

XVII.—*On the Fossil Flora of the Radstock Series of the Somerset and Bristol Coal Field (Upper Coal Measures). Part I.* By ROBERT KIDSTON, F.R.S.E., F.G.S. (Plates XVIII.—XXVIII.)

(Read April 4, 1887.)

My attention for the last few years having been specially directed to the vertical distribution of the Carboniferous Fossil Flora, it is my intention to publish a series of papers dealing with this subject.

While carrying on these investigations it has been necessary, in addition to visiting public and private collections, to visit several of the coal fields for the purpose of collecting specimens, as in almost no case have the smaller and less attractive species been secured, and, as a rule, only what strikes the ordinary collector as being "a fine specimen" is preserved, to the exclusion of many less striking but often more valuable examples. Hence our public collections, and, with few exceptions, also our private collections, give a very imperfect idea of the richness of the flora of the Carboniferous Formation of Britain.

For the last four years I have annually paid a visit to the Radstock portion of the Somerset and Bristol Coal Field, with the object of collecting and examining the fossil flora of this area, from which were obtained several of the species described by BRONGNIART, and which is probably richer in fossil plants than any other coal field in Britain,—not only in the number of species it contains, but also in their excellent state of preservation.

A most important point in an investigation of this nature is to have the position of the beds from which the specimens have been derived accurately determined. In regard to the Radstock series of the Somerset and Bristol Coal Field, this qualification is amply fulfilled, making this area peculiarly suitable as a starting point for investigations in the vertical distribution of the British Carboniferous flora.

The geology of the Somerset and Bristol Coal Field, and especially the geology of the Radstock portion, has been fully worked out by several geologists, but it may not be out of place to introduce here a short geological sketch of this district, especially referring to the Radstock Series, from which all the specimens mentioned in the following list have been collected.

The Somerset and Bristol Coal Field extends from Cromhall in Gloucestershire to Frome in Somerset, and from Bath in the east to Nailsea and Clevedon on the west.

Its extreme length from north to south is 26 miles, and its width, from east to west (if the outlying Nailsea basin be included), is 24 miles. If the Nailsea basin be excluded, its width from Bath in the east to Bristol in the west is reduced to 12 miles.

The Coal Measures are mostly covered by Secondary rocks, Jurassic and Triassic, which are unconformable to the underlying Palæozoic strata.

The Carboniferous Formation lies in a trough surrounded at intervals on the north, west, and south by the Old Red Sandstone.

The general geological structure of this coal field will be most easily understood by referring to Plate XVIII., which gives a reduced sketch of a section prepared by Mr J. M'MURTRIE, F.G.S., for the Royal Coal Commission in 1868.

This section shows the Secondary Formations lying unconformably on the upturned edges of the Palæozoic rocks. The centre of the basin is occupied by the Upper Division of the Coal Measures (Nos. in section 1, 2, 3). This rests on the Pennant Rock (No. 4), immediately beneath which is the Lower Division of the Coal Measures (5 and 6). Succeeding this is the Millstone Grit (7) and Carboniferous Limestone (8), which latter rests on the Old Red Sandstone (9).

It is necessary, however, to study in somewhat fuller detail the various *horizons* of the Coal Measures,—that is, all the Carboniferous rocks above the Millstone Grit. These, as already mentioned, resolve themselves into three great divisions, the *Upper* and *Lower Divisions* of the Upper Coal Measures, and the *Pennant Rock*.

The Upper Division of the Coal Measures, attaining a thickness of about 2200 feet, is separated into the *Upper* or *Radstock Series* (1), and the *Lower* or *Farrington Series* (3), between which are interposed a characteristic series of Red Shales (2).

The *Upper Division* (including the *Radstock* and *Farrington Series*) is separated from the *Lower Division* by the *Pennant Rock* (4), which attains a probable thickness of from 2500 to 3000 feet.

The *Lower Division*, of a thickness of about 2800 feet, is also divisible into two series, the upper of which is named the *New Rock Series*, and the lower the *Vobster Series*.

These two series are not so clearly separable from each other as those of the Upper Division are by the intervention of the Red Shales, being separated rather on account of the character of the veins and the nature of the strata than by the occurrence between them of any unproductive characteristic stratum of rock.

This coal field is traversed by many *faults*, some of which, especially the

Radstock great overlap fault, are well worthy of detailed study, but they do not fall in with the scope and object of these remarks.

Having now taken a general survey of the ground, let us return again to the *Upper Division* of the Coal Measures, which embraces the *Radstock* and *Farrington Series*.

The *Radstock* and *Farrington Series* occupy a basin, extending from Brislington in the north to Kilmersdon in the south, and form an oval tract whose length from north to south is about 12 miles, and whose width from east to west is about 5 miles.

There is another and smaller basin referable to the *Radstock* and *Farrington Series*, more particularly to the latter, which extends northwards from Pucklechurch for about 4 miles, with a width of about 2 miles.

From this portion I have not collected, nor have I seen many specimens from it, but this is most probably due to deficient collecting, and not to the absence of specimens.

I may mention here that the *Radstock* and *Farrington Series*, when viewed in their relation to the other coal fields of Great Britain, belong to their uppermost portion, and are the true *Upper Coal Measures*, altogether independently of their *local* position.

The coal of the *Upper* or *Radstock Series* is chiefly worked in the neighbourhood of Radstock, Writhlington, Midsomer-Norton, Camerton, Timsbury, and Paulton, and it is from the pits in the neighbourhood of these villages that most of the fossils referred to in this paper have been derived.

The *Radstock* or *Upper Series* of the *Upper Division* contains eight veins, viz.:—

The Withy Mills Seam,	1 ft. 4 in.
Great Vein,	2 „ 2 „
Top Little Vein,	1 „ 4 „
Middle Vein,	2 „ 2 „
Slyving Vein,	2 „ 4 „
Under Little Vein,	1 „ 2 „
Bull Vein,	2 „ 2 „
Nine-inch Vein,	1 „
Total,	13 ft. 8 in.

The total thickness of these veins is considerable, but in no case is the whole of it available at any one place.

In the majority of cases I have found it impossible to note the vein from which the various fossils came, but the whole of the *Radstock Series* are so intimately connected that the knowledge of the actual veins from which the fossils originate appears to be of little importance in the present instance.

The pits at which I have collected most are:—Braysdown Colliery, near

Radstock; this is one of the few collieries from which are worked the coals of both the *Radstock* and *Farrington Series*. Tynning and Ludlows Pits, Radstock, which are here treated as one, as they are connected and the débris of both is brought to the same rubbish tip near the Tynning Pit; in the localities given for the species, Tynning and Ludlows Pits are recorded as "Radstock." Middle Pit and Wellsway Pit, Radstock; Kilmersdon Pit and Lower Writhlington Pit, near Radstock; the Camerton Pits; and the Upper and Lower Conygre Pits, Timsbury.

The veins belonging to the *Radstock Series* worked at these collieries are:—

Braysdown Pit, . . .	{	Great Vein, Top Little Vein, Middle Vein, Slyving Vein, Under Little Vein, and Bull Vein.
Ludlows and Tynning Pits, . . .		Do.
Middle Pit, . . .		Do.
Wellsway Pit, . . .		Do.
Kilmersdon Pit, . . .		Do.
Lower Writhlington Pit, .		Do.
Camerton Pits, . . .	{	Great Vein, Top Little Vein, Middle Vein, Slyving Vein, and Under Little Vein.
Upper Conygre Pit, . . .		Do.
Lower Conygre Pit, . . .		Do.

In addition to my own collecting, I have examined the specimens from the Radstock coal field in the Bath and Bristol Museums, and am indebted to the Rev. H. H. WINWOOD, F.G.S., for the use of specimens contained in the collection of the former, and to the Council of the Bristol Museum for a similar privilege; and I am further under obligation to Mr E. WILSON, Curator of the Bristol Museum, for giving every facility for examining the specimens under his charge.

I have also examined specimens from this coal field in the British Museum; University Museum, Oxford; Museum of the Geological Society of London; as well as some specimens from the same district in the Collection of the Geological Survey of England, in their Museum, Jermyn Street, London.

I am, however, principally indebted to Mr J. M'MURTRIE, F.G.S., Radstock, for kindly placing at my disposal, for the purpose of examination and description, his fine collection of fossil plants from the Radstock Series. I am also further indebted to him for much information as to the geology of the neighbourhood, and from his various papers on the Geology of the Somerset and Bristol Coal Field the short geological sketch just given has been compiled.*

* Those wishing fuller information on the geology of the Somerset and Bristol Coal Field will find it contained in the following papers and works:—Rev. Prof. W. BUCKLAND and Rev. W. D. CONY-

SYNOPSIS OF SPECIES.

FUNGI.

Excipulites, Göppert, 1836, *Die fossilen Farrnkrauter*, p. 262.

Excipulites callipteridis, Schimper, sp.

Excipula callipteridis, Schimper, *Traité d. paléont. végét.*, vol. i. p. 142, and Explanation to pl. xxxii. figs. 6, 7.

Excipula callipteridis, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 19.

Remarks.—On *Sphenopteris neuropteroides*. The minute fossils included here appear to be similar to those described by SCHIMPER and WEISS as occurring on *Callipteris conferta*, Brongt. The central opening is not very well seen in our examples, which are situated on the limb of the pinnules between the veins.

It is interesting to find that both LESQUEREUX (*Coal Flora of Pennsylv.*, vol. i. p. 207, pl. xxxviii. fig. 2; *P. anceps* = *Sphen. neuropteroides*) and ZEILLER (*Bull. soc. géol. de France*, 3^e sér., vol. xii. p. 192) have noted the occurrence of these small fossils on the pinnules of *Sphen. neuropteroides*.

There seems little reason to doubt that *Excipulites* comprises a group of minute parasitic fungi.

Locality:—Radstock.

BEARE, "Observations on the South-Western Coal District of England," *Trans. Geol. Soc.*, ser. 2, vol. i. p. 210; G. C. GREENWELL, "Notes on the Coal Field of East Somerset," *Trans. N. of Eng. Inst. of Mining Eng.*, vol. ii. p. 258; G. C. GREENWELL, "On the Southern Portion of the Somerset Coal Fields," *Trans. S. Wales Inst. of Eng.*, vol. i. p. 147; H. COSSHAM, "On the Northern End of the Bristol Coal Field," *Trans. N. of Eng. Inst. of Mining Eng.*, vol. x. p. 97; G. C. GREENWELL, "On the Somersetshire Sections of the Bristol Coal Field," *Trans. N. of Eng. Inst. Mining Eng.*, vol. x. p. 104; G. C. GREENWELL and J. M'MURTRIE, *The Radstock Portion of the Somerset Coal Field*, 1864, 8vo, Newcastle-on-Tyne; R. ETHERIDGE, "On the Physical Structure of the Northern Part of the Bristol Coal Basin," *Proc. Cottsw. Nat. Field Club*, vol. iv. p. 28; C. MOORE, "On Abnormal Conditions of Secondary Deposits where connected with the Somersetshire and South Wales Coal Basin, &c.," *Quart. Journ. Geol. Soc.*, vol. xxxiii. p. 449; J. M'MURTRIE, "On the Carboniferous Strata of Somersetshire," *Proc. Bath Nat. Hist. and Antiq. Field Club*, vol. i. No. 2, p. 45; J. M'MURTRIE, "The Faults and Contortions of the Somersetshire Coal Field," *ibid.*, vol. i. No. 3, p. 127; *Report of the Commissioners appointed to inquire into the several matters relating to Coal in the United Kingdom*, vol. i., 1871; JOHN ANSTIE, *The Coal Fields of Gloucestershire and Somersetshire and their Resources*, 8vo, London, 1873; J. M'MURTRIE, "The Geographical Position of the Carboniferous Formation in Somersetshire, &c.," *Proc. Bath Nat. Hist. and Antiq. Field Club*, vol. ii. p. 454; J. M'MURTRIE, "Notes on the Physical Geology of the Carboniferous Strata of Somersetshire and associated Formations," *Somerset Arch. and Nat. Hist. Soc.*, 1875; J. M'MURTRIE, "The Somersetshire Coal Fields, and the Method of working thin Seams in the Radstock District," *Proc. S. Wales Inst. of Eng.*, vol. xii. No. 5, p. 424; H. B. WOODWARD, *Memoirs of the Geological Survey, Geology of East Somerset and the Bristol Coal Fields*, 1876.

EQUISETACEÆ.

Calamites, Suckow, 1784, *Act. Acad. Theod. Palat.*, vol. v. p. 359.

Group I. **Calamitina** (emend.), Weiss, 1884, *Steinkohlen-Calamarien*, part ii. p. 59.*

Calamitina (**Calamites**) **varians**, var. **insignis**, Weiss.

Cal. (Calamites) varians, var. *insignis*, Weiss, *Steinkohlen-Calamarien*, part ii. p. 63, pl. i.; pl. xxviii. fig. 1.

Calamites varians, Germar, *Vers. v. Wettin u. Löbejun*, p. 49, pl. xx. figs. 1–3.

Remarks.—Rare.

Locality :—Camerton.

Group II.—**Eucalamites**, Weiss, 1884, *Steinkohlen-Calamarien*, part ii. p. 96.

Eucalamites (**Calamites**) (**cruciatus**) **senarius**, Weiss.

Calamites (cruciatus) senarius, Weiss, *Steinkohlen-Calamarien*, part ii. p. 114, pl. xiii. fig. 2.

Calamites approximatus, L. & H., *Fossil Flora*, vol. iii. pl. ccxvi.

Remarks.—The University Museum of Oxford possesses a fine specimen of this species from Camerton, which is the original of pl. ccxvi. of LINDLEY and HUTTON's *Fossil Flora*. In the description of their plate (which is a reduced figure of the fossil), the authors say—"It agrees in a striking manner with the figures of ARTIS and ADOLPHE BRONGNIART, with the addition of a number of pits placed on the articulations, in a quincuncial manner, as in *Calamites cruciatus*. Hence it is probable that the latter proposed species will require to be reduced to *C. approximatus*."

The specimen referred to in the above quotation, and figured by the authors of the *Fossil Flora* on their plate ccxvi., belongs, however, to an entirely different group of *Calamites* from that in which *C. approximatus* is now placed.

In *Eucalamites*, which includes the Camerton plant, every node bears branches. In *Calamitina*, on the other hand, in which *C. approximatus*, Brongt., is enrolled, the branch-bearing nodes are separated by a greater or less number of nodes that do not produce branches.

The Camerton specimen of *Calamites (Eucalamites) senarius*, which is a compressed stem removed from the matrix, measures about 15 inches in length and about $3\frac{3}{4}$ inches in width at its lower extremity. It consists of sixteen perfect internodes and portions of two incomplete ones—one at each end of the fossil. On the circumference of each node are borne six branch scars. The internodes decrease slightly in length from below up, but in a somewhat irregular manner. Their exact measurement is—

* *Abhandl. z. geol. special-karte v. Preussen u. Thüringischen Staaten*, Band v. part ii.

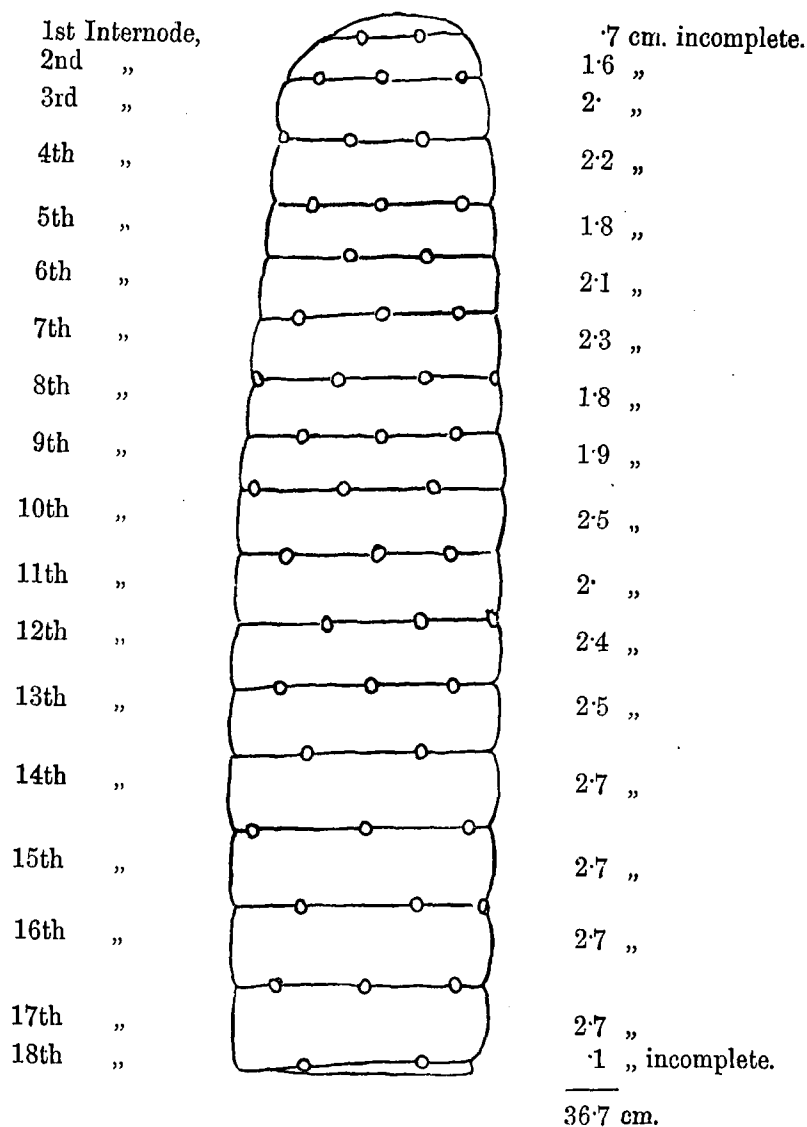


Fig 1. *Eucalamites cruciatus senarius*, Weiss ; Camerton ($\frac{2}{3}$ nat. size).

Locality :—Camerton.

Eucalamites (*Calamites*) *ramosus*, Artis.

Calamites ramosus, Artis, *Antedil. Phyt.*, pl. ii.

Calamites ramosus, Brongt., *Hist. d. végét. foss.*, p. 127, pl. xvii. figs. 5 6.

Calamites ramosus, Zeiller, *Végét. foss. du terr. houil.*, p. 15.

Cal. (Eucalamites) ramosus, Weiss, *Steinkohlen-Calamarien*, part ii. p. 98, pls. ii. fig. 3 ; v. figs. 1-2 ; vi. ; vii. figs. 1-2 ; viii. figs. 1, 2, 4 ; ix. figs. 1, 2 ; x. fig. 1 ; xx. figs. 1, 2.

Calamites nodosus, L. & H., *Foss. Flora*, vol. i. pls. xv., xvi.

Calamites nodosus, Lebour, *Illustrations of Foss. Plants*, p. 3, pl. ii. ; p. 7, pl. iii.

Calamites carinatus, Sternb., *Vers.*, i. fasc. 3, pp. 36 and 39, pl. xxxii. fig. 1 ; fasc. iv. p. xxvii.

As foliage :—

Annularia radiata, Brongt., *Prodrome*, p. 156.

Annularia radiata, Zeiller, *Végét. foss. du terr. houil.*, p. 24, pl. clx. fig. 1.

Asterophyllites radiatus, Brongt., *Class d. végét. foss.*, p. 35, pl. ii. fig. 7.

Asterophyllites foliosus, L. & H., *Foss. Flora*, vol. i. pl. xxv. fig. 1.

Asterophyllites foliosus, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 10, pl. xvi. figs. 1–3 (fig. 4 ?) (excl. pl. xv.).

Remarks.—Rare.

Locality.—Radstock.

Group III.—**Stylocalamites**, Weiss, 1884, *Steinkohlen-Calamarien*, part ii. p. 119.

Stylocalamites (Calamites) Suckowii, Brongt.

Calamites Suckowii, Brongt., *Hist. d. végét. foss.*, p. 124, pl. xiv. fig. 6 ; pl. xv. figs. 1–6 ; pl. xvi. figs. 2, 3, 4 (1 ?).

Calamites Suckowii, Feistmantel, *Vers. d. böhm. Kohlenab.*, p. 102, pl. ii. figs. 3, 4 ; pl. iii. figs. 1, 2 ; pl. iv. figs. 1, 2, pl. v. ; pl. vi. fig. 1 (excl. as fruit *H. carinata*).

Calamites Suckowii, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 6, pl. xiii. figs. 1–6.

Calamites Suckowii, Roehl, *Foss. Flora d. Steink. Form. Westph.*, p. 9, pl. i. fig. 6 ; pl. ii. fig. 2.

Calamites Suckowii, Weiss, *Steinkohlen-Calamarien*, part i. p. 123, pl. xix. fig. 1 (1876) ; part ii. p. 129, pl. ii. fig. 1 ; pl. iii. figs. 2, 3 ; pl. iv. fig. 1 ; pl. xxvii. fig. 3 (1884).

Calamites Suckowii, Kidston, *Catal. Palæoz. Plants*, p. 24.

Calamites decoratus, Artis, *Antidel. Phyt.*, pl. xxv.

Calamites decoratus, Brongt. (in part), *Hist. d. végét. foss.*, p. 123, pl. xiv. figs. 1, 2 (excl. figs. 3, 4).

Remarks.—Not common.

I have observed two specimens of this species from Camerton,—one in the Bristol Museum, the other kindly given me by Mr G. WEST,—which show the peculiarity of a double row of tubercles, one row at each extremity of the ribs ; thus each nodal line has a row of large tubercles immediately below it, and a row of smaller tubercles immediately above it. The same peculiarity is figured by BRONGNIART (*C. decoratus*, Brongniart (not Artis), *Hist. d. végét. foss.*, pl. xiv. figs. 3, 4) and WEISS (*C. ramosus*, *Steinkohlen-Calamarien*, part ii. p. 108, pl. ix. fig. 2). It is shown from the specimen given me by Mr WEST, which is a portion of the stem near its base, that the larger tubercles occupy the normal position, viz., the upper extremities of the ribs, and the smaller tubercles the lower extremity. WEISS's figure is therefore, as suspected by him, drawn in inverted position. My Camerton specimen also shows the further peculiarity, likewise mentioned by WEISS in the description of his example, that many of the ribs, instead of alternating at the nodes in a normal manner, are exactly opposite. This latter abnormality, however, in the case of a few ribs, is not a very uncommon phenomenon on stems of *Calamites*.

Localities.—Radstock ; Camerton.

Stylocalamites (Calamites) cannæformis, Schloth.

Calamites cannæformis, Schlotheim, *Petrefactenkunde*, p. 398, pl. xx. fig. 1.

Calamites cannæformis, Brongt., *Hist. d. végét. foss.*, p. 131, pl. xxi.

Calamites cannæformis, Lindley and Hutton, *Foss. Flora*, vol. i. pl. lxxix.

Calamites cannæformis, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 115.

Calamites cannæformis, Zeiller, *Végét. foss. du terr. houil.*, p. 16.

Calamites pachyderma, Brongt., *Hist. d. végét. foss.*, p. 132, pl. xxii.

Remarks.—A few stems have been met with that should perhaps be referred to this species, which, however, appears to me to be a very ill-defined

one, and in which are often placed large and badly-preserved stems that probably belong to *C. Suckowii* or some other species.

The type figure of *C. cannaeformis* represents the terminal portion of a stem which does not seem to have been well preserved, hence there is difficulty in recognising the plant really meant by Schlotheim.

Localities :—Camerton ; Welton Hill, Midsomer-Norton.

Stylocalamites (Calamites) Cistii, Brongt.

Calamites Cistii, Brongt., *Hist. d. végét. foss.*, p. 129, pl. xx.

Calamites Cistii, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 7, pl. xi. figs. 7, 8 ; pl. xii. figs. 4, 5 ; pl. xiii. fig. 7.

Calamites Cistii, Schimper, *Traité de paléont. végét.*, vol. i. p. 313.

Remarks.—More frequent than the foregoing species ; not common, however.

Localities :—Radstock ; Braysdown ; Camerton ; Wellsway ; Lower Writhlington.

Calamocladus, Schimper, 1869, *Traité d. paléont. végét.*, vol. i. p. 323.

Calamocladus equisetiformis, Schloth., sp.

Calamocladus equisetiformis, Schimper, *Traité d. paléont. végét.*, vol. i. p. 324, pl. xxii. figs. 1–3.

Asterophyllites equisetiformis, Germar, *Vers. v. Wettin u. Löbejun*, p. 21, pl. viii.

Asterophyllites equisetiformis, Zeiller, *Végét. foss. du terr. houil.*, p. 19, pl. clix. fig. 3.

Hippurites longifolia, L. & H., *Fossil Flora*, vol. iii. pls. exc., exci.

Casuarinites equisetiformis, Schlotheim, *Flora d. Vorwelt*, p. 30, pl. i. figs. 1, 2 ; pl. ii. fig. 3.

Annularia calamitoides, Schimper, *Traité d. paléont. végét.*, vol. i. p. 349, pl. xxvi. fig. 1.

Remarks.—Not very frequent.

Localities :—Radstock ; Braysdown ; Wellsway ; Upper Conygre Pit ; Kilmersdon.

Annularia, Sternberg, 1820, *Vers. einer Geog. Botan. Darstellung d. Flora d. Vorwelt*, fasc. 2, p. 32.

Annularia stellata, Schloth., sp.

Annularia stellata, Zeiller, *Végét. foss. du terr. houil.*, p. 26, pl. clx. figs. 2, 3.

Casuarinites stellatus, Schloth., *Flora d. Vorwelt*, p. 32, pl. i. fig. 4.

Annularia longifolia, Brongt., *Prodrome*, p. 156.

Annularia longifolia, Germar, *Vers. d. Wettin u. Löbejun*, p. 25, pl. ix.

Annularia longifolia, Weiss, *Foss. Flora d. jüngst. Stk. u. Rothl.*, p. 30.

Asterophyllites longifolia, L. & H., *Foss. Flora*, vol. ii. pl. cxxiv.

Asterophyllites longifolia, Binney, *Palæontological Soc.*, 1868, p. 28, pl. vi. fig. 3.

As its fruit :—

Stachannularia tuberculata, Weiss, *Steinkohlen-Calamarien*, vol. i. p. 17, pl. i. figs. 2–4 ; pl. ii. figs. 1–3, 5 (left) ; pl. iii. figs. 3–10, 12.

Stachannularia tuberculata, Kidston, *Catal. Palæoz. Plants*, p. 56.

Buckmannia tuberculata, Sternberg, *Vers.*, i. fasc. 4, p. xxix. pl. xlv. fig. 2.

Remarks.—Frequent. STERZEL* notes the occurrence of specimens of *Annularia stellata* with *Stachannularia tuberculata* organically united, which proves what had previously been suspected, that this cone is the fruit of *Annularia stellata*.

The cones of this species are rare in the Radstock Coal Field.

Localities.—Radstock; Braysdown; Camerton; Upper Conygre; Lower Conygre; Paulton; Kilmersdon.

Annularia sphenophylloides, Zenker, sp.

Annularia sphenophylloides, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 11, pl. xviii. fig. 10.

Annularia sphenophylloides, Schimper, *Traité d. paléont. végét.*, vol. i. p. 347, pl. xvii. figs. 12, 13.

Annularia sphenophylloides, Sterzel, *Zeitsch. d. deut. geol. Gesell.*, vol. xxxiv. p. 685, pl. xxviii.

Annularia sphenophylloides, Weiss, *Foss. Flora d. jüngst. Stk. u. Rothl.*, p. 131.

Annularia sphenophylloides, Zeiller, *Végét. foss. du terr. houil.*, p. 25, pl. clx. fig. 4.

Annularia sphenophylloides, Kidston, *Catal. Palæoz. Plants*, p. 44.

Galium sphenophylloides, Zenker, *Neues Jahrb.*, 1833, p. 398, pl. v. fig. 6.

Annularia brevifolia, Brongt., *Prodrome*, p. 156.

As its fruit:—

Stachannularia calathifera, Weiss, *Steinkohlen-Calamarien*, vol. i. p. 27, pl. iii. fig. 11.

Remarks.—Frequent. Some large slabs were entirely covered with the leaves of this plant. STERZEL† has shown that the little cones, described by WEISS as *Stachannularia calathifera*, are the fruit of this species. The fruit is rare in the Radstock Coal Field, having only been found once at Radstock.

Localities.—Radstock; Upper Conygre; Lower Conygre; Camerton; Braysdown; Kilmersdon.

(?) RHIZOCARPEÆ.

Sphenophyllum, Brongniart, 1822, *Sur la Classification d. végét. foss.*, p. 34.

Sphenophyllum emarginatum, Brongniart.

Sphenophyllum emarginatum, Coemans and Kickx, *Bull. Akad. roy. Belgique*, 2° sér. vol. xviii. p. 144, pl. i. fig. 2; pl. ii. figs. 1-3.

Sphenophyllum emarginatum, Geinitz (in part), *Vers. d. Steinkf. in Sachsen*, p. 12, pl. xx. figs. 1, 3, 4.

Sphenophyllum emarginatum, Schimper, *Traité d. paléont. végét.*, vol. i. p. 339, pl. xxv. figs. 15, 16.

Sphenophyllum Schlotheimii, L. & H. (not Brongt.), *Fossil Flora*, vol. i. pl. xxvii.

Remarks.—Frequent.

Localities.—Radstock; Braysdown; Camerton; Paulton; Upper Conygre; Lower Conygre.

FRUCTIFICATION.

Macrostachya, Schimper, 1869, *Traité d. paléont. végét.*, vol. i. p. 332.

Macrostachya infundibuliformis, Brongniart, sp.

Macrostachya infundibuliformis, Schimper, *Traité d. paléont. végét.*, vol. i. p. 133, pl. xxiii. figs. 15-17 (excl. figs. 13, 14).

* *Zeitsch. d. deut. geol. Gesell.*, 1882, p. 685.

† *Loc. cit.*, p. 685.

Macrostachya infundibuliformis, Weiss, *Steinkohlen-Calamarien*, part i. p. 71, pl. vi. figs. 1-4 ; pl. xviii. figs. 1, 3, 4 (1876) ; part ii. p. 197 (1884).

Equisetum infundibuliforme, Brongt. (in part), *Hist. d. végét. foss.*, p. 119, pl. xii. figs. 14, 15 (excl. syn. and fig. 16).

Huttonia carinata, Germar, *Vers. v. Wettin u. Löbejun*, p. 90, pl. xxxii. figs. 1, 2.

Macrostachya carinata, Zeiller, *Végét. foss. du terr. houil.*, p. 23, pl. clix. fig. 4.

Equisetum, Brongt., *Class. d. végét. foss.*, p. 90, pl. iv. fig. 4.

Remarks.—Very rare ; only two examples having been found.

Localities.—Radstock ; Kilmersdon.

FILICACEÆ.

Sphenopteris, Brongniart, 1822, *Sur la Classification d. végét. foss.*, p. 33.

Sphenopteris tenuifolia, (Brongt. ?) Gutbier.

Plate XIX. fig. 2.

(?) *Sphenopteris tenuifolia*, Brongt., *Hist. d. végét. foss.*, p. 190, pl. xlviii. fig. 1.

Sphenopteris tenuifolia, Gutbier, *Abdrücke u. Vers. d. Zwickauer Schwarzkohl*, p. 39, pl. v. fig. 10 ; pl. x. fig. 9.

