

[From the BOTANICAL GAZETTE, Vol. xiii, No. 2.]

**A monograph on Stigmaria.**<sup>4</sup>

Professor Williamson has done more, probably, than any other individual towards perfecting our knowledge of the structure and affinities of the plants of the coal-measures. Entering the field of palæontological science in 1833 as a contributor to the "Fossil Flora of Great Britain," by Lindley & Hutton, almost every year since has witnessed the production from his pen of papers of more or less extent, describing in detail the histology and relationships of carboniferous plants. The last is the elaborate and beautiful memoir before us.

*Stigmaria ficoides* is one of the most abundant and well-known plants of the carboniferous age. It is most frequently met with, however, in the form of inorganic casts of the scarred exterior or of the fistular medullary interior. As these casts were the only conditions under which it was known for a long time, the histology, and consequently the affinities, long remained in question. During the last half-century, however, specimens have been obtained from various localities in which the structure has been more or less clearly preserved, and through a study of these considerable light has been thrown upon the affinities of these curious plants.

Professor Williamson has spent the past twenty years in collecting the material upon which present results are based, and his is undoubtedly the most complete collection extant. These specimens, with the structure exquisitely preserved, come mostly from the districts around Oldham and Halifax, occurring in calcareous nodules imbedded in coal seams.

The results of a study of the histological elements in these specimens, briefly stated, are as follows: The medulla was composed exclusively of parenchymatous tissue, and early, by absorption or decay, became hollow. Into this fistular medullary cavity stigmarian or other rootlets penetrated, sometimes to the number of half a dozen, thus causing great complication. These specimens, to the casual observer, would appear to be traversed by fibro-vascular bundles, and by a study of such specimens several observers were led into error.

Surrounding the medulla was a vascular or xylem cylinder composed of transversely barred vessels or tracheids. These tracheids, arranged in bundles, did not preserve a longitudinally straight, but an undulating course through the stem, the undulating curves of one bundle being opposed to those of its neighbor on either side. "The result of the wavy undulations was that contiguous bundles alternately touched and separated from one another, inclosing, in the latter case, large, vertically elongated lenticular spaces, occupied by extensions of the medullary parenchyma which thus reached the bark. As the vascular cylinder grew

<sup>4</sup> WILLIAMSON, WILLIAM CRAWFORD.—A monograph on the morphology and histology of *Stigmaria ficoides*. (The Palæontographical Society, volume for 1886.) 62 pp., 15 plates. London, 1887.

Lectura Hub

exogenously each new superadded vessel followed exactly the undulating course of those upon which it rested."

The cortex consisted of three layers, which pass more or less gradually into each other. The outer is composed of parenchymatous cells, which are without special order of arrangement; the inner of a zone of cells arranged in radial parallel lines; while the middle is a transition with slight distinguishing characters, from the one to the other.

The origin of the root-bundles which run to the rootlets is as follows: Some of the vessels of the xylem cylinder, or usually, in the initial step, one vessel, instead of pursuing the undulating course, is deflected outward and forms the basis of one of these bundles. Other vessels are added to it from time to time, and it thus increases in diameter. Where these emerge from the bark a lenticular scar is produced, giving rise to the well-known stigmarian characters.

Without going further into a description of the histology, the conclusions of Professor Williamson may be summed up as follows: Stigmaria were *always* roots, and, moreover, were roots alike of *Lepidodendra* and *Sigillaria*, which primeval *Lycopodiaceæ* were undoubtedly the remote ancestors of the modern *Lycopodiaceæ*. This view is strengthened by the analogy which is shown to exist between stigmarian roots and the roots of modern *Lycopodiaceæ*, particularly of *Selaginella* and *Isoetes*. The latter, like *Stigmaria*, has a fistular medullary cavity which is produced by the early absorption or non-development of the delicate parenchyma which ought to be present. The origin of the rootlets is also similar.

F. H. KNOWLTON.