...	...	...	...	...	...	...	...	...	*							
Cyclopteris cuneata, Carr	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*						
Gangamopteris angustifolia, M'Coy ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*					
Rhacopteris Feistmantelii, Johnston ...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	*		
,, *intermedia*, Feist...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*		
,, *inaequilatera*, Goepp	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*			
Thinnfeldia obtusifolia ** Johnston ...	*	...	...	...	...	...	...	...	*	...	...	...	...	*							
,, *superba* ** Johnston	...	...	...	...	...	*															
,, *trilobita*, Johnston	...	...	...	...	...	*															
,, *media* ** Woods	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	*			
,, *odontopteroides*, Morris ...	...	...	...	...	*	...	...	...	...	...	...	...	*	...	...	...	*	*	...	...	*
Pecopteris tenuifolia, M'Coy	...	...	...	...	...	...	...	...	...	...	...	...	...	*?	...	...	*				
,, *caudata* Johnston	...	...	...	...	...	*	...	...	*	...	...	...	*								
Alethopteris Australis Morr	*	...	...	...	...	*	*	...	*	...	*	...	*	...	...	...	...	...	...	...	*
Taeniopteris Tasmanica, Johnston ...	...	...	...	...	...	...	*	...	...	...	...	...	...	*							
,, *Morrisiana*, Johnston ...	...	...	...	...	...	...	...	...	...	...	...	...	*								
Glossopteris Browniana, Brong	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	*		
,, *linearis*, M'Coy	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...	*		
,, *ampla*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	*	...	...	*		
Gangamopteris spathulata, M'Coy. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	*		
,, *obliqua*, M'Coy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*						
Sagenopteris Tasmanica, Feist	...	...	...	...	*																
LYCOPODIACEÆ.																					
Tasmanites punctatus, Newton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*					
Lepidostrobus Müelleri, Johnston... ...	...	...	*																		
CYCADACEÆ.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*						
Podozamites Sp.	...	...	...	...	...	.	*?														
Zeugophyllites elongatus, Morr.	*	*	...	...	*	...	*	*	*	...	*	...	*	...	...	...	...	...	*		
Nöggerathiopsis spathulata, Dana ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	*	*?	
Cordaites Sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	*	
Coniferous Trunks of Trees	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*					

** Considered to be merely varieties of the protean *T. Odontopteroides*. Morris.

LOCAL DISTRIBUTION.

The foregoing table will be useful to students who may be interested in the distribution of the Fossil Plants of the Upper and Lower Coal Measures of Tasmania.

Further particulars are given in the following summary :—

I.—Lower Coal Measures. (Upper Palæozoic.)

MERSEY COAL BASIN.

Don and Mersey Coal Measures.

Glossopteris Browniana, Brong., abundant.
Gangamopteris spathulata, M'Coy, abundant.
Gangamopteris angustifolia, M'Coy, abundant.
Gangamopteris obliqua, M'Coy, abundant.
Noeggerathiopsis media (?), common.
Noeggerathiopsis spathulata, common.
Schizoneura, sp. (?), rare.
Curious orbicular scale with marginal rim, and ornamented with curved furcate vein-like septæ as in Actinopteris, rare.
Carpolithes (?) Tasmanicus, mihi, abundant.

Tasmanite Beds.

Tasmanites punctatus, Newton, prolific.

Mersey Upper Marine Beds.

Gangamopteris angustifolia (?), M'Coy, rare.

Porter Hill Beds. Hobart.

Gangamopteris ampla (?), abundant.
Cyclopteris cuneata, Carr., rare.
Equisetaceous, stems abundant.

The apex of a pinnule was also obtained in these beds, which probably belongs to the genus *Pecopteris*. The Upper Marine Beds, at Porter Hill are remarkable as showing connection with the Lower Marine Beds in a complete unbroken series.

II.—Upper Coal Measures. (Mesozoic.)

New Town Coal Basin.

Zeugophyllites elongatus, Morris, abundant.
Phyllotheca Hookeri, M'Coy, abundant.
Alethopteris Australis, Morris, abundant.
Thinnfeldia odontopteroides, var., obtusifolia, Morris, common.
Sphenopteris alata, Brong., prevailing form.
Sphenopteris plumosa, Brong., common.
Sphenopteris lobifolia, Morris, common.
Sphenopteris elongata, Carr., common.
Sagenopteris (?), rare.

No species of Glossopteris or Tæniopteris observed.

Richmond Coal Basin.

Zeugophyllites elongatus, Morris, common.
Phyllotheca Hookeri, M'Coy, abundant.
Sphenopteris elongata, Carr., abundant.

Jerusalem Coal Basin.

Lepidostrobus Muellerii, Johnston, one specimen.
Zeugophyllites elongatus, Morris, abundant.
Phyllotheca Hookeri, M'Coy, abundant.
Phyllotheca Australis, Brong., abundant.
Alethopteris Australis, abundant.

Spring Bay Coal Beds.

Phyllotheca Australis, Morris, common.
Sphenopteris elongata, Carr., common.
Thinnfeldia superba, Johnston, common.
Thinnfeldia trilobita, Johnston, common.
Pecopteris caudata (?), Johnston, common.
Alethopteris Australis, Morris, common.

Impression Bay and Coal Mine Beds, Tasman's Peninsula.

Phyllotheca Australis, Brong., common.
Sphenopteris alata (?), Brong., common.
Alethopteris Australis, Morris, common.

Ben Lomond Coal Beds.

Zeugophyllites elongatus, Morris, abundant.
Alethopteris Australis, Morris, abundant.

No other form could be obtained in the shales where these two forms are so abundant.

Mount Nicholas Coal Beds. (Killymoon seam.)

Glossopteris linearis (?) M'Coy, common.
Zeugophyllites elongatus, Morris, abundant.

Seymour Coal Measures.

Zeugophyllites elongatus, Morris, abundant.
Alethopteris Australis, Morris, abundant.

Occur in the same way as at Ben Lomond.

Campania Sandstones and Shales.

Phyllotheca Hookeri, M'Coy, abundant.
Lepidostrobus Muellerii, Johnston, one specimen.
Minute, concentrically striated, winged scales, abundant.

Gravelly Beach.—Rosevear Sandstones. Tamar.

Phyllotheca Australis (?), common.
Thinnfeldia odontopteroides, Morris, common.
Silicified trunks of coniferous trees, abundant.

Constitution Hill Beds.

Broad, variable, coarsely marked stems of *Phyllotheca Australis*, and *Phyllotheca Hookeri*

Very abundant in many places in the sections along the main road. The absence of all other forms is very remarkable in these beds.

Spring Hill Beds.

Thinnfeldia odontopteroides, Morris, var. obtusifolia, prevailing form. Abundant.
Thinnfeldia odontopteroides, var. media, common.
Sphenopteris elongata, Carr., not uncommon.
Trichomanides Ettingshauseni, Johnston, not uncommon.
Tæniopteris Tasmanica, Johnston, common.
Rhacopteris Feistmantelii, Johnston, common.

The absence of *Zeugophyllites elongatus*, Morris, *Alethopteris Australis*, Morris, and of the various species of *Sphenopteris* and *Phyllotheca* is here worthy of special notice, so far as the beds containing the above species are concerned. This is specially remarkable as Strezelecki positively states (p. 128 "Physical Description of N.S.W. and V.D.L.") that in a section of a well sunk at the locality of London Inn, near to the beds referred to, he discovered *Alethopteris Australis* and *Zeugophyllites* overlying a seam of coal.

York Plains Coal Beds.

Zeugophyllites, elongatus, Morris, abundant.
Phyllotheca, Australis, Brong., common.
Phyllotheca, ramosa, M'Coy, common.
Phyllotheca, Hookeri, M'Coy, abundant.
Thinnfeldia obtusifolia, abundant.
Alethopteris Australis Morris, very abundant.
Pecopteris caudata (?), Johnston, common.
Sphenopteris sp , common.

Longford Coal Beds (Mason's Seam).

Zeugophyllites elongatus, Morris, abundant.
Phyllotheca Hookeri, M'Coy, common.
Alethopteris Australis, Morris, common.
Pecopteris caudata, Johnston, common.
Tæniopteris Morrisiana, Johnston, rare.

