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A REVIEW AND REVISION OF THE FLORA OF THE VICTORIAN LOWER JURASSIC

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Abstract

Fossil plants occur in the Victorian Jurassic sediments. The majority are impressions only, and are unsuitable for detailed anatomical study.

A review of the literature of the flora, and a list of collections from all recorded localities, are given.

The genera and species are described and discussed in detail.

The most abundant and widespread plants are the typical Jurassic species, but there is also a distinct Triassic element, which indicates that the flora is close to the base of the Jurassic. There is no regularity of distribution or localization of species which would allow a stratigraphical subdivision of the flora to be made.

The Victorian Lower Jurassic—General Geology

The Victorian Jurassic sediments consist of interbedded mudstones and felspathic sandstones or arkoses, with minor amounts of conglomerates, felspathic grits, and bituminous coal seams (Edwards and Baker 1943). They outcrop in the Merino District in Western Victoria (Merino Group), the Otway Ranges (Otway Group), the Barrabool Hills near Geelong (Barrabool Sandstone), and the South Gippsland Highlands (Strzelecki Group), where the Wonthaggi Coal Measures are developed. In northern Victoria, the Ovens Group is represented by several small isolated outcrops in the Ovens Valley (Fig. 1).

Jurassic sediments are also proved by boring over large areas. The most westerly record is at Robe, South Australia, where bores showed Jurassic mudstones and thin coal seams at 1,450 feet (Ward 1926). In the east, Jurassic sediments have been encountered between 2,956 feet and 3,100 feet below sea level in the Sperm Whale Head Bore No. 1, Parish of Boole Poole, 10 miles S.S.E. of Bairnsdale (*Vic. Mines Dept. Boring Rec.*, 1939), and between 3,058 feet and 3,144 feet below sea level in Bore No. 1, Parish of Goon Nure (*Vic. Mines Dept. Boring Rec.*, 1938).

The total thickness of the sediments is not known with certainty. Selwyn (1868, p. 19) estimated 5,000 feet, and Hunter and Ower (1914) also placed the thickness at 5,000 feet, allowing for 1,000 feet of erosion and 1,000 feet possible extension beneath the lowest bore records. Bores have penetrated 2,804 feet in the Otways (Bore No. 1, Forrest, Parish of Yaugher, *Vic. Mines Dept. Ann. Rep.*, pp. 153, 154, 1908, and pp. 157, 158, 1909); 3,032 feet in South Gippsland (Bore No. 1, Coalville, Parish of Moe, *Vic. Mines Dept. Diamond Drill Rec.*, p. 35, 1884); and 2,633 feet at Powlett River (Bore No. 9, *Vic. Mines Dept. Ann. Rep.*, p. 178, 1908); without passing out of the Jurassic.

The base of the series is seen in the Tyers Conglomerate along the Tyers River; the conglomerates and interbedded grits of the San Remo Peninsula, which contain pebbles of the Woolamai granite and of Ordovician sediments and thus mark a marginal facies; and the 'Basal Beds'—conglomerates and boulder beds—in the Barrabool Hills, Geelong (Coulson 1930). The fossiliferous sandstones at Rhyll must also be near the base of the series. At Chitt Creek, near Toora, a conglomerate occurs at the junction of the Jurassic and Silurian (Ferguson 1906).

Silurian bedrock outcrops at Wonthaggi and at Kongwak. It has been reached at relatively shallow depths at Powlett River—382 feet (Bore No. 10, 1908); at Kongwak—610 feet (Bore No. 17, 1930) and 916 feet (Bore No. 16, 1930); at Kirrak—599 feet (Bore No. 2, 1912) and 810 feet (Bore No. 29D, 1912); and at Korumburra—935 feet (Bore No. 93, 1943).

The sediments are of lacustrine origin. It is not known whether deposition occurred simultaneously in several small isolated basins, or in one large basin which was later broken up by Tertiary earth movements. Close faulting, the absence of marker horizons, the lenticular nature of the deposits, and the great thickness and uniformity of the arkoses, make attempts to subdivide the formation very difficult.

Workable coal is restricted to the area around Wonthaggi, Jumbunna, Korumburra and Outtrim, but small coal seams occur throughout the whole Jurassic area. Fossil plants are found in both the arkoses and the mudstones. In the coarser arkose, the impressions are generally coalified and indeterminable. Tree trunks occur in abundance in the arkose, and often reach considerable dimensions, but are not well preserved. Silicified stems are rare. The mudstones allow a much better preservation, and contain abundant impressions of leaves, often very delicate, which show details of leaf shape and venation well. The fragmentary nature of the plant remains, in conjunction with the nature of the sediments, points to a drift origin of the coal and plant beds.

The Flora of the Victorian Lower Jurassic

Introduction

With the beginning of the Geological Survey of Victoria, and the search for workable coal, many fossil plants were collected from localities in South Gippsland, the Bellarine Peninsula, and the Cape Otway and Merino Districts in Western Victoria, and most of these were examined and identified by Professor Sir Frederick McCoy. The death of Professor McCoy occurred in 1900, before manuscript descriptions of these fossils had been completed, and plates of McCoy's illustrations were published by Stirling with very inadequate descriptions. Stirling states that he found it impossible to compare all the illustrations with the original specimens.

Seward (1904) examined a collection of Jurassic plants sent from South Gippsland and the Otways, and Chapman (1908 to 1919) identified and recorded plants from many Victorian localities. Since then, material has been collected by various field workers, and has remained undescribed and for the most part unidentified in the National Museum of Victoria, the Geological Museum, and the Geology Department of the Melbourne University.

In the past thirty years great advances have been made in the study of fossil plants. The investigations of Harris, Thomas, Florin, and many others, have greatly modified the older concepts and methods of investigation, and as a result much of the work of earlier palaeobotanists is in need of revision. In Australia this has been done, as yet, only for Queensland material, the most recent work in other States having been done before the significance of the new methods of investigation was realized.

In this revision of the Jurassic flora of Victoria, all the available material, including most of the specimens investigated by Stirling, McCoy, Seward and Chapman, has been examined. Specimens collected since 1917 from many previously known localities, and from new localities discovered in connection with the revision, have been dealt with.

The Victorian material consists mainly of carbonaceous impressions in which the preservation is poor, and in general is unsatisfactory for detailed anatomical study. This is unfortunate, as recent work has shown the importance of the study of cell structure in fossil plants. Cuticles, in particular, are being used increasingly in the definition of species, and where these remain unknown, many forms can be placed only in the wider form genera and species, and accurate determination is often impossible.

Attempts to obtain cuticles from the Victorian material were completely unsuccessful. The material was first treated with 40 per cent HF, and then macerated with Schultze's solution, followed, after washing, by dilute ammonia. Various modifications of the method were tried, but in all cases the fossil completely disintegrated in solution. An attempt was made to remove the plant from the rock for closer examination, by using a modification of the peel methods of Walton and Koopmans (1928), Graham (1933), and Darrah (1936). With the nitrocellulose peel solution given below, the whole fossil was readily removed from the rock, but no further structural details were observable, and features such as venation, outline, etc., were very little clearer.

Peel Solution:

40 gm. nitrocellulose.
200 cc. solvent—1 part butyl acetate.
2 parts acetone.
20 cc. xylol.
2 cc. plasticiser (castor oil or dimethyl phthallate).

It was thought that by mounting and redissolving the peel, the fossil alone could be obtained, but when the peel dissolved, the fossil disintegrated completely. It seems that there is no film of any type to hold the carbonaceous material together, such as would be expected if the cuticle were preserved. Cuticle is present in the Victorian Jurassic material only in exceptional cases.

Owing to the closing of the Geological Museum prior to the proposed Royal Tour, the Mines Department material became unavailable before a second examination could be made. All the specimens in the National Museum and the Geology Department of the Melbourne University have been examined.

Review of Literature

Literature concerning Victorian Mesozoic plants and the strata in which they occur extends back to the middle of the nineteenth century, but it is nearly fifty years since Seward's important paper appeared, and since then little has been written on the Victorian Jurassic flora. In the following review the results of previous work are given chronologically to show the growth of knowledge of the flora and of ideas on the age of the plant-bearing beds.

At a meeting of the Royal Society of Victoria McCoy (1860) exhibited a new species of *Taeniopteris,* collected by Daintree from the coal works of the Bass River. He particularly noted the strong midrib, with some simple and some forked veins perpendicular to it. The species was compared with *T. vittata* Brongniart of the Whitby Oolite and was named *T. daintreei* McCoy. McCoy believed that it indicated Oolitic age.

In a controversy between Clarke (1860) and McCoy, published by the Royal Society of Victoria, in which the age of the Victorian coal beds and the significance of *Taeniopteris* were involved, McCoy maintained that the Victorian specimens were of Oolitic age, and that as they were identical with many in the Newcastle seams of New South Wales these too should be referred to the Oolite. Clarke combated both conclusions.

Selwyn (1861) reported 'Oolitic Coal Rocks' in a large area in south-western Victoria, outcropping at intervals along the valleys of the Wannon and Glenelg Rivers. *Taeniopteris daintreei* was recorded. A shaft sunk for water at Coleraine yielded Oolitic plants.

Daintree (1861) believed that Jurassic rocks underlay the entire area of Bellarine and Paywit, outcropping only at Port Arlington. Figures, drawn from photographs of specimens, were given of *Zamites longifolius* McCoy, *Z. barklyi* var. *brevior* McCoy, *Z. ellipticus* McCoy and '*Pecopteris* and *Sphenopteris*, new species'.

McCoy (1862) recorded the following fossil plants associated with the coal seams at Cape Patterson and Bellarine, highly characteristic of the Mesozoic: *Pecopteris australis* (identical with the Indian species from the Rajmahal Hills); from Bellarine: *Zamites ellipticus* McCoy, *Z. barklyi* McCoy, *Z. longifolius* McCoy (also seen from N.S.W.); from Cape Patterson, Bellarine and Barrabool Hills: *Taeniopteris daintreei* McCoy.

Wilkinson (1864-65) reported that Mesozoic coal-bearing rocks extended continuously from Geelong to Cape Otway, and thence westwards for an unknown distance, and recorded plants.

McCoy (1867) gave a summary of the plants of the Victorian coal beds and reasserted their age as Mesozoic, relating them to the Burdwan and Rajmahal coal beds of India and the Scarborough series of the Yorkshire Oolite.

The Select Committee on Coalfields, Hodgkinson, Brough Smyth and Couchman (1872), reported that the Cape Patterson, Bellarine, Wannon and Cape Otway fields were all Mesozoic but not equivalent.

Brough Smyth (1874) reported the following plants, identified by McCoy, from shales associated with coal at Corinella, Cape Patterson, Strzelecki Ranges, Bellarine, Loutit Bay, Apollo Bay, Cape Otway and the Wannon River: *Taeniopteris daintreei*, *Sphenopteris* sp., *Zamites ellipticus*, *Z. longifolius*, *Phyllotheca australis*, *Neuropteris* spp., *Hymenophyllites* sp., *Rhizomata*, *Pecopteris australis*.

Krause (1874) recorded plants and abundant impressions at Spout Creek, near Airey's Inlet, at Retreat Creek, Bambra, and at Wild Dog Creek, Apollo Bay. Brough Smyth and Couchman (1874) reported numerous plants one mile from the mouth of Wild Dog Creek.

McCoy (1874-79) in his Prodromus of the Palaeontology of Victoria, figured and described many of the plants associated with the black coal of Victoria, referring them to the Oolite, and provided the first full descriptions of Victorian fossil plants. 1874, Decade I: *Podozamites barklyi* McCoy, *P. barklayi* var. *gracilis*, *P. barklyi* var. *brevior*, *P. ellipticus* McCoy, *P. longifolius* McCoy; 1875, Decade II: *Taeniopteris daintreei* McCoy, *Pecopteris australis* Morris.

Clarke (1878) discussed at length the age of the New South Wales and Victorian coal beds. He contested the opinion of the Victorians that the New South Wales Coal Measures were of Mesozoic age, stating that the beds containing *Glossopteris* were Palaeozoic. He quoted Feistmantel's suggestion of the presence of an Upper and Lower Coal Measures and placed the Victorian beds in the Upper.

Tenison-Woods (1883) listed Jurassic shales as occurring at Cape Otway, Wannon and Glenelg, Cape Patterson to the Latrobe River, and Welshpool, and recorded plants from these beds.

Murray (1889) recorded a new species *Sphenopteris warragulensis* McCoy from the west branch of the Lang Lang River.

Feistmantel (1890) discussed the stratigraphical relations of Australian plant beds and gave complete descriptions of the known plant species.

Stirling (1891) recorded *Taeniopteris* and *Alethopteris* from South Warragul and (1891A) *T. daintreei*, with description, a species of Sphenopteris, and a *Podozamites*, from Korumburra. McCoy (1892) gave a list of determinations of a series of photographs, contained in the National Museum of Victoria, made by Stirling, which included: *Taeniopteris daintreei* McCoy from Jeetho Valley, Wild Dog Creek and South Warragul; *Sphenopteris* (*Eremopteris*) *warragulensis* McCoy, Jeetho Valley and Korumburra; *S. ampla McCoy*, Korumburra; *Podozamites* or *Albertia* or *Palissya*, *Pecopteris australis; Baiera robusta* McCoy; *B. gracilis* McCoy. These made up 'the first moderately extensive collection' of fossil plants from Gippsland and demonstrated the identity of these beds with those at Bellarine and Apollo Bay.

In *Reports on Victorian Coalfields* (1892-1900) Stirling made the first attempt to assemble data on the coal-bearing strata in Victoria. The first report (1892) deals with an area around Korumburra, Nyora, Loch and Bena, and appendix Ci 'Notes on the Fossil Florula and Faunae of the Gippsland Carbonaceous Area' contains a bibliography of the previous literature relating to the Mesozoic flora and a list of the species recorded. Of these *Alethopteris* (*Pecopteris*) *australis* Morris was figured and the following figured for the first time: *Sphenopteris warragulensis* McCoy, *S. ampla* McCoy, *Baiera subgracilis* McCoy, *B. australis* McCoy, *Albertia australis* McCoy. Photographic illustrations are given but descriptions are often lacking and in all cases are inadequate. The age of the beds was stated by McCoy to be Jurassic. The seventh report deals with several plants of which *Sphenopteris warragulensis* McCoy, *S. crassinervis* McCoy, *S. ampla* McCoy, *Podozamites barklyi* McCoy, *Albertia australis* and *Palissya australis* are figured, *Baiera robusta* McCoy and *Phyllotheca australis* are described, and *Alethopteris australis* Morris, *Taeniopteris daintreei* McCoy, *T. carruthersi* Woods, *Sphenopteris fosteri* Stirling, *S. travisi* Stirling, *Sagenopteris carruthersi*, *Baiera australis* McCoy and *Brachyphyllum gippslandicum* McCoy were figured and described.

Dun (1898) discussed *Taeniopteris daintreei* McCoy and concluded that the Victorian form could not be separated from the Indian *Angiopteridium spathulatum*. *T. carruthersi* Woods was also described.

Stirling (1901) placed the prevailing formation at Apollo Bay as 'Trias-Jura', stating that this had been changed from Jurassic on the opinion of Etheridge. In an appendix a list of fossils from Skene's Creek, determined by Etheridge, was given.

Seward (1904) described and discussed specimens sent to him by the Department of Mines and Water Supply of Victoria, from South Gippsland and Apollo Bay. The examination of numerous specimens of *Taeniopteris daintreei* and associated plants led him to agree with McCoy's opinion of the Jurassic age of the flora. Stirling's figured specimens were reviewed and the possibility noted of referring some of McCoy's species to other species, as follows: *Sphenopteris crassinervis* = ? *S. ampla; S. fosteri* and *S. travisi* = ? *Coniopteris hymenophylloides; Taeniopteris carruthersi* = *T. daintreei* var. *major; Palissya australis* = *Taxites*. Several plants are fully described and figured and Seward correlated the Victorian beds with the Inferior Oolite of England or the Rajmahal Series of India on the following ten types 'almost indistinguishable from English forms': *Marchantites* sp., *Lycopodites victoriae* n. sp., *Coniopteris hymenophylloides Brongniart* var. *australica* Seward, *Taeniopteris daintreei* McCoy, *Cladophlebis denticulata* Brongniart var. *australis* Seward, *Ginkgo* sp., *Baiera australis* McCoy, *B. delicatula* n. sp., *Nilssonia* sp. *Araucarites* sp. *A*, *Taxites* sp. Seward noted that although *Taeniopteris* is generally unsatisfactory as an index fossil the narrow form is relatively uncommon, but occurs also in the Rajmahal (Lias) and Kota-Maleri (Lower Oolite) Series of India. He regarded *Sphenopteris ampla* as identical with *S. hislopi* Oldham and Morris (1863), and *Lycopodites victoriae* as very similar to *Araucarites gracilis* (*Cheirolepis* Feistmantel) from the Rajmahal Hills.

Chapman (1908) listed specimens collected by Kitson from Whitelaw railway station, South Gippsland. These are 'Jurassic plants which appear to be from a slightly different horizon or at all events from an area exhibiting a different facies from that which yielded the specimens dealt with by Seward'. Chapman was of the opinion that '*Taeniopteris spatulata* and its varieties range through the whole series, but that the other plants probably occur at definite horizons, and can be used for correlation'. He recorded *Sphenopteris elongata* which would indicate an horizon lower than that of Seward's collection. Species recorded by him not contained in the material examined by Seward include: *Thinnfeldia odontopteroides* Morris, *T.* sp. indet., *T.? indica* Feistmantel, *Araucarites* sp., *Brachyphyllum gippslandicum* McCoy, *Palissya australis* McCoy, *Cheirolepis* cf. *cetosus* Phillips, *Albertia*? or *Dammara*?. He discussed at length the species *Taeniopteris* and commented on *Brachyphyllum, Palissya,* and a new record of *Cheirolepis setosus*. Chapman (1909) listed a number of plants from many localities in South Gippsland and the Western District, of which those not mentioned in the 1908 paper include: *Rhizomopteris etheridgei* Seward, *Conites* sp., *Araucarioxylon* sp., *Podozamites kidstoni* Etheridge fil., *Stenopteris elongata, S.* sp. Correlating the Tasmanian and Victorian Jurassic beds (1912) he believed them to be only partly comparable, and suggested that a complete revision of the Tasmanian Mesozoic might throw light on the relationship with the Victorian beds, which are of 'approximately similar age'. Genera common to the two are *Taeniopteris, Cladophlebis, Baiera* and *Ginkgo,* while *Macrotaeniopteris, Phoenicopsis* and *Pterophyllum* tend to indicate a lower horizon in Tasmania, probably Triassic.

