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On the Fossil Floras of the Coal Measures of South Staffordshire

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IV. *On the Fossil Floras of the Coal Measures of South Staffordshire.*

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[Plates 2–4.]

Contents.

1. Introduction.

In the present paper some additions are made to our knowledge of the fossil floras of the South Staffordshire Coalfield. The plant remains here described belong to two distinct horizons, the Red Clay Series, part of the Transition Coal Measures, and the Productive Group, or Middle Coal Measures.

In the past four years, during which my attention has been particularly engaged by this coalfield, I have received much help, both as regards geological information and the collection of fossil plants, from many residents in the district, and this aid I desire to acknowledge here.

I am particularly indebted to my friend, Mr. Henry Kay, F.G.S., of Birmingham, who has not only placed his unique collections of fossil plants at my disposal, but has, in the kindest way, always been ready to help me by his remarkable knowledge of the geology of the district. My obligations to Mr. L. Jackson, also of Birmingham, are hardly less complete. Mr. Jackson has devoted much time over a long period to searching the northern part of the field for further examples of fossil plants for the purpose of this paper. To both these gentlemen I return my grateful thanks. By their aid, the specimens which I have been able to collect myself, during my visits to the district, have been very greatly extended. Both Mr. Kay and Mr. Jackson have also very generously presented the best examples from their collections to the Sedgwick Museum, Cambridge, including those figured in the present memoir, in order that we may have there a representative collection from this coalfield.

For the loan or presentation of other specimens or for a special search for fossils I also desire to thank, among others, Mr. W. H. Hardaker, M.Sc., Mr. W. H. Foxall, F.R.G.S., both of Birmingham, and Mr. L. J. Reade, of Wolverhampton.

2. The Flora of the Red-grey Unproductives of the Red Clay Series (Old Hill Marls).

The "Red Coal Measure clays" of Jukes,* which now appear to be more widely known as the Old Hill Marls, or even as the Oldbury Marls, are a series of red rocks which immediately overlie the grey productives of the Middle Coal Measures, over a wide area in South Staffordshire. These beds, which are about 300 feet thick, contain many bands of characteristic "Espley Rocks," which only occur on this horizon in South Staffordshire.

Hitherto no plant remains, with the single exception of a curious thalloid growth described by Miss Wills† quite recently, have been known for certain from this lithological horizon in South Staffordshire. The beds as a whole are undoubtedly very unfossiliferous.

As I announced, however, in a preliminary note‡ published in 1913, Mr. Kay has unearthed a very fine suite of specimens from this horizon at Old Hill and elsewhere, while the same gentleman and also Mr. Hardaker have obtained further specimens from West Bromwich and Oldbury.§ Many of these plants are extraordinarily well preserved.

Mr. Hardaker has also kindly given me examples of the plants occurring in an Espley rock proved in the sinking of the shafts of Hamstead Colliery. It is true that the occurrence of the Red Clay series was not mentioned in the published record of these shafts,‖ nor is there any information as to the depth at which the specimens were obtained. As, however, Espley rocks are entirely confined to this group in South Staffordshire, I here include a list of the species of plants represented.

The following are the localities of the fossils recorded here from this horizon.

(A) Red Clay series; Granville Pit at Old Hill Station. O.D. about 465 feet. Height above the Thick Coal 734 feet.

(B) Red Clay series at Pouke Lane Clay Pit,¶ Old Hill. O.D. about 410 feet Height above the Thick Coal about 585 feet

* Jukes (1859).

† Wills (1914), p. 388

‡ Arber (1913).

§ In this connection, I desire to express my thanks to Mr. W. H. Palmer, formerly manager of Granville Clay Pit, and to Mr. F. Smart, manager of the Pouke Lane Pit, and to Messrs. Hamblet's Blue Brick Co., Limited, of West Bromwich, for their kindness in affording every facility for the collection of specimens in these localities.

‖ Kidston (1888[1]), p. 318.

¶ This locality in the Red Clay series should not be confused with the better known Pouk Hill, near Walsall, where the productive measures and igneous rocks are exposed.

(C) Red Clay series, Messrs. Hamblet and Co.'s clay pit at West Bromwich. O.D. 497 feet. Height above Thick Coal 439 feet.

(D) Shaft of Hamstead Colliery, Great Barr. In an Espley bed, at an unrecorded level.

(E) Red Clay series, Messrs. Webster's clay pit at Oldbury. O.D. about 490 feet. Height above Thick Coal 429–512 feet.

(F) Red Clay series, Cakemoor Clay Pit, Rowley Regis. O.D. about 450 feet. Height above Thick Coal 344 feet.

List of Species from the Brick Clay Series (Old Hill Marls).*

Species.	Localities.					
	A.	B.	C.	D.	E.	F.
Equisetales.						
Calamites Suckowi Brongn.	—	+	—	—	—	—
C. ramosus (Art.)	+	—	—	—	—	—
C. varians? (Sternb.)	+	—	—	—	—	—
C. sp.	—	—	+	—	—	—
Calamophloios rugosus sp. nova	+	—	—	—	—	—
Calamocladus equisetiformis (Schl.)	+	+	—	—	—	—
Annularia radiata Brongn.	+	—	—	—	—	—
Annularia sphenophylloides (Zenk.)	+	—	—	—	—	—
Annularia galioides (L. and H.)	+	+	—	—	—	—
Palæostachya pedunculata? Will.	—	+	—	—	—	—
Calamostachys tuberculata (Sternb.)	—	—	—	+	—	—
C. germanica Weiss	—	+	—	—	—	—
Sphenophyllales.						
Sphenophyllum cuneifolium (Sternb.)	—	+	—	—	—	—
S. cuneifolium, var. *saxifragæfolium* Sternb.	+	—	—	—	—	—
S. myriophyllum Crép.	+	—	—	—	—	—
S. majus Bronn	+	—	—	—	—	—
Filicales and Pteridospermeæ.						
Sphenopteris (*Renaultia*) *Schwerini* (Stur)	+	—	—	—	—	—
S. obtusiloba Brongn.	—	+	?	—	—	—
S. Kayi sp. nov.	+	—	—	—	—	—
S. furcata? Brongn.	—	—	—	+	—	—
S. artemisiæfolioides Crép.	—	—	+	—	—	—
Sphenopteris (*Zeilleria*) *avoldensis* (Stur)	+	—	—	+	—	—
Neuropteris Blissi Lesq.	+	—	+	—	—	—
N. flexuosa Brongn.	+	—	—	—	—	—
N. heterophylla Brongn.	—	+	—	—	—	—
N. gigantea (Sternb.)	—	—	—	+	—	—

* Reference Collection, Nos. 3322–3431, 3442, 3485–3518, in Carbon. Plant Coll., Sedgwick Mus., Cambridge.

List of Species—*continued.*

Species.	Localities.					
	A.	B.	C.	D.	E.	F.
FILICALES AND PTERIDOSPERMEÆ—*contd.*						
N. tenuifolia (Schl.)	—	—	+	—	—	—
N. Kosmanni Goth.	—	+	+	—	—	—
Alethopteris Serli (Brongn.)	+	—	+	—	—	—
A. Davreuxi (Brongn.)	+	—	+	—	—	—
P. oreopteridia (Schl.)	+	—	—	—	—	—
P. Miltoni (Art.)	+	?	—	—	—	—
P. (*Dactylotheca*) *plumosa* (Art.)	+	+	—	+	—	—
SEMINA INCERTÆ SEDIS.						
Cardiocarpus Kayi sp. nov.	—	—	—	—	—	+
C. Gutbieri? Gein.	—	?	—	—	—	—
Samaropsis latior Lesq.	+	—	+	—	—	—
Platyspermum sulcatum (Presl.)?	+	—	—	—	—	—
Rhabdocarpus sp.	—	—	+	—	—	—
Samaropsis sp.	—	+	+	+	+	—
Trigonocarpus? sp.	+	—	—	—	—	—
LYCOPODIALES.						
Lepidodendron obovatum Sternb.	+	—	—	—	—	—
L. lycopodioides Sternb.	—	—	+	—	—	—
L. Wortheni Lesq.	—	—	+	—	—	—
L. dichotomum Sternb.	—	—	+	—	—	—
L. sp.	—	+	—	—	—	—
Lepidophloios acerosus (L. and H.)	+	—	—	—	—	—
Lepidostrobus variabilis L. and H.	+	—	—	—	—	—
Sigillaria principis Weiss	+	—	—	—	—	—
S. tessellata (Steinh.)	+	—	—	—	—	—
S. mamillaris Brongn.	—	—	+	—	—	—
S. scutellata Brongn.	—	—	+	—	—	—
S. elongata Brongn.	—	—	+	—	—	—
Sigillariostrobus nobilis Zeill.	+	—	—	—	—	—
S. sp.	—	—	+	—	—	—
Stigmariopsis anglica Kidst.	—	—	+	—	—	—
CORDAITALES.						
Cordaites borassifolius (Sternb.)	—	+	—	—	—	+
C. principalis (Germ.)	+	—	—	—	+	—
Cordaicarpus cordai Gein.	—	—	?	+	—	—

Several of these plants are figured here, and will be found described in Section IV of this paper.

The horizon of the Brick Clay series of South Staffordshire is clearly Transition

Coal Measures. It includes a large number of species common to the Middle Coal Measures, but there are also others, such as :—

Annularia sphenophylloides (Zenk.).
Alethopteris serli (Brongn.).
Pecopteris oreopteridia (Schl.).

which are more characteristic of the Upper Coal Measures than of any lower horizon. In addition to five new British records, several of the species are new to this horizon, particularly :—

Sigillariostrobus nobilis Zeill.
Sphenophyllum myriophyllum Crép.
Sphenopteris (*Zeilleria*) *avoldensis* (Stur).
Neuropteris Blissi Lesq.
Stigmariopsis anglica Kidst.

The above flora of 58 records is now the largest known from any stratigraphical horizon in the unproductive series of the Midland fields. There are, however, considerable differences between it and the Transition flora of the North Staffordshire coalfield,* though they both belong to the same horizon.

The number of records from the unproductives of the Midland fields is now as follows :—†

Number of Plant Records from the Unproductive Red-grey and Red Measures of the Midland Coalfields.

Horizon.	Series.	South Stafford coalfield.	North Stafford‡ coalfield.	Warwick§ coalfield.
?Stephanian	Enville	3	0	3
Upper Coal Measures	Keele	20	8	5
Transition Coal Measures	Newcastle	5	22	13
	Etruria marl	58	1	2
	Blackband ironstone	Absent	29	Absent
Total species		86	60	23

This table illustrates the general rarity of fossil plants on these horizons in the Midlands. It also shows that the South Staffordshire floras are now somewhat better known than those of the Potteries coalfield.

* Kidston (1905), p. 311.
† These horizons are unknown in Leicestershire.
‡ Kidston (1905), p. 311.
Vernon (1912).

3. The Flora of the Grey Productive Measures.

The fossil flora of the productive measures of this coalfield has, for some unaccountable reason, been much neglected until quite recently.* As late as 1913, only some 28 plants had been recorded from this division. In the following year, however, the publication of Dr. Kidston's† memoir, which was entirely confined to the Middle Coal Measure flora, did much to remedy this neglect. Kidston recorded 141 species (not including many other incomplete determinations) from these beds. Of these, however, 34 species were made known from one locality only, and 28 were represented by unique specimens. The chief interest of this paper is the account which it contains of an extremely rare set of Middle Coal Measure fossils, all from one bed at Claycroft, Coseley, just above the Thick Coal. The specimens from other localities are quite of secondary interest.

I may, perhaps, first of all add a few words with regard to the distribution of fossil plants in these measures. With the exception of one or two long famous localities, from which literally enormous collections have been made from time to time, it is, speaking generally, difficult, in comparison with many other coalfields, to obtain good specimens from these beds at the present day. There appear to be several causes which will account for this scarcity. The coals, and especially the Thick Coal, have been worked out over a large area, and the visible field is reaching a stage of senile decay. The thickness of the measures, especially in the southern portion of the field, is small. The general vertical section of the field, given by Jukes‡, has recently been recapitulated by Dr. Kidston§, and thus need not be restated here. It is true that a number of large collieries still exist, especially in the south of the field, near or over the eastern and western boundary faults, and in the Cannock Chase district, but these are far outnumbered by pits long since abandoned. Again the methods of working the coals result in very little roof material or "dirt" being brought above ground as a rule. Thus the "tip-heaps," which form the great collecting grounds for fossil plants in most coalfields, and on which the palæobotanist relies largely for his specimens, do not help him in South Staffordshire to the same extent as is usually the case. It would appear also that the roofs of many of the seams worked in South Staffordshire are not, as a rule, rich in well-preserved fossil plants. Further, the natural and artificial exposures of any size are, on the whole, few, as might be expected in a district so densely populated and overgrown with buildings as the Black Country. In certain areas also the

* The only literature on the plant impressions of this horizon is found in Kidston (1888[1]), (1894), (1905), Horwood (1912), Arber (1914[1]), and notes on individual specimens by Kidston (1888[3]), Smith (1905), Thomas (1912), and Arber (1914[2]). Compare, however, Beckett (1845), Ick (1845), Dawes (1845), Carruthers (1873).

