ART. XVIII.—*On a Collection of Upper Palaeozoic and Mesozoic Fossils from West Australia and Queensland, in the National Museum, Melbourne.*

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(Plates XXVII.-XXX.).

[Read 8th December, 1903].

INTRODUCTORY REMARKS.

The fossils enumerated or described in this paper consist of a series of plant and various invertebrate remains, chiefly mollusca, sent in March, 1866, by the Hon. Sir (then Mr.) A. C. Gregory, K.C.M.G., F.R.G.S., to Mr. Richard Daintree, F.G.S. The latter forwarded them, with others of his own collecting, to Professor F. M'Coy, for the National Museum collection.

We are, in this paper, chiefly concerned with the specimens from the Gregory collection. These fossils were not localised, but bore numerals referring them to sets from various districts. Two of the localities from whence they came were mentioned in a letter accompanying the collection, from Mr. A. C. Gregory to Mr. Daintree, dated 6th March, 1866, and which runs as follows:—

"I send you a few of the fossils from the West Coast in forming a flat-topped range 600 to 800 feet high. Sandstone, latitude 28° 20′. The specimens are from the upper beds of rock, shale and limestone alternate and rest on gneiss-rock, which is rich in mineral veins, several being worked for copper and lead. Inland of this range is a valley 50 miles wide, occupied by Carboniferous rocks and beds of coal resting on limestone, which closely resemble the lower beds on the Hunter River; these seem to rest on a thin bed of old slate without trace of fossils, and below it the granite, which forms the main table-land of West Australia."

The above notes in Sir A. C. Gregory's letter relate to the fossils from the districts of the Greenough and Irwin Rivers, of Mesozoic and Carbo-permian ages respectively. The fossils from the Greenough River were easily recognised. Any doubts about the localities of the Palaeozoic fossils have been cleared up within the last few months by the Hon. Sir A. C. Gregory, who very kindly favoured us with further notes on the fossil localities. Sir A. C. Gregory also stated that the West Australian fossils were not collected by himself personally, but were forwarded to him by residents in the districts where he had previously collected specimens.

Since the original specimens of West Australian Mesozoic fossils described by Charles Moore are, presumably, in the Bath Museum, and other records of West Australian fossils are not too numerous, it has been considered of sufficient interest and importance to publish some notes on the collection now before us.

The Palaeontological Literature of the West Coast District.

The ages of the fossiliferous beds of the Greenough River and Irwin River districts were stated to be Mesozoic and Carboniferous as early as 1861,[1] by Mr. F. T. Gregory, who, however, classed the Mesozoic fossils as doubtfully Cretaceous. A list of the fossils sent to London with Mr. Gregory's paper was inserted by the editor of the Quarterly Journal, Professor (then Mr.) T. Rupert Jones,[2] who also referred to these fossils as of secondary age.

Charles Moore gave, in 1862, an account of some fossils from West Australia, and referred them to the Mesozoic period.[3]

Later, the same author, in a paper read before the Geological Society of London,[4] describing a series of fossils collected by Messrs. Shenton and Clifton in Western Australia, referred the strata which yielded them to the Middle Lias or the Lower

1 Quart. Journ. Geol. Soc., vol. xvii. (1861), p. 480.
2 *Tom. cit.*, p. 484.
3 Rep. Brit. Assoc., 1862 (1863), Cambridge Meeting, p. 83.
4 Quart. Journ. Geol. Soc., vol. xxvi. (1870), p. 229.

Oolite of Europe. Moore also recognised typical Cretaceous fossils from this district.

The Government Geologist for Western Australia (H. Y. L. Brown), in 1873,[1] dealt in some detail with the stratigraphy of the Greenough River district, and regarded these beds as of Oolitic age. In the same report the chalky limestone of Gin Gin and Yatheroo, which overlies the ammonite-bearing beds, is referred to as most likely of Mesozoic age. A useful geological map of the West Coast district accompanies this report, and the horizontal sections give a good idea of the peculiar conformation of this part of the country, with its characteristic flat-topped ranges.

H. P. Woodward (Government Geologist, W.A.) gave, in his annual report for 1890-1891, a list of Mesozoic fossils; but these are all from the Victoria district.

G. C. Crick has done good service in re-examining Chas. Moore's original types of Jurassic Cephalopoda, as well as describing many specimens from other collections, and which are distributed among the Bath Museum, the Geological Society's Museum and the Natural History Museum, London. This work appeared in two papers, published in the "Geological Magazine," in 1894.[2]

The Carbo-permian fossils of the Irwin River district came from the area known as the "Coal-seam," which is about fifty miles from the coast, on parallel 29°. The discovery of these Carboniferous rocks was made as early as 1846 by the brothers A. C., F. T. and H. C. Gregory;[3] and the occurrence of associated coal beds with a six-foot seam was recorded by Lt. Helpman, R.N.[4]

Although not dealing with the fossils of the Irwin River district, Hudleston's notes on fossils from north of the Gascoyne River[5] supply further knowledge of Upper Palaeozoic forms, and

1 General Report on a Geological Exploration of that portion of the Colony of Western Australia lying southward of the Murchison River, and westward of Esperance Bay. Parliamentary Papers, No. 1, 1873.

2 Geol. Mag., Dec. iv., vol. i., 1894, pp. 385-393; pp. 433-441, pls. xii., xiii.

3 See Journal of an Expedition undertaken by the Messrs. Gregory in the months of August and September, 1846. Journ. R. Geogr. Soc., 1848, p. 26.

4 *Tom. supra cit.*, p. 41.

5 Quart. Journ. Geol. Soc., vol. xxxix. (1883), p. 582.

this author concludes, from the evidence before him, that the Upper Palaeozoic strata in this part of Australia correspond with the Lower rather than the Upper Carboniferous of other areas of Australia.

R. Etheridge, Jun.,[1] recorded several species of brachiopods and bivalves from the Irwin River Coal Field, as well as a Mesozoic Cucullaea from the Greenough River District (Paxton Coll.).

Messrs. E. T. Hardman and H. P. Woodward have extensively collected in the Upper Palaeozoic and Mesozoic beds of West Australia, and series of their fossils have been described by various specialists in England.

The widely distributed and variable fossil Ctenostreon pectiniformis has lately been figured by R. Etheridge, Jun., for the first time from Australia.[2]

Fossils from the Carboniferous[3] (Star Beds) of the Drummond Range, Queensland.

Collected and Presented by the Late Mr. Richard Daintree, F.G.S.

Plantae—Lycopodiales.

Lepidodendron australe, M'Coy. (Plate XXVII., Figs. 1-5).

Lepidodendron (Bergeria), australe, M'Coy, 1874. Prodr. Pal. Vict., Decade i., p. 37, pl. ix.

[For a full discussion of the specific standing of L. australe, see R. Etheridge, Jun., in Records Geol. Surv., N.S.W., vol. ii., pt. iii., 1891, p. 119].

Structure in L. australe.—Although much has been written on the subject of the Australian Lepidodendra, there is ample room for fresh discoveries, especially in relation to their structure and

1 Ann. Rep. Dept. Mines, New South Wales, for 1889 (1890), p. 239.

2 Rec. Austr. Mus., vol. iv., No. 1, 1901, p. 13, pl. iii.

3 The "Star-beds" are here regarded as Carboniferous in correlation with beds in Victoria, similarly containing L. australe.

organization; for, as usually found, they consist only of more or less decorticated stems and branches, associated with fragments of leaves. The stem-remains generally present a striking appearance as fossil specimens, with their ornament of regular rhomboidal depressions; but the conditions of their preservation did not, in the majority of cases, favour the retention of their internal structure. It is, therefore, worthy of notice that some of the stems, branches, and even leaves of Lepidodendron from the Drummond Range show very clearly, under a moderate magnification, the fundamental tissue of the cortex underlying the epidermis, as a cellular meshwork. This structure seems to be invariably preserved in our specimens as a replacement by limonite, the latter being most probably derived from the actual rock in which the fossils are embedded, and which seems to have been originally a ferruginous and silty clay.