Walkom (1918) remarked upon the work done on the Victorian flora by Seward and Chapman and stated that 'there is no doubt that the Victorian Mesozoic Coal Measures are to be correlated with the Walloon Series of Queensland and its equivalent in New South Wales' (i.e. the Clarence, Talbragar and Artesian Series).

Chapman (1919) again discussed the Victorian flora which he correlated with the Upper Oolite plants of Yorkshire, noting that some, e.g. *Stenopteris* and *Thinnfeldia* pointed to a lower Mesozoic horizon.

Coulson (1930) discussed the lithology and distribution of the Jurassic rocks of the Barrabool Hills and collected plants, determined by Keble, from basal beds exposed in a cliff of the Barwon River. These are listed in the locality list under Locality No. 138, Queen's Park, Geelong. Keble compared the flora with the *Sphenopteris ampla* beds from Archie's Creek and Binginwarri but suggested that the Barrabool Hills beds at Ceres were older than them, though still Jurassic, because of the presence of *Ginkgo* and *Baiera,* and that at Jumbunna there is at least 1,500 feet of Mesozoic rocks below the fossil band while at Ceres there would not be more than 100 feet. A record was also made of a collection obtained from a mudstone band in Queen's Park and the Newtown Brickpit.

Florin (1952) revised the type specimens of *Zamites* (*Podozamites*) *barklyi* McCoy 1874, and *Z.* (*P.*) *longifolius* McCoy 1874. He obtained cuticle from *Z. barklyi* and for this conifer instituted the new genus *Bellarinea* Florin 1952. *Z. longifolius* did not yield material suitable for detailed anatomical study and was transferred by Florin to the artificial genus *Elatocladus* Halle 1913 and placed in a new species, *Elatocladus mccoyi* Florin 1952. Florin pointed out that both specimens were probably podocarpaceous conifers, and not cycads as supposed by McCoy.

The cuticle of *Bellarinea barklyi* was found to have been attacked by a saprophytic fungus, probably belonging to a group of the pyrenomycetes.

Record of Fossil Plants

A list of collections from various localities is set out below. The list is arranged under county and parish, proceeding from east to west across the State. The names are those recorded by the author concerned but where revision has been necessary the revised name appears in parenthesis.

The following new localities may be mentioned in more detail:

Rhyll, Phillip Island

Material was obtained from the road metal quarry at Rhyll, at the only Mesozoic outcrop on Phillip Island. The fossiliferous shale occurs as small lenses in the prevailing arkose. One such lens was found by Mr. A. N. Carter in the floor of the quarry, and yielded *Taeniopteris tenison-woodsi, Thinnfeldia pinnata,* and *Cladophlebis australis.* Further bands were found by the author 6 feet and 18 feet from the top of the quarry face. The fossils occur in a fine micaceous arkose, which is rather crumbly, and obscures details of venation in nearly all specimens.

Screw Creek

At Screw Creek, $1\frac{1}{4}$ miles east of Inverloch, beds containing fossil plants dip to the north-east, outcropping at the mouth of the creek in the cliff and in the shore platform. Two beds were examined:

BED A.—20 yards east of the creek, containing many unidentifiable ? gymnosperm cones.

BED B.—16 yards east of the creek.

Coastline, Cape Patterson to Inverloch

Shore platform at Cape Patterson. Good specimens were found in the vicinity of the two coal seams marked on the 76 S.W. Quarter Sheet, west of the volcanic neck at Cape Patterson.

Shore platform off Petrel Rock. Material was collected here by Messrs. E. D. Gill and A. A. Baker. Excellent specimens were obtained from beds dipping north at about 15° between high and low tide levels, 80 yards north of the northern basalt dyke marked on Quarter Sheet 76 S.W.

Queen's Park, Geelong

Fossils were collected from a narrow band about 30 feet above the road level in the Barwon River cliffs at the bridge on the Highton Road, directly opposite the gates to Queen's Park Reserve.

The collection in the National Museum of Victoria listed under Locality 138 was made by Mr. D. F. Jeffrey from a band at the same level 2 chains west of the bridge.

KEY TO LOCALITY LIST

Location of Specimen

1. Specimen not available.
2. Specimen in Geology Dept., University of Melbourne.
3. Specimen in Geological Museum, Melbourne.
4. Specimen in the National Museum of Victoria.
5. Specimen in the Pritchard Collection, N.M.V.
6. Specimen in the Deane Collection, N.M.V.

Record

S.	Record made by Seward, 1904.
C(i).	Record made by Chapman, 1908.
C.	Record made by Chapman, 1909.
C(ii).	Unpublished determination by Chapman.
M.	Record made by McCoy, 1874.
M(i).	Record made by McCoy, 1871-72.
M(ii).	Record made by McCoy, 1867.
E.	Unpublished catalogue, Mines Dept. Vic., Etheridge.
E(i).	Record made by Etheridge, 1914.
E(ii).	Record made by Etheridge, 1902.
St(i).	Record made by Stirling, 1892.
St(ii).	Record made by Stirling, 1893.
St(iii).	Record made by Stirling, 1895.
St(iv).	Record made by Stirling, 1895a.
St(v).	Record made by Stirling, 1895b.
St(vi).	Record made by Stirling, 1897.
St(vii).	Record made by Stirling, 1900.
St(viii).	Unpublished catalogue, Mines Dept. Vic., Stirling.
St(ix).	Record made by Stirling, 1901.
Sel.	Record made by Selwyn, 1886.
H.	Record made by Hall, 1901.
Cn.	Record made by Coulson, 1930.

Gippsland

County of Buln Buln

Parish of Calignee

1. Calignee: 1C, *Taeniopteris spatulata*; 1St(vii), *T. spatulata* var. *daintreei* (*T. spatulata*); 1S, *Podozamites longifolius* (? *Elatocladus*); 4St(vii), *Baiera australis* (*Ginkgoites australis*); *B. robusta* (*G. australis*); 1S, *Sphenopteris crassinervis* (*S. hislopi*); *S. warragulensis* (*S. hislopi*); 4S, *Baiera subgracilis* (*Ginkgoites australis*).

Parish of Devon

2. Allot. 157a: 1C, *Sphenopteris ampla* (*S. hislopi*).

Parish of Binginwarri

3. Allot. 74Bi: 1C, *Sphenopteris ampla* (*S. hislopi*).
4. Allot. 74Bj: 1C, *Sphenopteris ampla* (*S. hislopi*); 4C, *Stenopteris elongata* (*Czekanowskia* sp.).
5. Allot. 74Bf: 1C, *Sphenopteris ampla* (*S. hislopi*).
6. Allot. 74J: 1C, *Sphenopteris ampla* (*S. hislopi*).
7. Allot. 74H: 1C, *Sphenopteris ampla* (*S. hislopi*); 1C, *Taeniopteris spatulata*; 1C, *Baiera australis* (*Ginkgoites australis*); 1C, *Carpolithes* sp.; 1C, *Araucarites* sp.
8. Allot. 76Bi: 4C, *Sphenopteris ampla* (*S. hislopi*); 1C, *Taeniopteris spatulata*; 1C, *Podozamites kidstoni*; *P. ellipticus*; *P. barklyi* (? *Bellarinea*); 1C, *Conites* sp.; 1C, *Araucarites* sp.
9. Allot. 77B: 1C, *Coniopteris hymenophylloides* var. *australica*; 4C, *Sphenopteris ampla* (*S. hislopi*); 1C, *S. elongata*; 1C, *Taeniopteris spatulata*.

Parish of ?.

10. Albert River: 1S, *Sphenopteris crassinervis* (*S. hislopi*); 1St(vii), *Podozamites barklyi* (? *Agathis* or *Araucaria*); 1St(vii), *Baiera subgracilis* (*Ginkgoites australis*); 4St(vii), *Albertia australis*; 1St(vii), *Phyllotheca australis*; 1St(vii), *Brachyphyllum gippslandicum*; 4C, *Stenopteris elongata* (*Czekanowskia*).

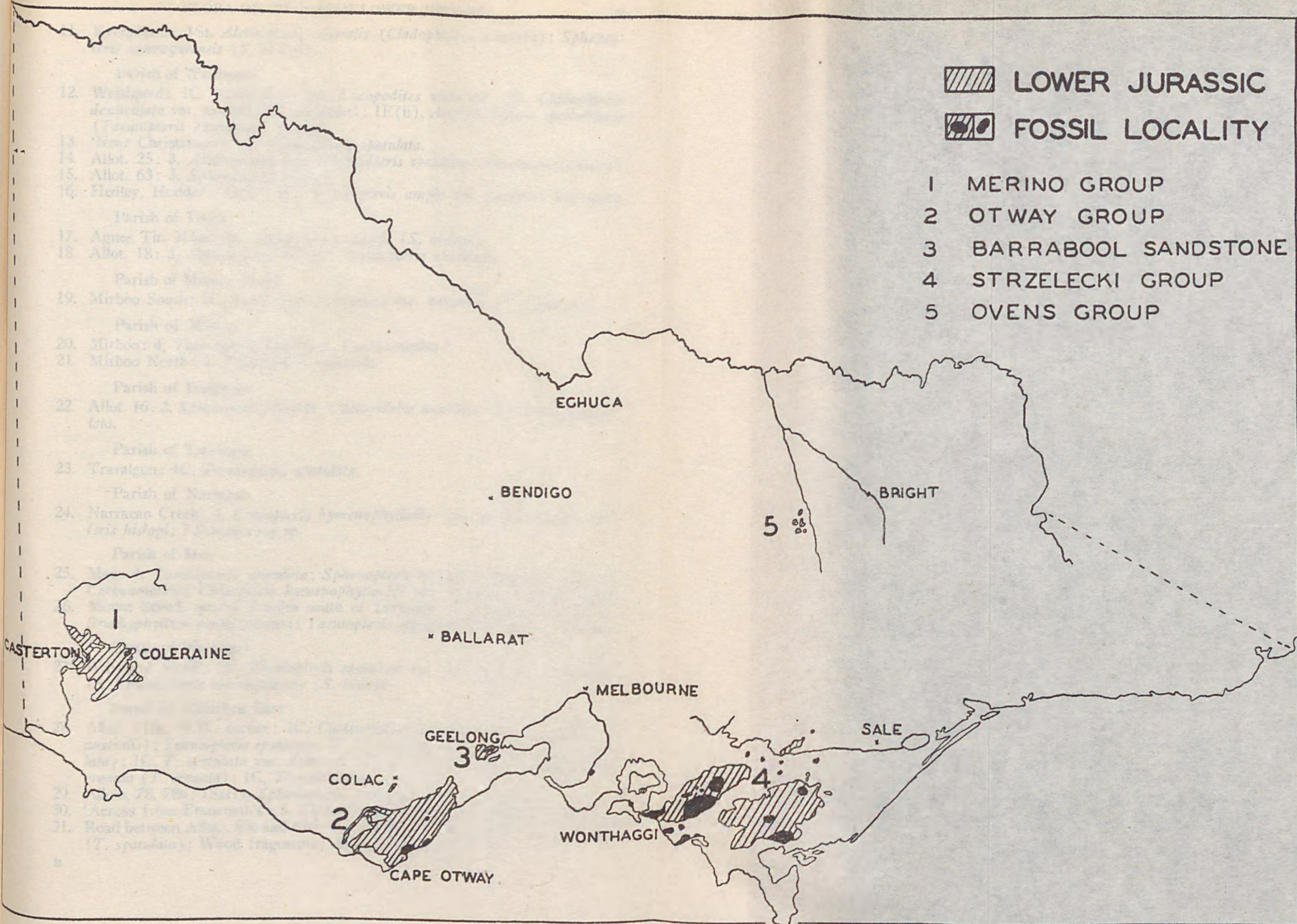
LOWER JURASSIC
FOSSIL LOCALITY
1 MERINO GROUP
2 OTWAY GROUP
3 BARRABOOL SANDSTONE
4 STRZELECKI GROUP
5 OVENS GROUP
ECHUCA
BENDIGO
BRIGHT
5
1
CASTERTON
COLERAINE
BALLARAT
MELBOURNE
GEELONG
3
SALE
COLAC
4
2
WONTHAGGI
CAPE OTWAY

Fig. 1

11. Kyergaards: 1St, *Alethopteris australis* (*Cladophlebis australis*); *Sphenopteris warragulensis* (*S. hislopi*).

Parish of Welshpool

12. Welshpool: 1C, *Equisetites*; 4S, *Lycopodites victoriae*; 1S, *Cladophlebis denticulata* var. *australis* (*C. australis*); 1E(ii), *Angiopteridium spathulatum* (*Taeniopteris spatulata*); *Conifer*.
13. 'Near Christenson's': 3, *Taeniopteris spatulata*.
14. Allot. 25: 3, *Albertia australis*; *Taeniopteris spatulata*; *Sphenopteris hislopi*.
15. Allot. 63: 3, *Sphenopteris hislopi*.
16. Hedley, Hodder's Gully: 1C, *Sphenopteris ampla* (*S. hislopi*); *Rhizomes*.

Parish of Toora

17. Agnes Tin Mine: 3C, *Sphenopteris ampla* (*S. hislopi*).
18. Allot. 18: 3, *Sphenopteris hislopi*; *Taeniopteris spatulata*.

Parish of Mirboo South

19. Mirboo South: 1C, *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*).

Parish of Mirboo

20. Mirboo: 4, *Taeniopteris spatulata*; *Czekanowskia* ?.
21. Mirboo North: 4, *Taeniopteris spatulata*.

Parish of Budgeree

22. Allot. 16: 3, *Sphenopteris hislopi*; *Cladophlebis australis*: *Taeniopteris spatulata*.

Parish of Traralgon

23. Traralgon: 4C, *Taeniopteris spatulata*.

Parish of Narracan

24. Narracan Creek: 4, *Coniopteris hymenophylloides* var. *australica*; *Sphenopteris hislopi*; ? *Schizoneura* sp.

Parish of Moe

25. Moe: 4, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Ginkgoites australis*; *Czekanowskia*; *Coniopteris hymenophylloides* var. *australica*; *Neocalamites*.
26. Mount Speed, quarry 2 miles south of Trafalgar: 2, *Sphenopteris hislopi*; *Brachyphyllum gippslandicum*; *Taeniopteris spatulata*; *Cladophlebis australis*.

Parish of Warragul

27. Warragul South: 1C, *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*); 1S, *Sphenopteris warragulensis* (*S. hislopi*).

Parish of Allambee East

28. Allot. 110a, N.W. corner: 1C, *Cladophlebis denticulata* var. *australis* (*C. australis*); *Taeniopteris spatulata*; 3C, *T. spatulata* var. *carruthersi* (*T. spatulata*); 1C, *T. spatulata* var. *daintreei* (*T. spatulata*); 4C, *T. spatulata* var. *crenata* (*T. crenata*); 1C, *Thinnfeldia mccoyi*.
29. Allots. 78, 78a: 1St(i), *Sphenopteris warragulensis* (*S. hislopi*).
30. 'Across from Francomb's': 5, *Cladophlebis australis*; *Taeniopteris spatulata*.
31. Road between Allots. 69c and 69d: 1C, *Taeniopteris spatulata* var. *carruthersi* (*T. spatulata*); Wood fragments; Araucarian cone scales.

Parish of Allambee

32. Reserve, 12 miles north of Mirboo North: 3, *Taeniopteris spatulata*; *Cladophlebis australis*.
33. Bowden's Creek, Tarwin Coal Company Seam: 1St(ii), *Taeniopteris*; *Sphenopteris*.

Parish of Koorooman

34. Ruby Creek: 1C, *Sphenopteris ampla* (*S. hislopi*); *Brachyphyllum gippslandicum*; *Araucarites* sp., cone scale.
35. Splitter's Gully, off Ruby Creek: 1C, *Sphenopteris ampla* (*S. hislopi*); 4, *Taeniopteris spatulata*.
36. Harman's Coal Seam, Ruby Creek: 1C, *Thinnfeldia mccoyi*; *Sphenopteris ampla* (*S. hislopi*); *Taeniopteris spatulata*; *T. spatulata* var. *daintreei* (*T. spatulata*); *T. spatulata* var. *carruthersi* (*T. spatulata*); *Rhizomopteris etheridgei*; *Podozamites ellipticus*; *P. kidstoni*; *Carpolithes*.

Parish of Korumburra

37. Korumburra: 1S, *Baiera australis* (*Ginkgoites australis*); *B. subgracilis* (*G. australis*); *B. robusta* (*G. australis*); *Sphenopteris warragulensis* (*S. hislopi*); *S. crassinervis* (*S. hislopi*); 4, *S. hislopi*; *Taeniopteris spatulata*.
38. Fay's Hill: 1C, *Taeniopteris* sp. (*T. spatulata*); *Sphenopteris ampla* (*S. hislopi*).
39. Cutting, Jumbunna Line: 1C, Stems, roots and seeds.
40. Coal Creek Proprietary Mine, Allot. 87. 4S, *Rhizomopteris etheridgei*; 4C, *Taeniopteris spatulata*.
41. Shaft No. 1: 3C, *Coniopteris hymenophylloides* var. *australica*; *Sphenopteris ampla* (*S. hislopi*); *Taeniopteris spatulata*; 1C, *T. spatulata* var. *daintreei* (*T. spatulata*); *T. spatulata* var. *carruthersi* (*T. spatulata*); *T.* sp.; *Rhizomopteris etheridgei*.
42. Foster Creek: 1E, ? *Phyllopteris* (? *Phyllopteroides*); *Sphenopteris warragulensis* (*S. hislopi*); *S. ampla* (*S. hislopi*); *Trichomanites*; *Baiera subgracilis* (*Ginkgoites australis*); *Angiopteridium spathulatum* (*Taeniopteris spatulata*); 3S, *Sphenopteris ampla* (*S. hislopi*); 1S, *Taeniopteris daintreei*.
43. Allot. 97: 1S, *Carpolithes* sp. A; *C.* sp. B.
44. Strzelecki Mine, above seam: 3C, *Taeniopteris spatulata* var. *carruthersi* (*T. spatulata*); 1C, *Carpolithes* sp. A; 3, Fragment of *Thinnfeldia*.