PLANTAE.

Class Acrogens. *(Al Lycopodales.)*

Ord. Marsileaceae (?).

Vertebraria (Royle).

Gen. Char.—Stem slender, surrounded by densely aggregated whorls of verticillate, cuneiform leaves, having a dichotomous neuration.

Vertebraria Australis (M'Coy).

Sp. char.—Leaves constantly eight in each whorl.

Localities.—Tasmania (?). N.S. Wales—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 147, t. 9, f. 1 ; ibid, Proc. Roy. Soc., V.D. Land, 1851, I., p. 304, t. 9, f. 1 ; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 101.

Equisetum.

Fructificationes in spicam ovato-oblongam digestæ. Singula orbiculata basi dehiscens pluribus valvulis, apice plano peltato connexis.

The definition of Schimper (Paleontologie vegetale, vol i., p. 259), remedies this:—It is *Fructus spicaeformis cylindraceus oblongus, seu ovatus, sporangiorum receptaculis peltoidis. Folia in vaginam connata.* (Tenison-Woods).

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.

PHYLLOTHECA AUSTRALIS (Br.)

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.

Localities.— TASMANIA— Upper Coal Measures (Mesozoic). Jerusalem, Constitution Hill, Spring Bay, Gravelly Beach, Tamar (?) York Plains. N.S. WALES—Anvil Creek, Newcastle, Clarke's Hill, Wianamatta. VICTORIA—Cape Paterson.

References.— Brongniart Prodrome, 1828, p. 152; Morris, Strezelecki's Phys. Descrip. N.S.W. and V.D. Land, 1845; Lindley and Hutton, Foss. Flora, 1833—35 II. p. 89; M'Coy, Annals, Nat. Hist., 1847, XX., p. 196; Ibid, Proc., Roy. Soc. V. D. Land, p. 312; Schimper, Traité Pal. Veg., 1869, I., p. 289; Tenison Woods. Proc. Lin. Soc. N. S. Wales, 1883, vol. VIII., pt. I., p. 69-73; R. Etheridge, Jun., Cat. Aust. Fossils, 1878, p. 98.

PHYLLOTHECA RAMOSA (M'COY).

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.

Localities.—TASMANIA--Upper Coal Measures (Mesozoic), Richmond, Spring Bay, York Plains, Jerusalem. N.S. WALES—Mulimbimba.

References.—M'Coy Annals Nat. Hist, 1847., XX., p. 156, t. 11, figs 2 and 3; ibid Proc. R. Soc. V.D. Land, 1851, I., p. 312, t. 11, figs 2 and 3; Schimper Traite de Pal. Veg., 1869, I., p. 289; Tenison-Woods Proc. Lin. Soc. N.S. Wales, 1883, vol. VIII., pt. 1, p. 72-73; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

PHYLLOTHECA HOOKERI (M'Coy).

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.

Localities.—TASMANIA—Upper Coal Measures (Mesozoic), New Town, Richmond, Jerusalem, Longford, York Plains, Constitution Hill, Impression Bay, Hamilton. N. S. WALES—Mulimbimba, Clark's Hill, Arowa.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 157, t. 11 figs. 4-7; ibid, Proc. R. Soc., V.D. Land, 1851, p. 313; Schimper, Traite Pal. Veg., 1, 1869, 1, p. 289; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883. Vol. VIII., pt. 1, p. 72-74; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

SPHENOPTERIDEÆ.

Including *Sphenopteris*, *Hymenophyllum*, *Eremopteris*, *Coniopteris*, *Steffensia*, *Trichomanides*.

Fronds petiolate, simple or divided, pinnate, bi-tri-pinnatifid. Pinnules connate or lobate. Lobes dentate or subdivided. Costa fine and delicate, often bifid or free at the top; veins diverging above, or produced to the sinus of the lobes or teeth. Venules either indistinct or only proceeding from the lower part of the secondary nerves.

SPHENOPTERIS LOBIFOLIA (Morris).

Frond bipinnate; pinnæ, somewhat linear, elongate, alternate; pinnulæ membranous, those of the lower pinnæ equal, ovate oblong, contracted at the base, approximate, with three nearly equal rounded lobes on each side, and a terminal obtuse one; the veins proceeding into each lobe, divide near the mid rib, the upper one being furcate; the pinnulæ towards the apex of the frond are rather sharply three-lobed and decurrent, the veins becoming furcate in each lobe.

Localities.—TASMANIA—New Town, York Plains, Longford (?). N.S. WALES—Newcastle, Mulimbimba.

References.—Morris, Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 246, t. 7, f. 3; M'Coy, Annals, Nat. Hist., 1847, xx., p. 149; ibid, Proc. Soc. V.D. Land, 1851, i., p. 306; Tenison-Woods, Proc. Lin. Soc. N.S. Wales, 1883, vol. viii., pt. 1, p. 88; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS ALATA (Brong.).

Frond tripinnate, rachis winged, pinnæ pinnate, above pinnatifid, with decurrent sessile pinnules, lower pinnatifid, with three to six bluntly toothed segments, upper ones inciso-dentate, veins either simple or forked, diverging slightly into each lobe from the costa at an acute angle.

Localities.—TASMANIA—New Town, Longford (?). N.S. WALES—Mulimbimba.

References.—Brongniart (*Pecopteris*), Hist. Vég. Foss., 1828, i., p. 361, t. 127; (*Sphenopteris* var. *exilis*) Morris, Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 246, t. 7, f. 4; M'Coy, Annals Nat. Hist., 1847, xx., p. 149; ibid, Proc. R. Soc., V.D. Land, 1851, i., p. 306; Schimper Traité de Pal. Vég., 1869, i., p. 411; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. viii., pt. 1, p. 90; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

SPHENOPTERIS ELONGATA (Carr).

Frond dichotomously divided, each division irregularly pinnate; pinnæ simple, bi-furcate or irregularly pinnate; segments narrow, linear, slightly tapering upwards to the somewhat blunt apex, the costa sending out simple veins which run along the middle of each segment.

It is doubtful whether the Tasmanian variable form, the rhachis of which, sometimes scarcely a millimetre in width, is not specifically distinct from *S. elongata.* The former is very distantly and sparingly branched.

Localities.—TASMANIA — New Town, Richmond, Spring Hill, Jerusalem, York Plains, Spring Bay, Mt. Nicholas (?). QUEENSLAND —Tivoli mines.

References.—Carruthers, Quart. Jour. Geol. Soc., 1872, XXVIII., p. 355, t. 27, f. 1; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 92; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

SPHENOPTERIS HASTATA (M'Coy).

Sp. Char.—Bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulato-dentate, having obsolete lobes on each side; nerves bipinnate, two branches reaching each lobe of the margin.

Localities.—TASMANIA—Upper Coal Measures (Mesozoic), New Town (?). N.S. WALES—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 149, t. 10, f. 1; ibid, Proc. Roy. Soc., V.D Land, 1851, I. pp. 306-307, t. 10 f. 1; Schimper, Traité de Pal. Vég., 1869, I. p. 410; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, Vol. VIII., pt. I., p. 90; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS GERMANUS (M'Coy).

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.

Localities.—TASMANIA (?). N.S. WALES—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 150, t. 10, f. 2; ibid, Proc. R. Soc., V.D. Land, 1851, I, p. 307; Schimper, Traité de Pal. Vég., 1869, I., p. 411; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 91; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS PLUMOSA (M'Coy).

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.

Localities. — TASMANIA — New Town (?). N. S. WALES — Mulimbimba. VICTORIA—Wild Dog Creek, Apollo Bay.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 150, t. 1 , f. 3; ibid, Proc. R. Soc., V.D. Land, 1851, I., p. 307, t. 10, f. 3; Schimper, Traité de Pal. Vég., 1869, I., p. 411; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1., p. 91; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS FLEXUOSA (M'Coy).

Sp. Char.—Bipinnate; pinnæ very long, with a strongly flexuous naked rhachis; 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.

