AUSTRALIAN MUSEUM SCIENTIFIC PUBLICATIONS

Etheridge, R., 1899. On a fern (*Blechnoxylon talbragarense*), with secondary wood, forming a new genus, from the Coal Measures of the Talbragar District, New South Wales. *Records of the Australian Museum* 3(6): 135–147, plates xxiv–xxvii. [11 December 1899].

doi:10.3853/j.0067-1975.3.1899.1158

ISSN 0067-1975

Published by the Australian Museum, Sydney

On a Fern *(Blechnoxylon Talbragarense)*, with Secondary Wood, forming a New Genus, from the Coal Measures of the Talbragar District, New South Wales.

By R. Etheridge, Junr., Curator.

(Plates xxiv. – xxvii.)

The very remarkable and interesting plant remains about to be described were entrusted to me by Mr. J. Clunies Ross, B.Sc. (Lond.), of the Technical College, Bathurst, who received them from Mr. W. Pascoe, the Technological Museum Attendant at Bathurst. The specimens were obtained from the Coal Measure strata in the neighbourhood of the Talbragar River, somewhere between Gulgong and Cockabutta* Hill in the County of Bligh.

The Talbragar or Erskine River rises in the Liverpool Range, and flowing in a general south-west direction, joins the Macquarie River a little to the north of Dubbo.

Beds of Permo-Carboniferous age, containing *Vertebraria*, and probably belonging to the Upper or Newcastle Coal Measures, have been casually referred to by Messrs. David and Pittman,† and it is from some portion of these that the fossils about to be described possibly came.

There are ten specimens, six showing cross or transverse sections of the stem, with leaves attached, and four in profile, similarly more or less provided, to say nothing of sundry detached leaves, in a greater or less state of preservation. I believe these fragmentary remains to be those of a Fern, and shall in consequence make use of terminology of this section of the Cryptogamia.

In the first specimen the caudex (? or rhizome) is seen in cross section surrounded by seven radiating fronds, or portions thereof. (Pl. xxiv. fig. 1.)

The second is a similar fossil, but with eight radiating fronds, one protruding from below a layer of matrix at a lower level. The section of the caudex is rather less apparent than in the first example.

* ? Cockaburra, *i.e.*, the "Laughing Jackass."

† Mem. Geol. Surv. N.S.W., Pal. Series, No. 9, 1895, p. ix.

In the third specimen there are certainly eight fronds visible, and possibly portion of a ninth, but this example is otherwise particularly valuable for it shows evidence of the minute structure of the caudex; the venation is also remarkably well preserved. (Pl. xxiv., fig. 2.)

The fourth individual is a similar specimen to fig. 2, in that there are the remains of caudex structure, with five or perhaps six radiating fronds, being, in the present instance, impressions of the upper surface (Pl. xxiv., fig. 4). Attention is specially directed to the frond on the upper left hand protruding from below the two fronds immediately above it, and the two on the right hand projecting from a still lower level.

The fifth specimen displays a small caudex surrounded by seven fronds, one of them a young frond, and all again impressions of the upper surface.

The sixth example consists of two small individuals contiguous to one another on the same piece of matrix, one of which is shown in Pl. xxiv., fig. 3. Each possesses three fronds, or portions of three, much shorter and wider than in any of the preceding specimens, and to all intents and purposes pyriform in outline.

The remaining specimens are preserved in profile. The first (Pl. xxv., fig. 5) is a portion of a caudex, with at one end a set of attached fronds, four or perhaps five, forming a kind of corona; and a second series, six or seven in all, at the opposite end, detached and bent backwards out of position, but guided by the evidence of other specimens, there is reason to believe that, although detached, they are practically *in situ*. Immediately above the latter, on one side of the caudex, is a round depression, and half way up it on the other is a small protuberance. Amongst the fronds at the end first described is a small somewhat pyriform scale-like body.

The second specimen seen in profile (Pl. xxvi., fig. 6) is a highly important one, in fact one of the most important of the series, consisting of a short portion of caudex, surmounted by a crown comprising six or seven fronds, and a couple of the scale-like bodies, already noticed in connection with Pl. xxiv., fig. 5. On the face of the crown are what I take to be leaf-scars. On the left of the figure one of the frond petioles is definitely attached to this scar-bearing face, and on the right is a petiole disappearing beneath the matrix, and reappearing beyond in frond form.

The third fossil (Pl. xxiv., fig. 7) is part of a caudex seen partly in a transverse view and partly in profile, in the former case displaying portions of three fronds, radiating therefrom. On the right hand side of the caudex is one of the wart-like protuberances described in Pl. xxv., fig. 5.

The fourth example (Pl. xxvi., fig. 8) is supplementary in some points to Pl. xxv., fig. 5, and is the longest portion of caudex in the collection, but much decorticated. At one end are portions of two fronds extended in opposite directions, and somewhat more than halfway down are traces of two others, one attached, the other protruding through the matrix, and although not attached, as in the first instance, so clearly answering in position to the corresponding frond above, on the right hand side, as to leave little doubt that it also is *in situ*.

Finally Pl. xxiv., fig. 9, is the enlarged caudex of Pl. xxiv., fig. 2, and displays the broken edges of the different zones of the stem which will be explained later on.

