

FURTHER CONTRIBUTIONS TO THE FOSSIL FLORA
OF TASMANIA

PART I.

[By R. M. JOHNSTON, F.L.S.]

The following descriptions and observations are principally based upon collections made recently in a tour of examination of the rocks in the southernmost part of the island, and particularly that portion lying between Southport and South Cape. Some of the plants referred to, however, have been obtained from the coal measures near Spring Bay, and others from the tertiary leaf beds underlying the basaltic cap at the Forest, near Glenora railway station.

PECOPTERIS LUNENSIS, nov. sp. Pl. 1., figs. 5, 6, 7.

Frond or Pinna? 3— $3\frac{1}{2}$ in length; 4—6 lines broad, symmetrical, the larger ones linear-lanceolate, or lingulate; the smaller ones sometimes narrowly spatulate; commonly tapering gradually upwards to pointed or bluntnish apex, and constricted rather abruptly towards the short stem; texture somewhat membranaceous; margins simple, never incised or lobed, although occasionally wavy or slightly undulating; mid-rib firm, evanescent at apex; veins free, fine, distinct, arising from mid-rib at an acute angle, and then curving outwards to margin, each primary nerve bifurcate, or branching dichotomously. One remarkable example of these fronds is divided, or dichotomised within an inch of the apex, each division being marked with the same simple characters exhibited in the lower undivided portion.

Obs.—This interesting fern occurs in the greatest abundance in the shales associated with the four-feet coal seam just opened out near Ida Bay, Southport. These shales are replete only with this one form. Two other associates occur, sparingly, viz., *Zeugophyllites elongatus* (Morris) and *Vertebraria Australis*. In the black shales, further east at Southport, I have also discovered the fronds of *P. Lunensis*, but here they are found sparingly associated with *Vertebraria Australis*. The latter occurs in these Southport beds in the most wonderful profusion, as in the shales of Port Cygnet a short distance to the north-east. It is probable that the simple fronds of *P. Lunensis* belong to a tufted form, as, in the thousands of examples examined by me, I have not been able to trace attachment as in bipinnate, dichotomous, or compound species. The only kind of attachment which might break up so completely, by pressure, would be that exhibited in the zig-zag dichotomy of such forms as the existing *Gleichenia Cunninghamii*, or *G. dicarpa*.

The nearest ally with which I am acquainted appears to be *Pecopteris caudata* (mihi) occurs in the York Plains shales. The latter species, however, appears to be of a more coriaceous

texture, and the lower portion of the pinna or frond is invariably incised or lobed.

Locality and Horizon.—Ida Bay and Southport.

The beds exposed along the shore at the Red Bluff, near Kennedy's Hotel, afford the best evidence of the nature and sequence of the various members of the coal measures, containing *P. Lunensis* (mihi) and *Vertebraria Australis*. The north-eastern horn of the Southport Bay is composed of greenstone, against which the Permo-Carboniferous mudstones form a broken fringe along the shore towards the police station westward. The "Stack of Bricks" islet, at the Heads, is also a fragment or survival of the mudstone series, which at one time probably occupied the whole of the eastern part of the present bay. The whole of these mudstones dip very slightly south and west. The junction with the succeeding coal measures below Kennedy's Hotel is concealed by a low lying tract of sand. Below Kennedy's Hotel the lower beds of the coal measures first make their appearance in low-lying flat reefs or terraces, all of which have a uniform dip of from 10 to 15 degrees to the south-west in the direction of Ida Bay, and disappear in a distance of about 300 yards, at the same angle under the reddish sandstone of the Red Bluff. The lower division is composed of a series of thin laminated beds of sandstone, alternating with similar thin laminated blackish arenaceous shales. The thickness of those in view probably does not in all exceed 50 feet. Although some of the shales are highly carbonaceous, there is no appearance of coal seams. The blackish shales, however, are rich in plant impressions, mainly the remains of *Vertebraria Australis* (McCoy). *P. Lunensis*, its associate, only occurs sparingly at this place. The irregularly bedded reddish sandstones succeeding the shales rise into a bold bluff towards the east, upon which is built the Roman Catholic Church.

The lower part of these sandstones, however, are laminated and flaggy. On the shore some parts of the exposed surface exhibit fine examples of ripple marking. The wavy ripples generally agree in direction, being generally at right angles to line of dip. The total thickness of the formation at Southport probably does not exceed 300 feet.