(?) *Cheilanthes tenuifolius*, Göppert, *Syst. fil. foss.*, p. 241.

Description.—Frond tripinnate ; primary (?) and secondary pinnae alternate, lanceolate ; pinnules alternate, lanceolate ; lower pinnules divided into numerous (as many as fourteen) segments ; the lower segments are again divided into four to six simple or bifid lanceolate acute teeth ; upper pinnules less divided, bearing simple, bifid or trifid acute lanceolate segments, into each of which extends a vein. Rachis of pinnae thin. Fruit borne at the extremities of the secondary (?) pinnae, and situated at the margin of the pinnule segments.

Remarks.—The specimen, of which a drawing is given natural size, shows two (?) primary pinnae lying parallel to each other. As their parent rachis is not shown, their entire length cannot be estimated. The portions of the pinnae preserved measure about 6 inches each.

This, the only example which I have seen, is beautifully preserved, and shows the most minute details of the pinnule cutting. The lower pinnules of the lower secondary pinnae are much divided into broadly lanceolate segments, and the lower segments are again divided into a few simple and bifid acute lanceolate teeth, into each of which runs a vein. A careful drawing of one of these pinnules, magnified three times, is given on Plate XIX. fig. 2*b*. An upper pinnule, also enlarged three times, is shown at fig. 2*a* ; the segments of this are, with one exception, bifid, but these details vary according to the position of the pinnule on the pinna, the uppermost pinnules being even less divided.

The fruit is borne on the upper secondary pinnae, apparently at the margins of the pinnules. Its structure is not well shown, the fruit appearing as little indistinct groups at the extremities of the ultimate segmentation. Owing to the somewhat indistinct details of the fruit, I am led to believe it had not reached maturity, as the other parts of the specimen show their structure exquisitely.

I may note here that many of the Pecopteroids from this Coal Field are found in fruit, but always in an immature condition, and seldom show their structural details clearly, though in all other points the preservation of the fossils is very fine.

The mode of fructification of *Sphen. tenuifolia* appears to be similar to that of *Sphen. Gützoldi*, as figured by Gutbier.*

STUR regards as distinct species the *Sphen. tenuifolia*, Brongt., and the plant figured under that name by GUTBIER, and has described a third species, *Sphenopteris (Calymmotheca) subtenuifolia*.†

BRONGNIART states in his description of his *Sphen. tenuifolia* that the specimen was preserved in a coarse-grained sandstone; hence he was not satisfied as to the thorough accuracy of his enlarged drawing of the pinnule. If, however, we compare the pinnule, as represented by BRONGNIART, with that on our Pl. XIX. fig. 2*a*, their similarity is very striking. On the other hand, BRONGNIART's plant has apparently a more rigid growth, and the main rachis is very thick for the size of the pinnæ; on our example the main rachis is unfortunately not shown.

With the fern from Zwickau, figured by GUTBIER as *Sphen. tenuifolia*, our example agrees perfectly, his fig. 9, pl. x. being apparently identical with my fig. 2. The enlargement of the other example given by GUTBIER in his pl. v. fig. 10*a*, does not seem to differ essentially from my fig. 2*a*, though the segments of the pinnules of his figure are shown to be a little stouter than in the Somerset plant.

STUR's *Sphen. (Calymmotheca) subtenuifolia* is very closely allied to *Sphen. tenuifolia*, if really distinct from it; but in the absence of enlarged details of the pinnule segmentation, a critical comparison can scarcely be made.

I have distinguished my example as *Sphenopteris tenuifolia*, Gutbier (? Brongt.), till the true relationship of these plants to each other is decided.

Locality:—Upper Conygre Pit.

Sphenopteris geniculata, Germar and Kaulfuss.

Plate XXI. fig. 1.

Sphenopteris geniculata, Germar and Kaulfuss, *Verhandl. d. K. Leop. Carol. Akad. d. Naturf.*, vol. xv. part ii. p. 224, pl. lxxv. fig. 2, 1831.

Diplothemema geniculatum, Stur (in part), *Carbon-Flora*, p. 297, pl. xxxv. fig. 1.

Sphenopteris Kaulfussi, Schimper, *Traité d. paléont. végét.*, vol. i. p. 412.

Description.—Primary (?) pinnæ divided into two symmetrical portions; rachis flexuous, winged; secondary (?) pinnæ alternate, lanceolate; pinnules

* *Vers. d. Rothliegenden in Sachsen*, p. 9, pl. ii. figs. 3, 4, 5.

† *Die Carbon-Flora der Schatzlarer Schichten*, p. 257, pl. xxxi. fig. 5, 1885.

alternate, the lower divided into numerous simple or bifid linear acute segments, into each of which runs a vein; upper pinnules less divided, and may consist of only one or two bifid segments.

Remarks.—The only British specimen of this rare species which I have seen is that figured on Pl. XXI. fig. 1. It shows very beautifully the peculiar dichotomisation of the pinnæ as developed on many *Sphenopterids*. The general outline of the pinnæ is more or less subrotund,—that of its two component parts oval. The stalk uniting this compound pinna to the rachis is not preserved, but was probably naked like that of the other members of this group of *Sphenopteroids*.

Two of the pinnules are enlarged at fig. 1*a.b.* Throughout their segmentation there can generally be traced a series of dichotomous divisions; this is exhibited in both enlargements, where each of the two larger segments dichotomises.

Both the primary (?) and secondary (?) rachis are distinctly winged and geniculate.

Sphenopteris geniculata appears to have been much confused with *Sphen. furcata*, Brongt., and, following GEINITZ, I united them in my Catalogue of Palæozoic Plants, but now regard the two species as essentially distinct.

Of the two figures of *Sphen. geniculata* given by STUR in his *Carbon-Flora*, that on his pl. xxxv. fig. 1, is evidently GERMAR and KAULFUSS' plant, but I think that on his pl. xxviii. fig. 1, is referable to *Sphen. furcata*. I believe also that the figure given by GEINITZ as *Sphen. geniculata* * (which he unites with *Sphen. furcata*, Brongt.) must be excluded from GERMAR and KAULFUSS' plant.

Locality :—Kilmersdon Pit.

Sphenopteris Grandini, Göppert, sp.

Sphenopteris Grandini, Schimper, *Traité d. paléont. végét.*, vol. i. p. 404.

Sphenopteris Grandini, Boulay, *Terr. houil. du nord de la France*, p. 27.

Hymenophyllites Grandini, Göppert, *Syst. fil. foss.*, p. 255, pl. xv. fig. 12.

Sphenopteris alata, Brongt., *Hist. d. végét. foss.*, p. 180, pl. xlviii. fig. 4.

Sphenopteris alata, Sauveur, *Végét. foss. de la Belgique*, pl. xvii. fig. 2.

Sphenopteris alata, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 34, pl. v. figs. 16 and 17; pl. xi. fig. 1.

Remarks.—This species is rare in the Radstock Coal Field, but has been observed at several collieries.

STUR unites *Sphen. trichomanoides*, Brongt., with *Sphen. Grandini* † (*Sphen. alata*, Brongt.). On the other hand, it is suggested by BOULAY ‡ that *Sphen.*

* *Vers. d. Steinkf. in Sachsen*, pl. xxiv. fig. 13.

† *Carbon-Flora d. Schatzlarer Schichten*, p. 304, 1885.

‡ *Loc. cit.*, p. 27.

trichomanoides is simply a pinna of *Sphen. furcata*, Brongt., and ZEILLER, though he includes *Sphen. trichomanoides* in his "Fougères du terrain houiller du nord de la France,"* is inclined to accept BOULAY's suggestion.

The specimens from Radstock are similar to BRONGNIART's type figure.

Sphen. Grandini appears to me a very distinct plant, though, according to BOULAY, even it may be only a variety of *Sphen. furcata*, Brongt. This latter species has not yet been observed in the Radstock area, where *Sphen. Grandini*, though rare, is widely distributed.

The ferns figured by GEINITZ and LESQUEREUX as BRONGNIART's plant belong to another species.†

Localities.—Radstock; Braysdown; Lower Conygre.

Sphenopteris macilenta, L. & H.

Sphenopteris macilenta, L. & H., *Fossil Flora*, vol. ii. pl. cli.

Sphenopteris macilenta, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 14, pl. xxiii. fig. 1.

Sphenopteris macilenta, Zeiller, *Bull. de la soc. géol. de France*, 3^e sér. vol. xii. p. 194.

Sphenopteris lobata, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 44, pl. v. figs. 11, 13, 14, 15; pl. x. figs. 1-3.

Remarks.—Of very unfrequent occurrence.

Dr STUR is evidently in error in separating GEINITZ's and GUTBIER's figures from *Sphen. macilenta*, L. & H.,—a species in which the pinnule cutting varies much according to the position the pinnæ hold on the frond.‡

Localities.—Radstock; Braysdown; Camerton.

Sphenopteris Woodwardii, Kidston, n.s.

Plate XIX. fig. 1.

Description.—Frond tripinnate; rachis very stout; primary pinnæ subopposite, ascending; secondary pinnæ alternate or subopposite, lanceolate, ascending; pinnules alternate, oblong-lanceolate, pinnatifid, rarely divided into lobes; veins distinct, veinlets usually simple, occasionally bifid,—especially in those pinnules which are divided into lobes.

Remarks.—The specimen figured is the only example of this species with which I have met. It was collected on one of my earlier visits to Camerton, and though diligent search has since been made for additional specimens I have not yet succeeded in securing any.

The pinnules are most commonly merely pinnatifid, as shown at fig. 1*a*. The limb of the pinnules is of very delicate texture, but the veins are thick

* *Bull. de la soc. géol. de France*, 3 sér., vol. xii. p. 194, 1883

† See Kidston, *Catal. Palæoz. Plants*, p. 78.

‡ *Carbon-Flora*, p. 375 (*Diplothmema macilentum*).

and prominent, being raised like threads on the surface of the pinnule. The veinlets are usually simple, but where the pinnules show a tendency to become lobed they are bifid, as seen in the lower lobe of fig. 1*b*. When the pinnules are divided into lobes, the vein in each lobe usually bifurcates, as shown in fig. 1*c*. These lobed pinnules are of somewhat irregular occurrence on the pinnæ. At the points marked *x* and *x'*, where examples of these lobed pinnules occur, that at *x* is situated on a basal secondary pinna, whereas that at *x'* is on a secondary pinna, placed well up a primary pinna. On the same primary pinna the majority of the pinnules, even on secondary pinnæ borne lower down on the rachis, are only pinnatifid, as seen at *z* and on the other pinnæ of the specimen.

The main rachis and those of the primary pinnæ are very stout, as compared with those of the secondary pinnæ; they are feebly striated, and bear slightly elevated points.

The only species to which the Camerton plant appears to have any resemblance are *Sphenopteris* (*Cheilantheites*) *grypophylla*, Göppert,* and *Sphen. bidentata*, Gutbier.†

From *Sphen. grypophylla*, *Sphen. Woodwardii* is easily distinguished by its lanceolate, upward-directed pinnæ, and the pinnatifid pinnules. In *Sphen. grypophylla* the pinnæ are long and linear, and spring from the rachis at almost right angles, and the pinnules are uniformly divided into bifid lobes. In addition, the whole general appearance of the two plants is characteristically distinct.

The type figure of *Sphen. bidentata*, Gutbier, is very fragmentary, and, except from the enlarged figure of the pinnule, a comparison of the species with any other is almost impossible. This enlarged pinnule shows a sharply bifid-toothed, spinous-like fern, which, both in the form of the pinnule and its segmentation, is essentially distinct from my plant.

I have great pleasure in naming this specimen after Dr HENRY WOODWARD, F.R.S., of the British Museum.

Locality:—Camerton.

Sphenopteris neuropteroides, Boulay, sp.

Sphenopteris neuropteroides, Zeiller, *Bull. de la soc. géol. de France*, 3^e sér., vol. xii. p. 191, 1883.

Pecopteris neuropteroides, Boulay, *Le terr. houil. du nord de la France*, p. 32, pl. ii. figs. 6 and 6 bis, 1876.

Pseudoppecopteris anceps, Lesqx., *Coal Flora of Pennsylv.*, vol. i. p. 207, pl. xxxviii. figs. 1–4, 1880.

Remarks.—Rare. I have compared a specimen of *Pseudoppecopteris anceps*, Lesqx., from Pittston, communicated to Mr W. CASH, Halifax, by Mr R. D.

* *Syst. fil. foss.*, p. 242, pl. xxxvi. figs. 1, 2. See also STUR, *Sphenopteris* (*Saccopteris*) *grypophylla*, *Carbon-Flora*, p. 176, pl. liii. figs. 3, 4, 5.

† Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 16, pl. xxiv. fig. 3.

LACOE, with the examples of *Sphen. neuropteroides* from Somerset, and find, as suspected by ZEILLER, that *Pseudopectopteris anceps* is identical with *Sphen. neuropteroides*, with which species it must therefore be united.

It is interesting to note that the British, as well as the American and French, specimens of this fern appear to be infested with a species of *Excipulites*.

Localities.—Radstock; Camerton; Withy; Clandown.

Sphenopteris cristata, Brongt., sp.

Sphenopteris cristata, Schimper, *Traité d. paléont. végét.*, vol. i. p. 397.

Sphenopteris cristata, Kidston, *Catal. Palæoz. Plants*, p. 74.

Pecopteris cristata, Brongt., *Hist. d. végét. foss.*, p. 356, pl. cxxv. figs. 4, 5.

Remarks.—The only specimen of this species with which I have met is that contained in the collection of the British Museum.

Locality.—Camerton.

Ptychocarpus, Weiss, 1869, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 94.

Description.—"Sori round or oval, divided by a longitudinal cleft into two oblong halves."

Remarks.—The fruit of the genus *Ptychocarpus* appears to consist of two sporangia lying side by side. The systematic position of the genus is near to *Asterocarpus* (= *Pecopteris*), but is separated from it by the sporangia being arranged in pairs, whereas in the *Asterocarpus-Pecopteroids* the fruit is composed of several stellately arranged sporangia. In the type of *Ptychocarpus* (*P. hexastichus*) the sporangia are surrounded by a narrow flat border, from which WEISS thinks that the two sporangia were covered by an indusium, which, springing from the centre of the medial line, extended over and beyond the sporangia.

He compares his genus *Ptychocarpus* to *Didymochloëna*, Desv., and the external resemblance of the upper surface of the fruiting pinnules of *Didymochloëna sinuosa*, as figured by BAUER,* to the species about to be described (*P. oblongus*) is very striking. In pointing out this external resemblance I do not at all infer any affinity between the recent and fossil genera.

Ptychocarpus oblongus, Kidston, n. sp.

Plate XX. fig. 2.

Description.—Frond tripinnate (?); pinnæ subopposite, lanceolate; pinnules subopposite, oblong, usually bearing four pairs of oblong lateral lobes and a terminal one. On each lobe is situated an oblong synangium (?), composed of

* Bauer and Hooker, *Genera Filicum, or Illustrations of the Ferns and their other Allied Genera*, table viii. figs. 2, 3.

two sporangia (?). The main rachis and those of the pinnæ are stout, and pitted with scale-scars.

Remarks.—It is with considerable reservation that I place this species in the genus *Ptychocarpus*, Weiss.

The general appearance of my specimen exhibits a great similarity to WEISS' genus, but, on minute examination, I cannot positively affirm that the longitudinal cleft entirely divides the two supposed sporangia, as it does in *P. hexastichus*, Weiss (*loc. cit.*, pl. xi. fig. 2). The usual appearance of the fruit of the Camerton plant is shown at Plate XX. figs. 2*a* and *b*; at fig. 2*b* the cleft is seen to be much more prominent in the central part than at the two extremities, where it becomes indistinct. This may be merely caused by imperfect preservation, or even by the degree of maturity at which the specimen had arrived when embedded. This supposed bi-sporangial synangium is generally surrounded by a faint border, as shown at figs. 2*a* and *b*, which appears as a slight surrounding staining, but is clearly observable in many cases.

The pinnules seem to have been divided into lobes, on each of which was borne a (?) synangium. I am disposed to think that this surrounding border may not represent an indusium, but the margin of the limb of the pinnule on which the sporangia sat. The fruit seems to have had a firm consistency, and has still considerable elevation.

On collecting this fossil, my first impression was that each segment of the pinnules bore a *split exannulate sporangium*, but, as a result of further examination and comparison with the description of *Ptychocarpus*, Weiss, I have provisionally placed it in that genus.

The only example met with is that figured.

Locality:—Camerton.

Schizostachys, Grand' Eury, 1877, *Flore carbon du Département de la Loire*, &c., p. 200.

Remarks.—This genus is characterised by its oblong, slightly curved, pedicellate sporangia, attached around a common point, or on the sides of a short pedicel. In the species described by GRAND' EURY* the cellular tissue of the sporangia was still visible; some of these cells were especially prominent, and formed a band which encircled the sporangium. This band may perhaps represent an annulus. On the surface of the sporangia is a longitudinal line, to which these (?) annulus-forming cells seem to lie at a right angle.

GRAND' EURY regarded his *Schizostachys frondosus* as the male inflorescence of *Noeggerathia*; RENAULT, on the other hand, places it among the ferns,† and this appears to be its true position.

* *Schizostachys frondosus*; on his pl. xvii. fig. 3, named *Androstachys frondosus*.

† *Cours d. botan. foss.*, Troisième Année, 1883, p. 103.

RENAULT has further suggested that the fruit described by GRAND' EURY as *Schizostachys* may perhaps be identical with that described by him as the fruit of *Zygopteris*.*

In the whole mode of its growth *Schizostachys ramosus*, Gr.' E., approaches so closely to *Schizopteris pinnata*, Gr.' E., and *S. cycadina*, Gr.' E., that it induces the supposition that it might be the fruit of one of these, or of a closely allied species.

As, however, the fruiting specimens show no barren foliage, they cannot be referred to these ferns with any degree of certainty.

Schizostachys sphenopteroides, Kidston, n. sp.

Plate XX. fig. 1.

Description.—Frond bipinnate; pinnæ subopposite, linear, lanceolate; pinnules subopposite, coriaceous, and composed of one sporangium on the upper pinnæ, and of two diverging sporangia on the lower pinnæ. Sporangia oblong, with a central line, from which extends a series of transverse bars. Rachis faintly striated.

Remarks.—A specimen is shown on Plate XX. fig. 1, natural size. The pinnules, which are quite destitute of any leafy expansion, are reduced to one or two sporangia, according to their position on the frond. The sporangia are oblong and straight, or very slightly curved. On their surface is a longitudinal line, from which the little transverse bars extend at right angles. The specimen is not sufficiently well preserved to exhibit the cellular structure of the sporangia, as in the case of that described by GRAND' EURY, but it shows the transverse bars as drawn at fig. 1a. These bars extend over almost the whole of the exposed surface of the sporangia, but that they indicate the presence of an annulus I am unable to determine.

I apply the specific name of *sphenopteroides* to this species from its superficial resemblance to some of the members of that genus.

Locality:—Radstock.

Macrosphenopteris, Kidston, n. gen.

Description.—Pinnules very large, ovate, of delicate texture, provided with a central vein, from which spring numerous upward-directed dichotomous veinlets. Margin dentate or laciniate.

Remarks.—This genus is proposed for the *Adiantites Haidingeri*, Ettingshausen,† and the specimen about to be described.

* *Loc. cit.*, p. 102.

† *Die Steinkohlenflora von Radnitz*, p. 34, pl. xix. fig. 3.

The genus *Adiantites*, Göppert, as originally employed by its author, had a very vague significance, and in it were placed ferns of very different character. The genus has been emended by SCHIMPER,* and as now defined, *Adiantites Haidingeri*, Ett., can no longer be included in it. It is therefore necessary to create a new genus for this fern and for the one I now describe as *Macrosphenopteris Lindsæoides*.

The remains of these ferns are treated as pinnules, as their general appearance points to this conclusion rather than to their being fronds.

Macrosphenopteris, in the delicate texture of the pinnules and the arrangement of the veins, shows affinities with *Sphenopteris*, hence the name (*Macrosphenopteris*) now proposed for it.

Macrosphenopteris Lindsæoides, Kidston, n. sp.

Plate XXVII. fig. 1.

Description.—Pinnules very large, of delicate texture, with a central vein, from which arise numerous ascending slightly curved dichotomous veinlets. Margin sinuous or dentate.

Remarks.—The specimen figured is the only example met with. It is unfortunately very imperfect, but the portion preserved shows that the pinnule must have been of large size. Its texture is very delicate, and the veins are distinct. At several parts of the pinnule the margin is thickened in a very peculiar manner; whether this is caused by a folding over of the margin or a thickening of the tissue at this part of the pinnule, cannot be determined. The appearance is not accidental, and is possibly connected with the fructification of the species; it has a strong superficial resemblance to the arrangement of the *indusia* of the genus *Lindsæa*, which has suggested the specific name of *Lindsæoides*.

Macrosphenopteris Lindsæoides, though closely related to *Macrosphenopteris Haidingeri*, Ett., sp., appears to have been a much larger species, with more distant nervation, and the margin not regularly dentate as in ETTINGSHAUSEN'S plant, where each of the veinlets seems to end in a small tooth.

The *Aphlebia pateriformis*, Germar,† may be allied to *Macrosphenopteris*, but "a distinct dichotomy of the longitudinal stripes (veins?) is not recognisable" in GERMAR'S plant.

Locality.—Radstock.

* *Traité d. paléont. végét.*, vol. i. p. 424 (*Adiantides*).

† *Vers. de. Steink. v. Wettin u. Löbejun*, fasc. 1, p. 5, pl. ii.

Neuropteris, Brongniart, 1822, *Sur la Classification des végétaux fossiles*, p. 33.

Neuropteris macrophylla, Brongt.

Plate XXI. fig. 2; Plate XXII. figs. 2, 3.

Neuropteris macrophylla, Brongt., *Hist. d. végét. foss.*, p. 235, pl. lxxv. fig. 1.

Neuropteris macrophylla, Schimper, *Traité d. paléont. végét.*, vol. i. p. 434.

Neuropteris Clarksoni, Lesqx., in Roger's *Geol. of Pennsylv.*, vol. ii. p. 857, pl. vi. figs. 1-4.

Neuropteris Clarksoni, *Coal Flora of Pennsylv.*, p. 94, pl. ix. figs. 1-6.

Neuropteris Scheuchzeri, Kidston (not Hoffm.), *Catal. of Palæoz. Plants*, p. 95.

(?) *Osmunda*, Scheuchzer, *Herbarium diluvianum*, p. 48, pl. x. fig. 3, edition 1709.

Description.—Frond very large; pinnæ dividing by a series of dichotomies. Pinnules alternate, varying much in shape and size, triangular, lanceolate-acute, oblong-obtuse, and cyclopteroid. Midrib distinct, and extending to the apex; lateral veins numerous, arched, generally dichotomising four times, rarely five times, the last dichotomy being near the margin of the pinnule. Veins reaching the edge of the pinnule at an open angle. The cyclopteroid pinnules are situated on the rachis.

Remarks.—*Neuropteris macrophylla* was described by BRONGNIART from a specimen collected at Dunkerton, Somerset, which belonged to the Geological Society of London, and in whose collection it still remains. The species is frequent in the Radstock Coal Field, from which some large and fine specimens have been secured.

Having compared my specimens with the type, I am satisfied of their identity with it. This comparison was necessary as BRONGNIART'S representation of the nervation of his type is too coarse and distant. In fact, the nervation of *Neuropteris macrophylla* is much more like the nervation of *Neur. auriculata* as represented by BRONGNIART on his plate lvi. fig. A, than it is to the enlarged drawing that accompanies the original figure of the species. This led me to conclude that these two species were identical, but ZEILLER, to whom I sent specimens of *Neur. macrophylla*, kindly compared them with the type of *Neur. auriculata*, and informed me that *Neur. auriculata* has a much closer nervation than *Neur. macrophylla*, and the apex of the pinnules of *Neur. auriculata* is rounded. As the nervation forms a constant character for distinguishing the species of the genus *Neuropteris*, *Neur. auriculata* cannot be united with *Neur. macrophylla*. The form of the pinnules, at least in the present case, seems of little specific value. A figure is given on Plate XXII. fig. 3, of a specimen from Radstock in the Bath Museum. On the left side of the rachis the pinnules are oval, and very blunt, whereas on the right they are lanceolate. These differences are very clearly exhibited towards the apex of the fossil.

The posterior basal angle of the pinnules is usually more or less auricled. The various forms assumed by the pinnules of this species will be best appreciated by an examination of the three figures that accompany these notes. To Plate XXII. fig. 3, reference has already been made; at fig. 2 of the same plate

a fragment of a pinna is given, which, in addition to showing lanceolate pinnules, exhibits the dichotomous ramification of the rachis. The pinnules situated at the angles formed by the dichotomies are of very irregular shape, being frequently triangular and irregular, sometimes even bifid at their apex, as if two pinnules had become confluent. The most interesting specimen I figure is that on Pl. XXI. fig. 2. On this example (which lies on the corner of a very large slab of *Neur. macrophylla*, which I received from Mr STEART, manager of the Braysdown Colliery), the gradual transition in the form of the pinnules from lanceolate to cyclopteroid can be followed. On some specimens in the collection of Mr J. M'MURTRIE, F.G.S., large cyclopteroid pinnules occur on a thick rachis, which may be the main rachis of the frond.

From *Neur. Scheuchzeri*, Hoffm., this species is easily distinguished by the absence of the small cyclopteroid pinnules at the base of the large terminal lobe, by its being destitute of the bristle-like hairs, and, above all, by its nervation. In *Neur. macrophylla* the ultimate dichotomy of the veins is much closer to the margin of the pinnule than the corresponding dichotomy in *Neur. Scheuchzeri*, and in the latter species the veins are closer.

From the figure of *Neur. Scheuchzeri* given by ZEILLER (*loc. cit.*, pl. xli. fig. 1), it appears that this species possesses a similar dichotomous ramification of the pinnae to that which maintains in *Neur. macrophylla*.

Through the kindness of Mr C. CASH, F.G.S., Halifax, Yorkshire, I have been able to compare with my specimens of *Neur. macrophylla* a specimen of *Neur. Clarksoni*, Lesqx., from OLYPHANT, which was communicated to him by Mr R. D. LACOE, and find this last mentioned species is specifically identical with BRONGNIART'S plant.

I am inclined to refer the figure given by SCHEUCHZER (*loc. cit.*, pl. x. fig. 3) to *Neur. macrophylla*, Brongt., though several writers have placed it under *Neur. Scheuchzeri*, Hoffm. From the roughness of SCHEUCHZER'S figure, it is impossible definitely to refer it to either of these species.

While writing my Catalogue of Palæozoic Plants in the British Museum, believing that SCHEUCHZER'S figure should be referred to HOFFMANN'S *Neur. Scheuchzeri* (which, however, I treated as distinct from *Neur. cordata*, L. & H. = *Neur. hirsuta*, Lesqx.), I identified in error the specimens of *Neur. macrophylla* as *Neur. Scheuchzeri*, Hoffm.

The inaccurate drawing of the nervation of BRONGNIART'S type of *Neur. macrophylla* prevented me from identifying the specimens in the British Museum with his plant, to which, however, they really belong, and it was only on a subsequent examination of the specimens in the collection of the Geological Society of London that I detected the type of *Neur. macrophylla*, which enabled me to discover my former error.

Localities.:—Dunkerton (Type); Wellsway; Radstock; Upper Conygre; Lower Conygre; Braysdown; Kilmersdon.

Neuropteris Scheuchzeri, Hoffmann.

Plate XXIII. figs. 1, 2.

Neuropteris Scheuchzeri, Hoffm., Keferstein's *Teuchland geognostisch-geologisch dargestellt*, vol. iv. p. 156, pl. i.b, figs. 1-4, 1826.

Neuropteris Scheuchzeri, Zeiller, "Flore Houillère d. Asturies," p. 10 (*Mem. Soc. Géol. du Nord*, 1882).

Neuropteris Scheuchzeri, Zeiller, *Gîtes Minéraux de la France. Descrip. de la Flore Foss. Bassin houil. d. Valenciennes*, pl. xli. figs. 1-3, 1886.

Neuropteris angustifolia, Brongt., *Hist. d. végét. foss.*, p. 231, pl. lxiv. figs. 3-4.

Neuropteris acutifolia, Brongt., *Hist. d. végét. foss.*, p. 231, pl. lxiv. figs. 6, 7.

Neuropteris acutifolia, Ettingshausen, *Foss. Flora v. Radnitz*, p. 32, pl. xviii. fig. 5.

Neuropteris acutifolia, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 22, pl. xxvii. fig. 8.

Neuropteris acutifolia, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 52, pl. vii. fig. 6.

Neuropteris cordata (not Brongniart), Bunbury, *Quart. Jour. Geol. Soc.*, vol. iii. p. 423, pl. xxi. fig. 1, a-f.

Neuropteris cordata, Göppert, *Foss. Flora d. perm. Form.*, p. 100, pl. xi. figs. 1, 2.

Neuropteris cordata, Lindley & Hutton, *Foss. Flora*, vol. i. pl. xli.

Neuropteris cordata, Kidston, *Catalogue of Palæozoic Plants*, p. 98.

Neuropteris hirsuta, Lesquereux, *Rep. Geol. Survey of Illin.*, vol. ii. p. 427, pl. xxxv. figs. 6-10.

Neuropteris hirsuta, Lesquereux, *Coal Flora of Pennsylv.*, p. 88, pl. viii. figs. 1, 4, 5, 7, 9, 12.

Dictyopteris cordata, Römer, *Palæontographica*, vol. ix. p. 30, pl. vi. fig. 4, 1862.

Dictyopteris Scheuchzeri, Römer, *Palæontographica*, vol. ix. p. 30, pl. ix. fig. 1, 1862.

Description.—Frond large, ultimate pinnæ alternate, lanceolate, and usually composed of a large terminal and two small cyclopteroid pinnules; medial vein extending to within a very short distance of the apex, lateral veins fine, close, numerous, usually divided four times,—the fourth dichotomy occurring about midway between the midrib and the margin, and reaching the edge of the pinnule at a wide angle. The surface of the pinnules bears irregularly scattered short bristle-like hairs. Large cyclopteroid pinnules are also present on the frond.

Remarks.—The specimen I figure, which is in the collection of the Bath Museum, shows a fragment of what must have been a very large frond. At the top of the specimen the pinnæ are reduced to a large pinnule with a basal lobe. The other pinnæ consist of a very large terminal pinnule, at the base of which, on each side of the rachis, is a small cyclopteroid pinnule. The terminal pinnule marked *x* is 8 cm. long, but the one immediately below it must have been larger.

Probably no species of the Carboniferous flora has been so much misunderstood and misidentified as *Neur. Scheuchzeri*, Hoffm. This arises from the imperfect figures and description of the type specimens, to which may be added the difficulty in obtaining the work in which the original description appears.

We are chiefly indebted to ZEILLER for unravelling the synonymy of this species.

Neur. Scheuchzeri has, in the great majority of cases, been identified in error as *Neur. cordata*, Brongt.*

* *Hist. d. végét. foss.*, p. 229, pl. lxiv. fig. 5.