A specimen showing the parenchymatous tissue overlying the traces of the ridges bordering the rhombic leaf cushions of the stem is here figured (Pl. XXVII., Fig. 4).

The same specimen shows what may eventually prove to be the ligule; and in comparing this structure with other known examples it will be seen that it is here also seated in a pit or depression. Further, it occupies a similar relative position to the vascular impression; and in L. Australe both are nearer than is usual in other species to the upper angle of the rhombic area.[1]

Another example of the occurrence of the fundamental tissue preserved in L. australe is now also figured (Pl. XXVII., Fig 5). It is presumably near the extremity of a slender terminal branchlet. This particular specimen is of much interest, on account of its showing so well the parenchyma strengthened by traversing plates of sclerenchyma.[2]

Evidences of leaves.—The remains of leaf-fragments are abundant in the shales containing stems of Lepidodendron, but have been much mutilated prior to their enclosure in the original mud which formed the shale.

We now figure two of the more interesting specimens, one representing the back of a long parallel-sided leaf, having a

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1 Compare Scott, Studies in Fossil Botany, 1900, p. 144, fig. 57B.

2 See Solms-Laubach, Fossil Botany, 1891, p. 217, fig. 22A (after Renault).

strong median ridge corresponding to the grooving of the opposite surface (Pl. XXVII., Fig. 2).

Another specimen noticed in the shale seems to be a small sporophyll, such as might be found closely grouped around the axis of the strobilus (Pl. I., Fig. 3). It shows the characteristic hollow for the reception of the sporangium.

Remarks on variation in the form of the leaf-cushions in Lepidodendron australe.—There are two specimens of L. australe in the present collection, occurring in a grey-coloured and limonitic shale, both of which show the transversely elongate form of the leaf-cushions[1]; a modification undoubtedly due to the fact that they represent older portions of the stem. On this point Kidston may be quoted[2]:—"In most species the increase in the girth of the stem has a tendency to produce a greater lateral increase in the proportion of the leaf-scars than is equalised by the upward growth of the trunk; consequently in some species, where the leaf-scars on the young twigs have a vertical length much greater than their width, their older conditions show proportionally a much greater transverse diameter."

The average relative diagonals of the rhombic leaf-cushions in the present specimens are:—Transverse, 13.5 mm.; vertical, 10.5 mm. An extreme form in another exposed fragment on one of these blocks measures 16 x 9 mm. That the variation of the relative elongation of the rhombic areas is due to the age of the stem is proved in the case of this Australian species by measurements which I have taken on the relative diagonals of the leaf-cushions of the type-specimen of L. australe, in the National Museum, a portion only of which was figured in the Prodromus by McCoy. Near the base of this type-specimen the leaf-cushions measure 10.5 mm. trans., by 8 mm. vert. Close to the top of the left branch they become almost equilateral, measuring 8 mm. trans., by 7.5 vert. The two points at which measurements were taken are 21 centimetres distant from one another.

The conspicuous depression usually seen near the upper angle of the leaf-cushion in L. australe must be regarded as the opening

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1 "Leaf-scars" of some authors; a term applied more correctly to the upper portion of the area covered by the leaf base.

2 Cat. Palaeozoic Plants in the British Museum, Lond., 1886, p. 152.

through which the vascular bundle passed, connecting the leaf with the stem (the leaf-bundle having been torn away); for the actual leaf-base, which is closely connected with the stem, does not appear to have been preserved in the Australian specimens, since the lateral points of the parichnos[1] have not yet been detected. This latter structure it would be hopeless to look for, if we assume that the known specimens represent a "Bergeria" condition of the stem, in which the epidermis has been lost before fossilisation.

The elongate-elliptical depression indicating the passage of the vascular bundle is, as a rule, situated close to the upper angle of the rhombic area. On examining the type-specimen, I noticed that where these pits are central, or nearly so, they seem to be only partially preserved; that is to say, the lower portion of the vascular depression has been filled up and preserved as a cast, which, by its obliquity and projection, brings it nearer the centre. It would be interesting to discover whether this evidence is borne out in other examples that may come under observation.

On the same pieces of shale there are several fragments of what at first sight appear to be remains of Cordaites, but, although this genus has been recorded from the Drummond Range, in this instance, it seems safer to regard these fragments as decorticated branches of Lepidodendron, chiefly on account of the parallel grooving of the fragments bearing indication of intermittent thickening along the slender ridges.

Fig. 1, on Plate XXVII., is taken from a specimen from Wynn Creek, Queensland, presented to the National Museum by R. Daintree, Esq.; it was selected for figuring on account of the greater detail on its surface.

L. australe has previously been noted from the Drummond Range by Tenison Woods.[2]

Locality and Horizon.—Drummond Range, near Clermont, Queensland. Star beds. [2161-2; 1376-7].

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1 See Scott, Studies in Fossil Botany, p. 120, fig. 50.

2 Journ. R. Soc., N.S.W., 1882 (1883), vol. xvi., p. 179; Proc. Linn. Soc., N.S.W., 1883 (1884), vol. viii., pt. 1, p. 135.

Fossils from the Carbo-Permian[1] of Queensland and Western Australia.

Collected by Messrs. A. C. Gregory and R. Daintree.

Plantae—Equisetales.

Phyllotheca australis, Brongn. (Pl. XXVII., Figs. 6–7).

Phyllotheca australis, Brongniart, 1828. Hist. Foss. Véget., p. 152.

Feistmantel, 1878. Palaeontographica, Suppl. Band. III., Lief. III., Heft. 3, p. 83, pl. vi., fig. 3; pl. vii., figs. 1–2; pl. xv., fig. 1. *Idem*, 1890. Mem. Geol. Surv., N.S.W., Pal. No. 3, p. 79, pl. xiv., figs. 1–4 (fig. 5 = P. deliquescens, Goepp; see Arber, *loc. infra cit.*, p. 17, synonomy).

Etheridge, Jun., 1892 (in Etheridge and Jack). Geol. and Pal. of Queensland, p. 189, pl. xvii., fig. 3.

Arber, 1902. Quart. Journ. Geol. Soc., vol. lviii., p. 14.

This species has already been recorded from the Bowen River Coal Field in Queensland, although not from the precise locality as the present example, and it is possible that our specimen comes from the same horizon in the series.

A slab of black, carbonaceous shale in the present collection is crowded with remains of the stems of Phyllotheca and Archaeocalamites. At first sight it seemed possible that these stems were all referable to the genus Phyllotheca, the broader and more closely-grooved forms closely resembling Phyllotheca deliquescens (Goeppert). The presence of leaf-scars was afterwards detected, on a closer examination, which compels one to refer these particular stems to the Calamites section of the Equisetales.

