Coal...	3	0
Blue clay shales	0	3
	21	9
Fine grey sandstone	—	—

WISE'S SHAFT.

	Feet.	In.
Yellowish-white clay, more or less laminated with impressions of *Zeugophyllites*, etc....	65	0
Coal	4	0
	69	0
Sandstone	—	—

FRESH CONTRIBUTION TO OUR KNOWLEDGE OF THE PLANTS OF MESOZOIC AGE IN TASMANIA.

By R. M. Johnston, F.L.S.

Certain beds of the well-known grey shales have recently been exposed at Lord's Hill, New Town, by Mr. Dorman, builder, who kindly afforded me every facility for their examination. These beds are intimately associated with the beds containing the coal seams at New Town, and as they were unusually full of impressions of plant remains, I spent several days in making collections and in thoroughly examining the numerous forms. The results have far surpassed my utmost expectation, for in the following pages I shall be able to show that about 15 forms of great interest, new to science, have been added to the list of the Mesozoic plants of this island.

The cycadeous and coniferous plants especially are very important, and are more fully discussed under the section where they are specifically classed and described. The genus Baiera is of more than ordinary interest, as I was fortunate in obtaining both the male and female fructification attached to the pedicels of the plants, which are very numerous in these shales, and share with Thinnfeldia obtusifolia, Johnston; Alethopteris Australis, Morris; Neuropteris Tasmaniensis, Johnston; Pterophyllum Strahani, Johnston, in being the most abundant and typical of the numerous forms of plants occurring in great perfection in the shaly beds at the place indicated.

The following is a more complete list of the species observed by me at this place, all of which were obtained within the space of a few yards in width and one or two feet in

depth. Shales of a similar kind, rich in plant impressions, and containing many forms in common, are frequently met with in road cuttings, etc., throughout the districts of New Town, Glenorchy, Old Beach, Richmond, Spring Hill, and Spring Bay. It will be seen that the new discovery has contributed a very important addition to the already known plants of the period.

LIST OF SPECIES OCCURRING IN SHALY BEDS AT LORD'S HILL, OPPOSITE AUGUSTA-ROAD, NEW TOWN.

FILICES.		
*Glossopteris	moribunda	*R. M. Johnston*
Tæniopteris	Tasmanica	,,
*Sagenopteris	salisburioides	,,
*Rhacophyllum (?)	coriaceum	,,
*Neuropteris	Tasmaniensis	,,
,,	antipoda	,,
*Alethopteris	Australis	*Morris*
* ,,	serratifolia	*R. M. Johnston*
Thinnfeldia	obtusifolia	,,
,,	media	*Tenison Woods*
	superba (?)	*R. M. Johnston*
*Odontopteris	crispata	,,
Sphenopteris	lobifolia (?)	*Morris*
*Cyclopteris	Australis	*R. M. Johnston*
CYCADACEÆ.		
Podozamites	distans (?)	*Presl.*
*Pterophyllum	Strahani	*R. M. Johnston*
*† ,,	Risdonensis	,,
* ,, (?)	dubia	,,
EQUISETACEÆ.		
Phyllotheca	Hookeri	*M'Coy*
,,	ramosa	,,
,,	Australis	*Brongt.*
CONIFERÆ.		
*Baiera	tenuifolia	*R. M. Johnston*
*Salisburia	Hobartensis	,,
*Ginkgophyllum	Australis	,,
Zeugophyllites (Poa-Cordaites)	elongatus	*Morris*

To this list may be added, for the sake of completeness, the remaining forms known to occur in other formations of the Mesozoic period in Tasmania :—

FILICES.		
Sagenopteris	Tasmanica	*Feist*
Danæa	Morrisiana	*R. M. Johnston*
Trichomanides	Ettingshauseni	,,
Thinnfeldia	trilobita	,,
,,	odontopteroides	*Morris*
Sphenopteris	alata	*Brongt*

* Those marked with an asterisk are new species. † This form occurs at Brock's coal seam, Compton.

LYCOPODIACEÆ.

Lepidostrobus	Muelleri	*R. M. Johnston*

CYCADACEÆ.

Sphenozamites (?)	Feistmantelii	*R. M. Johnston*

Formerly referred with doubt to *Rhacopteris*.

CONIFERÆ.

Coniferous trunks of trees belonging to the class *Taxinaceæ*, to which the Poa-cordaites-like leaves of Zeugophyllites elongatus (Morris) in all probability belong.

Mr. Wintle, who has written many interesting articles upon Tasmanian geology, refers to two other species of plants, viz., *Odontopteris Wintlei*, M'Coy; *Endogenophyllites Wellingtonensis*, M'Coy, but it is probable that they are MS. names, as I am not aware that Prcf. M'Coy has ever published specific descriptions. It is impossible, therefore, to say whether my *O. crispata* now described may not be identical with the form submitted by Mr. Wintle to Prof. M'Coy.

Mr. Wintle informs me that he discovered, years ago, a form which he considered to be identical with *Glossopteris Browniana*, near the same spot.

Table showing approximately the known distribution in time of genera of plants occurring in the Upper Palæozoic and Mesozoic rocks of Australasia.

Characteristic Genera in Australia.	Palæozoic.			Mesozoic.			Cainozoic.		
	Dev.	Carb.	Per.	Trias.	Juras.	Cret.	Eo.	Mio.	Plio.
PLANTÆ.									
Filices.									
Glossopteris* †		—	—	—					
Gangamopteris†		—	—						
Tæniopteris*				—	—				
Macrotæniopteris*				—	—				
Angiopteridium*					—				
Sagenopteris*...				—	—				
Sphenopteris* († ?) ¶		—	—	—	—	—	—	—	
Trichomanides*				—	—				
Aneimites‡	—								
Archæopteris‡	—	—							
Rhacopteris†		—							
Neuropteris*				—	—				
Thinnfeldia* ¶				—	—				
Pecopteris* († ?)	—	—	—	—	—	—		—	
Odontopteris*			—	—					
Cyclopteris*									
Alethopteris* ¶		—		—	—				
Merianopteris*				—	—				
Gleichenia*					—	—			
LYCOPODIACEÆ.									
Lepidodendron‡	—	—	—						
Lepidostrobus*		—	—	—					
Cyclostigma*		—							
Tasmanites†		—	—						
Phyllotheca* († ?) ¶				—	—				
EQUISETACEÆ, CYCADACEÆ.									
Podozamites*				—	—	—			
Sphenozamites*					—				
Pterophyllum*		—	—	—	—	—			
Ptilophyllum*				—					
Otozamites*				—	—				
Cordaites†	—	—							
CONIFERÆ.									
Salisburia*				—	—	—	—	—	—
Noeggerathiopsis† (Rhipidopsis ?)... ...		—	—	—	—				
Zeugophyllites* (Poacordaites ?) ¶... ...		—				—			
Baiera*				—	—				
Ginkgophyllum ?*			—	—	—				
Brachyphyllum*				—	—				
Walchia*			—	—					
Sequoiites ?*				—	—	—	—	—	—
Cunninghamites*				—	—	—	—	—	—
Araucarites*					—	—	—	—	—

† In rocks of Carboniferous age. * In rocks of Mesozoic age.
¶ Occurs in Newcastle beds.