Of *Neur. cordata*, BRONGNIART only figured a single pinnule, which in its form closely resembles the pinnules of *Neur. Scheuchzeri*. The type of *Neur. cordata* appears to be lost, but ZEILLER has discovered in the Museum at Paris many other specimens named *Neur. cordata* by BRONGNIART himself; these, however, embrace two species. Some of them are the true *Neur. cordata* as figured by BRONGNIART and others, are identical with the plants named *Neur. acutifolia*, Brongt., and *Neur. angustifolia*, Brongt. ZEILLER has very kindly sent me a specimen from the mines of Alais, Grand' Combe, of the plant he identifies as the true *Neur. cordata*, Brongt. With this before me there is no difficulty in recognising BRONGNIART'S *Neur. cordata* as essentially distinct from *Neur. Scheuchzeri*, with which, as will be presently seen, must be united *Neur. acutifolia*, Brongt., and *Neur. angustifolia*, Brongt. In *Neur. cordata* the veins are not nearly so close to each other as those of *Neur. Scheuchzeri*, and in addition to this the characteristic hairs of *Neur. Scheuchzeri* are absent from *Neur. cordata*;—even on specimens of *Neur. Scheuchzeri* where, through imperfect preservation, the hairs are not visible, the nervation is a sufficiently distinctive character by which to distinguish the two species.

The nervation of *Neur. Scheuchzeri*, enlarged three times, is shown on Plate XXIII. fig. 2. The hairs are omitted from this figure to avoid confusion. It will be observed from this drawing that the veins usually divide four times,—the first dichotomy being close to the midrib, the second and third dichotomy carry the veins to about midway between the central vein and the margin of the pinnule, and the arms of the fourth dichotomy extend from this point to the edge of the pinnule. A fifth dichotomy is but rarely observed, and equally rarely do its veins only divide three times throughout their course.

An enlarged drawing, to show the bristle-like hairs, is given at fig. 1a. These usually lie obliquely to the veins, imparting to the pinnule a *dictyopteroid* appearance, which has given rise to RÖMER'S *Dictyopteris cordata* and *Dictyopteris Scheuchzeri*.

On the original specimens of *Neur. Scheuchzeri* the presence of the hairs appears to have escaped HOFFMANN'S observation, or had been effaced through imperfect preservation, but, from his description of the plant and the accompanying figures, the identification of the specimens occurring in the Radstock Coal Field with HOFFMANN'S *Neur. Scheuchzeri* appears to be correct beyond doubt.

ZEILLER has examined the types of *Neur. acutifolia* and *Neur. angustifolia* which originated from "Camerton" and "near Bath," and "Wilkesbarre in Pennsylvania," and has observed on them the characteristic hairs, though BRONGNIART in his description of the two species does not indicate their existence. These two supposed species do not differ from each other except in the outline of the pinnules, which is not of sufficient value for specific distinction,

and, further, it has been shown by ZEILLER that they are specifically identical with *Neur. Scheuchzeri*, Hoffm.

BUNBURY was the first to point out the presence of hairs on specimens of *Neur. Scheuchzeri* from Cape Breton, though he identified his plants as *Neur. cordata*.* He also mentions that he had observed these little hairs on specimens of *Neur. cordata*, L. & H. (not Brongniart), from Leebotwood (the locality from which LINDLEY and HUTTON's examples come), in the collection of the Geological Society of London, and this observation I am able to corroborate.

BUNBURY here also places *Neur. angustifolia*, Brongt., as a *variety* of *Neur. cordata*, and further suggests that *Neur. cordata*, *Neur. angustifolia*, *Neur. acutifolia*, and *Neur. Scheuchzeri* of BRONGNIART are all of them forms of *Neur. cordata*.

LESQUEREUX† at one time expressed a similar belief, but subsequently he treated *Neur. cordata*, *Neur. hirsuta*, and *Neur. angustifolia* as distinct, giving LINDLEY and HUTTON's figure as a reference under *Neur. cordata*, Brongt., but, as already stated, the specimens from Leebotwood belong to *Neur. Scheuchzeri*, and not to *Neur. cordata*, Brongt.‡

Neur. hirsuta, Lesq.,§ agrees in every respect with *Neur. Scheuchzeri*; LESQUEREUX's species, however, was created before the true characters of *Neur. Scheuchzeri* were clearly understood; but it must now be reduced to a synonym of the latter-mentioned plant.

GÖPPERT gives a figure in his *Permian Flora* which he names *Neur. cordata*.|| This does not show the small cyclopteroid pinnules that are generally present, but the form of the large pinnules and their nervation, as shown by his enlargement, agree entirely with *Neur. Scheuchzeri*, to which plant I believe his fern may belong.

ZEILLER, in his excellent remarks on *Neur. Scheuchzeri*, to which I am much indebted for a right understanding of this species, includes under *Neur. Scheuchzeri* the figure of a *Neuropteris* from England given by SCHEUCHZER in his *Herbarium Deluvianum*, pl. x. fig. 3 (edition 1709). It is impossible to speak definitely on the specific position of the fern figured by SCHEUCHZER, but I feel more inclined to identify it as *Neur. macrophylla*, Brongt., than *Neur. Scheuchzeri*, Hoffm.

While preparing the Catalogue of the Palæozoic Plants in the British Museum, with only figures and descriptions of these species before me, and all

* *Quart. Jour. Geol. Soc.*, vol. iii. p. 424, 1847.

† In ROGER's *Geol. of Pennsylv.*, vol. ii. part 2, p. 857, 1858.

‡ The nervation of LINDLEY and HUTTON's figures is very diagrammatic, and by no means represents the correct nervation of the plant they figure.

§ *Coal Flora of Pennsylv.*, pp. 88, 89, 91, 1880.

|| Pl. xi. fig. 1.

of them, with one exception, misidentifications, I now find that the plants I there placed under *Neur. cordata*, L. & H. (? Brongt.),* should be referred to *Neur. Scheuchzeri*, Hoffm., and the ferns I placed under *Neur. Scheuchzeri* must be referred to *Neur. macrophylla*, Brongt. Further remarks will be found on this subject under *Neur. macrophylla*, Brongt.

My thanks are due to the Rev. H. H. WINWOOD, F.G.S., for facilities given for figuring the fine specimen shown on Pl. XXIII. fig. 1.

Neur. Scheuchzeri occurs in several of the English coal fields.

Localities.—Braysdown; Radstock; Upper Conygre; Lower Conygre; Camerton; Wellsway.

Neuropteris flexuosa, Sternberg.

Neuropteris flexuosa, Sternb., *Vers.*, i. fasc. iv. p. xvi.

Neuropteris flexuosa, Brongt., *Hist. d. végét. foss.*, p. 239, pl. lxxviii. fig. 2; pl. lxxv. figs. 2, 3.

Neuropteris flexuosa, Schimper, *Traité d. paléont. végét.*, vol. i. p. 434, pl. xxx. figs. 12, 13.

Neuropteris flexuosa, Kidston, *Catal. Palæoz. Plants*, p. 93.

Osmunda gigantea, var. β , Sternb., *Vers.*, i. pp. 36 and 39, pl. xxxii. fig. 2.

Neuropteris plicata, Lesqx., *Coal Flora of Pennsylv.*, pl. x. figs. 1-4.

Remarks.—Frequent. The plants figured as *Neuropteris plicata* by LES-QUEREUX,† seem clearly referable to *Neur. flexuosa*, Sternb., whatever may be the true value of STERNBERG's species.‡

Var. *rotundifolia*.

Neuropteris rotundifolia, Brongt., *Hist. d. végét. foss.*, p. 238, pl. lxx. fig. 1.

Neuropteris rotundifolia, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 56, pl. vii. figs. 3, 4.

Remarks.—This form has been found at Camerton, but it passes into *Neur. flexuosa*, of which it can only be regarded as a varietal form.

Localities.—Radstock; Camerton; Upper Conygre; Lower Conygre.

Neuropteris ovata, Hoffmann.

Plate XXII. fig. 1.

Neuropteris ovata, Hoffmann, Keferstein's *Teuchland geognostisch-geologisch dargestellt*, vol. iv. p. 158, pl. 1b, figs. 5, 6, 7 (excl. fig. 8), 1826.

Description.—Fronde much divided; rachis of primary pinnæ broad and finely striated; secondary pinnæ subopposite; rachis stout; pinnules alternate, oblong, apex rounded, superior basal angle rounded and sloping inwards, inferior angle produced as a rounded auricle. Veins fine, close, arched,

* The true *Neuropteris cordata* has not yet, as far as I am aware, been discovered in Great Britain.

† *N. plicata*, Lesqx., *Coal Flora*, loc. cit.

‡ *Vers.*, i. fasc. 4, p. xvi.; ii. p. 74, pl. xix. figs. 1-3.

usually divided four times, and meeting the margin of the pinnule at an acute angle. Midrib, strictly speaking, absent. Terminal lobe but little enlarged, broadly lanceolate, and generally confluent with uppermost pinnule or pinnules.

Remarks.—The specimens I identify as HOFFMANN'S plant agree in all respects with the figures and description given by him.

Neur. ovata has a great similarity in general appearance to *Neur. flexuosa*, Sternb., but is distinguished from it by constant and well-marked characters. Both species occur in the Radstock Coal Field; *Neur. flexuosa* is of frequent occurrence, but *Neur. ovata* is scarcely so common.

The terminal pinnule in *Neur. ovata* is never enlarged as in *Neur. flexuosa*. It is usually more or less broadly lanceolate, and at its basal extremity is connected with the uppermost pinnule or pinnules. The pinnules are auricled in a manner similar to those of *Neur. flexuosa*, but they do not overlap so much as in the latter-mentioned species. The veins are more arched than in *Neur. flexuosa*, and also appear to be more numerous.

A few of the upper pinnules are attached by their whole base to the rachis; the others are articulated by a short, almost imperceptible footstalk. A carefully enlarged drawing of a pinnule to show the nervation is given at fig. 1a. A true midrib can scarcely be said to be present. One or two veins, springing from the base of the pinnule, lie almost parallel, but, before reaching the apex, are lost in repeated dichotomies.

I have excluded from HOFFMANN'S reference his fig. 8, as there is really no evidence to show that this figure belongs to *Neur. ovata*, and much less that it should be regarded as the fruit of that species.*

HEER appears to have included under *Neur. flexuosa* more than one species of *Neuropteris*.† Some of his figures, I believe, should be referred to *Neur. ovata* (cf. pl. ii. fig. 2; pl. iii. fig. 2, &c.).

As neither the figure nor the description of the plant given by RÖMER as *Neur. ovata* agrees very well with HOFFMANN'S figures or description, I am doubtful of the correctness of RÖMER'S identification.‡

Neur. ovata is liable to be mistaken for a small form of *Neur. flexuosa*, but a comparison of well-preserved specimens of the two species will, I believe, at once show their specific individuality.

At fig. 1, Plate XXII., are given some pinnæ of *Neur. ovata*, drawn natural size.

Localities.:—Upper Conygre; Camerton; Radstock; Wellsway.

* See Kidston, *Trans. Roy. Soc. Edin.*, vol. xxxiii. pt. i. p. 150, 1887.

† *Flora foss. Helvetiæ*, p. 20, pls. ii. figs. 1-7; iii. 1-5; iv. 7-13; v. 2, 3.

‡ *Paleontographica*, vol. ix. p. 28, pl. vi. fig. 1.

Neuropteris rarinervis, Bunbury.

Neuropteris rarinervis, Bunbury, *Quart. Jour. Geol. Soc.*, vol. iii. p. 425, pl. xxii.

Neuropteris rarinervis, Lesqx., *Coal Flora of Pennsylv.*, p. 109, pl. xv. figs. 2-5.

Neuropteris rarinervis, Zeiller, *Bull. soc. géol. de France*, 3^e sér., vol. xii. p. 197.

Neuropteris rarinervis, Kidston, *Catal. Palæoz. Plants*, p. 91.

Remarks.—Though occurring at most of the localities visited, this fern is nowhere plentiful in the Radstock Coal Field.

Localities.:—Radstock; Camerton; Wellsway; Upper Conygre; Lower Conygre.

Neuropteris fimbriata, Lesqx.

Plate XXI. figs. 3-5.

Neuropteris fimbriata, Lesqx., *Geol. Report of Illin.*, vol. ii. p. 430; vol. iv. p. 384, pl. vi. fig. 4.

Neuropteris fimbriata, Lesqx., *Coal Flora of Pennsylv.*, vol. i. p. 81, pl. v. figs. 1-6.

Remarks.—A few isolated pinnules have been met with which may perhaps be referred to *Neur. fimbriata*, Lesqx. These are shown on Pl. XXI. figs. 3-5.

In the specimen given at fig. 5 the veins are a little finer than in those of figs. 3 and 4, and it may possibly be a small specimen of *Neuropteris (Cyclopteris) lacerata*, Heer.*

The other two figures, however, appear to agree more closely with LESQUEREUX'S *Neur. fimbriata*, but HEER'S and LESQUEREUX'S species approach very closely to each other, and the distinctive characters are not very prominent.

The fimbriation of the pinnules is a natural character, and not produced by an accidental flaying out of the tissue.

Localities.:—Upper Conygre; Camerton; Wellsway.

Dictyopteris, Gutbier, 1835, *Abdrücke und Versteinerungen des Zwickauer Schwarzkohlengebirges*, p. 62.**Dictyopteris Münsteri, Eichwald, sp.**

Plate XXI. fig. 6.

Odontopteris Münsteri, Eichwald, *Die Urvwelt Russlands*, Heft i. p. 87, pl. iii. fig. 2, 1840.

Dictyopteris Münsteri, Schimper, *Traité d. paléont. végét.*, vol. i. p. 618, 1869.

Dictyopteris Münsteri, Zeiller, *Bull. soc. géol. de France*, 3^e sér., p. 197, vol. xii.; *Études d. Gîtes Minéraux de la France; Bassin houil. d. Valenciennes, Descr. d. l. Flore Foss.*, pl. xlix. figs. 1-5, 1886.

Dictyopteris Hoffmanni, Römer, *Palæontographica*, vol. ix. p. 29, pl. vii. fig. 3, 1862.

Dictyopteris Hoffmanni, Schimper, *Traité d. paléont. végét.*, vol. i. p. 619.

Description.—Frond tripinnate, secondary pinnæ alternate, lanceolate; pinnules alternate, from shortly oval to oblong in form; upper pinnules united

* *Flora foss. Helvetiæ*, p. 17, pl. vi. fig. 7.

to the rachis by their whole base, lower attached by a short footstalk, articulated. Anterior basal angle of pinnule rounded, posterior basal angle slightly auricled. Medial vein flexuous, and extending almost to the apex. Lateral veins dividing several times, anastomosing, and forming an irregular network. Meshes next the midrib longer than those further removed from it. Terminal pinnule lanceolate. The frond also bears large cyclopteroid pinnules.

Remarks.—I am indebted to Mr GEORGE WEST, Camerton, for the fine specimen of this species shown on Pl. XXI. fig. 6. From the inequality of the pinnæ on opposite sides of the rachis, the example is evidently only a pinna. At the apex are several large simple lanceolate pinnules; on the third highest pinna of those preserved, on each side of the terminal pinnule are a pair of almost semicircular pinnules (fig. 6a × 3) attached to the rachis by their whole base. On the lower pinnæ the pinnules are oblong, with occasionally slightly tapered apices.

The veins form a very loose and irregular network. Those next the flexuous midrib are elongated in the longer direction of the pinnule, *i.e.*, more or less parallel with the midrib. The meshes formed by the subsequent dichotomies of the veins are directed more upwards and outwards, and become smaller towards the margin of the pinnule. The reticulation is formed rather by a bending of the veins towards each other than by their actual union. The pinnules on the main figure are not so large as some shown at the part indicated by an *x*. ZEILLER figures a cyclopteroid pinnule of this species (*loc. cit.*, fig. 4). These were probably borne on the main rachis as in *Neuropteris*.

A comparison of my example with RÖMER's *Dictyopteris Hoffmanni* leaves no doubt as to the identity of the two plants. But it seems equally clear that *D. Hoffmanni*, Römer, is only a more perfect specimen of *D. Münsteri*, Eich., sp., and this opinion has already been indicated by ZEILLER.*

Through the kindness of Dr WEISS I have been enabled to compare a specimen of *D. Hoffmanni* from Piesberg (the original locality of this species) with the Camerton plant; their nervation is similar, but in the size of the pinnules the Piesberg example agrees more with the figures of *D. Münsteri*, as given by ZEILLER, than the plant figured by me.

The presence of the large terminal pinnule does not seem to be a constant character, for on some of the specimens of *D. Münsteri*, figured by ZEILLER, which agree exactly on their nervation with the specimen of *D. Hoffmanni* sent me by Dr WEISS, the terminal pinnules are comparatively small.

Locality:—Camerton.

* *Bull. soc. géol. de France*, 3^e sér., vol. xii. p. 197.

Odontopteris, Brongniart, 1822, *Sur la classification des végétaux fossiles*,
p. 34.

Odontopteris Lindleyana, Sternb.

Odontopteris Lindleyana, Sternb., *Vers.*, ii. p. 78.

Odontopteris obtusa, L. & H. (not Brongt.), *Fossil Flora*, vol. i. pl. xl.

(?) *Odontopteris heterophylla*, Lesquereux, *Geol. Rep. of Illin.*, vol. ii. p. 433, pl. xxxviii. figs. 2, 5.

(?) *Odontopteris heterophylla*, *Coal Flora of Pennsylv.*, vol. i. p. 129, pl. xxii. fig. 6.

Remarks.—The type of LINDLEY and HUTTON's species is preserved in the University Museum, Oxford, but the figure given in the *Fossil Flora* is not a very correct representation of the specimen.

Odontopteris Lindleyana is very rare in the Radstock Coal Field, but occurs more plentifully in the shale over Pontydwaith Seam, Pochin Pit, near Tredegar, South Wales. The examination of the type and the additional specimens from Radstock and South Wales has shown that LESQUEREUX's *Odontopteris heterophylla* is probably identical with the plant figured in error by LINDLEY and HUTTON as *Odontopteris obtusa*.

Localities :—Radstock; Braysdown.

Mariopteris, Zeiller, 1879, *Bull. soc. géol. de France*, 3^e sér., vol. vii. p. 92.

Mariopteris nervosa, Brongt., sp.

Mariopteris nervosa, Zeiller, *Végét. foss. du terr. houil.*, p. 69, pl. clxvii. figs. 1–4.

Pecopteris nervosa, Brongt., *Hist. d. végét. foss.*, p. 297, pl. xciv.; pl. xcv. figs. 1, 2.

Pecopteris nervosa, Lindley and Hutton, *Fossil Flora*, vol. ii. pl. xciv.

Alethopteris nervosa, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 30, pl. xxxiii. figs. 2, 3.

Pseudopecopteris nervosa, Lesqx., *Coal Flora of Pennsylv.*, vol. i. p. 197, pl. xxxvi. figs. 1–3.

Remarks.—Very rare.

Localities :—Radstock; Upper Conygre.

Mariopteris muricata, Schlotheim, sp.

Mariopteris muricata, Zeiller, *Végét. foss. du terr. houil.*, p. 71, pl. clxvii. fig. 5.

Pecopteris muricata, Brongt., *Hist. d. végét. foss.*, p. 352, pl. xcv. figs. 3, 4; pl. xcvi.

Alethopteris muricata, Roehl, *Foss. Flora d. Steink. Form. Westphalens*, p. 78, pl. xi. fig. 1.

Pseudopecopteris muricata, Lesqx., *Coal Flora in Pennsylv.*, p. 203, pl. xxxvii. fig. 2.

Filicites muricatus, Schlotheim, *Flora d. Vorwelt*, p. 54, pl. xii. figs. 21 and 23.

Remarks.—Very rare.

Locality :—Radstock.

EXPLANATION OF PLATES.

PLATE XIX.

- Fig. 1. *Sphenopteris Woodwardi*, Kidston, n. sp., Camerton (nat. size), p. 348.
 Fig. 1a.b.c. *Sphenopteris Woodwardi*, pinnules enlarged, showing nervation.
 Fig. 2. *Sphenopteris tenuifolia*, Gutbier (Brongt. ?), Upper Conygre Pit, Timsbury (nat. size), p. 345.
 Fig. 2a.b. *Sphenopteris tenuifolia*, pinnules enlarged 3 times, showing nervation.
 Fig. 3. *Sphenopteris species*, Old Mills Pit, Farrington, Guernsey (nat. size). *Farrington Series*, p. 411.

PLATE XX.

- Fig. 1. *Schizostachys sphenopteroides*, Kidston, n. sp., Radstock (nat. size), p. 352.
 Fig. 1a. *Schizostachys sphenopteroides*, sporangia enlarged 3 times.
 Fig. 2. *Ptychocarpus oblongus*, Kidston, n. sp., Camerton (nat. size), p. 350.
 Fig. 2a. *Ptychocarpus oblongus*, two pinnules enlarged 3 times.
 Fig. 2b. *Ptychocarpus oblongus*, synangium? further enlarged.
 Fig. 3. *Rhacophyllum spinosum*, Lesquereux, Radstock (nat. size). Specimen in the collection of Mr J. M'Murtrie, p. 389.

PLATE XXI.

- Fig. 1. *Sphenopteris geniculata*, Germar and Kaulfuss, Kilmersdon Pit (nat. size), p. 346.
 Fig. 1a.b. *Sphenopteris geniculata*, pinnules enlarged, showing nervation.
 Fig. 2. *Neuropteris macrophylla*, Brongt., Braysdown (nat. size), p. 354.
 Fig. 3. *Neuropteris fimbriata*, Lesquereux, Wellsway Pit (nat. size), p. 361.
 Fig. 4. *Neuropteris fimbriata*, Camerton (nat. size).
 Fig. 5. *Neuropteris fimbriata* (?), Upper Conygre Pit, Timsbury (nat. size).
 Fig. 6. *Dictyopteris Münsteri*, Eichwald, sp., Camerton (nat. size), p. 361.
 Fig. 6a.b. *Dictyopteris Münsteri*, pinnules enlarged, showing nervation.

PLATE XXII.

- Fig. 1. *Neuropteris ovata*, Hoffmann, Camerton (nat. size), p. 359.
 Fig. 1a. *Neuropteris ovata*, pinnule enlarged $2\frac{1}{2}$ times, to show the nervation.
 Fig. 2. *Neuropteris macrophylla*, Brongt., Radstock (nat. size), p. 354.
 Fig. 2a. *Neuropteris macrophylla*, pinnule enlarged 2 times, to show the nervation.
 Fig. 3. *Neuropteris macrophylla*, Radstock (nat. size). Specimen in the collection of the Bath Museum.
 Fig. 3a. *Neuropteris macrophylla*, portion of pinnule enlarged, to show the nervation.

PLATE XXIII.

- Fig. 1. *Neuropteris Scheuchzeri*, Hoffmann, Radstock (nat. size). Specimen in the collection of the Bath Museum, p. 356.
 Fig. 1a. *Neuropteris Scheuchzeri*, portion of pinnule enlarged, to show the hairs.
 Fig. 2. *Neuropteris Scheuchzeri*, portion of pinnule enlarged 3 times, to show the nervation.
 Fig. 3. *Trigonocarpus Noeggerathi*, Brongt. (nat. size). In the collection of Mr J. M'Murtrie, p. 403.
 Fig. 4. *Rhabdocarpus multistriatus*, Presl, sp., Radstock (nat. size), p. 404.
 Fig. 5. *Cardiocarpus Gutbieri*, Geinitz, Radstock (nat. size). In the collection of Mr J. M'Murtrie, p. 403.
 Fig. 6. *Cardiocarpus*, Upper Conygre Pit, Timsbury (nat. size), p. 403.
 Fig. 7. *Carpolithus ovoideus*, Göppert and Berger, Wellsway Pit (nat. size), p. 404.
 Fig. 8. *Carpolithus ovoideus*, Camerton (nat. size).

PART II.

(Read 6th June 1887.)

Pecopteris, Brongniart.*Pecopteris*, Brongt., *Sur la Classification des Végétaux Fossiles*, p. 33, 1822.*Cyatheites*, Göppert, *Syst. fil. foss.*, p. 319, 1836.*Asterocarpus*, Göppert, *Syst. fil. foss.*, p. 188, 1836.*Scolecopteris*, Zenker, *Linnæa*, vol. xi. p. 509, 1837.*Hawlea*, Corda, *Flora protogæa*, p. 90, 1845.

Remarks.—Several generic names, originating from some supposed likeness to recent genera, or from the arrangement of the sporangia, have been proposed by different authors for the ferns included here, and which were originally placed by BRONGNIART in his genus *Pecopteris*.

The name *Cyatheites* was given by GÖPPERT to certain members of the genus on account of their supposed resemblance to some of the *Cyathea*. This supposed resemblance was dependent in great measure on imperfect preservation of the fruit.

The genus *Asterocarpus* of the same author was founded to comprise certain *Pecopterids*, in which the *exannulate sporangia* are arranged in a stellate manner; the greater number of his *Cyatheites* are now known, from the structure of their fruit, to belong to his *Asterocarpus*.

In *Scolecopteris*, Zenker, the *exannulate sporangia* are also arranged in stellate groups, but the individual sporangia are produced upwards in a sharp point, thus differing from *Asterocarpus*, where the sporangia are short.

Hawlea, Corda, is most probably identical with *Asterocarpus*.

The upper surface of the pinnules of many species of *Pecopteris* is covered with short closely adpressed hairs. This villosity has been observed on many of the Radstock species, viz.,—*Pec. arborescens*, *Pec. arborescens*, var. *cyathea*, *Pec. oreopteridia*, *Pec. villosa*, and *Pec. Miltoni* (*Pec. abbreviata*), and I have also observed the same character on specimens of typical *Pec. Miltoni*, from Claycross, Derbyshire, and Ashton-under-Lyne, Lancashire, and on *Pec. polymorpha* from the Forest of Dean. On several of these species a villosity has previously been observed. It is probable that this villosity will be found to be much more common in the genus *Pecopteris* than generally supposed, as it is only observable on specimens in an exceptionally good state of preservation.

The fruit of many of the species of the genus has been observed and described.

Pecopteris arborescens, Schlotheim, sp.

- Pecopteris arborescens*, Brongt., *Hist. d. végét. foss.*, p. 310, pls. cii. ; ciii. ; figs. 2, 3.
Pecopteris arborescens, Germar, *Vers. v. Wettin u. Löbejun*, p. 97, pls. xxxiv, xxxv. (fig. 4?).
Pecopteris arborescens, Grand' Eury, *Flore Carbon du Départ. de la Loire*, p. 68, pl. viii. fig. 6.
Pecopteris arborescens, Zeiller, *Végét. foss. d. terr. houil.*, p. 81, pl. clxix. fig. 4.
Pecopteris arborescens, Kidston, *Catal. Palæoz. Plants*, pp. 113 and 253.
Cyatheites arborescens, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 24, pl. xxviii. figs. 7-11.
Cyatheites arborescens, Heer, *Flora foss. Helv.*, p. 27, pl. viii. figs. 1-4.
Cyathocarpus arborescens, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 84.
Filicites arborescens, Schlotheim, *Flora d. Vorwelt*, p. 41, pl. viii. figs. 13, 14.
Pecopteris platyrachis, Brongt., *Hist. d. végét. foss.*, p. 312, pl. cii. figs. 4, 5.
Pecopteris aspidioides, Brongt., *Hist. d. végét. foss.*, p. 311, pl. cxii. fig. 2.
Asplenites nodosus, Göpp., *Syst. fil. foss.*, p. 280, pl. xix. figs. 1-3.
Pecopteris cyatheoides, Schimper, *Traité d. paléont. végét.*, vol. i. p. 523, pl. xli. fig. 14.
Pecopteris cyathea, Brongt., *Hist. d. végét. foss.*, p. 307, pl. ci. figs. 1-3 (excl. fig. 4 = *P. Candoliana*).
Pecopteris cyathea, Grand' Eury, *Flore Carbon d. Départ. de la Loire*, p. 68, pl. viii. fig. 7.
Pecopteris cyathea, Zeiller, *Végét. foss. du terr. houil.*, p. 82, pl. clxix. figs. 5, 6.
Filicites cyatheus, Schlotheim, *Flora d. Vorwelt*, p. 38, pl. vii. fig. 11.
Aspidites decussatus, Göpp., *Syst. fil. foss.*, p. 369, pl. xxvi. figs. 1, 2.

Remarks.—In typical *Pec. arborescens* the veins are simple ; in the form distinguished by SCHLOTHEIM as *Filicites cyatheus* the veins are sometimes simple, but usually once divided, and even occasionally divided three times. The pinnules are also more oblong than in typical *Pec. arborescens*.

The majority of botanists unite *Pec. cyathea* with *Pec. arborescens*, but, among recent writers, ZEILLER and GRAND' EURY keep them separate. The species is very common in the Radstock area, and occurs in a very fine state of preservation. After carefully examining many examples, though the specimens can generally be referred to their respective forms without much difficulty, they are so connected by intermediate conditions that I can only regard *Pec. arborescens* and *Pec. cyathea* as different states of one species.

The upper surface of the pinnules of some of the typical specimens of *Pec. arborescens* and the form *cyathea* is covered with short adpressed hairs, similar to those on the specimen of *Pec. (Scolecopteris) cyathea* figured by STUR.*

The *Asplenites nodosus*, Göpp., is only a somewhat imperfectly preserved fruiting specimen of *Pec. arborescens*, and his *Aspidites decussatus* is apparently the corresponding condition of SCHLOTHEIM'S *Filicites cyatheus*. Specimens agreeing with both these so-called species have been collected.

The form *cyathea* is of as frequent occurrence as typical *Pec. arborescens*.

Localities.:—Radstock; Wellsway Pit, Braysdown; Kilmersdon Pit; Upper Conygre Pit; Camerton.

* STUR, *Sitzb. d. k. Akad. d. Wissensch.*, vol. lxxxviii. Abth. i. p. 750, fig. 25, 1883.

Pecopteris Candolliana, Brongniart.

- Pecopteris Candolliana*, Brongt., *Hist. d. végét. foss.*, p. 305, pl. c. fig. 1.
Pecopteris Candolliana, Germar, *Vers. v. Wettin u. Löbejun*, p. 108, pl. xxxviii.
Pecopteris Candolliana, Grand' Eury, *Flore Carb. du Départ. de la Loire*, p. 69, pl. viii. fig. 8.
Pecopteris Candollei, Zeiller, *Végét. foss. du terr. houil.*, p. 84.
Cyathocarpus Candolleanus, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 85.
Pecopteris affinis, Brongt. (not Schlotheim), *Hist. d. végét. foss.*, p. 306, pl. c. figs. 2, 3.
Pecopteris cyathea, Brongt. (in part), *Hist. d. végét. foss.*, pl. ci. fig. 4.

Remarks.—Very rare.

Localities :—Radstock ; Braysdown Colliery.

(?) Pecopteris asper, Brongniart.

- Pecopteris asper*, Brongt., *Hist. d. végét. foss.*, p. 339, pl. cxx. figs. 1–4.
Pecopteris asper, Zeiller, *Bull. soc. géol. d. France*, 3^e sér., vol. xii. p. 202 ; *Flore foss. d. Bassin Houil. d. Valenciennes*, pl. xxix. figs. 1–3.