The stems of Phyllotheca now under consideration are slender and generally coarsely fluted or grooved, having usually only 4 to 5 vertical furrows visible. The width of the stems varies from 5 to 10 mm. The leaf-sheaths are well preserved in some

1 The later (coal-bearing) Carboniferous strata of Australia and Tasmania are usually referred to as Permo-carboniferous. There is, however, good reason for reversing the components of this term to ensure uniformity with words like Siluro-devonian or Trias-jura, which refer in their proper age sequence to strata having a mixed fauna. "Hunterian," as suggested by Professor Ralph Tate, is possibly a convenient term to apply to these beds, which, as the Hunter River Series, are so well developed locally.

cases, and the internodes vary in vertical height from 10 to 15 mm. The separate leaf-like terminations of the sheaf have a distinct mid-rib, characteristic of this genus.

Fructification in Phyllotheca.—Arising from the base of what appears to be an undoubted leaf-sheath of Phyllotheca australis, which has been torn from the stem, is an extremely interesting example of a stout, sub-rotund strobilus, covered with numerous ovate imbrications (Pl. XXVII., Fig. 7). The distal end of this specimen was presumably flat, and the strobilus seems to have been sheathed around the external margin with small bracts or sporophylls. A somewhat similarly formed cone has been described by Kidston,[1] under the name of Equisetites hemingwayi.

Another remarkable specimen occurs along with the Phyllotheca stems. It is conoidal and imbricated and strongly resembles the conical group of sporophylls seen in some species of Equisetum. Similar strobili have been described and figured by R. Etheridge, Jun.,[2] found as terminal cones attached to actual stems of Phyllotheca. Our specimen is cylindrically ovate and terminates in a somewhat sharp apex. Its length, so far as preserved, is 18 mm. One side of the strobilus has been ruptured, and the surface spread out lengthwise. The imbricated scales are set closely to one another, and terminate in blunt points. They alternate, as in Etheridge's specimens, with the series above and below. Where the surface has been flattened out, however, there is evidence of long filamentous leaves, similar to those seen in the strobili described by Etheridge, Jun.

The recorded examples of fructification in Phyllotheca are few, and until the discovery of the strobili by Messrs. J. Mitchell and C. Hedley in the Upper Coal Measures of Newcastle, New South Wales, and which Mr. Etheridge has described and figured, there was only one instance in which a supposed inflorescence had been seen in Phyllotheca australis, which was described many years ago by M'Coy[3]. That author figured a portion of a fertile branch with closely set joints, having sheaths which bore on their upper margin a fringe of "anthers," which he compared

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1 Ann. Mag. Nat. Hist., ser. 6, vol. ix., 1892, p. 138. See also Seward's "Fossil Plants," Cambridge, 1898, p. 262, fig. 57A.

2 Rec. Austr. Mus., vol. iv., No. 1, 1901, pp. 1-4, pls. i., ii.

3 Ann. Mag. Nat. Hist., vol. xx., 1847, p. 155, pl. xi., fig. 1.

with the male flowers of Casuarina stricta. Arber has re-examined this specimen[1], which is in the Woodwardian Museum at Cambridge, but he failed to find any leaf-sheath, and only one leaf-like segment, and suggested that the striated internodes have been mistaken for leaf-sheaths. Remarking on this specimen, Arber says :—" The preservation of the fossil is by no means good, and will only permit me to say that at each node, and on either side, a bunch occurs of several small ovate bodies, apparently closely attached to the node, which may be sporangia. I have not, however, been able to make out any sporangiophores, or further details." The fructification of the Permian examples of Phyllotheca described by Schmalhausen[2] consists of sporangia, borne on peltate sporangiophores attached to the internodal area of the stems between the infertile leaf-whorls. Zeiller has described the fructification of Phyllotheca rallii,[3] in which the sporangiophores alternate with the whorls of sterile bracts.

That our second described specimen is comparable with the beautiful examples from the New South Wales coal-measures does not admit of doubt, on referring to the illustrations given by Etheridge, Jun. As regards the laterally formed strobilus now figured, attached to the leaf-sheath, it is open to question whether this represents another mode of fructification for the same species, but more light may be looked for on this interesting point by the discovery of further specimens. In Equisetites hemingwayi, mentioned above, the cones are sessile, as in our example, but no leaves occur on the nodes with the cones.

Locality and Horizon.—From the Baron River (a southern tributary of the Burdekin River) below the coal seams, Queensland. Carbo-permian. [1381 ; 2167.].

Archaeocalamites scrobiculatus, Schlotheim sp. (Pl. XXVII., Figs. 8, 9).

Calamites scrobiculatus, Schlotheim, 1820. Petrefactenkunde, Abth. 1, p. 402, pl. xx., fig. 11.

C. radiatus, Brongniart, 1828. Hist. Foss. Véget., p. 122, pl. xxvi., fig. 2.

1 Quart. Journ. Geol. Soc., vol. lviii., 1902, p. 16.

2 Mém. Acad. Imp. Sci., St. Petersburg, ser. 7, vol. xxvii., No. 4., 1879.

3 Mém. Soc. Geol. France, Pal. Mém., No. 21, vol. viii., fasc. iv., 1899, p. 65.

Asterocalamites scrobiculatus (Schloth.), Eth., Jun. (in Eth. and Jack). Geol. and Pal. Queensland, 1892, p. 189, pl. iv., figs. 11 and 12.

Archaeocalamites scrobiculatus (Schloth.), Seward. Fossil Botany, 1898, p. 386, fig. 103.

Stems of the above plant are associated with Phyllotheca in the specimen now being described, one example measuring 22 cm. in length. Greatest width 24 mm. The surface of the stem is closely striate, the groovings numbering about 24 on the larger portion of one stem. There are a few scattered and attached filiform leaves associated with the stems, and others can be indistinctly seen closely adpressed near the nodes. Leaf and branch scars are not infrequent, and appear as circular depressions with a central mammilla, sometimes radially striate (Pl. XXVII., Fig. 9). The stem grooves pass continuously from internode to internode.

This plant occurs here at a higher horizon than was formerly known, for its previous records are restricted to the Star beds.

It is just possible that some of the doubtful forms thought to be Phyllotheca of the P. deliquescens type may eventually prove to be referable to Archaeocalamites.[1]

Locality and Horizon.—From the Baron River (a southern tributary of the Burdekin River), below the coal seams, Queensland. Carbo-permian. [1381.].

Filicales.

Glossopteris browniana, Brongniart.

Glossopteris browniana, Brongn., 1828. Hist. Foss. Végət., p. 223, pl. lxii.

Feistmantel, 1878. Palaeontographica, Suppl. Band iii., Lief. iii., Heft 2, p. 78 ; Heft 3, p. 90 ; pl. viii., figs. 3–4 ; pl. xix., figs. 1, 1*a*, 3, 4, 4*a*, 5, 5*a*, 7 ; pl. xi., fig. 1.

Idem, 1890. Mem. Geol. Surv., N.S.W., Pal. No. 3, p. 121 ; pl. xiii., fig. 1 ; pl. xvi., fig. 34 ; pl. xvii., figs. 1, 3, 4, 5 (?), 7 ; pl. xx., fig. 2.

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1 *Cf.* Seward, Quart. Journ. Geol. Soc., vol. liii. (1897), p. 324, pl. xxiv., fig. 1 ; also "Fossil Plants," Cambridge, 1898, p. 285, fig. 67 ; also Feistmantel, 1890, Mem. Geol. Surv., N.S.W., Pal. No. 3, p. 79, pl. xiv., fig. 5.

Etheridge, Jun. (in Etheridge and Jack), 1892. Geol. and Pal., Queensland, p. 193, pl. xvi., figs. 6, 8 ; pl. xvii., figs. 9–10.

Some pieces of greenish coloured sandstone from the Baron River show several recognisable leaves of this species. Their nervation is beautifully contrasted in white on the dark green sandstone surface. It is of interest to note the occurrence of what appears to be an imbricated stem, resembling a terminal spike of Lepidodendron, on one of the slabs with the Glossopteris ; but it is not sufficiently well preserved to enable one to determine its relationship with certainty.

