

NOTE.

ON THE OCCURRENCE OF SIGILLARIOPSIS IN THE LOWER COAL-MEASURES OF BRITAIN.—In 1879, M. Renault, in his classical work 'Structure comparée de quelques tiges de la flore carbonifère,' established the genus *Sigillariopsis* for a small silicified stem, with leaves attached, from the Permian of Autun; he named the species *S. Decaisnei*¹. The general character of the fossil is Lycopodiaceous; the stem resembles *Sigillaria Menardi* in structure, but has the peculiarity that the outer tracheides of the secondary wood are pitted and not scalariform, a character which seems to be unknown elsewhere among Palaeozoic Lycopods. The leaves are even more remarkable, for each leaf contains two parallel vascular bundles, except towards the apex where they unite into one. No member of the Lycopodiales, recent or fossil, is known to present this character. Yet the details of structure described by M. Renault agree very closely with those of a Sigillarian or Lepidodendroid leaf, except for the presence, here as in the stem, of pitted tracheides in addition to those of the usual scalariform type. M. Renault regarded his genus as establishing a bond of union between the smooth-barked Sigillariae and the Cordaiteae, a view which is connected with his general theory of the origin of the Gymnosperms, and which it would take too long to discuss in this preliminary note.

Hitherto no other fossil referable to the genus *Sigillariopsis* has been described. Recently, however, two specimens have come under my observation which agree with M. Renault's genus in so far as they are Lycopodiaceous leaves with two vascular bundles. Both specimens occur in calcareous nodules from the Lower Coal-Measures of Lancashire; the one, which I received about three years ago, came from the well-known locality at Dulesgate, while the other, which only reached me this spring, is derived from a new source, lately opened up, at Shore Littleborough. The material in which the leaves occur was in each case collected and prepared by Mr. J. Lomax.

The Shore Littleborough specimen is better preserved than the other and may therefore be first described. Two leaves are shown, both in transverse section. The larger is about 4 mm. wide by 1.4 mm. in maximum thickness. The lower surface is strongly convex, the upper more or less flat, but with a shallow median depression. The leaf thins out rapidly towards its edges, and on each side is a deep and narrow furrow, on the sides of which the stomata appear to have been placed. Thus the form of the section is that characteristic of the leaves of *Lepidodendron* and *Sigillaria*².

The mesophyll, which is almost perfectly preserved, has a well-marked palisade-layer on the upper side, interrupted about the median line. In the narrow wings of the leaf, and extending round the lateral furrows, characteristic spongy parenchyma is present. A sclerotic hypoderma extends all round the leaf, except at the lateral

¹ l. c. p. 270, Pl. XII, Fig. 15-19; Pl. XIII, Figs. 1-4.

² Renault, Flore fossile d'Autun et d'Épinac, Part II, Atlas, Pl. 34 and 41; Scott, Studies in Fossil Botany, Fig. 59.

furrows, but is thicker on the lower side; otherwise the mesophyll is made up of rather large, isodiametric cells.

The vascular tissue lies within a definite central region about $960\ \mu$ wide by $480\ \mu$ deep, which is well defined, but not marked off by any evident sheath. There are two vascular bundles with their xylem-groups widely separated, the distance between them being $280\ \mu$, while the maximum diameter of each xylem-strand is under $200\ \mu$. The xylem-strands are embedded in thin-walled tissue, in which the limits of the phloem cannot be distinguished in transverse section. Below each bundle is a broad band of dark, apparently sclerotic tissue, perhaps identical with the 'gaîne' of M. Renault's description. In the median line of the leaf and below the level of the bundles is a gap in the tissue, exactly agreeing in position with the lacuna or strand of delicate tissue figured by M. Renault in the leaf-traces and leaves of *Sigillaria*¹.

The transfusion-tissue ('tissu vasiforme' of M. Renault), consisting of reticulate tracheides, is extremely well developed, and forms a horseshoe, embracing the whole lower side of the central region, and approaching the bundles at its two upper extremities. Thus the whole structure of the leaf, apart from the presence of two bundles instead of one, is altogether that of a leaf of one of the *Lepidodendreae*; the analogy with certain Coniferous leaves is striking, though probably quite unconnected with affinity.

The other leaf in the Shore slide was evidently cut near its tip. The width is 1.7 mm. and the maximum thickness only $190\ \mu$. The lateral furrows are scarcely indicated; it is sufficient to say that here also the two vascular bundles are quite separate, with a group of thick-walled tissue between them.

Of the Dulesgate specimen there are four successive sections, passing through the same leaf (Nos. 1166-1169 in my collection), but there is little change of structure throughout the series. The leaf has a different sectional form from that of the Shore specimen, for the upper surface is markedly concave, giving some of the sections a U-shaped outline. A sharp median depression is present on the upper side and a narrow dorsal rib on the opposite surface. There is very little trace of lateral furrows, but the hypoderma is interrupted at points corresponding to them. Here also palisade-tissue is present towards the upper surface. The central region is less well defined than in the Shore leaf; the two vascular bundles are quite separate, though not so far apart as in that specimen; the space between the two xylem-groups is about $140\ \mu$ wide, the xylem-groups themselves having a maximum diameter of about $260\ \mu$. Transfusion-tissue is present, chiefly towards the lower side, as in the first specimen.

Another leaf is cut in obliquely longitudinal section; I have not yet been able to make out any pitted elements for certain.

The Dulesgate specimen makes the impression of being less highly differentiated than that from Shore; it is possible that all the sections of the former were cut from the apical part of a large leaf, but of course it is quite doubtful whether the two specimens belonged to the same species.

¹ *Tiges de la flore carbonifère*, Pl. 12, Fig. 1; *Flore foss. d'Autun, &c.*, Pt. 2, Pl. XLI, Fig. 7, c; Figs. 12-14; Figs. 18 and 19, r.

It appeared desirable to place these specimens on record as the first of the kind obtained in Britain, or from so ancient an horizon as the Lower Coal-Measures. At present no stem is known with which these leaves can be correlated. While they appear to find their natural place in M. Renault's genus, it is evident that they are specifically different from the form described by him, as shown for example by the marked lateral furrows of the Shore leaf, while they are described as entirely absent from the leaf of *S. Decaisnei*, even in its widest part. Neither is there any trace of centrifugal wood, as in the latter species, in the British examples.

The name *Sigillariopsis sulcata* may conveniently be given to the leaf described above, the specific designation referring to its characteristic lateral furrows. The new species must be regarded as founded on the Shore specimen, with which the Dulesgate leaf may or may not prove to be identical.

There is every prospect that additional specimens will be recognized on further search, and we may hope to identify the stem; in any case it is proposed to give a fuller account of these fossils, with illustrations, on another occasion.

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