The structure of the foregoing specimens may be summarised as follows :—

The Caudex.—The caudex is round, varying from one to three millimetres in diameter, and in length from ten to forty-three millimetres, so far as preserved, sometimes in the round, at other times only as impressions, or both conditions may occur on the same example. When in the former state there is clear evidence of a peeling-off of layers, thus reducing the general bulk of the caudex from what it must have really been in nature. At varied and inequidistant points may be seen the minute thorn-like projections, when a caudex is seen in the round, or, in the case of an impression, as small depressions. I am unable to offer any definite explanation of these, but similar projections have been figured by Mr. R. Kidston on problematical stems from the Lanarkshire Coal-field, called *Psilotites unilateralis*,* but as the name implies they are on one side only, nor do I, by calling attention to the resemblance mean to suggest any relation between the two plants. Mr. A. C. Seward has suggested that these may mark the positions of roots given off from a creeping rhizome.

The mode of distribution of the fronds on the caudex is peculiar, and, so far as the specimens permit me to judge, constant. At intervals occur clusters or tufts of fronds, the intervening caudex surface being destitute of leaf clothing. A caudex is therefore divided into nodes and internodes (Pl. xxv., fig. 5 ; Pl. xxvi., fig. 8). In Pl. xxv., fig. 5, we observe a cluster proceeding from an enlargement or corona, and at the other end a displaced cluster that has been accidentally pressed backwards. In Pl. xxvi., fig. 8, traces of two of these nodes are visible, one a little below the middle of the caudex, the second at the upper end. The enlargement caused by the attachment of the frond bases has almost weathered away, but to the right and left of each the edge of a frond is traceable, particularly on the right of the lower tuft, where it is distinguishable by its revolute margin, and traces of

* Ann. Mag. Nat. Hist., xvii. (5), 1886, p. 495.

venation. There is a distance of twenty millimetres between the nodes. Pl. xxiv., fig. 7, is on the opposide of the same piece of matrix to that on which Pl. xxvi., fig. 6, is preserved, and the stem of the one is continuous through the shale, and joins that of the other, thereby confirming—first, that the two sets of fronds in Pl. xxv., fig. 5, belong to one and the same caudex, and are looking in opposite directions by accidental displacement; second, that the clusters of fronds, occur at intervals along the caudexes, dividing the latter into nodes and internodes with great regularity.

All the caudexes with fronds attached, as well as sundry small fragments scattered over the matrix of the various specimens, exhibit the remains of internal structure, but in varied degrees of distinctness. From two of the best fragments sections were prepared by Mr. Charles Merton, Section Cutter to the Geological Survey of New South Wales. A general view of one of these, enlarged, is shown in Pl. xxvi., fig. 10, and an enlargement of a portion of the latter in fig. 11 of the same plate. A longitudinal section from another fragment is seen in Pl. xxvii., fig. 12. There is not the slightest shade of a doubt that the portions from which these sections are taken are those of caudexes of the same plant to which the fronds are attached, and not that of any fortuitous intruder. It will be observed that in Pl. xxvi., fig. 10, the centre is occupied by an amorphous mass of opaque material surrounded by a zone of cellular tissue, and two other discontinuous zones. The enlarged illustration indicates that this tissue consisted of radial rows or lines of cells roughly arranged in bundles. Further remarks on these sections will be made later on.

Frond Scars.—The corona, or enlargement, terminating the short caudex impression in Pl. xxvi., fig. 6, bears numerous fronds in various states of preservation. On that portion left bare by the falling off of the latter, are visible triangular frond scars in oblique lines indicating a spiral arrangement of the fronds, precisely as on the caudex of a living Tree-fern. Each of these scars bears a more or less central single pit, indicating the former presence of a vascular opening. On the right-hand side of the figure are broken stipe bases, with portion of a frond protruding through the matrix beyond, whilst on the left-hand are three fronds in a revolute condition, the stipes of two being actually attached to the frond scars. I do not think a more complete demonstration of the relation of these parts, one to the other, could be made.

Fronds.—The fronds are linear-lanceolate, narrow, entire, decreasing very gradually in size towards their apices, which are obtusely pointed. In the young frond (Pl. xxiv., fig. 3) the linear-lanceolate outline gives place to a shorter, broader, and sub-pyriform shape. The fronds appear to have been thick and fleshy; the longest observed measured twelve millimetres. The proximal end of each is in the form of a broad stipe, articulating

to the caudex, and is at once distinguishable from the frond proper by the absence of fascicles, and narrower proportions transversely. The largest number of fronds in any one whorl is twelve, ordinarily there are eight.

The venation is very characteristic and stable throughout the whole of the specimens. A strong midrib, or costa, was present continuous to the apex, but perceptibly decreasing in thickness upwards. The fascicles are free and bilaterally symmetrical, the largest number observed on any one frond being twelve, but the usual number is eight. The veins are short, sub-internal, equal on each side, non-costæform, and rising at a very acute angle. The first bifurcation gives rise to two veinules, which are long and excurrent, following an upward and outward direction, the anterior always the longer of the two. The latter is almost invariably dichotomous, the posterior sometimes so, more often single, the resulting veinlets being short. There is, however, one very characteristic feature—the posterior veinule of the first fascicle on each side is always unbranched, and further, the veins of the first facicles are always the longest in each frond, springing from the costa well within the stripe, and remaining subparallel to the former. The margins of the fronds are at times revolute.