Locality and Horizon.—Baron River (below coal seams), Queensland. Carbo-permian (Bowen River Coal Fields). [1378; 1619.].

Glossopteris ampla, Dana.

Glossopteris ampla, Dana, 1849. Geol., Wilke's U.S. Expl. Exped., p. 717 ; Atlas, pl. xiii., fig. 1.

Feistmantel, 1878. Palaeontographica, Suppl. Band iii., Lief iii. Heft 3, p. 91, pl. xi., fig. 2 ; pl. xii., fig. 7.

Etheridge, Jun. (in Etheridge and Jack), 1892. Geol. and Pal., Queensland, p. 195, pl. xv., fig. 7.

In the present collection there are two pieces of sandstone bearing impressions of the leaves of the above species. This form has previously been recorded from the Bowen River Coal Field, at Coral Creek, by Etheridge and Jack.

Locality and Horizon.—Baron River (below coal seams), Queensland. Carbo-permian (Bowen River Coal Fields). [1379-80.].

Glossopteris parallela, Feistmantel.

Glossopteris parallela, Feistmantel, 1878. Palaeontographica, Suppl. Band iii., Lief. iii., Heft 3, p. 93, pl. ix., figs. 2–4.

A specimen of sandstone from the Queensland collection bears portions of seven leaves on its surface, three of which are sufficiently complete to show their characteristic elongate form. The nervation of the leaves is clearly marked, and compares closely with the examples of G. parallela, figured and described by Feistmantel. The parallel character of the nervation is seen at a glance, and is due to the elongation of the polygonal areas formed by the anastomosing nerves. The mid-rib is broad and distinctly hollowed.

It is interesting to note the occurrence of this species in the Bowen River Coal Field of Queensland, since its previous records seem to have been only from the upper coal measures of Bowenfels in New South Wales.

Locality and Horizon.—Baron River (below coal seams), Queensland. Carbo-permian (Bowen River Coal Fields). [2160].

Coniferae.

Araucarioxylon, Kraus, 1864.[1]

General Remarks on the Determination of Fossil Coniferous Wood.—The generic name Araucarioxylon is here employed in a restricted sense for coniferous wood allied to Araucaria and Dammara, and agrees in the main with Kraus' definition, in having the medullary rays in a single row on the tangential section, with bordered pits mutually in contact.[2] The determination of generic or typical groups in the Coniferae from a microscopical examination of their fossil woods is a somewhat hopeless task, notwithstanding the beautiful preservation of the tissues in many silicified and otherwise mineralized specimens. Although the wood thus mineralized often shows a structure so well replaced that thin sections of it can be examined in all their details, under a high magnification, with that of a recent wood; yet, as some eminent palaeobotanists, as Solms-Laubach,[3] Scott,[4] and others, have recently pointed out, unless we can examine sections taken from all parts of the stem and root, and sliced in the various directions necessary to give a complete knowledge of their structure, we may easily fall into the error of confusing the woods of entirely different groups. The above genus affords a case in point, in which the stems of Cordaites were grouped

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1 G. Kraus.—"Mikroskopische Untersuchungen über den Bau lebender und vorweltlicher Nadelhölzer." Würzburger Naturwiss. Zeitschr, vol. 5 (1864).

See also Schimper, 1870, Traite, Pal. Vég., vol ii., pt. 1, p. 380.

2 The arrangements and characters of the bordered pits of the tracheides are, however, so inconstant, even in the Araucarian group, that little value can be attached to them for determinative purposes.

3 "Fossil Botany," Cambridge, 1891, pp. 80-82.

4 "Studies in Fossil Botany," London, 1900, p. 419.

with true coniferous wood. The Cordaitean stem, for example, exhibits in its secondary wood tracheides with bordered pits, a character for long supposed to be typical of Coniferous woods, and, in fact, very closely resembling, if not identical with, that of Araucaria itself. Undoubted stems of Cordaites have also yielded in the earlier portion of the xylem the scalariform and spiral elements commonly seen in many other plants.

In the present instance the wood structure has been carefully compared with sections of wood taken in various directions from Araucaria cunninghami and Dammara australis. For the opportunity of examining these recent woods I am indebted to Mr. R. H. Walcott, of the National Museum.

Occurrence of Palaeozoic Fossil Wood in Australia.—Silicified stems and roots of trees have long been known to occur in the upper palaeozoic strata of Queensland[1] and New South Wales.[2]

With regard to the Queensland occurrences Jack remarks on the silicified wood exposed on the sides of Jack's Creek, as follows[3]:—"About a mile north of the Bowen River a thickness of about fifty feet of greenish-gray sandstone is seen, containing numerous, large, drifted coniferous trees. The trees, which are silicified to a black flint, and sometimes opalized, occasionally retain some of the branching roots. Fragmentary plant remains, in a carbonized condition, are also common. About half a mile from the river the creek divides into two branches, both of which show for some distance up sections of the greenish-gray pebbly sandstone with silicified drifted trees. One tree measured thirty-one feet in length and tapered from twelve inches to three inches in diameter."

The same author mentions other large silicified trees, about a quarter of a mile west of Rosella Creek, in one of which he counted about thirty rings of growth.

Of the Upper Bowen formation of Walker's Creek, Jack remarks[4]:—"Some sandstone beds in the neighbourhood contain silicified logs, and similar logs, evidently weathered out of the

1 Etheridge, Jun., and Jack. Geol. and Pal., Queensland, 1892, pp. 165, 166, 168, 175.

2 Nicol, Edinburgh New Phil. Journ., vol. iv., 1832, p. 153; Clarke, Quart. Journ. Geol. Soc., vol. iv., 1848, p. 60; Dana, Geol. U.S. Expl. Exped., 1849, p. 714; Eth. Jun., Cat. Aust. Foss., 1878, p. 32 (footnote *e*).

3 *Tom. cit.*, p. 165.

4 *Tom. cit.*, p. 168.

sandstone, bestrew the surface in the neighbourhood so thickly that one might imagine a forest to have been felled on the spot and subsequently petrified."

It is interesting to notice that these coniferous tree-remains are not confined to the freshwater (upper) series of the Bowen River Coal Field, but that they are also found in the marine (middle) series.

Araucarioxylon daintreei, sp. nov. (Plate XXVIII., Figs. 1–3; Plate XXIX., Figs. 1–3; Plate XXX., Figs. 3–4).

Chief Characters.—Stem sub-elliptical in section in the present example. The broken, transverse surface shows very clearly the succession of rings of the wood cells (annual rings). Area of pith cells very restricted, the bundle measuring in this specimen 1.7 mm. in diameter. The pith bundle is not circular in transverse section but somewhat elongated in one direction, and angular on the periphery. The parenchymatous cells of which it is composed are rectangular to polygonal in transverse section. They are made out with difficulty in this direction on account of their absorption of so much iron oxide along with their silicification. The primary xylem appears to consist of four or five rows of tracheides, which show traces of scalariform and spiral structure in the sections taken through the stem in a radial direction.

The tracheides of the secondary wood are sub-rectangular in transverse section, and run in series of 4 to 6 between the medullary rays in plane section. No resin cells were noticed.

The radial section shows the pith cylinder to be immediately followed by the short series of scalariform and spiral elements mentioned above, and succeeded by the secondary xylem. The ordinary prosenchymatous vessels forming the wood have their radial surfaces crowded with bordered pits, showing the central mark as an oblique, elliptical, slit-like depression, and similar to those in both the Araucariae and the Cordaiteae. The pits are closely adpressed, but generally not so close as to become polygonal; they occur sometimes in single rows, but more often in as many as 4 to 6.

