MACRO- AND MICRO-FLORAS OF NORTH-EASTERN NEW SOUTH WALES

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(Communicated by C. T. McElroy)


PART I: FOSSIL PLANTS FROM THE NYMBOIDA COALFIELD.

Introduction

The following is an account of a collection of fossil plants submitted for identification and age determination by Mr. C. T. McElroy, of the Geological Survey of New South Wales. The collection comprises: (1) approximately forty specimens with the plants preserved as carbonised impressions in dark grey shale, from the No. 2 workings, Nymboida colliery; and (2) three specimens preserved as impressions in light grey siltstone, from a locality three miles north of Nymboida. The investigation of these fossils has been greatly facilitated by a recent paper by J. A. Townrow (Townrow, 1957) in which several species previously included in the genus Thinnfeldia Ettingshausen have been revised and transferred to Gothan's genus Dicroidium. The writer is in agreement with Townrow's conclusions, and accordingly the species recorded here—D. odontopteroides, D. feistmanteli and D. narrabeenensis—have been placed in the latter genus.

Species Present in the Collection

Genus Dicroidium Gothan

Townrow (1957, p. 8) summarises the differences between Dicroidium and Thinnfeldia as follows:

"(1) Thinnfeldia is never forked, Dicroidium almost always.
(2) In Thinnfeldia the leaf is hypostomatic and the stomata are mostly in interveinal bands. The stomatal pit is rounded and is surrounded by a regular ring of fairly numerous subsidiary cells. The wall between the guard and lateral subsidiary cells is only weakly cutinised. In Dicroidium the leaf is amphistomatic, the stomata are scattered, and the subsidiary cells do not form a regular ring and are commonly only four. The common wall of the guard and lateral subsidiary cells is strongly cutinised, at least in those species where the stomatal aperture is sunken.
(3) In Thinnfeldia the cell outlines are straight, and the cuticle surface smooth, but in Dicroidium the cell outlines are sinuous, or with processes, and there is normally a papilla in each epidermal cell."

With regard to the age of Dicroidium, Townrow concludes that it is mainly a Triassic and early Jurassic genus, and states that "On the other hand, the genus Thinnfeldia, in a strict sense, is known from rocks of Rhaetic and Lower Liassic age (mostly Lower Liassic) in Europe and Greenland...; and thus, though it overlaps one end of the time range of Dicroidium, it is in the main considerably younger than Dicroidium and not contemporary with it as was earlier supposed."
With regard to geographical distribution, Townrow states (1957, p. 13) “Dieroidium has only been convincingly recorded from the region of the Glossopteris flora” and “On the other hand there are no convincing records of Thinnfeldia from rocks in which Dieroidium occurs.” Thus Thinnfeldia is a northern hemisphere genus, while Dieroidium is restricted to the Gondwanaland areas, i.e. Australia, South Africa, India and South America.

*Dieroidium odontopteroides* (Morris) Gothan
(for synonymy see Townrow 1957, pp. 13, 14).

Several well preserved specimens of this species are included in the collection from the No. 2 workings, Nymboida Colliery. As they are identical in frond habit and venation with specimens described by Townrow, and earlier workers such as Walkom, Arber, Antevs and Gothan, the diagnosis and description (see Townrow 1957, pp. 14–17) will not be repeated here. Townrow has made out a convincing case for uniting the forms previously recorded as *T. lanceifolia* with *D. odontopteroides* as there is a continuous gradation in characters between the two forms. This procedure is also followed here.

*Dieroidium feistmanteli* (Johnston) Gothan
(for synonymy see Townrow 1957, p. 19)

Under this name are recorded several specimens in the collection from the colliery workings, which are identical in frond habit and venation with the diagnosis given by Townrow (1957, p. 19). Accordingly the description and figures of this common species will not be repeated here.

*Dieroidium narrabeenensis* (Walkom) Frenguelli
(for further references see Townrow 1957, p. 17).