With such important additions to our knowledge of the flora of the Mesozoic rocks of Tasmania, it becomes a question of much interest to enquire how far they shed light upon disputed questions regarding the exact age of the beds in which they are found, and therefore of the age of the upper coal measures of Tasmania and Australia generally.

The comparative tables given showing the wide range of distribution of most of our typical Mesozoic genera indicate that parallelism with the subdivision of distant regions is not such a simple question as some authorities seem to think. It is beset with many fundamental difficulties, among which I cannot too strongly urge the consideration of centres of origin.

Have we any just reason for supposing that there were many centres of origin from whence sprung independently similar genera, and if so, have we also good reasons for supposing that from these several centres identical forms sprang into existence in opposite hemispheres at the same point of time, or even within the same geological period?

Those who agree with Darwin in referring the origin of higher forms of life to one pair (an hypothesis which the author inclines to) would at once reject such a supposition as being opposed to the best evidence. But even should it be admitted that the higher species and genera sprang from one particular pair, have we at this moment sufficient evidence to show, with anything like certainty, at what point of time and in what spot of the earth's surface each particular genus came into existence?

When we consider how small a portion of the earth's surface has yet been examined with sufficient care, and how large is the space comparatively unexplored, he must be bold indeed who would allege that those centres (principally European) where certain species or genera are first known to appear are also the centres of their original appearance as regards the face of the whole globe.

Further, the question of *distribution* over wide areas requires special consideration. It is well enough known that *species* of the lower forms of plant life, such as ferns and mosses amid the vicissities of change of situation, have spread over both hemispheres without such a departure from the central type as would constitute a distinct species; but is this true as regards higher forms, such as cycads and conifers? And even where this question can be answered in the affirmative can we be certain that the distribution of a given species from, say, one hemisphere to its antipodes would be effected within a single geological period, not to mention the difficulties of transfer—natural and physical—which would

act as checks to distribution within the period covered by any one *sub-division* of a system?

It is difficult to answer such questions satisfactorily, but if we take each point carefully into consideration we must arrive roughly at such conclusions as the following:—

1. It is improbable that all species had their origin in one particular hemisphere.

2. It is probable that some species originated in the Northern Hemisphere, while others had their origin in the Southern.

3. It is reasonable to assume when species or genera have spread from the centre of origin to another hemisphere that a considerable period of time must have elapsed.

4. Where such world-wide distribution of forms has taken place we can imagine in either hemisphere their appearance in one local *formation* or *series*, some of them having originated locally within the age of the system or formation, while others were immigrants from an opposite hemisphere, which might date their original appearance to an anterior period in some spot on the opposite hemisphere, where it is natural to expect a wide difference in the form and character of their associates as compared with those to be met with in the subsequent position to which they migrated.

If this very reasonable supposition be admitted, and I do not see why it should be rejected, of what value is the classification of Australian rocks which too slavishly follows the sub-divisions of great periods or systems as they occur in Europe, upon the mere evidence of two or three genera whose association in the rocks of a particular horizon in Europe may only be of local significance? No better illustration of the utter futility of such modes of classification can be given than that indicated by the peculiar association of animals and plants in Australia, within the Upper Palæozoic age, as compared with the associated animals and plants in the European rocks of the same period. For whatever disputes there may have been regarding the relationship of the Upper Palæozoic marine beds of Australia with the lower coal measures, chiefly containing plants belonging to the genera *Glossopteris*, *Gangamopteris*, and *Noeggerathiopsis*, there is now not the slightest doubt but that these plants are as characteristic and are as intimately related with the carboniferous marine beds of Australasia as the characteristic genera *Pecopteris*, *Neuropteris*, *Alethopteris*, *Sphenopteris*, *Lepidodendron*, *Sigillaria*, and *Calamites* are with respect to the carboniferous marine beds of Europe.

Judging from the marine organisms alone there are little difficulties in the way of proving the homotaxial relationship

of the Australasian and European rocks of carboniferous age, for, out of a known list of about 311 Australasian species, we have the high authority of de Koninck for stating that fully 23 per cent. are specifically identical with those of the carboniferous marine beds of Europe. In this instance the results of migration from one centre does not present greater difficulties than could be disposed of by the ordinary interpretation of the theory of homotaxis.

But what shall we say of the plants? Here there is an insuperable difficulty. The common interpretation of homotaxis does not help us much, for there is not the faintest correspondence between the typical plants of the same age in opposite hemispheres. Indeed, it can easily be seen by reference to accompanying lists of plants that there is a greater characteristic relationship between the Mesozoic plants of Australasia with the Carboniferous of Europe than there is between the known Carboniferous plants of the respective regions.

How can we explain this anomaly? For my own part I do not see what other explanation can be given than that already suggested—viz., independent and widely separate centres of origin, producing by slow radiating diffusion subsequently into far distant regions those seemingly inexplicable complications where characteristic types of two separate ages appear to commingle.

This interpretation would help to explain the utter lack of homotaxial parallelism between the marine and terrestrial organisms of Australasia and the corresponding organisms of Europe.

The fact that there is a closer parallelism between the marine remains of the two widely separated regions is probably due to the greater facilities for more rapid diffusion of types among the marine inhabitants of a continuous sea as compared with the slower diffusion of terrestrial organisms, barred as it must often have been by wide tracts of sea and other physical obstructions. This conclusion is borne out by the illustrious Darwin, who states (pp. 229-300, "Origin of Species"):—"The process of diffusion would often be very slow, depending on climatal and geographical changes, on strange accidents, and on the gradual acclimatisation of new species to the various climates through which they might have to pass, but in the course of time the dominant forms would generally succeed in spreading, and would ultimately prevail. The diffusion would, it is probable, be slower with the terrestrial inhabitants of distinct continents than with the marine inhabitants of the continuous sea. We might therefore expect to find, as we do find, a less strict degree of

parallelism in the succession of the productions of the land than with those of the sea."