Ida Bay.—The members of this division again appear a few miles further east in the vicinity of Ida Bay. My information from this particular locality has in part been supplied by Mr. Schachner, who is engaged in working one of the coal seams (about 4 feet thick) developed in the formation at this place. I have not yet obtained full particulars of the sections opened out, but hope to do so shortly.

The shales associated with the coal here are almost wholly composed of the remains of *P. Lunensis*, although at Southport it only occurs rarely. It is also of interest to find that

the associated form here is *Zeugophyllites elongatus*, (Morris). *Vertebraria Australis* (M'Coy) the characteristic form at Southport has evidently disappeared entirely. It may be remembered that the earliest known habitat of *Vertebraria Australis* (M'Coy) in Tasmania was discovered by the writer some years ago associated with an anthracite coal seam at Mount Cygnet. The beds at this place, like those further south at Adventure Bay, are intimately associated with the upper members of the marine mudstones of Permo-Carboniferous age, upon which they lie conformably in unbroken stratigraphic succession. Both at Adventure Bay and Mount Cygnet the characteristic plants are of a *Permo-Carboniferous* character, consisting almost entirely of remains of *Vertebraria Australis* (M'Coy) and *Gangamopteris spathulata* (M'Coy). Dr. Feistmantel, at the time he published his last memoir, only knew of the existence of *Vertebraria Australis* (M'Coy) in connection with the "Newcastle beds (upper coal measures) of New South Wales at various localities," which he refers to *Permian* age. It is significant to note the gradual appearance and disappearance of *Vertebraria Australis* (M'Coy), associated at their origin by such a purely restricted Permo-Carboniferous form as *Gangamopteris spathulata* (M'Coy) as at Adventure Bay and Mount Cygnet, and linked as it disappears with the beginnings of mesozoic plants such as *Zeugophyllites* at Ida Bay, and with the form *Pecopteris Lunensis* (mihi), which latter serves to link together the *Vertebraria* shales of Southport with the prevailing *P. Lunensis* and *Zeugophyllites elongatus* shales of Ida Bay. It would seem probable, therefore, that the Southport and Ida Bay formations supply an important link in the chain of plant life, connecting the close of the *Permo-Carboniferous* period with the beginnings of the mesozoic period; and the following may be taken as the sequence of the typical formations, taking in order the formations in Tasmania, beginning with the lower marine beds of *Permo-Carboniferous* age, thus:—

	Formations.	Characteristic Form.
PERMO-CARBONIFEROUS.	1. Lower Marine Beds.	
	2. Tasmanite Beds.	
	3. Coal Measures : Mersey, Henty, Tippagory, etc. } 4. Upper Marine Beds.	<i>Tasmanites punctatus</i> , <i>Glossopteris</i> , <i>Gangamopteris</i> , <i>Noeggerathiiopsis</i> .
	5. Adventure Bay Coal Measures.	<i>Gangamopteris spathulata</i> & <i>Vertebraria Australis</i> .
	6. Mount Cygnet Coal Measures. }	<i>Vertebraria Australis</i> and <i>Pecopteris Lunensis</i> .
	7. Southport Beds.	
MESOZOIC.	8. Lower Sandstones (Lower Mesozoic).	Ganoid Fishes. <i>Vertebraria</i> .
	9. Ida Bay Coal Measures.	<i>Pecopteris Lunensis</i> and <i>Zeugophyllites elongatus</i> .
	10. Upper Coal Measures : Jerusalem, Fingal, Spring Hill York Plains, Hamilton, Richmond New Town, Sandfly, Recherche South Cape, Longford, etc.	<i>Pecopteris</i> , <i>Alethopteris</i> , <i>Thinnfeldia</i> , <i>Sagenopteris</i> , <i>Neuropteris</i> , <i>Zeugophyllites</i> , <i>Baiera</i> , etc.