Localities.—TASMANIA—New Town (?). NEW SOUTH WALES—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 150, t. 9, f. 4; ibid Proc. R. Soc., V.D. Land, 1851, I., p. 307 t. 9., f. 4; Schimper Traité de Pal. Vég., 1869, I., p. 411; Tenison-Woods, Proc. Lin. Soc. N.S. Wales, 1883, vol. VIII., pt. 1, p. 91; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

TRICHOMANIDES. (Tenison-Woods, Proc. Lin. Soc., New South Wales, p. 94.)

Frond simple or divided, bi, or tri-pinnate, primary rachis narrow, or terete, sori unknown.

TRICHOMANIDES, ETTINSHAUSENI. Nov. Sp.

Frond pinnate; (or bi-pinnate ?) pinnæ delicate, membranous narrow, with closely adpressed, simple distant alternate pinnules, similar in character to winged rhachis; pinnules simple, linear, sub-decurrent towards winged base, slightly diverging towards bluntly pointed apices. A simple nerve traverses branches and simple pinnule as in the existing *Hymenophyllum rarum* Br. Length of pinna, 3 inches; length of pinnules from junction of median nerve to apex, 15 millimetres; breadth of pinnule, $1\frac{1}{2}$ millimetres.

This form is very distinct from *Sphenopteris elongata*, Carr., which also occurs in the Spring Hill beds, and with which it has some points of resemblance.

RHACOPTERIS, SCHIMPER.

Frond pinnate, rachis rigid, grooved in the middle. Pinnæ elongate, broadly linear. Pinnules sub-horizontal, somewhat remote, contiguous or sub-imbricate, spreading, oblong rhomboidal, more or less deeply incised and flabellate; lobes narrow, straight or slightly removed.—*Obs.*—The incisions are in the direction of the veins, and each ligule comprises one or two branches. The name refers to the incision of the pinnules. The genus hitherto was supposed to be confined to the Devonian or Lower Carboniferous.

RHACOPTERIS (?) FEISTMANTELII. Nov. Sp.

Frond coriaceous imparipinnate, handsome; rhachis strong; pinnæ sub-opposite, variable, distant, symmetrical or unsymmetrical, lingulate or obovate lanceolate, curved or spreading, greatly contracted at attachment to rhachis; terminal pinnule erect, inequilateral, with a rounded lobe on one side at base, somewhat falciform; apex generally more rounded than the terminations of lateral pinnæ; neuration parallel and crowded at contracted or petiolate attachment, thence gently spreading and forking, the lateral nerves, terminating in dentate or curiously recurved and variable laciniate segments, which are more strikingly developed at base of lateral pinnæ; the central nerves reach the extreme termination of pinnæ; nerves form a somewhat coarse linear grooving on surface of pinnæ, but do not anastamose. Not uncommon in shaly beds at Spring Hill, Tasmania.

I have placed this singularly handsome form under the genus Rhacopteris, although the form of its neuration is very suggestive of alliance with certain forms of Otozamites. See *O. imbricatus*, Feistm. The rhachis, though strong and rigid, with a broad shallow groove on one side, lacks the prominent mesial angle which characterises *R. intermedia*, Feistm, and the more closely related *R. septentrionalis*, Feistm. It almost invariably happens also that, unlike the latter, the most pronounced recurved segment is the lower one of any marginal group; the segments are smaller and finer as a rule towards the apex of each pinna where they usually are simply dentate. It is here again noteworthy that the European members of this singular genus is confined to the Devonian and Lower Carboniferous rocks, a fact which should not be overlooked in attempts made to correlate the widely separate groups of Upper Pal. and Mesozoic rocks of Australasia.

R. INÆQUILATERA (Goeppert).

Frond upper side broadly rounded, truncate at the base at a right angle. Petiole, short, straight, decurrent. Veins united at the base, spreading widely and dichotomously divided.

Localities.—TASMANIA — (Not known. See *R. Feistmantelii*). N. S. WALES—Arowa, Smith's Creek.

References.—Goeppert (Cyclopteris), Flora, A. Silur-Devon., p. 72, Vol. XXXVII., pp. 6, 7, and 8; Tenison-Woods, Proc. Lin. Soc., N. S. Wales, 1883, Vol. VIII., pt. 1., p. 98; Feistmantel, Foss. Flora. of E. Austral. and Tasmania, Geol. Mag., Nov., 1879, p. 489.

R. INTERMEDIA (Feistmantel).

Rhachis thick, with a prominent mesial angle, pinnules alternate, pedunculate, oblong, rhomboid, incised into cuneate segments, the centre longest, incisions scarcely marked above. Margins of the segments denticulate, veins numerous, forking, radiating in the segments. In the form of the rhachis this resembles very much *R. transitionis* and *R. machanechi*, Stur.

Localities.—TASMANIA—(Not known. See *R. Feistmantelii*). N.S. WALES—Port Stephens (Stroud).

References.—Feistmantel, Pal. Berträge Cassel., 1878, pt. III., p. 75, t. 11; Tenison-Woods, Proc. Lin. Soc., N. S. Wales, 1883, Vol. VIII., p. 98; Feistmantel, Foss. Flora. of E. Austral. and Tasmania, Geol. Mag., Nov., 1879, p. 490.

R. SEPTENTRIONALIS (Feistmantel).

Rhachis as in the last species, pinnulæ sub-alternate, with short petioles, sub-erect, oblong near the rhachis, deeply lobed, and thence sub-flabelliform, lobes sub-rhomboid, deeply incised, segments rounded above. Veins indistinct.

Localities.—TASMANIA—(Not known. See *R. Feistmantelii).* N.S. WALES—Smith's Creek (Stroud).

References.—Feistmantel, Pal. Berträge Cassel, 1878, pt. III., p. 147; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., p. 98.

CYCLOPTERIS (Brongniart).

Frond simple, pedicellate, flabelliform or reniform, symmetrical, membranaceous; margin sub-entire, crenulate or fringed; veins arising from the base, forking frequently, radiating, slender, all reaching the margin. (Tenison-Woods).

CYCLOPTERIS CUNEATA (Carruthers).

Form of the entire frond unknown; pinnæ entire, large cuneate, narrowed at the base, with the distal margins rounded; veins delicate, once or twice dichotomously divided, sometimes anastomosing once in their length in the middle of the pinnæ.

Localities.—TASMANIA–Porter's Hill, Hobart (?).* QUEENSLAND—Tivoli Coal Mines.

References.—Carruthers, Quart. Journ. Geol. Soc., 1872, XXVIII. p. 355, t. 27, f. 5; Feistmantel Records Geol. Survey, India, 1876, IX., pt. 4, p. 123.

THINNFELDIA (Ettingshausen).

Fronds pinnate, segments or pinnæ oblong, ovate lanceolate, decurrent, and confluent at the base, coriaceous; costa divided into many veins, venules and veinlets, before reaching the apex; veins emerging at a slight angle, diverging in ascending, and often forking, venules or veinlets reaching the margin. Stomata in both sides of the lobes. Obs.—The frond is generally dichotomous, and is with the leaves of a thick and fleshy habit. It belongs in Europe to the lower Lias and Rhaetic formations.

THINNFELDIA (PECOPTERIS), ODONTOPTEROIDES (Morris).

Frond pinnatifidly bipinnate, or flabellate (?); pinnæ, linear, elongate, acuminate; pinnulæ opposite, approximate, adnate, ovate obtuse, entire; veins nearly obliterated.

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* May only be a curiously cut fragment of a species of *Gangamopteris.*

Localities..— Tasmania — Jerusalem, Whale's Head. New South Wales—Clark's Hill, Hawkesbury Sandstones. Queensland—Ipswich, Tivoli Mines.

References.—Morris. Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 2, 49, t. 6, f. 2-4. M'Coy (Gleichenites) Annals Nat. Hist., 1847, XX., p. 147 ; Schimper, Traité dé Pal. Vég., 1869, I., p. 488 ; Feistmantel, Records Geol. Survey, India, 1876, IX., pt. 4. pp. 123-124 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, vol. VIII., pt. 1, pp. 106-107 ; R. Etheridge, junr., Cat. Aust. Fossils, 1878, p. 98.

Thinnfeldia Odontopteroides (Morris).
Var. *obtusifolia* (Johnston).