Parish of Drumdlemara

45. Guddon's Well, Allot. 31a: 1C, *Sphenopteris ampla* (*S. hislopi*).
46. Screw Creek. Bed A, 20 yards east of creek: 2, *Taeniopteris spatulata*; Gymnosperm cones.
47. Screw Creek. Bed B, 16 yards east of creek: 2, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Ginkgoites australis*; *Araucarites cutchensis*; ? *Thinnfeldia mccoyi*; *Dicroidium odontopteroides*.

County of Mornington

Parish of Jeetho

48. Bena: 1C, *Thinnfeldia odontopteroides* (*Dicroidium odontopteroides*); *T. maccoyi* (*T. mccoyi*); *Taeniopteris spatulata*; *T. spatulata* var. *carruthersi* (*T. spatulata*); *Palissya australis* (*Elatocladus conferta*); 3, *Sphenopteris hislopi*.

49. Canobea's Creek: 3S, *Sphenopteris ampla* (*S. hislopi*).
50. Allot. 48, Hennessy's Well: 3C(i), *Carpolithes* sp.; *Taeniopteris spatulata*; *T. spatulata* var. *daintreei* (*T. spatulata*); 1C(i), *T. spatulata* var. *carruthersi* (*T. spatulata*); 3C(i), ? *Plagiophyllum*.
51. Jeetho Valley: 1C, *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*); *T. spatulata* var. *carruthersi* (*T. spatulata*); 1St(vii), *Brachyphyllum gippslandicum*; 1S, *Albertia australis*; 4, *Czekanowskia*; 1St(vii), *Taeniopteris carruthersi* (*T. spatulata*); 3St(viii), *Sphenopteris warragulensis* (*S. hislopi*); 1St(vii), *Taeniopteris daintreei* (*T. spatulata*).
52. Jeetho, Cutting 89: 1St(i), Taeniopteridae, *Sphenopteris*.
53. Whitelaw: 1C(i), *Coniopteris hymenophylloides* var. *australica*; 3C(i), *Cladophlebis denticulata* (*C. australis*); *Sphenopteris ampla* (*S. hislopi*); 43C(i), *Thinnfeldia odontopteroides* (*Dicroidium odontopteroides*); 3C(i), *Thinnfeldia mccoyi*; *T.* sp. (*T. mccoyi*); 4C(i), *T. ? indica* (*Dicroidium acuta*); 43C(i), *Taeniopteris spatulata*; 4C(i), *T. spatulata* var. *daintreei* (*T. spatulata*); 3C(i), *T. spatulata* var. *carruthersi* (*T. spatulata*); 4C(i), *Araucarites* sp.; *Brachyphyllum gippslandicum*; 43C(i), *Palissya australis* (*Elatocladus conferta*); 4C(i), *Cheirolepis* cf. *setosus* (? *Brachyphyllum*); 1C(i), *Sphenopteris warragulensis* (*S. hislopi*); *Albertia* or ? *Dammara*.

Parish of Jumbunna

54 Jumbunna: 1C, *Taeniopteris spatulata* var. *carruthersi* (*T. spatulata*); 1St(i), *Alethopteris australis* (*Cladophlebis australis*); 3C, *Taeniopteris spatulata*; 4S, *Taxites* sp. (*Elatocladus conferta*); 3, *Sphenopteris hislopi*; *Ginkgoites australis*; 1C, *Rhizomopteris etheridgei*.
55. Screen's Railway Section: 1C, *Coniopteris hymenophylloides* var. *australica*; 3C, *Sphenopteris ampla* (*S. hislopi*); 1C, *Taeniopteris spatulata*; *T. spatulata* var. *daintreei* (*T. spatulata*); *Carpolithes* sp.; 4C, *Stenopteris* (*Czekanowskia*); 1C, *Baiera australis* (*Ginkgoites australis*); *Baiera* sp.
56. Railway Line to Outtrim: 4, *Dicroidium acuta*.
57. Gooch's Big Cutting: 4C, Root of *Equisetites*.
58. Chinaman's Gully: 3, *Taeniopteris spatulata*.
59. Allot. 62: 4S, *Adiantites lindsayoides*; *Araucarites* sp. *A.*, *Coniopteris hymenophylloides* var. *australica*; *Sphenopteris ampla* (*S. hislopi*).
60. Wolonga: 3S, *Sphenopteris ampla* (*S. hislopi*).
61. Allot. 29: 1S, *Sphenopteris ampla* (*S. hislopi*).
62. Allot. 51: 1S, *Sphenopteris ampla* (*S. hislopi*).
63. Allot. 53a, McKenzie's Coal Seam: 1S, *Sphenopteris ampla* (*S. hislopi*); 4S, *Taeniopteris daintreei* var. *major* (*T. spatulata*); *Cladophlebis denticulata* var. *australis* (*C. australis*); *Thinnfeldia mccoyi*; *Nilssonia* sp.; 3S, *Taeniopteris daintreei* (*T. spatulata*).
64. Allot. 48, Scotty's Creek: 3S, *Sphenopteris ampla* (*S. hislopi*).
65. Allot. 65, Lance Creek, Barregowa: 4S, *Sphenopteris ampla* (*S. hislopi*); 3S, *Taeniopteris daintreei* (*T. spatulata*); 43S, *Coniopteris hymenophylloides* var. *australica*; 3S, Rhizome; 1S, *Araucarites* sp. *B*.
66. Allot. 22: 1S, *Carpolithes* sp. *A*.
67. Allot. 49, Luke's Laurel Gully (Krowera): 3S, *Sphenopteris ampla* (*S. hislopi*); 43S, *Taeniopteris daintreei* (*T. spatulata*); 4S, *Thinnfeldia* sp. (*Phyllopteroides*); *Ginkgo* sp. (*Ginkgoites antarcticus*); 3, *Phyllopteroides*; 1S, *Araucarites* sp. *B*.
68. Allot. 39: 43S, *Ginkgoales* flowers.

69. Allot. 13: 1S, *Taeniopteris daintreei* (*T. spatulata*).
70. Allot. 55: 1S, *Sphenopteris ampla* (*S. hislopi*); 4S, *Brachyphyllum* sp. (*Brachyphyllum gippslandicum*); Coniferous shoot.
71. Allot. 39c, Foster Creek, Moyarra: 1S, *Adiantites lindsayoides*; 43S, *Sphenopteris ampla* (*S. hislopi*); 1E(ii), *Taeniopteris tenison-woodsi*.

Parish of Jumbunna East

72. Heath's Creek: 1C, *Sphenopteris ampla* (*S. hislopi*).
73. Allot. 55, Elm's House: 1C, *Coniopteris hymenophylloides* var. *australica*; *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*); *Baiera* cf. *gracilis* (? *Ginkgoites australis*); *Carpolithes* sp.
74. Allot. 50, Rainbow Creek, Moyarra: 3S, *Araucarites* sp. *B*; 1S, *Carpolites* sp. *A*; 4S, *C.* sp. *B*; *Taeniopteris daintreei* (*T. spatulata*); 1S, *Taxites* fragment (*Elatocladus*).
75. Allot. 20: 1S, *Sphenopteris ampla* (*S. hislopi*); 34S, *S.* sp. (*S. hislopi*); 3S, *Coniopteris hymenphylloides* var. *australica*; *Taeniopteris daintreei* var. *major* (*T. spatulata*); *Araucarites* sp. *B*.
76. Allot. 16: 3S, *Coniopteris hymenophylloides* var. *australica*; Rhizome.
77. Allot. 54: 3S, Rachis of fern.
78. Allot. 14, Foster Creek: 3S,*Taeniopteris daintreei* (*T. spatulata*); *Sphenopteris*.
79. Allot. 53, Moyarra: 1S, *Coniopteris hymenophylloides* var. *australica*; 3S, *Taeniopteris daintreei* (*T. spatulata*); 3, *Cladophlebis australis*; 1S, *Sphenopteris ampla* (*S. hislopi*).
80. Allot. 22, Canobea's Creek: 3, *Sphenopteris hislopi*, 3S, *Carpolithes* sp. *A*; *Ginkgoales* flowers.
81. Allot. 48: 3S, *Sphenopteris ampla* (*S. hislopi*); 1S, *Taeniopteris daintreei* (*T. spatulata*).
82. Allot. 29a, Foster River: 1S, *Sphenopteris ampla* (*S. hislopi*); *Taeniopteris daintreei* (*T. spatulata*).
83. Allot. 30: 4S, *Baiera australis* (*Ginkgoites australis*); 1S, *Sphenopteris ampla* (*S. hislopi*).
84. Allot. 50, Rainbow Creek, Moyarra: 1S, *Sphenopteris ampla* (*S. hislopi*); *Taeniopteris daintreei* (*T. spatulata*); 4S, *Araucarites* sp. *B*; 1S, *Carpolithes* sp. *A*; *Carpolithes* sp. *B*; *Taxites* (*Elatocladus*).
85. Jumbunna East: 1E(ii), *Schizolepis* ?; *Phyllopteris* sp. (? *Phyllopteroides*); *Angiopteridium etheridgei* (*Taeniopteris spatulata*); *A. tenison-woodsi*; *Alethopteris* (*Cladophlebis*) ? *Albertia*; *Sphenopteris ampla* (*S. hislopi*); *S. warragulensis* (*S. hislopi*); *Trichomanites*; *Baiera subgracilis* (*Ginkgoites australis*); Seed of *Baiera subgracilis* (?); ? *Sagenopteris* (? *Phyllopteroides*); ? *Eremopteris* (*Sphenopteris hislopi*); *Angiopteridium spathulatum* (*Taeniopteris spatulata*); *A. carruthersi* (*T. spatulata*).
86. Bridge Railway Cutting, Outtrim: 1C, Roots of *Equisetites*; 4S, *Coniopteris hymenophylloides* var. *australica*; 3C, *Taeniopteris spatulata*; *T. spatulata* var. *daintreei* (*T. spatulata*); *T. spatulata* var. *carruthersi* (*T. spatulata*); 3CS, *Sphenopteris ampla* (*S. hislopi*); 1C, *Sphenopteris* sp.; ? *Albertia australis*; 4C, *Carpolithes*; 1E(ii), *Baiera subgracilis* (*Ginkgoites australis*); *Taeniopteris*; *Araucarites*.
87. Outtrim North: 4C, *Equisetites* sp.
88. Ballast Quarry, Outtrim: 3, *Taeniopteris spatulata*; *Ginkgoites australis*; *Cladophlebis australis*.

89. Outtrim: 6, *Ginkgoites australis.*

Parish of Kongwak

90. Kongwak: 1E(ii), *Angiopteridium carruthersi* (*Taeniopteris spatulata*); 1C, *T. spatulata* var. *carruthersi* (*T. spatulata*); *Equisetites*—nodal diaphragms; 3, *Sphenopteris hislopi, Coniopteris hymenophylloides* var. *australica*; 1E(ii), *Baiera subgracilis* (*Ginkgoites australis*).
91. G. Dowell's Bore: 1C, *Cladophlebis denticulata* var. *australis* (*C. australis*); 6C, *Sphenopteris ampla* (*S. hislopi*).
92. Allot. 1: 4S, *Ginkgo* sp. (*Ginkgoites australis*); 3S, *Taeniopteris daintreei* (*T. spatulata*); 1S, *T. daintreei* var. *major* (*T. spatulata*); 1E(ii), *Angiopteridium spathulatum* (*Taeniopteris spatulata*); *Alethopteris australis* (*Cladophlebis australis*); ? *Phyllopteris* (*Phyllopteroides*); *Cordianthus*-like influorescence.
93. Allot. 3: 1S, *Taeniopteris daintreei* (*T. spatulata*); *T. daintreei* var. *major* (*T. spatulata*); *Ginkgo* sp.; *Baiera australis* (*Ginkgoites australis*).
94. Allot. 33: 1S, *Taeniopteris daintreei* (*T. spatulata*).
95. Allot. 33d.: 4S, *Equisetites* sp.
96. Allot. 33c: 1E(ii), *Angiopteridium spathulatum* (*Taeniopteris spatulata*); 3S, *T. daintreei* (*T. spatulata*); Rhizome.
97. Allot. 32a: 1S, *Marchantites* sp.; 3S, *Coniopteris hymenophylloides* var. *australica*; 4S, *Sphenopteris ampla* (*S. hislopi*); 34S, *Taeniopteris daintreei* (*T. spatulata*), *T. daintreei* var. *major* (*T. spatulata*); 4S, *T. daintreei* var. *major* (*T. crenata*); *Cladophlebis denticulata* var. *australis* (*C. australis*); 3S, *Thinnfeldia mccoyi*; 1S, *Baiera australis* (*Ginkgoites australis*); 4S, *Ginkgoales* flowers.
99. Scotty's Creek: 1E(ii), *Angiopteridium spathulatum* (*Taeniopteris spatulata*); *A. carruthersi* (*T. spatulata*); *T.* fragments; 3, *Sphenopteris hislopi*; *Coniopteris hymenophylloides* var. *australica*; 1E(ii), *Baiera subgracilis* (*Ginkgoites australis*); *Baiera bidens* (*Ginkgoites australis*); ? *Podozamites*; ? *Phyllopteris* (*Phyllopteroides*).

Parish of Wonthaggi

100. Wonthaggi: 3, *Coniopteris hymenophylloides* var. *australica*; 4, *Sphenopteris hislopi.*
101. Cape Patterson: 4C(iii), *Taeniopteris multinervis* (*T. spatulata*); 4S, *T. daintreei* (*T. spatulata*); 1M(ii), *Phyllotheca australis.*
102. Shore Platform off Petrel Rock, Cape Patterson: 4, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Cladophlebis australis*; *Ginkgoites australis*; *Czekanowskia*; Wood.
103. Near Coal Seam west of volcanic neck, Cape Patterson: 2, *Taeniopteris spatulata, Sphenopteris hislopi.*
104. Cape Patterson Coalfield: 1Sel, *Phyllotheca australis.*
105. Cliffs and Shore Platform west of Eagle's Nest: 2, *Osmundites dunlopi*; 4, *O. gibbiana*; *O.* sp.
106. Wonthaggi State Coal Mine: 2, *Coniopteris hymenophylloides* var. *australica*; *Taeniopteris spatulata*; *Sphenopteris hislopi.*
107. Bore 72, 798 feet: 6, *Taeniopteris spatulata*; *Sphenopteris hislopi.*
108. Bore 186, 250 feet: 4, *Araucarites* sp.; *Taeniopteris.*
109. East Area Mine, 3 feet above coal seam: 3, *Coniopteris hymenophylloides* var. *australica*; *Taeniopteris spatulata*; Cone scale.

110. West Area, Wardle's Section, Top Seam: 2, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Ginkgoites antarcticus*.
111. 20 Shaft, 5 feet above Intermediate Seam: 2, *Sphenopteris hislopi*; *Taeniopteris spatulata*; *Ginkgoites australis*; *Neocalamites*; ? *Nillsonia*.
112. Bore 208, 400 feet: 4, *Taeniopteris crenata*; *Czekanowskia*; *Sphenopteris hislopi*; *Taeniopteris tenison-woodsi*; *Thinnfeldia mccoyi*.
113. Bore 175, 760 feet: 34C(ii), *Equisetites wonthaggiensis*.

Parish of ? Wonthaggi North

114. Archie's Creek, Keating's Paddock: 1C, *Marchantites* sp.; *Coniopteris hymenophylloides* var. *australica*; *Cladophlebis denticulata* var. *australis* (*C. australis*); *Sphenopteris ampla* (*S. hislopi*); *S.* sp.; *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*); 4C, *Podozamites kidstoni*; 1C, *Araucarioxylon*; *Carpolithes* sp.
115. Archie's Creek, Gates' Block: 3, *Taeniopteris spatulata*.
116. West Creek, Allot. 14: 3C, *Sphenopteris ampla* var. *crassinervis* (*S. hislopi*); 1C, *Coniopteris hymenophylloides* var. *australica*.

Parish of Woolamai

117. Burne's Creek: 1C, *Taeniopteris spatulata*; 1St(vii), *T. daintreei* (*T. spatulata*); 1S, *T. carruthersi* (*T. spatulata*); 1St(vii), *Brachyphyllum gippslandicum*; 4St(vii), *Baiera australis* (*Ginkgoites australis*); *Baiera subgracilus* (*G. australis*); 1St(vii), *Baiera robusta* (*G. australis*); 1S, *Sphenopteris crassinervis* (*S. hislopi*); *Palissya australis* (*Elatocladus conferta*); 1st(vii), *Albertia australis*; 1E(ii), *Angiopteridium spathulatum* (*Taeniopteris spatulata*); *Baiera subgracilis* (*Ginkgoites australis*); *Sphenopteris crassinervis* (*S. hislopi*).
118. Griffith's Point, San Remo: 4, *Taeniopteris crenata*; 1C, *T. spatulata* var. *daintreei* (*T. spatulata*); 4St(vii), *T. carruthersi* (*T. spatulata*); 1St(vii), *Podozamites barklyi* (? *Agathis* or *Araucaria*); *Sagenopteris carruthersi*; 4, *Elatocladus longifolius* (*E. mccoyi*).
119. Section No. 14—? Griffith's Point: 1St(ii), *Sphenopteris warragulensis* (*S. hislopi*); *Alethopteris australis* (*Cladophlebis australis*); *Taeniopteris carruthersi* (*T. spatulata*); *Podozamites barklyi* (? *Agathis* or *Araucaria*).
120. Kilcunda: 1E(ii), Equisetaceous stem; *Angiopteridium spathulatum* (*T. spatulata*); *Sphenopteris crassinervis* (*S. hislopi*); *Baiera subgracilis* (*Ginkgoites australis*); 1S, *Sphenopteris ampla* (*S. hislopi*).
121. Sandy Water Holes, Allot. 130, 1¾ miles west of Kilcunda: 3, *Taeniopteris spatulata*; 1C(i), *T. spatulata* var. *carruthersi* (*T. spatulata*); *T. spatulata* var. *daintreei* (*T. spatulata*); *Carpolithes*.
122. Hoddinott's Seam, No. 2 Bore, Kilcunda: 1C, *Taeniopteris spatulata*; *Taeniopteris spatulata* var. *carruthersi* (*T. spatulata*); *Sphenopteris ampla* (*S. hislopi*); *Equisetites* sp.; 1S, *Podozamites barklyi* (? *Bellarinea*); *P. ellipticus*.
123. Western Port to Kilcunda: 1St(ii), *Sphenopteris*; *Alethopteris*; *Taeniopteris*; *Sagenopteris*; 3St(vii), *Coniopteris*.
124. Western Port Coalfield: 1M(i), *Phyllotheca australis*.
125. Bore 30, at 70 feet: 6, *Ginkgoites australis*; *Sphenopteris hislopi*; *Taeniopteris spatulata*; at 174 feet: Fruits ?; at 390 feet: *Sphenopteris hislopi*.
126. Bore 28, at 480 feet: 6, *Ginkgoites australis*; at 574 feet: *Taeniopteris spatulata*; at 780 feet: *Sphenopteris hislopi*.

