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CYLOMEIA UNDULATA (BURGES) GEN. ET COMB. NOV.,  
A LYCOPOD OF THE EARLY TRIASSIC STRATA OF  
NEW SOUTH WALES

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SUMMARY

"*Taeniopteris undulata* Burges" leaves are identified as lycopod leaves which were borne in flat, plate-like crowns on *Pleuromeia*-like plants which are given the new generic name *Cylomeia*. "*Pleuromeia longicaulis* (Burges) Retallack" is referred to the same genus. It is suggested that *Cylomeia undulata* (Burges) might have borne cones recently described as *Skilliostrobos* Ash 1979, in the same manner as *Cylomeia longicaulis* (Retallack) bore *Cylostrobos* cones.

AN EARLY TRIASSIC LYCOPOD

Burges (1935) described as *Taeniopteris undulata* long, narrow leaves with a pronounced midrib (two median grooves) and undulating margins in his account of the Narrabeen Flora of New South Wales. Leaf fragments of this type are fairly common in the Narrabeen Group sediments which outcrop in many localities in Sydney's Northern Beach suburbs from Narrabeen to Palm Beach. Similar long, narrow leaves with less obvious midribs and without undulating margins, occur in great profusion locally in some areas, and have been assigned to *Pleuromeia longicaulis* by Retallack (1975) in his reconstruction of that plant.

In 1977, a specimen was obtained by The Australian Museum, prompting this investigation which has resulted in its identification as a whorled lycopod leaf crown comprising leaves of "*Taeniopteris undulata*" type. The specimen AMF 58791 was obtained from Early Triassic roof shales above the Upper Permian Bulli Seam in the Bellambi Colliery (K panel), Wollongong. It is beautifully preserved as an impression with a film of carbon on the surface, and shows a whorl of ribbon-like leaves which are attached to the stem apex in several layers, forming a plate-like crown 18 cm in diameter, slightly concave in the centre. Unfortunately no cell structure is preserved. The leaves are broken off, or interrupted by the edges of the specimen at a length of 8 or 9 cm. They average 5 mm in width (Figure 1).

The leaves have parallel margins and are without visible midribs for most of their preserved length, but towards their extremities the margins start to undulate and the midribs become more pronounced (Figure 2). If the leaves had been preserved as broken up fragments, as is usually the case in plant fossils, the undulating distal parts would have been consistent with *Taeniopteris undulata* and the proximal parts indistinguishable from *Pleuromeia longicaulis*.

A new genus *Cylomeia* is erected as this specimen cannot be accommodated in any existing genus of lycopods for reasons detailed below. The name is derived from *Lyco* — reversed as in *Cylostrobos* — and *meia* a diminutive as in *Pleuromeia* to indicate the dwarf-tree nature of the lycopod, and also to indicate its relationship with those plants.

A second specimen showing a less complete crown of more mature leaves was found in the Wollongong University collection by Dr. A. Wright, and presented to The Australian Museum. It came from the same horizon and general locality in the Bellambi Colliery, Wollongong. This specimen, AMF 60882, shows approximately ten broader