When Darwin, therefore, refers to simultaneous change of organisms in different ages throughout the world, he expressly states that the meaning must be taken in the broadest sense. Indeed, he affirms, "it must not be supposed that it has a very strict geological sense, for if all the marine animals now living in Europe, and all those that lived in Europe during the Pleistocene period, were compared with those now existing in South America, or in Australia, the most skilled naturalist would hardly be able to say whether the present or the Pleistocene inhabitants resembled most closely those of the southern hemisphere." A more striking illustration might be added as regards terrestrial forms of life, for if we regard the existing characteristic plants—*Banksia, Grevillea, Lomatia, Eucalyptus, Laurus, Cinnamomum*—of Australia the skilled naturalist would find equal difficulty in concluding whether the Miocene or existing terrestrial forms of Europe resembled most closely those characteristic terrestrial forms now existing in Australia. And a still more striking illustration may also be given from Tasmanian rocks of Miocene age, where a vegetation, consisting of oaks, elms, beeches, alders, laurels, etc., prevails, showing a *closer* resemblance to the existing vegetation of Europe than is exhibited by the existing vegetation of Tasmania.

Henry Alleyne Nicholson, in his "Manual of Palæontology," also gives a striking illustration of the danger of drawing hard and fast lines of demarcation between subdivisions of systems in widely separated regions on the basis of European classification. He states (p. 48):—"Moreover, when we come to examine the boundary-line between the Cretaceous and Tertiary in a region far removed from Europe—namely, in North America—we find that between the two formations, so widely separated in the Old World, we have some four thousand feet of strata (the so-called 'Lignitic series') containing such a complete intermixture of the forms of life characteristic of these two periods, that it has been a matter of lively controversy whether they should be regarded as the summit of the older or the base of the newer series of sediments." In New South Wales we have also a similar illustration in the existence of an assemblage of plants, combining in the same formation (Newcastle Beds) the typical forms *Glossopteris, Gangamopteris*, of the lower carboniferous coal measures, with the typical forms *Phyllotheca, Sphenopteris*, and *Zeugophyllites* of the more recent Mesozoic formations, and hence we must concur with Prof. Nicholson in the statement (pp. 45, 46), "and therefore we

cannot parallel the *sub-divisions* of such formation with anything approaching to absolute precision. Regarded as a whole, however, the Carboniferous formation of America is the geological equivalent of the Carboniferous formation of Europe." Of similar value are the utterances of W. T. Blanford and Prof. Hutton. The former urges that in India "the breaks in the sequence do not correspond with those especially remarkable in Europe." The latter boldly affirming, in respect of New Zealand, a truth which, in my opinion, is equally applicable to Australia and Tasmania, viz., that "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."

I have on a former occasion observed that Palæontology divorced from facts of *local* stratigraphy is most unsatisfactory, for we have the authority of Huxley ("Lay Sermons," p. 234) for the statement, "All that geology can prove is *local order of succession*." The question of distribution from one geographical centre to its antipodes is also complicated by the tendency in later periods to an increase in number and variability of species, involving a greater risk in the increasing struggle for *specific* existence over wide areas. This is plainly indicated by the fact that while the molluscs of the Carboniferous period in Europe and Australasia have at least 23 per cent. of the *species* in common, the molluscs of the tertiary period in the same regions have not even *one* per cent. of the species in common.

Of course English geologists have not had this aspect of the case pressed home so closely to them in a practical way, because unlike Australian geologists they have not been hampered in their schemes of local classification by dependence upon the widely differing association with respect to the stratigraphy and palæontology of a far distant region. Had they to form their sub-divisions of systems with dependence upon the associations of Australasian stratigraphy and palæontology the difficulties of the matter would have at once become apparent to them as it now appears to Australasian geologists.

With these facts and considerations before us I cannot but express my strong conviction that it would be unwise to accept the triple sub-division of *Triassic*, *Jurassic*, and *Cretaceous*, for the Mesozoic rocks of Australia and Tasmania, as such triple sub-division does not in the remotest degree harmonise with the local facts of either stratigraphy or palæontology.

In Tasmania there is no break showing alternations of sea

and land throughout the whole series of formations belonging to the Mesozoic period, and typical specific forms persist throughout all the separate groups which, from their extent, indicate a vast period of time. The great sameness of forms of vegetable life throughout presents a great difficulty in breaking up our scattered formations of this age into geological subdivisions, and I, at least, am as yet far from prepared to indicate any satisfactory lines whereby the whole series could even be separated into superior and inferior groups. In time, when the distribution of certain forms can be more exactly determined, a simple method of grouping, having a local significance, may be adopted with advantage; but in the meantime I am convinced that it is only on the broad lines of systems that we can suggest parallels with European and other distant regions.

DESCRIPTION AND REMARKS REGARDING NEW SPECIES, ETC.

DESCRIPTION OF NEW SPECIES.

FILICES.

Glossopteris (?) moribunda, Nov. sp.

I have discovered two fragments of a small species associated with the common Mesozoic forms at the shaly beds at Lord's Hill, New Town. It is not certain that they may yet prove to be a form of Sagenopteris, as their bases were both imperfect. The largest fragment is 42 millimetres long, 13 millimetres at its broadest part near the top, and 9 millimetres at the base of fragment, to which it gradually tapers; midrib distinct, from which branch off at an acute angle about 12 principal nerves in the length of fragment. These nerves, after acutely ascending from midrib, curve and branch outward dichotomously and flexuously, forking two or three times before reaching margin, anastomosing at each fork. The meshes, however, are more open than in the larger forms of *G. Browniana* from the lower coal measures, and the nerves appear to be more raised and wrinkled. The frond itself also appears to be more coriaceous and fleshy.

As indicated by the measurements, the frond is somewhat linear-spathulate in form. In the smaller specimens the spathulate appearance is far less pronounced. They are unlike any description given of *Sagenopteris rohifolia* or *S. Tasmanica,* and apart from the circumstance that their bases and mode of insertion are unknown, they seem to me to be more akin to the genus Glossopteris, to which they have been provisionally referred. It would appear, therefore, that these rare forms are the dwarfed or degraded descendants of that genus which gave such a peculiar character to the

shales of the lower coal measures by its wonderful profusion, and are an indication of the fast approaching extinction of the genus in Australian rocks.