Several microscopic sections of portions of fronds were made with more or less satisfactory results. In Pl. xxvii., fig. 16, which is a section transverse to the line of growth, the general form of the frond is admirably shown, the revolute lateral margins, and the median longitudinal depression occupied by the mid-rib; none of the leaf tissues are preserved. The width of this frond is 1·45 mm., the thickness in the centre 0·17 mm., and the thickness of the ends, including the revolute portions, is 0·3 mm. Pl. xxvii., fig. 15, is a longitudinal section of a frond, or one parallel to its line of growth, and of special interest from the fact that the cellular tissue of the epidermis is to some extent visible, and both the upper and lower surfaces are clothed with setiform hairs. I cannot distinguish either stomata or the parenchymatous mesophyll of the frond. There are certain peculiar and equidistant tissue-pillars, extending transversely for half-way between the upper and lower surfaces, which appear to be composed of much decayed tissue, and enclose clear vacuities that certainly possess determinate margins; one at the end of the section is filled with amber-brown pulverulent matter. The space below these pillars, extending nearly the whole length of the frond, does not show any regular parenchyma, but has distributed throughout it a number of straight or curved filaments.* A second longitudinal section

* These filaments are not unlike the fungal borings described by me under the names of *Palæachlya tortuosa* and *P. torquis* (Rec. Austr. Mus., iii., No. 5, 1899, pp. 121 and 126), but if of this nature, distinct from either of these forms.

(not figured) exhibits the tissue pillars extending completely across the frond from surface to surface, without the intervention of the space just referred to. There are no clear vacuities between the tissue-pillars, but their place is taken by patches of dark brown pulverulent material, as if filling up such hollows. In Pl. xxvii., fig. 14, we see a section taken horizontally through the leaf, immediately below the surface, exposing the mid-rib, veins, and epidermal tissue between the latter, as well as very dark brown round patches between the veins, which occupy the same relative position as the dark spots in Pl. xxvii., fig. 15.

There is evidence of fructification only in the microsections of the fronds, although when the undersides of the latter are visible, and disintegration has taken place, an appearance very similar to fructification presents itself, but that is all. This is due simply to the veinules passing over the revolute margins.

In Pl. xxvii., fig. 16, however, are probably the remains of sori, consisting of a number of filaments clustered under the revolute margins, which remind one of pedicels for the support of sporangia, and attached to one of these on the right-hand side of the frond is a small ovate body that may be a sporangium (Pl. xxvi., fig. 7), very similar to the arrangement of the fructification in *Pteris.** There is no trace of an indusium. The length of the revolute portion of the frond is 0·3 mm., width of the receptacles containing the pedicels 0·1 mm., its depth 0·06 mm., and the length of the pedicle 0·1 mm.

When first this Fern came under my notice, I took the fronds to be attached in a verticillate manner. I now look upon them as forming small tufts arranged in ordinary close spirals. The structure shown in Pl. xxvi., fig. 6, showing that the fronds were not arranged in a verticil on the same plane, but in a spiral manner, is emphasised by the fact that in Pl. xxiv., figs. 2 and 4, and particularly in the last, some of the fronds appear protruding from below the others. This is specially the case in Pl. xxiv., fig. 4, where the dark shade running across the matrix, indicates a piece removed, displaying a lower level than that to the left of the shading; on the former are two fronds.

The Scales.—More or less pyriform bodies are visible associated with the fronds in Pl. xxv., fig. 5, and Pl. xxvi., fig. 6; these I have tentatively termed "scales." Mr. A. C. Seward, to whom I submitted photographic copies of the present plates, has been good enough to suggest that these may be bulbil-like appendages, or scale-leaves. He remarks that bulbils occur in some recent ferns, such as *Cystopteris bulbifera.* A dimorphic condition of the fronds has been shown to exist in *Glossopteris browniana,*

* See Hooker and Baker's Synop. Filicium, 1868, pl. iii., fig. 31.

both by Zeiller and Seward* ; by the latter in examples from the Newcastle or Upper Coal Measures. These secondary fronds present a scale-like appearance, with an upper convex surface, and slightly spreading and anastomosing veins, but no mid-rib ; the first two characters accord well with the appearance of the "scales" in the present plant. Instances of other recent Ferns possessing two kinds of simple fronds are given by Mr. Seward, in the paper referred to below.

No very satisfactory alliance amongst recent Ferns can be mentioned. All I can do is, as suggested by Mr. Thomas Whitelegge, to call attention to the shrub-like *Oleandra neriiformis*, Cav., in which the fronds are simple-linear-lanceolate, as in our form, subverticillate, and the short stipes articulated with erect frutescent stems.† Except that the fronds here are spiral, and not verticillate at all, there is otherwise a general resemblance between the two. *O. neriiformis* is said by the late Mr. John Smith, formerly of Kew, to be the "only representative of a shrub among Ferns."‡ I believe that some Botanists do not recognise *Oleandra* but merge it in *Aspidium* ; I am, however, content to speak of the plant as referred to by Mr. Smith.

I have been similarly unable to find any near relative of this extraordinary little plant amongst extinct species. The venation is to some extent Pecopteroid, as may be seen by a comparison with the many excellent figures of *Pecopteris* species given by Brongniart in his "Histoire," particularly *P. aquilina*, *P. nervosa*, or *P. cistii.*§

There is a superficial resemblance in the form and venation of the fronds to those of *Marzaria*, Zigno‖ ; but in the latter the frond is pinnate, and the pinnules are described as digito-radiate. Indeed it is the linear-lanceolate form of the pinnules in *Marzaria paroliniana*, and their often radiate arrangement, that first strikes the eye as resembling the fronds of the Australian fossil, especially when the former are pressed from above downwards, in a similar manner to some of those of the latter. The venation of the two forms is almost identical.

Mr. Seward has called my attention to the figures of a Taxodinaceous Conifer, *Cyclopitys nordenskiöldi*, Schml.,¶ from the Russian Permian. In a letter recently received, Mr. Seward remarks :—"In the Russian plant there are apparently no lateral

* Quart. Journ. Geol. Soc., liii., 1897, p. 218, pl. xxiii., fig. 1.

