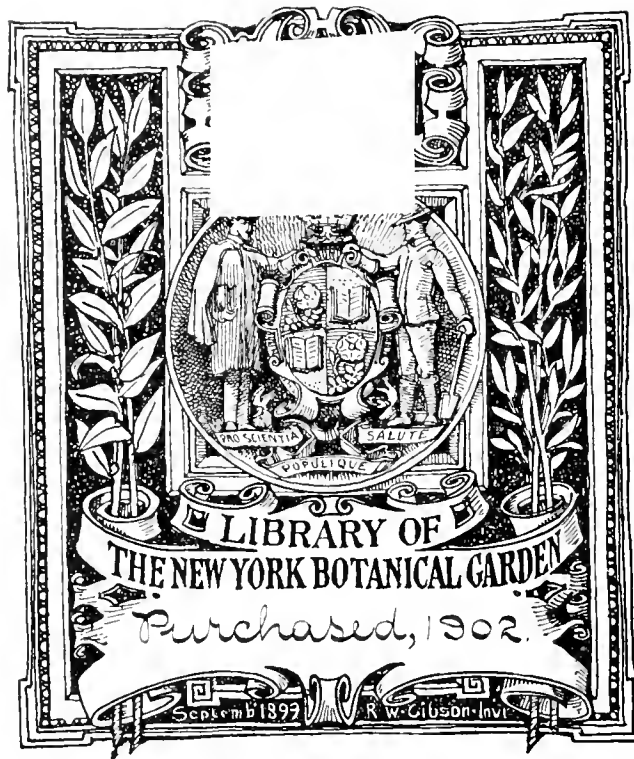


919  
447

Kidston.  
On Neuropteris  
and Neuropteris  
plicata  
Rectin-  
eris.

Kidston.  
Fossil flora  
of the Staf-  
fordshire coal-  
fields. p. 12







TRANSACTIONS  
OF THE  
ROYAL SOCIETY OF EDINBURGH.

VOL. XXXV.—PART I., Nos. 5 AND 6.

---

ON NEUROPTERIS PLICATA, STERNBERG,  
AND  
NEUROPTERIS RECTINERVIS, KIDSTON, n. sp.  
[WITH A PLATE].

---

ON THE FOSSIL FLORA OF THE STAFFORDSHIRE  
COAL FIELDS.  
[WITH A PLATE].

BY  
ROBERT KIDSTON, F.R.S.E., F.G.S.

---

EDINBURGH :  
PUBLISHED BY ROBERT GRANT & SON, 107 PRINCES STREET,  
AND WILLIAMS & NORGATE, 14 HENRIETTA STREET, COVENT GARDEN, LONDON.

7/8/88.

MDCCCLXXXVIII.

*Price Three Shillings.*



V.—On *Neuropteris plicata*, Sternberg, and *Neuropteris rectinervis*, Kidston, n. sp.  
 By ROBERT KIDSTON, F.R.S.E., F.G.S. (With a Plate.)

(Read 30th January 1888.)

*Neuropteris plicata* was described by STERNBERG in 1826, from a specimen from Mireschau, Bohemia, but the species seems to be very rare and imperfectly known. As other ferns have been identified as *N. plicata* in error, I give a figure of what I believe to be STERNBERG'S plant, an identification with which my friend M. ZEILLER entirely agrees.

I also figure and describe a new species of *Neuropteris*, which is identical with that identified as *N. plicata* by ROEHL, but from which species it is essentially distinct.

***Neuropteris plicata*, Sternberg (figs. 1, 1*a*).**

*Neuropteris plicata*, Sternb., *Vers.*, i. fasc. iv. p. 16; ii. p. 74, pl. xix. figs. 1 and 3.

*Description*.—Frond tripinnate (?), pinnæ alternate (?), linear-lanceolate; pinnules sessile, approximate or separated a short space, cordate-ovate or cordate-lanceolate, apex blunt, margin plicate; nervation very fine, central vein dividing into numerous branches some distance below the apex; lateral veins numerous, curved upwards, and dividing three times. Terminal lobe elongate-triangular, small.

*Remarks*.—The only specimen of this species which has come under my notice is that given on fig. 1. It was collected by Mr JOHN WARD, F.G.S., Longton, from whom I received it. It is in an exquisite state of preservation, and shows the nervation very beautifully. The veins are too close and too fine to be represented in a sketch of natural size (fig. 1), but a portion of a pinnule, enlarged four times to show the nervation, is given at fig. 1*a*. There are five of the ultimate divisions of the veins in 1 mm. at the margin of the pinnule. The central vein appears to be formed rather by the united bases of the lateral veinlets than to consist of a mid-vein giving off lateral veinlets. The specimen I figure is identical in all respects with the type figure; and, when the two figures are compared, they bear a wonderful similarity.

Before seeing this example, I was inclined to regard *N. plicata* as identical with *N. flexuosa*,\* being partly led to this belief by finding what I now regard as undoubtedly *N. flexuosa* identified as *N. plicata*.† As STERNBERG has omitted to give enlarged details of the nervation of his fern, its identification has been made much more difficult.

\* *Catal. of Palæoz. Plants*, p. 94, where it is in error united with *Neur. flexuosa*. I however excluded *Neur. plicata* from *Neur. flexuosa* in my paper on the "Radstock Fossil Flora," *Trans. Roy. Soc. Edin.*, vol. xxxiii. pt. ii. p. 359.

† Lesquereux, *Coal Flora of Pennsylv.*, vol. i. p. 96, pl. x. figs. 1-4.

In addition to the type, two other published figures have been referred to *N. plicata*. These are the figures given by LESQUEREUX,\* which are clearly referable to *N. flexuosa*, Sternb., and those given by ROEHL,† of which, probably both figures, but certainly one, is referable to my *N. rectinervis*, which is described below.

In *N. flexuosa*, of which I have lately been able to examine many fine specimens from the Radstock Series, the terminal lobe is always very large, the pinnules more obtuse and not so lanceolate, and the lower auricle more pronounced than in *N. plicata*. The nervation in *N. flexuosa* is also stronger and not so fine, there being usually at the margin of the pinnules only four veins in 1 mm. Occasionally, however, in some specimens of *N. flexuosa*, immediately within the margin of the pinnule, a fourth dichotomy of the veins takes place, which makes them more numerous than four in 1 mm.

*Locality*.—Longton Hall Colliery, Longton, Staffordshire.

*Horizon*:—Middle Coal Measures. From a bed about 2 feet above the Great Row Coal.

### *Neuropteris rectinervis*, Kidston, n. sp. (figs. 2-4.)

*Neuropteris plicata*, Roehl (not Sternberg), *Foss. Flora d. Steink.-Form. Westphalens*, p. 38, pl. xiii. fig. 8 (? pl. xx. fig. 7).

*Description*.—Pinnules sessile, alternate, oval or oblong, blunt, approximate or slightly separate, margin entire and free from plications; midrib very distinct, and extending almost to the apex; lateral veins distinct, numerous, fine, springing from the mid-rib with a gentle curve, and then running the greater part of their course at almost right angles to the margin of the pinnules, usually once, but occasionally twice, divided. At the margin of the pinnules there are five to six ultimate divisions of the veins in 1 mm. Terminal lobe oblong.

*Remarks*.—The specimens figured were collected in 1879, but, from their fragmentary nature, have remained undescribed till now, when, in treating of *N. plicata*, it has been thought advisable to specifically distinguish this species, which has been confused with *N. plicata*, Sternb. I have the less hesitation in doing so, as the nervation is so characteristic, that *N. rectinervis* can at once be distinguished from all other species.