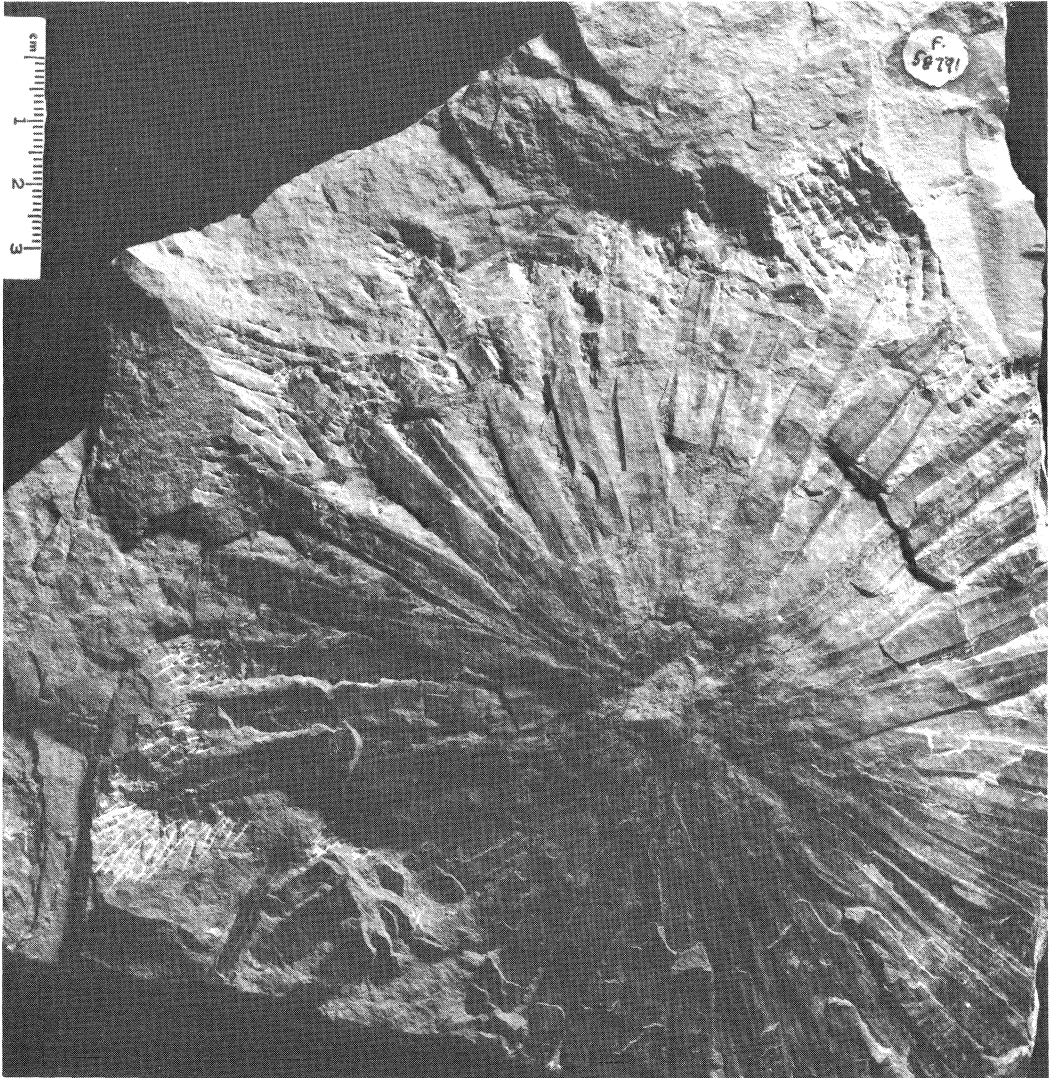


Figure 1. Specimen AMF 58791. Natural size. Plate-like crown of ribbon leaves.

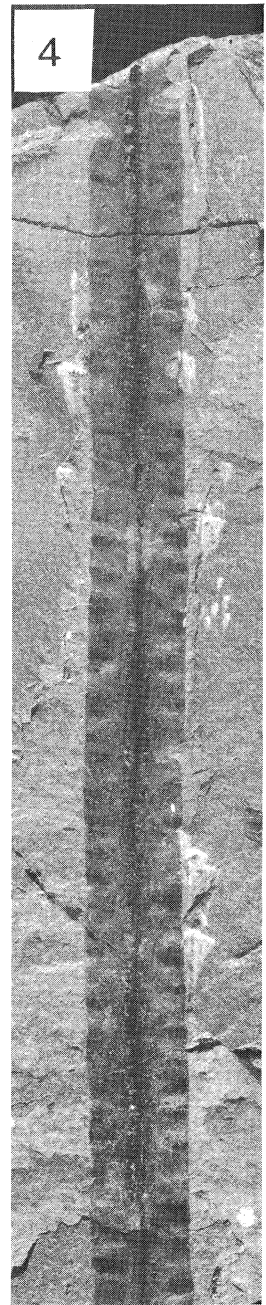
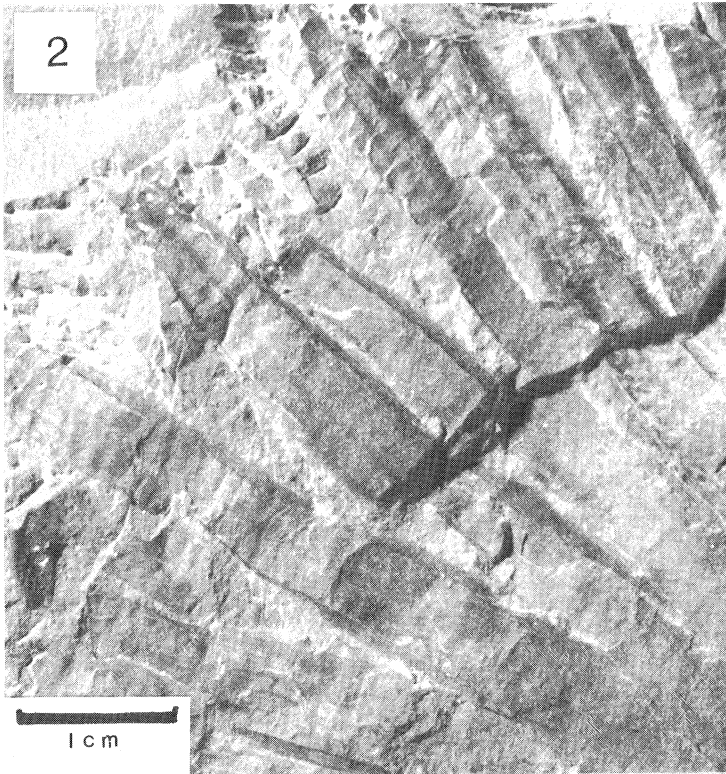