† Lowe—Ferns : British and Exotic, 1868, p. 41, pl. xvi. ; Beddome—Ferns of Brit. India, ii., p. 264, pl. cclxiv.

‡ Historia Filicium, 1875, p. 81.

§ Hist. Vég. Foss., i., 1828, pls. xc., xciv., and cvi.

‖ Flora Foss. Form. Oolithicæ, i., p. 168, pl. xix., figs. 3–17.

¶ Beiträge zur Jura-Flora Russlands, 1879, pl. xiv., figs. 6–8.

veins in the leaves, although it is conceivable that the 'cross-wrinklings' may be veins. I do not think that the two are identical, but the plant is worth referring to. Schmalhausen regards his plant as a Conifer comparable to *Sciadopitys* ('Umbrella Pine')." These are the only comparisons I am able to suggest.

When first dealing with this fossil, I came to the conclusion that it was a Fern of anomalous structure, probably a new genus, but my difficuities were increased on the preparation of the micro-sections of the stem, for I at once saw that the structure revealed was not that of an ordinary Fern. I accordingly forwarded notes and copies of the illustrations to Mr. Seward, who in an exceedingly kind manner has solved my doubts in the letter already referred to, as follows:—"The internal structure strikes me as particularly interesting; your figures 10 and 11 suggest a fairly broad zone of secondary wood—a form of structure practically unknown among recent Ferns, but slightly developed in some species of *Botrychium*, which have undoubted secondary thickening. From Permian and Coal Measure rocks we have, however, several genera of plants which possess characters now shared by Cycads and Ferns, *e.g.*, *Lyginodendron*, *Heterangium*, *Poroxylon*, and others; in the first two the leaves are of the type long known as *Sphenopteris elegans* and other forms, and the stems have a broad zone of secondary wood, with a structure like that of living Cycads. These intermediate types have recently been placed by Potonié in a special class, which he calls Cycadofilices; the genera have been described by Williamson and Scott, Renault, and others. It would seem not improbable that your plant may belong to this class; it certainly suggests a Fern with secondary wood. It would be very interesting to know more about the anatomy, whether the wood consists of radial rows and tracheids separated by *broad* bands of medullary ray tissue—as in Cycads, or, if it is of the more compact form, with narrower and less obvious rays, such as we have in Conifers; also what the tracheids look like in longitudinal section."

Mr. Seward's remarks suggest comparison with *Botrychium*. The structure of the stem in this genus is thus described* by Dr. D. H. Campbell:—"The vascular bundles of the stem are much more prominent than in *Ophioglossum*, and form a hollow cylinder with small gaps only corresponding to the leaves. This cylinder shows the tissues arranged in a manner that more nearly resembles the structure of the stem in Gymnospermes or normal Dicotyledons than anything else. Surrounding the central pith is a ring of woody tissue, with radiating medullary rays, and outside of this a ring of phlœm, separated from the xylem by a zone of cambium,

* Mosses and Ferns, 1895, p. 243.

so that here alone among Ferns the bundles are capable of secondary thickening. The whole cylinder is enclosed by a bundle-sheath (endodermis) consisting of a single layer of cells. The cortical part of the stem is mainly composed of starch-bearing parenchyma, but the outermost layers show a formation of cork." An excellent diagramatic sketch of the several parts accompanies these remarks.

I believe Pl. xxvi., fig. 10, to practically represent the greater portion, if not all, of the stem or caudex, viewed transversely. It will be noticed that the central portions retain a fairly continuous oval contour, but the outer portions, possibly from extraneous causes, have been crushed together, and the contour broken or distorted. The dark centre in our figure, and from which the whole structure in the specimen has been obliterated, represents without doubt the pith (there is no evidence of primary wood), whilst the zone surrounding this is the secondary wood or xylem. The two outer rings in Pl. xxvi., fig. 10, judging by Dr. Campbell's, may possibly represent—the inner one the endodermis, and the outer the cork formation of the parenchyma. These rings in the fossil are of a dark orange-brown colour. In the enlarged figure, (Pl. xxvi., fig. 11) the dark radiating lines perhaps represent the medullary rays.

The following measurements were kindly made by Mr. T. Whitelegge:—

Longer diameter of caudex	1·8 mm.
Shorter „ „	1·2 „
Diameter of pith	0·35 „
Width of ring of secondary wood	0·25 „
Space between exo- and endoderm... ...	0·1 to 0·2 mm.
Space between endoderm and secondary wood...	0·0 to 0·1 „
Width of exoderm	0·04 mm.
Width of endoderm...	0·03 „

In a longitudinal section of the caudex (Pl. xxvii., fig. 12) the same number of zones can be distinguished as in a transverse section (Pl. xxvi., fig. 10). Thus, the central cylinder, without structure, is followed by the zone of secondary wood, in which faint longitudinal parallel lines can be discerned, answering to the radial lines in Plate xxvi., figs. 10 and 11, but no minute details can be made out. The edge of the secondary wood is of the same deep amber-brown colour already referred to in other parts of the organism, and between this and the layer corresponding to the endoderm in Dr. Campbell's diagram of the stem in *Botrychium*, is a further narrow structureless zone (the inner of the two in Pl. xxvi., fig. 10), that varies so much in radial diameter. The endoderm and the exoderm are again of a deep amber-brown tint, and form strongly marked features of the section, the intermediate

space between them being again structureless. This section, which was prepared from a stem fragment enveloped in matrix in the hope that it would display the longitudinal structure simply, has by accident revealed other unexpected details, in the form of three bract-like bodies on each side, opposite to one another, two and two, those on the right being better preserved than those on the left. As sectioned they form an extension of the parenchymatous zone, and are margined by a continuation of the amber-brown exodermic layer, which is cellular, the tissue having the appearance of the epidermal of the fronds. The two lowest bodies are the longest and best preserved. The only suggestion I can offer of this structure is that the section at this point traverses a node, and that we here see petioles of some of the fronds.