Remarks.—I refer to this species two small specimens collected at Timsbury, but, owing to their fragmentary nature, it is desirable that more perfect examples be examined before definitely recording the occurrence of this species.

Locality :—Upper Conygre Pit.

Pecopteris pennæformis, Brongniart.

- Pecopteris pennæformis*, Brongt., *Hist. d. végét. foss.*, p. 345, pl. cxviii. figs. 3, 4.
Pecopteris pennæformis, Brongt., *Class. d. végét. foss.*, p. 33, pl. ii. fig. 3.
Pecopteris pennæformis, Schimper, *Traité d. paléont. végét.*, vol. i. p. 505.
Pecopteris pennæformis, Zeiller, *Bull. soc. géol. d. France*, 3^e sér., vol. xii. p. 201, 1883 ; *Flore foss. d. Bassin houil. d. Valenciennes*, pl. xxx. figs. 1–4.
Pecopteris æqualis, Brongt., *Hist. d. végét. foss.*, p. 343, pl. cxviii. figs. 1, 2.

Remarks.—Extremely rare, only a single specimen having been met with.

Locality :—Camerton.

Pecopteris unita, Brongniart.

Pl. XXIV. figs. 2–9.

- Pecopteris unita*, Brongt., *Hist. d. végét. foss.*, p. 342, pl. cxvi. figs. 1–5.
Pecopteris unita, Kidston, *Catal. Palæoz. Plants*, p. 122 (excl. syn. *Pecopteris elegans*).
Pecopteris unita, Grand' Eury, *Flore Carb. du Départ. de la Loire*, p. 76, pl. viii. fig. 13.
Pecopteris unita, Lesqx., *Coal Flora of Pennsylv.*, p. 223, pl. xl. figs. 1–7.
Cyatheites unitus, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 25, pl. xxix. figs. 4, 5.
Cyathocarpus unitus, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 88, pl. xii. figs. 5, 6.
Goniopteris elliptica, Font. and White, *Perm. or Upper Carb. Flora*, p. 83, pl. xxx. fig. 1.

Pecopteris unita, forma emarginata, Göpp., sp.

- Pecopteris longifolia*, Brongt., *Hist. d. végét. foss.*, p. 273, pl. lxxxiii. fig. 2.
Pecopteris longifolia, Germar, *Vers. v. Wettin u. Löbejun*, p. 34, pl. xiii. figs. 2–4.
Stichopteris longifolia, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 97, pls. ix., x. figs. 7, 8.
Pecopteris emarginata, Bunbury, *Quart. Jour. Geol. Soc.*, vol. ii. p. 86, pl. vi., 1846.
Pecopteris emarginata, Lesqx., *Coal Flora of Pennsylv.*, p. 225, pl. xxxix. fig. 11.
Diplazites emarginatus, Göpp., *Syst. fil. foss.*, p. 274, pl. xvi. figs. 1, 2.

Remarks.—This species is common throughout the whole of the Radstock area, but usually occurs in a fragmentary condition, seldom more than isolated pinnæ being met with.

Many botanists regard *Pec. emarginata*, Göpp., sp. (= *Pec. longifolia*, Brongt., not Sternb.), as specifically distinct from *Pec. unita*, Brongt.; on the other hand, some regard them as only different portions of one species.

I have carefully collected specimens of the plants that have been referred respectively to *Pec. unita*, Brongt., and *Pec. emarginata*, Göpp., sp., and compared them with specimens of the latter species from Wettin, with which many of the Radstock examples agree, but have failed to discover any character by which *Pec. emarginata* can be separated specifically from *Pec. unita*. They seem to me so to pass into each other that their separation appears arbitrary, and not determined by any fixed character peculiar to either form.

A few specimens in fruit, identical with WEISS's figure of *Stichopteris emarginata* (= *Pec. emarginata*, Göpp., sp.), have also been met with.

For the satisfaction of those who may regard *Pec. emarginata* as a distinct species, its distribution is given separately under the distinction of *Pec. unita*, *forma emarginata*.

Description of Specimens Figured.

Pl. XXIV. fig. 3, *Pec. unita*, Brongt.; from New Mills Pit (*Farrington Series*).—This sketch shows the typical plant as figured by BRONGNIART in his *Hist. d. végét. foss.*, pl. cxvi. fig. 1. On the lower pinnæ the pinnules are separate to the base, but as the pinnæ approach the apex of the specimen (which from the inequality of the pinnæ on the two sides of the rachis is evidently a pinna and not the terminal portion of a frond), the pinnules become more or less united among themselves, till on the uppermost pinnæ the pinnules are so completely united that the pinnæ appear entire or only slightly dentate. At fig. 3a are given two pinnules, enlarged 2 times, from a lower pinnæ, to show the nervation.

The veinlets are sometimes almost straight, but usually curved upwards (as in fig. 5a), though occasionally curved outwards (as in fig. 3a).

Pl. XXIV. fig. 9, *Pec. unita*, Brongt.; Camerton.—This figure shows the pinnules united to each other for about two-thirds of their entire length. The specimen is a portion of a primary (?) pinna nearer its base than that just described (fig. 3), and corresponds to BRONGNIART's fig. 5, pl. cxvi. The veinlets are curved upwards,—the two contiguous basal veinlets coalescing and extending to the base of the notch that separates the free portions of neighbouring pinnules. This arrangement of the nervation—the union of the two basal contiguous veins and the formation of a veinless triangle at the base and

between the contiguous pinnules—has induced some botanists to employ PRESL's genus *Goniopteris* for this and some allied species.

Pl. XXIV. fig. 5, *Pec. unita*, Brongt. ; Old Mills Pit (*Farrington Series*).—This small specimen differs from the last in the segments being slightly more elliptical, the specimen being in fact the *Goniopteris elliptica*, Fontaine and White.*

Pl. XXIV. fig. 4, *Pec. unita*, Brongt. ; Camerton.—This would perhaps be regarded by some as *Pec. longifolia*, Brongt., but I believe it to be the uppermost entire pinnæ of *Pec. unita*. A like view is taken of a similar specimen figured by WEISS in his *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, pl. xii. fig. 5.

Probably the *Pec. lanceolata*, Lesqx., should also be referred to *Pec. unita* as its upper portion.†

Pl. XXIV. fig. 6, *Pec. unita, forma emarginata* ; Camerton.—This specimen is clearly the *Pec. longifolia*, Brongt. (= *P. emarginata*, Göpp.).‡ Enlarged drawings of the nervation are given at fig. 6a. In comparing this specimen with that given at fig. 4, the differences are not greater than what occur in pinnæ situated on different parts of the same frond.

Figs. 4 and 6 are similar to the specimens GERMAR has figured as *Pec. longifolia* in his *Vers. d. Steink. v. Wettin u. Löbejun*, fasc. 3, pl. xiii. My fig. 4 corresponds to his fig. 2, and my fig. 6 to his figs. 3, 4.

Pl. XXIV. figs. 7, 8, *Pec. unita, forma emarginata*. Fig. 7 from Radstock ; fig. 8 from Upper Conygre Pit, Timsbury.—These figures also represent the *Stichopteris longifolia*, Brongt., sp., of WEISS,§ which is evidently similar to *Pec. emarginatus*, Göpp., sp., as figured by BUNBURY.

Pl. XXIV. fig. 2, *Pec. unita, forma emarginata* ; from Camerton.—This specimen would also be referred, by those who regard *Pec. unita* and *Pec. emarginata* or *longifolia* as distinct species, to the latter plant.

In regard to the various figures I have given in illustration of the different forms assumed by *Pec. unita*, if only characteristic specimens of *Pec. unita*, Brongt. (fig. 3), are dealt with on the one hand, or those characteristic of *Pec. longifolia* (figs. 2 and 6) on the other hand, one would probably be led to conclude that there were here two very distinct species. When, however, a large series of specimens is examined, these two supposed species are so intimately connected by intermediate forms that I have found myself unable definitely to say where *Pec. unita* ends and *Pec. emarginata* begins. I therefore class the latter as a form of *Pec. unita*.

* *Perm. or Upper Carb. Flora*, p. 83, pl. xxx. fig. 1.

† *Pecopteris lanceolata*, Lesqx., *Coal Flora of Pennsylv.*, p. 227, pl. xxxix. figs. 9, 10 = *Alethopteris lanceolata*, Lesqx., *Geol. Rep. of Illin.*, vol. iv. p. 398, pl. xiii. figs. 1-3.

‡ *Hist. d. végét. foss.*, pl. lxxxiii. fig. 2.

§ *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, pls. ix., x. figs. 7, 8.

|| *Quart. Jour. Geol. Soc.*, vol. ii. p. 86, pl. vi., 1846.

In my *Catalogue of Palæozoic Plants* I united *Pec. elegans* with *Pec. unita* in error.*

Localities:—

Pec. unita, Brongt.

Radstock ; Braysdown Colliery ; Upper Conygre Pit ; Lower Conygre Pit ; Kilmersdon Pit ; Wellsway Pit ; Camerton.

Pec. unita, Brongt., *forma emarginata*, Göpp., sp.

Wellsway Pit ; Braysdown Colliery ; Camerton ; Radstock ; Upper Conygre Pit.

Pecopteris villosa, Brongniart.

Pecopteris villosa, Brongt., *Hist. d. végét. foss.*, p. 316, pl. civ. fig. 3.

Remarks.—This species is included here merely as having been founded by BRONGNIART on a specimen from near Bath.

It is now well known that the outer surface of the pinnules of various species of *Pecopteris* possesses a villosity, and as this villosity often quite obscures the veins, it is occasionally extremely difficult, if not even impossible, to determine to which species such specimens should be referred. ZEILLER suggests that *Pec. villosa* may perhaps belong to *Pec. abbreviata*, Brongt. (= *Pec. Miltoni*, Artis), but as the nervation on the type specimen is obliterated, it is quite impossible, in the absence of this most important character for the specific determination of the members of the genus *Pecopteris*, to decide to which species it should be referred.

Having observed a villosity on an undoubted specimen of *Pec. oreopteridia*, Schl., sp.,† and from the general outline of *Pec. villosa*, Brongt. agreeing so closely with that of *Pec. oreopteridia*, I am inclined to refer *Pec. villosa* to that species. The point, however, cannot be definitely settled from the meagre evidence before us.‡

Only one thing seems clear, that *Pec. villosa*, Brongt., most probably represents a condition of a species known under another name when the veins are not obscured by the villosity, and is not itself a plant possessing a true individuality.

The *Cyatheites villosus*, Geinitz,§ is referable to *Pec. abbreviata*, Brongt. (= *Pec. Miltoni*, Artis).

Locality:—Near Bath (*Brongniart*).

* See ZEILLER, *Végét. foss. d. terr. houil.*, p. 93, pl. clxvi. figs. 5, 6.

† See Pl. XXVII. figs. 3, 4.

‡ See ZEILLER, "Notes sur la flore houillère des Asturies," *Mem. Soc. Géol. du Nord*, 1882, p. 12.

§ *Vers. d. Steinkf. in Sachsen*, pl. xxix. figs. 6–8.

Pecopteris oreopteridia, Schlotheim, sp.

Pl. XXVII. figs. 3, 4; Pl. XXVIII. figs. 1, 2.

Pecopteris oreopteridia, Brongt., *Hist. d. végét. foss.*, p. 317, pl. civ. figs. 1, 2; pl. v. figs. 1, 2, 3.*Pecopteris oreopteridia*, Renault, *Cours d. botan. foss.*, 1883, p. 110, pl. xviii. figs. 5, 5bis; pl. xix. figs. 7-12.*Pecopteris oreopteridia*, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 66.*Pecopteris oreopteridia*, Zeiller, *Bull. soc. géol. d. France*, 3^e sér., vol. xiii. p. 138, pl. ix. figs. 1, 1a.*Cyatheites oreopteroides*, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 25, pl. xxviii. fig. 14.*Filicites oreopteridius*, Schlotheim, *Flora d. Vorwelt*, p. 36, pl. vi. fig. 9.

Remarks.—This species is common in the Radstock Series, and some very fine specimens have been collected. Of these, one which I received from Mr JOB MOON, Camerton, deserves special note. This example shows three primary (?) pinnae springing from a common rachis, of which only the central primary pinna is perfect. It measures $14\frac{1}{2}$ inches in length, and its greatest diameter, which is towards the centre of the pinna, is 6 inches. The pinna to the right of this one is longer, but, not being perfect, I am unable to give its exact measurements. In outline the primary pinnae are broadly lanceolate.

Of the three primary (?) pinnae shown on the portion of the frond that has been preserved, the uppermost primary (?) pinna exhibits still, on the inferior side of its rachis, portions of 17 secondary (?) pinnae. These are all barren.

The central primary (?) pinna bears about 36 pairs of alternate lanceolate secondary (?) pinnae, of which the 6 or 7 lower pairs are barren, or only bear a few fruiting pinnules; the succeeding 6 or 7 pairs of pinnae are soriferous, the fruit being borne on the central pinnules of the pinnae. The remaining upper pinnae are barren.

On the remaining and lowest of the three primary (?) pinnae preserved on the specimen, the 15 lowest secondary (?) pinnae are soriferous, the remaining upper pinnae being barren.

Two secondary (?) pinnae from the central primary (?) pinna are shown on Pl. XXVIII. figs. 1, 2. On fig. 1 the fruiting pinnules are seen to occupy the central part of the pinna; on fig. 2 only the third pair from the base are soriferous.

The most interesting point in connection with these soriferous pinnules is the occurrence on them of a dense villous covering. An enlarged drawing of such a pinnule is shown on Pl. XXVII. fig. 4. On a few of the barren pinnules a villosity can also be detected, but it is so slight that it cannot be compared in importance or prominence with that of the soriferous pinnules.

An enlarged barren pinnule (Pl. XXVII. fig. 3) shows from its nervation that this specimen is clearly referable to *Pec. oreopteridia*, Schl., sp.

Since detecting the presence of a villosity on the pinnules of *Pec. oreopteridia*,

I have been led to suspect that perhaps *Pec. villosa*, Brongt., should be referred to this species.

Localities:—Radstock; Braysdown Colliery; Upper Conygre Pit; Camerton.

Pecopteris Cistii, Brongniart.

Pecopteris Cistii, Brongt., *Hist. d. végét. foss.*, p. 330, pl. cvi.

Remarks.—I only know this species from BRONGNIART'S figures and description. Of the two specimens figured by him, one came from Dunkerton, near Bath, and the other from Wilkesbarre, Pennsylvania.

Dunkerton Pit is now closed, but I have carefully examined other localities where the same coals are worked in the hope of rediscovering this species, but have hitherto been unsuccessful. LESQUEREUX says in regard to *Pec. Cistii*—"Though I have seen many fragments referred to it, I have never been able to positively recognise in any the characters indicated by the author."* I can fully endorse this statement, for, though I have also seen specimens labelled "*Pec. Cistii*," none of them possessed characters entirely in agreement with BRONGNIART'S description, and were, I am afraid, only *Pec. oreopteridia*.

The type from Dunkerton, which belonged to the Museum of the University of Oxford, appears to have been lost or mislaid, for, when visiting that collection a short time ago, we were unable to discover it.

Locality:—Dunkerton (*Brongniart*).

Pecopteris Bucklandii, Brongniart.

Pecopteris Bucklandii, Brongt., *Hist. d. végét. foss.*, p. 319, pl. xcix. fig. 2.

Pecopteris Bucklandii, Grand' Eury, *Flore Carb. du Départ. de la Loire*, p. 75.

Pecopteris Bucklandii, Schimper, *Traité d. paléont. végét.*, vol. i. p. 504.

Pecopteris Bucklandii, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 64.

Pecopteris pseudo-Bucklandii, Germar, *Vers. d. Steink. v. Wettin u. Löbejun*, p. 106, pl. xxxvii.

Remarks.—This species is very rare, but a few examples have been collected at Camerton—the original locality.

It is very doubtful if the fern figured as *Pec. Bucklandii* by LINDLEY and HUTTON† really belongs to this species. If their figure is correct, I am inclined to think that it does not. STUR suggests that LINDLEY and HUTTON'S plant may perhaps be his *Hawlea Schaumberg-Lippeana*, but this is also very doubtful.‡

Locality:—Camerton.

* *Coal Flora of Pennsylv.*, p. 244.

† *Fossil Flora*, vol. iii. pl. cexxiii.

‡ *Carbon-Flora d. Schatzlarer-Schichten*, p. 120, pl. lvii. fig. 1; pl. lviii. figs. 1–4.

Pecopteris pteroides, Brongniart.*Pecopteris pteroides*, Brongt., *Hist. d. végét. foss.*, p. 329, pl. xcix. fig. 1.*Pecopteris pteroides*, Germar, *Vers. d. Steink. v. Wettin u. Löbejun*, p. 103, pl. xxxiv.*Pecopteris pteroides*, Grand' Eury, *Flore Carb. du Départ. de la Loire*, p. 75.*Asterocarpus pteroides*, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 91.

Remarks.—*Pec. pteroides* is extremely rare; the only specimen I have seen from the Radstock Series is one in the British Museum, labelled as coming from "near Bath."

The figures given by GEINITZ as *Pec. (Alethopteris) pteroides* do not appear to belong to this species.*

Locality:—"Near Bath."

Pecopteris crenulata, Brongniart.*Pecopteris crenulata*, Brongt., *Hist. d. végét. foss.*, p. 300, pl. lxxxvii. fig. 1.*Pecopteris crenulata*, Zeiller, *Bull. soc. géol. d. France*, 3^e sér., vol. xii. p. 200, 1883; *Flore foss. du Bassin houil. de Valenciennes*, pl. xxv. figs. 1-4.

Remarks.—I refer to this species a single specimen collected at Camerton. It is, however, possible that some other examples which I have not yet been able satisfactorily to identify may belong to this species.

Locality:—Camerton.

Pecopteris polymorpha, Brongniart.*Pecopteris polymorpha*, Brongt., *Hist. d. végét. foss.*, p. 331, pl. cxiii.*Pecopteris polymorpha*, Grand' Eury, *Flore Carb. du Départ. de la Loire*, p. 74, pl. viii. figs. 10, 11.*Pecopteris polymorpha*, Renault, *Cours d. botan. foss.*, p. 116, pl. xx. figs. 1-10, 1883.*Pecopteris polymorpha*, Zeiller, *Végét. foss. d. terr. houil.*, p. 91, pl. clxix. figs. 1, 2, 3.*Pecopteris Miltoni*, Brongt. (not Artis), in part, *Hist. d. végét. foss.*, pl. cxiv. figs. 2, 7 (other figs.?).

Remarks.—Not common. A good fruiting example was collected at Radstock.

I have detected the presence of short adpressed hairs on the upper surface of the pinnules of a specimen of this species from Trafalgar Colliery, near Drybrook, Forest of Dean. This villosity is so copious that on some of the pinnules the nervation is almost completely obscured.

Localities:—Radstock; Braysdown Colliery; Camerton.

* *Vers. de Steinkf. in Sachsen*, pl. xxxii. figs. 1-5.

Pecopteris Miltoni, Artis, sp.

- Pecopteris Miltoni*, Germar, *Vers. d. Steink. v. Wettin u. Löbejun*, p. 63, pl. xxvii. (excl. syn. *Pec. polymorpha*, and *P. Miltoni*, Brongt., not Artis).
Pecopteris Miltoni, Sterzel, *Die Flora d. Rothl. im nordwest. Sachsen*, p. 6, pl. i. (xxi.) figs. 1-7 (in Dames & Kayser's *Paléont. Abhandl.*, Band iii. Heft ii. p. 240 (excl. syn. *Pec. polymorpha*).
Cyatheites Miltoni, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 27, pl. xxx. fig. 5 (fig. 6?), var. *abbreviata*, pl. xxx. figs. 7-8; pl. xxxi. figs. 1 (2, 3?), 4 (refs. in part).
Filicites Miltoni, Artis, *Antedil. Phytol.*, pl. xiv.
Pecopteris crenata, Sternberg, *Vers.*, i. p. xx. pl. x. fig. 7; ii. p. 154.
Hawlea pulcherrima, Corda, *Flora protogæa*, p. 90, pl. lvii. figs. 7, 8.
Hawlea Miltoni, Stur, *Carbon-Flora*, p. 108, pl. lix. and pl. lx. (excl. figs. 3-4., syn. in part).
 (?) *Goniopteris brevifolia*, Schimper, *Traité d. paléont. végét.*, vol. i. p. 546.
Pecopteris abbreviata, Brongt., *Hist. d. végét. foss.*, p. 337, pl. cxv. figs. 1-4.
Pecopteris abbreviata, L. & H., *Fossil Flora*, pl. clxxxiv.
Pecopteris abbreviata, Zeiller, "Notes sur la flore houillère des Asturies," p. 12, (*Mem. Géol. Soc. du Nord*, 1882); *Flore foss. du Bassin houill. de Valenciennes*, pl. xxiv. figs. 1-4, 1886.
Cyatheites villosus, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 25, pl. xxix. figs. 6-8.*

Remarks.—A great difference of opinion exists among botanists in regard to the specific value of *Pec. Miltoni*, Artis, sp., *Pec. abbreviata*, Brongt., and *Pec. polymorpha*, Brongt.

For a few years I have carefully collected those species and visited several of the British Coal Fields where they occur, with the special object of satisfying myself as to the true relations of *Pec. Miltoni*, *Pec. abbreviata*, and *Pec. polymorpha* to each other.

Several authors have united them under one name.† In the barren condition, the discrimination of the species is often difficult. In *Pec. polymorpha* the nervation is closer, the divisions of the veinlets more numerous and straighter than in *Pec. Miltoni* and *Pec. abbreviata*, where the nervation has often a slight flexuosity. *Pec. abbreviata*, as will be seen, I regard as identical with *Pec. Miltoni*.

Even in the barren condition, I believe, *Pec. polymorpha* can be safely separated from all other species, if the specimens are well preserved and at all typical. Its fruit, however, at once establishes its individuality, and clearly separates it from *Pec. Miltoni*.

Pec. Miltoni was described by ARTIS from El-se-car Colliery, near Milton Furnace, Yorkshire, in 1825:—*Pec. abbreviata* by BRONGNIART from mines near

* I am very doubtful if the following species referred by STUR to *Pec. Miltoni* should be so included:—*Asplenites heterophyllus*, Göpp.; *Aspl. crispus*, Göpp.; *Balantites Martii*, Göpp. The following, also included by the same author, appear to me to have no connection with *Pec. Miltoni*:—*Adiantites giganteus*, Göpp.; *Cyclopteris obliqua*, L. & H.; *Schizopteris lactuca*, Roehl. (*Foss. Flora Westph.*, pl. xviii.); and *Cyclop. oblata*, L. & H.

† Geinitz, *loc. cit.*; Germar, *loc. cit.*; Sterzel, *loc. cit.*

Bath (Radstock Coal Field), and from the mines of Anzin, near Valenciennes, Département du Nord.

I may mention here that the plants figured by BRONGNIART as *Pec. Miltoni*, *Hist. d. végét. foss.*, pl. cxiv., with perhaps the exception of his fig. 8, probably do not belong to this species, but to his own *Pec. polymorpha*.* BRONGNIART's figs. 2 and 7 evidently belong to *Pec. polymorpha*; his figs. 1, 3, 4, 5, and 6 most probably also belong to the same fern, but on these figures I express no definite opinion. His fig. 8 has been raised to specific rank by SCHIMPER, under the name of *Goniopteris brevifolia*,† but I think it is referable to *Pec. Miltoni*. I have collected at Radstock specimens which I cannot distinguish from it. BRONGNIART's figure does not give much data from which to form any satisfactory opinion.

The type of *Pec. Miltoni* has disappeared, but while visiting some museums and private collections in Lancashire, Yorkshire, and Derbyshire, where coals are worked on or about the same horizon as those from which *Pec. Miltoni* was derived, I met with a number of undoubted specimens of it; but I am specially indebted to Mr GEORGE WILD, Bardsley Colliery, Ashton-under-Lyne, and to Dr PEGLER, Stonebroom, Derbyshire, for facilities for examining specimens of this species.

In my several visits to Radstock I also collected many fine specimens of the plant described as *Pec. abbreviata* by BRONGNIART. These specimens I have compared with the figures and descriptions of *Pec. Miltoni* and *Pec. abbreviata*, and have also compared the specimens from different localities with each other, as well as with some from the Coal Field of Valenciennes, kindly sent me by M. ZEILLER, but have failed to discover any character by which they can be separated.

It is admitted by all, including those who regard *Pec. Miltoni* and *Pec. abbreviata* as distinct species, that *Pec. abbreviata* at all events is very polymorphic, and those who are most intimate with this fern are most cognizant of this fact.

ZEILLER has carefully entered into this subject in his *Notes sur la flore houillère des Asturies* in his remarks on *Pec. abbreviata*. He describes the little hairs on the upper surface of the pinnules of this species, whose presence, often entirely obscuring the nervation, has led to its being identified as *Pec. villosa*, and as an instance he cites the identification of *Pec. abbreviata* as *Pec. villosa* by GEINITZ.‡

Whether the *Pec. villosa*, Brongt., can be referred to *Pec. abbreviata* or not, must in the meantime from want of evidence remain an open question.

* See ZEILLER, *Mem. Soc. Géol. du Nord*, loc. cit.

† *Traité d. paléont. végét.*, vol. i. p. 546.

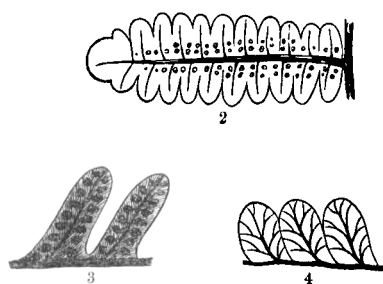
‡ That this so-called *Pec. villosa* is in reality the *Pec. Miltoni* (= *Pec. abbreviata*, Brongt.) will, I think, be admitted by all who have studied the subject.

Referring to the specific value of *Pec. Miltoni*, Artis, sp., and *Pec. abbreviata*, Brongt., ZEILLER says:—"In regard to the question whether *Pec. Miltoni* and *Pec. abbreviata* are not identical, and of which *Pec. Miltoni* is the older name, having been founded in 1825, though not arriving at a wholly sure conclusion, I incline meanwhile towards the negative.

"The general form of the pinnules indicated by ARTIS appears very analogous to those of *Pec. abbreviata*, but the nervation is not figured, which renders a comparison almost impossible, this character being almost the only one by which one is able satisfactorily to support it; further, the figure and diagnoses given by the author indicate the sori to be marginal, or almost marginal, while I have already mentioned that the groups of capsules of *Pec. abbreviata* cover all the inferior surface of the pinnule, and are by no means marginal. The figures given by GEINITZ, under the name of *Cyatheites Miltoni*,* show likewise the fructification almost marginal (pl. xxx. figs. 6, 6a, and also *Cyatheites Miltoni* var. *abbreviatus*, figs. 8, 8a, and 8b). This character of the disposition of the sori appears to me sufficiently important to compel one to regard *Pec. abbreviata* as decidedly distinct from *Pec. Miltoni*. When, as to its union with *Pec. polymorpha*, proposed by various authors, it is hardly necessary to mention that the characters of the fructification separate absolutely these two species, *Pec. abbreviata* having the short capsules of *Asterotheca*, and *Pec. polymorpha* the long sharp capsules of *Scolecopteris*. They belong further to different horizons" ("niveaux différents").†

I must first refer to *Pec. Miltoni* as being of older date than *Pec. abbreviata*.

As is frequently the case with *Pec. abbreviata*, in *Pec. Miltoni* the nervation is seldom shown on account of the dense villosity with which the upper



Pecopteris Miltoni, Artis, sp.

Fig. 2. From Bardsley Colliery, Ashton-under-Lyne, Lancashire.

Figs. 3, 4. From Claycross, Derbyshire (Middle Coal Measures).

Figures enlarged two diameters.

surface of the pinnules is covered. This villosity is in all respects identical to that occurring on the pinnules of specimens which have been distinguished as *Pec. abbreviata*, Brongt., from the Radstock Series. At text fig. 4 is given an enlarged drawing of three pinnules of *Pec. Miltoni*, Artis, sp., from Claycross, to show the nervation. This is absolutely identical in all respects with the enlargement of *Pec. abbreviata*, given by BRONGNIART on his pl. cxv. fig. 3a. There

can be no doubt that the plant occurring at Claycross, Derbyshire (Middle Coal Measures), is the true *Pec. Miltoni*, as its growth, segmentation, and the

* *Vers. d. Steinkf. in Sachsen*, p. 27, pl. xxx. figs. 5-8; pl. xxxi. figs. 1-4.

† ZEILLER, *Notes sur la flore houillère des Asturies*, p. 13. I may remark in passing, that in England *Pec. polymorpha* and *Pec. Miltoni* (including *Pec. abbreviata*) occur on the same horizon.

general character of many of the specimens is identical with the figure given by ARTIS.

Pec. Miltoni, Artis, sp. (whatever view may be taken of the relationship of *Pec. abbreviata* to it), is very polymorphic in the form and size of the pinnules. ARTIS has only figured one condition of his plant, a condition which probably corresponds to BRONGNIART'S *Pec. abbreviata*, fig. 1.

BRONGNIART gave several figures of his species, and these have been well supplemented by ZEILLER.* Forms corresponding to the figures of these authors occur among the Yorkshire, Lancashire, and Derbyshire specimens of *Pec. Miltoni*; in the barren condition, neither from the form of the pinnules nor their nervation can I discover any fixed character by which *Pec. abbreviata*, Brongt., can be separated from *Pec. Miltoni*, Artis, sp.

The only remaining point of comparison is the fructification. On this ARTIS says:—"Fructifications surrounding the leaflets near, but not entirely on the margin." And again—"The fructifications seated on the back of the leaves are not so closely seated on the margin as is expressed in the plate."

Many of the specimens of *Pec. Miltoni* which I have examined, from the counties already mentioned, are in fruit, though none have been in a condition to exhibit its minute structure, such as the number of sporangia that compose the sori, or the shape of the individual sporangia. These specimens, however, clearly indicate the position of the sori, which appear as little circular dots, as shown in the woodcut, figs. 2 and 3.

Fig. 2 is a pinnæ from a Lancashire example; fig. 3 from a Derbyshire plant. On both, the position of the fruit, as clearly indicated, is not marginal. In fact ARTIS, in referring to his own figure, clearly states that the fruit is not so closely seated on the margin as is expressed on his plate. Now, if his figure be carefully examined, it will be seen that on many of the pinnules the fruit holds almost a central position between the margin and the midrib, and certainly if it is not so near the margin as represented, it cannot be other than situated almost midway between the midrib and the margin, and then the sori will cover the whole of the under surface of the pinnule, as figured by ZEILLER.† In the pinnæ, where the pinnules are united throughout the greater part of their length, the fruit forms a single or double row along the midrib of the pinnæ; or, in other words, the pinnules only bear one or two groups of sori, situated at their base, as seen in woodcut, fig. 2.

Fig. 3 shows two pinnules densely clothed on their upper surface with short hairs,‡ which quite obliterate the veins. The fruit is seen as circular dots holding a similar position to those figured on *Pec. abbreviata* by ZEILLER. From

* *Flore foss. du Bassin houil. d. Valenciennes*, pl. xxiv.

† *Loc. cit.*, pl. xxiv. figs. 3, 4, 4a, 4b.