† Kidston (1914).

‡ Jukes (1859), pp. 20–22.

§ Kidston (1914), pp. 75–77.

ground is much obscured by drift. In fact, on the whole, some of the unproductive measures, already discussed, are better exposed than the Middle Coal Measures.

With the aid of several gentlemen resident in the district, who have kindly helped me in the task of collecting, I have devoted much time to an examination of nearly all the districts of the visible field for the purpose of obtaining plant remains. The Cannock Chase area, which I understand had not been examined for this purpose hitherto, has not been overlooked. The results of this work, however, for the reasons above mentioned, have proved to be exceptionally unprofitable palæobotanically.

Plant Petrifactions.—It has long been known that petrifactions, of more than one type, occur in the South Staffordshire field. Certain ironstone nodules occasionally contain a very limited variety of plants, the more resistant tissues of which are frequently well preserved. Such specimens were first described by the late Sir Joseph Hooker,* as long ago as 1848. According to Hooker the species in question were :

Stigmaria ficoides Sternb.*
Lepidostrobus ornatus L. and H.†
L. sp.‡

The record of the particular locality and ironstone from which these specimens were obtained has long been lost, and doubt has hitherto existed on this point.

In 1871 and the following year, Binney‡ also described a very well preserved Lycopod stem, from the neighbourhood of Dudley. This was redescribed by Seward§ as *Lepidophloios fuliginosus* (Will.) The sections of this plant are now in the Sedgwick Museum, Cambridge.‖ Here again there is no precise record as to the ironstone or locality.

I have made some enquiry into these matters, with the following results. The ironstones or ironstone nodules in question do not appear to differ in any important respect from those containing plant impressions, and, further, both types of preservation occur in much the same way. The variety of plants preserved in the petrified state is very small. Only three or four types are known—

Lepidophloios fuliginosus (Will.).
Lepidodendron sp.
Lepidostrobus variabilis L. and H.
Stigmaria ficoides Sternb.

* Hooker (1848[1]).

† Hooker (1848[2]).

‡ Binney (1868), Part II, p. 48, Plate 7, fig. 6, 1871; Part III, p. 77, Plate 13, figs. 1–6, Plate 15, figs. 1–4, 1872.

§ Seward (1899), p. 139, Plate 3, Plate 4, and text-figs. 1–4. See also (1910), p. 141, etc.

‖ Slides 1–4, Binney Coll.

So far as I can ascertain, the majority of the ironstones do not contain such petrifactions, which are distinctly rare. I am not aware, for instance, that any such have been found in the famous Ten-foot Ironstone of Claycroft, Coseley, though they occur in closely associated shales in that locality. I have only observed them in the Poor Robin ironstone, between the Bottom and Fireclay coals of Pendlebury Colliery, at Bentley, but they are also occasionally met with in the Gubbin ironstone between the Heathen and Thick coals, and in the Whitestone below the Heathen coal. Mr. HUGHES possesses part of one of the original specimens figured by HOOKER,* and he tells me that this was derived from the Gubbin ironstone at Russell's Hall Colliery, Dudley. Other Lepidostrobi in the same collection, similar to certain specimens also described by HOOKER,† were derived from the Whitestone in the same locality. The Gubbin ironstone of Claycroft has also yielded specimens.

The explanation of the lack of variety among these petrifactions is no doubt to be sought for in the fact that the shale beds, which now contain the ironstones, were laid down in a region bordered by forests, which consisted of an almost pure association of Lycopods, as also appears to have been the case at Pouk Hill, near Walsall.

I have, unfortunately, not discovered any examples of the other type of petrifaction which is only known, as far as South Staffordshire is concerned, in the case of *Cordaites Brandlingi* (With.)‡ This no doubt was a petrifaction of the isolated log type, and was derived from Rowley Regis; but the exact locality and horizon are unfortunately not recorded.

Impressions in Clay-ironstone Nodules.—Speaking generally, plant remains are not well distributed in the ironstones of South Staffordshire. A few examples are known from the Gubbin ironstones, between the Heathen and Thick coals, and from some others; but, with the exception of the Coseley ironstones, they appear to be decidedly rare. The fact that very few ironstones are to-day worked in this coalfield may, however, account in part for this seeming poverty.

On the other hand, the Ten-foot Ironstones, above the Thick Coal at Claycroft, near Coseley, have furnished one of the most remarkable plant assemblages known from the Coal Measures. These specimens occur there in extraordinary abundance, and during the many years when these beds were mined as an open work, the supply of nodules was unlimited. They can still be collected to-day, though with increasing difficulty, since the workings have long since been abandoned. Abundant examples from this locality are to be seen in every collection in South Staffordshire, and in most museums in England. Collections numbering many thousands of specimens have been formed by numerous collectors during the last half-century, some of which still remain in private hands.

That of my friend, Mr. H. W. HUGHES, F.G.S., of Dudley, is the most valuable of

* HOOKER (1848[2]), Plate 9, fig. 2, Plate 10, fig. 7.

† HOOKER (1848[2]), Plate 8.

‡ KIDSTON (1914), p. 152.

these. Others, such as the Lewis collection in the Sedgwick Museum, Cambridge, and the Henry Johnson, Sen., collection in the British Museum (Nat. Hist.), are among the largest ever made in this district. They were formed at a time when the abundance and beauty of the fossils of the Wenlock Limestone of Dudley and the plant nodules of Claycroft made the western margin of the South Staffordshire field a particularly noteworthy collecting ground.

A great feature of the Claycroft flora is that, in addition to an abundance of good specimens of the commoner plants, there is also a considerable variety of species which are extremely rare or unknown elsewhere. This remarkable assemblage forms the chief theme of Dr. KIDSTON's* recent paper, which is quite an exhaustive account of the flora of these beds.

Impressions in Other Sediments.—Impressions occur in the shales and other sediments throughout the measures, though they are often ill-preserved, and never so abundant as in many other coalfields. Lycopod remains are the most frequent. Among the artificial exposures of the measures, which are but few, the three pits—at Saltwells and Netherton—belonging to Messrs. Doulton and Co., and the famous quarry at Pouk Hill, near Walsall, are the most noteworthy. Further specimens collected from these localities are described here. The Pouk Hill quarries, which furnish large exposures of a brittle, thinly-laminated black shale, overlying the well-known dolerites, and intermediate between the Bottom and Fireclay coals, contain an abundant and remarkable flora, almost entirely composed of Lycopod remains. It would seem that, in Coal Measure times, this region was surrounded by a forest country, the vegetation consisting of an exceptionally pure association of Lycopods, especially *Lepidodendron obovatum* Sternb., and *L. lycopodioides* Sternb., of which the rhizophores, stems, leaves, and cones abound, with an occasional Calamite, and a still rarer Sigillarian stem.

Elsewhere plant remains are usually only to be obtained from the very limited amount of unweathered material on the small waste-heaps of the collieries. These, however, especially in the Cannock Chase district, are often very barren, and where several seams are worked together at a single pit, it is manifestly impossible to ascertain the exact horizon of any of the specimens collected.

New Records from the Productive Measures.

The following are new records from the productive measures, to be added to the list recently given by KIDSTON.† A list of new localities or horizons for species already recorded is also given. The figures, enclosed in brackets after the localities, indicate specimens in the reference collection from this coalfield preserved in the Carboniferous Plant Collection in the Sedgwick Museum, Cambridge.

* KIDSTON (1914).

† KIDSTON (1914), p. 175.

New Records from the Productive Measures.

	Horizon.	Locality.
Calamites varians Sternb. . . .	Between Bottom and New Mine Coals.	Pouk Hill, Walsall (3243, 3244).
	Ironstone 25 feet above Thick Coal.	Doulton's Pit, Saltwells* (3273).
	Bottom Coal	Pendlebury Colliery, Bentley (3298).
	New Mine Coal	Lodge Holes Colliery, Darlaston (3309).
	Uncertain	Cannock and Leacroft Colliery, near Cannock (3432).
	Uncertain	Cannock Chase Colliery, Brownhills, No. 3 Pit.
	Uncertain	Cannock Chase Colliery, Hednesford, No. 8 Pit (3433, 3434).
	Uncertain	Cannock Wood Colliery, Hednesford (3435, 3443).
	Uncertain	Aldridge Colliery, No. 2 Pit (3474).
Calamites Cannockensis n. sp. . .	Top Hard Coal	West Cannock, No. 3 Pit, Hednesford (3519).
Samaropsis fluitans (Daws.) . . .	Below Bottom Coal . .	Doulton's Old Pit, Netherton (3287, 3288).
Lepidodendron Wortheni Lesq. . .	Between Bottom and New Mine Coals.	Pouk Hill, Walsall (3247).
L. dichotomum? Sternb.	Bottom Coal	Pendlebury Colliery, Bentley (3302).
Lepidostrobus Jacksoni sp. nov. .	Between Bottom and New Mine Coals.	Pouk Hill, Walsall (3250).
Lepidophloios laricinus Sternb. .	Between Bottom and New Mine Coals.	Pouk Hill, Walsall (3261–3264, 3901).
Sigillaria Deutschi Brongn. . . .	Brooch Clays.	Doulton's New Pit, Saltwells (3289, 3297).
S. principis Weiss	Roof of Thick Coal . . .	Cakemoor Colliery, Blackheath (3479).
Cordaicarpus Cordai (Gein.) . . .	Brooch Clays.	Doulton's New Pit, Saltwells (3280, 3292).

A List of New Localities or Horizons for Species already Recorded.

Calamites Suckowi Brongn. . . .	Ironstone 25 feet above Thick Coal.	Doulton's Pit, Saltwells (3272).
	Brooch Clays	Doulton's New Pit, Saltwells (in Mr. Jackson's Collection).
	Between Fireclay and Bottom Coals.	Pendlebury Colliery, Bentley.
	Uncertain	Conduit Colliery, North Canes (3436).
	Uncertain	Brownhills Colliery, Brownhills.
Calamites approximatus Brongn. .	Uncertain	Cannock Wood Pit, Hednesford (3437).

* Some confusion may arise between the three pits of Messrs. Doulton and Co. The most northerly of these, lying south-east of Netherton Church and north of the canal, is here described as Doulton's Old Pit, Netherton. This pit is now being filled up The largest of the three pits, which lies on the south side of the reservoir and canal, is here termed Doulton's Pit, Saltwells. The most southerly and smallest of the three is termed Doulton's New Pit, Saltwells.

	Horizon.	Locality.
C. approximatus Brongn. (contd.) .	Ironstone 25 feet above Thick Coal.	Doulton's Pit, Saltwells (3270).
	Below Bottom Coal . .	Doulton's Old Pit, Netherton (in Mr. Jackson's Collection).
Calamites Cisti Brongn.	Brooch Clays	Doulton's New Pit, Saltwells (in Mr. Jackson's Collection).
Calamites ramosus Artis.	Uncertain	Cannock Chase Colliery, Hednesford, No. 8 Pit (3441).
Calamites undulatus Sternb. . .	Ironstone 25 feet above Thick Coal.	Doulton's Pit, Saltwells (3271).
	Uncertain	Cannock Chase Colliery, Hednesford, No 8 Pit (3442).
Palæostachya Ettingshauseni Kidst.	Below Bottom Coal . .	Thistle Green Pit, Springfield (3314–3316).
	Uncertain	Cannock Chase Colliery, Hednesford, No. 8 Pit (3445, 3446).
Calamocladus grandis (Sternb.) .	Uncertain	Old Engine Pit, Rugeley (3444).
Annularia radiata (Brongn.) . .	Below Bottom Coal . .	Thistle Green Pit, Springfield (3316).
Sphenophyllum cuneifolium (Sternb.)	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3448, 3449).
	Uncertain	Wimblebury Colliery, Hednesford.
	Below Bottom Coal . .	Ettingshall Park (3318).
Sphenopteris quadridactylites Gutb.	Below Bottom Coal . .	Doulton's Old Pit, Netherton (in Mr. Jackson's Collection).
Neuropteris tenuifolia (Schl.) . .	Below Bottom Coal . . .	Doulton's Old Pit, Netherton (3285).
N. heterophylla Brongn.	Below Bottom Coal . . .	Thistle Green Pit, Springfield (3317).
	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3451).
	Uncertain	Wimblebury Colliery, Hednesford (3452).
	Uncertain	East Cannock Colliery, Hednesford.
N. gigantea (Sternb.)	Roof of Thick Coal . . .	Cakemoor Colliery, Blackheath (3481).
	Uncertain	West Cannock Colliery, No. 4 Pit, Hednesford (3453).
	Shallow Coal	West Cannock Colliery, No. 1 Pit, Hednesford (3466, 3467).
Alethopteris lonchitica (Schl.) . .	New Mine Coal	Lodge Holes Colliery, Darlaston (3312).
	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3454, 3458).
A. decurrens (Art.)	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3455, 3457).
	Shallow Coal	West Cannock Colliery, No. 1 Pit, Hednesford (3470).
A. Serli (Brongn.)	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3456).
Mariopteris muricata (Schl.) . . .	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3450).
	Uncertain	Cannock and Wimblebury Colliery, Hednesford.
	Roof of Thick Coal . . .	Cakemoor Colliery, Blackheath (3480).