Figure 2. AMF 58791. magn. X 2. Part of leaf whorl.  
Figure 4. AMF 59987. Natural size. Part of long leaf. Avalon, N.S.W.  
Figure 5. AMF 39862. Natural size. Leaves. Rylstone. N.S.W.

leaves, each slightly more than 1 cm wide, attached to the rim of a concavity which represents the stem apex. The leaves have strongly undulating margins and are manifestly "*Taeniopteris undulata*" throughout their entire length. A tracing of this specimen is seen in Figure 3.

Re-examination of the Triassic collections of The Australian Museum has revealed two more examples of leaf whorls, both poorly preserved, one a coal sample with no locality information, presumed to be from a South Coast Colliery and of Upper Permian age (the coal seam being just below the roof shales which contained the other specimens), and the other from Triassic shale (? Ashfield Shale) from an old brick pit at Erskineville, Sydney (AMF 16178). The range of *Cylomeia undulata* leaf whorls is thus shown to be from Upper Permian to probably Middle Triassic.

Unattached, long, narrow leaves of "*Taeniopteris undulata*" from Avalon (Figure 4) and from Early Triassic strata at Rylestone New South Wales (Figure 5) show the diversity of size and the wide geographical range of the specimens. They are referred to *Cylomeia undulata*. A leaf of "*Taeniopteris undulata*" occurs in the Upper Permian assemblage at Merewether Beach, Newcastle (AMF 26060) so the unattached leaves are also seen to range from Upper Permian into Triassic. Leaves of this type are known to reach 50 cm in length, with undulating margins throughout, and it seems that only the part of each closest to its attachment to the stem is smooth, and then probably only in immature leaves.

The very numerous leaves of "*Pleuromeia longicaulis* (Burges) Retallack" occurring in some layers of Narrabeen Group shales are now assigned to *Cylomeia longicaulis* (Retallack). Associated with these leaves, and with the rarer leaves of *Cylomeia undulata*, are lycopod stems which are woody and approximately 1 - 1.5 cm in diameter (before compression). Some of these show widely spaced, single leaf-traces in ascending spiral arrangement. These are also rhizophores, some in continuity with stems similar to those with leaves attached in Retallack's "*Pleuromeia longicaulis*". The rhizophores are elongated and unlobed, or more buttress-like and somewhat lobed, the latter occurring in numbers in some localities in growth position, preserved as casts which separate from their impressions (Figure 7). The rhizophores are referred to *Cylomeia*, but not to any species as rhizophores of similar lycopods would be expected to be of a general type, as *Stigmara* are the general root type for species of *Lepidodendron*.

Very large numbers of lycopod cones which were described by Helby and Martin (1965) as *Cylostrobus*, are associated with the leaves, stems and rhizophores in Narrabeen Group sediments. Retallack (1975) reconstructed *Pleuromeia longicaulis* (Burges) from the evidence of non-undulate leaves, stems, rhizophores and cones of *Cylostrobus*, and believes that all the *Cylostrobus* species separated by Helby and Martin are best considered as one species — *Cylostrobus sydneyensis* (Walkom) — as only the size varies. Figure 8 illustrates part of a specimen with numbers of *Cylostrobus* cones associated with numerous *Cylomeia longicaulis* leaves from Avalon. Retallack's reconstruction of *Pleuromeia longicaulis* is illustrated in Figure 6 in a comparison with *Cylomeia undulata*.

Retallack's use of the genus *Pleuromeia* for his species cannot be justified. *Pleuromeia* is completely known from a study of the northern hemisphere fossils assigned to it and differs in significant details. If Retallack's interpretation and reconstruction are correct, and the ubiquitous association of the *Cylostrobus* cones and the vegetative organs leaves little doubt, then a new genus is indicated. The most