127. Bore 23, at 12 feet: 4, *Taeniopteris spatulata*; at 140 feet: 6, *T. spatulata*; *Cladophlebis australis*; *Ginkgoites australis.*
128. Bore 20, 1,039 feet: 6, *Ginkgoites australis.*
129. Bore 24, 33 feet: 6, *Taeniopteris spatulata.*
130. Kardella: 1St(vii), *Taeniopteris carruthersi* (*T. spatulata*).
131. Allot. 97d, 236 feet: 3C(i), *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*) ; 1C(i), ? *Sphenopteris* sp.; ? *Albertia* or ? *Dammara*; 3C(i), *Araucarites* (Cone scales).
132. South end of Allot. 46b, west branch of Bridge Creek: 1E(ii), *Angiopteridium spathulatum* (*Taeniopteris spatulata*) ; *Baiera subgracilis* (*Ginkgoites australis*).

Parish of Corinella

133. Allot. 149: 1St(vi), *Sphenopteris.*

Phillip Island

134. Rhyll, floor of quarry: 2, *Thinnfeldia pinnata*; *Taeniopteris tenison-woodsi*; *Cladophlebis australis.*
135. Rhyll, top of quarry: 2, *Thinnfeldia pinnata*; *Taeniopteris spatulata*; *Cladophlebis australis*; *Sphenopteris hislopi.*

Parish of Mooroodue

136. Grice's Creek: 1C(i), *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*); *Thinnfeldia odontopteroides* (*Dicroidium odontopteroides*); *Coniopteris hymenophylloides* var. *australica*; *Cladophlebis denticulata* var. *australis* (*C. australis*).

County of Grant

Parish of Barrabool

137. Barrabool Hills: 4, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Cladophlebis australis*; *Thinnfeldia mccoyi*; *Coniopteris hymenophylloides* var. *australica*; *Ginkgoites australis*; *Czekanowskia*; *Phyllopteroides dentata*; 4C(iii), *Coniopteris arguta* (*Sphenopteris*).
138. Queen's Park, Geelong: 4, *Marchantites barwoni*; *Brachyphyllum gippslandicum*; *Araucarites*; *Thinnfeldia mccoyi*; *Elatocladus conferta*; *Sphenopteris hislopi*; *Schizoneura* sp.; *Taeniopteris crenata*; 1Cn, *Equisetites* sp., *Coniopteris hymenophylloides* var. *australica*; *Coniopteris* sp.; *Sphenopteris ampla* (*S. hislopi*) ; *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*) ; *T. spatulata* var. *carruthersi* (*T. spatulata*) ; *Cladophlebis denticulata* var. *australis* (*C. australis*) ; *Taeniopteris crassinervis*; *Cladophlebis indica*; *C.* sp.; *Thinnfeldia* cf. *indica*; *T.* sp.; *Dictyophyllum* sp.; *Ginkgo digitata* var. *huttoni*; *Gingko* sp.; *Baiera australis* (*Ginkgoites australis*) ; *Araucaria* sp.; *Brachyphyllum gippslandica*; *Palissya* sp.; *Cyparissidium* sp.; *Carpolithes* sp.; *Sphenopteris mccoyi*; *Linguifolium* sp. (? *Phyllopteroides*) ; 2, *Elatocladus conferta*; *Araucarites cutchensis.*

Parish of Bellarine

140. Bellarine: 4, *Marchantites* sp.; *Sphenopteris hislopi*; *Taeniopteris spatulata*; *Cladophlebis australis*; 4C(iii), *C. indica* (*C. australis*) ; 1M, *Pecopteris australis* (*Cladophlebis australis*) ; 4, *Czekanowskia*; *Elatocladus conferta*; *Thinnfeldia mccoyi*; 1M, *Phyllotheca australis*; 1St(vii) *Podozamites ellipticus*; *P. longifolius* (*Elatocladus mccoyi*) ; 4M, *Zamites* = *Podozamites barklyi*

(*Bellarinea barklyi*); *Zamites* = *Podozamites longifolius* (*Elatocladus mccoyi*); 4C(iii), *Equisetites*; *Coniopteris hymenophylloides* var. *australica*; 1C(i), *Brachyphyllum gippslandicum*.

141. Allot. 111, 2 miles north of Geelong and Queenscliff Road: 4, *Cladophlebis australis*; *Sphenopteris hislopi*; *Dicroidium odontopteroides*; Conifers.

Parish of Bambra

142. Dean's Marsh, Bore No. 1, 132 feet, 994 feet: 6, *Sphenopteris hislopi, Taeniopteris spatulata.*

Parish of Lorne

143. Lorne: 4, *Sphenopteris hislopi*; *Taeniopteris spatulata*; *Dicroidium odontopteroides*; *Brachyphyllum gippslandicum*; *Elatocladus conferta*; *E. mccoyi*.

County of Polwarth

Parish of Krambruk

144. Irvine's Creek: 3S, *Taeniopteris daintreei* (*T. spatulata*); 4S, *Baiera delicatula*; 1E(ii), *B. bidens*; *B. subgracilis* (*Ginkgoites australis*); Fragment of a cupressinadous conifer ?; Lanceolate uninerved leaves; ? *Cyclopitys*.
145. Skene's Creek: 1St(ix), *Taeniopteris daintreei* (*T. spatulata*); *Baiera bidens*; *B. subgracilis* (*Ginkgoites australis*); Cupressinadous conifer; Lanceolate uninerved leaves; 1E(ii), ? *Cyclopitys*.
146. Skene's Creek, in vicinity of two 3 inch coal seams marked on Q.S. 47, ¾ mile from mouth of creek: 2, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Ginkgoites australis*.
147. Wild Dog Creek, Apollo Bay: 1St(vii), *Taeniopteris daintreei* (*T. spatulata*); *T. carruthersi* (*T. spatulata*); 1C, *T. spatulata*; 1St(ix), *Coniopteris hymenophylloides* var. *australica*; 4, *Taeniopteris crenata*; *Czekanowskia*; *Brachyphyllum gippslandicum*; *Araucarites cutchensis*.
148. Apollo Bay: 2, *Neuropteridium*; *Microphyllopteris minuta*.

Parish of ? Elliminyt

149. Barongarook Creek, Colac: 2, *Phyllopteroides dentata*; *Sphenopteris hislopi*.

County of Dundas

Parish of Coleraine

150. Coleraine, 3/77 Shaft: 4, *Taeniopteris spatulata*; *Sphenopteris hislopi*.
151. Coleraine, No. 2 Prospect Shaft: 4, *Taeniopteris spatulata*.
152. Coleraine: 2, Rhizome.

Parish of Bochara ? or Redruth

153. 'Wannon': 2, *Taeniopteris spatulata*.

Parish of Casterton

154. Casterton, from the railway cutting on the east bank of the Glenelg River, collected by P. Kenley and W. Esplan, 1952: 3, *Taeniopteris spatulata*; *Sphenopteris hislopi*; *Ginkgoites australis*; *Brachyphyllum gippslandicum*.

County of Normanby

Parish of Murndal

155. Murndal: 4, *Ginkgoites australis*; 1C, *Taeniopteris spatulata* var. *daintreei* (*T. spatulata*).

Parish of Merino

156. Merino Creek: 3C, *Taeniopteris spatulata*; 1C, *Sphenopteris ampla* (*S. hislopi*).

? Parish of Koroit

157. 'Mount Koroite': H1, *Otozamites*.

Description of Species

Full descriptions are given only for new species and for those about which additional information has been obtained. Species which require no revision are simply listed, with a note on any new localities. Synonymies are complete only for Australian forms.

The classification used is that outlined by Arnold (1948). Arnold pointed out that the difficulty of placing fossil plants in the existing classifications arises chiefly as a result of the fact that most classifications have been based on living forms. The importance of the reproductive organs has dominated botanical thought for generations, with consequent overstressing of the gametophyte and neglect of the sporophyte in classification. The gametophyte is rarely fossilized, and this largely accounts for the difficulty experienced in classifying fossil plants.

Any natural system of classification must be based on affinity of origin, and to compile such a classification fossil as well as living material must be taken into account. In the process, seeds and spores lose the almost overwhelming proportions they have assumed, and other important anatomical features are utilized as well. Such characters as stelar structure and cuticle are increasingly used in classification.

Arnold is concerned chiefly with the *Gymnosperms*, but his outline can be adapted to a classification of the whole plant kingdom. From the point of view of fossil plants, it is much more convenient than many previous groupings.

Within the *Pteridophyta*, the classification used is that of Smith (1938), with only minor modifications.

THALLOPHYTA
EUMYCETAE
ASCOMYCETAE
EUASCOMYCETAE
(PYRENOMYCETAE)

Florin (1952) records the presence of the mycelium of a saprophytic fungus in the leaf cuticles of *Bellarinea barklyi*. The dark fruiting bodies form postules of 0·3 to 0·4 mm. diameter on the leaf surface, opening by three or four radiating slits. The exact systematic position of this fungus is uncertain, but Florin regards it as probably belonging to a group of the *Pyrenomycetes*.

BRYOPHYTA
HEPATICAE
Oi. MARCHANTIALES

To the Order *Marchantiales* belong plants with prostrate, ribbon-like, dichotomously branched thalli. The dorsal part of the thallus is internally differentiated into air chambers, each opening externally by a pore. Rudimentary conducting tissue in the axis of the thallus consists of simple elongate cells. Scales and rhizoides are borne on the ventral surface.

Specimens from Bellarine and from Queen's Park, Geelong, seem best placed in this order of the *Hepaticae*. In these, the central axis of the dichotomously branching thallus is composed of elongate cells, at right angles to which are hexagonal or polygonal areas probably corresponding to the walls of air chambers beneath. One specimen bears what appears to be two rows of scales on the ventral surface, and thus indicates affinity with the family *Marchantiaceae,* in which several such rows of scales occur, rather than with the *Ricciaceae,* in which one row only is found.

Genus **Marchantites** Brongniart 1849

Brongniart (1849) instituted the genus *Marchantites* for fossil hepatics of Oligocene age, found in the calcareous travertine of Sézanne. Seward defined the genus as follows: 'Vegetative body of laminar form, with apparently dichotomous branches, agreeing in habit with the recent thalloid Hepaticae, as represented by such a genus as *Marchantia*.' (Seward 1898, Vol. 1, p. 233.)

The Victorian specimens may be grouped under this name.

Marchantites cf. **Marchantites erectus** (Leckenby 1864) Seward 1900

For full synonymy see Seward 1900, p. 49.

The material from Bellarine most resembles *Marchantites erectus,* originally described from the Lower Oolite of Yorkshire as *Fucoides erectus*. Seward described a *Marchantites sp.* from Allot. 32a, Kongwak, which bore a 'resemblance to the thallus of a *Marchantites*', but was 'too small and indistinct to refer to a specific type'.

Locality. 140.

Marchantites barwoni n. sp. (Pl. VI, fig. 21)

Holotype. N.M.V., No. P15702.

Diagnosis. Thallus prostrate, dichotomously branching; surface wrinkled, margin regularly dentate. Upper surface divided into hexagonal areas more or less at right angles to the central axis, and area above axis formed of cells elongate in the direction of the axis.

Remarks. The specimens seem to be quite distinctive in the possession of a markedly dentate margin, and approach the type of thallus seen in the recent *Marchantia polymorpha* (Smith 1938, fig. 7).

Locality. 138.

TRACHEOPHYTA

LYCOPSIDA

LYCOPODINAE

Oi. LYCOPODIALES

Fi. LYCOPODIACEAE

Lycopodites victoriae Seward 1904

1904. *Lycopodites victoriae* Seward. *Geol. Surv. Vic. Rec.,* 1: Pt. 3: 161. Fig. 2-4.

Syntypes. N.M.V., Nos. P14190, P14191.

Diagnosis. See Seward 1904.

Remarks. No new specimens have been found from Victoria. Walkom (1928) has described a form from the Lower Cretaceous of Plutoville, Cape York Peninsula, as 'not very different from *Lycopodites victoriae*'.

Locality. 12.

EQUISETINAE
Oi. EQUISETALES
Fi. EQUISETACEAE

Genus **Equisetites** Sternberg 1838

Equisetites is a generic name applied to fossil stems, leaves or strobili which closely resemble the modern *Equisetum*. In cases where only pith casts or stem impressions are preserved accurate determination is not possible botanically, but these fossils may still be used stratigraphically.

Equisetites sp. Nodal diaphragms.

Specimen. N.M.V., No. P14189.

Description. See Seward 1904, p. 160, fig. 1.

Remarks. No further examples have been recorded.

Locality. 95.

Equisetites wonthaggiensis Chapman 1914

1914. *Equisetites wonthaggiensis* Chapman. *Geol. Surv. Vic. Rec.*, III: Pt. 3: 317. Pl. LXII.

Holotype. N.M.V., No. 12893; Geological Museum, No. 691.

Diagnosis. See Chapman 1914.

Locality. 113.

Fii. CALAMITACEAE

Genus **Neocalamites** Halle 1908

Specimens. Geology Dept., University of Melbourne.

Remarks. Numerous long, narrow, undivided leaves, 1 to 2 mm. wide. They are not seen attached to a stem, but resemble *Neocalamites* leaves such as are found in the Ipswich and Bundamba Series of Queensland. Walkom (1915.)

Locality. 25, 111.

PTEROPSIDA
PTERIODPHYTA
FILICINEAE
LEPTOSPORANGIATAE
Oi. FILICALES
Fi. OSMUNDACEAE

Genus **Osmundites** Unger 1854

From the cliffs at Cape Patterson, and particularly from the vicinity of Eagle's Nest, Mr. A. A. Baker has made an excellent collection of the trunks of osmundaceous ferns. Two specimens of these are well preserved in silica, and, on sectioning, showed excellent details of the anatomy of the stem and petioles.

The stems do not exceed a few centimetres in diameter, the deceptively large appearance arising from the presence of a thick mantle of persistent petioles and roots surrounding the stem. One specimen sectioned showed the structure of the petioles and roots excellently preserved, but the central stelar region was destroyed.

The other specimen showed a well preserved stele, as well as leaf bases and roots. At least two species are present.

Osmundites dunlopi Kidston and Gwynne-Vaughan 1907 (Pl. IV, figs. 1, 2)

1907. *Osmundites dunlopi* Kidston and Gwynne-Vaughan. *Trans. Roy. Soc. Edin.*, XLV: 759. Figs. 1-16.

Specimen. Geology Dept., University of Melbourne. 2003.

Diagnosis. Osmundites possessing a continuous ring of xylem. Leaf bases arranged in alternating rings representing foliage and scale leaves. Leaf trace semi-circular with deeply incurved ends, the bays thus formed containing two large bands of sclerenchyma. Isolated bands of sclerenchyma scattered through the stipular wing.

Description. The specimen from Cape Patterson is 31 cm. long, tapering from a flattened elliptical section of 10 cm. by 6·5 cm., to 2 cm. at the base, and is incomplete. The stem is eccentrically situated, and is 1·5 cm. in diameter. It has been entirely replaced during fossilization, and no details of the stele are available. The stem is surrounded by a covering of closely packed leaf bases, which near the centre are imperfctly preserved, but which show excellent detail towards the outer portion of the trunk. As a result of flattening during fossilization, most of the leaf bases are greatly distorted.

A transverse section was made at the level indicated (Pl. IV, fig. 1, A-A). The outer portion sectioned well, but it was necessary to impregnate the specimen with canada balsam to prevent the centre from breaking away.

Structure of the petiole. The less distorted leaf bases show a semi-circular or horse-shoe shaped leaf trace with incurved ends, but with distortion all variations are seen. The sclerotic tissues are well preserved; the more delicate tissues have been replaced by finely granular material. Some cell outlines of what was probably parenchyma remain in this granular matrix, but details of the phloem, pericycle, and parenchyma are lacking.

The xylem consists of tracheae of the typical osmundaceous type. These possess several rows of pits on the vertical walls, as shown by the mottled appearance of the walls in transverse section. There is a single median protoxylem strand on the adaxial side of the leaf trace, but this evidently divides as the outer leaf traces show two endarch groups of protoxylem. A thin, slightly darker band surrounds the xylem, and this probably represents the endodermis. The leaf trace is surrounded by a band of sclerenchyma six to eight cells thick, and the boundary of the stipular wing may also be seen in parts of the section.

Isolated groups of sclerenchyma of irregular size and shape are scattered through the petiole, and represent thick-walled fibrous elements which were embedded in the parenchyma of the trace and stipule. The most marked of these are two large groups constantly situated in the bays formed by the incurved ends of the leaf trace xylem. They consist of large polygonal isodiametric cells and are darker than the xylem or the matrix.

The roots appear in pairs arising from the leaf bases. They possess a central diarch xylem strand and a broad cortex. The endodermis and phloem are not preserved.

Although the stele is not preserved, the structure of the petiole, particularly the presence of the two large groups of sclerenchyma, allows the specimen to be placed in *Osmundites dunlopi*.

Locality. 105.

Osmundites gibbiana Kidston and Gwynne-Vaughan 1907
(Pl. IV, fig. 3; Pl. V, figs. 4, 5, 6)

1907. *Osmundites gibbiana* Kidston and Gwynne-Vaughan. *Trans. Roy. Soc. Edin.*, XLV: 763. Pl. III, figs. 17-19: Pl. IV, fig. 20.