Two specimens in the collection from the colliery workings can be definitely placed in this species, as they compare closely with specimens figured in Walkom’s original account of the species (*e.g.* Walkom 1925, pl. XXVI, fig. 4). According to Townrow (1957, p. 19), while *D. narrabeenensis* has a cuticle like *D. odontopteroides*, it differs from that species in being normally twice as large, and in having long pinnae with alethopteroid venation. An additional characteristic which is evidently of specific importance is the contraction of the pinnae at the base; this feature is not shown in any of Townrow’s figures of *D. odontopteroides* (1957, Fig. 3).

*Dieroidium* sp.

Under this heading is recorded an incomplete specimen (labelled NP 33) from the locality 3 miles north of Nymboida. This specimen represents the apical portion of a dichotomous frond, the pinnae of which have lobed margins and alethopteroid venation. In these features it is similar to those described by Walkom (1921) as *Thinnfeldia talbragarensis*. Presumably, by analogy with the other species, this should also be transferred to *Dieroidium*; however, as the species has not been listed among those revised by Townrow, its specific status is not fully established, and the specimen is simply recorded as *Dieroidium* sp.

*Phoenicopsis elongatus* (Morris) Seward
(see Jones and de Jersey 1947, p. 62).

This species is characterised by long, narrow linear leaves, up to 15 cm. in length and 1–4 cm. in breadth, which taper gradually from the middle portion both to the base and to the acute apex. It is one of the most abundant species in the collection from the No. 2 workings, Nymboida Colliery.
Tceniopteris carruthersi Tenison-Woods

One specimen from the colliery workings can be definitely placed in this species. It compares so closely with a specimen described and figured by Walkom (1924, p. 85, Text–Fig. 3) from the Esk shales that it is placed without hesitation in Tenison-Woods’ species.

Tceniopteris crassinervis ? (Feistmantel) Walkom

Fragments of large fronds from the colliery workings, characterised by coarse venation, may possibly be representatives of this species, but the material is too fragmentary for definite identification.

Pterophyllum nathorsti (Seward) Walkom

(see Walkom 1917, p. 18)

Several leaf fragments on one slab of shale from the colliery workings can be definitely identified with this species on the basis of Walkom’s description and figures (1917, p. 18, pl. 5, figs. 4, 5). It is characterised by narrow pinnae, which are acutely pointed, have a width of 1 to 3 mm. and a length of 2-5 cm. Each pinna is traversed by a small number (3 to 5) of simple, parallel veins.

Cladophlebis australis (Morris) Seward

The collection from the No. 2 workings, Nymboida Colliery, includes one specimen of this common Mesozoic species.

Pterophyllum sp. (Figs. 1 and 2).

Figure 1. Pterophyllum sp. (× ½).
Figure 2. Pterophyllum sp. showing venation (× 3).
Figure 3. ? Haegia sp. (× ½).
Figure 4. ? Haegia sp., showing venation (× 3).
Description.—The frond is relatively large, the specimen, which is far from complete, attaining a length of 14 cm. and a width of 13 cm. The rachis is strong, 3 to 4 cm. in breadth, and the pinnae are attached laterally. They are at right angles, or almost at right angles (80°–90°) to the rachis, and are well separated, being about 5 mm. apart. The pinnae are attached by the whole base, adjacent pinnae being joined by slight expansions, and are approximately parallel sided, narrowing slightly towards the base. The nature of their apices is unknown, no complete pinnae being present; the largest (incomplete) pinna is more than 7 cm. in length. They average about 5 mm. in width, and are traversed by a small number of parallel veins (average number 6 or 7 at a distance of 3 cm. from the rachis). These veins are produced by dichotomous division of 3 or 4 veins which arise directly from the rachis, the dichotomy taking place near the base of the pinnae. Branching of the veins further away from the rachis is infrequent.