Of the two figures given by ROEHL as *N. plicata*, that on his pl. xiii. fig. 8, is clearly *N. rectinervis*. About the other figure, given in his pl. xx. fig. 7, one cannot speak with so great certainty, though the probability is that it is also referable to *N. rectinervis*. He says, in describing the nervation of his specimens,‡ “the lateral nerves stand almost upright to the principal nerve, are very distinct, close together, once bifurcated, feebly bent”—which agrees entirely with the character of my plant.

The figures given show the variation in the size and form of the pinnules.

\* *Loc. cit.*, pl. x. figs. 1-4.

† *Foss. Flora d. Steink.-Form. Westphalens*, p. 38, pl. xiii. fig. 8; pl. xx. fig. 7.

‡ *Loc. cit.*, p. 38.



*Locality*.—Polton, Bonnyrigg, Mid-Lothian.

*Horizon*:—Lower Coal Measures.

#### EXPLANATION OF PLATE.

Fig. 1.—*Neuropteris plicata*, Sternberg. From shale above Great Row Coal, Longton Hall Colliery, Longton. Middle Coal Measures. (Collected by J. WARD, F.G.S.). Nat. size.

Fig. 1a, Nervation  $\times 4$ .

Figs. 2-4.—*Neuropteris rectinervis*, Kidston, n. sp. From Polton, Bonnyrigg, Mid-Lothian. Lower Coal Measures. Nat. size.

Fig. 2a, Nervation  $\times 4$



VI.—*On the Fossil Flora of the Staffordshire Coal Fields.* By ROBERT KIDSTON,  
F.R.S.E., F.G.S. (With a Plate.)

(Read 30th January 1858.)

PART I.

ON THE FOSSIL PLANTS COLLECTED DURING THE SINKING OF THE SHAFT OF THE HAMSTEAD  
COLLIERY, GREAT BARR, NEAR BIRMINGHAM.

The area comprised in the county of Stafford embraces five coal fields—

- I. The *Goldsitch Moss Coal Field*, in the extreme north-east of the county.
- II. The *Cheadle and Churnet Valley Coal Field*.
- III. The *Wetley and Shafferlong Coal Field*.
- IV. The *Coal Field of the Potteries*.
- V. The *South Staffordshire Coal Field*.

The three first mentioned are of small extent, and as I know little of their fossil flora they are omitted from this series of papers on the Carboniferous Flora of the Staffordshire Coal Fields.

I, however, devote a separate communication to the fossil plants met with while sinking the shaft of the Hamstead Colliery, Great Barr, as a considerable part of the rocks passed through during this operation is clearly *Upper Coal Measures*, not *Permian*, as has been generally stated. The palæontological evidence, therefore, becomes of special importance in determining the age of the red shales occurring in the upper part of this sinking, which have been usually mapped as Permian.

Strata of the same age also occur in the Potteries Coal Field, but the fossil plants are not so fully known from them as from the strata passed through in the sinking at Hamstead. The determination, therefore, of the true position of the red shales at Hamstead assists one in dealing with the stratigraphy of other districts of Staffordshire.

At the meeting of the British Association, held at Birmingham in 1886, Messrs FREDERICK G. MEACHEM, M.E., and H. INSLEY, read a paper, entitled “Notes on the Rocks between the Thick Coal and the Trias north of Birmingham and the Old South Staffordshire Coal Field;” this paper, of which an abstract is given in the *Report of the British Association* for 1886,\* contains the only published opinion, as far as I am aware, that these *red shales* belong to the *Upper Coal Measures*.

\* Page 626.

Last year Mr MEACHEM kindly gave me the opportunity of examining the fossils collected during the sinking operations at Great Barr, and the Upper Coal Measure *facies* of many of the specimens is very pronounced. I revisited Hamstead Colliery this year, and went more carefully over the specimens. Mr MEACHEM diligently collected examples of all the fossils met with during the sinking of the shaft, and at the same time noted at what depths they occurred, and the nature of the beds in which they were contained. The whole of this collection was most kindly placed at my disposal for determination and description. Mr F. G. MEACHEM has further favoured me with the details shown in the following section, which give the general character of all the beds from which the fossils were derived, as well as the thickness of the beds, and the depths at which they occur.

VERTICAL SECTION, showing the position of the Fossiliferous Strata passed through while sinking the Shaft of the Hamstead Colliery.

Depth from Surface in yards.	Thickness of Bed in yards.	Description of Bed.	Fossil Contents.
Surface to 209 yards.	...	Red and brown sandstones, and light red marls.	
209	2	Light marl.	(?) <i>Rachis</i> of Fern.
243	34	Red Marl.	<i>Odontopteris Lindleyana</i> , Sternb.
267 $\frac{1}{2}$		Unconformity.	
336-346	10	Red marls (4 $\frac{1}{2}$ yards) and red sandstone. Raindrop impressions and desiccation cracks occur at depth of 336 yards in a blue band 6 inches thick. The " <i>Spirorbis</i> " Limestone occurs at a depth of 341 yards 1 foot, with a thickness of 8 inches.	<i>Pecopteris arborescens</i> , Schl., sp. „ <i>unita</i> , Brongt. „ <i>Miltoni</i> , Artis, sp. <i>Neuropteris orata</i> , Hoffm. „ <i>Scheuchzeri</i> , Hoffm. „ <i>flexuosa</i> , Sternb. <i>Althopteris aquilina</i> , Schl., sp. <i>Calamites</i> , sp. <i>Annularia stellata</i> , Schl., sp. <i>Sphenophyllum emarginatum</i> , Brongt. <i>Lepidophyllum lanceolatum</i> , L. & H. <i>Cyperites bicarinata</i> , L. & H. <i>Conlites angulosostrigatus</i> , G. Eury.
350	13	Brick-coloured marls.	<i>Walchia imbricata</i> , Schimper.
400	5 $\frac{1}{2}$	Light purple rocky marl.	<i>Neuropteris rarinervis</i> , Bunbury.
411	3	Purple and red shale.	<i>Calamites</i> , sp. <i>Pecopteris Miltoni</i> , Artis, sp. <i>Pecopteris</i> , sp. <i>Neuropteris rarinervis</i> , Bunbury. <i>Annularia stellata</i> , Schl. <i>Cyperites bicarinata</i> , L. & H. <i>Lepidostrobus</i> , sp. <i>Stigmaria ficoides</i> , Sternb., sp. <i>Walchia imbricata</i> , Schimper.

Upper Coal Measures.

VERTICAL SECTION—*continued*.