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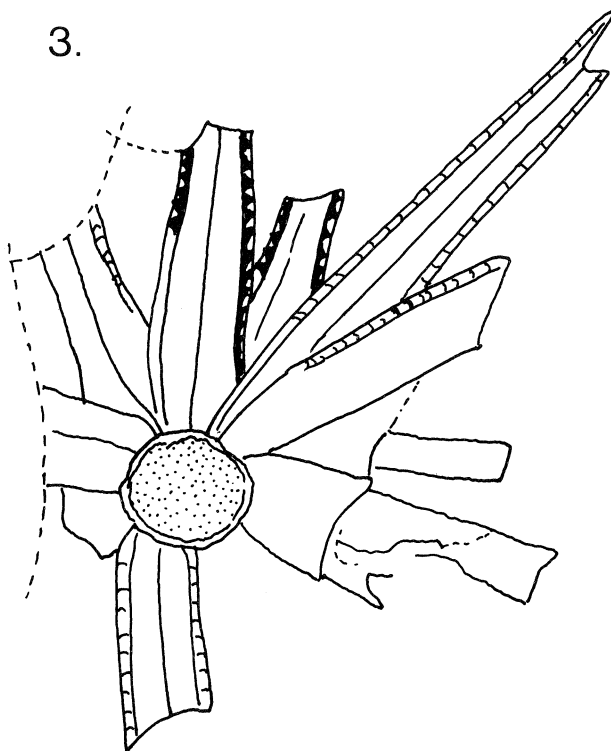


Figure 3. Tracing of incomplete whorl of *Cylomeia undulata*. Natural size. Specimen AMF 60882.

fundamental difference warranting generic separation is in the cones. *Pleuromeia* is dioecious (it has separate plants bearing male and female cones). The sporophylls bear unilocular sporangia, the megasporangia contain trilete megaspores, and the microsporangia bear monolete spores (as in *Cylomeia*). There has been some speculation about whether the sporangia were borne on the upper or lower surface of the sporophylls in *Pleuromeia* but Chaloner (in Boureau 1967) accepts that Neyburg (1961) has proved that they are on the upper surface of sporophylls as in *Cylomeia*. The mega- and microsporophylls of *Pleuromeia* are more or less round in shape and the "cone" is described as the "fertile region of the stem". There is no way that the cones of *Cylostrobos* could be described as "fertile regions" of stems. They are highly organised cones distinct from the rather lax aggregations of sporophylls in *Pleuromeia*. The plants of *Cylomeia* are monoecious, each cone has its distal sporophylls bearing unilocular microsporangia, while the lower (proximal) sporophylls have megasporangia. The sporophylls are true cone scales with keels and upturned apices. (Neyburg's 1961 *Pleuromeia rossica* is considered by the author to be excluded from *Pleuromeia* and distinct from *Cylomeia* and cannot be considered further here without access to the specimens from Russia.)