Frond bipinnate ; pinnæ simple or dichotomous ; rhachis strong and grooved, not winged; pinnules sub-opposite scarcely oblique, connate at the base, obtuse, broader than long, lower ones frequently emarginate ; upper margin emerging obliquely or at right angles to rhachis and roundly tapering downward towards lower margin, adhering base broadest ; lower pinnules free and relatively more square, emarginate, and shorter than the somewhat continuous or pinnatifid segments at the extremities of pinnæ ; the two inner pinnules at base of furcate pinnæ are slightly imbricate ; pinnæ usually from three to five inches long, and from six to thirteen millimetres broad ; veins extremely fine, all arising from the rhachis, dichotomous, diverging as they ascend.

This fern is especially the characteristic form in certain shales at the foot of Spring Hill. From the extreme divergence of this form from the types figured originally by Professor Morris in Strezelecki's work (Physical Descrip., N.S.W., and Tas.), and from the frequency which the very fine venules ascend from the rhachis independently, I was at first inclined to regard it as a distinct species allied to *Odontopteris*, but the further study of Dr. Feistmantel's able investigations and of the fuller and more correct characters of the various forms given by him led me to abandon my original view, and refer the whole of the various forms at Spring Hill to *Thinnfeldia odontopteroides*. There is one beautifully preserved specimen, however, in my possession which from the delicacy and independence of the branching venules would almost justify its inclusion under the genus *Odontopteris*. This specimen particularly is almost identical in form with *O. Schlotheimii*, far more so, I believe, than the *O. microphylla*, M'Coy. The latter is found common in the fine sandstones of Clarke's Hill, N.S. Wales (Wianamatta beds). The shales at Spring Hill appear to be older than the eruptive greenstone forming the high ridge at that place. It is possible that the shales at Spring Hill, may belong to a formation distinct from the Jerusalem basin.

It is significant to find that all the associated plants at this place are new to Tasmania, viz., *Tæniopteris Tasmanica* mihi; *Rhacopteris Feistmantelii*, mihi; *Thinnfeldia media*, Woods closely resembling *T. indica*, *Sphenopteris elongata*, Carr. and a form having the characters of the genus *Trichomanides* (*T. Ettingshauseni*, mihi). The prevailing forms of the Tasmanian Coal Measures as represented at Jerusalem, New Town, Oatlands, Longford, Fingal, Ben Lomond, and Seymour, could not be traced among those mentioned.

The prevailing forms throughout the Upper Coal Measures are *Pecopteris Australis* (Mor); *Sphenopteris lobifolia* (Mor); *S. alata*, Br.; *S. plumosa*, Br.; *Zeugophyllites elongatus* (Mor); *Phyllotheca Australis*, Br.; *P. ramosa* (M'Coy); *P. Hookeri* (M'Coy).

THINNFELDIA ODONTOPTEROIDES (Morris).

Variety *superba* (Johnston).

Frond bipinnate, large and graceful; pinna forking, dichotomous, contained angle of fork 48 degrees; segments of pinnules invariably cleft close to rhachis leaving a continuous wing along the latter, against which the broad bases of the pinnules are attached; the pinnules below the fork are broader than long, squarish, and become increasingly obtusely lobed on the upper marginal shoulder, the lower margin becoming gently rounded, thence parallel, and close to upper margin of the subjacent pinnules, all of which usually run into rhachis wing at a right angle. Pinnules at and above fork gradually lose the squarish appearance, are variably curved, broadly lanceolate and spreading, length greater than breadth at base, frequently becoming simply lanceolate towards apex; inner pinnules of fork generally smaller. Neuration fine, and forking repeatedly as in *T. falcata* from which it only differs in having a winged rhachis and in being a very much larger form. Rhachis strong, grooved; extreme length of pinnules below fork, 11 millimetres; above fork, 39 millimetres; average breadth of pinnules below fork, 18 millimetres; above fork, 12 millimetres.

This magnificent form occurs in shales associated with the coal seam at Spring Bay where it is associated with *Sphenopteris elongata*. (Carr.) *P. caudatus*, mihi, and *P. trilobita*, mihi.

THINNFELDIA TRILOBITA. (Nov. Sp.).

Frond bipinnate (?), pinnæ, linear elongate, dichotomously divided; pinnules pinnatfid, coriaceous, oblique, opposite trincately narrowly strap-shaped, invariably terminating in three variably shaped digits or lobes, the central one of which is usually the most prominent; veins obscure, not well defined. Adjacent margins of pinnules run closely parallel to each other, joining in a rounded sinus near to rhachis, giving to the latter the appearance of a broad marginal wing; rhachis strong and grooved; average breadth of of pinna, 15 millimetres; average length of pinnules, 9 millimetres; breadth, $4\frac{1}{2}$ millimetres.

Associated with *T. superba* mihi, in shales beneath coal seam at Spring Bay.

THINNFELDIA MEDIA (Tenison-Woods).

Frond pinnatifid or bipinnate (?) pinnæ nearly opposite, lanceolate, acuminate, on the margin sinuate, the lower ones shorter, the upper more or less nearly auricled, the lower ones more or less decurrent, the costa dividing into many veins; these veins are forked. Stalk thick, striated.

Localities.—TASMANIA—Spring Hill, Spring Bay. QUEENSLAND —Dubbo.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., plate 6, fig. 1.

PECOPTERIDEÆ.

Frond undivided, simple, or pinnate many times in a beautiful manner. Pinnules often entire, but here and there sub-divided, and with a dentate margin, base wholly adnate, rarely constricted, sometimes confluent. Costa persistent to the apex, pinnately ramose; veins dichotomous, diverging to the margin at a more or less open angle. Venules simple, forking twice or thrice, rarely anastomosing When sori are present they are marginal or disposed towards the middle of the pinnule, punctiform, oval or linear.

PECOPTERIS (Brogniart).

Veins emerging from the costa in a more or less open angle, diverging arcuately, simple or dichotomous, venules often forked.

PECOPTERIS (?) TENUIFOLIA (M'Coy).

Sp. Char.—Bipinnatifid (?), pinnules and rhachis very slender, each about half a line wide; pinnules very long, oblique, linear, apparently simply united to the rhachis by their entire base, one very strong midrib running throughout; secondary nerves unknown.

Localities.—TASMANIA (?). N.S. WALES—Clark's Hill.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 152, t. 9, f. 6; ibid, Proc. R. Soc., V.D. Land, 1851, 1 p. 308, t. 9, f. 6; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 110; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 98.

PECOPTERIS CAUDATA. Nov. Sp.

Frond bipinnate (?); pinnæ linear-lanceolate, pinnules connected, lobate or slightly pinnatifid from base to within an inch of apex, where the pinnæ terminate in a simple or confluent linear terminal pinnule; all lobes oblique, rounded, with margins rough or finely venulate; primary vein of each lobe emerging acutely from rhachis, from which radiate dichotomously numerous small venules which reach the margin; an occasional independent venule arises from rhachis towards sinus of each lobe.

Pinnæ or frond (?), imperfect $2\frac{3}{4}$ inches long. Breadth across middle of terminal pinnule, 5 millimetres. Breadth across base, 14 millimetres.

From greyish shale below 4 feet coal seam at Longford

This is probably a very variable species, as it corresponds in some respects with a protean form occurring in the shales associated with a similar coal seam at Spring Bay and at York Plains. There are certain characters which link this form with the genus *Odontopteris*, but until more perfect specimens are obtained, it is referred by me provisionally to the genus *Pecopteris*. The veins are invariably strong and prominent, very unlike the fine neuration of *Thinnfeldia Odontopteroides* (Morris).

ALETHOPTERIS (PECOPTERIS), AUSTRALIS. Morris.

Frond bipinnate; pinnæ oblique, alternate, rather distant; pinnulæ thin falcate and rather obtuse, oblique and somewhat incurved, more or less adnate to the rhachis, and sometimes decurrent, dilate at the base, or auriculate; midrib slightly flexuous, evanescing towards the apex; veins oblique, bifurcate, or dichotomous.

Localities. — TASMANIA — New Town, Hamilton, Richmond, Jerusalem, Spring Bay, Impression Bay, York Plains, Longford, Ben Lomond, Seymour. VICTORIA—Bellarine.—N.S. WALES—Clarence River. QUEENSLAND—Ipswich, Darling Downs.