	Depth from Surface in yards.	Thickness of Bed in yards.	Description of Bed.	Fossil Contents.
Upper Coal Measures.	110	24	Red sandstone and grey shale.	<i>Calamites Suckowii</i> , Brongt. <i>Calamites undulatus</i> , Sternb. <i>Calamites varians</i> , Sternb. (var.). <i>Methopteris decurrens</i> , Artis, sp. <i>Lepidodendron Wortheni</i> , Lesqx. <i>Lepidostrobus variabilis</i> , L. & H. <i>Sigillaria</i> , sp. <i>Pinnularia capillaria</i> , L. & H. <i>Sternbergia approximata</i> , Brongt., sp.
	451	...	Unconformity and erosion of strata. Measures below this assume a much purpler hue.	...
Middle Coal Measures.	533-536	3	Blue bind.	<i>Calamites varians</i> , Sternb. (var.). <i>Calamocladus equisetiformis</i> , Schl., sp. <i>Lepidodendron aculeatum</i> , Sternb. <i>Lepidostrobus variabilis</i> , L. & H. <i>Sigillaria reniformis</i> , Bgt. <i>Sigillaria mamillaris</i> , Bgt. <i>Sigillaria</i> , sp. <i>Cyperites bicarinata</i> , L. & H. <i>Stigmaria ficoides</i> , Sternb., sp. <i>Cardaites</i> , sp. <i>Cardiocarpus Meuschenii</i> , Kidst., n. sp.
	550	1	Grey shale.	<i>Carpolithus ovalis</i> , Göpp. & Berger. <i>Ethmondia rudis</i> , M'Coy.
	555	1 $\frac{2}{3}$	Dark grey clod, marine beds.	<i>Productus semireticulatus</i> , Martin. " <i>scabriculus</i> , Martin. <i>Ethmondia rudis</i> , M'Coy. <i>Modiola lingualis</i> , Phill. <i>Anthracosia Urci</i> , Flem. (= <i>A. acuta</i> ), Sow. <i>Leda attenuata</i> , Flem. <i>Gonialites</i> , sp., allied to <i>G. curvatus</i> , Phill. <i>Schizodus</i> , allied to <i>S. carbonarius</i> , Portl.
	584	3	Purple and grey shales.	<i>Calamites Suckowii</i> , Brongt. <i>Neuropteris ravinensis</i> , Bunbury. <i>Macropteris muricata</i> , Schl., var. <i>nervosa</i> (Brongt., sp.).
	615	...	Top of "thick coal." Shales above it devoid of fossils.	...
	623-625	2	Shales with ironstones. A few fossils, chiefly <i>Stigmaria</i> .	...
	631	...	"Heathen coal."	...

The Fossil Plants can be most conveniently considered in connection with their geological positions.

1. Those from the *Upper Coal Measures*, comprising the strata passed through from the surface to a depth of 451 yards.

II. Those from the *Middle Coal Measures*, beginning at a depth of 451 yards, and comprising the remaining strata passed through.

I. THE FLORA OF THE UPPER COAL MEASURES.

**Calamites**, Suckow.

Group I.—**Calamitina**, Weiss., *Steinkohlen Calamarien*, part ii. p. 59, 1884.

**Calamitina (Calamites) varians**, Sternb., var.

*Calamites varians*, Sternb., *Vers.*, ii. p. 50, pl. xii.

*Horizon* :—At a depth of 440 yards.

Group III.—**Stylocalamites**, Weiss., *ibid.*, 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. 2–4 (fig. 1!).

*Horizon* :—At a depth of 440 yards.

**Stylocalamites (Calamites) undulatus**, Sternb.

*Calamites undulatus*, Sternb., *Vers.*, i. fasc. 4, p. xxvi.; *Vers.*, ii. p. 47, pl. i. fig. 2; pl. xx. fig. 8.

*Calamites undulatus*, Zeiller, *Flore foss. du bassin houiller de Valenciennes*, pl. liv. fig. 1, 1886.

*Calamites undulatus*, Brongt., *Hist. de végét. foss.*, p. 137, pl. xvii. figs. 1–4.

*Calamites Suckowii*, var. *undulatus*, Weiss., *Steinkohlen Calamarien*, part ii. p. 135, pl. xvii. fig. 4, and text figure, p. 135, 1884.

*Remarks*.—This plant is regarded by several writers as a distinct species, but by others as a variety of *Calamites Suckowii*, Brongt.

*Horizon* :—At a depth of 440 yards.

**Calamites**, sp.

*Remarks*.—Several fragments, which, however, cannot be specifically determined, occur at depths of 336 and 411 yards respectively.

**Annularia**, Sternb.

**Annularia stellata**, Schloth., sp.

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

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

*Asterophyllites equisetiformis*, L. and H. (not Schloth.), *Fossil Flora*, vol. ii. pl. cxxiv.

Fruit.—*Bruckmannia tuberculata*, Sternb., *Vers.*, i. fasc. 4, p. xxix. pl. xlv. fig. 2.

*Horizons* :—At depths of 336 and 411 yards.

**Sphenophyllum, Brongt.****Sphenophyllum emarginatum, Brongt.**

*Sphenophyllum emarginatum*, Brongt., *Prodrome*, p. 68.

*Sphenophyllum emarginatum*, Zeiller, *Flora foss. du bassin houiller de Valenciennes*, pl. lxiv. figs. 3-5, 1886.

*Horizon* :—At a depth of 336 yards.

**Neuropteris, Brongt.****Neuropteris rarinervis, Bunbury.**

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

*Horizons* :—At depths of 400 and 411 yards.

**Neuropteris ovata, Hoffm.**

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

*Neuropteris ovata*, Kidston, *Trans. Roy. Soc. Edin.*, vol. xxxiii. p. 359, pl. xxii. fig. 1.\*

*Horizon* :—At a depth of 366 yards.

**Neuropteris Scheuchzeri, Hoffm.**

*Neuropteris Scheuchzeri*, Hoffm., Keferstein's *Teuchland geognostisch-geologisch dargestellt*, vol. iv. p. 158, pl. *ib.* figs. 1-4, 1826.

*Neuropteris Scheuchzeri*, Kidston, *Trans. Roy. Soc. Edin.*, vol. xxxiii. p. 356, pl. xxiii. figs. 1-2.\*

*Horizon* :—At a depth of 336 yards.

**Neuropteris flexuosa, Sternb.**

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

*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.

*Horizon* :—At a depth of 336 yards.

**Odontopteris, Brongt.****Odontopteris Lindleyana, Sternb.**

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

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

*Horizon* :—At the depth of 243 yards.

\* Where remarks and further references will be found.

## Pecopteris, Brongt.

## Pecopteris arborescens, Schloth., sp.

*Filicites arborescens*, Schloth., *Flora d. Vorwelt*, p. 41, pl. viii. figs. 13, 14.

*Pecopteris arborescens*, Brongt., *Hist. d. végét. foss.*, p. 310, pls. cii. ciii., figs. 2, 3

*Pecopteris arborescens*, Kidston, *Trans. Roy. Soc. Edin.*, vol. xxxiii. p. 366.\*

*Horizon* :—At a depth of 336 yards.

## Pecopteris unita, Brongt.

*Pecopteris unita*, Brongt., *Hist. d. végét. foss.*, p. 342, pl. cxvi. figs. 1-5.

*Pecopteris unita*, Kidston, *Trans. Roy. Soc. Edin.*, vol. xxxiii. p. 367, pl. xxiv. figs. 2-9.\*

*Horizon* :—At a depth of 336 yards.

## Pecopteris Miltoni, Artis, sp.

*Filicites Miltoni*, Artis., *Antedil. Phyt.*, pl. xiv.

*Pecopteris Miltoni*, Kidston, *Trans. Roy. Soc. Edin.*, vol. xxxiii. p. 374.\*

*Pecopteris abbreviata*, Brongt., *Hist. d. végét. foss.*, p. 337, pl. cxv. figs. 1-4.

*Horizon* :—At a depth of 336 yards.

## Alethopteris, Stemb.

## Alethopteris decurrens, Artis, sp.

*Filicites decurrens*, Artis, *Antedil. Phyt.*, pl. xxi.