Specimen. N.M.V., No. P15703.

Diagnosis. Osmundites possessing a xylem ring of about twenty separate strands. Leaf trace semi-circular, bands of sclerenchyma irregular in the trace, single series of regular bands in the stipular wing.

Description. The specimen is a water-worn pebble, 5·5 cm. long, 4·5 by 6 cm. in diameter, and tapering to a point. It consists of a branched axis of two steles surrounded by leaf bases. One stele is destroyed by replacement, but the detail in the other one is well preserved.

The xylem ring consists of 29 oval strands separated by very narrow bands of granular material which has replaced the delicate tissues of the 'medullary rays'. The limits of the stem are not clearly defined, but there is an indefinite and incomplete band of sclerenchyma which probably represents the outer cortex. The cortex is traversed by leaf traces consisting of a curved xylem with a single median protoxylem. The xylem is surrounded by a very thin darker band, probably the endodermis, the space between the two representing the phloem of the leaf trace.

The delicate tissues of pith, pericycle, phloem, and xylem sheath have not been preserved. The pith was wide, and may not have been homogeneous, but details are insufficient to ascertain this. If the pith were a mixed pith, the specimen should be referred to *Osmundites kolbei* Seward 1907, but this has not been done as details of the pith are obscure, and the xylem of *Osmundites kolbei* has 56 separate strands, the Victorian specimen only half that number.

As the leaf traces pass outwards, the xylem becomes better developed, the protoxylem disappears, and the trace is enclosed in a band of sclerenchyma about eight cells thick. The outlines of the stipular wings are indistinct, and the regular bands of sclerenchyma described by Kidston and Gwynne-Vaughan are not seen.

Roots occur in pairs, and consist of a diarch xylem with a broad cortical region surrounded by a delimiting band of sclerenchyma.

Locality. 105.

? OSMUNDACEAE

Genus **Cladophlebis** Brongniart 1849

The genus *Cladophlebis* was instituted for species of *Pecopteris* formerly included in the *Neuropteridae.* It was founded on frond and venation characters, and is thus useful for the reception of sterile fronds whose affinities are still uncertain. The bipinnate leaf with linear pinnules attached to the rachis by the whole base, is an extremely common form of frond among modern ferns, so it is reasonable to suppose that fossils possesing this type of frond, now placed in the form genus *Cladophlebis,* will be assigned to several families and genera as evidence of their sporangial characters becomes available, and their affinities are revealed.

Cladophlebis denticulata Brongniart occurs in all parts of the world as a conspicuous element of the Mesozoic flora. It is impossible to discriminate specifically between the numerous sterile fragments from all geological horizons from Rhaetic to Cretaceous, and localities from all continents. Seward (1903) therefore adopted the term *Cladophlebis denticulata* as a 'comprehensive title for forms, for the most part of Jurassic age, characterized by bipinnate fronds with linear ultimate segments, of the shape and with the venation characters of *Cladophlebis denticulata forma atherstoni*. We may in particular cases employ a second name as denoting a possible variety or form and as an index of locality' (Seward 1903). Among these Seward lists '*Alethopteris australis* Morris', i.e. *Cladophlebis australis* (Morris 1845) Seward 1904.

Arber (1917) maintains that a specific distinction exists between *Cladophlebis denticulata* Brongniart 1849 and *Cladophlebis australis* Morris 1845, the pinnules of the former possessing a denticulate margin, and of the latter an entire margin. The denticulation is not always pronounced. Both species occur in the Mesozoic floras of the Southern Hemisphere, and it is doubtful that the difference is sufficient to warrant specific separation. Seward's suggestion outlined above is much more tenable.

Cladophlebis australis (Morris 1845) Seward 1904

See also Seward 1904.

1902. *Todea australis* Shirley. *Qld. Geol. Surv. Bull.*, 18: 10.
1904. *Cladophlebis denticulata* Brongniart, *var. australis* Morris, Seward. *Vic. Geol. Surv. Rec.*, I: Pt. 3: 171. Figs. 25-27.
1908. *Cladophlebis denticulata* Brongniart *var. australis* Morris, Chapman. *Vic. Geol. Surv. Rec.*, II: Pt. 4.
1909. *Cladophlebis denticulata* Brongniart *var. australis* Morris, Chapman. *Vic. Geol. Surv. Rec.*, III: Pt. 1.
1917. *Cladophlebis australis* (Morris), Walkom. *Qld. Geol. Surv. Pub.*, 257: 3.
1917. *Cladophlebis australis* (Morris), Arber. *N.Z. Geol. Surv., Pal. Bull.*, 6: 29.
1919. *Cladophlebis australis* (Morris), Walkom. *Qld. Geol. Surv. Pub.*, 263: 13, 54. Pl. 3, figs. 6, 7.
1921. *Cladophlebis australis* (Morris) Walkom. *N.S.W. Geol. Surv. Mem. Pal.* No. 12: 7. Pl. II, figs. 5, 6.
1925. *Cladophlebis australis* (Morris), Walkom. *Pap. Proc. Roy. Soc. Tas.*
1947. *Cladophlebis australis* (Morris), Seward, Jones and de Jersey. *Qld. Univ. Pap.*, III, N.S. No. 3, p. 11.

Diagnosis. See Walkom 1917.

Remarks. No fertile pinnules have been discovered from Victoria, but sterile fronds are abundant and widespread. With *Taeniopteris* and *Sphenopteris, Cladophlebis* makes up the greater part of the Victorian flora. *Cladophlebis australis* is a very common species, and is to be found in almost every collection of Mesozoic plants in Australia. Fertile specimens from New South Wales and Queensland indicate affinity with the *Osmundaceae*, and the presence of osmundaceous stems in the Victorian Jurassic would lend support to this view. In the Jurassic of Gore, New Zealand, *Cladophlebis australis* occurs with *Osmundites dunlopi* as recorded by Kidston and Gwynne-Vaughan (1907) and by Arber (1917).

The specimens from Rhyll, Phillip Island, seem smaller than is generally the case, and in this respect resemble the Tasmanian forms (cf. Walkom 1925). The difference is not sufficient to warrant separation from *Cladophlebis australis*, though it may be of ecological significance.

Locality. 12, 22, 26, 28, 30, 32, 53, 63, 79, 85, 88, 91, 97, 102, 114, 127, 134, 135, 136, 137, 140, 141.

Fii. GLEICHENIACEAE

Genus **Microphyllopteris** Arber 1917

In the F. H. McK. Grant collection (Geology Department, University of Melbourne) is an example from Apollo Bay of a bipinnate fern with pinnae of the type which resemble the modern *Gleichenias*. The specimens consist of impressions only, and preservation is not good, but it is clearly distinct from any other recorded Victorian species.

In 1917, Arber instituted the genus *Microphyllopteris* for ferns of this type: 'Fronds pinnate, bipinnate, or dichotomously branched; pinnules small or very small, subcircular or ovate, closely set, broadest at the base, and attached by their whole base. Median nerve feeble, breaking up into simple or forked branches not far from the base of the pinnule.' (Arber 1917.)

Microphyllopteris minuta n. sp. (Pl. VI, fig. 25)

Holotype. Geology Department, University of Melbourne. 2004.

Diagnosis. Frond bipinnate, incomplete. Rachis stout. Pinnae alternate; pinnules separate, alternate, rounded, 1-2 mm. in diameter, attached by the whole base. Venation not preserved.

Remarks. The Victorian specimens resemble *Microphyllopteris pectinata* Arber 1917 from Mataura Falls and Waikato Heads, New Zealand, except in size. Arber states that the New Zealand forms are separated from *Microphyllopteris gleichenoides* Oldham and Morris 1863 by the larger size of the pinnules of *Microphyllopteris pectinata*, so it seems that the specimens from Apollo Bay are closer to the Indian forms. However, *Pecopteris gleichenoides* of Oldham and Morris' Plate XXVI seems to have a stronger division of the pinnae than is seen in our specimens.

In the Apollo Bay material, the venation is not preserved. In outline, *Microphyllopteris minuta* somewhat resembles *Thinnfeldia pinnata* from Rhyll, but in the latter, the long petiole shows clearly the pinnate nature of the frond, while *Microphyllopteris* is at least bipinnate.

Locality. 148.

Fiii. DICKSONIACEAE

Genus **Coniopteris Brongniart** 1828

Coniopteris was instituted by Brongniart for fossil fern fronds occupying a more or less intermediate position between *Sphenopteris* and *Pecopteris*, and agreeing with the recent *Dicksonias* in the form of the sori, these being marginal, with a lipped indusium.

Coniopteris has been placed generally in the *Cyatheaceae*. Modern classifications place *Dicksonia* in the family *Dicksoniaceae*, equal in rank to the *Cyatheaceae*, the chief distinction between the two families being that accessory vascular strands, thought to be much dissected steles, are present in the stem of the latter, and are absent from the *Dicksoniaceae*. The sorus in the *Cyatheaceae* is gradate, superficial, and cup-shaped, while in the *Dicksoniaceae* it is gradate, marginal, and two-lipped. As *Coniopteris* is defined as agreeing with the recent *Dicksoniaceae* it must be placed in this family, although the evidence of fossil sori is not altogether conclusive, and of the presence or absence of accessory vascular strands is entirely lacking.

Coniopteris hymenophylloides Brongniart 1828 var. australica Seward 1904

See also synonymy in Seward 1904.

1904. *Coniopteris hymenophylloides* Brongniart *var. australica* Seward. *Vic. Geol. Surv. Rec.*, I: Pt. 3: 163.

1908. *Coniopteris hymenophylloides* Brongniart *var. australica* Chapman. *Vic. Geol. Surv. Rec.*, II: Pt. 4.

1909. *Coniopteris hymenophylloides* Brongniart *var. australica* Chapman. *Vic. Geol. Surv. Rec.*, III: Pt. 1.

1917. *Coniopteris hymenophylloides* Brongniart Arber. *N.Z. Geol. Surv. Pal. Bull.* No. 6, p. 32.

1921. *Coniopteris hymenophylloides* Walkom. *N.S.W. Geol. Surv. Mem., Pal.* No. 12, p. 7.

1940. *Coniopteris hymenophylloides* Sitholey. *India Geol. Surv. Mem., Pal. Indica* N.S., XXIX: 10.

Diagnosis. See Seward 1904.

Remarks. The absence in Victorian specimens of peculiar modified pinnules found at the base of the pinnae in the English examples was noted by Seward as probably due to lack of material, but in no specimens subsequently recorded have these been noted.

Sterile specimens of *Coniopteris* approach *Sphenopteris* and the relationship between these two forms is not easy to ascertain. *Coniopteris* tends to have more bluntly rounded lobes than *Sphenopteris*, but the distinction is small. In the absence of evidence of sori, doubtful specimens might perhaps be best placed in *Sphenopteris*.

Locality. 9, 24, 25, 41, 53, 55, 59, 65, 73, 75, 76, 79, 86, 90, 97, 99, 100, 106, 109, 116, 136, 137, 138, 140, 147.

Fiv. Polypodiaceae

Adiantites lindsayoides Seward 1904

1904. *Adiantites lindsayoides* Seward. *Vic. Geol. Surv. Rec.*, I: Pt. 3.

Holotype. N.M.V., P14192.

Diagnosis. See Seward 1904.

Remarks. No further specimens recorded.

Locality. 59, 71.

Cycadophyta

Genera of Unknown Position

Genus **Taeniopteris** Brongniart 1828

The study of the cuticle structure has enabled recent workers to break up this form genus into several genera, and in 1932 Harris proposed the following grouping of Taeniopterids.

1. Species (lacking cuticles), known to be sterile leaves of ferns—*Marratiopsis, Danaeopsis*, etc.—under these generic names.
2. Species with definite cuticles (seed plants)—
   (a) With Bennettitalean type of stoma—*Taeniozamites* Harris 1932.
   (b) With Cycadean type of stoma, small leaves attached to the side of the rachis—*Doratophyllum* Harris 1932. Small leaves with lamina attached to the top of the rachis—*Nilssonia*. Large leaves—*Macrotaeniopteris*.
3. Species in which the cuticle is absent or unknown, or, if present, is not well enough preserved to show the structure of the stomata—*Taeniopteris*.

As the cuticles of the Victorian forms are not preserved, these must all be placed in the genus *Taeniopteris*.

Taeniopteris spatulata Oldham and Morris 1863 (non McClelland 1850)

1860. *Taeniopteris daintreei* McCoy. *Trans. Roy. Soc. Vic.*, 7: 97.
1863. *Stangerites spathulata* Oldham and Morris. *Foss. Flora Gondw. Syst., Pal. Indica*, I: 34. Pl. VI, figs. 1-6.
1863. *Stangerites spathulata var. multinervis* Oldham and Morris. *Ibid.*, p. 34. Pl. VI, fig. 7.
1874. *Taeniopteris daintreei* McCoy. *Prodromus of the Palaeontology of Victoria*, Dec. 2, p. 15. Pl. XIV, figs. 1, 2.
1878. *Taeniopteris daintreei* Feistmantel. *Palaeontographica Suppl.* III, Lief 3, Heft 1, p. 110. Pl. 14, figs. 2, 3.
1878. *Taeniopteris daintreei* Etheridge. *Cat. Austr. Fossils*, p. 100.
1883. *Taeniopteris daintreei* Tenison-Woods. *Proc. Linn. Soc. N.S.W.*, VIII: 117.

1889. *Taeniopteris daintreei* Feistmantel. *Geol. Pal. Verhärt Süd Afrikas.* Pl. II, fig. 11.
1890. *Taeniopteris daintreei* Feistmantel. *Abhandl. K. böhm Gesell. Wissen.* (*Math. Natur. cl.*), Folge VII, Bd. 3, No. 6, p. 66. Pl. 2, fig. 11
1890. *Taeniopteris daintreei* Feistmantel. *N.S.W. Geol. Surv. Mem., Pal.* 3: 114. Pl. XXVII, figs. 4, 5; Pl. XXVIII, figs. 6, 6a.
1892. *Taeniopteris daintreei* McCoy. In Stirling, *Vic. Coal Fields Rep.*, 1: 12. Pl. II, figs. 11, 12.
1892. *Taeniopteris* (? *Angiopteridium*) *daintreei* Jack and Etheridge. *Geology of Queensland*, p. 371.
1898. *Angiopteridium spathulata* Dun. *Rep. A.A.A.Sc.*, 7: 390.
1898. *Taeniopteris spatulata* Shirley. *Qld. Geol. Surv. Bull.* 7: 23.
1900. *Taeniopteris carruthersi* McCoy. In Stirling, *ibid.*, 7. Pl. I, fig. 1a.
1902. *Taeniopteris spatulata* Shirley. *Qld. Geol. Surv. Bull.* 18: 12.
1902. *Oleandridium jaculi* Shirley. *Ibid.*, p. 12.
1904. *Taeniopteris daintreei* Seward. *Vic. Geol. Surv. Rec.*, I: Pt. 3: 168. Figs. 18-22.
1904. *Taenopteris daintreei* McCoy *var. major* Seward. *Ibid.*, p. 171. Figs. 23, 24.
1908. *Taeniopteris spatulata* Chapman. *Vic. Geol. Surv. Rec.*, II: Pt. 4: 4.
Taeniopteris spatulata var. carruthersi Chapman. *Ibid.*
Taeniopteris spatulata var. daintreei Chapman. *Ibid.*
1909. *Taeniopteris spatulata* Chapman. *Vic. Geol. Surv. Rec.*, III: Pt. 1: 110.
Taeniopteris spatulata var. carruthersi Chapman. *Ibid.*
Taeniopteris spatulata var. daintreei Chapman. *Ibid.*
1917. *Taeniopteris spatulata* Walkom. *Qld. Geol. Surv. Pub.*, No. 257, p. 30.
Taeniopteris spatulata var. major Walkom. *Ibid.*, p. 32.
1917. *Taeniopteris daintreei* Arber. *N.Z. Geol. Surv. Pal. Bull.* 6: 46. Pl. XI, fig. 5.
1919. *Taeniopteris spatulata* Walkom. *Qld. Geol. Surv. Pub.* No. 263, p. 36.
Taeniopteris spatulata Walkom. *Ibid.*, p. 57.
1921. *Taeniopteris spatulata* Walkom. *N.S.W. Geol. Surv. Mem., Pal.* No. 12, p. 11.
1934. *Taeniopteris spatulata* Edwards. *Ann. and Mag. Nat. Hist.*, Ser. 10, No. 13.

In 1850, McCelland instituted the species *Taeniopteris spatulata* for material from the Rajmahal Hills. 'Front linear, two or three inches long, narrow at the base, becoming broader towards the apex, or subspathulate.' (McClelland 1850.)

McClelland's original enlarged sketch shows the secondary veins as three-pronged. If this was drawn correctly, the reference to the genus *Taeniopteris* Brongniart was incorrect. However, as the three-pronged condition is not found in any other specimens subsequently referred to *Taeniopteris spatulata* McClelland, and McClelland's type material is not available, and is presumably lost, it is probable that the sketch given by McClelland was inaccurate. In 1863, Oldham and Morris applied *Stangerites* (? *Taeniopteris*) *spatulata* McClelland to material from the Rajmahal Hills, and as many other fossil leaves have been found in all parts of the world which agree closely with these forms, Halle (Florin 1948) has suggesetd that the trivial name *spatulata* be applied to these forms in the sense of Oldham and Morris. Thus *Taeniopteris spatulata* Oldham and Morris 1863 (non McCelland 1850) may be applied to leaf impressions having the form and the venation of the fossils figured by Oldham and Morris.

In June 1860, at a meeting of the Royal Society of Victoria, McCoy exhibited a new species of *Taeniopteris,* collected by Mr. Daintree from the 'coal beds of the Bass River', which he named *Taeniopteris daintreei,* and compared with the *Taeniopteris vittata* of the Whitby Oolite. In 1875 it was described and figured in Decade II of the Prodromus of the Palaeontology of Victoria. McCoy was aware of the similarity of the new form to the Indian *Taeniopteris spatulata,* but decided that '*Taeniopteris daintreei* is sufficiently distinct from McClelland's *Angiopteridium spathulatum* to merit specific rank'. (Stirling 1900, p. 3.)