References.—Morris, Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 248, t. 7, f. 1 and 2; M'Coy, Annals. Nat Hist., 1862, IX., p. 143; ibid, Geol. Survey, Vic., Dec. 1, 1874, p. 34; Schimper, Traité de Pal. Veg., 1869, I. p. 569; Feistmantel, Records, Geol. Survey India, IX., pt. 4, p. 123; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pp. 111-112; R. Etheridge jun., Cat. Aust. Fossils, 1878, p. 97.

TÆNIOPTERIDÆ.

Fronds stipitate, simple, oblong, lanceolate, and broadly elongate, entire or pinnate; pinnæ linear, lingulate, more or less acuminate, shortly pedicellate or sessile. Rhachis and costa conspicuous; veins emerging at an acute angle, but immediately becoming horizontal or oblique, simple and dichotomous. Sori transversely oblong, sub-marginal or rounded, and scattered over all the lower part of the surface, or in series along the venules.

TÆNIOPTERIS (Brongniart).

Frond simple, and in habit like *Scolopendron*. Costa conspicuous above, sub-terete underneath; veins generally conspicuous, slender, numerous, and close, dichotomous a little above the base; venules simple or dichotomous, parallel, with an occasional intermixture of simple nerves.

TÆNIOPTERIS TASMANICA. Nov. Sp.

Frond simple, broadly strap-shaped, not obovate; midrib moderately strong; veins well defined, exceedingly close and numerous, parallel, emerging from midrib at an acute angle, and immediately bending and reaching margin at a slight angle upwards. About one nerve in ten simply furcate near middle of wing; about 24 nerves in the space of half-an-inch. Length unknown. Breadth, about 46 millimetres, Common in the shales at foot of Spring Hill. This form approaches *Macrotæniopteris Wianamatta* (Feistm.) of the Hawkesbury sandstone, but seems to differ from the latter by its closer neuration and its broadly strap-shaped form. It also approaches *T. densinervis* (Feistm.), from Kukurbit, India, but it would appear that the latter differs in having the nerves more delicate if not more dense, and in being more frequently furcate.

TÆNIOPTERIS MORRISIANA. Nov. Sp.

Frond simple, narrowly strap-shaped; costa fine; veins numerous, parallel, one in six simply furcate, emerging and radiating outwards at a moderately acute angle to margin. Length, unknown; breadth about 16 millimetres; nerves fully 1 millimetre apart.

Occurs in a greyish white shale below 4 feet coal seam belonging to Mr. Mason near Longford. Associated with *Zeugophyllites elongatus* (Mor.), and *Alethopteris Australis* (Mor.).

T. Morrisiana is a very distinct form from *T. Daintreei* (M'Coy). It approaches *Oleandridium vittatum* (Brgt.) far more closely. It differs from the latter in the less frequent furcation of the nerves and in the delicacy of its midrib, *O. vittatum* being very strong comparatively. It is more closely allied to the example figured as *T. Daintreei*, by Mr. Carruthers (Quart. Jour. Geol. Soc. London, 1872, Pl. XXVII. fig. 1), but, which I consider, with Prof. M'Coy (p. 16, Decade. Prod. of Pal. of Victoria, Pl. XIV., fig. 1), to be a very distinct species. See *T. Carruthersii*, Tenison-Woods, Proc. Lin. Soc., 1883, Vol. VIII, p. 117.

TÆNIOPTERIS DAINTREEI (M'Coy).

Frond very long, linear, parallel sided; substance thick, edges straight, costa very strong; veins extending at right angles from the midrib to the lateral margins, a few straight and simple, the greater number once forked at a variable distance between the midrib and lateral margin; total width of frond four lines, about ten or eleven lateral veins in the space of two lines at the margin, both of ordinary specimens, four lines wide, and one specimen nearly two inches long, but only one and a half lines wide throughout.

Localities.—TASMANIA. Referred to by M'Coy (Dec. 2, Pal. Vic., p. 15), as occurring "in the same mass of stone with *Glossopteris Browniana*, in one of the Tasmanian specimens," therefore locality probably Mersey Coal Basin (?). N.S. WALES—M'Coy. VICTORIA.—Bellarine, Barabool Hills, Cape Paterson, Strezelecki Range, Murundal. QUEENSLAND.—Tivoli Mines (?).

References.—M'Coy, Trans. Roy. Soc. Vic., 1860, V., pp. 196 and 215; ibid, Dec. II., Pal. of Vic., p. 15, pl. 14, f. 1-2; Carruthers, Quart. Journ., Geol. Soc., 1872, XXVIII., p. 355, t. 27, f. 6 (?); Feistmantel, Geol. Survey, India, IX., pl. 4, pp. 123-124; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII. (T. Carruthersii, Woods), p. 117; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

Sub-Order.—DICTYOPTERIDEÆ †

Nerves *reticulate*, fronds many times pinnate or pinnatifid †

A. With a midrib.

a. Costa conspicuous, frond simple. *Glossopteris.*

b. Costa inconspicuous, except in the middle, frond quadrilobate. *Sagenopteris.*

B. Without a costa. *Gangamopteris.*

GLOSSOPTERIS (Brongniart).

Frond simple, elongately elliptical, acuminate, entire, coriaceous, petiolate, rhachis broad, gradually tapering up to the apex. Veins emerging from the rhachis at an acute angle, from which, to the middle of the leaf, they form a hexagonally rhomboid net, thence to the edge somewhat more free, dichotomous, not so often anastomising, and forming very large rhomboidal areolæ. Sori rounded.

GLOSSOPTERIS BROWNIANA (Brongniart).

Frond simple, spathulate, or oblong, lanceolate, entire, attenuate at the base; costa thick, canaliculate, gradually contracting towards the apex; veins oblique, anastomosing, hexagonal near the rhachis and elongate near the edge.

Localities. — TASMANIA — Lower Coal Measures (Up. Pal.), Mersey, Southport (Wintle), Lower Tamar (Wintle). N.S. WALES —Newcastle, Jerry's Plain, Mulimbimba, Illawara.

References. -- Brongniart, Prodrome, 1828, p. 54; Morris, Strezelecki's Phys. Descrip., N.S. Wales and V.D. Land, 1845, p 247, t. 1, f. 1; Schimper, Traité de Pal. Vég, 1869, p. 645; Carruther's Quart. Journ. Geol. Soc., 1872, XXVIII., p. 354; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pp. 122-123; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

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† In Schimper and Zittel's Paleontologie this is only a sub-order of Tæniopterideæ.

GLOSSOPTERIS BROWNIANA, Var. PRÆCURSOR (Feistmantel).

Leaves small, long, spathulate; costa distinct, fading away towards the apex; veins emerging at an acute angle, curved, forked, anastomosing, forming a sub-equal elongate, polygonal network.

Localities.—N.S. WALES—Stony Creek.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 126.

GLOSSOPTERIS LINEARIS (M'Coy).

Leaves very long, narrow, with nearly parallel sides; midrib very large; secondary veins fine, forming an angle of about 50deg. with the midrib, anastomising occasionally from the midrib to the margin.

Localities.— TASMANIA — Mount Nicholas (Killymoon Coal Seam ?). N.S. WALES—Woollongong, Arowa.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 151, t. 9, f. 5; ibid, Proc. R. Soc. V.D. Land, 1851, I., p. 308, t. 9, f. 5; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 97; Tenison-Woods Proc. Lin. Soc. N.S. Wales, 1883, vol. VIII., p. 123.

GLOSSOPTERIS AMPLA (Dana).

Frond very large, widely ovate, entire, undulating, obtusely acuminate; costa thick, extending to the apex; veins extremely fine and close, leaving long, narrow reticulations, which are longest towards the margin.

Localities.—TASMANIA—Porter's Hill, Hobart (?). Mersey (?). N.S. WALES—Newcastle, Illawara.

References.—Dana, Geol. U.S. Expl. Expd., 717, Atlas, t. 13, f. 1; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII. pt. 1, p. 124; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 976.

GLOSSOPTERIS RETICULATA (Dana).

Frond large, oblong-elliptical, the width not exceeding a third part of the length, gradually attenuate towards the apex; veins broadly reticulate to the margin. Considered to be a variety of *G. ampla* by Feistmantel.

Localities.—N.S. WALES— Newcastle, Illawara (Rare).