	Horizon.	Locality.
Lepidodendron ophiurus Brongn.	Uncertain	Cannock and Leacroft Colliery, Cannock (3447).
	Uncertain	West Cannock Colliery, No. 4 Pit, Hednesford (3465).
	Shallow Coal	West Cannock Colliery, No. 1 Pit, Hednesford (3472).
	Roof of Thick Coal	Cakemoor Colliery, Blackheath (3478).
L. aculeatum Sternb.	Uncertain	Cannock Chase Colliery, No. 8 Pit, Hednesford (3462).
L. obovatum Sternb.	Between Fireclay and Bottom Coals.	Pendlebury Colliery, Bentley (3301).
	New Mine Coal	Lodge Holes Colliery, Darlaston (3310).
	Uncertain	Cannock Wood Colliery, Hednesford (3463).
	Shallow Coal	West Cannock Colliery, No. 3 Pit, Hednesford (3471).
L. lycopodioides Sternb.	Below Thick Coal	Doulton's Pit, Saltwells (3269).
	New Mine Coal	Lodge Holes Colliery, Darlaston (3311).
	New Mine Coal	Bentley (3475).
	Uncertain	West Cannock Colliery, No. 4 Pit, Hednesford (3464).
	Uncertain	Old Engine Pit, Rugeley (3461).
	Shallow Coal	West Cannock Colliery, No. 1 Pit, Hednesford (3469).
	Roof of Thick Coal	Cakemoor Colliery, Blackheath (3477).
	Bottom Coal	Pendlebury Colliery, Bentley (3299).
Lepidostrobus intermedius (L. and H.)	Ten Foot Ironstone	Claycroft Openwork, Coseley (in Mr. L. J. Reade's Collection, Wolverhampton).
Lepidostrobus variabilis L. and H.	Bottom Coal	Pendlebury Colliery, Bentley (3300).
	Uncertain	Cannock and Leacroft Colliery, Cannock.
	Roof of Thick Coal	Cakemoor Colliery, Blackheath (3482–84).
Lepidophloios laricinus Sternb.	Below Bottom Coal	Doulton's Old Pit, Netherton.
	Uncertain	Millpool Colliery, Hateley Heath (3321).
Halonia tortuosa L. and H.	? Heathen Coal	Rough Hay Colliery, Willenhall (3307).
Sigillaria scutellata Brongn.	Brooch Clays	Doulton's New Pit, Saltwells (in Mr. Jackson's Collection).
S. tessellata (Steinh.)	Uncertain	Millpool Colliery, Hateley Heath (in Mr. Jackson's Collection).
S. discophora Kidst.	Between Bottom and New Mine Coals.	Pouk Hill, Walsall (3260).
	New Mine Coal	Lodge Holes Colliery, Darlaston (3313).
S. rugosa Brongn.	Between Bottom and New Mine Coals.	Pouk Hill, Walsall (in Mr. Jackson's Collection).
Sigillariostrobus sp.	Brooch Clays	Doulton's New Pit, Saltwells (3290).
Cordaites borassifolius (Sternb.)	Below Bottom Coal	Doulton's Old Pit, Netherton.
Cordaianthus Pitcairniæ (L. and H.)	Uncertain	Millpool Colliery, Hateley Heath.
	New Mine or Bottom Coal	Station Street, James Bridge (3320).
Artisia approximata (Brongn.)	Uncertain	Doulton's Pit, Saltwells (3276).

The Horizon.—There is no doubt that, as Dr. KIDSTON has already shown, the whole of the productive measures of South Staffordshire belong to the Middle Coal Measures. The following flora from *below* the Bottom Coal, at Doulton's Old Pit, Netherton, need only be instanced as a proof of this conclusion :—

Calamites approximatus Brongn.
Sphenopteris quadridactylites Gutb.
Neuropteris tenuifolia (Schl.).
N. heterophylla Brongn.
N. gigantea Sternb.
Mariopteris muricata (Schl.).
Pecopteris (*Dactylotheca*) *plumosa* (Art.).
Lepidophloios laricinus Sternb.
Cordaites borassifolius (Sternb.).
Samaropsis fluitans (Daws.).

4. REMARKS ON THE FIGURED SPECIMENS.

Calamites Cannockensis sp. nov. Plate 4, fig. 18.

Diagnosis.—Pith-cast of medium width. Internodes of unequal length, ribs numerous, narrow, not very prominent; branch-scars on every node, two or more on each node, small.

Description of the Specimen.—The only known example of this pith-cast, collected in Cannock Chase, is shown on Plate 4, fig. 18. When found the specimen was somewhat more perfect. In order to secure it, however, it had to be detached from a large block of shale in small pieces, owing to the irregular splitting of the rock in which it occurred. These fragments were afterwards mounted on a bed of plaster-of-Paris by Mr. L. JACKSON, who by this method has preserved many good examples of the flora of this coalfield, which would otherwise have perished.

The specimen shows four nodes, separated by internodes, which in the original condition measured as follows :—Lowest internode 2·25 cm., second internode 3·5 cm., third internode 5 cm., fourth internode 3 cm., highest internode 2·5 cm. The ridges are narrow and flat, the grooves narrow and shallow. The infranodal canals are not well seen. They appear to be very small and narrowly oval in shape.

The scars which occur on every node, and which are probably branch-scars, are small, about 3 mm. in diameter. Two are seen on most of the nodes, and perhaps the same number would be found to occur on the other side of the flattened cast. Thus probably four or more occur above each node. On the highest node two scars are clearly seen. On the next node below, two scars may have occurred, though only one is now visible, perhaps owing to the fracture of the specimen. Two scars again occur on the node below, but on the lowest node only one is seen. This, however, is probably due to the obvious imperfection of the specimen in this region.

Remarks on the Specimen.—This type of pith-cast is quite unknown to me, and obviously differs from the British Eucalamitean species, *Calamites ramosus* (Art.) and *C. cruciatus* (Sternb.), in the number of the branch scars in the whorl, their size, and the characters of the internodes. With *Calamophloios Britannicus* (Weiss.) there is no comparison, since the present species is a pith-cast, and *C. Britannicus* is the external surface of a stem. It is conceivable, however, that *C. Cannockensis* might be the pith-cast of *C. Britannicus*, though this is by no means certainly the case. It is at present impossible to prove or disprove this possibility.

There are but few foreign examples known to me with which any comparison can be made, and these are all from rocks of much younger age. There is some similarity to the *Calamites distichus* of Renault, from the Commentry Coalfield.* The length of the internodes and the shape of the infranodal canals are, however, different in the Stephanian specimen. The Staffordshire specimen also appears to be quite distinct from the *Calamites* (*cruciatus*) *quinquenarius*, var. *Döhlensis* of Sterzel,† from the Lower Permian of Saxony.

In view of these facts, and especially the great difference in the age of the Continental specimens, I prefer to regard the present plant as a new species, *C. Cannockensis*.

Occurrence:—Grey Productives, Top Hard (=Wyrley Deep, or 8 ft.) seam at No. 3 Pit, West Cannock Colliery, Hednesford, South Staffordshire.

Horizon:—Middle Coal Measures.

Type:—No. 3519 Carb. Plant Coll., Sedgwick Mus., Camb.

Genus *Calamophloios* gen. nov.

Diagnosis.—External surfaces of the stems and branches of Calamites. Nodes with or without branch-scars, internodes smooth or longitudinally striated.

Remarks.—Hitherto it has been customary to refer to the genus *Calamites* both pith-casts and casts or impressions of the external surfaces of stems and branches. These fossils are naturally of an entirely different nature, and most of the features which they present are of dissimilar origin. This convention, however, has not hitherto proved inconvenient, for the reason that specimens showing the external surface of the stem have been but rarely discovered, and quite 90 per cent. of all Calamite stems hitherto recorded have been obviously pith-casts. In the most recent monograph of the Calamites by Dr. Jongmans,‡ for instance, no attempt is made to discriminate between these two entirely dissimilar types of cast. Specimens showing the external surface are now, however, becoming less rare, and the time seems to have arrived when it will be wise to distinguish such fossils from the pith-casts, until it is possible to correlate the two types of evidence.

* Renault and Zeiller (1888), Plate 52, fig. 1.

† Sterzel (1893), p. 57, Plate 9, figs. 2, 3.

‡ Jongmans (1911).

In proposing the new term *Calamophloios*, as a general designation for specimens showing the external surfaces of the stems of all Calamites, I am aware that a very similar term, *Calamodendrofloyos*, was instituted many years ago by Grand' Eury,* and was also adopted later by Renault.† This term was also used in much the same sense, but as applying more particularly to the external surface of *Calamites cruciatus* Sternb. If objection be raised to the present term on these grounds (which is perhaps possible under certain rules of nomenclature to which I do not adhere), the present name may be regarded as an emendation of Grand' Eury's genus. It is very unlikely that the term *Calamodendron* itself will survive, as applied to impressions, or in any other sense than to denote a particular type of anatomical structure presented by certain of the later Calamites. I do not, therefore, think that any confusion is likely to arise between the new and the old term, which was a distinctly cumbersome name, of less general application than that proposed here. If the older name is retained, it should be as a subgenus of *Calamophloios*.

Calamophloios rugosus sp. nov. Plate 3, fig. 9.

1913. *Calamites ramosus* var. *rugosus*, Jongmans and Kukuk, 'Med. R. Herbar. Leiden,' No. 20, p. 38, Plate 13, figs. 1–3.

Description of the Specimen.—The specimen figured on Plate 3, fig. 9, natural size, consists below of part of a long internode, while a node is seen above. The surface of the internode has a peculiar granulated appearance, due to the presence of a large number of very small shallow pittings. The surface is also very finely striated longitudinally.

Remarks on the Figured Specimen.—This specimen is clearly an impression of the external surface of a Calamite stem or branch. The pith-cast is not seen, however, as it is in some of the examples recently figured by Jongmans and Kukuk (see above), which seem to me to furnish adequate proof of the correlation of this type of stem-cast with the pith-casts known as *Calamites ramosus*. The name proposed here may prove convenient in such cases as the present, in which the external surface is alone seen. The features presented by the bark of this specimen were, however, common to other species of Calamites, *e.g. C. paleaceus* Stur,‡ which is very similar as regards the stem-cast, but distinct as regards the foliage and fructification.

Locality:—Red Clay Series, Granville Pit, Old Hill, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3322, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

* Grand' Eury (1877), p. 293.

† Renault and Zeiller (1888), p. 462.

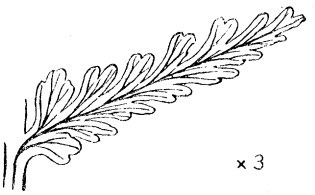
‡ Stur (1887), p. 116, Plate 11b, fig. 1; Kidston (1911), p. 110, Plate 10, figs. 1–4, text-figs. 16–19.

Sphenopteris (*Renaultia*) *Schwerini* (Stur). Plate 2, figs. 1 and 5; text-fig. 1.

1885. *Senftenbergia Schwerini*, Stur, 'Abhandl. K.K. Geol. Reichs.,' vol. 11, Part 1, p. 99, Plate 48, figs. 3–5.

1899. *Sphenopteris* (*Renaultia*) *Schwerini*, Zeiller, 'Mém. Soc. Géol. France,' Pal. Mém. 21, p. 16, Plate 1, fig. 12, 12 A.

Text-fig. 1.



Text-fig. 2.

Text-fig. 1.—*Sphenopteris* (*Renaultia*) *Schwerini* (Stur). Pinnules enlarged to show the nervation. × 3. (3357).

Text-fig. 2.—*Sphenopteris Kayi*, sp. nova. Pinnule enlarged three times (3365).

Description of the Figured Specimens.—A fairly complete pinna, 7 cm. long, is shown (natural size) on Plate 2, fig. 1. Another specimen, 11 cm. long, with larger pinnules (also natural size), is seen on fig. 5 of the same plate. The pinnules are relatively broad, and have large, rounded lobes with a slightly sinuous margin (*cf.* text-fig. 1).