It is of additional interest in connection with this genus that Erough Smith many years ago obtained a specimen of *Glossopteris*, stated to be *G. Browniana*, from beds of nearly the same horizon at Spring Hill. It is possible that the two forms may be closely allied. I am not aware whether the Spring Hill specimen has ever been figured or described. It would be of interest if both forms could be compared closely together.

Sagenopteris salisburioides. Nov. sp.

Frond, palmate or flabelliform, membranous, quadrilobate; the median division is wide, and the frond is thereby deeply cleft to base; the two lateral divisions are simple incisions to nearly the middle of frond. Segments entire wedge shaped; the principal ones very much contracted at base, almost pedicellate. Apices of segments truncate, with margins either crenulate, undulating, or simple. Nervules springing from two or three prominent nerves at peduncle, and rapidly spreading dichotomously into fine branching venules towards the upper margin, anastomosing frequently. No approach to a central rib on any segment.

Fronds variable in size but constant in general form. One of the smaller perfect forms measures 30 millimetres in breadth and 25 millimetres in length, but there are specimens occurring in fragments fully twice this size. At first sight the plant would seem to be a species of *Salisburia*, as in form it closely resembles *S. Huttoni* Sternb. from the Lower Jurassic of Europe.

Not uncommon in dark grey shales at Lord's Hill, New Town.

Rhacophyllum coriaceum. Nov. sp.

I have doubtfully placed a peculiar form under the above genus for the sake of reference, as it is of frequent occurrence in the Mesozoic rocks at New Town, Spring Bay, and elsewhere. The fronds are generally imperfect, and they are very variable within certain limits.

Frond or pinna simple, rarely distantly lobed, linear or linear lanceolate, very attenuate at the base, gradually but slightly widening towards obtusely rounded apex, usually forking at a very acute angle into two secondary linear pinnæ which preserve the same character as the principal one. Mid rib marked by a shallow central groove in the coriaceous and fleshy-like frond from which the acutely angled nerves can be traced with difficulty. Margins of secondary pinnæ, sometimes obsoletely lobed, but more frequently entire;

the greatest breadth is attained towards apex of secondary pinnæ, where it usually measures about from 4 to 10 millimetres. Extreme length of specimens about 5 inches.

Neuropteris. Brongt.

Fronds pinnate or bi-tri-pinnate generally twice or thrice divided. Pinnules entire, constricted at the base, and not uncommonly cordate with a short pedicel, rarely inserted by the whole width of the base, costa more or less distinct, only occasionally continuous beyond the middle of the pinnule, thence dividing into veins which emerge at a very acute angle, curved, diverging. Numerous slender dichotomous produced to the margin in parallel venules, and never anastomising.

Neuropteris Tasmaniensis. Nov. sp.

Frond bi- or possibly tri-pinnate; pinnules sub-opposite, generally constricted at base or sub-pedicellate, sub-distant; polymorphous, being either ovate, oblong-ovate, sub-hastate, panduriform, lozenge-shaped or dolabriform, and frequently auricled or lobed at base on one or both sides, and occasionally lobed towards apex; the middle series are generally larger and more symmetrical, usually oblong-ovate, and are attached to rachis at right angles by their constricted bases; the upper series are more oblique, and at the very extremity of one of the pinnæ the lobes are very oblique, simple, ovate, adnate; towards the base the inner lower pinnules (two to four) are rudimentary, rounded, shortly spathulate, or lozenge-shaped; the outer basal lobes are larger, generally auricled or lobed, oblong-ovate, or panduriform. Costa more or less distinct on the more elongate pinnules, continuous to near the extremities, from which numerous lateral nerves diverge arcuately at a considerable angle forking once or twice before reaching margin. Costa absent in the short rudimentary pinnules at base and apex of pinnæ.

Rachis comparatively thick; traversed longitudinally by wrinkled striæ.

Average length of pinnæ on specimen described about 5 inches; greatest breadth across pinnules about 40 millimetres; largest pinnules about 21 millimetres long and 8 mil. broad; smaller pinnules, 4 to 7 mil. long and 6 to 7 mil. broad.

The sub-pedicellate attachment and the fantastic shape and distribution of the pinnulæ bring this interesting species near to *N. valida* Feist, of the Lower Gondwanas of India. It differs from this species, however, in its branching habit and its much smaller proportions.

Dark grey shales, Mesozoic coal measures, Augusta Road, New Town, Hobart.

Neuropteris antipoda. Nov. Sp.

Frond pinnate (or bi-pinnate?); pinnæ probably linear-lanceolate; pinnules coriaceous, slightly falcate, symmetrical, regular (seven in the space of 40 millimetres), alternate, slightly angled, ovate-lanceolate, closely set, subauriculate, and only attached to rachis by a very short pedicel. Costa fine and flexuous but distinct, continuous beyond middle of pinnule; secondary nerves arising from costa and reaching margin at an acute angle, few, distant (about six pairs), alternate, flexuous, dichotomous.

Breadth of pinna, about 36 millimetres; breadth of pinnula, 6 to 7 mil.; length of pinnula, about 19 mil.

This distinct form approaches *N. gigantea* Brongt., but the small number of nerves is very exceptional, and is very characteristic.

Dark grey shales, Mesozoic coal measures, Augusta Road, New Town.

Alethopteris serratifolia. Nov. sp.

Frond bipinnate; pinnæ very oblique, sub-alternate, distant; pinnulæ rather coriaceous-lanceolate, falcate, and somewhat obtuse, oblique, slightly incurved, closely set or adnate, decurrent, dilated towards base where crispate, margins often overlapping are strongly distantly dentate or serrate; midrib somewhat flexuous, rather thick, evanescing towards apex; veins oblique, rather distant, forking once or twice before reaching margin. Stipes with two well-marked grooves, giving an angled appearance; rachis usually with one central groove; average distance apart of pinnæ, 27 millimetres; breadth of pinnæ, about 28 millimetres, near to rachis; average length of medial pinnæ, about 8 inches; length of larger pinnulæ, 17 millimetres; greatest breadth at base, about 7 millimetres; breadth of stipes, $3\frac{1}{2}$ to 4 millimetres; length of fragment, 10 inches. Occurring in shaly beds at Lord's Hill, New Town.