References.—Dana, Geol. U.S., Expl. Expd., p. 717, Atlas, t. 13, f. 1; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII, pt. 1, p. 124; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 976.

GLOSSOPTERIS ELONGATA (Dana).

Frond narrowly elongate, lanceolate, attenuate at the base; costa somewhat thick, distinct; veins neatly reticulate. Considered to be a variety of *G. ampla* by Feistmantel.

Localities.—N.S. WALES—Newcastle.

References.—Dana, Geol. U.S. Expl. Expd., p. 718, Atlas, t. 13, f. 5; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII., pt. 1, p. 124; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

GLOSSOPTERIS CORDATA (Dana).

Frond distinctly cordate towards the base ; lobes rounded; costa thick; veins reversed at the base, diverging from the costa, neatly reticulate, with narrow, oblong interspaces. Considered to be a variety of *G. ampla*, by Feistmantel.

Localities.—N.S. WALES—Illawara.

References.—Dana, Geol. U.S., Expl. Expd., p. 718, Atlas, t. 13, f. 5 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII., pt. 1, p. 124 ; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

GLOSSOPTERIS TÆNIOPTEROIDES (Feistmantel).

Frond simple, elegant in form, oblong, ovato-spathulate, attenuate at the base ; costa valid, striate or grooved. Veins emerging at nearly a right angle, giving at first sight the appearance of a *Tæniopteris.* Under the lens the venation is seen to form an oblong, narrow, obliquely acute parallel network which is sometimes indistinctly polygonal. The costa is stiff and straight. Only one specimen was known to Dr. Feistmantel, which came from Blackman's Swamp Coal Beds.

Localities.—N.S. WALES—Blackman's Swamp Coal Beds.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII., p. 125.

GLOSSOPTERIS WILKINSONI (Feistmantel).

Frond extremely narrow, sub-parallel, strap-shaped, costa distinct, produced at the apex; veins sub-horizontal, dichotomous, anastomosing usually once near the apex, forming an oblong network, with a few smaller meshes towards the margin of the rhachis.

Localities.—N.S. WALES—Blackman's Swamp.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., p. 125.

GLOSSOPTERIS PARALLELA (Feistmantel).

Frond very long, simple, elongately ovate, apex unknown; costa distinct, grooved in the middle. Veins emerging at an angle of 30 deg., in the lower portion, and at an angle of 20 deg. in the upper portion of the frond, dichotomous parallel, but anastomosing, forming a distinct oblong polygonal net, which is narrower towards the margin.

Localities.—N.S. WALES————(?)

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., p. 125.

GLOSSOPTERIS ELEGANS (Feistmantel).

Frond of medium size, oblong spathulate, with a costa which becomes merged in the tissue above ; below it is formed of pairs of areola spaces, which are oblong; above these are similar spaces, but shorter and somewhat polygonal. Veins arising at an acute angle from the medium areolar spaces, dichotomous, anastomosing, and forming an oblong network.

Localities.—N.S. WALES—Greta.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, pp. 125-126.

GLOSSOPTERIS PRIMŒVA (Feistmantel).

Frond spathulate, costa thick, grooved veins, emerging at an angle of from 20 to 30 deg., parallel, dichotomous, anastomosing, forming a polygonal network, which is wider and shorter near the rhachis, narrower and longer near the margin.

Localities.—N.S. WALES—Greta. INDIA—Damuda.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883. vol. VIII., pt. 1, p. 126.

GLOSSOPTERIS CLARKEI (Feistmantel).

Leaves oblong ovate, obtusely acuminate; costa distinct, grooved in the middle. Veins parallel, dichotomous, free for the greater part of the leaf, like a *Tæniopteris*, anastomosing only at the margin, twice or thrice forming a rhombo-polygonal network.

Localities.—N.S. WALES. ——————(?)

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 126.

GANGAMOPTERIS (M'Coy).

Frond simple or impari-pinnate; middle pinnæ spathulate, symmetrical, semi-elliptically pointed above, gradually tapering towards the base; lateral pinnæ variable, very acute, tapering from base or obliquely ovate, to trigonal or flabelliform, broad above, gradually narrowed towards the oblique adherent base, which is never auriculate, but moderately wide and embracing no costa; veins coarsely reticulate, many arising from the base, branching as they diverge towards the margin and frequently anastomosing to form an irregular polygonal network.

GANGAMOPTERIS SPATHULATA (M'Coy).

Spathulate, symmetrical, equal sided, semi-elliptically pointed above, tapering towards the base to a slender petiole; length 4½ inches, width about 1½ to 2 inches. (This is the rarest of the three forms in the Bacchus Marsh sandstones, M'Coy.)

Localities.—TASANMIA—Mersey. VICTORIA—Bacchus Marsh.

References.—M'Coy, Geol. Survey, Vic., Dec., II., 1875, p. 12, t. 13, f. 1; Feistmantel, Records, Geol. Survey, India, 1876, IX., pt. 4, p. 123; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 127.

GANGAMOPTERIS OBLIQUA (M'Coy).

Frond wide, inequilateral, oblique, sub-trigonal, widest near the broadly rounded distal end, gradually tapering towards the base, which is not petiolate, but obliquely truncated, with a moderately wide sessile base of attachment. Length, commonly about four or five inches; width near apex, about three and a half inches; width near base, commonly about nine lines.

Localities.—TASMANIA—Mersey. VICTORIA—Bacchus Marsh.

References.—M'Coy, Geol. Survey, Vic., Dec. II., 1875, p. 13, t. 12, f. 2-4; Feistmantel Records, Geol. Survey, India, 1876, IX., pt. 4, p. 123; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 127; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

GANGAMOPTERIS ANGUSTIFOLIA (McCoy).

Leaf linear, lanceolate, eight or nine times longer than wide; side straight, nearly parellel, 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.

Localities.—TASMANIA—Upper Marine Beds, Mersey. N. S. WALES—Guntawang, Newcastle. VICTORIA—Bacchus Marsh.

References.—McCoy (*Cyclopteris*), Annals Nat. Hist., 1847, XX., p. 148, t. 9. f. 3; ibid, Proc. Roy. Soc., V.D. Land, 1851, I., p. 306, t. 9. f. 3; Feistmantel, Rec. Geol. Survey, India, 1876, IX., pt. 4., p. 123; Tenison-Woods, Proc. Lin. Soc., 1883, Vol. VIII., pt. 1., p. 127; R. Etheridge, junr., Cat. Aust. Fossils, 1878, p. 95.

GANGAMOPTERIS CLARKEANA (Feistmantel).

Frond spathulately rounded, of medium size, coriaceous, entire, symmetrical, rounded above but greatly attenuated towards the base, whence the somewhat thick and distant veins radiate, forking and forming an oblong network. Resembles *G. spathulata.*

Localities.—N.S. WALES—Bowenfels.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, pp. 127-128.

SAGENOPTERIS (Presl.).

Frond quadri-lobate arising from a terete stipe, lobes free to the base, articulate, deciduous, extremely variable even in the same frond, being hastate cultriform, rhomboidal, oblong, lanceolate, and unsymmetrical, coriaceous, thickened at the articulation. Costa immersed in the tissue at the base, but distinct towards the middle; veins arising at an acute angle, but diverging in ascending, anastomosing, forming a hexagonal rhomboidal network. Epidermis unequally rectangular above, polygonally areolate below, and pierced with stomata.

SAGENOPTERIS RHOIFOLIA (Presl.).

Frond very variable both as to the shape and size. Pinnæ narrow at the base, articulate, spathulate, obovate, or oblong acuminate, rarely oblong lanceolate or sub-rotundate, inequilateral, very rarely sub-symmetrical, the middle leaves larger than the lateral ones, and quite entire. Ordinary length about 32 millimetres, with a diameter of 16 millimetres. The internal margins of the lateral fronds somewhat expanded, furnished here and there with a broad indistinct dental lobe.

Localities.—QUEENSLAND—Ipswich, Darling Downs.

References.—Presl. in Sternberg, Vol. I., p. 640, tab. XLIV., fig. 2-8 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 128.

SAGENOPTERIS TASMANICA (Feistmantel).