Remarks on the Specimens.—This *Renaultia* appears to me to agree more closely with Stur's species *S.* (*R.*) *Schwerini* than with any member of the same genus hitherto recorded from this country. I am not convinced, however, that the specimens more recently attributed to this species by Gothan* are identical with the fronds figured by Stur and by Zeiller. The present examples constitute the first British record of this species, so far as I am aware.

Locality:—Red Clay Series, Granville Pit, Old Hill, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimens:—Nos. 3357, 3361, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

Sphenopteris Kayi, sp. nov. Plate 2, figs. 3, 6; text-fig. 2.

Diagnosis.—Frond or ? primary pinna, bipinnate, small, exceeding 6 cm. in length. Primary (?) axis slender, with several faint longitudinal striations. Secondary pinnæ alternate, more or less lanceolate, up to 2 cm. in length, exceeding 1 cm. in width at base, but often smaller. Pinnules alternate, decurrent, small, 1–5 mm. long, up to 2 mm. broad, oval, lobed. Near the apex of the pinnæ, the pinnules have simple, wedge-shaped lobes, rounded distally. The lower pinnules are divided into

* Gothan (1913), p. 135, Plate 28, figs. 1, 2, 2A, 2B, Plate 29, fig. 2.

2 to 5 similar lobes or notches. The nerves are strong, one branch running to each lobe.

Description of the Figured Specimens.—Part of an apical portion of a pinna is shown on Plate 2, fig. 6, natural size. This is the best preserved specimen. One of the ultimate pinnæ of this leaf is seen enlarged in text-fig. 2, to show the form of the pinnules and their nervation. The photograph on Plate 2, fig. 3, shows, twice enlarged, part of another specimen.

Remarks.—This frond appears to be distinct from any British Sphenopterid known to me. It, however, approximates fairly closely in habit to some of the Stephanian Sphenopterids figured from the Commentry coalfield,* especially *Sphenopteris Matheti* Zeill., and *S. lenis* Zeill., with which, however, I am not convinced that it is identical. I therefore prefer for the present to regard it as a distinct species.

Locality :—Red Clay Series, Granville Clay Pit, Old Hill, South Staffordshire.

Horizon :—Transition Coal Measures.

Types :—No. 3363 and 3365, Carbon. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

Sphenopteris artemisiæfolioides Crépin. Plate 4, fig. 22.

For *Synonymy*, see Kidston, ' Trans. R. Soc. Edinburgh,' vol. 50, Part 1, p. 83, 1914.

Remarks on the Figured Specimen.—The portion of a frond shown on Plate 4, fig. 22, natural size, is admittedly very imperfect, in that the distal extremities of most of the lobes of the pinnules are wanting. I think, however, that the size of the pinnules, the broad wedge-shape form of their lobes, and the sub-parallel course of the branched nerves in each, are sufficient to support the identification.

Locality :—Red Clay Series, Hamblet's Pit, West Bromwich, S. Staffordshire.

Horizon :—Transition Coal Measures.

Figured Specimen :—No. 3420, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. W. H. Hardaker, M.Sc.

Neuropteris Blissi Lesq. Plate 2, fig. 8.

For *Synonymy*, see Arber, ' Phil. Trans.,' B, vol. 204, p. 390, 1914.

Remarks on the Specimen.—Several detached pinnules are seen on Plate 2, fig. 8, enlarged between two and three times to show the nervation more clearly. These seem to me to be identical with the specimens which I have recently described from a lower horizon in the Wyre Forest; the very fine, slender, much branched and slightly arched nervation being the chief characteristic of this species as I interpret it. The pinnules are always lanceolate, and often somewhat falcate.

* Renault and Zeiller (1888), Plate 1.

Locality:—Red Clay Series, Granville Clay Pit, Old Hill, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3378, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

Neuropteris Kosmanni Gothan.* Plate 2, figs. 2, 4, and 7.

1905. *Neuropteris Kosmanni*, Potonié, in Tornau, 'Jarhb. K. Preuss. Geol. Landesanst. für 1902,' vol. 23, p. 399.

1913. *Neuropteris Kosmanni*, Gothan, 'Abhandl. K. Preuss. Geol. Landesanst.,' N.F., Heft. 75, p. 204, Plate 47, fig. 3; Plate 50, figs. 1–4.

Description of the Figured Specimens.—Part of a pinna 7 cm. in length is seen, natural size, on Plate 2, fig. 7. The pinnules on the right-hand side are broadly elliptical, in one case exceeding 11 mm. in breadth. On the left-hand side the pinnules are much narrower and longer. The midribs are very stout in all cases.

Part of another pinna, in which all the pinnules are of the narrow lanceolate type, is seen on Plate 2, fig. 4, natural size, and on fig. 2 of the same plate, a portion of a pinnule is shown enlarged between three and four times to exhibit the lateral nervation.

The essential characters of this plant lie in the relatively large size of the pinnules, their variable shape even in the same pinna, the very strong median nerve, and the very close, oblique lateral nervation, the nerves of which are scarcely arched, and only once or twice forked. The shape of the pinnules varies from elliptical, broadest midway between the base and apex, to elongately lanceolate, broadest at or close to the base.

Remarks on the Figured Specimens.—The fronds with lanceolate pinnules figured here appear to me to agree closely with the Silesian *Neuropteris*, described by Potonié, and figured by Gothan as *N. Kosmanni*. This is a Neuropteris which I have not previously seen, and, if I am correct in the determination, a species new to Britain. It somewhat resembles the *Neuropteris rectinervis* of Kidston,† but the pinnules are larger and the lateral nerves less frequently dichotomised.

Locality:—Red Clay Series, Hamblet's Pit, West Bromwich, and Pouke Lane Clay Pit, Old Hill, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimens:—Nos. 3424, 3509, Carbon. Plant Coll., Sedgwick Mus., Camb. No. 3424 collected by Mr. W. H. Hardaker, M.Sc., at West Bromwich. The other specimen collected by Mr. H. Kay, F.G.S., at Old Hill.

* Potonié's specific name, but published without figures.

† Kidston (1888[2]), p. 314, Plate, figs. 2–4; Gothan in Potonié (1906), No. 67.

Pecopteris oreopteridia (Schl.). Plate 3, figs. 10, 11.

1804. —— Schlotheim, 'Flora der Vorwelt,' p. 36, Plate 6, fig. 9.
1820. *Filicites oreopteridius*, Schlotheim, 'Petrefactenk.,' Part 2, p. 407.
1834. *Pecopteris oreopteridius*, Brongniart, 'Hist. Végét. Foss.,' vol. 1, p. 317, Plate 104, figs. 1–2; Plate 5, figs. 1, 2, 3.
1883. *Pecopteris oreopteridia*, Renault, 'Cours Bot. Foss.,' 3me Ann., p. 110, Plate 18, fig. 5, 5 bis; ? Plate 19, figs. 7–12.
1885. *Pecopteris* (*Asterotheca*) *oreopteridia*, Zeiller, 'Bull. Soc. Géol. France,' Series 3, vol. 13, p. 138, Plate 9, figs. 1, 1a.
1888. *Pecopteris oreopteridia*, Kidston, 'Trans. R. Soc. Edinburgh,' vol. 33, Part 2, p. 371; Plate 27, figs. 3, 4; Plate 28, figs. 1, 2.

Remarks on the Figured Specimen.—Since the occurrence of this frond on this horizon is of some importance, I have figured a specimen, natural size, on Plate 3, fig. 10, and part of the same example is shown, four times enlarged, on fig. 11 of the same plate, to exhibit the lateral nervation. The widely separated branches of the "tuning fork" lateral nervation leave, I think, no doubt as to the specific determination.

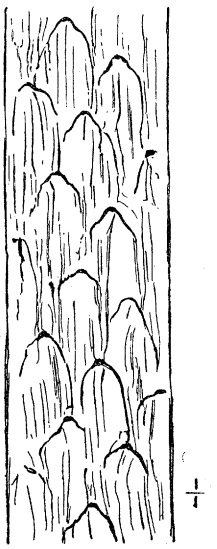
Locality:—Brick Clay Series, Granville Pit, Old Hill, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3370, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

Lepidodendron sp. Text-fig. 3.

Remarks on the Figured Specimen.—Part of a Lepidodendron stem with which Lepidodendroid leaves are associated, or perhaps are even still in continuity, is shown in text-fig. 3, natural size. There is no leaf-scar, merely an angular or oblique slit representing the leaf insertion, as in the case of *L. lycopodioides* Sternb. and *L. lanceolatum* Lesq., among British species. The extraordinary feature, in which the present specimen differs from the two species above mentioned, is in the absence of any indication of the limits of the leaf-base, or of a keel and its ornamentation. I do not remember having previously met with any similar specimen, and thus I do not propose to discuss it further for the present.



Text-fig. 3.—*Lepidodendron* sp. Nat. size. (No. 3495.)

Locality:—Red Clay Series, Pouke Lane Clay Pit, Old Hill, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3495, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

Lepidophloios laricinus Sternb. Plate 4, figs. 24 and 25.

1873. *Lepidophloios laricinus*, CARRUTHERS, 'Geol. Mag.,' dec. 1, vol. 10, p. 150, Plate 7, figs. 3, 4.

For full *Synonymy* see KIDSTON, 'Trans. Roy. Soc. Edinburgh,' vol. 37, Part 3, p. 555, 1893.

Remarks on the Specimens.—At Pouk Hill, Walsall, Halonial branches are of frequent occurrence, and these in some cases fork (Plate 4, fig. 24). They bear small tubercles, like those which have been described in the case of Halonial branches of *Lepidophloios scoticus* Kidst.* These branches correspond to the *Halonia? tortuosa* of LINDLEY and HUTTON.† As is usually the case, the leaf-bases are much decorticated, but Mr. JACKSON has found a specimen, part of which is figured in Plate 4, fig. 25, twice enlarged, in which the leaf-scars are well preserved, and are clearly of the *Lepidophloios laricinus* type, like that first figured by CARRUTHERS (see above). The question arises whether these slender Halonial branches, with small tubercles, are identical with the stouter axes with much larger tubercles, of which the *Halonia tuberculata* of BRONGNIART‡ and the *Halonia regularis* of LINDLEY and HUTTON§ are the earliest described specimens. The latter appear to be the commoner type, and further specimens have been figured by BINNEY, WILLIAMSON, RENIER and others. It may, of course, be a matter of age or of mere size, but for the present, however, I am inclined to regard this correlation as still an open question.

Locality:—Grey Productives, between Bottom and New Mine Coals, Pouk Hill, Walsall, South Staffordshire.

Horizon:—Middle Coal Measures.

Figured Specimens:—Nos. 3264, 3901, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. L. JACKSON.

Lepidostrobus intermedius (L. and H.). Plate 4, fig. 21.

1832. *Lepidophyllum intermedium*, LINDLEY and HUTTON, 'Foss. Flora,' vol. 1, Plate 43, fig. 3.

1877. *Lepidophyllum lanceolatum*, LEBOUR, 'Illustr. Foss. Plants,' p. 105, Plate 53.

1890. *Lepidophyllum majus*, RENAULT, 'Flore Foss. Terr. Houill. Commentry,' Part 2, p. 516, Plate 59, figs. 8 and 9.

1904. *Lepidophyllum majus*, ZALESSKY, 'Mém. Com. Géol. St. Pétersburg,' N.S., No. 13, p. 104, Plate 7, figs. 6 and 9.

Description of the Figured Specimen.—The specimen figured on Plate 4, fig. 21, natural size, shows part of a cone with several large lanceolate sporophylls, measuring

* KIDSTON (1893), Plate 2, figs. 5–6; RENIER (1910), Plate 11.

† LINDLEY and HUTTON (1831), vol. 2, Plate 85, fig. 1.

‡ BRONGNIART (1837), vol. 2, Plate 28, figs. 1–3.

§ LINDLEY and HUTTON (1831), vol. 3, Plate 228.

3–4 cm. in length, overlapping one another. The median nerve is only faintly indicated in one or two cases. The sporophylls have, in addition, a number of slender striæ or ? nerves, radiating from the base towards the margin, and some of these arch towards the margin at the broadest part of the sporophyll, and do not extend to the apex. These ? striæ are not, however, very clearly marked in the present specimen, and I have not been able to satisfy myself that they branch.

Remarks on the Figured Specimen.—The sporophylls of this cone are well known in the detached state under the name *Lepidophyllum intermedium* (L. and H.). I have also seen, from other coalfields, several specimens of similar cones, some of which I hope to describe on a future occasion. The present example is, I believe, the first to be figured showing the sporophylls still attached.

Locality :—Grey Productives, Ten-foot Ironstone, Claycroft openwork, Coseley, South Staffordshire.

Horizon :—Middle Coal Measures.

Figured Specimen in Mr. L. J. Reade's collection, Wolverhampton.

Lepidostrobus Jacksoni sp. nov. Plate 4, fig. 19.