This form is very handsome, and is easily distinguished from *A. Australis* by its more robust appearance and its crisp or sinuous dentate pinnulæ. In some respects it approaches *A. currani* (Ten. Woods), but its more robust form the greater size of the pinnulæ, and the more coarsely and continuously dentate margins, easily distinguishes it from that species.

Genus Odontopteris. Brongt.

Fronds pinnate; generally bi-pinnate at the apex. Pinnæ, pinnate, and pinnatifid. The apical ones single, sub-opposite, and sub-alternate, linear-lanceolate; pinnules obliquely inserted by the whole base; decurrent free, but towards the

apex more and more confluent, and the terminal ones united, slender, ovate-accuminate, rarely somewhat rounded, the lowest ones seated partly on the primary and partly on the secondary rachis of two forms, either narrow at the base, broadly cuneate, and more or less deeply emarginate above or obcordate. Veins all arising from the rachis, extremely fine, dichotomous, diverging as they ascend. No costa. Fructification unknown.

Odontopteris crispata. N.S.

Frond imperfect; pinna, linear-lanceolate, with undulating or pinnatifid lobes obliquely inserted upon rachis; pinnules or lobes crispate, with undulating margin sub-opposite, obtusely and obliquely rounded; length, twice the breadth; lower margin longest and very oblique; veins all arising from the rachis, closely set, but sharply marked; once forking at base or near the middle of the scarcely pinnatifid lobe. The veins follow the same highly oblique angle as the lower margin of lobe. Rachis thick with a continuous sub-central groove. It is evident from the absence of free lobes that the portion of pinna described was situated near the apex of frond. Greatest breadth of pinna, 16 millimetres. Greatest length of base of undulating lobe, about 16 millimetres.

Greyish black shales, Augusta Road, New Town.

Sphenopteris lobifolia. Morris.

S. hasta. M'Coy.
S. germanus. M'Coy.
S. plumosa. M'Coy.
S. flexuosa. M'Coy.
S. creba. M'Coy.

In the shales at New Town there are abundant remains of a fine large fronded species of Sphenopteris, which at first sight I was disposed to consider belonged to a new species, but a more careful diagnosis now strongly inclines me to believe that it is a very variable form whose pinnulæ are simple, free, or pinnatifid, serrated, incised, or variously lobed from 1 to 5 on each side in extreme cases, according to their situation on the pinnæ, the latter themselves varying accordingly as they are situated towards base, middle, or extreme apex. The neuration partakes in this tendency to vary with the form and situation of the pinnulæ.

From several fine specimens I am able to estimate that some of the fronds measured at least over 1 foot in length,

with greatest breadth towards middle of from 4 to 5 inches. There are 27 pairs of alternating pinnæ disposed on either side of the principal rachis or stipes diminishing gradually to either extremity, where they are reduced to variously lobed pinnulæ. The whole shape of frond is therefore broadly lanceolate or ovato-lanceolate-acuminate. At the base of the lower middle pinnæ the pinnules answer to Morris's *S. lobifolia.* The basal pinnules of immediately succeeding pinnæ answer to M'Coy's *S. hastata* and *S. flexuosa;* towards apex where the pinnæ are themselves reduced to pinnulæ examples could be found corresponding to M'Coy's *S. germanus* and *S. plumosa;* while in the greater number of intermediate pinnæ the following description for *S. crebra* (T. Woods) would equally serve for the pinnules of our abundant Tasmanian form, viz., "pinnules so close together as not to be easily distinguished, faintly pinnatifid; lobes a little more oblique than the pinnæ, oblong-ovate, with a slight undulating margin; costa sending off veins which fork once, and the venules reaching the margin." This being so, I shall be inclined to regard the various species named as so many varied parts of our variable form, that is, so long as it remains uncertain that the features which characterise the fragments hitherto erected into separate species are persistent throughout the whole frond of perfect specimens.

Cyclopteris Australis. Nov. sp.

Frond large, graceful, broadly rounded and flabelliform, divided towards extremities into seven or eight digitate segments. Segments somewhat cuneate, with irregularly truncate and crenulate margins. The nerves spring from a common centre at base of flabellate frond, where they compose about five primary groups, each one breaking up dichotomously into four branching venules, these again forking once or twice before reaching the extreme margin of the incised lobes. The nerves are fine and rather widely spreading, although firm and well marked, as in the existing *Trichomanes reniforme,* Forst.

Greatest breadth of frond, about 90 millimetres; greatest length, about 75 millimetres; breadth of segments, from 10 to 15 millimetres. Dark grey shales, Augusta-road, New Town.

ZAMIEÆ.

Genus, Pterophyllum.

Fronds probably caducous, pinnate; segments elongate, linear, firmly inserted at an angle by their whole base upon the rachis, but separate from each other, but truncate to the apex. Nervules simple, equal, parallel, reaching to the apex of the truncate pinnules.

Pterophyllum Strahani. N.S.

Frond imperfect; large, sub-alternate; pinnules moderately broad, linear, sub-opposite, roundly truncate at extremities, distant and horizontal towards middle and base; approximate almost confluent, and becoming highly angled towards apex of frond; each pinnule inserted by its whole base; bases confluent, curving, and broadening out into a narrow wing against rachis, between the middle and inferior pinnules; sinus rounded between the lower distant pinnules. The pinnules vary considerably in breadth, and some of them (three in specimen described) are cleft from the middle to the apex. Nerves, fine, parallel, dichotomous, about 8 to 16, according to breadth of pinnule; rachis thick grooved and striated. Lower and middle pinnules from 65 to 80 millimetres long, and from 12 to 15 millimetres broad.

Dark brown shales, Augusta-road, New Town, associated with *Salisburia*, *Baiera*, *Tæniopteris*, *Cyclopteris*, *Sagenopteris*, *Alethopteris*, *Thinnfeldia*, *Sphenopteris*, *Odontopteris*, *Zeugophyllites*, etc.

This remarkable fossil plant approaches close to *Pterophyllum Morrisianum*, Oldham, from Bindrabun, Rajmahal, India, and suggests affinities with European plants of Liassic age. The extraordinary association of genera in Australasian rocks of Mesozoic age, however, makes it hazardous as yet to fix the exact position of these Tasmanian beds from the association of genera in the opposite hemisphere. Considerations regarding the centres of origin, as indicated by the first appearance of *Glossopteris* in Upper Palæozoic of Australasia, suggest much caution in any attempt to break up our Mesozoic rocks into minor divisions corresponding with the sub-division of European rocks of the same system.