‡ These are also present on most of the pinnæ of the specimen from which fig. 1 was taken.

the examination of several such specimens I am led to conclude that the fruit of *Pec. Miltoni*, Artis, sp., and *Pec. abbreviata*, Brongt., is essentially the same, and therefore there exists no specific difference between *Pec. Miltoni* and *Pec. abbreviata*, hence BRONGNIART'S species must be united with *Pec. Miltoni*, Artis, sp.

REMARKS ON SOME FIGURES OF THE SPECIES.

Pec. Miltoni, Germar, *Vers. v. Wettin u. Löbejun*, Heft 6, pl. xxvii. 1849.

The figures given here are very characteristic of *Pec. Miltoni*, Artis, sp. The nervation agrees entirely with that of the specimens from Lancashire, Yorkshire, and Derbyshire. His fig. 2 corresponds to ARTIS'S type.

I have received from Dr WEISS a specimen of *Pec. Miltoni* from Wettin, which confirms this opinion.

GEINITZ, *Vers. d. Steinkf. in Sachsen*, 1855.

Cyatheites Miltoni, pl. xxx. figs. 5, 6 ; pl. xxxi. figs. 1-4.

Cyatheites Miltoni, var. *abbreviatus*, pl. xxx. figs. 7, 8.

Of these, fig. 5 (pl. xxx.) is characteristic of ARTIS'S species, but I have never seen the fruit as represented at fig. 6. Fig. 8 (pl. xxx.) probably corresponds to my woodcut, fig. 2. Pl. xxxi. fig. 4, gives a fair idea of the position of the fruit. Fig. 3 probably does not belong to *Pec. Miltoni*; it is not, at all events, a characteristic figure of the species.

It must be noticed that in all the fruiting examples given by GEINITZ the *sori* are *immature*, and only represented by circular swellings. Were the *sori* more fully developed, they would occupy a much larger area of the surface of the pinnule.

Hawlea Miltoni, Stur, *Carbon-Flora*, pl. xlix. fig. 1, 1885.

Though no enlarged details of this specimen are given, the fossil as represented in the plate is absolutely identical with typical *Pec. Miltoni*. All the other figures in this plate are too indistinct to admit of any criticism. Pl. xl. figs. 3, 4, I exclude from *Pec. Miltoni*.

Pec. Miltoni, Sterzel, *Flora d. Rothliegenden im nordw. Sachsen*, pl. i. figs. 1-7.*

The figures given here, though small, possess the characters of *Pec. Miltoni*.

* In Dames and Kayser, *Palæontologische Abhandl.*, vol. iii. Heft. 4, p. 237, Berlin, 1886.

Hawlea pulcherrima, Corda, *Flora protogæa*, pl. lvii. figs. 7, 8, 1845.

I have already stated my belief that *H. pulcherrima* is a fruiting specimen of *Pec. Miltoni*, Artis, sp.* STUR gives as the difference between the fruit of *H. pulcherrima* and *Pec. Miltoni*, that the former has shorter and broader pinnules (*Tertiärabschnitte*) and shorter and broader sporangia than *Pec. Miltoni*, where the pinnules and sporangia are narrower and longer. The fern being so polymorphic, and the form of the pinnules so greatly depending on their position on the frond, render this difference in form as a specific character in the case under discussion quite valueless. In regard to the other supposed

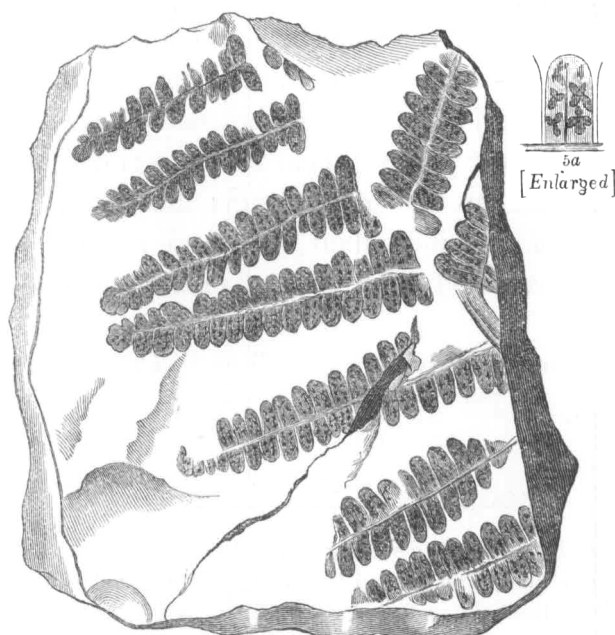


Fig. 5. (Nat. size.)

Pec. Miltoni, Artis, sp. (= *H. pulcherrima*, Corda), Forest of Wyre, Worcestershire.
In the collection of the British Museum.†

distinguishing character—the form of the sporangia,—the slight differences pointed out by STUR are far too slight to be of real value; they are even scarcely distinguishable in his text figure which illustrates this point,‡ and entirely disappear when *H. pulcherrima* is compared with ZEILLER's figures of the fruit of *Pec. (abbreviata) Miltoni*.§

I give a text figure (5) of a specimen from the Forest of Wyre, Worcestershire, in the collection of the British Museum, which appears to me to be at

* *Catalogue of Palæoz. Plants*, p. 121. In the remarks here appended to *Pec. Miltoni* I have inadvertently referred to *H. pulcherrima* as *Hawlea "elegans."* I have also (p. 256) referred *A. aquilina*, Geinitz, *Vers. d. Steinkf. in Sachsen*, pl. xxxi. figs. 5–7, to *Pec. Miltoni*. I still think it probable that his figures 6, 7 are referable to this species, but am more doubtful about his figure 5. They are therefore omitted meantime from the synonymy of *Pec. Miltoni*, Artis, sp.

† I am indebted to Dr Woodward, F.R.S., for permission to describe this specimen.

‡ *Loc. cit.*, p. 106, fig. 17.

§ *Loc. cit.*, pl. xxiv. figs. 3, 4.

once the *H. pulcherrima* of CORDA and the fruit of *Pec. Miltoni*. The fossil occurs as a dark brown impression of the lower surface of the frond on a yellow-brown matrix. On the left of the rachis, of which only a small portion is shown, are the remains of 7 pinnæ. The 3 lower ones are imperfect, but the 4 upper show their complete length. The pinnules at the base of the pinnæ are contiguous and oblong, with blunt apices; the upper pinnules are confluent. The whole of the surface of the pinnules is thickly covered with stellate groups of sporangia, hence the veins are only seen at a few points of the specimen, and even then indistinctly. The *sporangia* are oval, and arranged in stellate groups of 3–6 sporangia, though 4 is the common number in each little star. The central point of attachment of the groups of sporangia is situated midway between the central vein and the margin of the pinnule, which latter bears a greater or less number of sori. In this example the pinnules near the apex of the pinnæ bear very few sori; those about the centre bear three on each side of the midrib, whilst the lowest pinnules bear 5 or 6 sori on each side of the main nerve. The little stellate groups of sporangia measure in their greatest diameter 1 mm. to 1.5 mm., the individual sporangia ranging from .5 to .75 mm. This specimen was associated with barren examples of *Pecopteris Miltoni*, Artis, sp.

Localities :—Radstock ; Braysdown Colliery ; Camerton ; Welton ; Wells-way Pit ; Lower Conygre Pit.

Pecopteris Lamuriana, Heer.

Pecopteris Lamuriana, Heer, *Urwelt der Schweiz*, p. 13, fig. 12.

Pecopteris Lamuriana, Zeiller, *Bull. soc. géol. d. France*, 3^e sér., vol. xiii. p. 139.

Alethopteris Lamuriana, Heer, *Flora foss. Helv.*, p. 32, pl. xii. figs. 6, 7.

Remarks.—This species is very rare, only two specimens having been collected.

Localities :—Radstock ; Braysdown Colliery.

Pecopteris pinnatifida, Gutbier, sp.

Neuropteris pinnatifida, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 61, pl. viii. figs. 1–3.

Neuropteris pinnatifida, Gutbier, *Vers. d. Zechst. u. Rothl.*, p. 13, pl. v. figs. 1–4.

Pecopteris pinnatifida, Schimper, *Traité d. paléont. végét.*, vol. i. p. 507.

Pecopteris Geinitzii, Gutbier, *Vers. d. Zechst. u. Rothl.*, p. 16, pl. ii. fig. 10 ; pl. ix. figs. 1–3 ; pl. xi. figs. 5, 6.

? *Pecopteris fruticosa*, Gutbier, *Vers. d. Zechst. u. Rothl.*, p. 16, pl. v. figs. 8, 9.

Asterocarpus pinnatifidus, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 93.

Remarks.—Of this fern four specimens have been collected,—three at Radstock and one at the Upper Conygre Pit, Timsbury. The figures given by GUTBIER of this species are very rough, but with the plant as figured in his

Vers. d. Zwick. Schwarzkohl, pl. viii. figs. 1–3, and in his *Vers. d. Zechst. u. Rothl.*, pl. v. figs. 1, 2, the Somerset examples agree entirely.

The nervation of this species is described by GUTBIER as “nerves strong, once bifurcated, in pairs, or fascicled (*fiderig*) according to the pinnulation.”*

In the almost entire pinnules of one of our specimens, one of the arms of the dichotomously divided lateral veins usually divides again.

Pec. Geinitzii has been united with *Pec. pinnatifida* by WEISS and SCHIMPER, and in this I have followed them. Such a course, however, makes it difficult to reconcile the two figures given by GUTBIER of the fruit of his *Pec. pinnatifida*† with those he gives of the fruit of his *Pec. Geinitzii*, which is *Asterocarpous*!

Localities:—Radstock; Upper Conygre Pit.

Corynepteris, Baily.

Corynepteris, Baily, *Geol. Survey of Ireland*, Explan. to accompany Sheet 142, p. 16, 1860.

Grand' Eurya, Zeiller, *Ann. d. sc. nat. Bot.*, 6^e sér., vol. xvi. p. 203, 1883.

Corynepteris erosa, Gutbier, sp.

Pecopteris erosa, Gutbier, *Gaea von Sachsen*, p. 81.

Pecopteris erosa, Lesqx., *Coal Flora of Pennsylv.*, vol. i. p. 255, pl. xlv. figs. 1 and 3.

Alethopteris erosa, Geinitz, *Vers. d. Steinkf. in. Sachsen*, p. 29, pl. xxxii. figs. 7–9.

Grand' Eurya erosa, Zeiller, *Ann. d. sc. nat. Bot.*, vol. xvii. p. 9, 1884.

Remarks.—Very rare. Only one specimen of this species has come under my notice from the Radstock Series.

From the structure of the fruit of this fern, ZEILLER places it in his genus *Grand' Eurya*, but from an examination of the type of *Corynepteris*, Baily, I am led to conclude that ZEILLER'S *Grand' Eurya* is identical with BAILY'S *Corynepteris*, and the latter, being the older generic name, is here adopted.

Locality:—Camerton.

Dactylothea, Zeiller, *Ann. d. sc. nat. Bot.*, 6^e sér., vol. xvi. p. 184, 1883.

Dactylothea plumosa, Artis, sp.

Filicites plumosa, Artis, *Antedil. Phyt.*, p. 17, pl. xvii.

Pecopteris plumosa, Brongt., *Hist. de végét. foss.*, p. 348, pls. cxxi. cxxii.

Pecopteris delicatula, Brongt., *Hist. d. végét. foss.*, p. 349, pl. cxvi. fig. 6.

Aspidites Silesiacus, Göpp., *Syst. fl. foss.*, p. 346, pls. xxvii. and xxxix. fig. 1.

Senftenbergia crenata, Stur (not L. & H.) (in part), *Carbon-Flora*, p. 72, pl. xlv. fig. 1 (?).

Senftenbergia plumosa, Stur (in part), *Carbon-Flora*, p. 91, pl. li. fig. 1 (figs. indistinct, excl. syn. *Pec. pennæformis*, Brongt.).

Dactylothea plumosa, Kidston, *Catal. Paleoz. Plants*, p. 128 (excl. syn. *Pec. acuta*).

Pecopteris dentata, L. & H., *Fossil Flora*, vol. ii. pl. cliv.

* *Vers. d. Zwick. Schwarzkohl*, p. 61.

† *Vers. d. Zechst. u. Rothl.*, pl. v. figs. 3, 4.

Dactylothea plumosa, var. *dentata*, Brongt., sp.

Pecopteris dentata, Brongt., *Hist. d. végét. foss.*, p. 346, pls. cxxiii. cxxiv.

Pecopteris dentata, Zeiller, *Végét. foss. du terr. houil.*, p. 86, pl. clxviii. figs. 3, 4.

Cyatheites dentatus, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 26, pl. xxv. fig. 11 (in part); pl. xxix. figs. 10-12; pl. xxx. figs. 1-3 (4?).

Dactylothea dentata, Zeiller, *Ann. d. sc. nat. Bot.*, 6^e sér., vol. xvi. p. 184, pl. ix. figs. 12-15; *Bull. soc. géol. d. France*, 3^e sér., vol. xii. p. 201.

Senftenbergia plumosa, Stur, *Carbon-Flora*, pl. li. fig. 2 (3?).

Remarks.—Two distinct forms of this fern occur in Britain, which have usually been regarded as distinct species. In the above synonymy I have attempted to separate them.

This species was first described by ARTIS in 1825, under the name of *Filicites plumosus*, and what I regard as a variety of ARTIS's plant was described by BRONGNIART as *Pec. dentata* in 1828.

After examining numerous specimens of *Dactylothea* (*Pec.*) *plumosa* and *Dactylothea* (*Pec.*) *dentata*, I have been led to believe that *Pec. dentata* can only be regarded as a well-marked variety of *Pec. plumosa*, a view that has been indicated by GEINITZ.*

The two forms are, however, so well marked that a varietal name is demanded in the case of one of them; hence *Pec. dentata*, Brongt., being of later date than *Dacty. plumosa*, Artis, sp., BRONGNIART's form must be distinguished as the variety, and is therefore here designated *Dacty. plumosa*, var. *dentata*.

Dactylothea plumosa, var. *dentata*, Brongt., sp., is extremely common in the Radstock Series, and some very fine examples have been collected. The typical form, *Dactylothea plumosa*, Artis, sp., is very rare, having only been met with at Timsbury.

Dactylothea plumosa, Artis, sp., is more plentiful in the Middle than in the Upper Coal Measures, where the variety *dentata* is rare.

Dr STUR seems to have confused *Dacty. (Senftenbergia) plumosa* with several other species.† He unites *Aspidites Silesiacus*, Göpp.,‡ with *Sphen. crenata*, L. & H. Now *Aspidites Silesiacus*, Göpp. (specimens of which have been kindly sent me by Prof. WEISS), is identical with *Dactylothea plumosa*, Artis, sp., with which I have been able to compare it. On the other hand, *Sphenopteris crenata*, L. & H.§ I believe to be an entirely different species. Again STUR, on his plate li., gives three figures of *Dactylothea (Senftenbergia) plumosa*; one of these appears to be *Dacty. plumosa* (fig. 1), the other two probably are referable to the var. *dentata*. STUR further unites with his *Dactylothea (Senftenbergia)*

* *Vers. d. Steinkf. in Sachsen*, p. 26.

† *Carbon-Flora*.

‡ *Syst. fl. foss.*, p. 346, pls. xxvii. and xxxix. fig. 1.

§ *Lindley and Hutton*, vol. i. pl. xxxix.; vol. ii. pls. c. ci.

plumosa the *Pec. pennæformis*, Brongt., a species which, when the authentic plant is seen, is specifically distinguishable by many well-marked characters.

In my *Catalogue of Palæozoic Plants* I united *Pec. acuta*, Brongt., with *Dactylothea plumosa* (including var. *dentata*), Artis, sp. I have since had a specimen of *Pec. acuta*, Brongt., from Prof. WEISS, and now find my uniting them was an error. The uniformly simple nervation of *Pec. acuta*, as well as the acute falcate form of its pinnules, easily separate it from *Dacty. plumosa*, var. *dentata*. These differences are, however, better seen on actual specimens than in BRONGNIART'S figure.

Aspidites Glockeri, Göpp.,* was also regarded by me as a variety of *Dacty. plumosa*, Artis, sp., but perhaps it is not safe positively to refer GÖPPERT'S plant to ARTIS'S species without a comparison of specimens.

The fruit of *Dacty. plumosa*, var. *dentata*, has been described by ZEILLER.† It consists of broadly-lanceolate *marattiaceous* exannulate sporangia situated on the arms of the secondary nerves. The sporangia are not united to one another, and appear to open by a longitudinal cleft.

From characters derived from the structure of this fruit, ZEILLER has founded the genus *Dactylothea* for *Pecopteris dentata*, Brongt., which is adopted here.

Dactylothea plumosa, Artis, sp.

Locality :—Upper Conygre Pit.

Dacty. plumosa, var. *dentata*, Brongt., sp.

Localities :—Radstock; Braysdown Colliery; Wellsway Pit; Upper Conygre Pit; Lower Conygre Pit; Camerton.

Dicksoniites, Sterzel, *Botanisches Centralblatt*, Band xiii.
Nos. 8, 9, 1883.

Dicksoniites Pluckenetii, Schlotheim, sp.

Dicksoniites Pluckenetii, Sterzel, *Botan. Centralblatt*, Band xiii. Nos. 8, 9, pl. vi.; *Zeitsch. d. deut. geol. Gesell.*, 1886, p. 773, pl. xxi.

Pecopteris Pluckenetii, Brongt., *Hist. d. végét. foss.*, p. 355, pl. cvii. figs. 1-3.

Pecopteris Pluckenetii, Germar, *Vers. d. Steinkf. v. Wettin u. Löbejun*, p. 41, pl. xvi.

Pecopteris Pluckenetii, Zeiller, *Végét. foss. d. terr. houil.*, p. 90, pl. clxviii. figs. 1, 2.

Alethopteris Pluckenetii, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 30, pl. xxxiii. figs. 4, 5.

Cyatheites Pluckenetii, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 67.

Filicites Pluckenetii, Schlotheim, *Flora d. Vorwelt*, p. 52, pl. x. fig. 19.

Pecopteris bifurcata, Sternb., *Vers.*, i. p. xix. pl. lix. fig. 2; ii. p. 151.

Remarks.—Though this species has been noted from several localities, it is by no means common. All the examples collected are referable to the typical form.

* *Syst. fil. foss.*, p. 375, pl. xxix. figs. 1-4.

† *Ann. d. sc. nat. Bot.*, 6^e sér., vol. xvi. p. 184, pl. ix. figs. 12-15.

The fruit has been figured and described by STERZEL,* and I am indebted to Mr E. WILSON, Clifton, for a small fruiting specimen which he collected at Welton. This example shows the upper surface of the frond. The *sori* are scattered on the pinnules in an irregular manner, and appear to have been placed in little pockets, which produce on the upper surface of the pinnules a corresponding small circular wart-like elevation,—such as is seen in some recent genera of ferns.

Localities :—Radstock; Kilmersdon Colliery; Upper Conygre Pit; Welton.

Alethopteris, Sternberg, *Vers. einer geol. botan. Darstellung d. Flora d. Vorwelt*, i. fasc. iv. p. xxi., 1820.

Alethopteris lonchitica, Schlotheim, sp.

Alethopteris lonchitica, Schimper, *Traité d. paléont. végét.*, vol. i. p. 554.

Alethopteris lonchitidis, Sternb., *Vers.*, i. fasc. iv. p. xxi.; *Vers.*, ii. p. 142.

Pecopteris lonchitica, Brongt., *Hist. d. végét. foss.*, p. 275, pl. lxxxiv.

Pecopteris heterophylla, L. & H., *Fossil Flora*, vol. i. pl. xxxviii.

Pecopteris Mantelli, Brongt., *Hist. d. végét. foss.*, p. 278, pl. lxxxiii.

Pecopteris Mantelli, L. & H., *Fossil Flora*, vol. ii. pl. cxlv.

Alethopteris Mantelli, Zeiller, *Végét. foss. du terr. houil.*, p. 74, pl. clxiii. figs. 3, 4.

Pecopteris urophylla, Brongt., *Hist. d. végét. foss.*, p. 290, pl. lxxxvi.

Filicites lonchiticus, Schlotheim, *Flora d. Vorwelt*, p. 55, pl. xi. fig. 22.

Remarks.—On only two occasions have I collected *Aleth. lonchitica* in the Radstock Series. This species is extremely common in the Lower Coal Measures, less plentiful in the Middle Coal Measures, where *Aleth. Serlii* begins to appear, and extremely rare in the Upper Coal Measures, where *Aleth. Serlii* becomes very abundant.

Aleth. lonchitica, Schl., sp., is very variable in the form and size of the pinnules, and there appears to be no definite line of demarcation between the typical form and *Aleth. Mantelli*, *Aleth. heterophylla*, and *Aleth. urophylla*. *Aleth. heterophylla* and *Aleth. urophylla* appear to represent the same form of the plant.

In *Aleth. Mantelli* the pinnules are longer and narrower. On the lower corner of the slab containing the type specimen of *Aleth. heterophylla* figured by LINDLEY & HUTTON occurs a fragment of *Aleth. Mantelli*; and on the upper corner of the type specimen of *Aleth. Mantelli*, Brongt., occurs a specimen of *Aleth. heterophylla*!

After examining many specimens of the species, I have been led to the conclusion that the plants mentioned in the synonymy given here are only different forms of one fern—possibly in some cases even different portions of the same frond; and to the synonyms mentioned above I believe others might be added.

Localities :—Radstock; Braysdown Colliery.

* *Botanisches Centralblatt and Zeitsch. d. deut. geol. Gesell.*

Alethopteris Serlii, Brongniart, sp.*Alethopteris Serlii*, Sternb., *Vers.*, ii. p. 144.*Alethopteris Serlii*, Lesqx., *Coal Flora of Pennsylv.*, vol. i. p. 176, pl. xxix. figs. 1-5.*Alethopteris Serlii*, Zeiller, *Végét. foss. d. terr. houil.*, p. 75, pl. clxiii. figs. 1, 2.*Pecopteris Serlii*, Brongt., *Hist. d. végét. foss.*, p. 292, pl. lxxxv.*Pecopteris Serlii*, L. & H., *Fossil Flora*, vol. iii. pl. ccii.

Remarks.—This fern is extremely abundant—of so frequent occurrence that one can scarcely split a slab without finding some fragments of it.

BRONGNIART notices two varieties—

(a) *Europæa*—with obtuse pinnules.

(b) *Americana*—with acute pinnules.

The first variety he received from near Bath and Dunkerton, and the latter from Wilkesbarre, Pennsylvania.

Both of these forms are equally common in the Radstock Series, but do not form real *varieties*, for on a specimen from Radstock some of the pinnæ are var. *Europæa* and others var. *Americana*; and further, even on the same pinna I have observed that the pinnules on one side of the rachis were acute, and on the other shorter and obtuse.

Localities:—Radstock; Braysdown Colliery; Huish Pit; Wellsway Pit; Upper Conygre Pit; Lower Conygre Pit; Camerton; Dunkerton.

Alethopteris Grandini, Brongniart, sp.*Alethopteris Grandini*, Grand' Eury, *Flore Carbon. du Départ. d. la Loire*, p. 107.*Alethopteris Grandini*, Zeiller, *Flore foss. du Bassin houil. de Valenciennes*, pl. xxxviii. figs. 1, 2.*Pecopteris Grandini*, Brongt., *Hist. d. végét. foss.*, p. 286, pl. xci. figs. 1-4.

Remarks.—This species is very rare, only four or five specimens having come under my notice.

Localities:—Radstock; Braysdown Colliery; Wellsway Pit; Upper Conygre Pit.

Alethopteris aquilina, Schlotheim, sp.*Alethopteris aquilina*, Schimper, *Traité d. paléont. végét.*, vol. i. p. 556, pl. xxx. figs. 8-10.*Pecopteris aquilina*, Brongt., *Hist. d. végét. foss.*, p. 284, pl. xc.*Filicites aquilina*, Schlotheim, *Flora d. Vorwelt*, p. 38, pl. iv. fig. 7; pl. v. fig. 8.

Remarks.—This species is rare in the Radstock Series, but the specimens appear to me to be identical with SCHLOTHEIM's plant. It is true that this author does not give details of the nervation, but dealing with his figures and descriptions, the evidence seems to be in favour of BRONGNIART being correct in identifying the plant he figures on pl. xc. as SCHLOTHEIM's species.

Dr STUR holds a different opinion, and separates the plant figured by BRONGNIART from *Aleth. aquilina* as founded by SCHLOTHEIM, and for BRONG-

NIART's plant creates a new species, which he places in the genus *Danæites* under the name of *D. sarepontanus*.* I am, however, of opinion that Dr STUR is in error in separating BRONGNIART's figure from *Aleth. aquilina*, Schloth., sp.

It is doubtful if the plant figured by GEINITZ as *Aleth. aquilina* belongs to SCHLOTHEIM's fern.†

One specimen from Radstock, 10½ inches long, shows portions of fifteen pinnæ on the left side of the rachis and eleven on the right, the most perfect of which is 5½ inches long.

Localities.—Radstock; Wellsway Pit; and Braysdown Colliery.

Alethopteris obliqua, Brongniart, sp.

Alethopteris obliqua, Schimper, *Traité d. paléont. végét.*, vol. i. p. 557.

Pecopteris obliqua, Brongt., *Hist. d. végét. foss.*, p. 320, pl. xvi. figs. 1-4.

Remarks.—I have received from Mr GEORGE WEST, Camerton, a small specimen of a fern showing two pinnæ which agree entirely with BRONGNIART's figs. 3, 4, the originals of which came from Oldham.

Alethopteris Davreuxi, Brongniart, sp.

Plate XXIV. fig. 1.

Alethopteris Davreuxi, Göpp., *Syst. fil. foss.*, p. 295 (excl. syn.).

Alethopteris Davreuxi, Zeiller, *Bull. soc. géol. d. France*, 3^e sér., vol. xii. p. 199; *Flore foss. d.*

Bassin houil. d. Valenciennes, pl. xxxii. fig. 1.

Pecopteris Davreuxi, Brongt., *Hist. d. végét. foss.*, p. 279, pl. lxxxviii.

Description.—Fronde large, heterophyllous; primary and secondary pinnæ alternate; pinnules alternate. Secondary pinnæ on upper part of frond entire or more or less lobed, and united by their basal portions; secondary pinnæ on basal part of lower primary pinnæ, free and divided into many pairs of alternate pinnules. Pinnules oval or subrotund, united among themselves, the lowest inferior pinnule occupying the angle formed by the union of the rachis of the secondary and primary pinnæ. Terminal lobe oblong. The central vein in the pinnules is prominent in its lower part, and gives off numerous upward-directed once-divided veinlets. A few simple or dichotomous veins also enter the pinnules direct from the rachis. In the entire and lobed pinnæ the veins are fascicled and divided several times.

Remarks.—The specimen figured on Plate XXIV. fig. 1, has been kindly lent me for description by the Council of the Bristol Museum. It shows the remains of six primary pinnæ (numbered i.-vi.) on the left of the rachis and two on the right (numbered vii., viii.). The position of the rachis which has borne these pinnæ, and of which very little remains, is indicated by an arrow. The primary pinnæ i.-ii. bear quite entire secondary pinnæ; the lateral veins in these are slightly fascicled. On the primary pinnæ iii., the lower secondary pinnæ

* *Carbon-Flora*, p. 223, pl. lxi. fig. 2. † *Vers. d. Steinkf. in Sachsen*, p. 27, pl. xxxi. figs. 5-7.

become sinuous and lobed; in iv. this is more marked, a few of the lower secondary pinnæ bearing the ultimate pinnulation of the species.

The fasciculate arrangement of the veins is specially observable in those pinnæ with dentate or slightly lobed margins, but even in the upper entire pinnæ the veins show the same tendency. Pinna v. represents the most completely divided condition of the fern.

The pinnules are ovate, the pair at the base of the pinnæ being usually sub-rotund. The pinnules are very blunt, and united for about one-third of their length. The central vein is strongly marked, lying in a little furrow, and divides into several branches at its apex. From its sides are given off numerous once-divided veinlets. A few veins also enter the pinnules direct from the rachis to which they are attached. These are either simple or divided (see fig. 1a).

The species is very rare in the Radstock Series, only two specimens having come under my notice; both of these are, however, fine. One is in the collection of the Bristol Museum, and the other is in the collection of the Bath Museum.

Localities :—Radstock ; Camerton.

Spiropteris, Schimper, *Traité d. paléont. végét.*, vol. i. p. 688, 1869¹

Spiropteris, sp.

Remarks.—Under this name I place a specimen of *Pecopteris* in circinate veneration. It is impossible to determine the species to which this example belongs.

Locality :—Braysdown.

Rhacophyllum, Schimper, *Traité d. paléont. végét.*, vol. i. p. 684, 1869.

Rhacophyllum crispum, Gutbier, sp.

Fucoides crispus, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 13, pl. i. fig. 11 ; pl. vi. fig. 18.

Aphlebia crispa, Zeiller, *Végét. foss. d. terr. houil.*, p. 95.

Rhacophyllum Lactuca, Schimper, *Traité d. paléont. végét.*, vol. i. p. 684, pl. xlv. fig. 1 ; pl. xlvii. fig. 1 (2 ?) ; vol. iii. p. 524.

Schizopteris Lactuca, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 19, pl. xxvi. fig. 1.

Schizopteris Lactuca, Germar, *Vers. d. Steink. v. Wettin u. Löbejun*, p. 45, pls. xviii., xix.

Fucoides linearis, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 13, pl. i. figs. 10, 12.

Remarks.—Not common.

Localities :—Radstock ; Braysdown Colliery ; Camerton.

Rhacophyllum filiciforme, Gutbier, sp.

Rhacophyllum filiciforme, Schimper, *Traité d. paléont. végét.*, vol. i. p. 685, pl. xlviii. figs. 3-6.

Fucoides filiciformis, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 11, pl. i. figs. 3, 6, 7, 8, 13 (excl. syn.).

Fucoides crenatus, Gutbier, *Vers. d. Zwick. Schwarzkohl*, p. 14, pl. i. fig. 14.

Schizopteris Gutbieriana, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 19, pl. xxv. figs. 11-14.

Remarks.—Not common.

Localities.—Radstock; Camerton.

Rhacophyllum Goldenbergii, Weiss.

Plate XXVII. fig. 2.

Rhacophyllum Goldenbergii, Weiss in Schimper, *Traité d. paléont. végét.*, vol. i. p. 686, pl. xlv. fig. 2.

Description.—Frond membranous, pinnate (?); pinnæ lanceolate, pinnatifid; teeth of pinnæ directed upwards, simple or bifid, lanceolate acute. Midrib distinct, and giving off a veinlet to each tooth. Main rachis broadly winged, in which can be traced, for a considerable distance, the downward course of the midribs that enter the pinnæ.

Remarks.—This species is extremely rare in the Radstock Series, only two specimens having been observed, both of which are in the collection of Mr J. M'MURTRIE, F.G.S. The example figured, however, is from Pucklechurch,* and was presented to the Bristol Museum by Mr J. C. BLACKMORE.

The frond appears to have been of very delicate membranous character, in which the veins are distinctly seen.