*Alethopteris decurrens*, Zeiller, *Flore foss. du bassin houiller d. Valenciennes*, pl. xxxiv. figs. 2, 3; pl. xxxv. fig. 1; pl. xxxvi. figs. 3, 4.

*Pecopteris lictrophylla*, L. and H., *Foss. Flora*, vol. i. pl. xxxviii.

*Pecopteris Mantelli*, Brongt., *Hist. d. végét. foss.*, p. 278, pl. lxxxiii. figs. 3, 4.

*Remarks*.—This is most probably only a variety of *Alethopteris louchitica*, Schloth., sp., with which I have previously united it.

*Horizon* :—At a depth of 440 yards.

## Alethopteris aquilina, Schloth., sp.

*Filicites aquilina*, Schloth., *Flora d. Vorwelt*, p. 38, pl. iv. fig. 7; pl. v. fig. 8.

*Horizon* :—At a depth of 336 yards.

\* Where remarks and further references will be found.



**Lepidodendron, Sternb.****Lepidodendron Worthenii, Lesquereux.**

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

*Lepidodendron Worthenii*, Zeiller, *Flora foss. du bassin houiller d. Valenciennes*, pl. lxxi.

*Horizon*:—At a depth of 440 yards.

**Lepidophyllum, Brongt.****Lepidophyllum lanceolatum, L. and H.**

*Lepidophyllum lanceolatum*, L. and H., *Fossil Flora*, vol. i. pl. vii. figs. 3, 4.

*Horizon*:—At the depth of 336 yards.

**Lepidostrobus, Brongt.****Lepidostrobus variabilis, L. and H.**

*Lepidostrobus variabilis*, L. and H., *Fossil Flora*, vol. i. pls. x. xi.

*Horizon*:—At a depth of 440 yards.

**Lepidostrobus, sp.**

*Horizon*:—At a depth of 411 yards.

**Sigillaria, Brongt.****Sigillaria, sp.**

*Horizon*:—At a depth of 440 yards.

**Cyperites bicarinata, L. and H.**

*Cyperites bicarinata*, L. and H., *Fossil Flora*, vol. i. pl. xliii. figs. 1, 2.

*Remarks*.—The grass-like leaves placed under *Cyperites bicarinata* are the foliage of *Sigillaria*, and probably also of some species of *Lepidodendron*.

These fossils, as far as I have been able to observe, have not two veins as supposed by LINDLEY and HUTTON. The little ledges formed by the two sides of a flat, central, single vein, form protected lodgments for the carbonaceous matter of the leaf, and often after the greater part of this substance has been removed from the other portions of the fossil, the prominence of these two lines of carbonaceous material, which frequently conceal the two edges of the mid-rib, have given rise to the erroneous opinion that the leaves contain two veins.\*

\* *Lepidophyllum trinerve*, L. and H., vol. ii. pl. clii.; *Lepidophyllum binerve*, Lebour; *Illustrations of Fossil Plants* p. 103, pl. liii., are subject to the same explanation.

**Stigmaria**, Brongt.**Stigmaria ficoides**, Sternb., sp.

*Variotaria ficoides*, Sternb., *Vers.*, i. fasc. i. pp. 22, 24, pl. xii. figs. 1-3.

*Stigmaria ficoides*, Brongt., *Class. d. végét. foss.*, p. 28, pl. i. fig. 7.

*Horizon* :—At a depth of 411 yards.

**Pinnularia**, L. and H.**Pinnularia capillacea**, L. and H.

*Pinnularia capillacea*, L. and H., *Fossil Flora*, vol. ii. pl. exi.

*Remarks*.—Probably rootlets of various plants.

*Horizon* :—At a depth of 440 yards.

**Cordaïtes**, Unger.**Cordaïtes angulosostriatum**, Grand' Eury.

*Cordaïtes angulosostriatum*, Grand' Eury, *Flore Carbon. du Départ. de la Loire*, p. 217, pl. xix.

*Cordaïtes angulosostriatum*, Zeiller, *Végét. foss. d. terr. houill.*, p. 144, pl. elxxv. figs. 2, 3.

*Horizon* :—At a depth of 336 yards.

**Sternbergia**, Artis.**Sternbergia approximata**, Brongt.

*Sternbergia approximata*, Brongt., *Prodrome*, p. 137.

*Sternbergia approximata*, L. and H., *Fossil Flora*, vol. iii. pls. cxxiv.—cxxxv.

*Remarks*.—The fossils described as *Sternbergia* (and *Artisia*) are casts of the pith cavity of stems of *Cordaïtes*.

*Horizon* :—At a depth of 440 yards.

**Walchia imbricata**, Schimper. (Fig. 9.)

*Walchia imbricata*, Schimper, *Trait. d. paléont. végét.*, vol. ii. p. 239, pl. lxxiii. figs. 3, 3a, 3b.

*Walchia imbricata*, Renault, *Cours. d. botan. foss.*, Quatrième Anné, p. 85, pl. viii. figs. 7, 8, 1885.

*Description*.—Stem bearing closely placed distichous branches, patent, slightly curved. Stem leaves loosely imbricated, linear, thick, incurved, blunt with a sharp point, keeled, about 1 centimetre long. Branch leaves densely imbricated, short, sub-squamiform, pointed-obtuse, thick, back distinctly keeled.

*Remarks.*—Two specimens of this, the first true conifer I have met with in British Carboniferous rocks, have been found during the sinking of the shaft.

That figured comes from a bed of red marl at a depth of 350 yards from the surface : the other specimen is from a similar red bed, but at a depth of 411 yards.

Fig. 9 is taken from the first-mentioned specimen, and shows a number of lateral branches springing from the main stem. The leaves on the branchlets are tolerably well shown at various parts of the fossil, but the main stem is indistinct, and does not show any foliage. The stem leaves of this species are figured by SCHIMPER. Both branch and stem leaves are distinctly keeled from the presence of a prominent mid-rib.

The second example only shows a number of lateral branchlets, and is not so well preserved as that given at fig. 9.

SCHENK\* unites *Walchia imbricata* and *W. flaccida*, Göpp., to *W. piniformis*, Schloth., sp., as younger conditions of development. The same author also unites several other species of *Walchia* with *W. piniformis*.

As there appears to be some difference of opinion as to the value of some of these species, I provisionally adopt SCHIMPER'S name for the Hamstead plant, with whose figure and description it agrees in all respects.

*Walchia* is essentially a Permian genus, but on several occasions *W. piniformis*, Schloth., sp., has been recorded from the Coal Measures.† Conversely, several species which attain their maximum development in the Coal Measures extend into the Permian formation. In fact, there is a much greater similarity between the flora of the Upper Coal Measures and that of the Permian than exists between that of the Upper and Lower Carboniferous Rocks.

In stating that this record of *W. imbricata* is the first occurrence of a coniferous plant in the Carboniferous Rocks of Great Britain, it should be mentioned that there is now the strongest evidence to show that the stems previously supposed to be coniferous (*Araucarioxylon*) are eycadaceous.‡

*Horizons.*—At depths of 350 and 411 yards.

## II. THE FLORA OF THE MIDDLE COAL MEASURES.

A very imperfect idea is afforded of the richness of the flora of the Middle Coal Measures, as developed in South Staffordshire, from the few specimens collected at Hamstead ; but the meagre list of species recorded gives sufficient data for the comparison of the flora of the two divisions of the Coal Measures occurring at Great Barr.

\* Zittel's *Handbuch d. palæont.*, Band ii, Lief iii, p. 272, 1884.