Remarks.—This species is distinguished by its large size and coarse venation from species of Pterophyllum previously recorded from the Mesozoic of eastern Australia. More complete material, with the cuticle well preserved, would be required for comparison with species from other parts of the world or for recognition as a new species. The specimen described and illustrated (Figs. 1 and 2) came from the No. 2 workings, Nymboida Colliery.

Ginkgoites sp.

Under this heading are recorded leaf fragments of Ginkgoalean affinity from the colliery workings. As only the basal portion of the leaf is preserved in each case, no specific identification can be attempted.

Genus HOEGIA Townrow
(see Townrow 1957, pp. 27–31)
? Hoegia sp. (Figs. 3 and 4).

Description.—The frond is bipinnate, with a strong rachis averaging 3 mm. in width in the portion preserved. The rachis appears relatively smooth and unwinged. Pinnae are opposite to subopposite, rather crowded and with pinnules typically meeting; the pinna rachis is smooth and unwinged. In the portion of the frond preserved the pinnae diverge at angles close to 90°. Pinnules are borne on the pinnae only, none being observed on the main rachis between the pinnae. The pinnules diverge at an average angle of about 45°, the angle becoming slightly greater towards the base of the pinna and slightly less towards its apex. The pinnules are roughly rhomboidal, with bluntly pointed apices, and margins entire or slightly dentate. The lowest pinnule is attached directly to the rachis and is broader than usual.

The veins arise in two or three groups from the pinna rachis, arch strongly at first, and meet the pinnule margin at a wide angle. They branch dichotomously, with the branch veins diverging at an acute angle.

Remarks.—Two specimens from the locality 3 miles north of Nymboida (NP 27 and NP 29) are described here and the larger specimen (NP 27) is figured (Figure 3). They are preserved as impressions in light grey siltstone, and as the cuticle is not available, they are only doubtfully referred to Townrow's genus. The general form of the frond, insertion of the pinnules, and venation, are similar to the characteristics of the genus described by that author, and of the two species distinguished the present material comes closest to H. antessiana. The specimens have been described and figured here in the hope that further collecting may bring to light additional material, preferably with the cuticle preserved, so that the present doubtful identification may be confirmed.
Age and Relationships of the Flora.

Twelve different species have been identified in the collection. They are as follows:

- Dieroidium odontopteroides (Morris) Gothan
- Dieroidium feistmanteli (Johnston) Gothan
- Dieroidium narrabeenensis (Walkom) Frenguelli
- Dieroidium sp.
- Phoenicopsis elongatus (Morris) Seward
- Tæniopteris carruthersi Tenison-Woods
- Tæniopteris crassinervis? (Feistmantel) Walkom
- Pterophyllum nathorsti (Seward) Walkom
- Cladophlebis australis (Morris) Seward
- Pterophyllum sp.
- Ginkgites sp.
- ? Hoegia sp.

These species are of unequal value with regard to age determination and those determined only generically are of little value in this respect. Although Townrow regards Dieroidium as mainly a Triassic genus, it has been found in sediments which are definitely of Jurassic age (e.g. the Talbragar fish-beds of New South Wales, which, on evidence distinct from the plant fossils, are placed in the Jurassic). However the species D. narrabeenensis is only known from Triassic formations (the Narrabeen shales, Esk shales, Ipswich Coal Measures and the Molteno Beds of South Africa). Likewise Phoenicopsis elongatus is also restricted to the Triassic, and has been recorded from the Esk shales and Ipswich Coal Measures in Queensland, the Felspathic Sandstone of Tasmania, the Molteno Beds of South Africa and the Triassic of Argentina. Tæniopteris carruthersi is another Triassic species, having been recorded from the same formations as listed for P. elongatus. It has been shown by Medwell (1954, p. 88) that specimens from the Jurassic of Victoria, previously recorded as T. carruthersi, should actually be placed in Tæniopteris spatulata. Of the remaining species Tæniopteris crassinervis? is a doubtful record, while Pterophyllum nathorsti is, in Australia, only known from the Esk shales, although it has also been recorded from the Jurassic of Scotland. Cladophlebis australis ranges through most of the Mesozoic and is of little help in age determination. The record of ? Hoegia sp. if confirmed, would suggest a Triassic age, as the genus is so far only known from Triassic formations.