Recherche and South Cape Coal Measures.—The shales and sandstones occupying the low lying country east of South Cape, and south of Southport, have been so graphically described nearly 40 years ago by Dr. Milligan that little more can be added save as to organic contents.*

It is evident that these beds, containing several coal seams, attain a maximum thickness of about 400 feet in the coast line between South and South-East Cape. These beds evidently succeed the Ida Bay coal measures, and belong to the upper mesozoic group. Thus we have in their shales no longer any representations of *Vertebraria Australis* (M'Coy), or *Pecopteris Lunensis* (mihi), but instead we have abundant remains of upper mesozoic forms, viz.:—

<i>Alethopteris Australis</i>	...	...	M'Coy
<i>Thinnfeldia obtusifolia</i>	...	...	mihi
<i>Sphenopteris lobifolia</i>	...	...	Morris
<i>Baiera tenuifolia</i>	...	...	mihi
<i>Zeugophyllites elongatus</i>	...	...	Morris
<i>Phyllothecca Australis</i>	...	...	M'Coy

and abundant remains of the trunks of silicified conifers.

Localities where beds are best exemplified:—Pedro-Bancho Hill, Black Swan Lagoon, Pigsties, Catamaran Creek, Cockle Creek, Coast between South and South-East Cape.

The whole of the members are everywhere disturbed or overlaid by intrusive greenstones, as in the Jerusalem and other basins.

PECOPTERIS ODONTOPTEROIDES (MORRIS).

Pl. vi., fig. 2, 3, 4.

As there is still much doubt as regards the character and identification of the original forms described under the above name by Professor Morris from specimens obtained from the mesozoic rocks of Tasmania, and probably from sandstones of the Jerusalem Basin near Spring Hill, I have considered it advisable to review the whole matter at the present time with the view of helping to clear up some of the difficulties which, in my opinion, have been caused by confounding the original types of Professor Morris with at least two other distinct forms.

Professor Morris describes the original type *P. odontopterooides* as follows:—

Pecopteris odontopterooides (Pl. vi., fig. 2, 3, 4). †

“ Frond pinnatifidly bipinnate or flabellate; pinnae linear, elongate, acuminate; pinnulae opposite approximate, adnate, ovate obtuse, entire; veins nearly obliterated.

* See pp. 188-191, “Systematic account of the Geology of Tasmania,” by the Author.

† Physical description of New South Wales and Van Diemen's Land, by P. E. de Strzelecki, 1845.

"There is some difficulty in assigning this species to the proper genus, in consequence of all the specimens I have examined being imbedded in a coarse sandstone, so that the venation, with the exception of a slight central depression indicative of a mid-rib, is nearly obliterated. With some care, however, in detaching the matrix from the pinnulæ, I have been able to trace what appears to be a slight radiation in the form of the secondary veins, resembling that generally found in *Odonopteris* (whence the specific name); this may prove to be deceptive, and other specimens may perhaps better elucidate this view."

"The general contour of this fern (Pl. vi. fig. 3) somewhat resembles a single pinna of *Neuropteris conferta* (Sternb.); but the pinnules are more oblong, and the terminal one acuminate; but it still more closely approaches in form a pinna of *Odontopteris Permiensis*, a fern described from the Permian system in the work on the Geology of Russia, by R. J. Murchison, Esq.

"Presuming, on the other hand, that it forms a portion of a flabellate frond, a pinna, of which a drawing only has been seen, bears considerable affinity as to its mode of furcation to the recent species of *Gleichenia flabellata*, and under this point of view might be associated with the genus *Laccopteris* (Presl.) should the venation prove to be the same."

Locality : Jerusalem basin.

"A figure has also been given with more lanceolate shaped pinnular, which is probably only a variety of this species."

The above is a full account of the original description of Professor Morris' type species, which was also accompanied by three illustrations (Pl. vi., fig. 2, 3, 4).

Unfortunately in the shales of Jerusalem beds there exists a smaller dichotomous fern, which somewhat resembles the original type of Morris in the attachment of the pinnulæ. The pinnæ of the latter form *Thinnfeldia obtusifolia* (mihi), however, are invariably dichotomised; the pinnules are devoid of any distinct mid-rib, and are altogether smaller and less coriaceous in texture. The veins arise from a common point at the base of the pinnule, from which they diverge to margin by repeated furcations. This form, moreover, occurs in the greatest profusion in the shales of the upper mesozoic beds in Tasmania, and invariably presents the same general characteristics in widely separated localities. Forms identical in all respects with Prof. Morris' original type species are found rarely, and only occur in the coarse sandstones.