Etheridge (1897), Dun (1898), Shirley (1898), and Feistmantel (1890-), stressed the similarity to the Indian form. Stirling (1900) upheld McCoy's separation of *Taeniopteris daintreei,* and Seward (1904) also referred the Victorian species to *Taeniopteris daintreei* McCoy 1875. As pointed out by Walkom (1917), the specimens originally described by McCoy do differ from the Indian type material described by McClelland, but the variation is too small to warrant specific separation, and further collecting has revealed every gradation between the two forms.

Chapman (1908, 1909) made a varietal subdivision, considering *Taeniopteris spatulata* as a central form from which the varieties *daintreei* and *carruthersi* might be distinguished:

var. daintreei; leaf long, narrow, parallel sided; midrib thick, secondary veins leaving midrib at right angles.

var. carruthersi; leaf shorter, broader, with tendency for wider spacing of veins; secondary veins leave midrib at an acute angle and then turn and proceed to the margin at right angles.

Stirling (1900) had described a specimen from Griffith's Point as *Taeniopteris carruthersi* Tenison-Woods 1883, which he defined as follows: '. . . simple frond, broad linear, somewhat thick costa, veins leaving it at an acute angle, then passing at right angles to the margin, once or twice dichotomously divided.'

Victorian specimens referred to *Taeniopteris carruthersi* Tenison-Woods 1883, and to *Taeniopteris spatulata* var. *carruthersi* Chapman 1908, have been studied, and the conclusion reached that, at least for these Victorian forms, there is no essential difference from *Taeniopteris spatulata* Oldham and Morris 1863. The points of difference made have been the larger size and the curved trace of the secondary veins in *Taeniopteris carruthersi.*

An enlarged diagram (Fig. 11) is given of the venation of the original of Stirling's Plate I, fig. 1, 1a, 2 (specimen 71 JS in the National Museum of Victoria). It will be seen that the trace of the secondary veins shows all variations between the right angled pattern characteristic of McCoy's *Taeniopteris daintreei,* and the curve of *Taeniopteris carruthersi* Tenison-Woods. In the cases where the latter type is seen, there is frequently a bifurcation at the midrib, the second member of the pair curving down, and then passing on at right angles to the midrib.

Thus, at least for the Victorian forms, the name *Taeniopteris carruthersi,* or *Taeniopteris spatulata* var. *carruthersi,* must lapse, and these forms be referred to *Taeniopteris spatulata.*

A record of '*Taeniopteris multinervis* Weiss' from Cape Patterson may also be included in *Taeniopteris spatulata* (N.M.V., Nos. P2006, P2007).

Seward (1904) established *Taeniopteris daintreei* var. *major* to receive larger specimens of *Taeniopteris daintreei* McCoy. Measurements have been made of all available Victorian *Taeniopteris* leaves, and the results show the greatest frequency at a width of 6 mm. The number of measurements available was not sufficiently large to enable an accurate statistical analysis to be made, but a curve with a single mode seems to be indicated. Of the 266 specimens measured, only 19 were of 1·7 cm. or more. (This was the limit of *Taeniopteris daintreei* var. *major* as defined by Seward.) It seems advisable to include these larger specimens in *Taeniopteris spatulata* Oldham and Morris 1863, as size alone is not sufficient criterion for specific separation.

Walkom (1917) described leaves from Stewart's Creek and Beaudesert, in the Walloon Series of Queensland, which he referred to *Taeniopteris daintreei* var. *major* Seward 1904. The Victorian specimens may also be compared with leaves described by Kawasaki (1934) from the Kobasan Series, Daido district of Korea. These were placed in a new species—*Taeniopteris macrospatulata* Kawasaki 1934—and were said to 'closely resemble*Taeniopteris spatulata* except in size. Venation fine, at right angles, forking once.' (Kawasaki 1934.) They were compared with *Taeniopteris spatulata* var. *major* of the Walloon.

Diagnosis. A good general definition of *Taeniopteris spatulata* Oldham and Morris 1863 is found in Seward 1904 (as *Taeniopteris daintreei* McCoy): 'Frond simple linear, long and narrow . . . . The apex is gradually tapered to an acuminate tip or bluntly rounded; towards the petiole the lamina becomes gradually narrower. Midrib stout and prominent, giving off numerous secondary veins, usually at right angles; these veins are frequently forked close to the midrib, or the branching may occur at varying distances between the midrib and the edge of the leaf. The veins are delicate and numerous, approximately 15 veins per 5 mm. of lamina. Towards the apex of the fronds the secondary veins become oblique, branching at a wide angle from the midrib.' (Seward 1904, p. 168.)

Locality. 7, 8, 9, 12, 13, 14. 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 30, 31, 32, 33, 35, 36, 37, 38, 40, 41, 42, 44, 46, 47, 48, 50, 51, 52, 53, 54, 55, 58, 63, 65, 67, 69, 71, 73, 74, 75, 78, 79, 81, 82, 84, 85, 86, 88, 90, 92, 93, 94, 96, 97, 99, 101, 102, 103, 106, 107, 108, 109, 110, 111, 112, 114, 115, 117, 118, 119, 120, 121, 122, 123, 125, 126, 127, 129, 130, 131, 132, 134, 135, 136, 137, 138, 140, 141, 142, 143, 144, 145, 146, 147, 150, 151, 153, 154, 155.

Taeniopteris crenata McClelland 1850

1850. *Taeniopteris crenata* McClelland. *India Geol. Surv. Rec.*
1909. *Taeniopteris spatulata var. crenata* Chapman. *Vic. Geol. Surv. Rec.*, III: Pt. 1.

Diagnosis. 'Frond linear, two or three inches long, narrow at the base and rounded at the apex, margins lacerately crenate.' (McClelland 1850, p. 53.)

Description. N.M.V., No. P12808, shows three leaves whose arrangement suggests a frond similar to that of the genus *Matonia,* but an examination of the venation shows that the bases of two leaves and the apex of the third are adjacent. The leaves are simple, broad (13, 15, 20, and 26 mm.), with crenate margin, the lobation in no case extending as far as the midrib. Midrib broad with 8-9 ridges. Venation as in *Taeniopteris spatulata,* the secondary veins being at right angles or slightly acute (20-30°). Veins almost 1 mm. apart at the midrib, 2-3 per mm. at the margin.

On the same slab is a specimen of *Taeniopteris spatulata,* identical except in the absence of lobation.

N.M.V., No. P14211 (Seward's No. 167) also shows a lobed base.

Remarks. These specimens differ from *Taeniopteris spatulata* Oldham and Morris 1863 only in the crenate margin. They may be compared also with *Anomozamites* and *Nilssonia,* but no example was found which showed the lobation extending to the midrib. Oldham and Morris (1863) regarded the Indian forms as long fronds of *Taeniopteris spatulata* which had obtained the crenate margin by an accident of preservation.

Locality. 134, 112, 71.

Taeniopteris tenison-woodsi (Etheridge 1892) Dun 1898 (Fig. 9)

1925. *Taeniopteris tenison-woodsi* Walkom. *Proc. Linn. Soc. N.S.W.*, L.
1932. *Taeniopteris tenison-woodsi* Walkom. *Proc. Linn. Soc. N.S.W.*, LVII.

Specimen. Geology Department, University of Melbourne, No. 2010.

Diagnosis. See Walkom 1917.

Remarks. Queensland specimens have been transferred to Harris' genus *Doratophyllum* as a result of the study of the epidermal structure (Jones and de Jersey 1947). The specimen from Rhyll shows the venation clearly, but as it is only an impression it is impossible to check the determination by an examination of the cuticle. As a result, the genus *Taeniopteris* must be used.

A record of *Taeniopteris tenison-woodsi* was made by Etheridge from Jumbunna, but as no figure was published, and the specimen ('Nos. 363, 393, Australian Museum, Sydney') could not be traced, this record could not be checked.

Locality. 134.

Genus **Phyllopteroides** Medwell MS.

The genus is founded on leaves from Allot. 4, Parish of Killara, Victoria, which are close to *Linguifolium* Arber 1917 and *Phyllopteris* Walkom 1919. As has been discussed in a report on the flora of this locality (Fossil plants from Killara, Victoria, Medwell MS.) the genus *Linguifolium* is not sufficiently wide to include the Australian leaves, and Arber has shown the genus *Phyllopteris* to be invalid. The name *Phyllopteroides* has been instituted to include the Australian leaves formerly referred to *Phyllopteris.*

Diagnosis. Leaves simple, linear-lanceolate; margins dentate or entire; midrib prominent, lateral veins leaving midrib at an acute angle and dividing dichotomously once or twice at varying distances from the margin, not anastomosing. Epidermal cells polygonal in outline.

Phyllopteroides is rare in the Victorian Lower Jurassic. A specimen from Allot. 49 Jumbunna may be seen in the Geological Museum, and from the same locality Seward (1904, fig. 29) figured as *'Thinnfeldia sp.'* a fragment which Arber referred to *Linguifolium* and which may also be placed in *Phyllopteroides.* From several Victorian Jurassic localities doubtful records have been made, the original specimens of which have not been traced, but the names and descriptions given them by early workers are strongly suggestive of their inclusion in *Phyllopteroides.* Etheridge (1902) records *Phyllopteris sp.* ? from Kongwak, Korumburra and Jumbunna East, which he describes as possessing 'simple bifurcate venation' similar to that of the *Phyllopteris* of Leigh Creek, South Australia, and Ipswich, Queensland. No sign of net venation was observed. It is also possible that the specimens from San Remo referred by Stirling (1900) to *Sagenopteris carruthersi* may also be placed in *Phyllopteroides.*

Locality. 42, 67, ? 85, ? 92, ? 99.

Phyllopteroides dentata Medwell MS.

Holotype. Geology Department, University of Melbourne, No. 2005.

Diagnosis. Leaf linear-lanceolate, narrowing gradually towards the base, apex rounded. Margin dentate, dentation less marked at the apex. Midrib strong, straight, 1 mm. at the base, not persisting to the apex; lateral veins generally opposite, leaving midrib at an acute angle, arching, and bifurcating at varying distances from the margin; about 4 veins per tooth at margin.

Remarks. The *Linguifolium sp.* listed by Coulson (1930) from Queen's Park, Geelong, is probably *Phyllopteroides dentata.*

Locality. 137, 149.

Genus **Rhizomopteris** Schimper

Rhizomopteris etheridgei Seward 1904

1904. *Rhizomopteris etheridgei* Seward. *Vic. Geol. Surv. Rec.,* I: Pt. 3.

Syntypes. N.M.V., Nos. P14219, P14218, P14217.

Diagnosis. See Seward 1904, p. 176.

Remarks. Seward suggested that the rhizomes described might have borne leaves of *Cladophlebis australis.* Chapman (1909) described further specimens which, he claimed, showed portions of fronds of *Taeniopteris spatulata* crushed along the creeping stem.

Locality. 36, 40.

Genus **Sphenopteris** Brongniart 1822

Sphenopteris is a very variable form genus, and the separation of the Victorian species is not at all clear. From Victorian localities, McCoy distinguished three species of *Sphenopteris*—*Sphenopteris ampla, Sphenopteris crassinervis,* and *Sphenopteris warragulensis.* These were figured without description in Stirling (1892, 1900). Stirling defined and figured two additional species, *Sphenopteris fosteri* and *Sphenopteris travisi,* which had been marked as new species by McCoy. *Sphenopteris fosteri* was said to resemble *Sphenopteris warragulensis* 'except that the apex of the pinnae are more acutely serrate, and the nervures more pronounced' (Stirling 1900, p. 4) and *Sphenopteris travisi* was described as having 'very delicate pinnae'. The variation seen in these two forms is too slight to merit even varietal distinction.

Seward (1904) describes only one form, *Sphenopteris ampla,* and mentions *Sphenopteris warragulensis* as possibly specifically identical with *Sphenopteris ampla. Sphenopteris ampla* itself very closely resembles *Sphenopteris hislopi* Oldham and Morris 1863 (Pl. XXXI, figs. 1-5), and is probably specifically identical with this form.

There are two possible methods of treatment of the Victorian forms—to group them under a single species, or to separate two species or varieties. There appear to be two types of frond, one with rounder blunter pinnae, embracing the larger leaves placed in *Sphenopteris ampla* and *Sphenopteris crassinervis,* and the smaller species similar to *Coniopteris,* and including *Sphenopteris travisi*; and one with more elongate, acutely pointed pinnae such as are seen in the type specimens of *Sphenopteris warragulensis* and *Sphenopteris fosteri.* These could be separated as two species, *Sphenopteris ampla* and *Sphenopteris warragulensis.*

A rather similar situation exists in the Cretaceous of Maryland. Working with the flora of the Potomac Series, Berry found a group of ferns showing great variability in form. These he referred to *Onychiopsis* Yokoyama 1890, a genus based on soral characters in which have been placed specimens formerly in the form genus *Sphenopteris.* Berry distinguished 'two main types, the narrow pinnule type, that identified as *Sphenopteris Mantelli* by Fontaine . . . and the broader type exemplified by the foreign *Sphenopteris Goepperti*' (Berry 1911, p. 271).

Although the extreme types are distinct, as seen in McCoy's original specimens, every gradation exists between them so that fragmentary specimens are difficult to determine. Again as in the case of Berry, 'it was found impossible to fix upon any characters of specific value that would hold good for material other than the individual specimen upon which they were based' (Berry 1911, p. 271). Thus it seems best to unite all the Victorian specimens under one species. As these were large ferns with bi- or tripinnate fronds, one or two species with slight individual variation in form when broken up and fossilized could appear to represent more species than were actually present. Pinnae at the base of the fronds would differ from those higher up, and individual pinnules on these would vary. It seems wiser to regard these variations as due to age and position, rather than to allow them specific or varietal rank.

As pointed out by Seward (1904), there is a very close resemblance between the Victorian *Sphenopteris* and *Sphenopteris hislopi* Oldham and Morris 1863 from Bindrabun, Rajmahal Hills, India, and although Seward hesitated to unite *Sphenopteris ampla* with this species, this now seems the best course. No details are known of the epidermal structure of these forms, and the only evidence of sori is afforded by *Sphenopteris warragulensis* McCoy, where sori are seen at the tips of the lobes. As the affinities of the Victorian forms are not known, and until further evidence is available, *Sphenopteris ampla, Sphenopteris crassinervis, Sphenopteris warragulensis, Sphenopteris fosteri* and *Sphenopteris travisi* are included in *Sphenopteris hislopi* Oldham and Morris 1863.

Among Australian *Sphenopterids*, the Victorian forms most resemble *Sphenopteris superba* Shirley from Esk and Walloon Series of Queensland, and a specimen from the Esk Series (F12852, Geology Department, University of Queensland) identified only as '*Sphenopteris sp.*'

The relationship between sterile specimens of *Sphenopteris* and *Coniopteris* is not always clear. The leaf forms are very similar, though *Sphenopteris* possesses rather larger, more acute lobes. This distinction is not always obvious, and sterile fragments are frequently difficult to place. Doubtful specimens have been placed in the wider form genus *Sphenopteris*.

Sphenopteris hislopi Oldham and Morris 1863

1863. *Sphenopteris hislopi* Oldham and Morris. *India Geol. Surv. Mem., Pal. Indica, Fossil Flora Gondw. Syst.,* I: Pt. 1: Pl. XXXI, figs. 1-5.
1877. *Sphenopteris hislopi* Feistmantel. *Ibid.,* I: Pt. 2: 28.
1889. *Sphenopteris warragulensis* McCoy. In Murray. *Vic. Mines Dept. Ann. Rep.,* p. 18.
1892. *Eremopteris warragulensis* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep., Coalfields* 1.
Sphenopteris warragulensis McCoy. *Ibid.*
Sphenopteris ampla McCoy. *Ibid.*
1900. *Sphenopteris ampla* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep., Coalfields* 7.
Sphenopteris warragulensis McCoy. *Ibid.*
Sphenopteris crassinervis McCoy. *Ibid.*
Sphenopteris fosteri Stirling. *Ibid.*
Sphenopteris travisi Stirling. *Ibid.*
1904. *Sphenopteris ampla* Seward. *Vic. Geol. Surv. Rec.,* I: Pt. 3.
1908. *Sphenopteris ampla* Chapman. *Vic. Geol. Surv. Rec.,* II: Pt. 4.
1909. *Sphenopteris ampla var. crassinervis* Chapman. *Ibid.,* III: Pt. 1.

This species was figured by Oldham and Morris (1863), and was described by Feistmantel (1877).

Diagnosis. Frond bipinnate, very variable in form. Pinnae generally ovate, broad or narrow, may be elongate, wedge-shaped. Margin lobed to acutely serrate. Lobes linear, narrowing towards the base. Venation distinct, sphenopteroid, arising from the base of the leaf and bifurcating several times. Sori seen in only a few examples, situated at the ends of the lobes, and appearing to be covered by an indusium, but exact nature unknown.

Locality. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 22, 24, 25, 26, 27, 29, 33, 34, 35, 36, 37, 38, 41, 42, 45, 47, 48, 49, 51, 52, 53, 54, 55, 59, 60, 61, 62, 63, 64, 65, 67, 70, 71, 72, 75, 78, 79, 80, 81, 82, 83, 84, 85, 86, 90, 91, 97, 99, 100, 102, 103, 106, 107, 110, 111, 112, 114, 116, 117, 119, 120, 122, 123, 125, 126, 131, 133, 135, 137, 138, 140, 141, 142, 143, 146, 147, 149, 150, 155.

Oi. PTERIDOSPERMAE

Fi. CORYSTOSPERMACEAE

Thinnfeldia Ettingshausen and **Dicroidium Gothan**

A good deal of confusion has arisen regarding the Australian *Thinnfeldias*. In 1845, Morris described *Pecopteris odontopteroides* from Tasmania. Crépin (1876) suggested that this should be referred to Ettingshausen's genus, *Thinnfeldia*, and this was done by Feistmantel (1878), who also placed specimens from other Eastern Australian localities in this species. Later authors referred more specimens from many localities to *Thinnfeldia odontopteroides* (Morris) Feistmantel, and in addition several new species of *Thinnfeldia* were erected, the limits of which were not clearly defined. In 1909, Dun attempted to define the species of *Thinnfeldia* and gave synonymies of each.