† Zeiller, *Végét. foss. du terr. houil.*, p. 135 ; Geinitz, *Vers. d. Stinkf. in Sachsen*, p. 33.

‡ See Grand' Eury, *Flora Carbon. du Départ. de la Loire*, p. 249, 1877 ; Schenk, in Zittel's *Handbuch d. Palæont.*, Band ii, Lief iii, p. 243, 1884 ; Renault, *Cours. d. botan. foss.*, 1881, p. 82.

## Calamites, Suckow.

## Calamitina (Calamites) varians, Sternb.

*Horizon* :—At a depth of 533 yards.

## Stylocalamites (Calamites) Suckowii, Brongt.

*Horizon* :—At a depth of 584 yards.

## Calamocladus, Schimper.

## Calamocladus equisetiformis, Schloth., sp.

*Casuariniles equisetiformis*, Schloth., *Flora d. Vorwelt*, p. 30, pl. i. figs. 1, 2; pl. ii. fig. 3.  
*Calamocladus equisetiformis*, Schimper, *Traité d. paléont. végét.*, vol. i. p. 324, pl. xxii. figs. 1–3.  
*Hippurites longifolia*, L. and H., *Fossil Flora*, vol. iii. pls. exc., exci.

*Horizon* :—At a depth of 533 yards.

## Neuropteris, Brongt.

## Neuropteris rarinervis, Bunbury.

*Horizon* :—At a depth of 584 yards.

## Mariopteris, Zeiller.

Mariopteris muricata, Schloth., sp., var. *nervosa*.

*Pecopteris nervosa*, Brongt., *Hist. d. végét. foss.*, p. 297, pl. xciv.; pl. xcv. figs. 1, 2.  
*Pecopteris nervosa*, L. and H., *Fossil Flora*, vol. ii. pl. xciv.

*Horizon* :—At a depth of 584 yards.

## Lepidodendron, Sternb.

## Lepidodendron aculeatum, Sternb.

*Lepidodendron aculeatum*, Sternb., *Vers.*, i. fasc. i. pp. 20 and 23, pl. vi. fig. 2; pl. viii. fig. 1*b*; fasc. ii., p. 25, pl. xiv. fig. 1–4; fasc. iv. p. x.  
*Lepidodendron aculeatum*, Zeiller, *Flore foss. du bassin houiller d. Valenciennes*, pl. lxx.

*Horizon* :—At a depth of 533 yards.

## Lepidostrobus, Brongt.

## Lepidostrobus variabilis, L. &amp; H.

*Horizon*:—At a depth of 533 yards.

## Sigillaria, Brongt.

## Sigillaria reniformis, Brongt., fig. 11.

*Sigillaria reniformis*, Brongt., *Hist. d. végét. foss.*, p. 470, pl. cxlii.

*Sigillaria reniformis*, Goldenberg., *Flora Sarap. foss.*, Heft ii. p. 50, pl. viii. fig. 31.

*Sigillaria reniformis*, Sauveur, *Végét. foss. de la Belgique*, pl. 1. fig. 1.

*Sigillaria reniformis*, Zeiller, *Flore foss. d. bassin houiller de Valenciennes*, pl. lxxxiv. figs. 4–6.

*Sigillaria cactiformis*, Goldenberg., *Flora Sarap. foss.*, Heft i. p. 26, pl. iv. fig. I.

*Description*.—Ribs wide, straight, smooth. Leaf scars reniform, approximate or distant, lateral angles distinct but not prominent. Vascular cicatricules; the two lateral lunate, central punctiform. Above the scar is occasionally a small cicatricule, and between each scar is a transverse line. Decorticated stem longitudinally striate; cicatricules geminate, the two parts oval, united with each other or separate, varying much in shape with age.

*Remarks*.—The small specimen figured shows considerable difference in the size of the leaf scars and their relative distance apart. Towards the centre of the specimen the leaf scars are smaller than those both above and below them, and the scars on the lower part of the specimen are much closer together than those at the top of the fossil.

From the peculiar condition in which this specimen has been preserved, the sub-cortical cicatricules are discernible through the bark, as distinctly defined oval elevations, which are visible in most of the leaf scars. One of these scars enlarged at fig. 11*a* shows this clearly. Fig. 11*b* gives the normal condition of the outer surface of the leaf scar, and is a reproduction of fig. 11*a*, with the subcortical cicatricules omitted. From this specimen is learnt the position held by the lateral cicatricules of the leaf scar to its germinate cicatricules of the decorticated stem.

Had any evidence been necessary to prove that the genus *Syringodendron*, Sternberg, was only a decorticated condition of *Sigillaria*, such evidence is afforded by the specimen now figured.

*Sigillaria reniformis*, Brongt., is easily distinguished from *Sigillaria Sauveuri*, Zeiller,\* by the presence in the former species of a notch on the upper margin of the leaf scar, and the absence of the transverse wrinkling below the scars.

In regard to the function performed by these lateral lunate cicatricules, as exhibited on the outer surface of the leaf scars, there is every reason to believe that they are the

\* Zeiller, *Flore foss. d. bassin houiller de Valenciennes*, p. 559, pl. lxxxiv. figs. 1–3.

orifices of two secreting glands which are placed beneath the bark. These glands probably fulfilled their secreting function (whatever the nature of the secretion may have been) after the fall of the leaf, and throughout the whole life of the plant, and considering the great number of such glands on each plant of *Sigillaria*, RENAULT throws out the suggestion that perhaps it might be asked if the secretion from these glands does not form a large part of the inorganic matter found in coal.\*

The faint striations on the surface of the stem drawn at fig. 11 are caused by the striations on the subepidermal surface, which have been imparted to the outer surface by pressure.

*Horizon*:—In Blue Bind at a depth of 533 yards.†

### *Sigillaria mamillaris*, Brongt.

Fig. 10.

*Sigillaria mamillaris*, Brongt., *Hist. d. végét. foss.*, p. 457, pl. cxlix. fig. 1; pl. cxliii. fig. 1 (var. *intermedia*).

*Sigillaria mamillaris*, Goldenberg, *Flora Sarap. foss.*, Heft ii. p. 32, pl. viii. figs. 6-8 (fig. 8, var. *intermedia*).

*Sigillaria mamillaris*, Weiss, *Foss. Flora d. jüngst. Stk. u. d. Rothl.*, p. 164, pl. xv. figs. 1-4 (figs. 1, 2, var. *abbreviata*, fig. 4, var. *elongata*).

*Sigillaria mamillaris*, Zeiller, *Flore foss. du bassin houiller de Valenciennes*, pl. lxxxvii. figs. 5-10.

*Sigillaria pyriformis*, Brongt., *Hist. d. végét. foss.*, p. 448, pl. cliii. figs. 3, 4.

*Description*.—Ribs straight or slightly flexuous, separated by a well-defined furrow. Leaf scars hexagonal or pyriform-hexagonal, as broad as long, or longer than broad, lateral angles distinct (especially in the forms with hexagonal leaf scars.) The surface of the leaf scar is elevated from above downwards, so that the inferior margin stands at a higher level than the superior margin; the interfoliar portion of the ribs immediately below the leaf scar slopes downwards, the leaf scar is thus placed on the upper slope of an elevated cushion. Vascular cicatrice punctiform or slightly elongated transversely, lateral cicatrices lunate-elongate. Leaf scars somewhat close or more distant. The interfoliar portion of the cushion on which the leaf scars sit, bears two lines of transverse wrinkles, between which the wrinkles frequently extend, and thus cover the whole of the interfoliar portion of the cushion. Above the leaf scars is a well-defined arched transverse furrow.