Diagnosis.—Cone of medium size, stalked, more or less club-shaped. Lower portion of sporophylls, broad, scale-like, distal extremities prolonged as very narrow, elongated appendages, 4 mm. or more in length.

Description of the Specimen.—The single known example has a length of 6·1 cm. It is broadest near the apex, where it measures 2 cm. across. It contracts very suddenly at the base. A small portion of the stalk, 7 mm. long, is shown below on Plate 4, fig. 19. The sporophylls are clearly seen, their proximal portions being broad, while above they suddenly contract into long awn-like, distal prolongations, which are, however, not very distinctly shown in the photograph.

Remarks on the Specimen.—This cone, both in its shape and in the form of the sporophylls, obviously differs from the common *Lepidostrobus variabilis* L. and H. type. Further, the sporophylls do not agree with any of the British varieties of detached sporophylls, known as *Lepidophyllum*, such as *L. lanceolatum* L. and H. In shape the sporophylls somewhat recall those of certain species of *Sigillariostrobus*, notably, *S. nobilis* Zeill., and *S. ciliatus* Kidst., especially in the broad scale-like lower portion, suddenly contracted above into a very narrow, elongated terminal portion. There is, of course, no close comparison with the members of this genus, for the cones are obviously quite distinct. The small fragment of the stalk of this cone shows a number of leaf-bases, which unfortunately are not clearly preserved. They, however, suggest that this may be the cone of *Lepidodendron obovatum* Sternb., which is so abundant in the same locality. The evidence is, however, not sufficient to justify a confident attribution to that stem species.

In this connection a Belgian specimen, figured some years ago by RENIER,* and attributed by him to *Lepidodendron obovatum*, Sternb., is of interest. This cone approximates more closely to the present specimen than any other of which published figures are known to me, with the exception perhaps of an unnamed and imperfect cone figured by BRONGNIART.† It does not, however, agree precisely in shape, and the features of the sporophylls cannot be made out clearly from RENIER's figure. While admitting that the Belgian specimen may eventually prove to be identical with the British, and, further, that the attribution to *Lepidodendron obovatum* may later be more firmly established, it has seemed to me to be the best policy for the present to refer the English plant to a new species.

I have much pleasure in naming it after Mr. L. JACKSON, of Birmingham, who collected this as well as many other examples of the South Staffordshire flora.

Occurrence:—Grey Productives, between the Bottom and New Mine Coals, Pouk Hill, Walsall, South Staffordshire.

Horizon:—Middle Coal Measures.

Type:—No. 3250, Carb. Plant Coll., Sedgwick Museum, Camb. Collected by Mr. L. JACKSON.

Sigillaria Deutschi, Brongn. Plate 4, fig 17.

1836. *Sigillaria Deutschiana*, BRONGNIART, 'Hist. Végét. Foss.,' vol. 1, p. 475. Plate 164, fig. 5.

1857. *Sigillaria Deutschiana*, GOLDENBERG, 'Flora Saræp. Foss.,' Part 2, p. 47, Plate 8, fig. 16.

1886–88. *Sigillaria Deutschi*, ZEILLER, 'Flore Foss. Bass. Houill. Valenciennes,' p. 554, Plate 80, figs. 6–8.

1902. *Sigillaria Deutschi*, ZALESSKY, 'Mém. Com. Géol. St. Pétersbourg,' vol. 17, Part 3, p. 8, Plate 3, fig. 6.

Remarks on the Figured Specimen.—This is a rare species in Britain, not at present to be distinguished with as much clearness as might be desired from *S. rugosa*, and perhaps other species. The present specimen (Plate 4, fig. 17) differs from BRONGNIART's figure (see above) in the upper margin of the leaf-scar being markedly emarginate, and in the fact that the lateral grooves, arising from the lateral angles of the leaf-scar, disappear a short distance below the scar, and are not continued downwards as far as the scar below, as is the case apparently in BRONGNIART's specimen. Neglecting GOLDENBERG's figure, we have next that of ZEILLER (see above), in which the same differences are observable. I am, nevertheless, inclined to regard the present specimen as a variety of *S. Deutschi* Brongn., and I base this conclusion chiefly on the small size and shape of the leaf-scars, which are very widely separated.

* RENIER (1910), Plate 3, fig. *b*.

† BRONGNIART (1837), vol. 2, Plate 22, fig. 8, later termed by KIDSTON, *Lepidostrobus ? spinosus* Kidst.

Locality:—Grey Productives, Brooch Clays, Doulton's New Pit, Saltwells, South Staffordshire.

Horizon:—Middle Coal Measures.

Figured Specimen:—No. 3289, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. L. Jackson.

Sigillaria elongata, Brongn. Plate 4, fig. 20.

For *Synonymy*, see Kidston, 'Trans. Roy. Soc. Edinburgh,' vol. 50, Part 1, p. 145, 1914.

Remarks on the Figured Specimen.—The specimen figured on Plate 4, fig. 20, enlarged $2\frac{1}{2}$ times, does not show the ornamentation on the leaf-base below the leaf-scar at all clearly, though I think that the specific determination is correct in view of the shape and very elongated nature of the leaf-scars, which are well seen.

Locality:—Red Clay Series, Hamblet's Pit, West Bromwich, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3406, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. L. Jackson.

Sigillaria mamillaris, Brongn. Plate 3, fig. 13.

For *Synonymy*, see Kidston, 'Trans. Roy. Soc. Edinburgh,' vol. 50, Part 1, p. 143, 1914.

Remarks on the Figured Specimen.—I have added a figure (Plate 3, fig. 13) of this common *Sigillaria* here, because it is particularly abundant in the Red Clay Series in some localities. The leaf-bases are usually very prominent in these specimens.

Locality:—Red Clay Series, Hamblet's Clay Pit, West Bromwich, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3403, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

Sigillariostrobus nobilis, Zeill. Plate 3, figs. 12 and 16.

For *Synonymy*, see Arber, 'Phil. Trans.,' B, vol. 204, p. 399, 1914.

Description of the Figured Specimens.—Part of a cone, the axis of which exceeds 8 cm. in length, is shown, natural size, on Plate 3, fig. 12. Most of the sporophylls have fallen off, and thus the axis is laid bare. Several sporophylls are, however, seen still attached on the left-hand side. Another specimen (Plate 3, fig 16, also natural size) shows the axis above, and the bases of the broken sporophylls below.

Remarks on the Figured Specimens.—This cone is much more slender than the type specimen, or any other examples known to me. Yet the shape of the sporophylls, which are well seen at the top of Plate 3, fig. 12, appears to me to agree very closely with those of the French and British species of *S. nobilis*, and I therefore regard these specimens as a slender variety of that cone. So far as I am aware, the present is the first record of this genus from the British Transition Coal Measures.

Locality:—Brick Clay Series, Granville Pit, Old Hill Marls, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimens:—Nos. 3347 and 3352, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by the author.

Stigmariopsis anglica Kidst. Plate 3, figs. 14 and 15.

1901. *Stigmariopsis anglica*, KIDSTON, 'Trans. Nat. Hist. Soc. Glasgow,' vol. 4 (N.S.), p. 114, fig. 19 on p. 109.

1902. *Stigmariopsis anglica*, KIDSTON, 'Proc. Yorks. Geol. and Polyt. Soc.,' vol. 14, Part 3, p. 357, Plate 51, figs. 4–5.

Description of the Figured Specimen.—The portion of a specimen figured on Plate 3, fig. 14, natural size, shows an area of bark with a conspicuous ornamentation of sinuous vertical ridges, among which occur a number of small oval scars, usually very indistinctly seen. One of these is shown on the enlarged portion of the same specimen figured on Plate 3, fig. 15.

Remarks on the Figured Specimens.—This fossil appears to be a very rare type. I have not previously seen specimens of it, but the two examples collected in South Staffordshire appear to me, so far as I can judge, to be identical with the *Stigmariopsis anglica* of KIDSTON. The present specimens are from a higher horizon than that from which the type was recorded.

Locality:—Red Clay Series, Hamblet's Pit, West Bromwich, South Staffordshire.

Horizon:—Transition Coal Measures.

Figured Specimen:—No. 3414, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. W. H. HARDAKER, M.Sc.

Cardiocarpus Kayi sp. nov. Plate 4, fig. 23.

Diagnosis.—Seed large, broader than long, slightly pointed at the apex, in which region there is a short median groove. Base ? straight, or ? very slightly cordate. Testa smooth or reticulately pitted.

Description of the Specimen.—The single example collected is shown, natural size, on Plate 4, fig. 23. Its greatest breadth is 1·8 cm., and its length 13 mm. The base of the seed is not well preserved. It may have been straight. At any rate, it was not markedly cordate.

Remarks on the Specimen.—This seed differs from *Cardiocarpus Gutbieri* Gein.* in its larger size, and in its greater breadth in proportion to its length. So far as I am aware it has not been previously described from Britain. Among the innumerable seeds from the Continent and America, which have figured in one or other of the many memoirs dealing with Coal Measure plants, I have not been able to find any which agree at all exactly with the specimen here figured. Some of the seeds, referred by Grand' Eury† to the genus *Cordaicarpus*, from the Stephanian of France, are similar in type, especially *C. major* and the much larger *C. reniformis*, but neither of these appear to me to be identical with the South Staffordshire specimens.

Locality:—Red Clay Series, Cakemoor Clay Pit, Rowley Regis, South Staffordshire.

Horizon:—Transition Coal Measures.

Type:—No. 3485, Carb. Plant Coll., Sedgwick Mus., Camb. Collected by Mr. H. Kay, F.G.S.

5. Summary.

A flora of 58 records is described from a new plant horizon in South Staffordshire, the Red Clay Series or Old Hill Marls, of Transition Coal Measure age. A new genus *Calamophloios* and new species of *Sphenopteris* and *Cardiocarpus* are included, as well as several species new to this horizon.

Ten new records are added to the known flora of the Productive Series (Middle Coal Measures), including new species of *Calamites* and *Lepidostrobus*. A large number of additional records from new localities, or horizons, are added in respect to fossil plants already known from these beds.

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* See Arber (1914[2]), p. 97, Plate 6, fig. 15.

† Grand'Eury (1877), Plate 26, especially figs. 16 and 25.

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7. EXPLANATION TO THE PLATES.

(Those specimens which are in the Carboniferous Plant Collection of the Sedgwick Museum, Cambridge, are indicated by their numbers. The photographs are by Mr. W. Tams, Cambridge.)

Plate 2.

Fig. 1.—*Sphenopteris* (*Renaultia*) *Schwerini* (Stur). Red Clay Series, Granville Clay Pit, Old Hill. No. 3357. Nat. size.

Fig. 2.—*Neuropteris Kosmanni*, Gothan. Pinnule enlarged to show the nervation. Red Clay Series, Pouke Lane Clay Pit, Old Hill. No. 3509. ×10/3.

Fig. 3.—*Sphenopteris Kayi*, sp. nov. Part of a pinna enlarged. Red Clay Series, Granville Clay Pit, Old Hill. No. 3363. ×5/2.

Fig. 4.—*Neuropteris Kosmanni*, Gothan. Red Clay Series, Pouke Lane Clay Pit, Old Hill. No. 3509. Nat. size.

Fig. 5.—*Sphenopteris* (*Renaultia*) *Schwerini* (Stur). Red Clay Series, Granville Clay Pit, Old Hill. No. 3361. Nat. size.

Fig. 6.—*Sphenopteris Kayi*, sp. nov. Red Clay Series, Granville Clay Pit, Old Hill. No. 3365. Nat. size.

Fig. 7.—*Neuropteris Kosmanni*, Gothan. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3424. Nat. size.

Fig. 8.—*Neuropteris Blissi*, Lesq. Enlarged pinnules. Red Clay Series, Granville Clay Pit, Old Hill. No. 3378. ×5/2.

Plate 3.

Fig. 9.—*Calamophloios rugosus*, sp. nov. Red Clay Series, Granville Clay Pit, Old Hill. No. 3322. Nat. size.

Fig. 10.—*Pecopteris oreopteridia* (Schl.). Red Clay Series, Granville Clay Pit, Old Hill. No. 3370. Nat. size.

Fig. 11.—*Pecopteris oreopteridia* (Schl.). Pinnules of the specimen seen in fig. 10, enlarged to show the lateral nervation. ×4.