Frond compound digitate (?), with linear lobes, attenuate at the apex; costa distinct and rounded, veins emerging at an acute angle, forked, and once (so it seems in the fragments) anastomosing. A doubtful species resembling *S. Phillipsi*, Lindley and Hutton of the English Oolite.

Localities.—TASMANIA—Jerusalem Basin.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 129.

JEANPAULIA (Unger).

Fronds coriaceous, arising from a cylindrical stem, flabelliform ; segments, which are linear, forking repeatedly, entire, more or less elongate. Veins numerous, rather prominent, equal, parallel, dichotomous with the divisions of the frond. Superior epidermis formed of elongate rectangular or oblique cells ; lower side of hexagonal cells with an undulating margin, and numerous stomata. Fruit, ovate-pisiform.

JEANPAULIA BIDENS (Tenison-Woods).

Frond broadly flabellate ; segments somewhat short, often becoming broader towards the apex, and ending in a short wide bifurcation, or in a curved falcate, acute or acuminate point. Veins not conspicuous, numerous (6 to 10), parallel, not branching. The longest of the segments in the specimen figured is 55 millimetre, and the width is from 3 to 6 millimetre.

Localities.—QUEENSLAND—Burnett River Coal Seams.

References.—Tenison-Woods, Proc. Lin Soc., N.S. Wales, 1883, vol. VIII., pt. 1, p. 132.

Order. LYCOPODIACEÆ.

Stem or rhizome bearing true leaves, either linear, or small and one-nerved, or reduced to minute scales. Spore-cases solitary or few together, sessile in the axils of the leaves or of the bracts of a terminal spike, either all similar or of two kinds, larger ones *macro-sporangia*, containing a few larger spores or *macrospores*, and smaller *micro-sporangia*, containing numerous smaller often microscopic *microspores*, the differences now generally admitted to be sexual.

Lycopodium.

Stems leafy, hard, branching, creeping, prostrate, or erect. Leaves small, entire or minutely serrate, inserted all round the stem, usually in 4 rows. Spore cases all of one kind, flattened, one-celled, two-valved, sessile in the axils of the upper leaves, or of bracts usually smaller or broader than the stem leaves, and forming terminal or lateral spikes. Spores all minute and powdery.

Tasmanites punctatus (Newton).

Bituminous discs (Sporangia) minute, rounded, usually flattened. Surface under microscope ornamented with minute crateriform rings, in the centre of each of which occurs a fine pore or tube communicating between the internal and external surface. These tubes are generally filled with blackish matter, and appear through the transparent coating of sporangium wall as hairs. The peculiar nature of this organism and its ornamentation was first described by the author in "Memoranda to Tasmanian Botanists" (p. 53), published in August, 1874, where it is described as "the spore-cases of some ancient tree allied to the existing club moss family." Forms the bituminous matter of the shale of the Lower Coal Measures of the Mersey, known as *Tasmanite, Yellow Coal*, or *Dysodile.*

References.—Johnston Mem. Tas. Botanists, 1874, p. 53; *Newton* Geol. Mag, 1875, Dec., 5, II., pp. 337-342, t. 10, f. 1-9; *Johnston* pamphlet on Tasmanite, or Mersey Yellow Coal, Hobart, 1877, p. 6, *T. Australis*; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 199.

Lepidodendron (Sternberg).

Large trees with dichotomous branches, surface closely covered with alternately arranged rhombic scars, having a vascular cicatrix near the middle or upper angle. Leaves linear, or peltate, fruit a strobilus or cone at the extremity of certain branches.

Sub-Genus. Bergeria (Presl.).

Scars nearly flat, obovate, rhomboic or quadrate, with a very small oval vascular cicatrix near the upper angle.

This genus belongs to the Paleozoic rocks, and various portions of the same plant have been formed into *Stigmaria* (roots), *Lepidostrobus* (cones or fruit spikes), *Sigillaria* (fluted trunks of some species), *Cyperites* (foliage), *Knorria* (casts of stems), *Sternbergia* (pith) and other genera.

Lepidostrobus.

Cylindrical cones composed of winged scales, their axis traversed by a longitudinal cavity or receptacle, and terminating in rhomboidal disks, imbricated from above downwards.

LEPIDOSTROBUS MUELLERI (Johnston).

Strobilus or cone imperfect, oblong, narrow, clyindrical, $4\frac{1}{4}$ inches long, and $\frac{7}{8}$inches in diameter; the longitudinal, striated cylindrical core of specimen about half an inch in diameter, indicates that the central longitudinal cavity or core occupied fully one third of the total diameter; bractæ emerging from central axis at a slight descending angle, about 20 in number, from 4 to 6 millimetres thick at base, and tapering downwards to margin, where they are from 2 to 3 milimetres thick, and from which they suddenly bend upwards, and form long, thin, leaf-like imbricating bracts enclosing sporangia cavities or cells, of similar appearance and size to the enclosing bracteæ

This unique and interesting specimen was discovered by the author in the so-called auriferous sandstones of Campania, which belong to the Mesozoic Coal measures of Jerusalem.

The sandstones are intimately related with shaly beds replete with impressions of Phyllotheca Australis, P. Hookeri and Zeugophyllites elongatus.

Unfortunately the specimen soon after its discovery disappeared mysteriously from the Royal Society's Museum, Hobart, where it was temporarily deposited. Fortunately a careful drawing was taken by the author at the time when it was discovered. In the Royal Society's Museum, Hobart, there is a fragment of what appears to be a trunk of a species of *Knorria*. The locality cannot now be ascertained, but from the character of associated shales, it is probable that it came from the Jerusalem Basin. If so, there is a likelihood that it may be related to the strobilus *L. muelleri*.

Locality.—TASMANIA—Campania sandstones.

Reference.—Johnston, Proc. Roy. Soc., Tasmania, 1884, p. 225, fig. 1.

LEPIDODENDRON (BERGERIA) AUSTRALIS (M'Coy).

Stem about two inches in diameter, having rhombic scars, with straight thick boundaries, about four inches long, and three and a half inches wide, with a very small oval, rounded, vascular, cicatrix, rarely near the middle or more usually eccentric towards the upper angle, and often connected with the appearance of a vertical shallow rounded sulcus; branches one inch in diameter having similar scars three lines long, and two and a half lines wide, upper and lower angles of the scars usually slightly more acute that the lateral ones, very rarely the lateral ones more acute.

Locality.—VICTORIA—Avon River Sandstones, Gippsland.

References.— M'Coy Annals Nat. Hist., 1862, IX., p. 141; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 134; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 31.

LEPIDODENDRON NOTHUM (Unger).

Scars of the leaf contiguous, rhombic, with a single and generally central vascular scar; leaves small, peltate and imbricate, on long slender petioles, fruit produced on the apices of the thick branches, a single sporangium, almost sessile, borne on the middle of the petiole of the leaf, roots stigmarioid.

Localities.—N.S. WALES—Cowra, Canowindra, Goonoo-Goonoo Creek. QUEENSLAND—Mount Wyatt, Drummond Range, Ryedale, Mount Lambie.

References.—Unger, Deuksch K. Akad, Wien, 1856, XI., p. 175, t. 10, f. 4-8; Carruthers, Quart. Jour. Geol. Soc., 1872, XXVIII, pp. 350, 353, t. 26, f. 1-5, f. 7-14; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 135; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 31.

LEPIDODENDRON VELTHEIMIANUM (Sternberg).

Localities.—EUROPE—Silesia, Hartz Mountains, Upper Vosges. AUSTRALIA— ———— (?).

References.—R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 31; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 136. See also *L. rimosum* (Sternberg), ibid.

Order.—CYCADEÆ.