It is more than probable therefore that the examples examined subsequently by Prof. McCoy, Messrs. Carruthers, Crepin, Etheridge, sen., Dr. Feistmantel, were identical with the smaller and more abundant dichotomous fern

(*Thinnfeldia obtusifolia*, mihi) from the mesozoic shales, and not the form from the coarse sandstones examples of which are very rare.

As an illustration of the rarity of the latter, I may state that my own experience among Tasmanian rock extends over twenty-two years, and in that time I have only obtained about a dozen specimens of Prof. Morris' original types, always in the sandstone matrix; never in the shales. All of the casts of specimens agree with Prof. Morris' originals, which are invariably coarse, never show dichotomy, and frequently the pinnules, unlike the common *T. obtusifolia*, indicate a trace of a pretty well defined mid-rib.

With such doubt respecting these two forms, which are merged together as one species by Dr. Feistmantel in his last memoir on "The coal and plant-bearing beds of Palæozoic and Mesozoic age in Eastern Australia and Tasmania, pp. 101-105." I think it advisable to retain the original name of *Pecopteris odontopterooides* (Morris) for the rarer original type until such time as we obtain better evidence as to its identity.

To aid in this direction I have figured such of the fragments of the older and rarer fern as are still in my collection (pl. ii., figs. 1-5), all of which have been obtained from the sandstones of the Jerusalem basin. Like Professor Morris' specimens, the blackened impressions alone exist. There are traces of what appear to be a well-defined mid-rib in several of the pinnules, but in no example have I seen any indication of dichotomy of the terminals of the pinnæ, so constant a character in the smaller abundant form—*Thinnfeldia obtusifolia* (mihi).

Dr. Feistmantel has also, in the memoir already referred to, included another form under *Thinnfeldia odontopterooides* (Morris), viz., figs. 1, 1^a, 1^b, 2, 2^a, 2^b, Pl. xxix.; figs. 1, 1^a, 1^b, 2, 2^a, Pl. xxx., whose identity with either *P. odontopterooides* (Morris), or *T. obtusifolia* (mihi), is more than doubtful. The robust branching fern from Victoria, and New South Wales, the Hawkesbury series certainly approaches *T. obtusifolia* (mihi) in the upper pinnæ, but while I recognise the rare judgment and wide knowledge of Dr. Feistmantel, I am still doubtful whether the two forms are conspecific. The complete absence of dichotomy, in the terminal pinnæ, and the more robust character of this fine fern contrasts widely with *T. obtusifolia* (mihi), which, from the detached remains, never found in a branching connection, indicate probably repeated dichotomy, as in our existing *Gleichenia flabellata*, as suggested by Professor Morris.

For this reason I think it would be well at present to distinguish the splendid robust form from Mount Victoria by a separate name, say *Thinnfeldia Feistmantelli*, in honour of

the distinguished palaeontologist who has done such valuable work in the elucidation of our Australasian Fossil Flora.

OSMUNDIA.

In the leaf beds near Glenora, underlying the older basaltic plateau, of which a brief description is given in my larger work on "The Geology of Tasmania," p. 289, recent examination has enabled me to add several interesting new forms to our knowledge of the plant life of the Lower Tertiaries of this island (*Palaeogene Period*).

Among these occur the more or less perfect impressions of the pinnae of a fern which, from their size, form, mode of attachment, and characteristic neuration, suggest alliance with the existing genus *Osmunda*.

The absence of all knowledge regarding fructification, however, makes it hazardous now to refer it to that genus; for the form and mode of neuration also suggest alliance with certain barren pinnules of *Lygodium* (*Lygodium? Strzleckii* Ettings., "Tertiary Flora of Australia," Sydney, 1888), and with barren pinnules of *Llavea* (see *Llavea cordifolia*, Lagasca), and so cause much doubt as to its true generic position.

I have, therefore, thought it prudent in our present state of knowledge to place it under the provisional generic name *Osmundia*, under which also may be temporarily placed all *incertæ sedis* of allied characters.

PLANTÆ INCERTÆ SEDIS.

Osmundia (Nov. gen.)

Frond unknown; barren pinnules large, symmetrical oblong, or oblong-lanceolate, entire, somewhat obtusely pointed, the lower base slightly auricled; Neuration Neuropteridean; primary nerve distinct; secondary nerves acutely ascending, sharp, thin, dense, dichotomising and slightly curving towards extremities. Horizon--Lower Tertiary Leaf-Beds, Glenora, Tasmania.