In one of the specimens of this species in Mr M'MURTRIE'S collection, the midrib of the pinnæ appears thicker than in that figured, but the condition of preservation in the two specimens is different. That figured shows the upper surface of the frond, the carbon remaining as a thin brown film, whereas in the other examples an impression of the under surface of the frond is exhibited, from which the carbonaceous matter is entirely removed.

The British specimens agree very well with the figure of *Rhacophyllum Goldenbergii* given by SCHIMPER, but the Saarbrück example does not seem to have been so well preserved as that from Pucklechurch. The teeth of the pinnatifid pinnæ appear to be simple, with the exception of the basal tooth on the superior margin, which is bifid.

As far as I am aware, this plant has hitherto only been recorded from Saarbrück.

Locality.—Radstock.

* This specimen is probably from the neighbourhood of Pucklechurch—not actually from the village of that name, and therefore most likely from a bed on the horizon of the Farrington Series, i.e., the coal-producing series immediately below the Radstock Series.

Rhacophyllum spinosum, Lesquereux.

Plate XX. fig. 3.

Rhacophyllum spinosum, Lesqx., *Coal Flora of Pennsylv.*, p. 320, pl. lviii. figs. 4, 5.

Description.—Fronde tripinnate, pinnæ alternate, diverging from the broad flat membranous rachis at an acute angle; pinnules alternate, lanceolate, of delicate texture, with 2–3 short spine-like teeth, and a prominent lanceolate terminal lobe. In the centre of the flattened membranous rachis of the pinnæ is a nerve, from which simple veins are given off to each pinnule, in which again a single veinlet seems to extend into each tooth.

Remarks.—The above description varies somewhat from that given by LESQUEREUX in his *Coal Flora*, p. 320. It is there stated—"The veins are clearly seen in parallel fascicles on the rachis, and may be followed into the lateral pinnæ, where they disappear, probably there dividing into very thin branches, and passing into the lobes." "The rachis is distinctly dotted."

In comparing the outline and general form of the Radstock example with LESQUEREUX'S figures, especially with his figure 5, the identity of the two ferns is complete, the only differences between them being the simple veins in the Radstock specimen, and the absence of the dots on the rachis. In the Radstock example, unfortunately, the main rachis is almost entirely removed, and only a faint indication of it is given on the matrix. The scales, however, might have been shown on the rachis of the pinnæ, but there is no indication of their presence,—but this is a character of secondary importance, as their presence or absence depends so much on the part of the frond under examination, and the state of preservation of the fossil.

In regard to the discrepancy in the nervation, the specimen I figure shows clearly that a single vein penetrates the centre of the broad membranous rachis of the pinnæ, which gives off to each pinnule a similar single vein; I could further distinguish the presence of a single veinlet in the teeth of some of the pinnules.

I am, therefore, led to conclude that what has been regarded as veins by LESQUEREUX are only external striæ, and this view is strengthened from the examination of the last species (*R. Goldenbergii*), which belongs to the same group of *Rhacophylli*, and where the veins are of a similar simple nature as those occurring in the Radstock specimen of *Rhacophyllum spinosum*, Lesqx.

The only example of this fern that I have seen is that figured on Plate XX. fig. 3; it is in the collection of Mr J. M'MURTRIE, F.G.S., who has kindly submitted it to me for examination and description.

Locality.—Radstock.

Megaphyton, Artis, *Antediluvian Phytology*, p. 20, 1825.

Megaphyton frondosum, Artis.

Plate XXVI. fig. 4.

Megaphyton frondosum, Artis, *Antedil. Phyt.*, pl. xx.

Megaphyton frondosum, Kidston, *Catal. Palæoz. Plants*, p. 143.

Megaphyton approximatum, L. & H., *Fossil Flora*, vol. ii. pl. cxvi.

Megaphyton distans, L. & H., *Fossil Flora*, vol. ii. pl. cxvii.

Remarks.—Some notes on this fern stem will be found in my *Catalogue of Palæozoic Plants*, where the difficulties in the limitation of this species are indicated.

Locality :—Radstock.

Megaphyton elongatum, Kidston, n. sp.

Plate XXVI. fig. 1.

Description.—Frond scars arranged in two opposite vertical rows, distant ; those of one row alternative with those of the opposite corresponding vertical row. Frond scars elongated, rounded at their upper extremity, and gradually merging into the stem below. Vascular cicatrice oval, situated towards the apex of the scar. Stem striated, and bearing numerous cicatricules of aerial rootlets.

Remarks.—This species is the most frequently occurring fern stem in the Radstock Series, but in mentioning this it must not be inferred that the fossil is plentiful. One specimen from Radstock, removed from its matrix, is 3 feet 11 inches in length, and at one extremity is 5 inches across, and at the other extremity $3\frac{3}{4}$ inches ; the distance between the top of one scar and the top of that immediately succeeding it varies from 7 to 8 inches in this example. On another specimen the summits of the scars are about 10 inches apart.

The example figured, of which the sketch is reduced one half, is in the collection of the Bristol Museum. It does not show well the *Megaphyton* character of the stem, but was selected for figuring on account of the frond scar being more clearly defined on this specimen than on any of the compressed stems that show the two opposite vertical rows of scars.

The specimen I identified as *Caulopteris Cistii*, from Radstock, in the collection of the British Museum, is probably a fragment of a stem of this species.

Localities :—Radstock ; Middle Pit ; Camerton.

Caulopteris, Lindley & Hutton, *Fossil Flora*, vol. i. p. 121, 1832.

Description.—Stems of arborescent ferns, bearing distant or contiguous, circular or oval, smooth sars, arranged quincuncially, containing :—Type 1. An inner circular or oval closed ring, more or less following the contour of the frond scar ; within this is a second oval scar, open at its upper aspect, the free ends being bent inwards, and forming a “horse-shoe scar.” Type 2. A closed inner circular or

oval line, within which is a variously bent transverse scar. Stems usually bearing numerous aerial rootlet cicatrices, placed on the stem between the frond scars.

Scars on stems deprived of their outer envelope, oval or elongate-elliptical, upper and lower extremities rounded or pointed, and generally confluent, occasionally showing within the scar traces of an inner oval cicatrice; whole stem striate.

Remarks.—Several explanations have been given of the structure of the scars of *Caulopteris*, some maintaining that the large inner circle of the frond is closed; others, that its superior margin is open, and that the two free ends bend inwards, and thus form the characteristic "horse-shoe scar." Both of these descriptions of the structure of the scars appear to be correct.

ZEILLER was the first to demonstrate the closed nature of the inner circle of the scar of *Caulopteris*,* inside of which he detected a bent transverse band, which latter he regarded as the true vascular cicatrice (text fig. 6). GRAND'EURY, however, states in his *Flore carbonifère du Département de la Loire et du Centre de la France*,† that, though in the Upper Coal Measures of the centre of France the *Caulopteris* with "horse-shoe"-shaped inner scars are very rare, they do exist, and on such a specimen he finds his *Caulopteris protopteroides*, remarking, at the same time, that this form of *Caulopteris* was not so plentiful in France as he had seen it in England. GRAND'EURY‡ was further able to show, from the examination of a siliceous specimen of *Caulopteris*, that the inner closed circle, as well as the transverse central scar, is a vascular tract.

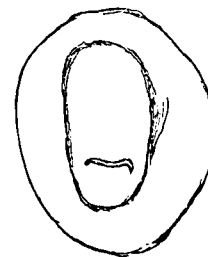


Fig. 6.

Caulopteris peltigera, Brongt., sp., showing inner closed vascular tract, within which is contained the transverse vascular cicatrice (copied from ZEILLER, half nat. size).

The genus has in England, as far as I am aware, only been found in the Upper Coal Measures, and on the majority of the specimens the scar is of the "horse-shoe" form.

Another very interesting point has been brought out by ZEILLER in his paper to which reference has already been made, that those fossils, for which CORDA proposed the genus *Ptychopteris*§ (of which *Caulopteris macrodiscus* is the type), only represent the inner portion of *Caulopteris*, corresponding probably to the sheath of *sclerenchyma* that surrounds the central ligneous cylinder.|| The figure ZEILLER gives of *Caulopteris patria* shows both these conditions on the same specimen.¶

* "Note sur quelques troncs de Fougères fossiles," *Bull. soc. géol. d. France*, 3^e sér., vol. iii. p. 574, 1874-75.

† p. 84.

‡ *Loc. cit.*, p. 84.

§ *Flora protogaea*, p. 76.

|| *Bull. soc. géol. d. France*, 3^e sér., vol. xii. p. 203, 1883.

¶ *Bull. soc. géol. d. France*, 3^e sér., vol. iii. pl. xvii. fig. 4. This is named on the plate *Caulopteris peltigera*, Brongt., sp. (!), but has since been described as a new species by GRAND'EURY under the name of *Caulopteris patria*. See also ZEILLER, *Végét. foss. d. terr. houil.*, p. 100; and GRAND'EURY, *Flore carbon. du Départ. de la Loire*, p. 87.

Those fern stems, therefore, of the type of *Caulopteris macrodiscus* lose all true specific value, but as at present it is usually impossible to refer them to their parent species, I have mentioned them under *C. macrodiscus*, merely with the object of noting the occurrence of such fossils.

On Plate XXVI. fig. 2, is shown a specimen, natural size, which exhibits the formation of a *Caulopteris macrodiscus* fern stem from one of *C. peltigera* type. There is shown here part of the outer envelope still adhering to the stem, which when removed, exhibits beneath it the striated surface of *macrodiscus*.

Caulopteris primæva, Lindley & Hutton.

Caulopteris primæva, L. & H., *Foss. Flora*, vol. i. pl. xlii.

Caulopteris primæva, Schimper, *Traité d. paléont. végét.*, vol. i. p. 707.

Sigillaria Lindleyi, Brongt., *Hist. d. végét. foss.*, p. 419, pl. cxl. fig. 1.

Remarks.—This species is very rare. As far as I am aware, only two specimens of it have been discovered. One of these is that figured by LINDLEY and HUTTON, from Radstock, and the other is from Camerton in the collection of the Bristol Museum.

Localities :—Radstock ; Camerton.

Caulopteris anglica, Kidston, n. sp.

Plate XXVI. fig. 3.

(?) *Caulopteris peltigera*, Geinitz, *Vers. d. Steinkf. in Sachsen*, pl. xxxiv. fig. 3.

Description.—Fronde cicatrices almost contiguous, oval, slightly narrowed above. Vascular cicatrices nearly equally distant from all parts of the circumference ; double, outer closed, inner “horse-shoe” shaped.

Remarks.—All the specimens of *Caulopteris* (with the exception of *C. primæva* and *C. macrodiscus*) from the Radstock area, which were in a sufficiently good state of preservation for specific determination appear to belong to this species.

On Pl. XXVI. fig. 3, is given, half natural size, an example from Radstock in the collection of the Bath Museum. The scars are oval, and slightly narrowed at the upper extremity. Some of them show a second inner circle, outside of and surrounding the “horse-shoe” scar. This is well seen in the middle scar in the left-hand row. The same character I have observed in other specimens. It is quite probable, then, that the outermost of the two inner circles correspond to the closed circle of ZEILLER, and the “horse-shoe” scar to the inner curved transverse scar, only much more developed.

On Plate XXVI. fig. 5, is shown an isolated scar with a very distinct “horse-shoe,” but with no trace of the surrounding closed circle. The scar is quite smooth, but the absence of the surrounding closed circle makes it improbable that this small specimen belongs to *Caulopteris anglica*.

The frond scars often touch laterally, but are occasionally separate.

Caulopteris anglica differs from *Caulopteris protopteroides*, Grand' Eury,* in the closed vascular circle surrounding, and not being within, the "horse shoe" as in GRAND' EURY'S species, and further I have not observed any trace of the small inner transverse vascular cicatrice, such as is described as occurring in *Caulopteris protopteroides*.

The specimen figured by GEINITZ as *Caulopteris peltigera* is probably referable to *Caulopteris anglica*.

Localities :—Radstock ; Camerton.

Caulopteris macrodiscus, Brongniart, sp.

Plate XXV. figs. 1, 2.

Caulopteris macrodiscus, Feistmantel, *Der Hangendflötzzug*, p. 85, pl. iv.†

Sigillaria macrodiscus, Brongt., *Hist. d. végét. foss.*, p. 418, pl. cxxxix

Caulopteris Phillipsii, L. & H., *Fossil Flora*, vol. ii. pl. cxi.

Ptychopteris macrodiscus, Corda, *Flora protogæa*, p. 76.

Ptychopteris macrodiscus, Germar, *Vers. d. Steinkl. v. Wettin u. Löbejun*, p. 115, pl. xl. fig. 1.

Remarks.—Perhaps the fossils placed here may be stems of *Caulopteris anglica*, deprived of their cortical envelope. They must not in any case be regarded as a distinct species.

Two of these stems are shown on Plate XXV. figs. 1, 2. The specimen illustrated at fig. 1 shows an inner oval cicatrice on the frond scars. Fig. 2 represents the more common appearance of the fossil.

Caulopteris Phillipsii, L. & H., does not appear to differ in any way from *Caulopteris macrodiscus*, Brongt.

Localities :—Radstock ; Camerton (type of *Caulopteris Phillipsii*, L. & H.).

Caulopteris, sp.

Remarks.—I place here a few specimens which, on account of their imperfect preservation, cannot be specifically identified, but may be distinct from those already given.

Localities :—Radstock ; Camerton.

LYCOPODIACEÆ.

Lepidodendron, Sternberg.

Vers. eines geol. botan. Darstellung d. Flora d. Vorwelt, i. fasc. i. p. 25 ; fasc. v. p. 10, 1820.

* *Flore carbon. d. Départ. de la Loire*, p. 85.

† In *Archiv d. naturw. Landesdurchforschung v. Böhmen*, iv. Band Nr. 6, Geolog. Abth., Prag, 1881.

Lepidodendron aculeatum, Sternberg.

Lepidodendron aculeatum, Sternb., *Vers.*, i. fasc. i. pp. 20, 23, pl. vi. fig. 2; pl. viii. fig. 1 b; fasc. ii. p. 25, pl. xiv. figs. 1-4; fasc. iv. p. x.

Lepidodendron aculeatum, Schimper, *Traité d. paléont. végét.*, vol. ii. p. 20, pl. lix. fig. 3.

Lepidodendron aculeatum, Kidston, *Catal. Palæoz. Plants*, p. 153.

Lepidodendron aculeatum, Zeiller, *Flore foss. d. Bassin houil. d. Valenciennes*, pl. lxxv.

Remarks.—Frequent.

A specimen in the roof of one of the workings of Braysdown Colliery, of which a piece was shown me by the manager, Mr STEART, was 40 feet long, but as both its upper and lower extremities were embedded, its complete length could not be ascertained. At some of the other collieries, fragments of very large stems were also seen.

Localities :—Radstock; Braysdown Colliery; Wellsway Pit; Camerton.

Lepidodendron Worthenii, Lesquereux.

Lepidodendron Worthenii, Lesqx., *Coal Flora of Pennsylv.*, vol. ii. p. 388, pl. lxiv. figs. 8, 9.

Lepidodendron Worthenii, Zeiller, *Flore foss. d. Bassin houil. d. Valenciennes*, pl. lxxi.

Remarks.—This species is comparatively common in the Radstock Series.

Localities :—Radstock; Wellsway Pit; Braysdown Colliery; Camerton.

Lepidodendron lanceolatum, Lesquereux.

Plate XXVII. fig. 5; Plate XXVIII. figs. 3, 4.

Lepidodendron lanceolatum, Lesqx., *Coal Flora of Pennsylv.*, p. 369, pl. lxiii. figs. 3-5.

Description.—Scars lanceolate or broadly fusiform, smooth, keeled; vascular cicatrice small, situated in upper part of scar; cicatricules indistinct. Leaves lanceolate, acute, slightly curved.

Remarks.—None of the specimens of this species with which I have met give a clear view of the vascular cicatrice, nor does it appear to have been well seen in LESQUEREUX'S specimen. His enlarged fig. 5 has been probably taken from an imperfectly preserved example, and seems to represent a leaf-scar, from which the leaf has been forcibly torn.

What I regard as the cone of this species is shown at Pl. XXVII. fig. 5.

Localities :—Radstock; Camerton; Upper Conygre Pit; Braysdown.

Lepidodendron rhombicum, Sternberg, sp.

Lepidodendron rhombicum, Schimper, *Traité d. paléont. végét.*, vol. ii. p. 37.

Bergeria rhombica, Presl, in Sternb., *Vers.*, ii. p. 184, pl. lxviii. fig. 18.

Bergeria angulata, Presl, in Sternb., *Vers.*, ii. p. 184, p. lxviii. fig. 17.

Bergeria quadrata, Presl, in Sternb., *Vers.*, ii. p. 184, pl. lxviii. fig. 19.

Remarks.—On several occasions, at Timsbury, I met with specimens of

Lepidodendra which agree in the form of their leaf-scars with PRESL's *B. rhombica*, *angulata*, and *quadrata*. On one example, about 7 inches long, the lower leaf-scars are *B. quadrata*; about half-way up the stem they assume the shape of the leaf-scars of *B. angulata*, and towards the top of the specimen the scars assume the ordinary Lepidodendroid form. I do not regard *L. rhombicum* as a true species, but think it probably includes only peculiar conditions of the leaf-scars of several species of Lepidodendra. The bolsters never seem to show any clear traces of the vascular cicatrice or cicatricules.

Locality:—Upper Conygre Pit.

Lepidophloios, Sternberg, *Vers. eines geol. botan. Darstellung d. Flora d. Vorwelt*, vol. i. fasc. vi. p. 13, 1825.

Lepidophloios, sp.

Remarks.—This genus is very rare. A small specimen of a *Lepidophloios* (sp.) was collected at Camerton, and a Halonian condition (*Halonian regularis*) of the same genus at Radstock.

Localities:—Radstock; Camerton.

Lepidophyllum, Brongniart, *Prod. d'une hist. d. végét. foss.*, p. 87, 1828.

Lepidophyllum majus, Brongniart.

Lepidophyllum majus, Brongt., *Prod.*, p. 87.

Lepidophyllum majus, Feistmantel, *Vers. d. Böhm. Kohlenab.*, Abth. ii. p. 41, pl. xiii. figs. 1–4.

Lepidophyllum trinerve, L. & H., *Fossil Flora*, vol. ii. pl. clii.

Lepidophyllum binerve, Lebour, *Illustrations of Fossil Plants*, p. 103, pl. lii.

Lepidophyllum lanceolatum, Lebour (not Brongt.), *Illustrations of Fossil Plants*, p. 105, pl. liii.

Remarks.—Not common. Probably the foliage of *Lepidophloios*.

Localities:—Radstock; Camerton; Upper Conygre Pit.

Lepidophyllum, sp.

Plate XXVII. figs. 7a, 7b.

Remarks.—Allied to *Lepidophyllum brevifolium*, Lesqx.*

Localities:—Radstock; Braysdown Colliery.

Lepidostrobus, Brongniart, *Prod. d'une hist. d. végét. foss.*, p. 87, 1828.

* *Coal Flora of Pennsylv.*, pl. lxix. fig. 33.

Lepidostrobus spinosus, Kidston, n. sp.

Lepidostrobus, Brongniart, *Hist. d. végét. foss.*, vol. ii. pl. xxii. figs. 2, 3, 8.

Remarks.—A single specimen of a cone, similar to that figured by BRONGNIART (*loc. cit.*), has been collected. Though this fossil is rare in the Radstock Series, it is of frequent occurrence in some of the British Coal Fields.

Locality:—Braysdown Colliery.

Lepidostrobus, sp.

Remarks.—There is placed here a cone, the exposed portion of whose bracts is rhomboidal. It appears to be a well-marked species, but is only represented by a single specimen.

Locality:—Radstock.

Sigillaria, Brongniart, *Sur la classification d. végét. foss.*,
p. 9, 1822.

Sigillaria major, L. & H., sp.

Ulodendron majus, L. & H., *Fossil Flora*, vol. i. pl. v. (excl. ref.).

Ulodendron minus, L. & H., *Fossil Flora*, vol. i. pl. vi. (excl. ref.).

Lepidodendron discophorum, König, *Icones fossilium sectiles*, pl. xvi. fig. 194.

Sigillaria discophora, Kidston, *Catal. Palæoz. Plants*, p. 174 (excl. syn. *Sig. Preuiana* and *Bothrodendron punctatum*); *Annals and Mag. Nat. Hist.*, 5th ser., vol. xvi. p. 251, pl. iv. fig. 5; pl. v. fig. 8; pl. vii. figs. 12, 13 (excl. syn. *Sig. Preuiana* and *Bothrodendron punctatum*).

Remarks.—Very rare. The leaf-scars in the specimen placed here are not distinctly preserved, but from what is discoverable of their form they seem to agree with those of *Sigillaria (Ulodendron) major*, especially with that form described as *U. minor* by LINDLEY and HUTTON.

As I find LINDLEY and HUTTON's name for this plant has priority over *Lepidodendron discophorum*, König, the former author's specific designation is now adopted.*

Locality:—Radstock.

Sigillaria Serlii, Brongniart.

Sigillaria Serlii, Brongt., *Hist. d. végét. foss.*, p. 433, pl. clviii. fig. 9.

Sigillaria Serlii, Carruthers, *Geol. Mag.*, new series, Dec. ii. vol. x. p. 49, 1883.

Remarks.—I only know this plant as occurring in the Radstock Series from the figure given by Mr CARRUTHERS in the *Geol. Mag.*

Long grass-like leaves, the *Cyperites bicarinata*, L. & H.,† similar to those shown in Mr CARRUTHERS's figure, are common throughout the whole of the

* I hope presently to publish my reasons for still retaining these Ulodendroid-Lycopods in *Sigillaria*, a position which some botanists are not inclined to accord them.—May 1887.

† *Foss. Flora*, vol. i. pl. xliii. figs. 1, 2.

Radstock area, but are evidently the foliage of more than one species of *Sigillaria*.

I am strongly inclined to regard *Sig. Serlii* as only a young condition of *Sig. Brardii*, Brongt.

Locality:—Radstock.

Sigillaria M'Murtriei, Kidston.

Sigillaria M'Murtriei, Kidston, *Ann. and Mag. Nat. Hist.*, 5th ser., vol. xv. p. 357, pl. xi. figs. 3-5, 1885; *Proc. Roy. Phys. Soc. Edin.*, vol. viii. p. 415, pl. xxi. figs. 3-5.

Remarks.—Rare.

Localities:—Radstock; Braysdown Colliery.

Sigillaria monostigma, Lesquereux.

Sigillaria monostigma, Lesqx., *Rept. Geol. Survey of Illin.*, vol. ii. p. 449, pl. xlii. figs. 1-5, 1866; *Coal Flora of Pennsylv.*, vol. ii. p. 468, pl. lxxiii. figs. 3-6, 1880; vol. iii. p. 793, 1884.

Sigillaria monostigma, Schimper, *Traité d. paléont. végét.*, vol. ii. p. 101.

Asolanus camptotænia, Wood, *Trans. Amer. Phil. Soc.*, vol. xiii. p. 342, pl. ix. fig. 3, 1866.

Sigillaria camptotænia, Zeiller, *Flore foss. du Bassin houil. d. Valenciennes*, pl. lxxxviii. figs. 4-6.

Remarks.—Rare. WEISS* is of opinion that *Sig. monostigma* is not specifically distinct from *Sig. rimosa*, Gold.;† on the other hand, SCHIMPER thinks them different.

In the meantime I prefer to regard *Sigillaria monostigma* as specifically distinct from *Sigillaria rimosa*, Gold., on account of the difference in the structure of the cicatricules.

Localities:—Braysdown Colliery; Lower Writhlington Pit.

Sigillaria tessellata (Steinhauer), Brongniart.

Sigillaria tessellata, Brongt., *Hist. d. végét. foss.*, p. 436, pl. clvi. fig. 1; pl. clxii. figs. 1-4.

Sigillaria tessellata, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 44, pl. v. figs. 6-8.

Sigillaria tessellata, Zeiller, *Végét. foss. du terr. houil.*, p. 132, pl. clxxiii. fig. 2; *Flore foss. d. Bassin houil. d. Valenciennes*, pl. lxxxv., pl. lxxxvi. figs. 1-6.

Favularia tessellata, L. & H., *Fossil Flora*, vol. i. pls. lxxiii.-lxxv.

Phytolithus tessellatus, Steinhauer, *Trans. Amer. Phil. Soc.*, vol. i. p. 295, pl. vii. fig. 2.

(?) *Sigillaria elegans*, Brongt., *Hist. d. végét. foss.*, p. 438, pl. cxlvi. fig. 1; (? clv.) and clviii. fig. 1.

(?) *Favularia elegans*, Sternb., *Vers.*, i. p. 14, pl. lii. fig. 4.

(?) *Sigillaria Knorrii*, Brongt., *Hist. d. végét. foss.*, p. 444, pl. clvi. figs. 2, 3; pl. clxii. fig. 6.

(?) *Calamosyrinx Zwickaviensis*, Petzholdt, *Neues Jahrb.*, 1842, p. 181, pl. v.

(?) *Sigillaria sexangula*, Sauveur, *Végét. foss. de la Belgique*, pl. liii. fig. 1.

Remarks.—This is the most common *Sigillaria* in the Radstock Series. The specific limitation of this extremely variable species is a very difficult and still unsettled point. All the specimens which I have seen from Somerset are

* WEISS, *Foss Flora d. jüngst. Stk. u. d. Rothl.*, p. 160. †

† GOLDENBERG, *Flora Saræpontana fossilis*, Heft ii. p. 22, pl. vi. figs. 1-4.

referable to typical *Sig. tessellata*, especially as figured by ZEILLER (*loc. cit.*, pl. clxxiii. fig. 2).

It seems probable that *Sig. elegans* and *Sig. Knorrii* are at the most only varieties of *Sig. tessellata*, and SCHIMPER* would not only unite these with *Sig. tessellata*, but many other so-called species, and in the Catalogue of Palæozoic Plants in the British Museum, I follow him in placing a number of species under *Sig. tessellata*. Some botanists, however, regard many of these plants as specifically distinct from *Sig. tessellata*. ZEILLER places considerable value for specific distinction on the disposition of the cone scars. According to this author, in *Sig. tessellata* they are placed in the bottom of the furrows separating the ribs, and are of rounded or quadrangular contour, placed in vertical parallel rows, and encircle the stem in a band of about equal width. In *Sig. elegans*, on the other hand, the scars are said to be larger, sometimes assuming a quadrangular or polygonal contour, and occur on the ribs as well as in the furrows that separate the ribs, and form a band of scars in vertical series, but the series are not so long as in *Sig. tessellata*.†

Examples of *Sig. tessellata* showing verticels of cone scars are frequently found at the localities here mentioned for the species.

Bifurcating branches of *Sig. tessellata* are rare, but lately I have seen two specimens—one from Camerton in the collection of Mr GEORGE WEST, and the other from Bardsley, Ashton-under-Lyne, Lancashire, in the collection of Mr GEORGE WILD.

Localities :—Radstock ; Braysdown Colliery ; Camerton.

Sigillaria lævigata, Brongniart.

Plate XXVIII. fig. 5.

Sigillaria lævigata, Brongt., *Hist. d. végét. foss.*, p. 471, pl. cxliii.

Sigillaria lævigata, Kidston, *Catal. of Palæoz. Plants*, p. 193 (excl. syn. *S. ovata*).

Sigillaria lævigata, Zeiller, *Végét. foss. du terr. houil.*, p. 125 ; *Flore foss. d. Bassin houil. de Valenciennes*, pl. lxxviii. figs. 1-4.

Description.—Stem furrowed, furrows straight, ribs smooth, leaf-scars more or less distant, oval, narrowed upwards, higher than broad, or height about equal to width, lower and upper margins rounded, lateral angles distinct, from which extend downwards two raised lines that reach the scar immediately below or vanish a little above it. Vascular cicatricules situated above the centre of the scar,—lateral linear, central transversely oval. A short distance above the leaf-scar is usually placed a small cicatricule.

Decorticated stems, striated, lateral vascular cicatricules linear-reniform, increasing much with age, and becoming confluent.

* *Traité d. paléont. végét.*, vol. ii. p. 81.

† ZEILLER, *Ann. d. sc. nat. Bot.*, 6^e sér., vol. xix. p. 275.

Leaves long, grass-like.

Remarks.—Not common. The width of the ribs varies much according to the age of the specimen.

On some old stems, which, however, may belong to *Sig. reniformis* (as these two species cannot be clearly distinguished when decorticated), the distance apart of the vertical rows of leaf-scars was as much as $4\frac{3}{4}$ inches. The example from which this measurement was taken might be referred to *Sig. catenulata* or *Sig. alternans*.

Localities :—Radstock ; Braysdown Colliery.

Sigillaria reniformis, Brongniart.

Sigillaria reniformis, Brongt., *Hist. d. végét. foss.*, p. 470, pl. cxlii.

Sigillaria reniformis, Lesqx., *Coal Flora of Pennsylv.*, p. 501, pl. lxx. figs. 5–9.

Sigillaria reniformis, Sauveur, *Végét. foss. de la Belgique*, pl. l. fig. 1.

Sigillaria reniformis, Zeiller, *Flore foss. du Bassin houil. de Valenciennes*, pl. lxxxiv. figs. 4–6.

Remarks.—Rare. I have observed at several localities large decorticated stems with long geminate cicatricules (= *Sig. alternans*). It is, however, unsatisfactory to refer all these specimens to *Sig. reniformis*, as *Sig. lævigata* and probably other species have similar large cicatricules on decorticated stems of old individuals.

Locality :—Radstock.

var. *Radstockensis*, Kidston.

Plate XXVII. fig. 6.

Description.—Stem furrowed, furrows straight, wide, longitudinally striated; leaf-scars close and placed on slightly raised square platforms; scars much broader than long, hexagonal, upper margin emarginate, lower margin rounded, lateral angles prominent; cicatricules situated above the centre of scar, the two lateral oval, the central double, transverse. Two short straight lines extend from the lateral angles, and two from the rounded angles of the lower boundary line of the scar, which divide the lower half of the platform on which the leaf-scar is situated into one equal and two unequal compartments. About midway between the leaf-scars is a transverse furrow. Decorticated stem striated.

Remarks.—The only specimen I have seen of this variety of *Sig. reniformis* is that figured, and is in the collection of Mr J. M'MURTRIE, Radstock. It differs from the type in the presence of the slightly raised square platforms on which the scars sit, and in the arrangement of the lines that extend from the leaf-scars. On the decorticated stem the cicatricules are oblong-geminate, as in *Sig. reniformis*.

Locality :—Radstock.

Sigillaria alternans, Sternberg, sp.

Sigillaria alternans, L. & H., *Fossil Flora*, vol. i. pl. lvi.

Sigillaria alternans, Feistmantel, *Vers. d. böhm. Kohlenab.*, Abth. iii. p. 23, pl. v. fig. 3; pl. vi. figs. 1-3; pl. vii. figs. 1, 2.

Syringodendron alternans, Sternb., *Vers.*, i. fasc. 4, p. xxiv. pl. lviii. fig. 2.

Sigillaria catenulata, L. & H., *Fossil Flora*, vol. i. pl. lviii.

Remarks.—*Sigillaria alternans* must not be regarded as a species, but only as a decorticated condition of *Sig. reniformis*, *Sig. lævigata*, and possibly other species.