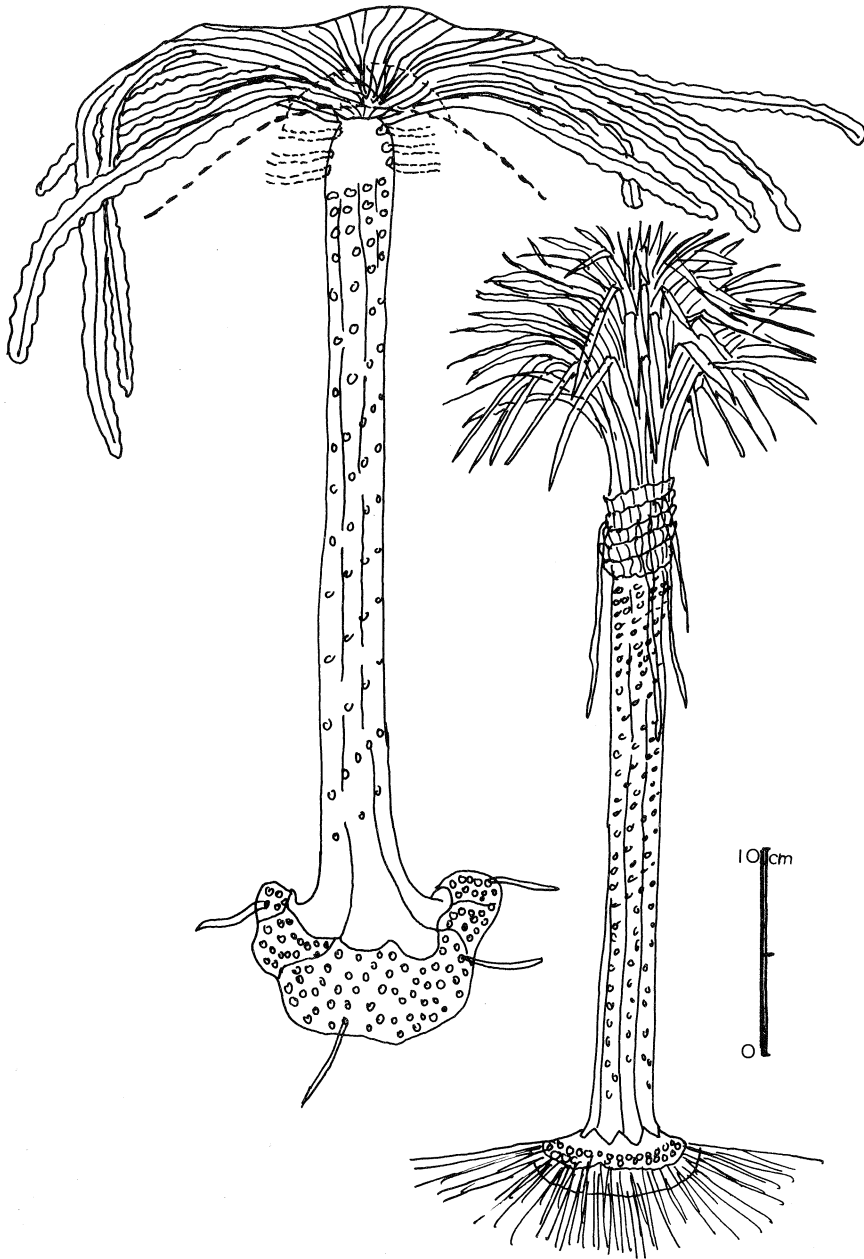


Figure 6. Reconstructions of *Cylomeia undulata* and *Cylomeia longicaulis* (after Retallack, 1975).



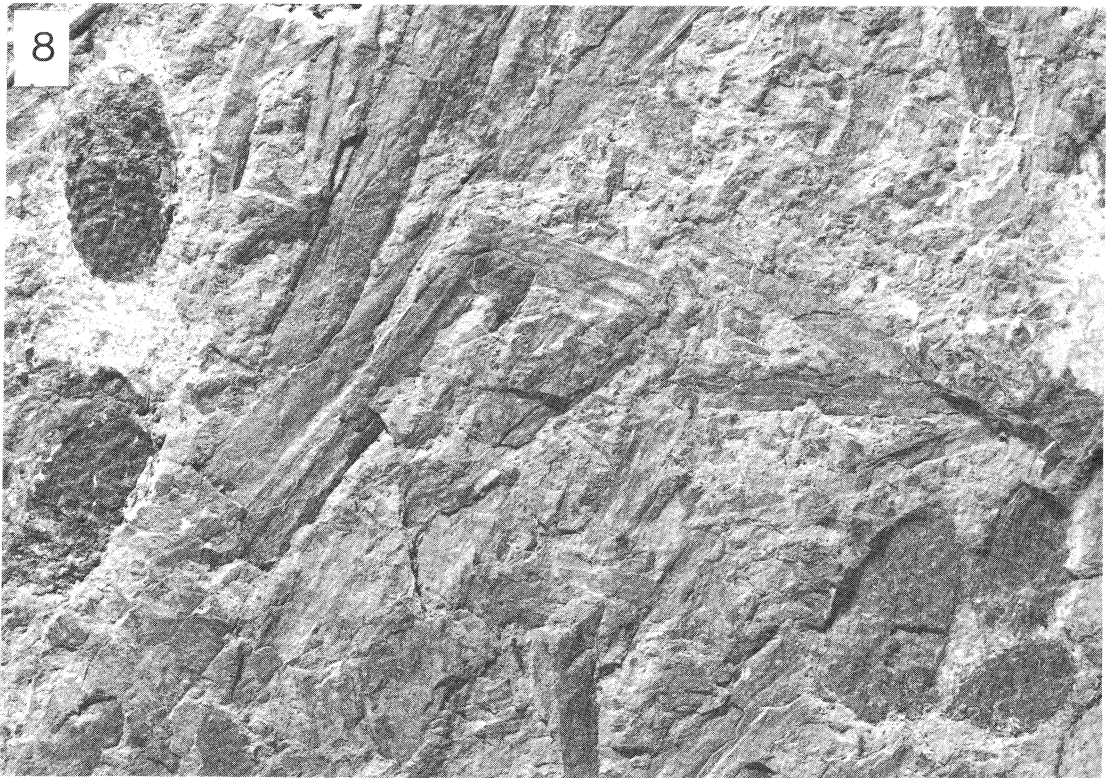
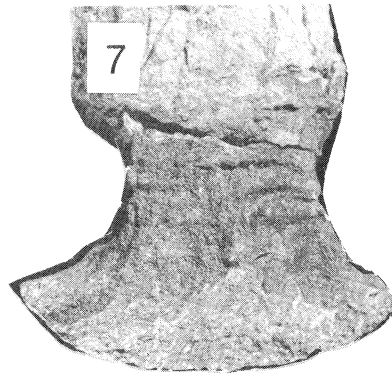
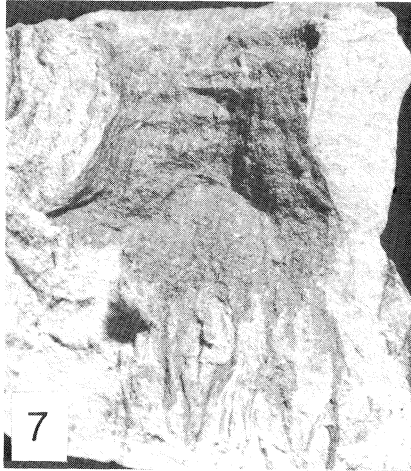


Figure 7. Rhizophore of lycopod. Natural size. AMF 59985 impression. AMF 59986 cast separated from impression.