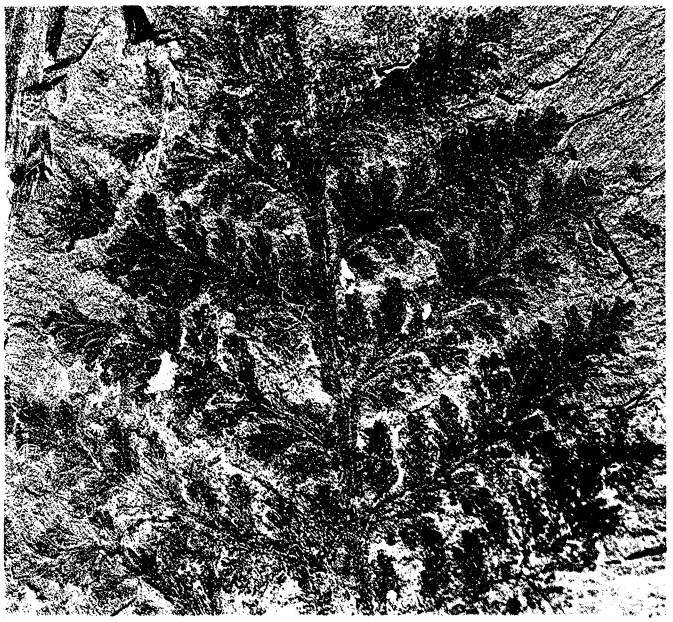
Fig. 12.—*Sigillariostrobus nobilis*, Zeiller. Red Clay Series, Granville Clay Pit, Old Hill. No. 3352. Nat. size.

Fig. 13.—*Sigillaria mamillaris*, Brongn. Red Clay Series, Hamblet's Clay Pit, West Bromwich. No. 3403. Nat. size.

Fig. 14.—*Stigmariopsis anglica*, Kidst. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3414. Nat. size.

Fig. 15.—*Stigmariopsis anglica*, Kidst. Part of fig. 14 enlarged to show a scar and the ornamentation. ×10/3.

Fig. 16.—*Sigillariostrobus nobilis*, Zeiller. Red Clay Series, Granville Clay Pit, Old Hill. No. 3347. Nat. size.



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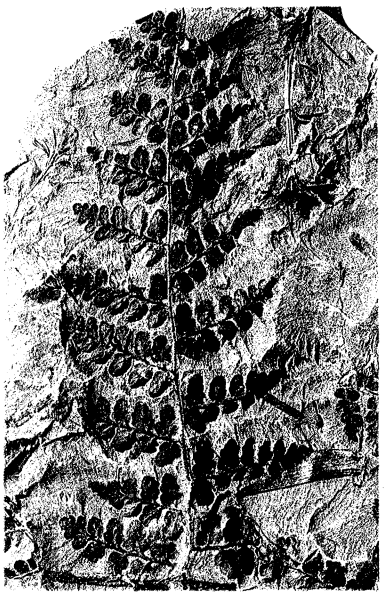

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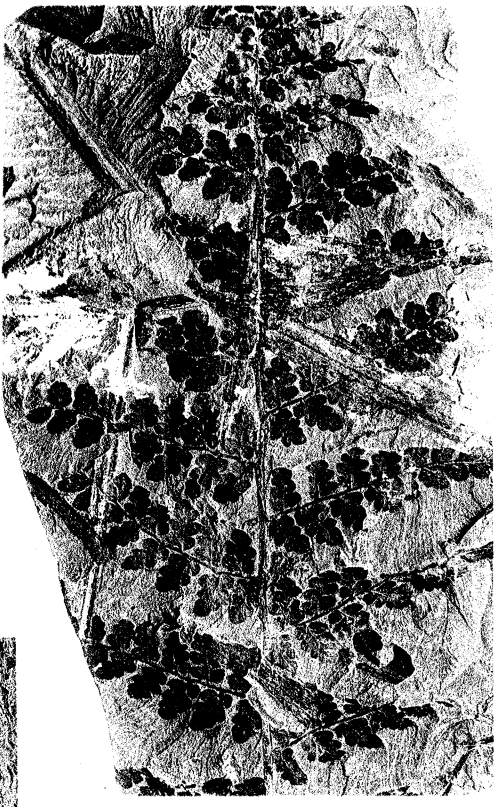

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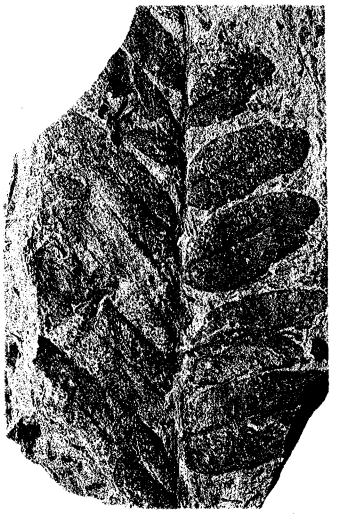

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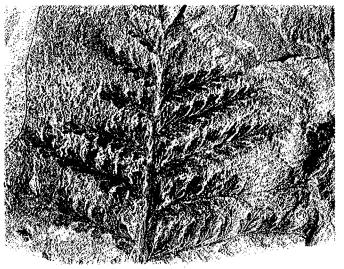

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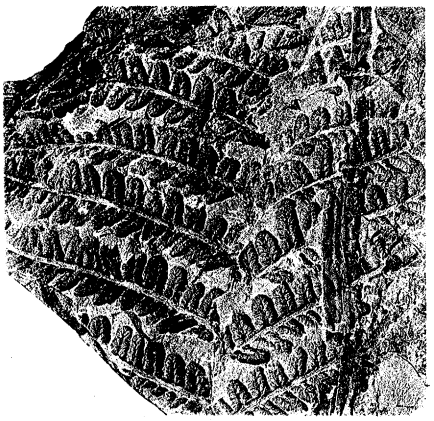

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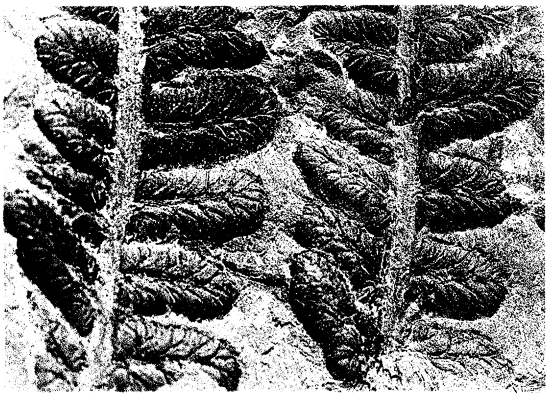

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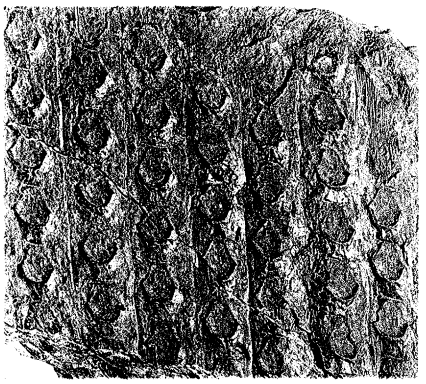

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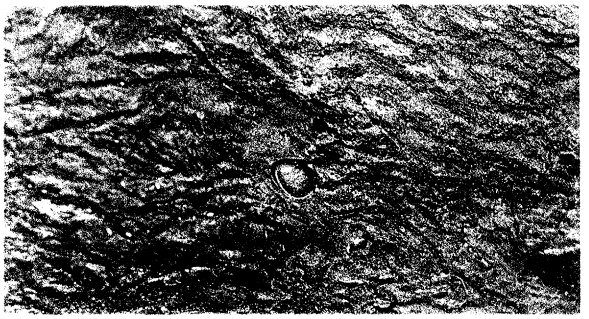

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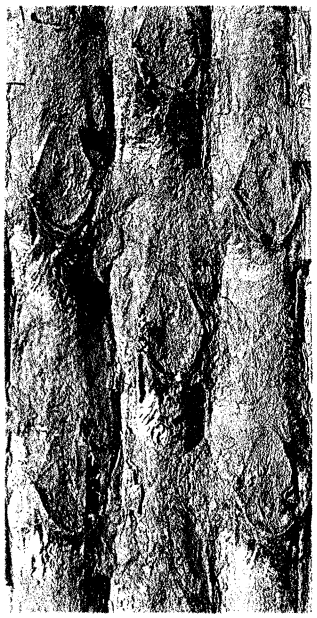

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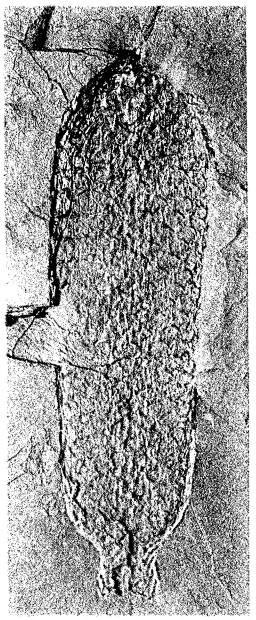

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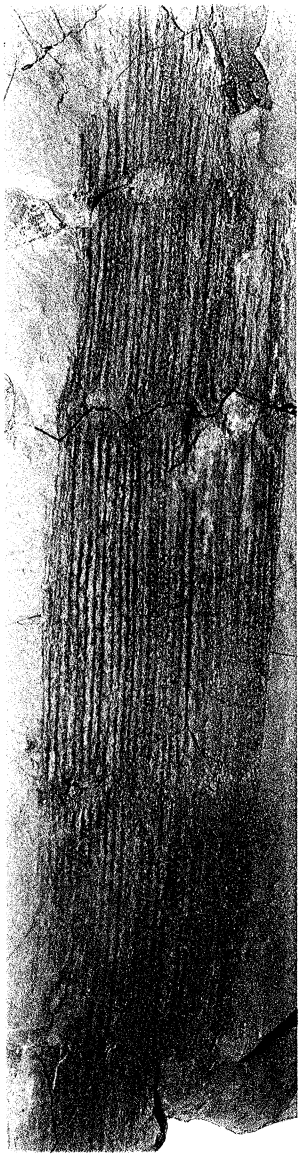

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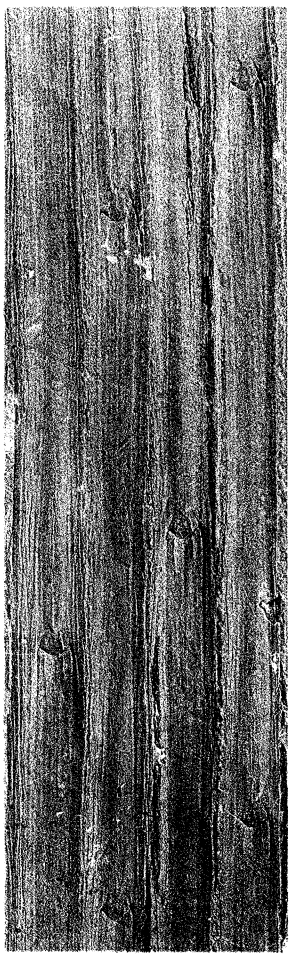

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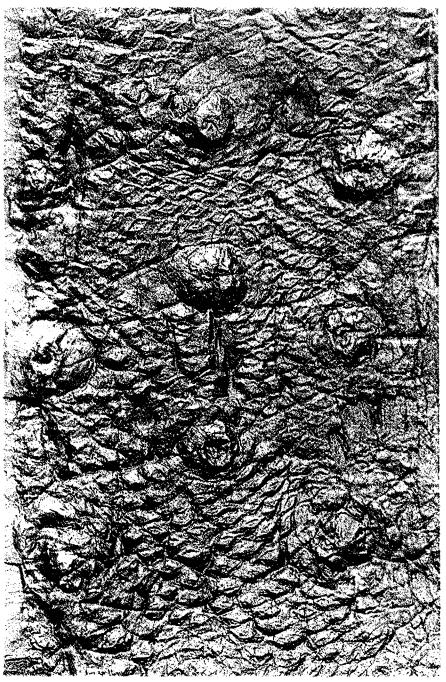

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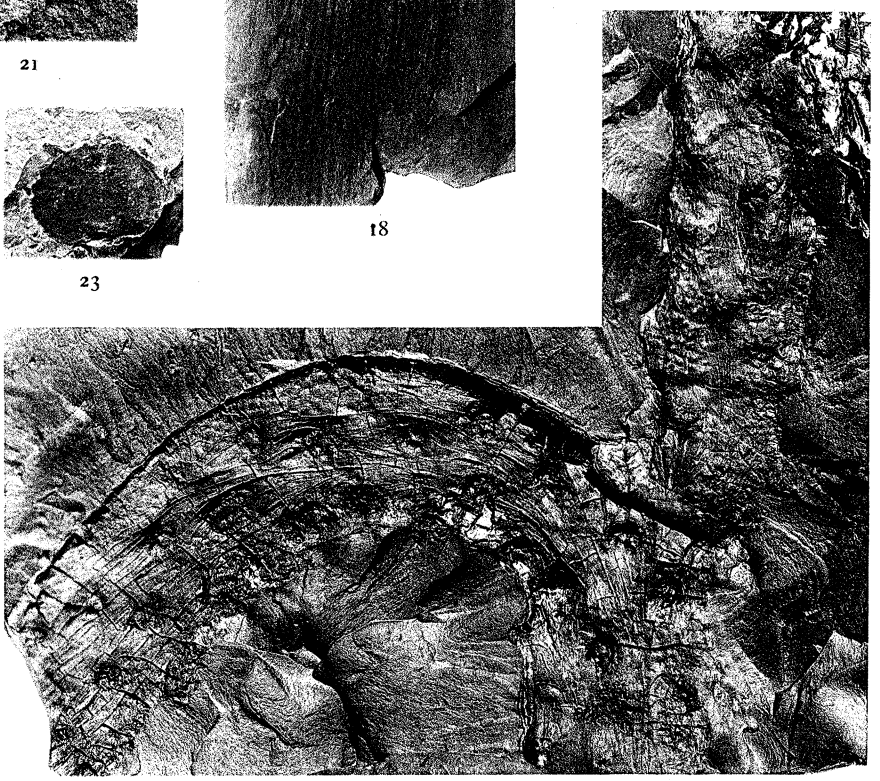

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Plate 4.