Cone scars, quadrate or irregular-triangular, with a central subcircular cicatrice, situated on the ribs, and forming a verticil of several series.

Decorticated stem striated longitudinally, and showing the three cicatrices, the lateral cicatrices almost straight or occasionally lunate and united at their extremities, thus forming a circle surrounding the vascular cicatrice.

\* Renault, "Sur les cicatrices des *Syringodendron*," *Comptes Rendus*, 24th October 1887.

† The lateral cicatrices in the leaf scars of *Lepidodendron*, *Lepidophloios*, and *Bothrodendron*, probably performed the same function. When the structure of these lateral cicatrices is examined, they never show any trace of vascular tissue, but are filled with lax parenchyma. A good figure of their structure is given by Dr Felix (*Untersuchungen über den Bau weisfölicher carbon Pflanzen*, pl. ii. fig. 3 f, König Preussischen geol. Landesanstalt, 1886.

*Remarks.*—Though the leaf scars of *Sigillaria mamillaris* are variable in the proportion of their length to their breadth, it is an extremely well-characterised species. The gradual elevation of the leaf scar from above downwards affords a character by which it is distinguished from several named forms, some of which are, however, most probably *Sigillaria mamillaris* in a different state of preservation.

Of these may be specially mentioned *Sigillaria pyriformis*, Brongt., which does not appear to differ in any essential character, except that the leaf scars are horizontal with the surface of the ribs—a distinction arising in all likelihood from pressure. *Sigillaria pyriformis* is therefore united here with *Sigillaria mamillaris*.

Other very close allies are *Sigillaria elliptica*, Brongt.,\* and *Sigillaria notata*, Steinhauer, sp.†

This latter species differs chiefly in the leaf scars being of less width than the breadth of the ribs. STEINHAUER'S example came from the coal pits of Dunkerton, Somerset, which are now closed. I have, however, searched in Somerset for specimens of *Sigillaria* that could be referred to *Sig. notata*, Steinhauer, in shales associated with coals on the same horizon as that from which the original specimens came, but without success.

The specimen of *Sig. notata*, figured by BRONGNIART, came from Anzin, near Valenciennes,‡ and BOULAY remarks§—“BRONGNIART indicates this species from Anzin. I have collected very well-characterised specimens of it at the pit of Petite-Sorcière, near Jemmapes (Belgium). This plant, which BRONGNIART regarded as allied to *Sigillaria elliptica*, is more closely allied to *Sigillaria mamillaris*, of which it might well be only a condition or a fragment.”

The question whether *Sig. elliptica*, Brongt., and *Sig. notata*, Steinhauer, sp., are only forms of *S. mamillaris*, or individual species, must therefore in the meantime remain open.

*Horizon* :—In Blue Bind, at a depth of 533 yards.

### Sigillaria, sp.

*Horizon* :—At a depth of 533 yards.

### Cyperites bicarinata, L. and H.

*Horizon* :—At a depth of 533 yards.

### Stigmaria, Brongt.

#### Stigmaria ficoides, Sternb., sp.

*Horizon* :—At a depth of 533 yards.

\* Brongt., *Hist. d. végét. foss.*, p. 447, pl. clii. figs. 1, 2; pl. clxiii. fig. 4.

† Steinhauer, *Trans. Amer. Phil. Soc.*, 1818, p. 294, pl. vii. fig. 3 (*Phytolithus notatus*).

‡ Brongt., *Hist. d. végét. foss.*, p. 449, pl. cliii. fig. 1.

§ Boulay., *Le terrain houiller du Nord de la France et ses végétaux fossiles*, p. 43, Lille, 1876.

## Cordaïtes, Unger.

## Cordaïtes, sp.

*Horizon*:—At a depth of 533 yards.

## Cardiocarpus, Brongt.

## Cardiocarpus Meachemii, Kidston, n. sp., figs. 5-7.

*Description*.—Seed cordate, about 13 mm. broad, 13 mm. long, base emarginate, apex acute. Nucule cordate, central, with a medial line extending from the base to the apex. Wing about 4 mm. broad.

*Remarks*.—Several of these little seeds are given on figs. 5-7. That at fig. 5*a* shows the outline of the seed, but the form of the nucule is not clearly defined; this deficiency is supplied by the isolated nucule given at fig. 7. The margin of the specimen shown at fig. 6 is not distinctly exhibited in the fossil, but there is an indication of a line surrounding the nucule, about halfway between the nucule and the margin of the wing. The apparent emarginate apex of fig. 5*b* is the result of an accidental splitting of the testa.

*Cardiocarpus Meachemii* is closely allied to the *Cardiocarpus* figured by FEISTMANTEL as *C. emarginatum*, Göpp. and Berger (not Brongt.),\* and differs only in its smaller size. My chief reason, therefore, for applying a new name to the Hamstead seeds is the circumstance that there is little evidence to show that the specimens figured by FEISTMANTEL are similar to the *Cardiocarpum emarginatum*, Göpp. and Berger†—in fact, from the imperfect nature of the figures given by these authors, it seems impossible to arrive at what are the true characters of their species.

Should FEISTMANTEL'S specimens eventually prove to be specifically similar to my *Cardiocarpus Meachemii*, his fossils might be distinguished as var. *major*.

I have pleasure in naming this seed after Mr F. G. MEACHEM.

*Horizon*:—In Blue Bind, at a depth of 533 yards.

## Carpolithus, Sternb.

## Carpolithus ovoideus, Göpp. and Berger, sp.

Fig. 8.

*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 ovoides*, Göpp. and Berger, *De fructibus et seminibus*, p. 22, pl. i. fig. 17.

*Rhabdocarpus ovoides*, Göppert, *Foss. Flora d. Perm. Form.*, p. 173, pl. xxvii. figs. 9, 10.

*Rhabdocarpus Germarianus*, Goppert, *Foss. Flora d. Perm. Form.*, p. 270, pl. lxiv. fig. 14.

*Carpolithus membranaceus*, Göpp. and Berger, *De fructibus et seminibus*, p. 25, pl. ii. figs. 19, 20.

*Carpolithus membranaceus*, Göppert, *Foss. Flora d. Perm. Form.*, p. 178, pl. xxix. figs. 19-21.

(?) *Carpolites ellipticus*, Sternb., *Vers.*, i. fasc. 4, p. xl. pl. vii. fig. 1.

(?) *Carpolites regularis*, Sternb., *Vers.*, i. fasc. 4, p. xl. pl. vii. fig. 2.

\* *Vers. d. Böhmischen Kohlenablagerungen*, Abeth. ii. p. 46, pl. xx. figs. 4-6.

† Göpp. and Berger, *De fructibus et seminibus*, p. 24, pl. iii. fig. 35.



*Description.*—Small oval or elliptical seeds, sometimes almost circular from pressure acting in the direction of their axis; one or both extremities rounded, or more or less pointed. Seeds bracteate, sessile, borne in two opposite alternate rows on a spike-like axis.

*Remarks.*—The form of these little seeds much depends on the direction in which pressure has acted upon them. When flattened with pressure acting at right angles to their axis, they are usually elliptical and pointed, as at fig. 8*b*, 8*d*; but when pressure acts on the apex or base of the seed, they are more or less circular, as at 8*c*. Between these two extremes are intermediate forms. The surface of the seeds generally shows foldings of the testa, and in some cases the seeds appear to have a narrow surrounding border; but this appearance is also due to pressure.