Figure 8. *Cylomeia longicaulis* leaves and *Cylostrobus sydneyensis* cones. AMF 59975, magn. X 1.5.



Supporting the separation of *Cylomeia* from *Pleuromeia* on evidence from cones, are less significant differences in vegetative structure. *Pleuromeia* has two scars on the leaf base, either double leaf trace or parichnos scars, and there is only one leaf trace on each leaf base in *Cylomeia* (see Fig. E. p.18, Retallack, 1975). The rhizophores of *Pleuromeia* are strongly four-lobed by dichotomy, those of *Cylomeia* are not.

It is becoming increasingly evident, as detailed knowledge of Australian plant fossils accumulates, that Australian Late Palaeozoic and Mesozoic plants have Southern affinities and cannot be equated with their Northern Hemisphere relatives and contemporaries.

As the form of the plant in *Cylomeia undulata* is different from *Cylomeia longicaulis* with its brush-like tuft of leaves, it is probable that its cones, which would have arisen at the centre of the leaf whorl in the concavity at the top of the stem, would have been different too. The only other lycopod cones or cone scales in the Narrabeen Group are the recently described *Skilliostrobis* Ash 1979. In essential structure these cones are the same as *Cylostrobis*, having the distal half composed of microsporophylls, and the proximal half of megasporophylls. Sporangia are unilocular, spore types the same as in *Cylostrobis*. The sporophylls are different in appearance because they have an elongated limb which is bifid at the apex. The cones have a "sunflower-like" appearance when compressed. It could be argued that *Skilliostrobis* should have been described as a species of *Cylostrobis*. It seems possible that *Cylomeia* bore *Skilliostrobis* cones. This theory is given support by evidence from the Early Triassic Blina Shale in the Canning Basin, Western Australia (White 1976) in which stems and rhizophores indistinguishable from those of the Narrabeen Group are associated with scales which are now referable to *Skilliostrobis*.

#### Definition of **Cylomeia** gen. nov.

Classification: (Chaloner in Boureau 1967)

Class: Lycophyta.

Order: Lepidodendrales.

Family: Lepidodendrales incertae sedis.

Genus: *Cylomeia*

Dwarf; woody stemmed lycopods, probably attaining about a metre in height, with single, erect stem arising from a rhizophore (somewhat lobed or unlobed) bearing stigmarian rootlets. Plants growing in swamps in monodominant thickets, occupying the mangrove niche of present day tidal or lagoonal habitats (Retallack, 1975) in Early Triassic horizons. Plants having the appearance of small palms, with naked trunks ornamented with ascending spiral leaf trace scars. Each leaf trace a single scar in the centre of the leaf base scar. Leaves attached to the stem near the top, either in a brush-like arrangement or in a flat, plate-like crown. Leaves ribbon-like, attaining considerable length in proportion to the height of the plants, each having two stomatal grooves.

Plants monoecious, bearing highly organised cones in which the proximal sporophylls bear unilocular megasporangia, and the distal sporophylls bear unilocular microsporangia. Sporangia on upper surface of sporophylls. Sporophylls are keeled with upturned apices — each being a well developed cone scale. Cone scales closely inserted on the cone axis, many in each whorl. Megaspores are trilete, microspores monolete.

Three species are so far recognised:

- a. *Cylomeia undulata*. Plant with plate-like crown of “*Taeniopteris undulata* (Burges)” leaves. Cones possibly *Skilliostrobus* Ash.
- b. *Cylomeia longicaulis* (Retallack). Plant with brush-like tuft of smooth, strap-like leaves. Cones *Cylostrobus sydneyensis* Helby and Martin.
- c. *Cylomeia* sp. From the Canning Basin, Western Australia, in Blina Shale (White 1976)  
Specimens BMR F 23662, 23660, 23704 — Stems  
BMR F 23786 — Rhizophore  
BMR F 23644, 23715 — Cone Scales cf. *Skilliostrobus*.