In tangential section the medullary rays are in single rows. They are of a simple type and therefore do not carry horizontal resin canals, as in the fossil wood referred by Kraus[1] to the type Pityoxylon.

The present specimen measures in its longest diameter about 9 cm.

General Remarks on the Specimen and its Alliances.—The stem now under description is clearly distinguishable from the wood of Cordaites, on account of the definite annual rings seen throughout the stem. Although these rings are somewhat irregular in the earlier part of the wood, and show a tendency to thin out at various places, causing an appearance of overlapping, they are very distinct later on, and throughout each complete ring show the regular transition from the spring to the autumn growth, and the sudden recurrence to the former with less crowded cell-structure. This feature of differentiated wood cells seems to be unknown in Cordaites, where the xylem is practically uniform in structure.[2]

The most important factor, however, in determining the difference between the Coniferous wood and Cordaites is the nature of the pith cylinder, which in the latter is unusually thick and transversely ruptured, so as to leave numerous diaphragms separated by cavities.

The pith is very small in our specimen, and the primary xylem is also of very limited extent.

With regard to the bordered pits seen in the radial walls of the tracheides, I notice that in our specimen of Araucarioxylon they agree most closely with those seen in Dammara australis, in that they are less crowded and only occasionally polygonal. The bordered pits in the tracheides of the wood of Araucaria cunninghami are perhaps more comparable with those seen in Cordaites, although much larger. The central depression is elliptical and oblique in all four types, so that this particular feature cannot be relied on as a determinative character.

There is, therefore, in view of the foregoing statements, no doubt as to the Coniferous affinities of our specimen.

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1 *Tom. supra cit.* See also Traité de Paléontologie., pt. ii., 1891, Palaeophytologie, by Schimper and Schenk, p. 856, fig. 417.

2 Scott—Studies in Fossil Botany, p. 419.

Another reason for referring the present specimen to the genus or type of Araucarioxylon is the absence of resin cells in the medullary rays and among the vertical tracheides.

It differs from the Cedroxylon type of coniferous wood—to which it otherwise bears most resemblance—not only in the above feature, but also in having the medullary rays, as seen in transverse section, more widely separated, and also in having the bordered pits of the radial walls of the tracheides disposed in several rows, instead of singly, as seems to be the general, though not invariable, rule in Cedroxylon

Enough has probably been said, having regard to the limited material at present at our disposal, upon the claims of the above to be regarded as a typical Araucarioxylon. This has been already done by Carruthers[1] and Etheridge, Jun.,[2] for the fossil wood found in the Bowen River formation; but these authors have unfortunately given no figures or description of any definite specimen, so that the name by which the fossil wood from Queensland was previously recorded must now lapse, as Mr. Etheridge himself suggests when recording the fossil wood occurrences.[3] The diagnosis now given will, it is hoped, strengthen the claim of the Conifers to be considered as having existed indubitably in Carboniferous times.

Locality and Horizon.—Baron River (a southern tributary of the Burdekin River), below the coal seams, Queensland. Carbo-permian (Bowen River Coal Fields). Coll., Hon. Sir A. C. Gregory and R. Daintree, Esq. [2235.].

Animalia–Coelenterata.

Stenopora leichardti, Nich. and Eth., Fil.

Stenopora leichardti, Nicholson and Etheridge, Jun., 1886. Ann. Mag. Nat. Hist., vol. xvii., p. 179, pl. iii., figs. 7–8. Etheridge, Jun., 1892 (in Etheridge and Jack). Geol. and Pal., Queensland, p. 204; pl. vi., figs. 9–10; pl. vii., fig. 2.

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1 *Araucaroxylon nicholi*, Carruthers, in Etheridge, Jun. Proc. R. Phys. Soc., Edinb., 1880, vol. v., p. 328.

2 *Araucaroxylon nicholi*, Carruthers (M.S.), Eth., Jun. (in Eth. and Jack). Geol. and Pal., Queensland, 1892, p. 198.

3 *Loc. supra cit.*

Our specimens from the Irwin River district are entirely replaced by limonite, but so perfectly that the exact form of the corallites can be seen under a slight magnification, as well as the large acanthopores, supposed to be a distinguishing feature of this species. Other points worthy of notice are the cylindrical and branching habit of the corallum, and the periodical external thickening of the corallites.

Locality and Horizon. — Irwin River District, Western Australia. Carbo-permian. [1397; 2159.].

Crinoidea.

Several pieces of crinoid stems occur in a brown sandy matrix. The columnals are circular in section, with radially striate surfaces, and having a small circular axial canal. They appear to belong to the family of the Actinocrinidae, but cannot be determined with certainty, as no remains of the calyx or arms were met with. Crinoid stems have been recorded from the Gascoyne River, Western Australia, by A. H. Foord,[1] who states that F. A. Bather regards them as probably referable either to the Rhodocrinidae or Actinocrinidae.

Locality and Horizon.—Irwin River district, Western Australia. Carbo-permian. [2110.]

Brachiopoda.

Derbyia (*cf.*) senilis, Phillips, sp.

Spirifer senilis, Phillips, 1836. Illustr. Geol. Yorkshire, vol. ii., p. 216, pl. ix., fig. 5.

Derbyia senilis (Phill.), Etheridge Jnr., 1892 (in Eth. and Jack). Geol. and Pal. Queensland, p. 246, pl. xii., figs. 1-6.

The only specimen in our collection from Daintree is a cast in limonite of the interior of a portion of the dorsal and ventral valves. The surface of the cast clearly shows the punctation of the shell, as innumerable tiny tubercles.

Locality and Horizon.—Irwin River District, Western Australia. Carbo-permian. [2111.].

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1 Geol. Mag., vol. vii. (1890), p. 104.

Strophalosia clarkei, Etheridge, sp.

Productus clarkei, Etheridge, 1872. Quart. Journ. Geol. Soc., vol. xxviii., p. 334, pl xvii., figs, 2, 2*a*, *b*; pl. xviii., figs. 4, 4*a*.

Strophalosia clarkei (Eth.), Etheridge Jun., 1892. (In Eth. and Jack). Geol. and Pal., Queensland, p. 258, pl. xiii., figs. 12-17; pl. xiv., fig. 19.

A dorsal and a ventral valve occur separately in the present collection. Foord[1] records this shell from the Kimberley District, Western Australia.

Locality and Horizon.—Irwin River District, Western Australia. Carbo-permian. [2163-4.].

Productus undatus, Defrance.

Productus undatus, Defrance, 1826. Dict. Sci. Nat., vol. xliii., p. 354.

Foord, 1890. Geol. Mag., vol. vii., p. 152, pl. vii., fig. 6.

This species has already been recorded from the Irwin River District by Foord. We have two specimens which, although internal moulds of the shell, show the bases of the spines, and the undulating wrinkles of the shell itself.

Locality and Horizon.—Irwin River District, Western Australia. Carbo-permian. [1385-6].

Productus cora, d'Orbigny.

Productus cora, d'Orbigny, 1842. Voy. Amérique mérid., vol. iii., pts. 3 and 4, p. 55, pl. v., figs. 8–9.

P. cora, d'Orb., Etheridge, Jun., 1892 (in Eth. and Jack). Geol. and Pal., Queensland, p. 248; pl. xii., fig. 14; pl. xiii., fig. 1; pl. xxxviii., fig. 11.