*Horizon.*—Many specimens on the surface of a small slab, of which fig. 8 gives four examples, from a depth of 550 yards.

#### GENERAL REMARKS.

From an examination of the foregoing lists, it will be seen that a proportion of the species recorded are common to both horizons.

*Annularia stellata*, *Sphenophyllum emarginatum*, *Neuropteris ovata*, *Neuropteris Scheuchzeri*, *Neuropteris flexuosa*, *Odontopteris Lindleyana*, *Pecopteris arborescens*, *Pecopteris unita*, *Lepidodendron Worthenii*, *Cordaites angulosostriatus*, and *Walchia imbricata* are, however, specially characteristic of British Upper Coal Measure rocks, though a few of these species have been observed in the Middle Coal Measures, but there they are much more scarce.

The Middle Coal Measure facies of the flora, collected from the strata of that horizon at Hamstead, is more characterised by the *absence* of Upper Coal Measure species than by the occurrence of species restricted to the Middle Coal Measures. *Sigillaria mamillaris* is, however, a specially characteristic Middle Coal Measure plant.

On the publication of lists of the fossil flora of the South Staffordshire Middle Coal Measures, the peculiar characteristics of the Middle Coal Measure flora will be much more distinctly seen.

In comparing the list of fossils from the Upper Coal Measures of Hamstead with those of the Upper Coal Measures of the Radstock and Farrington series of the Somerset Coal Field, one cannot fail to be struck with the great similarity of their fossil contents. All those found at Hamstead, with the exception of *Calamites undulatus* (which may be only a form of *C. Suckowii*), *Alethopteris decurrens* (which is, perhaps, a variety of *A. lonchitica* that occurs at Radstock), *Lepidophyllum lanceolatum*, and *Lepidostrobus variabilis*,—all occur in the Radstock series, and the greater part of the species also occur in the Farrington series. From the *Red Shales* which separate the Radstock and Farrington Series I have seen few vegetable remains,

but, as the Hamstead plants are found both below and above these Radstock red shales, it is clear that they existed during the deposition of these beds; and further, the few fossils which I have seen from them are similar to those of the Radstock and Farrington series, I therefore conclude that the Upper Coal Measure red shales that overlie the Middle Coal Measures at Hamstead are a northern extension of the red shales which form such a well-marked horizon over a considerable portion of the Somerset Coal Field.

The Molluscan remains, for whose identification I am indebted to Mr JOHN YOUNG, F.G.S., are of considerable interest, and bring forcibly forward some points in their vertical distribution which do not appear to have received the attention they deserve.

Mr MEACHEM informed me that, through an accident happening to the collection, a number of the specimens of shells were completely destroyed, and among these was a *Euomphalus*. The species examined and identified do not, therefore, represent the whole fauna collected, but only those that are still preserved.

The Mollusca identified are—

- Productus semireticulatus*, Martin.
- Productus scabriculus*, Martin.
- Edmondia rudis*, M'Coy.
- Schizodus*, sp., allied to *S. carbonarius*, Portl.
- Modiola lingualis*, Phill.
- Anthracosia Urei*, Flem.
- Leda attenuata*, Flem.
- Goniotites*, sp., allied to *G. excavatus*, Phill.

Leaving out of consideration those individuals which are only generically identified, two of the species, *Modiola lingualis* and *Leda attenuata*, have been recorded from the upper beds of the Calciferous Sandstone series.\* *P. semireticulatus*, *P. scabriculus*, and *Edmondia rudis* are frequent in the Carboniferous Limestone series of Scotland, while *Anthracosia Urei* is usually restricted to the Lower Coal Measures.

Any one, judging of the age of the rocks from the Molluscan remains, would, without doubt, class them as *Lower Carboniferous*, whereas they are undoubtedly of Upper Coal Measure age.

This case is not an isolated one, and Mr JOHN YOUNG has referred to such occurrences in his paper entitled "Notes on the Occurrence and Range of *Lingula* in the Carboniferous Series of the West of Scotland."† Speaking of the apparent extinction and reappearance of an organism in a higher horizon, the paper concludes with the following remark:—"Of such changes we have evidence in several of our coal seams, formed of the remains of a terrestrial vegetation accumulated in swamps at or near the sea level, and now found to be overlaid by a great thickness of fossiliferous marine strata. But

\* *Mem. Geol. Survey of Scotland*, Explan. to sheet 23, Lanarkshire Central District, p. 57.

† *Trans. Geol. Soc. of Glasgow*, vol. ii. p. 144.

wherever we find a sudden extinction of the organic life in any stratum, we are not to suppose that such extinction was universal. In most cases it must have been comparatively local, for a total extinction would imply a new creation of the same forms in every succeeding stage of strata in which they are met. The most probable supposition is, that during all the long geological ages in which our fossiliferous strata were being deposited, or from the first appearance of life on our globe, there never has been, at any one time, a total extinction of the flora or fauna from the remote period till the present time; and when we find in our Coal Measures the constant reappearance of certain well-known species after each local extinction, in higher and higher stages of strata in the same locality, we are naturally led to conclude that, while they become extinct over these tracts, they must have continued flourishing in other parts of our Carboniferous sea, and that they spread from these spots into their old localities wherever the condition of the sea-bottom again became favourable to their growth and development." In a letter, dated October 26, 1887, he further says:—"There can be no doubt of the repeated occurrence in higher and higher horizons of many of the marine and fresh water forms of life found in our Scottish Coal Measures. Since this paper (that quoted above) was printed, I have been able to trace other forms besides *Lingula*, that range from the very lowest fossiliferous marine beds up into that of the Permian Formation. It is, therefore, quite unsafe to take any one organism as characteristic of any special horizon, for closer investigation of the strata in any country is constantly proving their recurrence or occurrence in higher or lower beds."

Now, with organisms possessed with the property of locomotion, this is quite what may be expected. As the conditions became unfavourable for their growth and existence, they would remove to more suitable situations. Of course, conditions may arise which are unfavourable to the life of organisms that previously flourished in a given locality; and should no favourable conditions arise or exist within suitable distances for migration, there would be a total *local* extinction of species, which, perhaps, might extend over large areas, but that such occurrences were not universal is evidenced by the repeated recurrence of species in higher and higher zones, separated by great masses of strata destitute of their remains.

In regard to plants the case is different. They being fixed to the localities in which they grow, are of necessity obliged to succumb should any subsidence or unfavourable condition for their growth arise, and did the conditions again become favourable, descendants from the original individuals could never more return.

Of course, similar species were no doubt flourishing in other localities, and when the subsided area had again been elevated into dry land, it might have been peopled with new individuals of the same species, and it is true that certain species again revisit the old haunts of their kindred, but it is only comparatively few that ever do so, and with them they always bring new associates. Thus the change in the flora gradually progresses.

It is also true that there are vast masses of rock that show little change in their flora,

but these are succeeded by rocks in which many of the old species have disappeared and new species take their place by the side of the survivors.

This state of matters maintains throughout the whole of the Coal Measures, and further there does not seem to be the same complete disappearance, and then after a time a reappearance of the same old forms, as in the case of the Mollusca, but instead, a constant gradual change. This gradual change is, however, so marked, that it leaves a most sure and certain stamp for the recognition of the comparative age of the rocks in which the fossils occur. This leads me to believe, and every additional experience confirms this opinion, that for the classification and correlation of the rocks of the Carboniferous Formation, the evidence derived from plants is more reliably conclusive, and less liable to variation, than that derived from animal remains.