Localities:—Radstock; Braysdown Colliery.

Sigillaria notata, Steinhauer, sp.

Phytolithus notatus, Steinhauer, *Trans. Amer. Phil. Soc.*, vol. i. p. 294, pl. vii. fig. 3, 1818.

Remarks.—The type of this species was described by Steinhauer from Dunkerton. I have not, however, seen additional specimens from the Radstock Series.

Locality:—Dunkerton.

Sporangia.

Plate XXVII. fig. 9.

Remarks.—One of these sporangia is shown on Pl. XXVII. fig. 9. Several names have been applied to these organisms. That figured here is perhaps similar to LESQUEREUX's *Carpolithes perpussillus*.*

While examining Scotch carboniferous shales for spores with Mr JAMES BENNIE, great quantities of these fossils were met with in some of the shales. They varied much in size and form, and we believe them to be sporangia.

Locality:—Upper Conygre Pit. On slab with *Lepidodendron lanceolatum*, Lesqx.

Sporangia (?).

Plate XXVII. fig. 8.

Description.—More or less circular bodies about 5 mm. in diameter, with a small circular depression at the base, about 1 mm. in diameter, from which diverge four curved lines. The sides bear two slightly depressed areas.

Remarks.—These fossils are probably Lycopod sporangia. The small circular depression in all likelihood marks the point of attachment to the bract, and the slight lateral depressions may have been caused by the mutual pressure of similar bodies placed close together.

Locality:—Camerton.

* *Coal Flora of Pennsylv.*, vol. iii. p. 825, pl. cxi. fig. 23; ZEILLER, *Flore foss. du Bassin houil. de Valenciennes*, pl. xciv. fig. 18.

Lycopod macrospores.

Remarks.—I have received from Mr HENRY E. HIPPISEY a specimen of spore coal from the "Slyving Vein" of the Radstock Coal Seams almost entirely composed of *macrospores* bearing the characteristic triradiate ridge, embedded in a matrix, chiefly composed of *microspores*. These *macrospores* are probably similar fossils to those described as *Trigonocarpus sporites* by WEISS.*

Stigmara, Brongniart, *Sur la classification d. végét. foss.*, p. 9, 1822.

Stigmara ficoides, Sternberg, sp.

Stigmara ficoides, Brongt., *Class. d. végét. foss.*, p. 9, pl. i. fig. 7.

Stigmara ficoides, L. & H., *Fossil Flora*, vol. i. pls. xxxi.-xxxvi.

Variolaria ficoides, Sternb., *Vers.*, i. fasc. i. pp. 22 and 24, pl. xii. figs. 1-3.

Remarks.—Frequent.

Localities:—Radstock; Camerton; Lower Conygre Pit; Kilmersdon.

var. *minor*, Geinitz.

Stigmara ficoides, var. *minor*, Geinitz, *Vers. d. Steinkf. in Sachsen*, p. 49, pl. iv. fig. 6; pl. x. fig. 1.

Stigmara ficoides, var. *minor*, Zeiller, *Végét. foss. du terr. houil.*, p. 141.

Remarks.—Only one specimen has been met with.

Locality:—Braysdown Colliery.

Stigmara anglica, Sternberg, sp.

Plate XXVIII. figs. 9, 10.

Lepidodendron anglicum, Sternb., *Vers.*, i. fasc. iv. p. xi. pl. xxix. fig. 4.

Aspidiaria anglica, Sternb., *Vers.*, ii. p. 181, pl. lxviii. fig. 11.

Stigmara reticulata, Brongt., *Prod.*, p. 87.

Description.—Cicatrice circular or subrhomboidal, enclosed in contiguous rhomboidal fields; vascular cicatricule oval, and situated towards the upper part of the cicatrice.

Remarks.—This peculiar *Lepidodendron*-like *Stigmara* was described by STERNBERG from Paulton, and placed by him in *Lepidodendron*. Subsequently BRONGNIART removed it from this genus and placed it in *Stigmara*, to which genus the plant really belongs, notwithstanding its *Lepidodendroid* appearance. BRONGNIART, however, substituted the specific name of *reticulata* for the older one of *anglica*, but the original name for the species is here reinstalled.

I have examined a good many specimens of this fossil, mostly from

* WEISS, *Foss. Flora d. jüngst Stk. u. d. Rothl.*, p. 204, pl. xviii. figs. 22, 23. See also BENNIE and KIDSTON, *Proc. Roy. Phys. Soc. Edin.*, vol. ix. p. 82, "On the Occurrence of Spores in the Carboniferous Formation of Scotland."

Camerton, and portions of some of these are represented on Plate XXVIII. figs. 9, 9*a*, 10, 10*a*, 10*b*. The appearance of the species varies considerably with age. Fig. 10 shows the youngest condition of the plant with which I have met; fig. 10*a* is from the same specimen, but a little further up the root. Figs. 9 and 9*a* show parts of another example; these illustrate portions of the same specimen slightly separated laterally, but at the same height on the root. In many cases the lateral lines of the rhomboidal meshes are much more conspicuous than the upper and lower oblique boundary lines; in other cases the two oblique lines are so feebly indicated that the fossil assumes the appearance of a ribbed Sigillarian. This condition is slightly indicated in fig. 9*a*.

At fig. 10*b* a single enlarged scar is given to show the true Stigmarian nature of the vascular cicatrice.

This fossil attained considerable size. The largest roots that show their complete width measure $5\frac{1}{2}$ inches across, but some of the broken fragments are evidently parts of larger specimens. One of these large specimens, belonging to Mr GEORGE WEST, Camerton, shows a bifurcation of the root into two almost equal forks.

Localities :—Paulton (type); Radstock; Camerton.

Cordaïtes, Unger, *Genera et species Plantarum Fossilium*, p. 277, 1850.

Cordaïtes angulosostratus, Grand' Eury.

Cordaïtes angulosostratus, Grand' Eury, *Flore carbon. du Départ. de la Loire*, p. 218, pl. xix.

Cordaïtes angulosostratus, Zeiller, *Végét. foss. du terr. houil.*, p. 144, pl. clxxv. figs. 2, 3.

Cordaïtes angulosostratus, Renault, *Cours. d. botan. foss.*, 1881, p. 90, pl. xii. fig. 3.

Remarks.—This species is generally distributed throughout the whole of the Radstock Series, and in some localities is very plentiful.

Localities :—Radstock; Upper Conygre Pit; Camerton.

Poacordaïtes, Grand' Eury, *Flore carbonifère du Départ. de la Loire*, p. 222, 1877.

Poacordaïtes microstachys, Goldenberg, sp.

Poacordaïtes microstachys, Zeiller, *Végét. foss. du terr. houil.*, p. 146, pl. clxxv. fig. 1.

Cordaïtes microstachys, Goldenberg, in Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 194 (woodcut figs. 1–3, p. 195).

Poacordaïtes linearis, Grand' Eury, *Flore Carbon. du Départ. de la Loire*, p. 225, pls. xxiii. and xxiv. figs. 1–3.

Remarks.—Very rare.

Localities :—Radstock; Braysdown Colliery.

Cardiocarpus, Brongniart, *Prodrome d'une hist. d. végétaux fossiles*,
p. 87, 1828.

Cardiocarpus Gutbieri, Geinitz.

Plate XXIII. fig. 5.

Cardiocarpus Gutbieri, Geinitz, *Vers. d. Steink. in Sachsen*, p. 39, pl. xxi. figs. 23–25.

Remarks.—The specimen is smaller than the type, but is probably referable to *Cardiocarpus Gutbieri*.

Locality.—Radstock.

Cardiocarpus fluitans, Dawson.

Plate XXIII. fig. 6.

Cardiocarpum fluitans, Dawson, *Quart. Jour. Geol. Soc.*, vol. xxii. p. 165, pl. xii. fig. 74.

Samaropsis fluitans, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 209, pl. xviii. figs. 24–30.

Samaropsis fluitans, Zeiller, *Flore foss. du Bassin. houil. de Valenciennes*, pl. xciv. fig. 7.

Remarks.—Several specimens of these little seeds have been met with, but only at one locality.

Locality.—Upper Conygre Pit.

Trigonocarpus, Brongniart, *Prodrome d'une hist. d. végét. foss.*, p. 137, 1828.

Trigonocarpus Noeggerathi, Sternberg, sp.

Plate XXIII. fig. 3.

Trigonocarpus Noeggerathi, Brongt., *Prod.*, p. 137.

Trigonocarpus Noeggerathi, Göpp. & Berger, *De fruct. et semin.*, pp. 15 and 18, pl. i. figs. 1, 2 (excl. ref. L. & H.).

Trigonocarpus Noeggerathi, Zeiller, *Flore foss. du Bassin. houil. de Valenciennes*, pl. xciv. figs. 8–11.

Trigonocarpus Noeggerathi, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 204 (excl. ref. L. & H.).

Palmacites Noeggerathi, Sternb., *Vers.*, i. fasc. 4, p. xxxv. pl. lv. figs. 6, 7.

Trigonocarpum areolatum, Göpp. & Berger, *De fruct. et semin.*, p. 19, pl. i. figs. 3, 4.

Remarks.—All the figures given by LINDLEY and HUTTON, in their *Fossil Flora*, as *Trigonocarpum Noeggerathi*, are referable to the fruit figured without name by PARKINSON in his *Organic Remains*, vol. i. pl. vii. figs. 6–8, to which BRONGNIART, in his *Prodrome*, applied the name of *Trigonocarpum Parkinsoni*.

Localities.—Radstock ; Camerton ; Lower Conygre Pit.

(?) **Trigonocarpus Dawesii**, Lindley & Hutton.

Trigonocarpum Dawesii, L. & H., *Fossil Flora*, vol. ii. pl. ccxxi.

Remarks.—The specimen included here is in the collection of the Bristol

Museum. It is slightly larger than LINDLEY and HUTTON's figure, but I think may be referred to their species.

Locality :—Camerton.

Rhabdocarpus, Göppert & Berger, *Fructibus et seminibus*, p. 20, 1848.

Rhabdocarpus multistriatus, Presl, sp.

Plate XXIII. fig. 4.

Rhabdocarpus multistriatus, Lesqx., *Coal Flora of Pennsylv.*, p. 578, pl. lxxxv. figs. 22, 23.

Rhabdocarpus multistriatus, Kidston, *Catal. of Palæoz. Plants*, p. 213.

Carpolithes multistriatus, Sternb., *Vers.*, ii. pl. xxxix. fig. 1, 2.

Description.—Seed 3·5 cm. long and 2·1 cm. broad; exposed surface, bearing about eight longitudinal ridges, on and between which run fine parallel striæ.

Remarks.—In size this specimen is somewhat smaller than that figured in STERNBERG; otherwise there is no apparent difference. The presence of the fine longitudinal striæ on the Radstock specimen may be due to better preservation.

The relationship of several described species of *Rhabdocarpi* to *Rhabdocarpus multistriatus* is difficult to determine. These are referred to in my *Catalogue of Palæozoic Plants*.

Locality :—Radstock.

Carpolithus, Sternberg, *Vers. einer geol.-botan. Darstellung d. Flora d. Vorwelt*, vol. ii. p. 208.

Carpolithus ovoideus, Göppert & Berger, sp.

Plate XXIII. figs. 7, 8.

Carpolithus ovoideus, Grand' Eury, *Flore carbon. du Départ. de la Loire*, p. 239.

Rhabdocarpus (?) *ovoides*, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 206, pl. xvii. fig. 4; pl. xviii. figs. 10–14, 18–21.

Rhabdocarpus ovoideus, Göpp. & Berger, *De fruct. et semin.*, p. 22, pl. i. fig. 17.

Rhabdocarpus Germariannus, Göpp., *Foss. Flora d. Perm. Form.*, p. 270, pl. lxiv. fig. 14.

Carpolithes membranaceus, Göpp. & Berger, *De fruct. et semin.*, p. 25, pl. ii. figs. 19 and 20.

Carpolithes ellipticus, Sternb., *Vers.*, i. fasc. 4, p. xl. pl. vii. fig. 1.

Remarks.—Rare.

Localities :—Wellsway Pit; Camerton.

GENERAL REMARKS.

The genus *Calamites*, though represented by several species, is not of very frequent occurrence. *Calamocladus* is also rare. *Sphenophyllum*, as far as at present known, is only represented by one species. Though seven species of *Sphenopteris* have been met with, none of them are of frequent occurrence. *Neuropteris* is represented by six species, of which *N. macrophylla* and *N. Scheuchzeri* are the most common, the former being especially plentiful. *Dictyopteris* is very rare, only a single specimen having been seen. *Odontopteris* is not much more common. No less than fifteen species of *Pecopteris* have been observed; of these *P. arborescens*, *P. Miltoni*, *P. oreopteridia*, and *P. unita* are the most plentiful, the two first-mentioned species being especially common. *Dactylothea* is also of frequent occurrence. Of the six species of *Alethopteris*, only *A. Serlii* is common, but that is extremely plentiful. None of the species of *Rhacophyllum* are common. *Megaphyton* and *Caulopteris* are also rare. *Lepidodendra* are not very common, but *L. Wortheni* is the species most frequently met with. The genus *Lepidophloios* is very rare. The *Sigillariæ* are represented by eight species, the commonest being *S. tessellata*. *Cordaites*, though only represented by one species, is in some localities very plentiful. *Poacordaites* is, on the other hand, very rare. The genera *Cardiocarpus*, *Trigonocarpus*, *Rhabdocarpus*, and *Carpolithus* are of somewhat rare occurrence.

For the purpose of comparing the fossil plants from the Radstock Series with those of other coal fields, I append a table, in the first column of which are given the plants of the Radstock Series; Column II. shows the Radstock species that occur in the Coal Measures of France; and Column III. those common to the Zwickau Coal Beds.* Columns IV. and V. give the fossil plants common to both the Radstock and the Saarbrück and Ottweiler Series respectively.†

It must be borne in mind that the following Tables only show wherein the Floras of these respective areas agree with that of the Radstock Series, and do not take any note of the plants occurring in the various horizons taken for comparison which do not occur in the Radstock Series. If this point were taken into consideration, it would be found that each series has species more or less peculiar to itself.

* Compiled from Geinitz, *Foss. Flora d. Steinkf. in Sachsen*.

† Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 237.

TABLE comparing the Flora of the Radstock Series with that of other Coal Fields.

Number.	Name.	Page.				Saarbrück Series.			Ottweiler Series.		
			I.	II.	III.	IV.			V.		
						Lower.	Middle.	Upper.	Lower.	Middle.	Upper.
1	<i>Excipulites callipteris</i> , <i>Schimp. sp.</i>	339	x								
2	<i>Calamitina varians</i> , <i>var. insignis</i> , <i>W.</i>	340	x			x †	x †	x †	x †	x †	x †
3	<i>Eucalamites cruciatus</i> , <i>var. senarius</i> , <i>W.</i>	340	x	<i>a</i>		x †	x †				
4	<i>ramosus</i> , <i>Artis sp.</i>	341	x	<i>d</i>							
5	<i>Stylocalamites Suckowii</i> , <i>Brongt. sp.</i>	342	x	<i>d</i>	x	x	x	x	x	x	x
6	<i>cannæformis</i> , <i>Schl. sp.</i>	342	x	<i>a</i>	x	x	x				
7	<i>Cistii</i> , <i>Brongt. sp.</i>	343	x	<i>d</i>	x	x	x	x			
8	<i>Calamocladus equisetiformis</i> , <i>Schl. sp.</i>	343	x	<i>b</i>	x	x	x	x	x	x	x
9	<i>Annularia stellata</i> , <i>Schl. sp.</i>	343	x	<i>b</i>	x	x	x		x	x	x
10	<i>sphenophylloides</i> , <i>Zenker sp.</i>	344	x	<i>b</i>	x		x		x	x	x
11	<i>Sphenophyllum emarginatum</i> , <i>Brongt.</i>	344	x	<i>b</i>	x	x	x		x	x	x
12	<i>Macrostachya infundibuliformis</i> , <i>Brongt. sp.</i>	345	x	<i>a</i>	x	x	x				x
13	<i>Sphenopteris tenuifolia</i> , <i>Gutbier (? Brongt.)</i>	345	x		x						
14	<i>geniculata</i> , <i>Germ. & Kaul.</i>	346	x		‡						
15	<i>Grandini</i> , <i>Göpp. sp.</i>	347	x		x						
16	<i>macilenta</i> , <i>L. & H.</i>	348	x		x						
17	<i>Woodwardi</i> , <i>Kidston.</i>	348	x								
18	<i>neuropteroides</i> , <i>Boulay sp.</i>	349	x	<i>c</i>							
19	<i>cristata</i> , <i>Brongt.</i>	350	x	<i>a</i>	x						
20	<i>Ptychocarpus oblongus</i> , <i>Kidston.</i>	350	x								
21	<i>Schizostachys sphenopteroides</i> , <i>Kidston.</i>	352	x								
22	<i>Macrosphenopteris Lindsæoides</i> , <i>Kidston.</i>	353	x								
23	<i>Neuropteris macrophylla</i> , <i>Brongt.</i>	354	x								
24	<i>Scheuchzeri</i> , <i>Hoffm.</i>	356	x	<i>c</i>	x						
25	<i>flexuosa</i> , <i>Sternb.</i>	359	x	<i>c</i>	x						
26	<i>ovata</i> , <i>Hoffm.</i>	359	x								
27	<i>rarinervis</i> , <i>Bunbury.</i>	361	x	<i>c</i>							
28	<i>fimbriata</i> , <i>Lesqz.</i>	361	x								
29	<i>Dictyopteris Munsteri</i> , <i>Erchw. sp.</i>	361	x	<i>c</i>							
30	<i>Odontopteris Lindleyana</i> , <i>Sternb.</i>	363	x								
31	<i>Mariopteris muricata</i> , <i>Schl. sp.</i>	363	x	<i>c</i>							
32	<i>nervosa</i> , <i>Brongt. sp.</i>	363	x	<i>c</i>	x						
33	<i>Pecopteris arborescens</i> , <i>Schl. sp.</i>	366	x	<i>a</i>	x		x		x		x
34	<i>Candolliana</i> , <i>Brongt.</i>	367	x	<i>a</i>					x		x
35	<i>asper</i> , <i>Brongt. sp. (?)</i>	367	x	<i>c</i>							
36	<i>pennæformis</i> , <i>Brongt.</i>	367	x	<i>c</i>							
37	<i>unita</i> , <i>Brongt.</i>	367	x	<i>a</i>	x	x	x		x		x
38	<i>villosa</i> , <i>Brongt.</i>	370	x								
39	<i>oreopteridia</i> , <i>Schl. sp.</i>	371	x	<i>a</i>			x		x		x
40	<i>Cistii</i> , <i>Brongt.</i>	372	x								
41	<i>Bucklandii</i> , <i>Brongt.</i>	372	x	<i>a</i>			x				
42	<i>pteroides</i> , <i>Brongt.</i>	373	x	<i>a</i>	x	x	x		x	x	x
43	<i>crenulata</i> , <i>Brongt.</i>	373	x	<i>c</i>							
44	<i>polymorpha</i> , <i>Brongt.</i>	373	x	<i>a</i>							
45	<i>Miltoni</i> , <i>Artis sp.</i>	374	x	<i>c</i>		x	x	x	x	x	x
46	<i>Lamuriana</i> , <i>Heer.</i>	380	x	<i>a</i>							
47	<i>pinnatifida</i> , <i>Gutbier sp.</i>	380	x								
48	<i>Corynepteris erosa</i> , <i>Gutbier sp.</i>	381	x		x						

* The letters in this column show the Horizons in which the plants occur in the Coal Measures of France, as under :—

a, Superior (= Upper Superior) } Superior or Upper Coal Measures. *c*, Middle Coal Measures.
b, Lower Superior, } *d*, Species common to *a*, *b*, *c*.
‡ *C. varians*. ‡ *C. cruciatus*.

Number.	Name.	Page.				Saarbrück Series.			Ottweiler Series.		
			I.	II.	III.	IV.			V.		
			Radstock Series.	Coal Measures of France.	Zwickau Coal Field.	Lower.	Middle.	Upper.	Lower.	Middle.	Upper.
49	<i>Dactylothea plumosa</i> , <i>Artis</i> sp. } var. <i>dentata</i> , <i>Brongt.</i> sp. .	381	x	c } d }	x	x	x	x	x		x
50	<i>Dicksoniites Pluckenetii</i> , <i>Schl.</i> sp. .	383	x	a	x	x	x		x		x
51	<i>Alethopteris lonchitica</i> , <i>Schl.</i> sp. .	384	x	c							
52	<i>Serlii</i> , <i>Brongt.</i> sp. .	385	x	c		x	x	x		?	
53	<i>Grandini</i> , <i>Brongt.</i> sp. .	385	x	a c							
54	<i>aquilina</i> , <i>Schl.</i> sp. .	385	x	a	x	x	x		x		x
55	<i>obliqua</i> , <i>Brongt.</i> sp. .	386	x	c							
56	<i>Davreuxi</i> , <i>Brongt.</i> sp. .	386	x	c							
57	<i>Spiropteris</i> , sp. .	387	x								
58	<i>Rhacophyllum crispum</i> , <i>Gutbier</i> sp.	387	x	d	x	x	x				x
59	<i>filiciforme</i> , <i>Gutbier</i> sp. .	388	x		x						
60	<i>Goldenbergii</i> , <i>Weiss</i> .	388	x								
61	<i>spinosum</i> , <i>Lesqx.</i> .	389	x								
62	<i>Megaphyton frondosum</i> , <i>Artis</i> .	390	x	c	x						
63	<i>elongatum</i> , <i>Kidston</i> .	390	x								
64	<i>Caulopteris primæva</i> , <i>L. & H.</i> .	392	x								
65	<i>anglica</i> , <i>Kidston</i> .	392	x								
66	<i>macrodiscus</i> , <i>Brongt.</i> sp. .	393	x	a	x						
67	<i>Lepidodendron aculeatum</i> , <i>Sternb.</i> .	394	x	d	x						
68	<i>Worthenii</i> , <i>Lesqx.</i> .	394	x	c							
69	<i>lanceolatum</i> , <i>Lesqx.</i> .	394	x								
70	<i>rhombicum</i> , <i>Presl</i> .	394	x								
71	<i>Lepidophloios</i> , sp. (<i>Halon</i>) .	395	x	b							
72	<i>Lepidophyllum majus</i> , <i>Brongt.</i> .	395	x		x	x	x				
73	sp. .	395	x								
74	<i>Lepidostrobus spinosus</i> , <i>Kidston</i> .	396	x								
75	sp. .	396	x								
76	<i>Sigillaria (Ulodendron) major</i> , <i>L. & H.</i> sp.	396	x	c							
77	<i>Serlii</i> , <i>Brongt.</i> .	396	x								
78	<i>M'Murtrei</i> , <i>Kidston</i> .	397	x								
79	<i>monostigma</i> , <i>Lesqx.</i> .	397	x	b							
80	<i>tessellata</i> , <i>Brongt.</i> .	397	x	b							
81	<i>lævigata</i> , <i>Brongt.</i> .	398	x	c							
82	<i>reniformis</i> , <i>Brongt.</i> .	399	x	c		x	x				?
83	<i>alternans</i> , <i>Sternb.</i> sp. .	400	x			x	x		x		x
84	<i>notata</i> , <i>Steinhauer</i> sp. .	400	x								
85	<i>Sporangia</i> .	400	x								
86	" (?) .	400	x								
87	<i>Macrospores (Lycopod) (= Trigonocarpus sporites, W.)</i> .	401	x			x	x				
88	<i>Stigmara ficoides</i> , <i>Sternb.</i> sp. .	401	x	d	x	x	x	x	x	x	x
89	" " var. <i>minor</i> , <i>Geinitz</i> .	401	x								
90	<i>anglica</i> , <i>Sternb.</i> sp. .	401	x								
91	<i>Cordaites angulosostriatus</i> , <i>Grand' Eury</i> .	402	x	a							
92	<i>Poacordaites microstachys</i> , <i>Gold.</i> sp. .	402	x				x				
93	<i>Cardiocarpus Gutbieri</i> , <i>Geinitz</i> .	403	x		x						
94	<i>fluitans</i> , <i>Dawson</i> .	403	x	b			x				x
95	<i>Trigonocarpus Noeggerathi</i> , <i>Sternb.</i> sp. .	403	x	c		x	x				x
96	(?) <i>Dawsii</i> , <i>L. & H.</i> .	403	x								
97	<i>Rhabdocarpus multistriatus</i> , <i>Presl</i> sp. .	404	x								
98	<i>Carpolithes ovoideus</i> , <i>Göpp. & Berger</i> .	404	x			x	x	x			

A summary of the results brought out by these columns shows that, of the

98 species occurring in the Radstock Series—

55 are common to the Coal Measures of France (excluding the *Houiller inférieur*).*

30	"	"	Zwickau Coal Field.
24	"	"	{ Lower Saarbrück Series.
30	"	"	{ Middle " "
9	"	"	{ Upper " "
17	"	"	{ Lower Ottweiler Series.
10	"	"	{ Middle " "
22	"	"	{ Upper " "

The Radstock Series belong to the uppermost beds of the British Coal Measures, with which perhaps the Zwickau Beds are homotaxial. Although the middle division of the Saarbrück Beds contains as many as thirty species in common with the Radstock Series, the floras of the Saarbrück and Ottweiler Series, taken as a whole, indicate a somewhat higher horizon than that of the Radstock Beds.

A characteristic Permian conifer, *Walchia piniformis*, Schl., sp., has been observed in the Middle Saarbrück Series, and it also probably occurs in the Ottweiler Beds. No evidence of this genus has been found in the Radstock Series.

It is, however, interesting to observe that in the Upper Ottweiler Series (which overlie the Saarbrück Series) no fewer than twenty species occur that are also found in the Radstock Series. Beds of the same age as the Radstock Series appear to be absent from France. Their position is evidently between the Upper and Middle Coal Measures of the French Coal Fields. For the comparative list of the French Superior and Middle Coal Measure plants (Column II.) I am indebted to M. Zeiller, who has spared no trouble in providing me with the desired information. To elucidate this point more fully, I give some extracts from his letters on this interesting subject.

"Your list (Column I.) seems to me to indicate exactly the passage from the Middle Coal Measures to the Upper Coal Measures, something like the highest zone of the Saarbrück Beds of Weiss, or the base of the Coal Field of Saxony. You will see in my text of the Coal Field of Valenciennes (when it appears, which will not be so soon as I would wish †) what I say on this classification.

* It may be well to note here the probable equivalents of the French and British Carboniferous Rocks :—

France.	Britain.
Upper Coal Measures (Houiller Supérieur and Supérieur inférieur)	} Absent.
Absent	
Middle Coal Measures (Houiller Moyen)	Radstock Series (= Upper Coal Measures of Britain).
Inferior Coal Measures (Houiller inférieur)	{ Middle Coal Measures. Lower Coal Measures.
	{ Carboniferous Limestone Series. Calcareous Sandstone Series.

† The Atlas of Plates only has been issued.

"The species in your list that I have not found in our *Bassin du Nord*, but which occur in our *Bassins du Centre*, I have marked 'Superior'; others, which are found both in the *Bassin de Valenciennes*, but especially in its highest part, and at the base of our *Bassins de la Loire* and *Alais*, as *Sphenophyllum emarginatum* and *Sig. monostigma*, or even extending into the highest beds, as *Asterophyllites equisetiformis*, *Annularia stellata*, *Ann. sphenophylloides*, and *Alethopteris Grandini*, I have marked 'Inferior Superior.' Others again, that I have only known in the *Bassin de Valenciennes* and not in our *Bassins du Centre*, I have marked 'Inferior,' among these last a certain number occur in the north of France, towards the top of the Basin, that is to say, in the oil or gas-coal beds at the *Pas de Calais*, which the Abbé BOULAY has already shown, and which I show in my turn, to be the highest part of the *Bassin de Valenciennes*. These are *Sphen. neuropteroides*, *Neur. Scheuchzeri*, *Neur. rarinervis*, *Dictyopteris Munsteri*, *Pecopteris crenulata*, *Aleth. Serlii*, *Ulodendron majus*, and *Sigillaria reniformis*. What I have not marked as to *horizon* are those which I have not seen in France, but *Sphen. Grandini* (= *Sphen. alata*, Brongt.) is from Geislauntern, that is to say, from the summit of the middle zone or from the base of the highest zone of the *Saarbrück Beds*; *Corynepteris erosa* is from Saxony. These two indications agree with what I have said already.

"On the other hand, I remark the absence of several species which with us are abundant in the *Upper Coal Measures*, particularly *Sphenophyllum oblongifolium*, *Sphenophyllum angustifolium*, *Sphenophyllum longifolium* (to which my *Sphenophyllum Thoni* should, I now believe, belong), *Neuropteris cordata*, *Odonopteris Reichiana*, *Dictyopteris Brongniarti*, *Callipteridium pteridium* (= *Pec. ovata*, Brongt. = *Call. mirabile*, Rost., sp.), *Pec. arguta* (= *Fil. fœminæformis*, Schl.), *Sigillaria Brardii*, and *Sigillaria spinulosa*.

"From this, *Radstock* represents, in my opinion, a *horizon* (niveau) that we have not in France, but corresponds to the interval between the end of the Coal Deposits in the north of France and the beginning of the Coal Fields of the centre."

In a later letter M. ZEILLER further says—"The mixture they (the *Radstock Series*) present of *Upper Coal Measure* species with *Lower Coal* species is unquestionable, but I do not at all mean to say by that that they are equal both to all or part of our *Lower Coal* (or more exactly our *Middle Coal*) and of our *Upper Coal*; in my opinion they are *intermediate* between the two, and are situated immediately above our highest beds of the north of France and below our lowest beds of *St Etienne*, *Gard*, &c.; perhaps their base is equivalent to the summit of the first and their summit the equivalent of the base of the latter, but on the whole I think their position is between the two."

APPENDIX.

The Fossil Flora of the *Farrington*, *New Rock*, and *Vobster Series* has not been nearly so fully worked out as that of the *Radstock Series*, but still sufficient has been done to make a record of the species known to occur in these horizons of considerable value.

In none of these series are fossil plants so plentiful as in the *Radstock Series*, hence the difficulty of working out their flora,—in fact, it can only be done satisfactorily by those residing in the neighbourhood, who can take advantage of collecting when shafts are being sunk or new roads being driven underground, or when in any other mining operations good fossiliferous shales are met with. Some of the localities at the time of my visit appeared to be very barren, while at other times I know they yielded a very good harvest.

Next to the *Radstock Series*, the *Farrington Series* is that from which I have collected most, but the time devoted to it has been small compared to that given to the examination of the *Radstock Series*. I may remark in passing, *that palæontologically the Farrington Series cannot be separated from the Radstock Series, of which, in fact, they seem to form a part.*

The records from the *New Rock* and *Vobster Series* are chiefly obtained from the study of specimens in the museums already referred to; but I am also much indebted for information regarding the flora of these series to Mr E. WETHERED, F.G.S., Cheltenham, and to Mr S. JORDAN, Clifton, who kindly gave me every facility for examining the fossil plants in their collections.

The *Pennant Rock* seldom yields well-preserved examples, owing to the coarse-grained nature of the rock. Any specimens seen were usually coarse casts of *Calamites* or *Lepidodendra*.