Flowers unisexual, without any perianth. Male flowers forming catkins or cones, consisting of numerous spirally arranged imbricated scales (or stamens), more or less cuneate, bearing on the concealed portion of their under surface, numerous sessile or rarely stipitate anther-cells, each opening in two valves, the upper imbricated exposed part of the scales hardened, and often much thickened, the apex truncate or more or less produced into an incurved or recurved point or lanceolate appendix. Female cones consisting of numerous scales, imbricate at least when young, either with one pendulous ovule (or carpel) on each side of the thickened and hardened apex, or with three or more erect ovules (or carpels) in marginal notches below the flattened acuminate, and usually dentate or pinnatifid apex. Fruiting-cone enlarged, and either remaining imbricate with two pendulous seeds to each scale, or the scales with marginal seeds spreading as the central shoot is developed within the cone. Seeds naked (or nuts) with a thick or hard outer coating or integument, and a fleshy albumen in a central cavity of which the straight embryo is suspended by a long folded cord. Cotyledons two, undivided. Palm-like plants, with a thick globose, and underground or erect and cylindrical woody stem, simple or rarely slightly branched, marked with the scars or bases of the old leaves. Leaves forming a crown at the apex of the stem, once or twice pinnate. Cones sessile or very shortly pedunculate, within the crown of leaves.

ZAMITES (Brongniart).

(As amended by Schimper including *Zamia* and *Zamites* of Brongniart in part and *Crossozamia* of Powell.)

Leaves very variable in size and shape, either ovate oblong acuminate, or oblong or linear and oblong acuminate; all regularly pinnate. Pinnæ more or less horizontal and inserted perpendicularly into the rhachis, lanceolate, linear lanceolate, oblong, acuminate or obtuse, base contracting suddenly and fixed to the anterior side of the rhachis by a more or less distinct callosity; solidly coriaceous. Nerves distinct, straight, parallel, ending abruptly at the apical margin of the leaflet.

PODOZAMITES (Fr. Braun.).

Leaves of medium size. Leaflets distinct, spreading, oblong, ovate, and linear oblong, apex obtusely acuminate or rounded, gradually narrowed towards the base, sub-pedicellate, pedicel articulate, deciduous. Nerves dichotomous at the very base, then simple, erect, parallel, then converging towards the apex.

P. Barkleyi, M'Coy, *Victoria* — Queenscliff (Ten.-Woods, l.c., p. 144).
P. ellipticus, M'Coy (Ten.-Woods, l.c., p. 144).
P. longifolius, M'Coy, *Victoria*—Bellarine (Ten.-Woods, l.c., p. 145).
P. lanceolatus, Lindley and Hutton, *Queensland*—Ipswich (Ten.-Woods, l.c., p. 146).

OTOZAMITES (Fr. Braun).

(*Odontopteris*, Sternb. Goeppert, Unger, in part. *Otopteris*, Lindley and Hutton, Schenk.)

Leaves moderately large, rarely very large, regularly pinnate, elongately linear, narrowed at each end, leaflets, densely close or more or less remote, alternate or linear lanceolate, obovate rhomboid or sub-circular, base suddenly narrowed, obliquely inserted on the upper side of the sub-terete rhachis, unequally auriculate, upper auricle smaller than the lower one, and adpressed to the rhachis. Nerves radiating from the insertion of the leaflet, basilar arcuate, the others sub-arcuate, once or more dichotomous. Epidermis with elongate deeply sinuous cellules.

O. Mandeslohi.— Kurr. Talgai Diggings, Queensland (Tenison-Woods, l.c., p. 151).

ZEUGOPHYLLITES (Brongniart).

Fronds (?) petiolate, pinnate, opposite (?) oblong, nerves valid few, equal, becoming confluent at the base and apex.

Z. ELONGATUS (Morris).

Stem (?) leaves petiolate, oblong elongate, entire truncate, and slightly thickened at the base; veins distinct, equal, parallel.

Localities.— TASMANIA — New Town, Richmond, Jerusalem, Impression Bay, Seymour, Ben Lomond, York Plains, Longford, Hamilton. N.S. WALES—Mulimbimba (?).

References.—Morris, Strezelicki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 250, t. 6, f. 5, 5a; M'Coy Annals. Nat. Hist., 1847, XX., p. 152; ibid Proc. R. Soc., V.D. Land, 1851, 1, p. 309; Tenison-Woods, Proc. Lin., N.S. Wales, 1883, Vol. VIII., pt. 1, pp. 151-152; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 101.

NŒGGERATHIOPSIS (Feistmantel).

Leaves unknown, leaflets (pinnules) wedge-shaped from the base, or elongate-spathulate, sub-rhomboid or obovate, margins straight or incurved; nerves close and numerous, somewhat thick at the base, and from thence forking twice or oftener, becoming slender and diverging into the leaf.

NŒGGERATHIOPSIS SPATHULATA (Dana).

Leaves short, spathulate, apex triangular and sub-acute, narrowed at the base, and thence gradually dilating; nerves very delicate, and only partially distinct, four or five veins in the breadth of a line.

Localities.—N.S. WALES———— (?). TASMANIA (?).
References.—Tenison-Woods, l.c., p. 153.

NŒGGERATHIOPSIS MEDIA (Dana).

Elongate, lanceolate, tapering towards the base, and broadest within an inch of the apex. Extremity sub-triangular, and apex rounded. Veins a little divergent, about fifteen to half an inch. One leaf five inches long, about an inch wide within an inch of the apex, and a fourth of an inch at base; another shorter.

Localities.—TASMANIA — Mersey Coal Basin. N.S. WALES—Newcastle.

References—Tenison-Woods, l.c., p. 154.

NŒGGERATHIOPSIS ELONGATA.

This is a doubtful species, which Dana identified with *Zeugophyllites elongatus* Morris, but says that it was found at Newcastle, which is clearly an error. He says that it may be identical with Goeppert's *N. distans*, but that plant grew in clusters, and, moreover, had veins bi-furcating in the middle, which does not occur in Morris's fossil. (Tenison-Woods).

Locality.—N.S. WALES—Newcastle.

References.—Tenison-Woods, l.c., p. 154.

NŒGGERATHIOPSIS PRISCA (Feistmantel).

Leaves unkown, leaflets (pinnules) medium-sized, sub-rhomboid, obovate, slightly inequilateral, nerves close and fine, emerging radiately from a narrow base, and forking twice or thrice.

Greta Creek, N.S.W., under the marine Paleozoic fossiliferous strata. (Tenison-Woods, l.c., p. 154).

Cordaites (Unger).

Stem, a simple woody cylinder without medullary rays, but composed of radiating scalariform vessels, encircling a large pith with transverse lamellar partitions. Bark marked with leaf-scars. Leaves simple, sessile, very long, flat, parallel-sided, with broad clasping base, easily disarticulated from the stem, no midrib, but fine parallel neuration.

Cordaites Australis (M'Coy).

Leaves several inches long, thick, flattened, parallel-sided, with unequal, longitudinal, simple parallel striæ; clasping base, slightly widened and bent a little downwards. Leaves at one inch from the base, about four or five lines wide; base about two to three lines wider.

Localities.—Tasmania—Mersey Basin (?). Victoria—Upper Devonian Flags, Iguana Creek. Queensland—Gympie, Drummond Range. N.S. Wales—Mulimbimba.

References.—M'Coy, Geol. Survey, Vic., Dec., IV., 1876, p. 22, t. 36, f. 6-7; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 155; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 30.

Class.—Coniferæ.

Trees or shrubs, mostly with resinous secretions, the leaves are stiff, sometimes linear or needle-like, sometimes short and scale-like, or more rarely broad-lobed, or divided. The flowers are unisexual, either in cylindrical or short catkins, with closely packed scales, or the females are solitary. There is no perianth. The stamens in the males are either inserted on the axis of the catkin under the scales or the anther-cells are sessile, on the inside of the scales themselves, which then form part of the stamens. The ovules and seeds are naked, that is without ovary style or pericarp, although sometimes more or less enclosed in two bracts, or in a fleshy or hardened disk. The seeds are albuminous with one, or sometimes several embryos in the centres, each embryo having sometimes more than two cotyledons. (Tenison-Woods).

Localities.—Tasmania—Upper Coal Measures and Lower Coal Measures, silicified trunks abundant. See also :—

Taxites medius, Tenison-Woods (ibid, l.c., p. 160, Queensland).
Sequoites (?) Australis, Tenison-Woods (ibid, l.c., p. 162, Queensland).
Walchia Milneana, Tenison-Woods (ibid, l.c., p. 163, Queensland).
Cunninghamites Australis, Tenison-Woods (ibid, l.c., p. 165, Queensland).
Aracaurites polycarpa, Tenison-Woods (ibid, l.c., p. 165, Queensland).