In the same section, but detached from this caudex fragment, is what may well be termed a root and rootlets (Pl. xxiv., fig. 13). The former is straight, 2·7 mm. long, with a transverse measurement of 1·5 mm., and from it on each side are given off at right angles longer and shorter processes, varying in length from 0·15 to 0·3 mm. There is no structure preserved. Whether or no these are a root and rootlets of the plant under consideration, it is of course impossible to say.

Could further points of structure be made out in this interesting fossil, a comparison might then be instituted with that of *Lyginodendron*, Will., on the one hand, and that of *Heterangium*, Corda, on the other. On a superficial comparison with figures of both,* a general resemblance is noticable, particularly in the central cylinder, and the surrounding zone of secondary wood, but as we are unacquainted with the constitution of the central cylinder, whether of pith and primary wood, as in *Lyginodendron*, or primary wood alone, as in *Heterangium*,† it is impossible to carry the comparison further.

One very interesting point, however, remains to be referred to—the attachment of a fern foliage to stems with affinities of a higher order. The late Prof. W. C. Williamson suggested ‡ that the rachises of certain ferns known as *Rachiopteris aspera*, from a similarity in some of their tissues to those of *Lyginodendron*, were the petioles of the leaves of that genus. He remarked—"If we are correct in this supposition, we have now, for the first time, in *Lyginodendron Oldhamium*, a Fern of which the stem or rachis exhibits a highly developed form of exogenous growth. . . Some months ago Mr. Kidston sent me some stems which he believed

* Williamson—Phil. Trans. for 1873, clxiii., pl. xxii., fig. 1; Williamson and Scott—*Ibid.* (B) for 1895, clxxxvi., pl. xviii., fig. 1; Seward—Ann. Bot., xi., pl. v., fig. 1.

† Williamson and Scott—*Loc. cit.*, clxxxvi., p. 745.

‡ Phil. Trans. (B) for 1887, clxxviii., p. 298.

to belong to *Sphenopteris elegans*, the cortex of which displayed an exactly similar series of thickened horizontal parallel bands. Still more recently, he received from my friend Professor Von Weiss, of Berlin, and forwarded to me, a beautiful specimen of an exactly identical stem, attached to which are the unquestionable pinnules of *Sphenopteris elegans*. As far as these internally structureless specimens affect the question, they suggest the possibility that both the species of *Heterangium* may also prove to be Ferns." Again, speaking of the two genera already referred to, Prof. Williamson remarked*—"One thing is certain, viz., that in their internal organisation they present combinations of tissues that find no representatives amongst living plants. Possibly they are the generalised ancestors of both Ferns and Cycads, which transmitted their external contours to the former, and their exogenous modes of growth to the latter types. In considering this possibility, we must not forget that in *Strangeria* we have a still living plant in which the stem of a Cycad bears fronds, the leaflets of which retain the dichotomous nervation of a true Fern. The *Strangeria* has retained, not only the primitive exogenous stem of some ancestral type, in common with its other Cycadean relatives, but also the peculiar Fern-like leaflets, which may also have come down to it from Palæozoic times. Hence we have here a combination of Fern-like features and of an exogenous mode of growth. Such being the case, it need not startle us if we have to conclude that a similar cambination existed during the Carboniferous age." On this subject Messrs. Williamson and Scott remark conjointly†—"In all cases where the petioles can be determined as belonging to *Rachopteris aspera*, we now know that we have to do with the foliage of *Lyginodendron*," thus confirming previous conclusions, "namely, that the leaf would fall under the form-genus *Sphenopteris* of Brongniart, as shown by the finely cut foliage and the acute angles between the veins. . . The mere fact that the foliage of *Lyginodendron* resembled that of certain Ferns is in itself no proof of affinity with *Filices*. The classical case of *Strangaria* is a sufficient warning against any such hasty inference. It must, however, be remembered that in the foliage of *Lyginodendron* we have not only fern-like *form* and venation, but also fern-like *structure*, whereas in the case of *Strangeria*, a single transverse section of the petiole would be sufficient to prove that the plant is no Fern but a Cycad."

The form of the leaf in the present fossil is certainly that of a fern, but unfortunately the structure is not in a sufficiently good state of preservation to warrant any definite generalisations. There is certainly no evidence of the existence of palisade parenchyma; on the other hand the presence of a bifacial structure

* Phil. Trans. (B) for 1887, clxxviii., p. 299.
† Phil. Trans. (B) for 1895, clxxxvi., p. 727.

and epidermis seems to be tolerably apparent, and the fact that the fronds were supplied by a single vascular bundle, as in *Heterangium.**

As regards the petioles a general resemblance exists between those attached to our longitudinal section Pl. xxvii., fig. 12, and that of *Lyginodendron* given by Williamson and Scott,† but little or no minute structure can be made out. They are here opposite, and not spiral as in Pl. xxvi., fig. 6; they are spiral in *Heterangium.*‡

In conclusion, as to the general affinities of this very interesting little plant the following observations may not be inappropriate. Messrs. Williamson and Scott remark§—"The occurrence of secondary thickening in a Fern-like plant is not in itself very surprising. We know that it takes place in a perfectly typical way, though not to any great extent in the stems of *Botrychium* and *Helminthostachys* at the present day." The same may be justly claimed for the present plant.