Fig. 17.—*Sigillaria Deutschi*, Brongn. Grey Productives, Brooch Clays, Doulton's New Pit, Saltwells. No. 3289. ×3/2.

Fig. 18.—*Calamites Cannockensis*, sp. nov. Grey Productives, Top Hard Seam, No. 3 Pit, West Cannock Colliery, Hednesford. No. 3519. Nat. size.

Fig. 19.—*Lepidostrobus Jacksoni*, sp. nov. Grey Productives, between Bottom and New Mine Coals, Pouk Hill, Walsall. No. 3250. Nat. size.

Fig. 20.—*Sigillaria elongata*, Brongn. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3406. ×5/2.

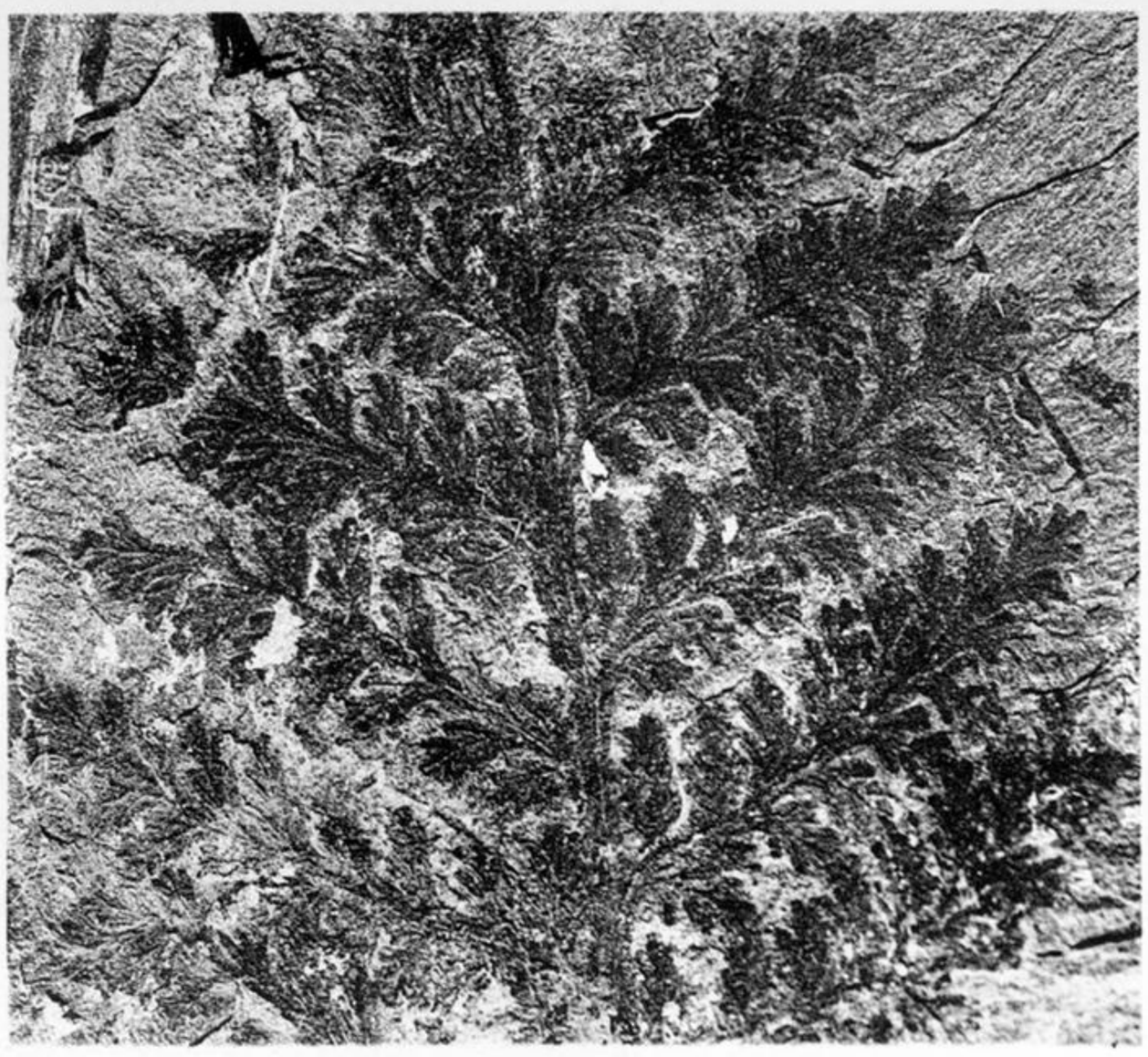
Fig. 21.—*Lepidostrobus intermedius* (L. and H.). Grey Productives, Ten-foot ironstones, Claycroft openwork, Coseley. In Mr. L. J. Reade's collection. Nat. size.

Fig. 22.—*Sphenopteris artemisiæfolioides*, Crép. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3420. Nat. size.

Fig. 23.—*Cardiocarpus Kayi*, sp. nov. Red Clay Series, Cakemoor Clay Pit, Rowley Regis. No. 3485. Nat. size.

Fig. 24.—*Lepidophloios laricinus*, Sternb. Branched specimen in the Halonial condition. Grey Productives, between Bottom and New Mine Coals, Pouk Hill, Walsall. No. 3264. Nat. size.

Fig. 25.—*Lepidophloios laricinus*, Sternb. Part of another Halonial branch, enlarged to show the leaf scars. From the same locality as fig. 24. No. 3901. ×2.



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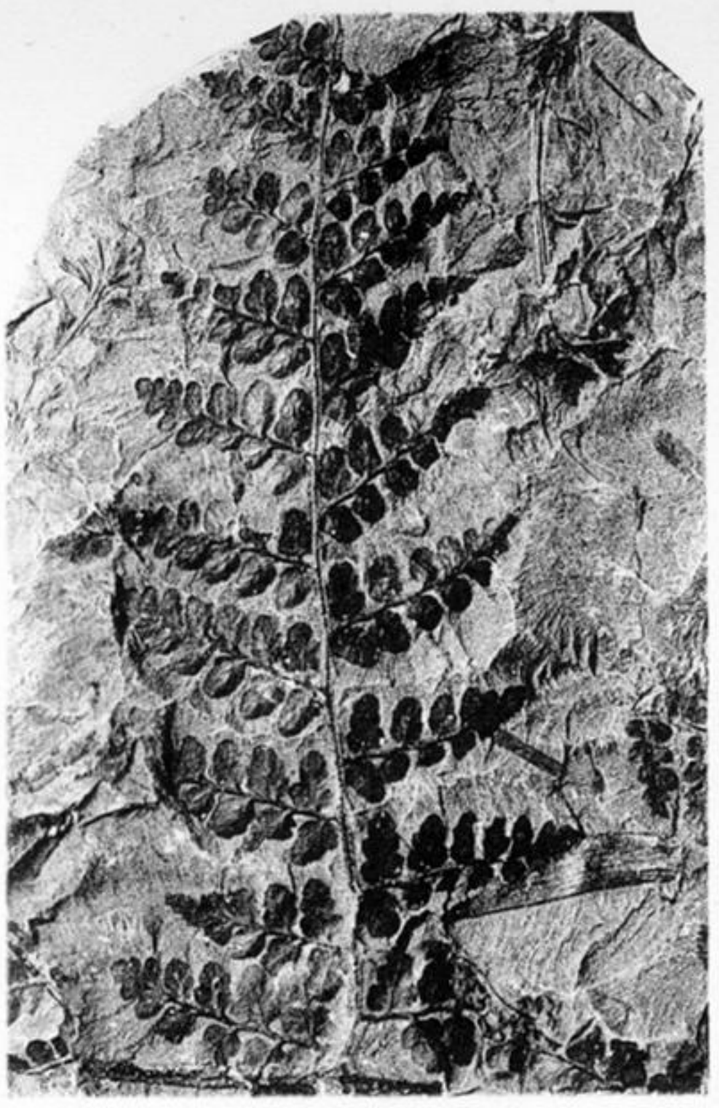

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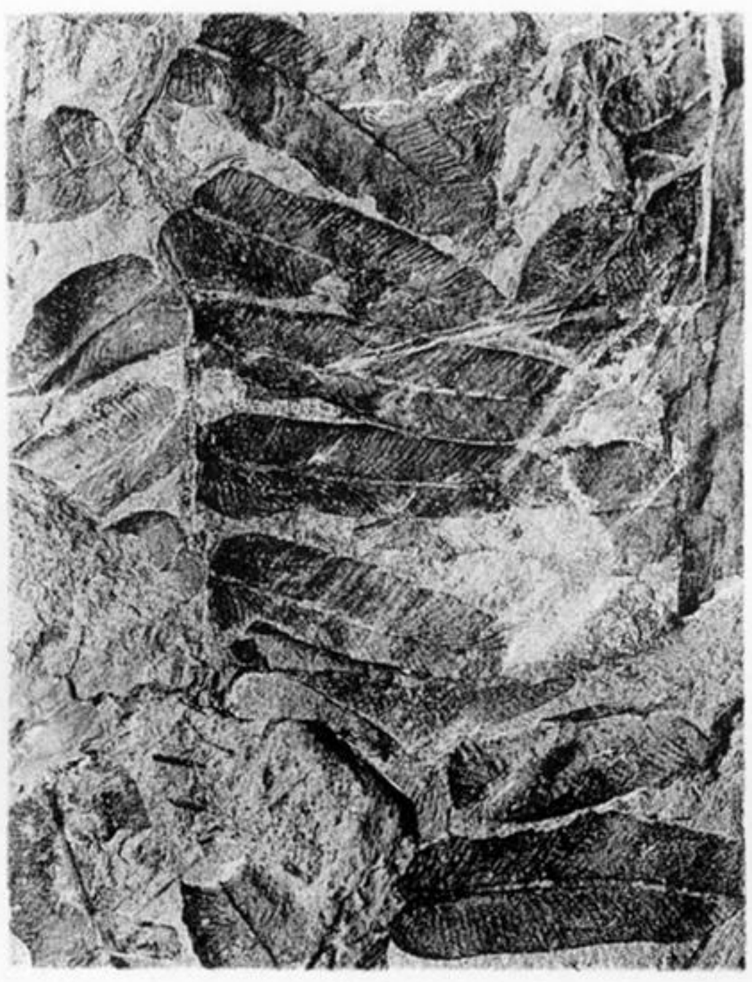