The general character of the flora, and in particular the presence of three species—Dieroidium narrabeenensis, Phoenicopsis elongatus and Tæniopteris carruthersi—which are restricted to the Triassic, thus indicate a Triassic age for the sediments at Nymboida. There is a close similarity to the assemblages in the Esk shales and Ipswich Coal Measures, which are geographically the closest Triassic formations of which the floras are known in detail. Of the two the relationship is perhaps closer to the former, as Pterophyllum nathorsti, recorded by Walkom from the Esk district, has not been found in the Ipswich Coal Measures.

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REFERENCES.


PART II: REPORT ON SPORE DISTRIBUTION IN COALS FROM NORTH-EASTERN NEW SOUTH WALES.

Six coal samples from the Mesozoic sediments of north-eastern New South Wales have been submitted by Mr. C. T. McElroy, of the N.S.W. Geological Survey, for examination of their microfossil content. These samples are as follows:

Sample No. | Locality
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Co 1 | Top Seam, Red Cliff
Co 2 | Bottom Seam, Red Cliff
Co 3 | 4 ft. coal and bands, Red Cliff
Co 4 | Bardool No. 2 Adit, near Nymboida
Co 5 | Inferior coal from Coaldale
Co 6 | Coal from Nymboida Colliery.

Four of these samples (excluding Co3 and Co5) were crushed and macerated by the normal technique adopted for Queensland coals. Of these three (Co1, Co2 and Co4) did not yield any spore or pollen exines, the maceration residue consisting of opaque and semi-opaque highly carbonised material. In the maceration residue from the remaining sample (Co6, from Nymboida) spores and pollen were present, but were so rare and poorly preserved that only a few forms could be identified after prolonged examination. Of the two samples not examined, sample Co3 (4 ft. coal and bands, Red Cliff) was not macerated because two other samples from the same locality gave negative results and sample Co5 (Inferior coal from Coaldale) was not studied because its shale content was too high to permit effective separation of spores by techniques normally applied to coals. The forms identified in the maceration residue from the Nymboida Colliery sample (Co6) were as follows:

*Leiotriletes directus* Balme and Hennelly
*Entylissa* sp.
*Neoraistriickia* sp.

Of these *L. directus* is long-ranged, having been found in both Permian and Jurassic coals, and the other two forms are also of little value in age determination. However, the Triassic age of the sediments at this locality has already been established by investigation of the macro-flora and consequently further attempts to improve the spore yield from this sample have not been made.

The absence, or rarity, of spore material in the samples studied may be due either to lack of spore material in the original plant debris or to alteration of
the spore exines by the metamorphism involved in rank advancement. The available evidence supports the latter alternative, as the maceration residues consist largely of opaque and semi-opaque highly carbonised material, and published analyses indicate that the Nymboida coals are of medium-volatile bituminous rank (A.S.T.M. classification), the fixed carbon content (d.m.f. basis) of approximately 72–73 per cent, being appreciably higher than that of Queensland coals from which spores have been effectively separated. In comparison with other New South Wales coals, the Nymboida samples are approximately similar in rank to the South Coast coals, from which Dulhunty (1947, p. 24) experienced difficulty in separating spore material. In this case also the rarity of identifiable spores was attributed to advanced metamorphism rather than to absence of spores in the original coal-forming debris.

The presence of spores in small proportions in the sample from Nymboida colliery, as contrasted with their total absence in the other samples examined, suggests that this seam may be slightly lower in rank than the other samples. If it is a persistent property, this feature may be of use in distinguishing the seam worked at Nymboida from the other seams examined. Apart from this, the general conclusion reached from examination of the micro-fossils from this coalfield is that they are of relatively slight interest, from the stratigraphic aspect, as compared with the macro-floras which are described in Part I of this paper.

Reference.


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