It is unnecessary to follow Messrs. Williamson and Scott through their very interesting line of reasoning to show the structural connection of *Lyginodendron* and *Heterangium*, with both Ferns and Cycads, but the following sentence‖ is probably very pertinent to the Talbragar fossil—"The view of the affinities of *Lyginodendron* and *Heterangium*, which we desire to suggest, is, that they are derivatives of an ancient and 'generalised' (or rather non-specialised Fern-stock), which already show a marked divergence in the Cycadean direction," and they think "the existence of a fossil group on the borderland of Ferns and Cycadeæ is now well established."¶ For this intermediate group of plants Dr. H. Potonié has proposed** the divisional name of Cycado-filices, a class not hitherto recognised, Mr. Seward remarks to me, in the Southern Hemisphere.

I intended using the generic name of *Pteroxylon* for this plant, but Mr. J. H. Maiden, Director of the Botanical Gardens, Sydney, informs me that as *Ptaeroxylon* it was employed in 1835 for the "Sneezewood" of South Africa. As, however, it is very desirable to retain in the name a connection between the presence of secondary wood and a Fern alliance I have adopted a suggestion made to me by Mr. Whitelegge, and term it *Blechnoxylon.*†† Now, although $\beta\lambda\hat{\eta}\chi\nu o\nu$, is literally a "kind of fern," still, according to Loudon it is also "one of the Greek names of the fern,"‡‡ and may

* Phil. Trans. (B) for 1895, clxxxvi., p. 754.
† *Ibid.*, pl. 26, fig. 22. ‡ *Ibid.*, p. 756.
§ Phil. Trans. (B) for 1895, clxxxvi., p. 766.
‖ *Ibid.*, p. 769. ¶ *Ibid.*, p. 770.
** Lehrbuch der Pflanzenpalaeontologie, Hief 2, 1897, p. 160.
†† $\beta\lambda\hat{\eta}\chi\nu o\nu$ and $\xi\acute{\upsilon}\lambda o\nu$.
‡‡ Encyclopædia of Plants, 1880, p. 881, Note 2183.

in consequence, I think, be justifiably used in the sense intended. The plant will therefore in future be known as *Blechnoxylon talbragarense.*

The fossils are associated in the same deposit with leaves of *Glossopteris*, and stems of our characteristic Coal Measure Conifer, *Brachyphyllum.*

Throughout this enquiry I have been very ably assisted by my Colleague, Mr. T. Whitelegge, and desire to take this opportunity of expressing my thanks not only to him, but also both to Mr. E. R. Waite, who has spared no pains to render the illustrations accurate and intelligible, and to Mr. J. P. Hill, B.Sc., of the Biological Laboratory, Sydney University, for the loan of micro-preparations of *Blechnum*, *Strangeria*, and other plants.

DESCRIPTIONS OF TWO BEETLES FROM MOUNT KOSCIUSKO.

By W. J. Rainbow, F.L.S., Entomologist.

In working over the collection of Australian Carabidæ contained in the cabinets of the Australian Museum, I came across two species apparently undetermined—one a *Percosoma*, and the other *Notonomus*, sp. These are, therefore, now described.

Some time ago, Mr. T. G. Sloane described the Australian and Tasmanian forms of the genus *Percosoma* as known to him.* Of these *P. montanum*, Casteln., and *P. concolor*, Sloane, were recorded from Victoria; the former from Yarragon, Gippsland (Sloane), Dandenong Ranges (French), and the latter from Marysville District (Track to Yarra Falls, Best). Two others, *P. carenoides*, White, and *P. sulcipenne*, Bates, were from Tasmania. The four species here enumerated comprised all that was known of the Australian *Percosoma* up to the date of the publication of Mr. Sloane's paper, and from then until now, no further additions to our knowledge of the native species of this genus have been made.

In the working out of the species *(Percosoma)* herein described, I have been courteously assisted by Mr. Geo. Masters, Curator of

* Proc. Linn. Soc. N.S.W., vii., 1892, pp. 60 - 62.

EXPLANATION OF PLATE XXIV.

Blechnoxylon tallragarense, Eth. fil.

Fig. 1. A cluster of fronds radiating from the caudex, which is partially hollow through disintegration; seen from above; × $2\frac{1}{2}$.

„ 2. A similar specimen, in which the caudex projects slightly above the level of the fronds; seen from above; × 2.

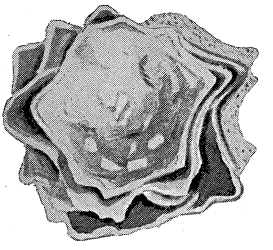
„ 3. The impressions of the upper surfaces of two more or less pyriform fronds, and portion of a third; the caudex is again partially hollowed by disintegration; × 3.

„ 4. A series of frond impressions, radiating from a caudex at three successive levels, as displayed by the shading; × 4.

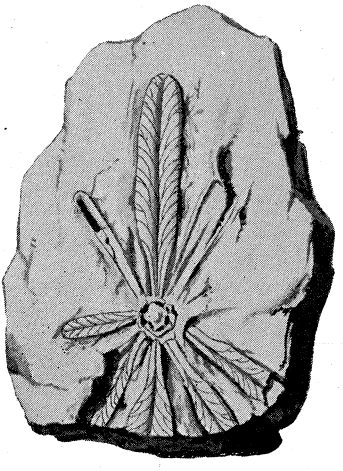
„ 7. Portion of an internode seen in profile, with portions of three fronds seen from above; × 2.