I have named this fossil plant in honour of His Excellency Sir George Strahan, K.C.M.G., Governor of Tasmania.

Pterophyllum Risdonensis. Nov. Sp.

This is a species occurring very abundantly in shales associated with Brock's coal seam at Compton. The fronds are too imperfect to give a proper description, although the fragments show that the species is larger and very distinct from *P. Strahani*, from New Town.

The leaflets are broad, linear, closely set, and inserted upon rachis by their entire bases; extremities truncate or obtusely rounded; nerves strong, parallel, not dichotomous, about 6 in the breadth of each leaflet; the nerves are thus wider apart than in P. Strahani.

Pterophyllum (?) dubia. Nov. sp.

Leaf elongately oval, margins apparently entire, and not divided into segments; nerves very fine or obsolete, sunk in the hard coriaceous integument, but the course of which can be traced by close, gentle, regular, parallel undulations, proceeding from fine but strong midrib, at a moderately acute angle.

It is difficult to find the true alliance of this very peculiar species. Its form is suggestive of *Macrotæniopteris*, but the character of its nerves, and its simple margin which seems to be bordered by a hardened edge or a continuous marginal nerve, leaves one in little doubt of its cycadeous nature.

It is a small specimen, imperfect at the base, and it is significant that at the apex of *Pterophyllum Strahani*, mihi., the segments seemed to coalesce. Greatest length, about $3\frac{1}{2}$ inches; greatest breadth, about 35 millimetres.

It is possible, therefore, that this may be a rudimentary frond of an allied species. The description, however, now given will enable others to identify the form, which is very peculiar, and it is now named provisionally for the sake of reference.

CONIFERÆ (Section Taxees—Renault).

Genus Baiera.

Leaves coriaceous, or more or less cartilaginous; divided from the base into narrow linear segments traversed by numerous fine parallel nerves. The nerves are finely divided, and although at first sight they appear to be dichotomous, they are long and simple in accordance with the length of the segment. Female flowers are disposed at the extremities of the pedicels several times bifurcate. Seeds articulated upon the dichotomous divisions, and the ovate bearing shell or covering swollen or inflated, much smaller than the cells of the *Salisburia*. Male flowers, formed out of the outer woolly covering, numbers of which bear towards the extremities of branchlets 5 to 7 pollen clusters.

Baiera tennifolia. Nov. Sp.

Leaves coriaceous, divided dichotomously from base, like the branching nerves of a fern, and superficially resembling *Sphenopteris linearis*, Carruthers.

Segments narrow, linear, threadlike, traversed by roughly wrinkled nerves, which appear to be dichotomous or discontinuous, but which traverse the whole length of the furcate segments. Greatest breadth of segments varies between one and two millimetres. Fragments of leaves from the three to eight inches in length are very numerous in dark grey shales

at New Town, Richmond, and Spring Hill, associated with Alethopteris Australis, Thinnfeldia obtusifolia, and other common Mesozoic form.

Associated with the larger fragments I was fortunate in obtaining the male and female fructification, which perfectly corresponds with the characteristic description given under the genus. The female fruit, drupe, or nut, is small and round, exserted on the extremities of one of the bifurcating branchlets, which are evidently modified into paired fruiting pedicels, one seed to each pedicel. The pair of short pedicels are symmetrically recurved in opposite directions; the male flower consists of minute clusters of bract-like scales or anthers, attached to a common pedicel, and evidently radiating from a common centre. Several pedicellate clusters near to each other towards the extremities of branchlets. The scale-like bracts are generally ovate and slightly wrinkled. There can be no doubt, therefore, of the reference to *Baiera*. Diameter of seed, about 3 millimetres; length of fruiting pedicel, about 8 millimetres. It is very probable that the plant from Queensland described by Tenison Wood, and classed among ferns as *Jeanpaulia bidens*, is a species of *Baiera*. The Tasmanian species is very graceful in form, and is one of the most abundant plants occurring in the Mesozoic shales at New Town.

Genus Salisburia.

Foliage springing from petiole, spathulate or flabellate, more or less developed towards the extremity; outline of fan rarely simple. Margin crenulate, very frequently its lobes are deeply and dichotomously divided and traversed by numerous nervules.

Salisburia Hobartensis. Nov. sp.

Frond imperfect. (Comp. *S. lepida*, Heer. One of the principal divisions only preserved in the specimen now described.) Principal lobe deeply cleft into two lanceolate segments. Nervules traversing, each lobe fine dichotomous. It is probable that the perfect frond would possess from 6 to 7 principal spreading lobes, each of which would be cleft as in the pair described. Length of each segment about 50 millimetres.

Genus Ginkgophyllum. Saporta.

Branches thick, bearing long cuneiform leaves, which are narrowed into a petiole at the base, decurrent, divided into dichotomous segments; nerve distinct, fine, and closely set.

Ginkgophyllum Australis. Nov. sp.

For the sake of reference I have ventured to give this name to fragments of a plant appearing in the shaly bed at Lord's Hill, New Town, associated with *Baiera*, *Salisburia*, *Pterophyllum*, Thinnfeldia, etc.

It consists of the terminal or rudimentary cluster of cuneate leaflets corresponding very closely to some of those attached to plant *G. Grasseti*, Sap., figured and described in "Cours de Botanique Fossile," by M. B. Renault (Paris, 1885, pp. 67-68, pl. 3, fig. 1.)

Leaves grouped in a curving, clasping cluster, decurrent, segments narrowly cuneate, dividing dichotomously into a crowded head of diminishing segments, some of which are truncate at apex, others obtusely rounded, and all more or less incurved.

The character of the genus is well-marked in these respects, and in the thickish fleshy appearance of the dichotomously divided leaflets, each of which is traversed longitudinally by fine but distinctly marked nerves, which, at the termination of the more obtusely-pointed ones, gradually coalesce. Length of average segment, 13 millimetres; greatest breadth, about 3 to $3\frac{1}{2}$ millimetres. Five successively branching segments in the space of 18 millimetres. Together with these I discovered one or two impressions of larger curved, short, broad, cuneate segments, truncate above, traversed by numerous fine, closely set nerves.