The examples in the present series are chiefly contained in a large block of limonitic sandstone. One of the valves measures 5 cm. in width, and a little over 4 cm. in length; whilst another imperfect specimen must have measured when complete between 6 and 7 cm. in width.

These specimens are denuded of spines, but traces of them are seen in the surrounding matrix. Some of the valves show the

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1 Geol. Mag., vol. vii., 1890, p. 103.

wrinklings at the cardinal angles, and faint concentric folds on the surface of the shell.

Locality and Horizon.—(?) Bowen River Coal Field, Queensland. Carbo-permian. Coll. and presented by R. Daintree, Esq. [2112-3].

Spirifer convolutus, Phillip, sp.

Spirifera convoluta, Phillips, 1836. Illustr. Geol., Yorkshire, vol. ii., p. 217, pl. ix., fig. 7.

This species has been previously recorded from beds of similar age on the Gascoyne River.

A specimen of this shell in a brown sandstone matrix occurs in the present collection.

Locality and Horizon.—(?) Bowen River Coal Field, Queensland. Carbo-permian. Coll. and presented by R. Daintree, Esq. [2166].

Spirifer (Martiniopsis) subradiatus, Sow.

Spirifera subradiata, Sowerby, 1844, in Darwin's Geol. Observations Volc. Ids., p. 159.

One specimen of the above, of a transversely oval form, occurs in our series, presented and collected by Daintree.

Locality and Horizon.—(?) Bowen River Coal-field, Queensland. Carbo-permian. [2114].

Pelecypoda.

Sanguinolites (*cf.*) hibernicus, Hind.

Sanguinolites hibernicus, Wheelton Hind, 1900. Pal. Soc. Mon. —Brit. Carb. Lamell., pt. v., p. 375, pl. xli. figs. 1-4.

A cast of an ovate elongate shell with prominent umbones occurs in this series, and seems closely allied to the above species. The concentric sulcate ornament on the shell-surface is fairly regular. The cast is haematitic in composition.

Locality and Horizon. — Irwin River District, Western Australia. Carbo-Permian. [2118].

Allorisma (*cf.*) maxima, Portlock, sp.

Sanguinolaria maxima, Portlock, 1843. Rep. Geol. Londonderry, p. 434, pl. xxxvi., figs. 1*a*, *b*.

Allorisma maxima (Portlock), Hind, 1890. Pal. Soc. Mon.— Brit. Carb. Lamell., pt. v., p. 419, pl. xlvii., figs. 5-7*a*.

Our specimen is a cast of a left valve and part of the right, preserved in a limonitic sandy matrix. The surface of the cast next the shell is smooth and shows the sulcate ornament very clearly. The valve is somewhat straight on the ventral edge, gibbous in front of the beaks, and compressed behind. It compares very closely with the above species.

Locality and Horizon.—Irwin River District, Western Australia. Carbo-permian. [2165].

Allorisma curvatum, Morris.

Allorisma curvatum, Morris, 1845 (in Strzelecki's Phys. Descr. N.S.W. and Van Dieman's Land), p. 170, pl. x., fig. 1.

A large specimen, which must have measured 16 cm. in length when complete, occurs in the present series. It is an internal cast of the two valves, which had been slightly displaced before the infilling of the interior.

Locality and Horizon.—Irwin River District, Western Australia. Carbo-permian. [1387].

CEPHALOPODA.

Goniatites micromphalus, Morris, sp.

Bellerophon micromphalus, Morris (in Strzelecki's Phys. Descr. N.S.W., p. 288, pl. xviii., fig. 7).

Goniatites micromphalus (Morris), de Koninck, 1877. Recherches sur les Fossiles Paléozoiques de la Nouvelles-Galles du Sud (Australie), p. 339, pl. xxiv., fig. 5.

Foord, 1890. Geol. Mag., vol. vii., p. 104, pl. v., figs. 10–10*a*.

Etheridge, Jun., 1892 (in Etheridge and Jack). Geol. and Pal., Queensland, p. 294.

Goniatites (Prolecanites?) micromphalus (Morris), Etheridge, Jun., 1894. Rec. Geol. Surv. N.S.W., vol. iv., pt. 1, p. 36, pl. vii., figs. 9–14.

This form has already been recorded from Western Australia, from Liverynga, Kimberley District, by Foord.[1]

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1 *Loc. supra cit.*, p. 104.

A neat cast in limonitic limestone occurs in the present series.

Locality and Horizon.—Irwin River District, Western Australia. Carbo-permian. [1383.].

Fossils from the Jurassic of the Greenough River District, Western Australia.

Collected for the Hon. Sir A. C. Gregory, and Presented by the Late R. Daintree, Esq.[1]

Mollusca–Pelecypoda.

Cucullaea, Lamarck.

Cucullaea semistriata, Moore.

Cucullaea semistriata, Moore, 1870. Quart. Journ. Geol. Soc., vol. xxvi., p. 250, pl. xiv., fig. 3.

This species was originally recorded by Moore from the Greenough River district, and it appears to be restricted, so far as recorded, to this part of Western Australia. Mr. Etheridge, Jun., mentions a fossil comparable with this species, and from the above locality, in the Paxton collection of Western Australian fossils in the Department of Mines at Sydney.[2] It also occurs in the Gabriel collection from Geraldton, along with at least two other species of the genus.

In the present series there are portions of two left valves, one being fairly complete. The matrix from this and another shell (Trigonia) yielded numerous species of microzoa.[3]

Locality and Horizon.—Greenough River District, Western Australia. Jurassic. [2060-1.].

Trigonia, Bruguière.

Trigonia moorei, Lycett.

Trigonia moorei, Lycett, 1870 (in Moore's paper). Quart. Journ. Geol. Soc., vol. xxvi., p. 254, pl. xiv., figs. 9, 10.

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1 Besides the following series, I have described 7 spp. and vars. of Ostracoda, and 23 spp. and vars. of Foraminifera, from material out of the same collection. See antea, p. 185.

2 Ann. Rep. Dept. Mines, Sydney, for 1889 (1890), p. 239, Appendix No. 5c.

3 These form the subject of a separate paper.

This species, which was originally recorded from Western Australia, is represented by three specimens in the present collection. Two of these are rather young valves, the third is an adult form with the concentric ridges less prominent and, perhaps, partly worn down.

As an additional instance of the affinity of the Indian with the Australian Jurassic fossils, attention is drawn to the remarks by Dr. F. L. Kitchen respecting Trigonia dhosaensis. Referring to the relatively coarse, raised ornaments on the marginal carina, corresponding in number to the ribs of the flank, he says :—"It is a noteworthy fact that this feature is well developed also in T. moorei, Lycett, from Western Australia, to which T. dhosaensis shows other such striking points of resemblance as to suggest near affinity."[1]

Locality and Horizon.—Greenough River District, Western Australia. Jurassic. [2064-6.].

Pecten, O. F. Müller.

Pecten cinctus, Sowerby.

Pecten cinctus, Sowerby, 1823. Min. Conch., vol. iv., p. 96, pl. 371.

Moore, 1870. Quart. Journ. Geol. Soc., vol. xxvi., pp. 231, 232.

This is one of the fossils recorded by Chas. Moore, of Bath, England, from Western Australia, and which is well-known as an English Inferior Oolite fossil.

The solitary specimen of P. cinctus, in the Daintree and Gregory collection from the Greenough River District, is imperfect. Quite lately, however, the collection of Western Australian fossils in the Museum has been enriched by the donation of a series of Jurassic fossils from Geraldton, by Chas. Gabriel, Esq., which includes four specimens of this particular shell, thus enabling one to make a more satisfactory comparison of the Australian with the British examples.