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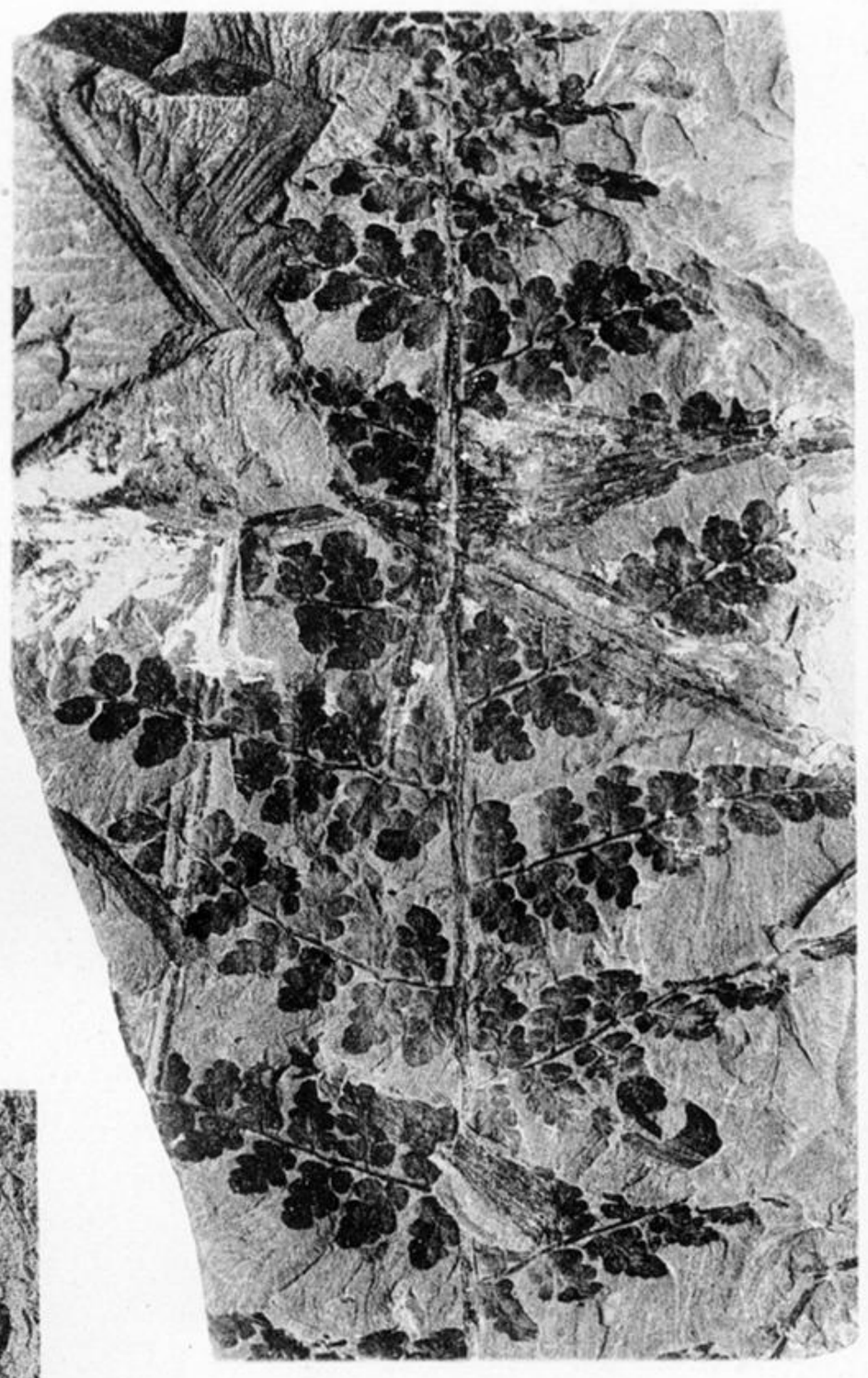

5

8 x $\frac{5}{2}$

7

6

FOSSIL PLANTS FROM THE SOUTH STAFFORDSHIRE COALFIELD.

Plate 2.

Fig. 1.—*Sphenopteris* (*Renaultia*) *Schwerini* (Stur). Red Clay Series, Granville Clay Pit, Old Hill. No. 3357. Nat. size.

Fig. 2.—*Neuropteris Kosmanni*, Gothan. Pinnule enlarged to show the nervation. Red Clay Series, Pouke Lane Clay Pit, Old Hill. No. 3509. ×10/3.

Fig. 3.—*Sphenopteris Kayi*, sp. nov. Part of a pinna enlarged. Red Clay Series, Granville Clay Pit, Old Hill. No. 3363. ×5/2.

Fig. 4.—*Neuropteris Kosmanni*, Gothan. Red Clay Series, Pouke Lane Clay Pit, Old Hill. No. 3509. Nat. size.

Fig. 5.—*Sphenopteris* (*Renaultia*) *Schwerini* (Stur). Red Clay Series, Granville Clay Pit, Old Hill. No. 3361. Nat. size.

Fig. 6.—*Sphenopteris Kayi*, sp. nov. Red Clay Series, Granville Clay Pit, Old Hill. No. 3365. Nat. size.

Fig. 7.—*Neuropteris Kosmanni*, Gothan. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3424. Nat. size.

Fig. 8.—*Neuropteris Blissi*, Lesq. Enlarged pinnules. Red Clay Series, Granville Clay Pit, Old Hill. No. 3378. ×5/2.

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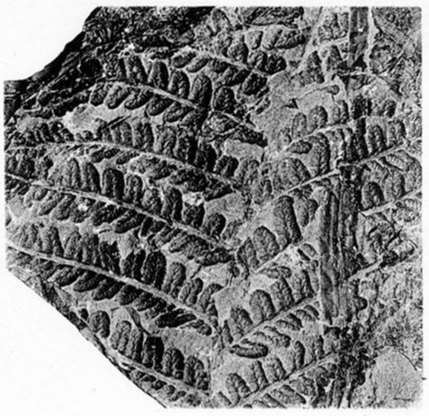

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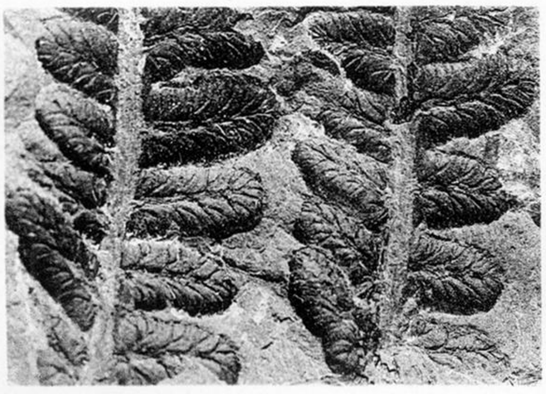

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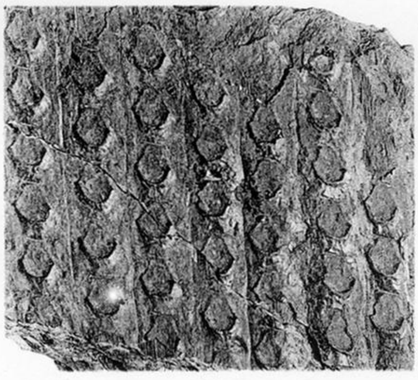
16



13

15 x $\frac{10}{3}$

14

FOSSIL PLANTS FROM THE SOUTH STAFFORDSHIRE COALFIELD.

Plate 3.

Fig. 9.—*Calamophloios rugosus*, sp. nov. Red Clay Series, Granville Clay Pit, Old Hill. No. 3322. Nat. size.

Fig. 10.—*Pecopteris oreopteridia* (Schl.). Red Clay Series, Granville Clay Pit, Old Hill. No. 3370. Nat. size.

Fig. 11.—*Pecopteris oreopteridia* (Schl.). Pinnules of the specimen seen in fig. 10, enlarged to show the lateral nervation. ×4.

Fig. 12.—*Sigillariostrobus nobilis*, Zeiller. Red Clay Series, Granville Clay Pit, Old Hill. No. 3352. Nat. size.

Fig. 13.—*Sigillaria mamillaris*, Brongn. Red Clay Series, Hamblet's Clay Pit, West Bromwich. No. 3403. Nat. size.

Fig. 14.—*Stigmariopsis anglica*, Kidst. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3414. Nat. size.

Fig. 15.—*Stigmariopsis anglica*, Kidst. Part of fig. 14 enlarged to show a scar and the ornamentation. ×10/3.

Fig. 16.—*Sigillariostrobus nobilis*, Zeiller. Red Clay Series, Granville Clay Pit, Old Hill. No. 3347. Nat. size.

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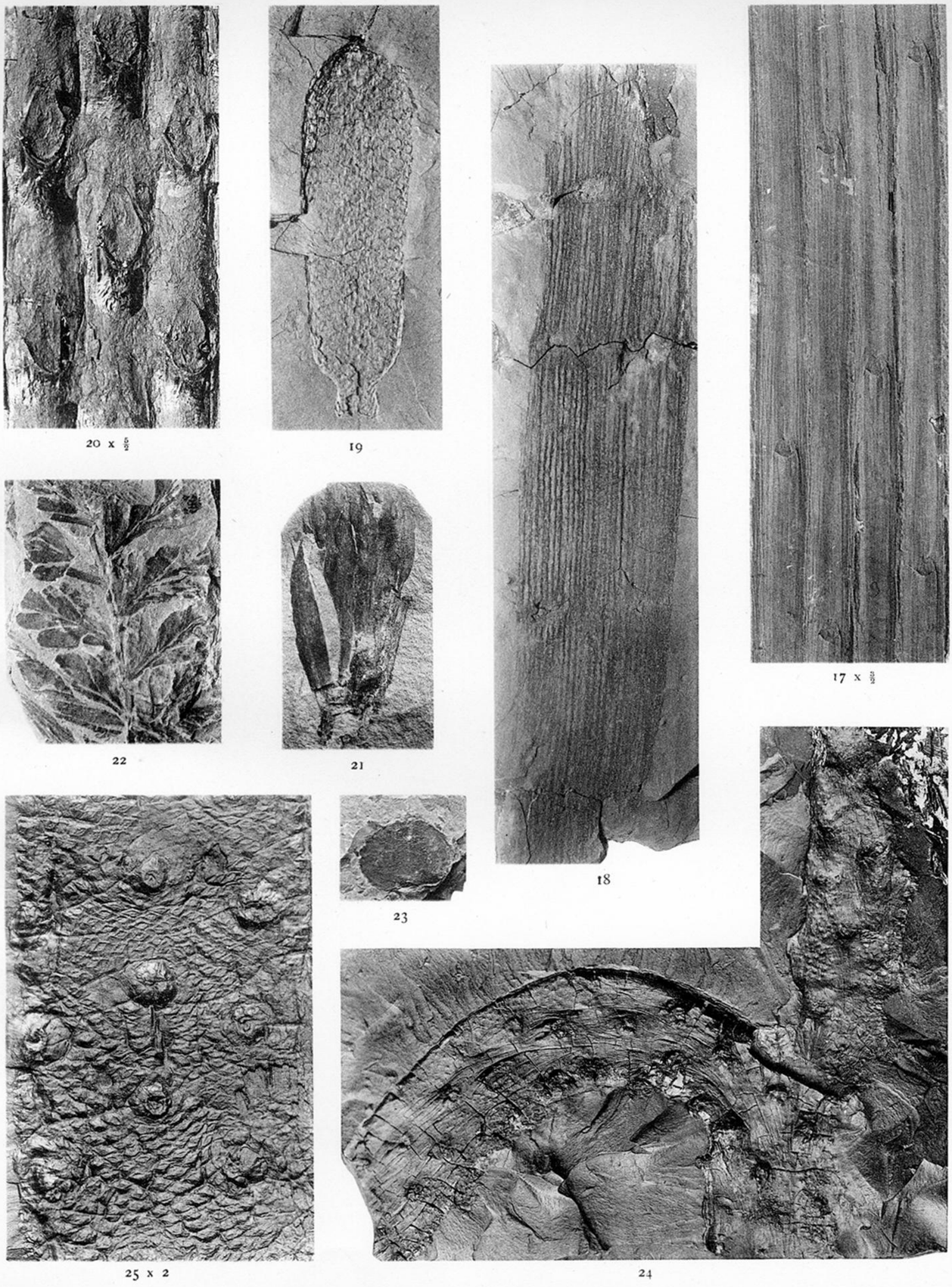

FOSSIL PLANTS FROM THE SOUTH STAFFORDSHIRE COALFIELD.

Plate 4.

Fig. 17.—*Sigillaria Deutschi*, Brongn. Grey Productives, Brooch Clays, Doulton's New Pit, Saltwells. No. 3289. ×3/2.

Fig. 18.—*Calamites Cannockensis*, sp. nov. Grey Productives, Top Hard Seam, No. 3 Pit, West Cannock Colliery, Hednesford. No. 3519. Nat. size.

Fig. 19.—*Lepidostrobus Jacksoni*, sp. nov. Grey Productives, between Bottom and New Mine Coals, Pouk Hill, Walsall. No. 3250. Nat. size.

Fig. 20.—*Sigillaria elongata*, Brongn. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3406. ×5/2.

Fig. 21.—*Lepidostrobus intermedius* (L. and H.). Grey Productives, Ten-foot ironstones, Claycroft openwork, Coseley. In Mr. L. J. Reade's collection. Nat. size.

Fig. 22.—*Sphenopteris artemisiæfolioides*, Crép. Red Clay Series, Hamblet's Pit, West Bromwich. No. 3420. Nat. size.

Fig. 23.—*Cardiocarpus Kayi*, sp. nov. Red Clay Series, Cakemoor Clay Pit, Rowley Regis. No. 3485. Nat. size.

Fig. 24.—*Lepidophloios laricinus*, Sternb. Branched specimen in the Halonial condition. Grey Productives, between Bottom and New Mine Coals, Pouk Hill, Walsall. No. 3264. Nat. size.

Fig. 25.—*Lepidophloios laricinus*, Sternb. Part of another Halonial branch, enlarged to show the leaf scars. From the same locality as fig. 24. No. 3901. ×2.