„ 9. The centre of Fig. 2, showing the crushed in zones comprising the stem; a naturally weathered section; × 9.

1

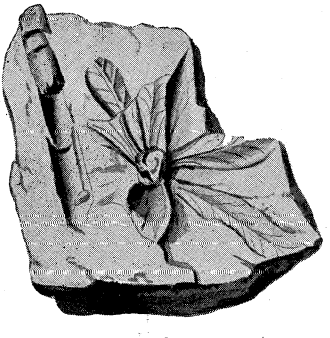


9

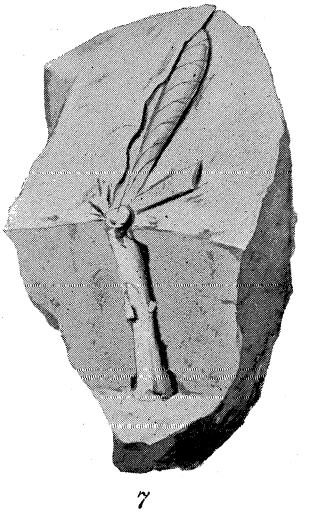


2

3



4



7

E. R. WAITE, Del. Aust. Mus.

EXPLANATION OF PLATE XXV.

Blechnoxylon talbragarense, Eth. fil.

Fig. 5. An internode, partly in the round and partly as an impression, and two nodes, the latter with fronds attached in a greater or less degree. In the centre of the internode is a small protuberance that may be the base of attachment of an adventitious root. The fronds on the right have been pressed back out of the normal position, and all have suffered from the disintegration of their parts by weathering. One of those on the left has been so much decomposed that only the outline remains, with the revolute margin subdivided by the impressions of the veinules; × 3½.

5

E. R. WAITE, Del. Aust. Mus.

EXPLANATION OF PLATE XXVI.

Blechnoxylon talbragarense, Eth. fil.

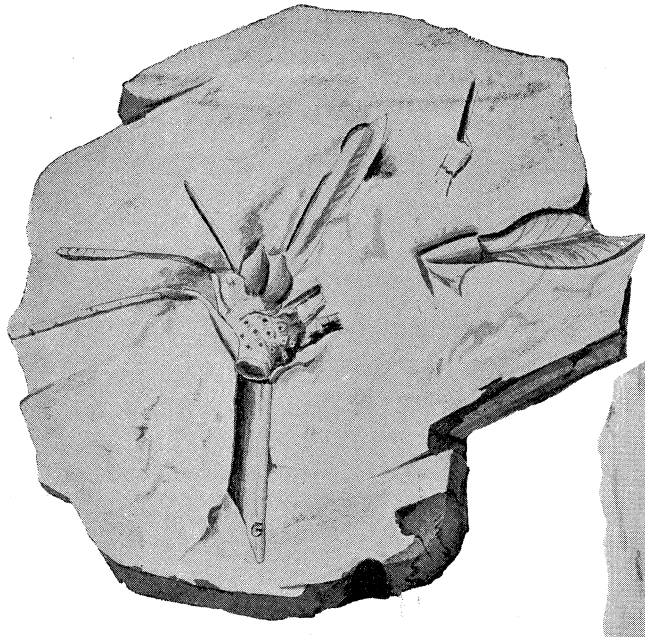
Fig. 6. The impression of part of an internode, with a node in the round, bearing a series of leaf-scars, spirally arranged, and each pierced by a single vascular opening; to some of the scars are attached the frond petioles. Between the fronds above are two scales similar to that seen in Fig. 5; × 4.

„ 8. An internode and portions of two others, more or less decorticated; two nodes are indicated by the remains of two fronds projecting from either side the stem; × 2½.

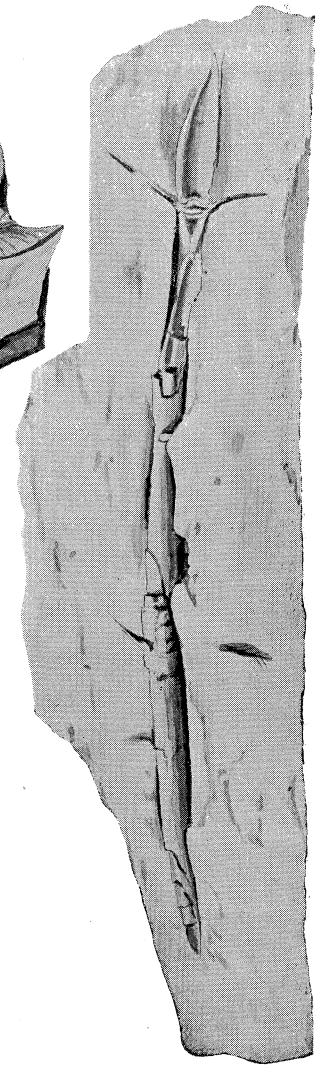
„ 10. Section of the stem prepared for the microscope. The black centre represents either the pith, or the pith and primary wood, whichever may have existed; the second zone with radii is the secondary wood; the third zone of varying thickness, caused probably by partial decomposition and extraneous pressure, occupies the position of the phlœm in the stem of *Botrychium*; whilst the fourth, or outer zone, represents the parenchyma of the latter. The endo- and exodermal layers are represented by the two outermost irregular rings; highly enlarged.