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#### ADDENDUM

Since this manuscript went to press, specimens have been found of another species of *Cylomeia* which is named *Cylomeia capillamentum* sp. nov. because it has a wig-like circlet of linear leaves surrounding its terminal cone. The specimens are part of a collection from Narrabeen Group shales at Long Reef, Narrabeen, made by Dr John Talent of Macquarie University and presented to the Australian Museum in July, 1980. There are five examples of *Cylomeia capillamentum*. Three are illustrated in Figures 9 (F 60890) and 10 (F 60891). Each has a large circular cone impression in the centre measuring 6, 7.5 and 6 cm in diameter, and the very numerous hair-like leaves of the circlet are up to 10 cm in length and less than 1 mm wide. There is some carbonaceous material on some of the cones and leaves and cuticle and spore preparations will be attempted. Preliminary examination of the carbon film on one cone kindly undertaken by Dr R. J. Helby showed only immature microsporangia. Dr Helby (pers. commun.) had believed that some of the relatively rare, large, spherical cones he had examined when studying *Cylostrobus* for his publication (1965) were distinct from the range now included by Retallack in *Cylostrobus sydneyensis*, and is now confident that these are the same as those borne by *Cylomeia capillamentum*.

#### Definition of *Cylomeia capillamentum* sp. nov.

A small, arborescent lycopod, presumed to be similar in habit to *Cylomeia undulata* and *C. longicaulis*, with densely inserted hair-like leaves up to 10 cm long,

forming a multi-layered whorl at the top of the axis. Large spherical cone of *Cylostrobos* type with a diameter of up to 7.5 cm borne in the hollow at the top of the axis, with small, very numerous sporophylls, at least 20 tiers high, in close, ascending-spiral arrangement. Up to 100 sporophylls in a equatorial whorl. Cones apparently spherical, in contrast to the oval cones of *Cylostrobos sydneyensis* which are borne by *Cylomeia longicaulis*, and larger than the top of the range included in that species when mature. The cones of the species are named *Cylostrobos capillamentum* sp. nov.

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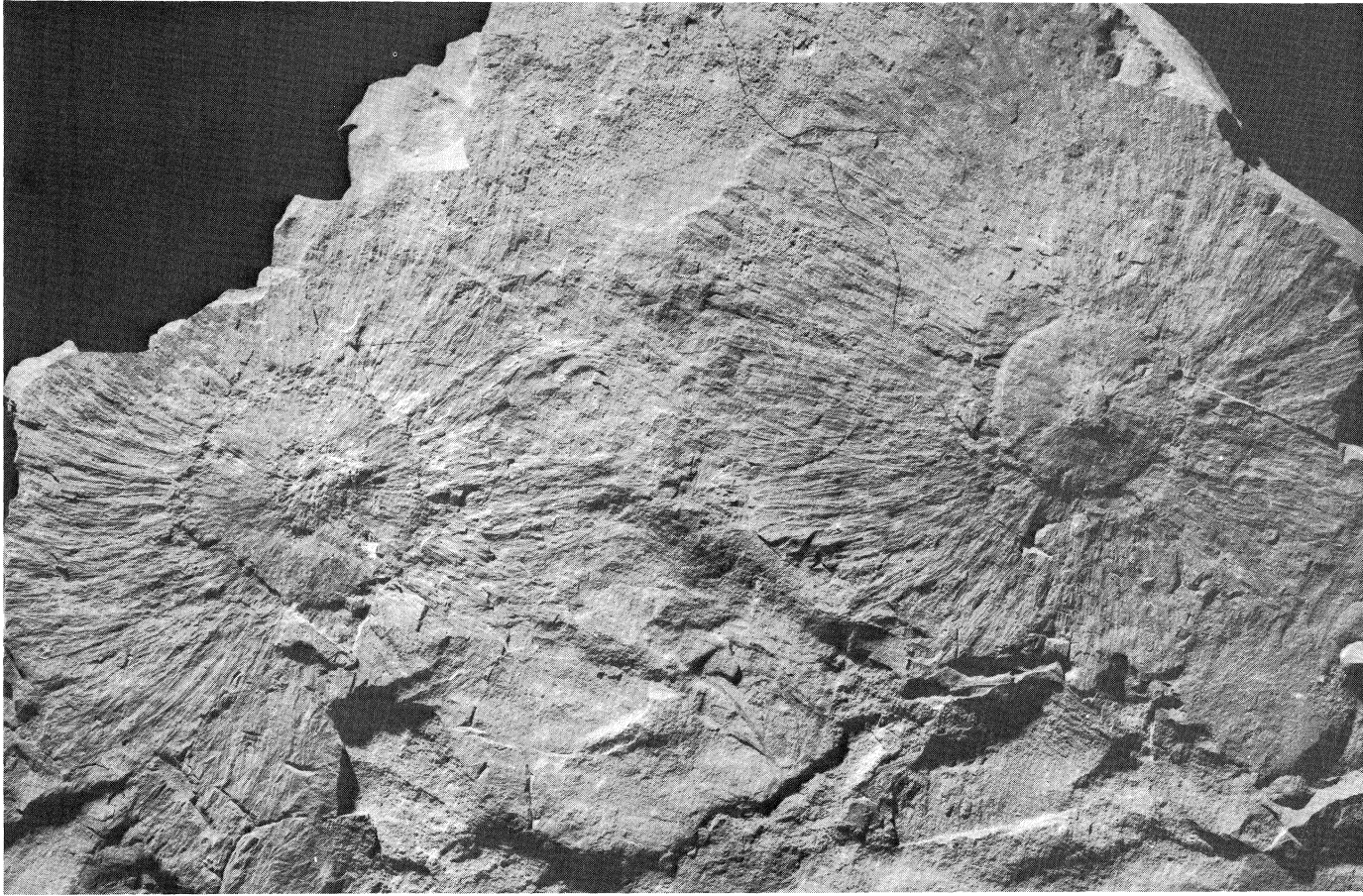