When complete, the specimen from the Daintree and Gregory collection must have been about 16cm. in width ; one example in the Gabriel collection measures even slightly more than that.

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1 Mem. Geol. Surv. India (Pal. Indica), ser. ix., vol. 3. pt. 2, No. 1, 1903, p. 113. For detailed comparison of the two species above-mentioned, see p. 31.

P. cinctus is recognized by the nearly circular outline, with fairly small, sub-equal auricles. The surface of the valves is broken up by thin, concentric laminae, more or less erect, and the shell is ornamented with fine, closely-set, radial striae. Auricles strongly marked with closely-set ridges, slightly flexuose. Right valve a little more convex than the left.

The outer layer of the shell has in some cases been almost entirely removed, and the intermediate layer shows weathered out on its surface a plexus of ramifying tunnels, now infilled with matrix ; they are most probably the work of a parasitic boring organism (?fungus), but coarser than either Duncan's Palaeachlya or Bornet and Flahault's Ostracoblabe. The average diameter of these tubes is about 0.4 mm. Besides this, there also occurs in one of the shells a much coarser kind of perforation, which does not confine itself to one layer of the shell but passes through at all angles, and its character makes it presumably referable to a boring sponge of the family Clionidae. Neither of these borings yield any residual structure which would assist in their identification.

Locality and Horizon.—Greenough River District, Western Australia. Jurassic. [2062].

Ctenostreon, Eichwald.

Ctenostreon pectiniformis, Schlotheim, sp.

(Pl. XXX., Fig 1).

Ostracites pectiniformis, Schlotheim, 1820. Petrefactenkunde, i., p. 231.

Lima proboscidea, Sow., 1821. Min. Conch. Gt. Brit., vol. iii., p. 115, pl. cclxiv.

Moore, 1870. Quart. Journ. Geol. Soc., vol. xxvi., pp. 231, 232.

Ctenostreon pectiniformis (Schloth.), Etheridge, Jun., 1901. Records Austr. Mus., vol. iv., No. 1, p. 14.

There is a left valve representing the above species in the Daintree and Gregory collection, which at first sight seemed to present almost specific differences from the specimens already figured by the above-named authors, and others mentioned in

Mr. Etheridge, Jun's. more copious synonymy in the Records of the Australian Museum.

The points of difference in our specimen consist in the greater length of the cardinal line as compared with typical British specimens[1]; in the strong and well-developed auricle at the anterior end of the hinge-line; and the sharper ridges, with pronounced tubular spines, formed by the intersection of costae with lamellae, especially towards the ventral margin. By Mr. Gabriel's donation I am enabled to compare the specimen now figured with similar fossils from Geraldton, which leads one to conclude that it is only an extreme variety of C. pectiniformis. The specimens in the Gabriel collection also show the variation in shell-sculpture in this species, due to the condition of the shell in relation to its preservation or decortication, the better preserved specimens usually having sharply ridged costæ.

Locality and Horizon.—Greenough River District, Western Australia. Jurassic. [2063].

Astarte cliftoni, Moore.

Astarte cliftoni, Moore, 1870. Quart. Journ. Geol. Soc., vol. xxvi., p. 249, pl. xiii., fig. 10.

A perfect specimen with united valves occurs in our series. Moore records it from the same locality.

Locality and Horizon.—Greenough River District. Western Australia. Jurassic. [2067.].

CEPHALOPODA–AMMONOIDEA.

Normannites, Munier Chalmas.

Normannites australe, Crick sp.

Ammonites macrocephalus, Moore (non Schlotheim), 1870. Quart. Journ. Geol. Soc., vol. xxvi., pp. 227–232, pl. xv., fig. 5.

Ammonites (Stephanoceras) australe, Crick, 1894. Geol. Mag., Dec. iv., vol. 1, p. 391, pl. xii., figs. 4*a*–4*b*.

Our specimen is fairly well preserved, but incomplete towards the extremity of the last whorl, and having the umbilicus filled

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1 Exemplified in the Wright collection of Oolite fossils in the National Museum.

with a tenacious matrix. The suture lines are obscure. The present specimen is smaller than that described by Crick, having a diameter of 45 mm., and with the width measurement of the last whorl of 19 mm.

This species was recorded by Crick from the same locality as ours, and, as that author remarks,[1] it is evidently allied to Ammonites braikenridgii, Sowerby, and which, according to Munier Chalmas, is the type form of the genus Normannites. Moore's specimen evidently came from the same district as the above.

Locality and Horizon.—Greenough River District, Western Australia. Jurassic. [2068.].

Perisphinctes, Waagen.

Perisphinctes championensis, Crick.

(Plate XXX., Fig. 2).

Ammonites (Perisphinctes) championensis, Crick, 1894. Geol. Mag., Dec. iv., vol. i., p. 436, pl. xiii., figs. 2*a-c*.

The specimen figured by Crick is precisely similar to the present example in its essential characters, so far as the preservation of the latter enables one to see. The inner whorls are obscured by a tenacious matrix.

The dimensions of the present specimen are somewhat greater than those given by Crick, and are as follows :—

Diameter of shell	... ...	135 mm.
Width of umbilicus, about	...	45 mm.
Height of outer whorl ...	...	60 mm.
Thickness of outer whorl	...	46 mm.

An extremely interesting feature is exhibited in this specimen in the occurrence of the aptychus, lying towards the extremity of the last whorl of the shell and close against the ventral surface of the living chamber. It was revealed by the fracture and removal of one side of the outer whorl of the ammonite shell. One valve of the aptychus is nearly complete, with a portion of the adjoining plate; the apparent line of junction of the two halves in this instance is, however, misleading, as they are the

1 *Loc. cit.*, p. 392.

outer borders of the two valves, brought into approximation by pressure. The plates of this aptychus are rather thin, a usual character in those known to occur in the Perisphinctidae. In this example the aptychus has almost entirely lost the outer granular layer—all but one small patch lying near to the fractured shell of the ammonite. That which is probably the outer surface of the intermediate layer of the aptychus is smooth, sparsely and finely punctate, and the surface is traversed by curved, distant, slightly depressed folds or imbrications (in places). The granulate condition of the outer layer corresponds with Zittel's group, the Granulosi, to which the Perisphinctidae seem to belong.

Locality and Horizon.—Greenough River District, Western Australia. Jurassic. [2069.]

Species Recorded in the Foregoing Paper.

The asterisk denotes its occurrence for the first time from that locality.

Lepidodendron australe, McCoy. Carboniferous; Drummond Range, Q.

*Phyllotheca australis, Brongn. Carbo-permian; Baron R., Q.

*Archaeocalamites scrobiculatus (Schloth). Carbo-permian; Baron R., Q.

*Glossopteris browniana, Brongn. Carbo-permian; Baron R., Q.

*Glossopteris ampla, Dana. Carbo-permian; Baron R., Q.

*Glossopteris parallela, Feistmantel. Carbo-permian; Baron R., Q.

*Araucarioxylon daintreei, sp. nov. Carbo-permian; Baron R., Q.

*Stenopora leichhardti, Nich. and Eth., Fil. Carbo-permian; Irwin R. District, W.A.

Crinoid stems. Carbo-permian; Irwin R. District, W.A.

*Derbyia (*cf.*) senilis (Phillips). Carbo-permian; Irwin R. District, W.A.

*Strophalosia clarkei (Etheridge). Carbo-permian; Irwin R. District, W.A.