„ 11. A portion of the two innermost zones of Fig. 10, the dark centre being the pith, or pith and primary wood, as the case may be, and the outer radial cellular portion the secondary wood; very highly enlarged.

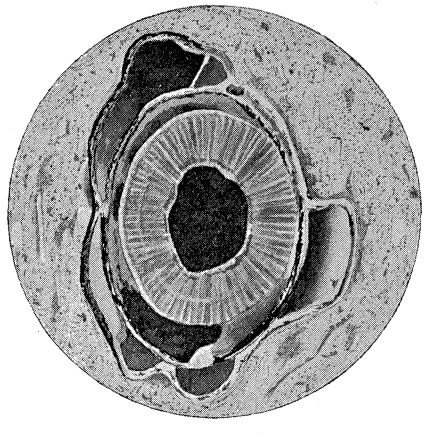
„ 17. The revolute end of the right-hand side of Fig. 16 (Pl. xxvii.) showing the supposed pedicels, one of them supporting a round body that may be a sporangium; very highly enlarged.



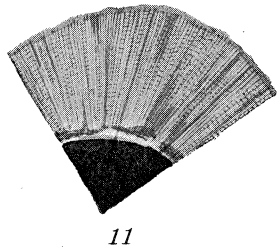
6



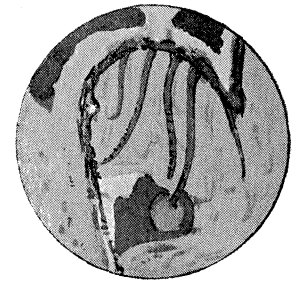
8



10



11



17

E. R. WAITE, Del. Aust. Mus.

EXPLANATION OF PLATE XXVII.

Blechnoxylon talbragarense, Eth. fil.

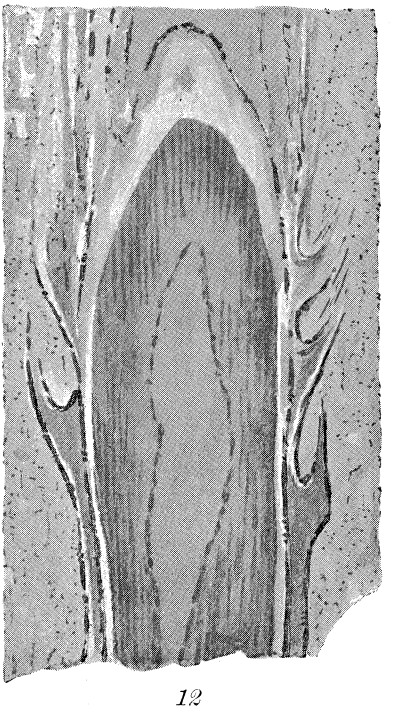
Fig. 12. Longitudinal section of portion of a caudex, prepared for the microscope. The centre represents either the pith, or the pith and primary wood, which ever may have existed; the second zone with longitudinal lines is the secondary wood. At the sides are probably seen the bases of petioles; highly enlarged.

,, 13. A root and rootlets, but whether or no of this organism it is impossible to say; highly enlarged.

,, 14. Horizontal section of a frond, prepared for the microscope, showing on the right-hand side epidermal tissue, and on the left dark brown patches between the veinules; highly enlarged.

15. Longitudinal section of a frond, prepared for the microscope, showing the upper and lower surfaces clothed with setiform hairs, internal "tissue pillars," alternating with clear vacuities, etc.; highly enlarged.

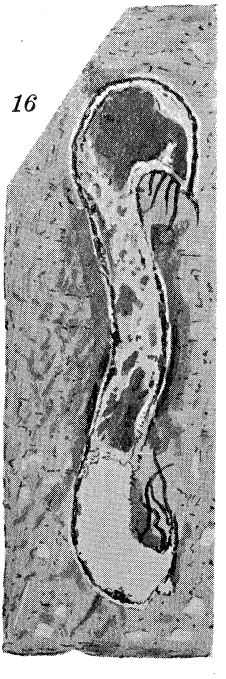
,, 16. Cross section of a frond prepared for the microscope, showing the form of the frond, its revolute margins; and on the right-hand side, filaments that may be pedicels for the support of sporangia; highly enlarged.

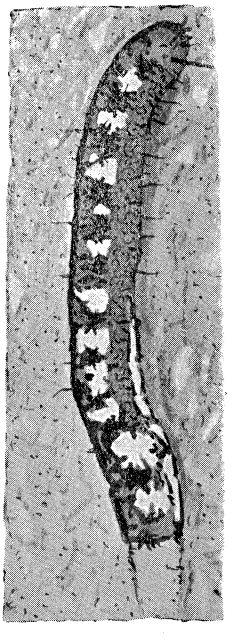


12

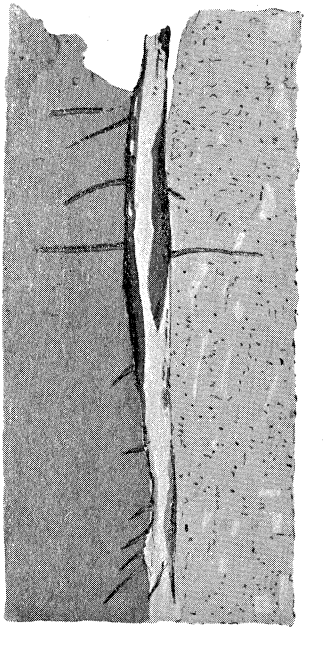
14

16





15



13