Figure 9. *Cylomeia capillamentum* sp. nov. Specimen AMF 60890. Approx. ½ natural size.

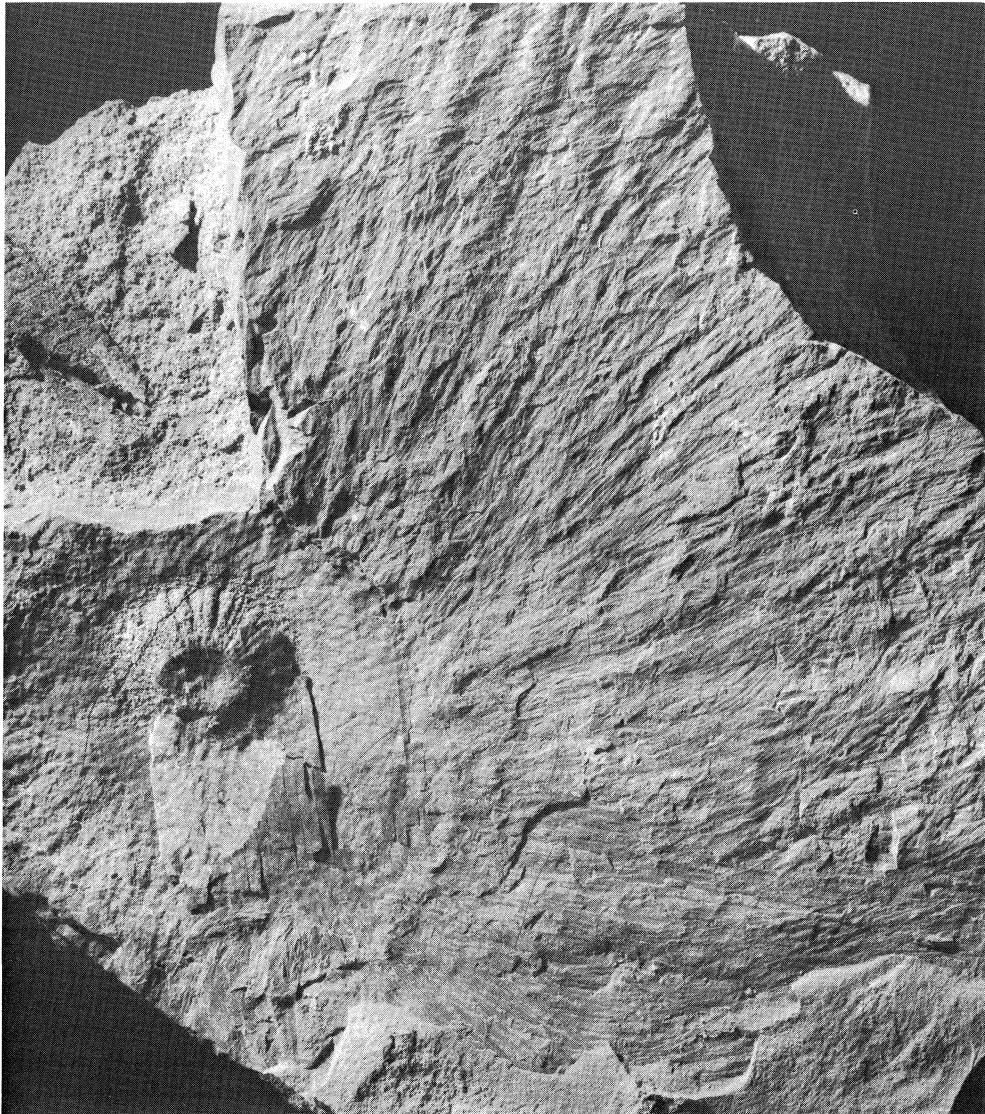


Figure 10. *Cylomeia capillamentum* sp. nov. Specimen AMF 60891. Approx. natural size. Cone *Cylostrobos capillamentum* sp. nov. at centre of whorl of hair-like leaves.