In 1912, Gothan revised the genus *Thinnfeldia* and, on the basis of form, venation, epidermal characters and geographical distribution, separated the Southern Hemisphere *Thinnfeldias* of the *Glossopteris* region as a new genus *Dicroidium*.

In 1914, Antevs critically examined Gothan's generic distinctions, and, while upholding the two-fold division, pointed out that, of the characters used by Gothan, there is hardly one which may not exist in both genera, and that the geographical division does not apply. He removed several forms from the genus *Thinnfeldia*, and for these he adopted the generic name *Dicroidium* proposed by Gothan.

Walkom (1917) contested the separation of *Dicroidium*, and continued to apply *Thinnfeldia* to the Australian forms. In this he was supported by Arber (1917) and du Toit (1927).

Later workers, Jones and de Jersey (1947) and Jacob and Jacob (1951) uphold the separation. Jacob and Jacob, working with Australian material, in a preliminary paper on the genus, describe in detail the cuticle of several species of *Dicroidium*. A full account of the problem may be found in Walkom (1917), Gothan (1912), Antevs (1914), Arber (1917), and du Toit (1927).

Frenguelli (1943-44) has placed Feistmantel's *Thinnfeldia odontopteroides* in a new genus, *Zuberia feistmanteli*, but the necessity of this course is yet to be substantiated.

The Victorian specimens, lacking workable cuticles, do not throw any light on the problem. *Thinnfeldia odontopteroides* and *Thinnfeldia acuta* have been placed in *Dicroidium* by analogy with the New South Wales and Queensland forms, but *Thinnfeldia pinnata* and *Thinnfeldia mccoyi*, whose cuticles are unknown, have been retained in *Thinnfeldia* until evidence is available.

Thinnfeldia and *Dicroidium* are placed in the family *Corystospermaceae* of the *Pteridospermae* on the evidence of Thomas (1933). In a more recent paper, Jacob and Jacob (1951) state that fronds of *Dicroidium* from New South Wales possess typically gymnospermous cuticle. In certain respects, the cuticle of these forms recalls the Bennettitalean cuticle and that of the *Ctenis* group, but the affinities of *Dicroidium* are still under investigation.

Genus **Dicroidium** Gothan 1912

Diagnosis. 'Frond dichotomous, each branch usually pinnate, seldom bipinnate. Venation odontopteroid, seldom alethopteroid. Epidermis delicate, walls of epidermal cells definitely undulating, delicate; stomata without subsidiary cells, irregularly arranged. Only in Rhaetic of the *Glossopteris* region. Common to date in Argentina, South Africa, Australia. Rare in East Indies.' (Translated from Antevs, 1914.)

Dicroidium odontopteroides (Morris 1845) Gothan 1912

For full synonymy see also Arber 1917, p. 50.

1845. *Pecopteris odontopteroides* Morris. In Strzelecki, *Physical Description of New South Wales and Van Dieman's Land,* p. 249, Pl. VI, figs. 2-4.
1908. *Thinnfeldia odontopteroides* Chapman. *Vic. Geol. Surv. Rec.,* II: Pt. 4.
1909. *Thinnfeldia odontopteroides* Chapman. *Ibid.,* III: Pt. 1.
1917. *Thinnfeldia odontopteroides* Arber. *N.Z. Geol. Surv. Pal. Bull.* 6, p. 50, Pl. I, fig. 7; Pl. V, fig. 5.
1925. *Thinnfeldia odontopteroides* Walkom. *Pap. and Proc. Roy. Soc. Tas.,* p. 78, fig. 5.
1947. *Thinnfeldia odontopteroides* Jones and de Jersey. *Qld. Univ. Pap.,* III (N.S.) : No. 3 : 16.

Specimens in the Geological Museum.

Diagnosis. Walkom's (1917a) definition of the species covers the Victorian forms.

Locality. 48, 53, 136, 143, 141.

Dicroidium acuta (Walkom 1917) Gothan 1912 (Pl. VI, fig. 24)

For full synonymy see Walkom 1917a.

1917. *Thinnfeldia acuta* Walkom. *Qld. Geol. Surv. Pub.,* 257: 23, Pl. III, fig. 4.

Specimen. N.M.V., No. P2169.

Diagnosis. See Walkom 1917a.

Locality. 53, 56.

Genus **Thinnfeldie** Ettingshausen

Diagnosis. 'Frond simple, usually pinnate; venation alethopteroid, seldom with a tendency to odontopteroid. Epidermis thick, walls of epidermal cells straight, thick; stomata with subsidiary cells in rows. Known from the Rhaetic of North Sweden, Hungary, Caucasus.' (Translated from Antevs 1914.)

Thinnfeldia mccoyi Seward 1904

1904. *Thinnfeldia mccoyi* Seward. *Vic. Geol. Surv. Rec.,* I: Pt. 3: 174, fig. 8.
1909. *Thinnfeldia mccoyi* Chapman. *Vic. Geol. Surv. Rec.,* III: Pt. 1: 110.

Holotype. Geological Museum, No. 149.

Diagnosis. Frond large, pinnate; pinnules opposite, broad, ovate, with decurrent margins. Venation alethopteroid. Each segment with a midrib which does not reach the tip and gives off dichotomously branched secondary veins at an acute angle.

Locality. 28, 36, 48, 53, 63, 97, 112, 137.

Thinnfeldia pinnata Walkom 1921 (Fig. 8; Pl. VI, fig. 27)

1921. *Thinnfeldia pinnata* Walkom. *N.S.W. Geol. Surv. Mem., Pal.* 12: 10, Pl. II, figs. 1-4.

Specimens in Geology Department, University of Melbourne.

Diagnosis. See Walkom 1921.

Remarks. Specimens from Rhyll, Phillip Island, of simple fronds, each with a relatively long petiole, and not seen attached to a rachis, seem best placed in this species. Neither venation nor cuticle is preserved, so that determination is based on leaf shape only. There is also no sign of the pitting seen on the rachis of many *Thinnfeldias.* In the outline of the leaf these specimens somewhat resemble *Reinitsia* Walkom 1932, but as venation and cuticle are unknown there is no evidence for placing them in this species.

Thinnfeldia pinnata is described only from the Talbragar Series of New South Wales.

Locality. 134.

O_2. CYCADALES

Genus **Neuropteridium** Schimper 1869

Neuropteridium sp. (Fig. 7, 7a)

Specimen No. 2004 in the F. H. McK. Grant Collection, Geology Department, University of Melbourne, determined by Chapman as *Sphenopteris ampla* McCoy.

Diagnosis. Frond pinnate, possibly bipinnate; pinnules broad, linear to ovate; margin shows a slight tendency towards lobing; pinnules alternate, attached only by the central portion of the base, auriculate. Venation neuropteroid, i.e. with a short midrib giving off repeatedly forked diverging veins.

Remarks. The larger isolated pinnules bear a resemblance to similar specimens from South Gippsland which have been referred to *Thinnfeldia mccoyi* Seward.

Locality. 148.

Nilssonia sp.

From Allot. 53a, Jumbunna, Seward (1904, fig. 41) figured an incomplete fragment which he called '*Nilssonia sp.*', stating that the material was too meagre for accurate diagnosis. A similar fragment has been obtained from the State Coal Mine, Wonthaggi (20 Shaft, 5 feet above the Intermediate Seam), but it too cannot be definitely determined.

CONIFEROPHYTA

O_1. GINKGOALES

A detailed investigation and devision of the fossil *Ginkgoales* was made by Florin in 1936. As a result of this work, the genera have been more exactly defined, and there has been considerable rearrangement of species. Utilizing presence or absence of a distinct petiole, leaf shape, lobation, venation, and epidermal characters, Florin compiled a comprehensive key, the portion of which relevant to the Victorian species is given below:

1. Foliage leaves with stalk distinctly offset from the lamina and approximately semi-circular to broad triangular in outline.
   - (i) Foliage leaves either unlobed, or ± deeply divided into 2-8 tongue-shaped and basally constricted cuneate primary lobes; these frequently arranged in a right and left group, normally only once deeply (into half or still deeper) divided into secondary lobes, which enclose 4-6 or more subparallel veins in the middle part of the leaf.
     - A. Venation spongy to moderately dense, showing less than 20 veins per cm. in the apical part.
       - (a) Foliage leaves closely agreeing with *Ginkgo biloba* (Recent) in epidermal structure or other systematically important anatomical characteristics.—*Ginkgo.*
       - (b) Foliage leaves in respect to epidermal structure or other systematically important characters either unknown, or in any one of these strongly differing from *Ginkgo biloba.*—*Ginkgoites.*
     - B. Venation very dense, 20 veins or more per cm. in the apical part of the foliage leaves.—*Ginkgoidium.*
   - (ii) Foliage leaves very strongly (to more than 2/3) divided into primary lobes, which can be arranged in two groups, and in their turn are at least once, but mostly repeatedly deeply lobed, all lobes narrow, linear or almost so, not more than 2-4 parallel veins included in any one part.—*Baiera.*

2. Foliage leaves without distinctly offset stalk, diminishing towards the base to wedge shape, and in their outline ± narrowly triangular or tongue-shaped to nearly linear.
   (i) Foliage leaves constantly ± lobed.
      A. Foliage leaves ± deeply lobed, these being almost everywhere more than 2-4 veins in width.—*Sphenobaiera.*
      B. Foliage leaves repeatedly deeply divided dichotomously into narrow linear lobes, and containing never more than 2-4 veins in width.—*Czekanowskia.*
   (ii) Foliage leaves polymorphic, either entire with rounded apices or each once or twice shallowly divided.
   (iii) Foliage leaves constantly entire. with rounded apices.
      A. Epidermal structure of foliage leaves unknown.—*Phoenicopsis.*

Genus **Ginkgoites** (Seward) emend. Florin 1936

As a result of Florin's investigation, the Victorian examples of *Baiera,* with the exception of *Baiera delicatula,* are now placed in the genus *Ginkgoites.*

Ginkgoites australis (McCoy 1892) Florin 1936

1892. *Baiera australis* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep., Coalfields 1,* Pl. I, fig. 2.
Baiera robusta McCoy. *Ibid.*
Baiera subgracilis McCoy. *Ibid.*
1900. *Baiera australis* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep., Coalfields 7.*
Baiera robusta McCoy. *Ibid.*
Baiera subgracilis McCoy. *Ibid.*
1901. *Baiera subgracilis* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep.* 3.
Baiera bidens. Ibid.
1904. *Baiera australis* Seward. *Vic. Geol. Surv. Rec.,* I: Pt. 3: 71.
1936. *Ginkgoites australis* Florin. *Palaeontographica,* Bd. 81.

Syntypes. N.M.V., Nos. P14221, P14222; 11c, 11b, 10.

Diagnosis. Leaves simple, fan-shaped, with distinctly offset slender petiole; divided into a number of primary lobes, frequently arranged in two groups; these further divided into secondary segments, bluntly rounded, each containing 5-14 subparallel dichotomising veins.

Remarks. In Stirling's report (1892), McCoy figured, without adequate description, two new forms, *Baiera australis* and *Baiera subgracilis. Baiera robusta* was recorded without figure of description. McCoy regarded these three species as 'of highest interest in confirming the oolitic age' of the deposits. In 1900, Stirling gave a brief description of these forms.

In an examination of the type material, I have been unable to separate *Baiera australis* and *Baiera subgracilis,* and with *Baiera robusta,* the type material of which is missing, and which was not figured, these have been grouped as one species.

Baiera subgracilis has been compared with *Ginkgoites simmondsi* Shirley, and Etheridge (1902) favoured grouping both species under the name *Baiera flabelliformis.* Etheridge described 'ovate elliptical bodies' from Kongwak, which he believed to be seeds of *Baiera.* Victorian specimens possess fewer and smaller segments, with fewer veins (5-14) than are found in *Ginkgoites simmondsi* (up to 36 veins). The division of the leaf into two portions, and the bifurcation at the end of the segments, are distinctive, and are not seen in *Ginkgoites simmondsi.*

Arber (1917) has compared *Sphenobaiera robusta* (Arber 1917) Florin 1936 from Mount Potts, New Zealand, with *Baiera robusta* and *Baiera subgracilis* McCoy. In the first figured specimens of *Baiera subgracilis* (Stirling 1892, Pl. II, fig. 13, and Stirling 1900, Pl. I, fig. 7) the petiole is shown as distinctly offset, and the base is too narrow to allow inclusion in the genus *Sphenobaiera.*

From the San Martin Flora of Patagonia, Halle (1913) described a *Baiera* which he compared with McCoy's species, and from his descriptions and figures it seems likely that these may be included in *Ginkgoites australis*.

Locality. 1, 7, 10, 25, 37, 42, 47, 54, 55, 67, 68, 73, 80, 83, 85, 86, 88, 89, 90, 92, 93, 97, 99, 102, 111, 117, 120, 125, 126, 127, 128, 132, 137, 144, 145, 146, 154, 155.

Ginkgoites antarcticus (Saporta 1898) Seward 1919

1898. *Ginkgo antarctica* Saporta. In Shirley, *Qld. Geol. Surv. Bull.*, 7: 11, Pl. I, fig. 1.
1917. *Ginkgo antarctica* Walkom. *Qld. Geol. Surv. Pub.*, 259: p. 1, Pl. I, figs. 1. 2.
1936. *Ginkgoites antarcticus* Florin. *Palaeontographica*, Bd. 81.
1947. *Ginkgoites antarcticus* Jones and de Jersey. *Qld. Univ. Pap.*, III (N.S.) : No. 3: 58.

Diagnosis. See Walkom 1917.

Remarks. A fragmentary specimen figured by Seward (Pl. XVII, fig. 5) as *Ginkgo sp.* may be placed in this species.

Locality. 67.

Genus **Baiera** (F. Braun 1843) Florin 1936

Baiera delicatula Seward 1904

1904. *Baiera delicatula* Seward. *Vic. Geol. Surv. Rec.*, I: Pt. 3: 178, fig. 38.

Holotype. N.M.V., No. P14223.

Diagnosis. Leaf fan-shaped, petiole distinctly offset, lamina divided into numerous narrow linear spreading segments, and bisected by a deep median sinus. Epidermal structure unknown.

Remarks. No further specimens have been found.

Locality. 144, 148.

Genus **Czekanowskia** Heer 1876

The genus *Czekanowskia* was introduced by Heer (1876, p. 65) for *Gymnosperms* from the Mesozoic of Siberia. Heer describes the reproductive structure of these plants, but the evidence that the fertile and sterile specimens described belong to the same plants is not conclusive. In later work, the name *Czekanowskia* is used exclusively for leafy short shoots. The genus has been examined by Nathorst (1906), Harris (1926), Black (1929), Oishi (1930, 1933), and has been thoroughly revised by Florin (1936).

The following definition is a translation from Florin: 'Foliage leaves leathery, proportionately thick, rather long, not diminishing to a stalk but somewhat broadening close to the base, bifurcating at an acute angle 1-5 times, with very narrow, parallel-sided, entire lobes. In the apical part these were short, narrow, pointed. Leaf lobes further traversed by 2-4 veins, parallel, furcating according to the splitting of the leaf surface, and mostly arranged in pairs. Foliage leaves bunchy, placed on short, almost bulbous, downward sloping short shoots, and surrounded at the base by small persistent lower leaves.'

Czekanowskia sp. (Pl. VI, fig. 20)

Most of the known species of *Czekanowskia* are characterized by features of the cuticle, and in the absence of cuticle in Victorian forms, these cannot be allied to any described species.

Diagnosis. Foliage leaves bunchy, deeply lobed, bifurcating repeatedly from a relatively broad base to give narrow linear entire lobes, greatest number of bifurcations observed 5. Apices of lobes short, abruptly pointed. Veins parallel, dichotomising just prior to dichotomy of lamina. Cuticle unknown.

Locality. 101.

Czekanowskia tenuifolia (Johnston 1886) Jones and de Jersey 1947

Several records have been made of rather rigid fronds, branching several times and with reduced lamina and a single median vein. These generally have been regarded as *Stenopteris elongata* Carruthers 1872.

In 1947, Jones and de Jersey pointed out that the description and figure of *Stenopteris* species given by Carruthers (1872) is not clear, and the specimen could be *Czekanowskia tenuifolia*. A study of the evolutionary trends of the genus and of details of the cuticle was made, and *Stenopteris elongata* was redefined and figured.

The Victorian specimens differ appreciably from Jones and de Jersey's specimens. Our material is fragmentary, and no cuticle is present to give conclusive evidence of the genus. On the leaf form alone, it seems closest to *Czekanowskia*.

Locality. 9, 10, 25, ? 20, 54, 102, 112, 137, 147.

O_2. CONIFERALES

ARAUCARINEAE

Fi. ARAUCARIACEAE

Genus **Araucarites** Presl.

The genus *Araucarites* includes cones, detached cone scales and wood, which bear a close resemblance to those of the modern *Araucarineae*. Sterile shoots have been referred to *Araucarites*, but with less justification.

The *Araucarineae* are characterized by simple cone scales, laterally winged and with a prolonged tip, arranged around an axis to form a cone. Each scale bears a single centrally situated seed, and possesses a prominent appendage, the ligule.

Araucarites cutchensis Feistmantel 1876 (Pl. VI, figs. 22, 23)

1896. *Araucarites cutchensis* Feistmantel. *Foss. Flora Gondw. Syst.*, II: Pt. 1.
1917. *Araucarites cutchensis* Arber. *N.Z. Geol. Surv. Bull. Pal.* 6: 56: Pl. 8, fig. 5: Pl. 13, fig. 4.
1919. *Araucarites cutchensis* Walkom. *Proc. Linn. Soc. N.S.W.* XLIV.
1920. *Araucarites cutchensis* Seward and Sahni. *India Geol. Surv. Mem. Pal. Indica,* 7 (N.S.): Mem. No. 1: Pl. VI, figs. 63, 64.
1922. *Araucarites cutchensis* Seward and Holttum. *Q.J.G.S.*, LXXVII: Pt. 3: 274: Pl. XII, fig. 17.
1928. *Araucarites cutchensis* Sahni. *India Geol. Surv. Mem. Pal. Indica,* XI (N.S.): Pt. 1: 31: Pl. V, figs. 65-67.

Diagnosis. See Sahni 1928.