The fragment appears to be much curved, as if its petiole were affixed to stem in a decurrent clasping manner. It is only a fragment, however, about 27 millimetres long; 21 millimetres broad at its convexly truncate apex; and narrows to 14 millimetres at the base of the fragment. It is possible that it may be the terminal part of one of the larger segments placed lower on the stem of *G. Australis.* I think in the meantime the reference to the genus *Ginkgophyllum* is fairly justifiable. It is interesting to observe that this genus is associated with the rocks of Permian age in Europe.

Branchlet of a Supposed Conifer.

I figure a small branchlet of what may be a conifer, also from the shaly beds at Lord's Hill, New Town. The branchlet is about 80 millimetres in length, composed of a central simple linear stem, from which arise at an acute angle about 6 pairs of sub-opposite filamentous branches, each about from 30 to 35 millimetres long. The stem is a little over a millimetre broad, swelling out slightly where the branches emerge; the breadth of the branchlets are less than a milli-

metre, and preserve the same thickness throughout to their blunted extremities.

I have not attempted to name this specimen. It may be an *Abietites* whose minute branches may have lost their leaflets.

Zeugophyllites elongatus. Morris.

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

When Morris described the above species from the Jerusalem Basin he was uncertain as to its affinities, and it is now for many reasons probable that its true alliance is rather with *Poa-cordaites* among the *Coniferæ*.

So far as the prevailing Tasmanian forms are concerned the following description of *Poa-cordaites* would serve equally well with the specific description given by Prof. Morris:—

Genus Poa-cordaites. Grand 'Eury.

Leaves, narrow linear, very long, entire slightly attenuated and obtuse at the apex, traversed by almost equal nerves, parallel not dichotomous, connivent at the base, apparently fleshy.

It is true that M'Coy doubtfully refers the genus to palms, while Tenison-Woods suggests alliance with the cycads near to Podozamites. My own opinion is strongly in favour of a coniferous alliance under *Poa-cordaites*, because of the intimate relation which these linear leaves have with abundant stems and trunks of conifers which, from their beautifully preserved structure, can be referred to the same family *Taxineæ* (Renault).

There is the remains of a perfect forest of these coniferous trunks in the Jerusalem Valley in the same formation where these *Poa-cordaite*-like leaves are so remarkably abundant. Throughout the whole range of the Mesozoic rocks of Tasmania it is significant that these leaves and coniferous trunks abound. I think, therefore, that the leaves of *Zeugophyllites elongatus*, Morris, belong to the coniferous trunks with which they are everywhere so intimately associated. No other coniferous foliage is found in most places where these trunks are in such profusion.

Genus, Noeggerathiopsis.

Leaves (pinnules or segments?) wedge-shaped 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.

Dr. Feistmantel, who has so ably elaborated the Indian fossil plants, erected this genus to include certain peculiar forms which had been previously classed as *Noggerathia*, which, though of doubtful position, is usually referred to the conifers. As regards the position of *Noeggerathiopsis* itself, Dr. Feistmantel is not quite certain, although he inclines to the opinion that it is the leaf of a cycadeous plant. The late Prof. Heer, on the other hand, regarded the closely allied forms classed as *Noeggerathieæ* as belonging to the coniferæ; and Dr. Feistmantel also refers another somewhat similar form *(Euryphyllum)*, associated with *Noeggerathiopsis* in the Talchir Karharbari beds of India, to the coniferæ. Dr. Feistmantel further considers the reference of *Noeggerathiopsis* to *Cycadeæ* with such doubt that he considers it possible (Mem. Geol. Survey, India, ser. xii., 1879, p. 26) that Noeggerathiopsis may yet prove to be closer to the *Coniferæ* than to the *Cycadeacece*, and in such case he suggests they would perhaps represent other species of *Euryphyllum*, which he classes as belonging to the coniferæ.

My present object in drawing attention to this matter is to make further suggestions why *Noeggerathiopsis media*, so abundant in the lower coal measures of Tasmania, should be regarded as a conifer rather than as a cycad.

In the first place there exists in great abundance in Tasmanian carboniferous rocks coniferous trunks of trees, often of great size. One in particular at One Tree Point, Bruni Island, must, at least, have been 40 feet long, and 4 feet in diameter. The only foliage yet discovered associated in the same rocks with these coniferous trunks are the abundant forms of *Noeggerathiopsis*.

If, therefore, the latter be not the foliage belonging to these very abundant silicified trunks of conifers, it is strange that no other trace of coniferous foliage should fail to be disclosed when such forms as *Glossopteris* and *Noeggerathiopsis* occur in such wonderful abundance.

I am all the more inclined to relate the coniferous trunks with the *Noeggerathiopsis* foliage, when I regard how closely the latter corresponds with the coniferous genus *Rhipidopsis*, Schmalhausen, which is described as follows:—

Leaves supported by a very long petiole, coriaceous, palmate, digitate. Segments varying from 6 to 10 entire, those of the middle part extending much beyond the lateral segments, cuneiform almost pedicellate, truncate towards the exterior margin, traversed by numerous nerves repeatedly bifurcate. Fruit in the form of a drupe, but internally striate.

It is further of significance that the fruit of *Rhipidopsis ginkgoides*, Schmalhausen, is almost identical in appearance with certain winged seeds which are invariably found in more

or less abundance wherever *Noeggerathiopsis media* is found in Tasmania. Taking all these matters into consideration, I am strongly inclined to regard *Noeggerathiopsis* as the foliage, and the winged seeds as the fruit of the coniferous trunks referred to.

Thinnfeldia (Pecopteris) Odontopteroides. Morris.

The original descriptions by Morris are as follows :—

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

Prof. Morris also adds that his specimens were embedded in a coarse sandstone, and that he could trace a central depression indicative of a midrib, from which secondary veins radiated. Some of the pinnules in specimens examined by him are stated to have been "more lanceolate shaped," and he considered such forms to be only a "variety" of the one figured. In all these references there is no indication to the smaller form with forking pinnæ and small obtusely rounded pinnules devoid of anything approaching a midrib named by me as a variety under the name *T. obtusifolia.*

Through the kindness of Mr. Robinson, of Spring Bay, I have had the opportunity of examining a large and varied collection of the original types of forms from sandstone at Okehampton. They correspond in every respect to Morris' original descriptions.

In all the variations there is not the slightest approach to a form showing forked pinnæ, nor do they in any way show intermediate forms approaching the form *T. obtusifolia.* In all the pinnules there is clear evidence of a distinct and rather strong midrib, and in this respect differing widely from the finely nerved pinnules of *T. obtusifolia*, which are always free after leaving margin of rachis, approaching the nerves of the genus *Odontopteris* in this respect.