While speaking on this subject I might add further, that from the base of the Carboniferous Formation to the base of the Millstone Grit, the flora has a *facies* peculiar to that period, and of the many species of plants occurring in Lower Carboniferous rocks in Britain, it is very doubtful if any species pass into or above the Millstone Grit. I have seen slight evidence to think there may be one exception, but as far as I at present know, only one.\*

From the Millstone Grit, though the difference of the flora is sufficiently clearly defined to admit of a satisfactory threefold division of the Coal Measures, there is no such sudden break as occurs between the Lower and Upper Carboniferous, nor does a sudden break take place even at the top of the Upper Coal Measures, for several of the Upper Coal Measure plants pass into the Permian Formation.

For the facilities I have had given me for examining and describing the Hamstead fossils, my thanks are due to Mr J. MEACHEM, Manager of the Hamstead Colliery, and especially are they due to Mr FRED. G. MEACHEM, by whom the records of the sinking were kept, and from whom I have received the particulars contained in the section given on pp. 318-19. I am also indebted for assistance to Mr H. INSLEY, Ashton.

It is to be hoped that all who have similar facilities for collecting the fossils met with in Pit Sinkings and other mining operations, will avail themselves of these opportunities, as such collections as that made at the Hamstead Colliery, where the horizon of each specimen has been carefully noted, are of the utmost importance in working out British Palæontology.

\* I exclude *Stigmaria*, which is the root of several Lycopods, and as *none* of the Lower Carboniferous Lycopods pass into or above the Millstone Grit as far as I know, *Stigmaria*, being the root of any one of these Lycopods (*Lepidodendron*, *Sigillaria*, *Lepidophloios*) cannot be regarded as a true, individual species, and though these Lower Carboniferous *Stigmaria* are individually undistinguishable from the *Stigmaria* of the Upper Carboniferous, they cannot be regarded as specifically the same.

## EXPLANATION OF PLATE (figs. 5-11).

Fig. 5-7. *Cardiocarpus Meachemii*, Kidston, n. sp. From shaft of Hamstead Colliery, Great Barr, at a depth of 536 yards. Middle Coal Measures. Nat. size.

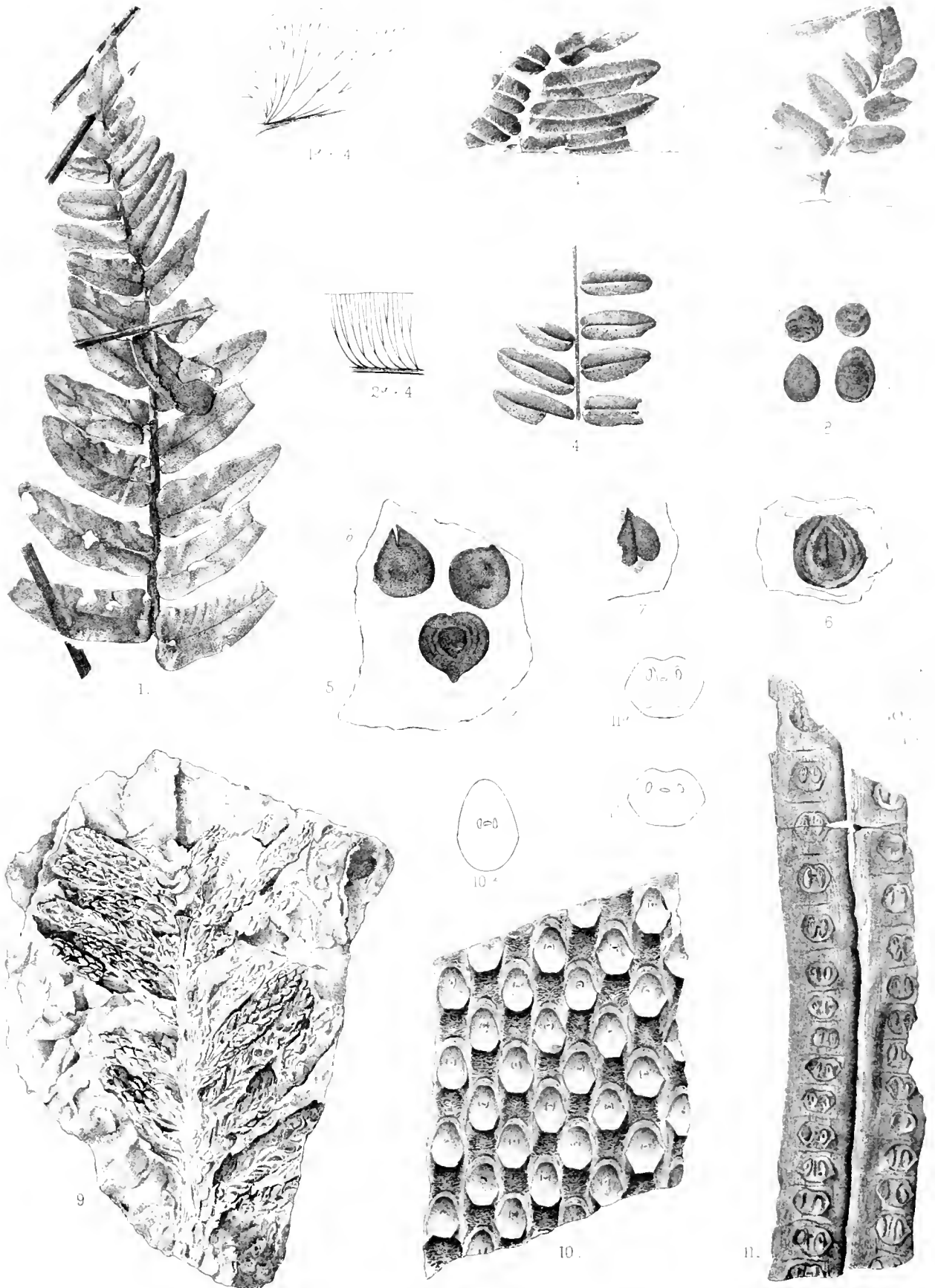
Fig. 8. *Carpolithus ovibons*, Gopp. and Berger. From shaft of Hamstead Colliery, Great Barr, at a depth of 550 yards. Middle Coal Measures. Nat. size.

Fig. 9. *Hatchia imbricata*, Schimper. From shaft of Hamstead Colliery, Great Barr, at a depth of 350 yards. Upper Coal Measures. Nat. size.

Fig. 10. *Sigillaria mamillaris*, Brongniart. From shaft of Hamstead Colliery, Great Barr, at a depth of 533 yards. Middle Coal Measures. Nat. size. 10*a*, Leaf scar  $\times 2$ .

Fig. 11. *Sigillaria rotiformis*, Brongniart. From shaft of Hamstead Colliery, Great Barr, at a depth of 533 yards. Middle Coal Measures. Nat. size. 11*a*, 11*b*, Leaf scars  $\times 2$ .





R. Hadston del. H. Falconer sculp.  
 Fig 1. NEUR. Plicata, Sternb. 2-4. NEUR. RECTINERVIS, Hadston n. s. 5-7. CARDIOPARPUS MEACHEMII, Hadston n. s.  
 8. CARPOLITHUS OVOIDEUS, Göpp. & Berger. 9. WALCHIA IMBRICATA. 10. SIGILLARIA MAMILLARIS, Brongt.  
 11. SIGILLARIA RENIFORMIS, Brongt.









gen