Remarks. Specimens have been recorded from many Victorian localities which are best placed in this species (as revised by Sahni 1928). Seward (1904) described two cone scales from Victoria, and his *Araucarites sp. A* may be included in *Araucarites cutchensis*. Cone scales of this type are very widespread, having been recorded from the Clarence Series (Jurassic) of New South Wales; the Burrum Series (Lower Cretaceous) of Queensland (Walkom 1919); Graham Land (Halle 1913); the Rhaetic and Jurassic of New Zealand (Arber 1917); the Jurassic of Ceylon (Seward and Holttum 1922); the Umia Beds of Kach, India, (Lower Cretaceous) (Feistmantel 1876); and from the Rhaetic of Patagonia (Berry 1924). The plants allied to the Eutacta section of *Araucaria* have a wide distribution in both space and time.

Locality. 7, 8, 31, 34, 47, 53, 59, 65, 67, 74, 75, 86, 108, 109, 131, 138, 147.

? Araucarian Cone Scale (Fig. 17)

In Mr. D. Jeffrey's collection from Queen's Park, Geelong, is a single specimen of a cone scale identical with those described above, except in the possession of three spines instead of the usual single prolongation of the tip of the scale. The scale is also rather broader than those of *Araucarites cutchensis.*

? ARAUCARINEAE

Genus **Brachyphyllum**

The genus *Brachyphyllum* has been revised by Kendall (1947), who has obtained cuticle preparations of material from the Jurassic of Yorkshire and Wiltshire. The external features of the genus as defined by Kendall are as follows: 'Conifer twigs, often pinnately branched in one plane but individual shoots not flattened. Leaves borne spirally arising from about the middle of the rhomboidal or hexagonal leaf base cushion. Leaf, with leaf base cushion, broad, typically about as broad as long. Leaf forming the pointed continuation of the leaf base cushion, either pointing directly upwards and outwards, but only slightly overlapping its own leaf base cushion. Substance of leaf very thick indeed. Venation not known.' (Kendall 1947.)

Brachyphyllum gippslandicum McCoy 1900 (Fig. 10; Pl. VI, fig. 26)

1900. *Brachyphyllum gippslandicum* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep., Coalfields 7.*
1904. *Brachyphyllum sp.* Seward. *Vic. Geol. Surv. Rec.,* 1: Pt. 3: fig. 44.
1909. *Brachyphyllum gippslandicum* Chapman. *Vic. Geol. Surv. Rec.,* III: Pt. 1: 110.

Lectotype. N.M.V., No. P15705.

Diagnosis. Brachyphyllum with ovate-elliptical leaves, protruding considerably from the leaf base cushion. Epidermal structure unknown.

Remarks. In Stirling's report (1900), McCoy described a new species of *Brachyphyllum* from Gippsland as closely resembling *Brachyphyllum mamillare* Lindley and Hutton of the Indian Jabalpur Group, in the ovate rhomboidal form of the leaf scales and in the repeated ramification. In the absence of knowledge of the epidermal structure, accurate comparison with the revised species cannot be made and *Brachyphyllum gippslandicum* is retained as a separate species until such information becomes available.

The fragment described by Chapman as *Cheirolepis* is rather too small and incomplete for accurate diagnosis.

Locality. 10, 34, 51, 53, 55, 117, 138, 140, 143, 147, 154.

PODOCARPINEAE

F_1. PODOCARPACEAE

Genus **Bellarinea** Florin 1952

The genus was instituted by Florin for a podocarpaceous conifer from Bellarine, Victoria, described by McCoy as *Zamites* (*Podozamites*) *barklyi.*

Diagnosis. 'Woody plants. Leaves on branchlets of moderate length, bifacial, spirally disposed but expanded approximately in one plane, turning the morphological upper surface upwards, spreading to divaricate, coriaceous, entire, flat, linear-lanceolate, straight or more or less strongly falcate, subacute or obtuse at the apex, only slightly contracted at the base, decurrent on the axis, and uninerved.

Leaves on branchlets hypostomatic, showing two narrow bands with irregularly, mostly obliquely orientated stomata on the under surface. Stomatal apparatus in the bands somewhat irregularly arranged in longitudinal rows. Leaf margins entire. Stomatal apparatus haplocheilic; perigene subsidiary cells 4 to 6 in number; guard cells only slightly sunk. Anticlinal walls of epidermal cells straight in the stomatiferous bands, but often slightly sinuous in the non-stomatiferous areas on both surfaces.' (Florin 1952, p. 179.)

Bellarinea barklyi (McCoy 1874) Florin 1952

1874. *Zamites (Podozamites) barklyi* McCoy. *Prodromus of the Palaeontology of Victoria*, pp. 33-34: Pl. 8, fig. 1. (non Stirling 1900, p. 5: Pl. 5, figs. 4-5.)

Holotype. N.M.V., No. P12220.

Diagnosis. See Florin 1952, p. 179.

Remarks. *Bellarinea barkyli* is the only specimen from the Victorian Jurassic which has yielded workable cuticle. It is distinctive in that it combines long, linear-lanceolate leaves, with obliquely orientated stomata arranged in longitudinal rows forming two narrow bands on the under surface of the leaf.

Locality. 140, ? 8, ? 122, ? 199.

POSITION UNKNOWN

Genus **Elatocladus** Halle 1913

Sterile shoots of Mesozoic conifers are frequently difficult to place, as Gymnosperm genera are based chiefly on reproductive organs. In the absence of cones, fossils should not be grouped with such known genera, and Halle (1913) has erected the form genus *Elatocladus* to receive 'sterile coniferous branches of radial or dorsiventral type, which do not show any characters which permit them to be included in one of the genera instituted for more peculiar forms' (Halle 1913). In this form genus fall specimens from Victoria previously placed in the genera *Taxites, Palissya* and *Zamites*.

Elatocladus conferta Oldham and Morris 1863

For full synonymy see Arber 1917, Sahni 1928.

1900. *Palissya australis* McCoy. In Stirling, *Vic. Mines Dept. Spec. Rep., Coalfields 7*, p. 6, Pl. III, figs. 8, 9.

1904. *Taxites sp.* Seward. *Vic. Geol. Surv. Rec.*, I: Pt. 3: 182.

1908. *Palissya australis* Chapman. *Vic. Geol. Surv. Rec.*, II: Pt. 4: 7.

1909. *Palissya australis* Chapman. *Vic. Geol. Surv. Rec.*, III: Pt. 1: 110.
Taxites sp. Ibid.

1917. *Elatocladus conferta* Arber. *N.Z. Geol. Surv. Bull, Pal.*, 6: 58.

1928. *Elatocladus conferta* Sahni. *India Geol. Surv. Mem., Pal. Indica,* XI (N.S.): Pt. 1.

Diagnosis. See Sahni 1928, p. 12.

Remarks. In this genus is now included *Palissya australis* McCoy, which was figured without description by Stirling (1900), and compared with *Palissya indica*. Chapman (1909) recorded specimens of *Palissya australis* describing them as superficially similar to *Taxites*, but separable on the decurrent habit of the leaves. He compared the Victorian species with *Palissya brauni* Endlicher and *Palissya conferta* Oldham and Morris 1863.

The genus *Palissya* is reserved for plants with a particular type of fructification, so its application to the Victorian plants is inadmissable. *Palissya australis* McCoy is referred to *Elatocladus conferta* Oldham and Morris by Arber (1917) and Sahni (1928).

Several additional specimens have been obtained but no further details of the structure and affinity are available. Seward's *Taxites sp.* (1904, p. 182) is probably also *Elatocladus*.

Elatocladus conferta is recorded from India, Australia, New Zealand, and Graham Land.

Locality. 48, 53, 54, 74, 117.

Elatocladus mccoyi Florin 1952

1874. *Zamites longifolius* McCoy. *Prodromus of the Palaeontology of Victoria*, pp. 35-36: Pl. 8, fig. 3.
1952. *Elatocladus mccoyi* Florin. *Palaeobotanist*, I: 180: Pl. I, fig. 7: Pl. II, figs. 8a and 9.

Holotype. N.M.V., No. P12203.

Diagnosis. See Florin, p. 180, 1952.

Locality. 140, 143.

Gymnosperm Wood

A specimen collected from Cape Patterson by Dr. A. B. Edwards was suitable for sectioning. A transverse section revealed compact uniform secondary wood. Annual rings were clearly defined.

A radial longitudinal section showed medullary rays of from 6-16 cells deep. In tangential longitudinal section these rays were seen to be only one cell thick.

Preservation was not sufficiently good to allow the examination of the pitting on the tracheal walls. In the absence of such evidence no attempt was made to identify genus or species.

? Rhizome

Specimens. Geology Department, University of Melbourne.

Diagnosis. Jointed stems or rhizomes, longitudinally striated, curved, 5 mm. wide; hollow, traversed at 3 mm. intervals by transverse partitions.

Remarks. These most resemble a transverse longitudinal section of the type seen in *Vertebraria indica*, figured by Feistmantel (1877). Feistmantel's figured specimens show radial longitudinal sections, in which both longitudinal and transverse partitions may be seen. It is possible that the Coleraine material is a related structure which does not show the longitudinal septa as these are not in the plane of the section.

The genus *Vertebraria* is reserved for rhizomes of *Glossopteris*, and so cannot be applied to the Victorian specimens.

Locality. 152.

Conclusions

The Age of the Flora

The age of the Victorian Mesozoic flora has generally been placed as Jurassic. Seward (1904) regarded the specimens which he examined as belonging to 'a jurassic flora approximately of the same age as the inferior oolite flora of England or . . . of the Rajmahal series of India'. This opinion was based on the presence of ten forms almost indistinguishable from Inferior Oolite species. Seward also noted that some of the plants, e.g. the *Thinnfeldias*, bore a very close resemblance to those of a somewhat lower horizon.

Chapman (1908, 1909) placed the Victorian flora in the Jurassic, but also noted the presence of *Stenopteris*, which, with *Thinnfeldia*, would indicate a lower horizon than that which yielded the plants examined by Seward. Chapman remarked on the similarity between the Victorian and Tasmanian floras, believing them to be 'of approximately similar age'.

Walkom (1919) stressed the resemblance with the Walloon flora of Queensland, and correlated the Victorian beds with this series and with the Clarence, Artesian, and Talbragar Series of New South Wales.

Of the species present in the Victorian flora, the following throw some light on the age of the beds:

(a) Suggesting a Jurassic age.

Taeniopteris spatulata. Taeniopteris is not generally a good index fossil, but the narrow form, *Taeniopteris spatulata,* is relatively uncommon except in the Jurassic, where it occurs in great abundance.

Thinnfeldia pinnata is known elsewhere only from the Jurassic of the Talbragar Series of New South Wales.

Coniopteris hymenophylloides is a characteristic Jurassic plant within Australia and abroad.

Sphenopteris hislopi is identical with the Indian form from the Rajmahal Hills.

Osmundites dunlopi and *Osmundites gibbiana* are Jurassic species, and fronds of *Cladophlebis denticulata* range throughout the Mesozoic, and are especially abundant in the Jurassic.

Taeniopteris crenata is known also from the Rajmahal Hills.

Microphyllopteris occurs in the Lower Jurassic of India, and in the Waikato Heads flora of New Zealand, which was formerly believed to be Neocomian, but is now thought to be Jurassic.

The presence of the conifers *Brachyphyllum, Bellarinea, Elatocladus,* and *Araucarites* also suggests a Jurassic age.

(b) Suggesting a Triassic age.

There is a strong Triassic element in the flora, represented by:

Neocalamites. Known from the Ipswich, Esk, and Bundamba Series of Queensland, and from Tasmania.

Dicroidium and *Thinnfeldia* are typically Lower Mesozoic forms.

Stenopteris, if present, is a typically Triassic genus.

Ginkgoites and *Czekanowskia* are in Queensland practically restricted to the Ipswich and Esk Series, and are rare in the Bundamba and Walloon Series.

Taeniopteris tenison-woodsi is also an Ipswich species.

Although the Victorian flora contains both Triassic and Jurassic elements, there is no indication of any localization of species which would enable a stratigraphical subdivision of the flora to be made. Plants usually regarded as Triassic, and typical Jurassic forms coexisted at most localities—in the east at Albert River, throughout South Gippsland, at Grice's Creek on the Mornington Peninsula, in the Barrabool Hills, and in the west at Apollo Bay. Both elements were present near the base of the series at Rhyll, Griffith's Point and Kilcunda, and also where considerable depths of sediments have been proved by boring at Jumbunna, Korumburra, Wonthaggi, and Coalville. The most abundant records of the Triassic element are in the parishes of Jumbunna, Jumbunna East, Korumburra and Jeetho, but as these are also the most extensively explored areas, too much significance cannot be attached to this. At Welshpool, Binginwarri and Koorooman, Jurassic forms predominate, but this could be due to lack of material. From the Merino District, the few available records are of Jurassic forms, with the exception of *Ginkgoites* from Murndal and Casterton.

TABLE 1

Comparison of the Victorian Flora with other Mesozoic Floras

		Triassic								Jurassic										Cretaceous			
		L.		M.			U.																
	Victoria	Narrabeen, Hawkesbury	Esk, Qld.	Wianamatta, N.S.W.	Tasmania	Ipswich, Qld.	Bundamba, Qld.	Brighton Beds, Qld.	Stormberg, S. Africa	Talbragar, Clarence	Artesian, N.S.W.	Walloon, Qld.	New Zealand	Ceylon	Afghan-Turkestan	India	Graham Land	Yorkshire	Burrum, Qld.	Styx, Qld.	Maryborough, Qld.	? Waikata Heads, N.Z.
Neocalamites	+		+		+	+	+															
G. antarcticus	+		+			+																
Czekanowskia	+		+		+	+																
Stenopteris	+		+			+	+															
D. acuta	+		+		+	+																
D. odontopteroides	+	+	+	+	+	+	+		+	+	+		+									
T. tenison-woodsi	+	+	+	+	+	+	+															
G. australis	+		cf.			cf.	cf.						cf.					cf.		cf.		
T. mccoyi	+		cf.																			
Cladophlebis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+
Equisetites	+					+		+	+													
Lycopodites	+																	+				
Neuropteridium	+		cf.			cf.							+	+	+			+				
Nilssonia	+												+		+			+				
Osmundites	+											+	+									
Coniopteris	+									+			+		+			+				
T. pinnata	+									+												
S. hislopi	+		cf.							cf.		cf.	cf.		cf.	+					cf.	
T. spatulata	+								+	+	+	+	+	+		+		+	?	?		
Araucarites	+									+	+	+	+	+		+		+		+		
Brachyphyllum	+											+	+	+				+	+			
Elatocladus	+											+	+	+					+			
Microphyllopteris	+												+			+			+	+		+

Some species may predominate at one locality, e.g. the conifers at Bellarine, but there does not seem to be any regularity of distribution, and no stratigraphical pattern is evident. By far the most abundant forms throughout are the Jurassic *Taeniopteris spatulata* and *Sphenopteris hislopi*, and *Cladophlebis australis* is also frequently present. The flora is therefore placed in the Jurassic, the presence of the persistent Triassic element suggesting that the beds are very low in the Jurassic.

Correlation

Table 1 shows the relationship of the Victorian plants with other Mesozoic floras. It will be seen that five species are restricted to Triassic beds in other parts of the world, but the bulk of the flora is Jurassic. Some genera, e.g. *Cladophlebis* and the conifers, also extend into the Cretaceous.

Within Australia, the closest comparison possible is with the Queensland floras. These have been revised in recent years, and are more fully known than any others. In Queensland all stages of the Mesozoic are present. The Triassic is represented by the Ipswich Series—regarded by Jones and de Jersey as of Middle Triassic age, equivalent to the Hawkesbury and Wianamatta Series of New South Wales—and the Esk Series—which is correlated with the Kholo and Tivoli Stages of the Ipswich Series. The Bundamba Series contains a flora essentially Ipswich in character, and has been placed between the Ipswich and Walloon—probably Upper Triassic—with a greater break between the Bundamba and Walloon than between the Ipswich and Bundamba. The Jurassic of Queensland is represented by the Walloon Series, while Cretaceous is present in the Maryborough (Lower Cretaceous), Burrum (= Weald, Neocomian) and Styx Series (Patapsco of the Potomac, = Albian).

In addition, Queensland possesses several small floras which cannot be related with any certainty to either the Ipswich or Walloon Series. These include the Brighton Beds (Jones and de Jersey 1947), the material from North Arm, Parish of Maroochy, examined by Dr. Whitehouse, the Cracow flora (Jones 1948), and material from Marburg.

The Victorian flora contains representatives of both the Queensland Triassic and Jurassic floras. *Neocalamites, Dicroidium acuta, Dicroidium odontopteroides, Sphenopteris superba, Doratophyllum tenison-woodsi, Ginkgoites antarcticus, Czekanowskia tenuifolia*, the large *Thinnfeldias* and *Cladophlebis australis* of the Ipswich and Esk Series may be compared with the Victorian forms, while the Walloon flora is represented by *Equisetites, Cladophlebis australis, Dicroidium odontopteroides, Sphenopteris superba, Taeniopteris spatulata, Phyllopteris, Doratophyllum tenison-woodsi, Ginkgoites*, and the conifers *Araucarites, Brachyphyllum*, and *Elatocladus*.

The Victorian flora is not directly comparable with either of these series, but seems to be an intermediate facies. It is possible that when more is known of the smaller Queensland floras mentioned above, the Victorian plants may be correlated more closely with these than with either of the more clear-cut and better-known series.

The plant-bearing felspathic sandstones of Tasmania are very similar to the Victorian Lower Jurassic, but the flora is distinctly Triassic, and is most comparable with the Ipswich and Esk floras. *Neocalamites, Dicroidium acuta, Dicroidium odontopteroides, Czekanowskia* and *Ginkgoites*, which make up the Triassic element in Victoria, and *Cladophlebis australis*, which ranges throughout the Mesozoic, are also present in Tasmania.

From the Runnymede Formation, near Casterton, Victoria, a flora has been obtained which is quite distinct from the Lower Jurassic one described above, and which appears to range from Upper Jurassic to Cretaceous. (Medwell, MS.) It is a small flora of strongly Mesozoic aspect, and contains two Angiosperms. The plants are found in a soft white claystone, and occur in two distinct horizons, overlain without any marked break by fifty feet of ferruginous grits and clays which have yielded an Eocene fauna.

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