As the latter is the prevailing form in the shales associated with the coal at New Town, Compton, York Plains, Longford, Mount Nicholas, etc., and as the two widely forms have never been found by me together in the same beds, I am inclined to consider them as distinct species. The original form of Morris's *T. odontopteroides* is readily recognised by its more robust and coriaceous appearance, and especially by the deeply-furrowed midrib on the long linear ovate or lanceolate-ovate pinnules.

APPENDIX.

"I adhere to my old divisions under a belief confirmed by subsequent survey that in many regions of the earth the geolo-

gist will find it impossible to classify by the means of such smaller sub-divisions." (Sir Rod. Murchison, Siluria, p. 51.)

Ideal Distribution of Genera in Time from independent or widely-separated geographical centres.

On the hypothesis that all organic genera did not arise and radiate repeatedly from one geographical centre only, and that a considerable space of time would be consumed in the greater extremes of distribution as regards terrestrial plants of higher organisation, the following diagram is designed, roughly illustrating the possible complication arising out of the radiating distribution of genera from widely-separated centres; and also illustrating the different nature of the possible associates to be met with at different stations should the survivals succeed in reaching a middle station or the antipodes of the place of their generic origin.

The cross dotted lines indicate the possible lapse of geological time between the commencement and close of the migration of each genus, and also the curious interweaving of different genera which originated in centres widely apart.

NOTES ON A RECENT CASE OF POISONING CAUSED BY THE EXHALATION OF RHUS RADICANS (TOXICODENDRON) AT THE BOTANICAL GARDENS, HOBART.

By F. Abbott, Superintendent Botanical Gardens.

A very peculiar case of poisoning, caused by plant exhalation, having occurred at these gardens, it is desirable that it should be recorded, not alone for general information, but more especially as it is possible that the plant in question may, to a limited extent, be under cultivation in other places.

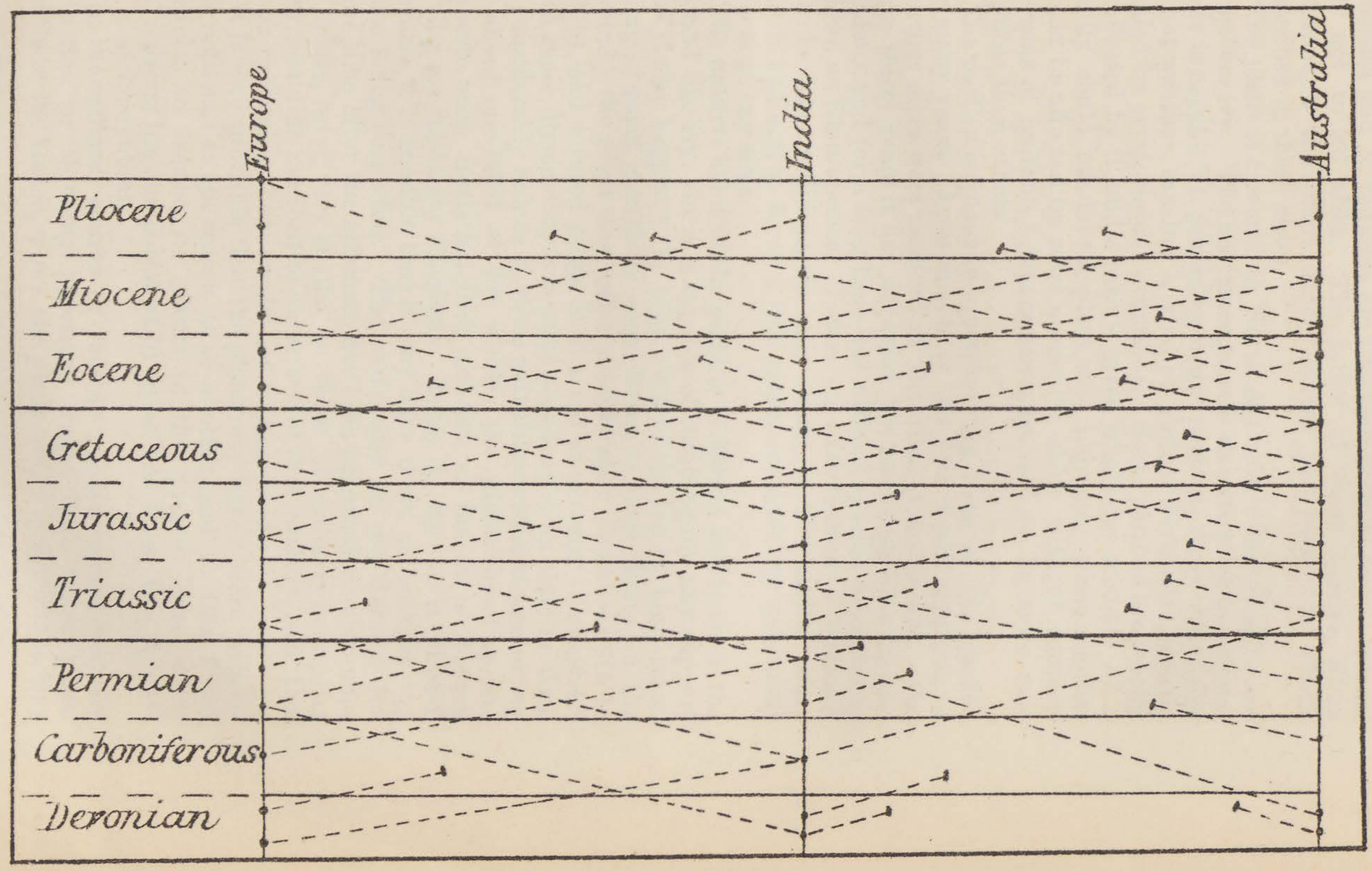
Before describing the case, a few general observations relative to the matter may not be out of place.

The genus Rhus embraces numerous species, many of which produce gums and resins used in the manufacture of superior kinds of varnish. R. verincifera yields the very best japan varnish; others are rich in tannic matter, and are esteemed for the preparation of leather, while not a few of the species are poisonous to a greater or less degree, R. pumila, of Upper Carolina, being the most pernicious of them. A case is reported where the mere gathering of seeds from this species resulted in the poisoning of the whole body, and produced lameness, which lasted for a considerable time. Rhus

Ideal Distribution of Genera in Time

From independent widely separate centres

by R. M. Johnston



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