Osmundia Tasmanica. Nov. sp. (Pl. I., fig. 2).

Sp. char.—The same as the genus. Apex generally pointed and roundly-obtuse; primary nerve firm, evanescent towards apex; margin somewhat indistinct, but showing indication of serrature. Length of larger pinnules 2 inches; breadth, $\frac{5}{8}$ ths of an inch.

There is every appearance that Dr. Ettingshausen's *Lygodium Strzleckii* is generically allied. The fragment of a pinnule described by this eminent authority from a similar horizon at Vegetable Creek, New South Wales, was too

imperfect to determine either its position or even the character of the entire pinnule, or its mode of attachment. It would be perfectly safe, however, to refer it to the specially created genus *Osmundia* as defined by me, and I would suggest that, for the present, it be referred to as *Osmundia Strzleckii* Ettings, as a congener of the closely allied *O. Tasmanica*, mihi, occurring in the Leaf Beds of Glenora.

Phyllites salicifolium, nov. sp.

(Pl. I., fig. 3.)

Leaf imperfect, linear lanceolate acuminate, sharply serrato-dentate; mid-rib distinct; secondary nerves thin, simple, curving gently upwards, and reaching margin and forming the sharply-defined upper edge of each serrature; 13 pairs in upper half of leaf; length of complete specimen about 3 inches; greatest width at middle about $\frac{9}{16}$ of an inch.

Horizon.—Lower Tertiary. Leaf Beds near Glenora.

Phyllites Oleaciformis, mihi.

(Pl. I., fig. 1; also Pl. XXXVII., fig. 2. Geol. of Tas.)

Leaf imperfect, ovate; margin distantly serrato-dentate; mid-rib distinct; secondary nerves—14 pairs—obscure, fine, simple, hidden in a somewhat coriaceous integument, and gently curving upward, reaching upper margin of each serrature; surface covered regularly with small round glandular dots.

Length complete, $2\frac{3}{4}$ inches; greatest breadth at middle, 1 inch.

Horizon.—Occurring with the previous species.

Banksia lancifolia. Ett.

(Pl. I., fig. 4.)

Although only a fragment, the characters of this leaf impression are in all respects identical with a form under the above name described by Ettingshausen ("Tertiary Flora of Australia," p. 141, Pl. xii., fig. 15) from a specimen obtained at Old Rose Valley Lead, N.S. Wales. The following is the description given of the complete specimen:—

"*Banksia lancifolia*. Sp. char. B. foliis petiolatis coriaceis anguste lanceolatis, basi acutis, apicem versus sensim attenuatis, margine spinoso-serratis; nervatione brochido-crassipedodroma; nervo primaris valido, prominente; nervis secundariis subangulis 55-56° orientibus, tenuibus subarcuatis, approximatis; nervis tertiaris rectangularibus, dictyodromis; rete microsynammato tenerrimo."

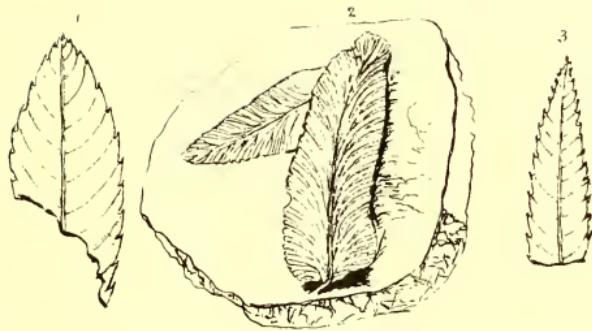
. . . Approaches near to the *Banksiæ* of the European Tertiary Flora.

Locality and Horizon.—Old Rose Valley Lead, N.S. Wales; Glenora Leaf Beds, Tasmania.

In part II., now under preparation, will be described a number of new and interesting plant forms, discovered in collections sent to me by the Rev. J. Bufton, F.L.S., of Dunally, from Mesozoic shales in that locality.

Geologists, as well as the writer, are indeed much indebted to this accomplished naturalist for the skill and commendable energy he has displayed in enriching our knowledge of the fossil plants of this island by his numerous collections in that part of the country in which he now resides.

Pl. i.



Pl. ii.