Productus undatus, Defrance. Carbo-permian; Irwin R. District, W.A,

Productus cora, d'Orbigny. Carbo-permian; (?) Bowen R. Coal Field, Q.

*Spirifer convolutus (Phillips). Carbo-permian; Irwin R. District, W.A.

*Spirifer (Martiniopsis) subradiatus, Sow. Carbo-permian; (?) Bowen R. Coal Field, Q.

*Sanguinolites (*cf.*) hibernicus, Hind. Carbo-permian; Irwin R. District, W.A.

*Allorisma (*cf.*) maxima (Portlock). Carbo-permian; Irwin R. District, W.A.

*Allorisma curvatum, Morris. Carbo-permian; Irwin R. District, W.A.

*Goniatites micromphalus (Morris). Carbo-permian; Irwin R. District, W.A.

Cucullaea semistriata, Moore. Jurassic; Greenough R. District, W.A.

Trigonia moorei, Lycett. Jurassic; Greenough R. District, W.A.

Pecten cinctus, Sow. Jurassic; Greenough R. District, W.A.

Ctenostreon pectiniformis (Schlotheim). Jurassic; Greenough R. District, W.A.

Astarte cliftoni, Moore. Jurassic; Greenough R. District, W.A.

Normannites australe (Crick). Jurassic; Greenough R. District, W.A.

Perisphinctes championensis, Crick. Jurassic; Greenough R. District, W.A.

EXPLANATION OF PLATES.

Plate XXVII.

Fig. 1.—Lepidodendron australe, McCoy. Leaf cushions and vascular impressions. Carboniferous; Wynn Creek, Queensland. [1335]. × 3.

2.—Portion of the lower surface of leaf of Lepidodendron australe, with prominent mid-rib. Carboniferous; Drummond Range, Queensland. [2161]. Nat. size.

3.—A (?) sporophyll of Lepidodendron fruit (Lepidostrobus), associated with L. australe. Carboniferous; Drummond Range, Queensland. [2161]. × 3.

4.—Portions of four leaf-cushions on stem of Lepidodendron australe, showing at the extreme top of the lower cushion a trace of the (?) ligule. The sub-epidermal surface with parenchymatous tissue. Carboniferous; Drummond Range, Queensland. [1376]. × 6.

5.—Portion of a stem of Lepidodendron australe, evidently from near the end of a terminal branchlet, showing fundamental parenchymatous tissue, traversed by strengthening plates of sclerenchyma. Carboniferous; Drummond Range, Queensland. [1376]. × 6.

6.—An imbricated (?) terminal bud, possibly belonging to Phyllotheca australis, or to Archaeocalamites scrobiculatus. Carbo-permian; Baron River, Queensland. [2167]. × 2.

7.—Strobilus of Phyllotheca australis, attached to a whorled leaf-sheaf. Carbo-permian; Baron River, Queensland. [1381]. × 4.

8.—Part of stem of Archaeocalamites scrobiculatus. Carbo-permian; Baron River, Queensland. [1381]. Nat. size.

9.—Portion of the nodal area of Archaeocalamites scrobiculatus, with leaf scars. Carbo-permian; Baron River, Queensland. [1381]. × 4.

Plate XXVIII.

Fig. 1.—Araucarioxylon daintreei, sp. nov. Stem transversely fractured, showing growth rings of the xylem extending close to the centre. [2235]. Nat. size.

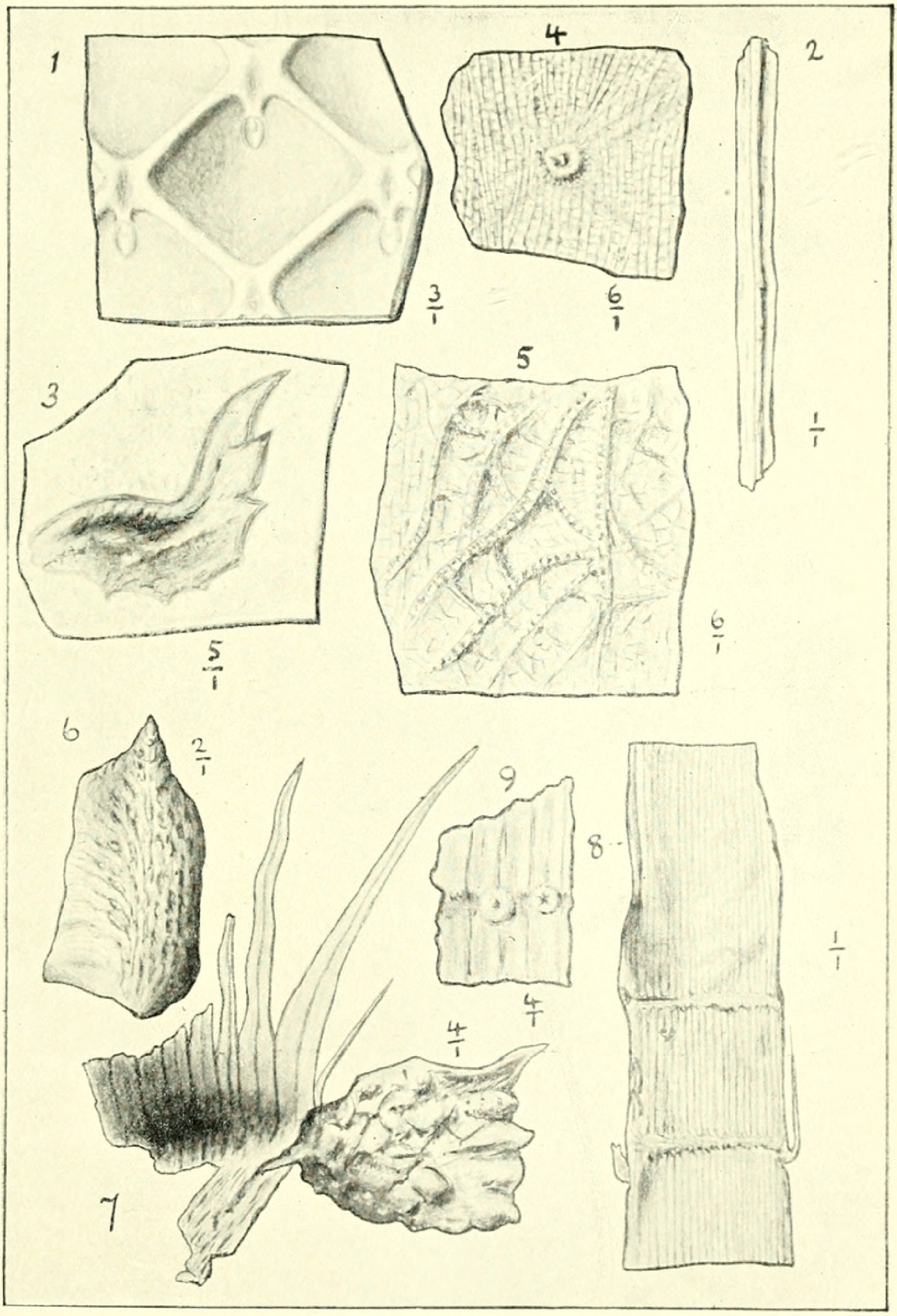
2.—A. daintreei, sp. nov. Transverse section of wood. × 180.

3.—A. daintreei, sp. nov. Radial section of wood, showing pitted tracheides. × 180.

Plate XXIX.

Fig. 1.—Araucarioxylon daintreei, sp. nov. Radial section of wood. × 180.

2.—A. daintreei, sp. nov. Tangential section of wood. × 180.



F.C. *delt.*

West Australian and Queensland Fossils.