The *Red Shales* which separate the *Radstock* and *Farrington Series* are also very barren, but the plants observed were similar to those of the two series just mentioned.

The flora of these various horizons are treated of in descending series :—

I. FARRINGTON SERIES.

(Upper Coal Measures.)

Eucalamites (Calamites) ramosus, Artis.

Loc.—Parkfield.

Stylocalamites (Calamites) Suckowii, Brongt.

Loc.—Farrington Pit, Farrington-Gurney.

Annularia stellata, Schl., sp.

Loc.—Old Mills Pit, Farrington-Gurney ; Farrington Pit ; Parkfield.

Annularia sphenophylloides, Zenker.

Loc.—Old Mills Pit.

Sphenophyllum emarginatum, Brongt.

Loc.—Old Mills Pit ; Parkfield ; Farrington Pit.

Sphenopteris macilenta, L. & H. (?)

Loc.—Old Mills Pit.

Sphenopteris neuropteroides, Boulay, sp.

Loc.—Old Mills Pit.

Sphenopteris, sp. Pl. XIX. fig. 3 shows a small fragment of *Sphenopteris* having considerable similarity to the fruiting specimens of *Sphenopteris (Diplothmema) Zeilleri*, Stur,* figured by ZEILLER, but is too fragmentary for a satisfactory identification. On the same slab are the indistinct remains of another specimen, which is apparently specifically distinct from that just mentioned.

Loc.—Old Mills Pit.

Neuropteris macrophylla, Brongt.

Loc.—"Top Vein," Parkfield ; Old Mills Pit ; Farrington Pit.

Neuropteris Scheuchzeri, Hoffm.

Loc.—Foxcote, near Radstock ; Middle Pit, Radstock ; Farrington Pit ; Old Mills Pit.

Neuropteris flexuosa, Brongt.

Loc.—Old Mills Pit.

Neuropteris ovata, Hoffm.

Loc.—"Hollybush Vein," Parkfield ; Old Mills Pit.

Neuropteris rarinervis, Bunbury.

Loc.—Old Mills Pit ; Foxcote.

Mariopteris nervosa, Brongt., sp.

Loc.—Old Mills Pit ; Farrington Pit.

Pecopteris arborescens, Schl., sp.

Loc.—Old Mills Pit ; Pucklechurch, near Mangotsfield ; Parkfield.

* = *Diplothmema acutilobum*, Zeiller, *Ann. d. sci. nat. Bot.*, 6^e sér., vol. xvi. pl. xi. fig. 2 ; see also *Flore foss. d. Bassin houil. d. Valenciennes*, pl. xv. fig. 5.

Pecopteris unita, Brongt.

Loc.—Farrington Pit ; Old Mills Pit.

Pecopteris oreopteridia, Schl., sp.

Loc.—Parkfield.

Pecopteris pteroides, Brongt.

Loc.—Parkfield.

Pecopteris Miltoni, Artis, sp.

Loc.—Farrington Pit.

Dicksoniites Pluckenetii, Schl., sp.

Loc.—Farrington Pit ; Foxcote.

Alethopteris lonchitica, Schl., sp.

Loc.—Shale over "Top Vein," Parkfield ; Middle Pit, Radstock.

Alethopteris Serlii, Brongt., sp.

Loc.—Old Mills Pit ; Farrington Pit ; Middle Pit, Radstock.

Alethopteris Grandini, Brongt., sp.

Loc.—Old Mills Pit.

Rhacophyllum crispum, Gutbier, sp.

Loc.—Parkfield ; (?) Old Mills Pit.

Rhacophyllum Goldenbergi, Weiss.

Pl. XXVII. fig. 2.

Loc.—Pucklechurch, near Mangotsfield.

Rhacophyllum, sp.

Loc.—Farrington Pit.

Caulopteris macrodiscus, Brongt.

Pl. XXV. fig. 1.

Loc.—Coal Pit Heath, near Bristol.

Caulopteris, sp.

Loc.—Old Mills Pit.

Lepidodendron Worthenii, Lesqx.

Loc.—Old Mills Pit.

Lepidostrobus.

Loc.—Old Mills Pit.

Sigillaria monostigma, Lesqx.

Loc.—Old Mills Pit.

Sigillaria M'Murtriei, Kidston.

Loc.—Farrington Pit.

Sigillaria tessellata, Brongt.

Loc.—Foxcote, near Radstock.

Sigillaria reniformis, Brongt.

Loc.—Coal Pit Heath

Sigillaria principis, Weiss.

Pl. XXVIII. figs. 6–8.

Sigillaria principis, Weiss, Zeiller, *Flore foss. du Bassin houil. de Valenciennes*, pl. lxxix. figs. 1, 2, 1886.

Description.—Stem furrowed, furrows straight, ribs smooth; leaf-scars more or less distant, oval or suborbicular, lateral angles distinct, vascular cicatricules situated slightly above the centre of the scar, the two lateral lunate, the central punctiform. Leaf-scar surmounted by a small cicatrice. Decorticated stem striate.

Remarks.—The specimens from Farrington-Gurney agree with fig. 2 of ZEILLER'S plate, where the scars are orbicular, and not so oval as in his fig. 1. In the Somerset examples there is no trace of the downward running lines that proceed from the lateral angles. In some cases the scars are slightly emarginate, in others they are simply rounded at the top. The central portion of the ribs is flattened in my fossils, but this may be due to pressure. Only two specimens were met with, and, from the position in which they were found, they probably belong to the same individual.

Loc.—Old Mills Pit, Farrington-Gurney.

Sigillaria Voltzii, Brongt.

Loc.—Coal Pit Heath.

Sigillaria elongata, var. *minor*, Brongt.

Loc.—Parkfield.

Stigmaria ficoïdes, Sternb., sp.

Loc.—Parkfield; Old Mills Pit; Foxcote, near Radstock.

Cordaïtes angulosostriatus, Grand' Eury.

Loc.—Old Mills Pit; Foxcote.

Cardiocarpus fluitans, Dawson.

Loc.—Old Mills Pit.

Trigonocarpus Noeggerathi, Sternb., sp.

Loc.—Old Mills Pit.

Carpolithes ovoideus, Göpp. & Berger.

Loc.—Old Mills Pit.

II. PENNANT ROCK.

Stylocalamites (Calamites) Suckowii, Brongt.

Loc.—Crewshole, near Bristol.

Stylocalamites (Calamites) canncæformis, Schl., sp. (?).

Loc.—Crewshole (perhaps only *C. Suckowii*).

Calamitina (Calamites) approximatus, Brongt.

Loc.—Downend, near Mangotsfield; Crewshole; Fish Ponds, near Bristol.

“*Ulodendron*.”

Loc.—Downend, near Mangotsfield.

“*Halonia*.”

Loc.—Fish Ponds, near Bristol.

Stigmaria ficoides, Sternb., sp.

Loc.—Near Bristol.

III. NEW ROCK SERIES.

Stylocalamites (Calamites) Suckowii, Brongt.

Loc.—“Thoroughfare Seam,” Kingswood, near Bristol.

Sphenopteris trifoliolata, Artis, sp.

Loc.—Above “Toad Vein,” Deep Pit, Kingswood.

Mariopteris nervosa, Brongt.

Loc.—Deep Pit, Kingswood.

Pecopteris arborescens, Schl., sp.

Loc.—Golden Valley.

Pecopteris Miltoni, Artis, sp.

Loc.—“Top Vein,” Warmley, near Bristol; Golden Valley.

Lepidostrobus, sp.

Loc.—Kingswood.

“*Ulodendron*” (*Sig. major*, L. & H., sp. (?)).

Loc.—“Little Toad Vein,” Speedwell Colliery, Kingswood.

Sigillaria monostigma, Lesqx.

Loc.—Warmley, near Bristol.

Sigillaria tessellata, Brongt.

Loc.—Kingswood.

Sigillaria mamillaris, Brongt.

Loc.—Warmley, near Bristol.

Sigillaria mamillaris, var. *abbreviata* (Brongt.), Weiss.

Foss. Flora d. jüngst. Stk. u. d. Rothl., p. 165.

Loc.—"Great Toad Vein," Kingswood.

Sigillaria scutellata, Brongt.

Loc.—Kingswood.

Sigillaria rugosa, Brongt.

Loc.—"Great Toad Vein," Kingswood.

Sigillaria Schlotheimii, Brongt.

Loc.—2 feet above "Toad Vein," Kingswood.

Stigmaria ficoides, Sternb., sp.

Loc.—Kingswood ; Bedminster, near Bristol.

Cordaites, sp.

Loc.—Deep Pit, Kingswood.

IV. VOBSTER SERIES.

Calamitina (Calamites) varians, Sternb.

Loc.—Edford Colliery, near Radstock.

Stylocalamites (Calamites) cannaeformis (?), Schl., sp. (or *C. Suckowii*, Brongt.)

Loc.—Edford Colliery.

Sphenophyllum emarginatum, Brongt.

Loc.—Ashton Pits, near Bristol.

Pecopteris oreopteridia, Schl., sp.

Loc.—Ashton Pits, near Bristol.

Lepidodendron aculeatum, Sternb.

Loc.—Edford Colliery.

Lepidodendron rimosum, Sternb.

Loc.—Bed between Stone Rag and Main Seam, Edford.

Sigillaria Sillimani, Brongt.

Loc.—Ashton Pits, near Bristol.

Sigillaria mamillaris, Brongt.

Loc.—Ashton Pits, near Bristol.

EXPLANATION OF PLATES.

PLATE XXIV.

- Fig. 1. *Alethopteris Davreuxi*, Brongt., sp.; from Camerton, nat. size. Specimen in the collection of the Bristol Museum. 1a, two pinnules $\times 2$, p. 386.
- Fig. 2. *Pecopteris unita*, forma *emarginata*, Göpp., sp.; Camerton, p. 367.
- Fig. 3. *Pecopteris unita*, Brongt.; New Mills Pit, Farrington-Gurney (*Farrington Series*). 3a, two pinnules $\times 2$, showing the nervation.
- Fig. 4. *Pecopteris unita*, forma *emarginata*, Göpp., sp.; Camerton. 4a, portion $\times 2$, showing the nervation.
- Fig. 5. *Pecopteris unita*, Brongt., forma *elliptica* (*G. elliptica*, Font. and White); Old Mills Pit, Farrington-Gurney (*Farrington Series*), nat. size. 5a, pinnule $\times 2$, showing nervation.
- Fig. 6. *Pecopteris unita*, forma *emarginata*, Göpp., sp.; Camerton. 6a, portion $\times 2$, showing nervation.
- Fig. 7. *Pecopteris unita*, forma *emarginata*, Göpp., sp.; Radstock, nat. size, showing fructification (= *Stichopteris longifolia* (Brongt.), Weiss).
- Fig. 8. *Pecopteris unita*, forma *emarginata*, Göpp., sp.; Upper Conygre Pit, Timsbury, nat. size, showing fructification (= *Stichopteris longifolia* (Brongt.), Weiss).
- Fig. 9. *Pecopteris unita*, Brongt.; Camerton, nat. size. 9a, pinnule $\times 2$, showing nervation.

PLATE XXV.

- Fig. 1. *Caulopteris macrodiscus*, Brongt., sp.; Coal Pit, Heath, near Bristol (*Farrington Series*), half nat. size. Specimen in the collection of the Bristol Museum, p. 393.
- Fig. 2. *Caulopteris macrodiscus*, Brongt., sp.; Radstock, half nat. size. Specimen in the collection of Mr J. M'Murtrie.
- Fig. 3. *Megaphyton frondosum*, Artis; Radstock half nat. size. In the collection of Mr J. M'Murtrie, p. 390.

PLATE XXVI.

- Fig. 1. *Megaphyton elongatum*, Kidston, half nat. size. Specimen in the collection of the Bristol Museum, p. 390.
- Fig. 2. *Caulopteris*, sp., Radstock, nat. size, showing the epidermal layer removed in part, and exhibiting the *Caulopteris macrodiscus* condition. In the collection of Mr J. M'Murtrie.
- Fig. 3. *Caulopteris anglica*, Kidston; Radstock, half nat. size. Specimen in the collection of the Bath Museum, p. 392.
- Fig. 4. *Megaphyton frondosum*, Artis; portion of the outer surface of the stem of specimen figured on Pl. XXV. fig. 3, nat. size, showing rootlets, p. 390.
- Fig. 5. *Caulopteris*, sp., Radstock, nat. size, isolated scar, showing "horse-shoe" cicatrice.

PLATE XXVII.

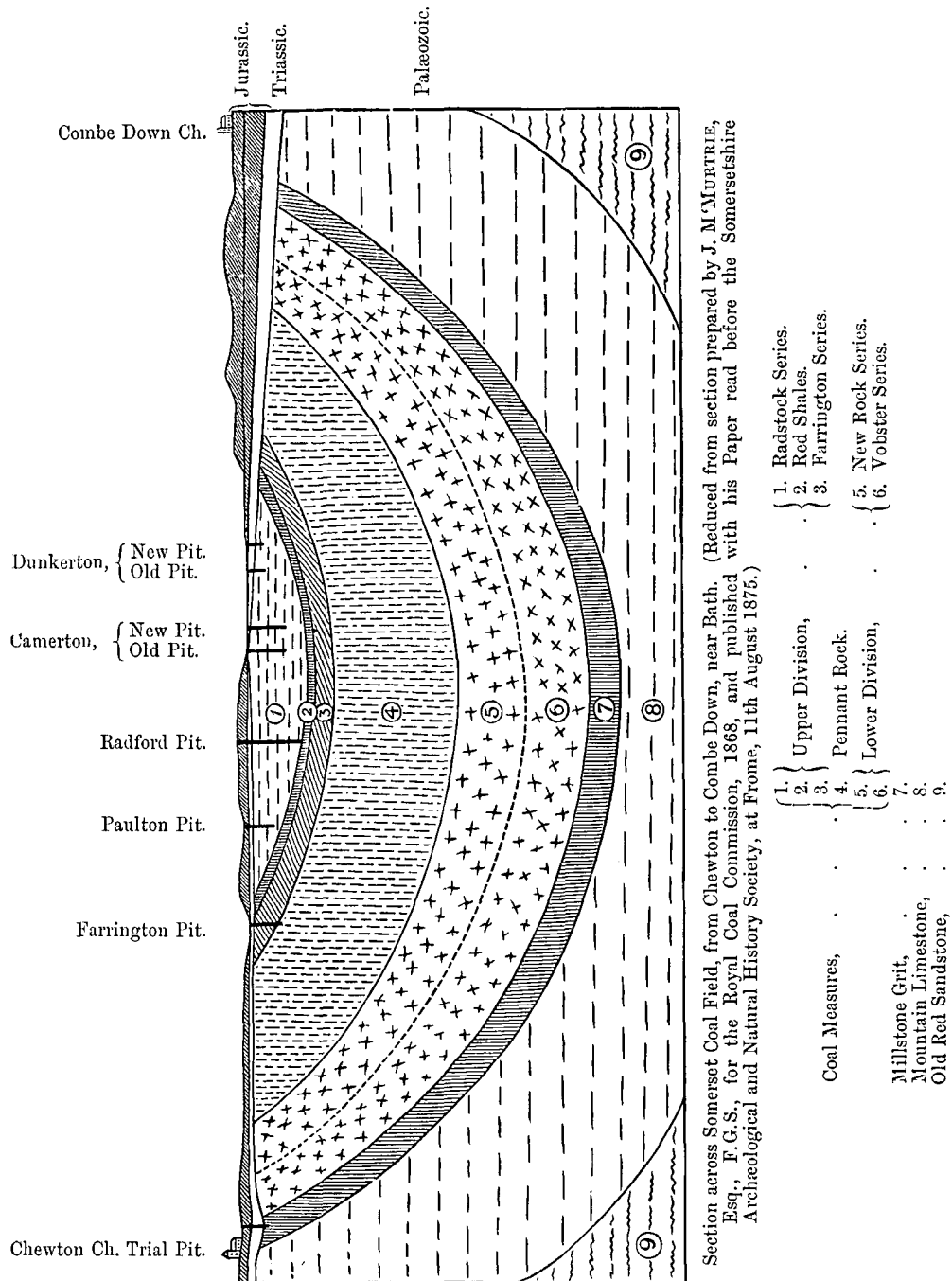
- Fig. 1. *Macrosphenopteris Lindsæoides*, Kidston, n. sp.; Radstock, nat. size, p. 353.
- Fig. 2. *Rhacophyllum Goldenbergii*, Weiss; Pucklechurch, nat. size. Specimen in the collection of the Bristol Museum, p. 388.
- Figs. 3, 4. *Pecopteris oreopteridia*, Schloth., sp.; Camerton. Fig. 3, barren pinnule $\times 3$, showing nervation. Fig. 4, fruiting pinnule $\times 3$, showing the villose upper surface, p. 371.
- Fig. 5. *Lepidodendron lanceolatum*, Lesqx.; Radstock, Cone, nat. size, p. 394.

RADSTOCK SERIES OF THE SOMERSET AND BRISTOL COAL FIELD. 417

- Fig. 6. *Sigillaria reniformis*, Brongt., var. *Radstockensis*, Kidston; Radstock, nat. size. 6*a*, scar $\times 1\frac{1}{2}$
In the collection of Mr J. M'Murtrie, p. 399.
Fig. 7. *Lepidophyllum*, sp. *a*, Radstock; *b*, Braysdown Colliery, nat. size, p. 395.
Fig. 8. *Sporangium*, Camerton, nat. size. 8*a*, $\times 2$, p. 400.
Fig. 9. *Sporangium*, Upper Conygre Pit, Timsbury, nat. size. 9*a*, $\times 2$, p. 400.

PLATE XXVIII.

- Figs. 1, 2. *Pecopteris oreopteridia*, Schloth., sp.; Camerton. Two pinnæ from different parts of the same specimen, nat. size, p. 371.
Fig. 3. *Lepidodendron lanceolatum*, Lesqx.; Camerton, nat. size, stem showing leaf-scars, p. 394.
Fig. 4. *Lepidodendron lanceolatum*, Lesqx.; Camerton, nat. size, small branches showing foliage.
Fig. 5. *Sigillaria levigata*, Brongt.; Radstock, nat. size. 5*a*, leaf-scar $\times 2$, p. 398.
Figs. 6, 7. *Sigillaria principis*, Weiss; Old Mills Pit, Farrington-Gurney (*Farrington Series*), nat. size. 6*a*, leaf-scar $\times 2$, p. 413.
Fig. 8. *Sigillaria principis*, Weiss, same locality as last. 8*a*, leaf-scar $\times 2$, p. 413.
Figs. 9, 9*a*, 10, 10*a*. *Stigmara anglica*, Sternb., sp.; Camerton, nat. size. 10*b*, scar $\times 2$, p. 401.



Section across Somerset Coal Field, from Chewton to Combe Down, near Bath. (Reduced from section prepared by J. M'MURTRIE, Esq., F.G.S., for the Royal Coal Commission, 1868, and published with his Paper read before the Somersetshire Archaeological and Natural History Society, at Frome, 11th August 1875.)



Fig. 1. SPHENOPTERIS WOODWARDI, Kidston. n. s. 2. SPHENOPTERIS TENUIFOLIA, Gütber. (Brongt.?) 3. SPHENOPTERIS, sp.

Fig. 1^w. ANN. SPHENOPHYLLOIDES, Zenker. sp. Fig. 1^y. ANN. STELLATA, Schloth. sp.



Robt Kidston, del. ad nat.

M^rFarlane & Erskine, Lith^r Edin^r

Fig. 1. SCHIZOSTACHYS SPHENOPTEROIDES, Kidston, n.s. 2. PTYCHOPTERIS ELONGATUS, Kidston, n.s.
3. RHACOPHYLLUM SPINOSUM, Lesqx.



Robt Kidston, del. ad nat.

M^r Farlane & Erskine, Lith^r Edin^r

Fig. 1. SPHENOPTERIS GENICULATA, Germar & Kaulfuss. 2. NEUROPTERIS MACROPHYLLA, Brongt.
Fig. 3-5. NEUROPTERIS FIMBRIATA, Lesquereux.(?) 6. DICTYOPTERIS MUNSTERI, Eichwald, sp.



Robt Kidston, del. ad nat.

M. Falcane & Erskine, Lith. Edin.

Fig. 1. *NEUROPTERIS OVATA*, Hoffmann.

2-3. *NEUROPTERIS MACROPHYLLA*, Brongt.

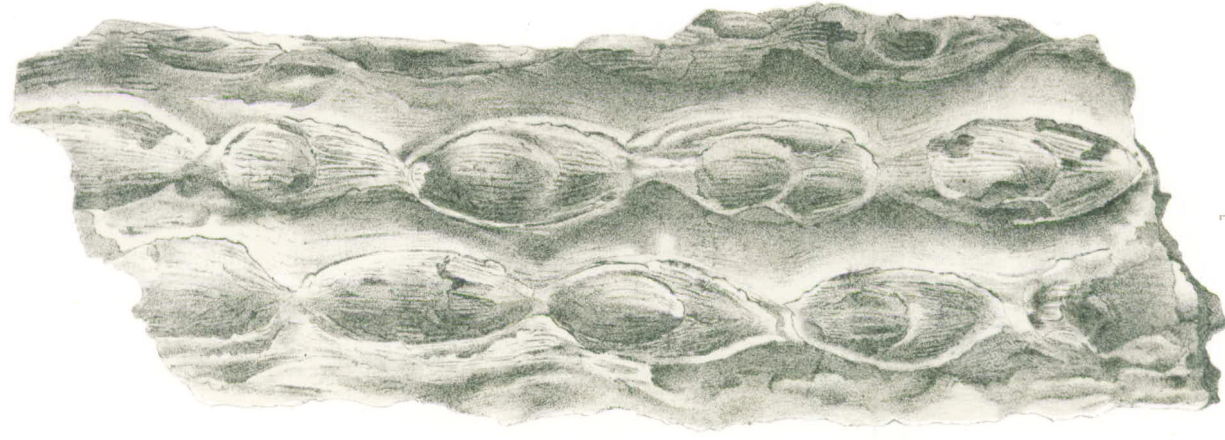


Fig. 1-2. *NEUROPTERIS SCHEUCHZERI*, Hoffm. 3. *TRIGONOCARPUS NOEGGERATHI*, Brongt.
 Fig. 4. *RHABDOCARPUS MULTISTRIATUS*, Presl, sp. 5. *CARDIOCARPUS GUTBIERI*, Geinitz.
 Fig. 6. *CARDIOCARPUS*. 7-8. *CARPOLITHUSOVOIDEUS*, Göppert & Berger.

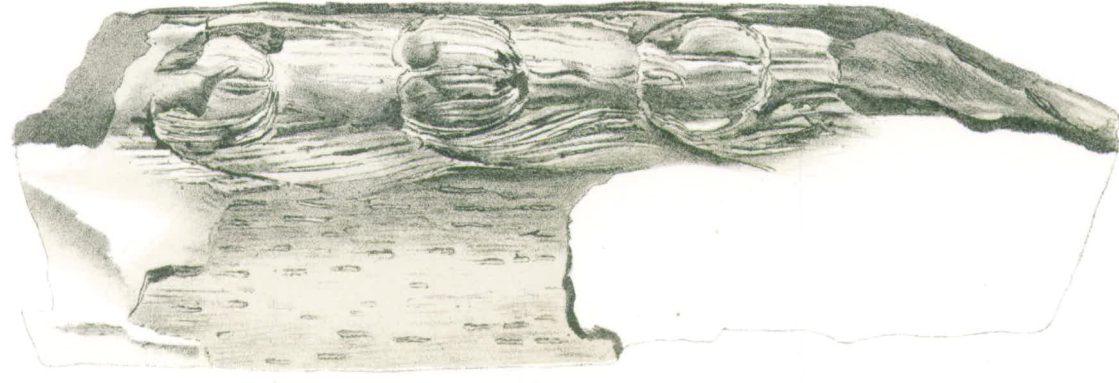


Fig 1, ALETHOPTERIS DAVREUXI, Brongt. sp.

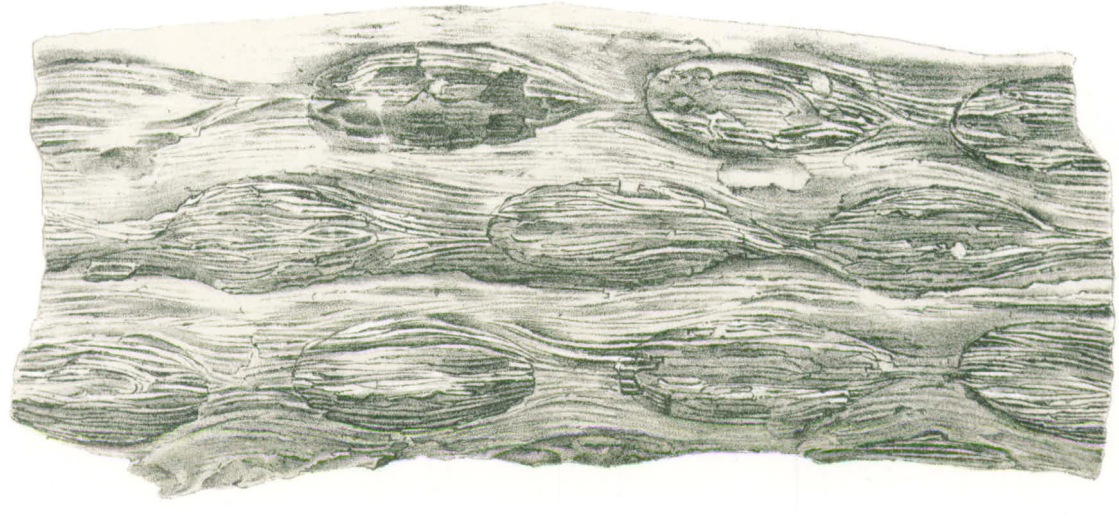
Fig 2 9, PECOPTERIS UNITA, Brongt.



1.



2.



3.

Fig. 1-3. CAULOPTERIS MACRODISCUS, Brongt. sp. J. MEGAPHYTON FRONDOSUM, Artis.



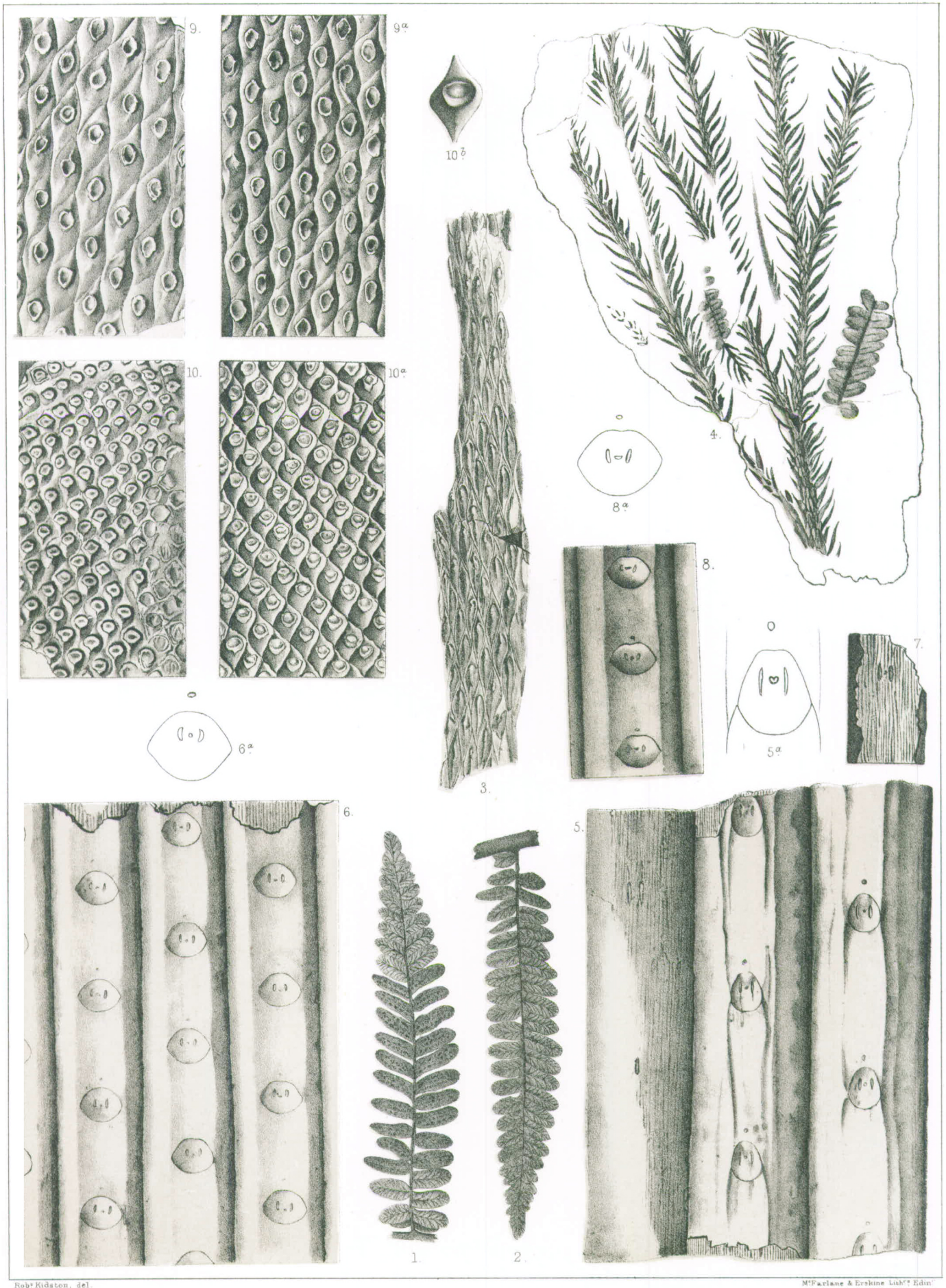
Robt Kidston, del.

McFarlane & Erskine Lith^r Edin^r

Fig 1. MEGAPHYTON ELONGATUM, Kidston, n. s. 2. CAULOPTERIS, sp. 3. CAULOPTERIS ANGLICA, Kidston, n. s.
Fig. 4. MEGAPHYTON FRONDOSUM, Artis. 5. CAULOPTERIS, sp.



Fig. 1. *MACROSPHENOPTERIS LINDSÆOIDES*, Kidston, n. s. 2. *RHACOPHYLLUM GOLDENBERGII*, Weiss.
 Fig. 3-4. *PECOPTERIS OREOPTERIDIA*, Schloth. sp. 5. *LEPIDODENDRON LANCEOLATUM*, Lesq. (Cone.)
 Fig. 6. *SIGILLARIA RENIFORMIS*, Brongt. var. *RADSTOCKENSIS*, Kidston. 7. *LEPIDOPHYLLUM*, sp. 8-9, SPORANGIA.



Robt Kidston, del.

M^{rs} Farlane & Erskine Lith^{rs} Edin

Fig 1-2. *PECOPTERIS OREOPTERIDIA*, Schloth, sp. 3-4. *LEPIDODENDRON LANCEOLATUM*, Lesqx.
 Fig. 5. *SIGILLARIA LAEVIGATA*, Brongt. 6-8 *SIGILLARIA PRINCIPIS*, Weiss. 9-10. *STIGMARIA ANGLICA*, Sternb.sp.