

ON A PRIMITIVE TYPE OF STRUCTURE IN CALAMITES¹.—Palaeontological research has afforded evidence that the Horsetails and Lycopods—groups now so distinct—had a common origin. The class Sphenophyllales, restricted, so far as we know, to the Palaeozoic epoch, combines in an unmistakable manner the characters of Equisetales and Lycopodiales, while at the same time presenting peculiar features of its own. Broadly speaking, it is in the external morphology and in the reproductive structures that the Equisetales are approached, while the anatomy has an evidently Lycopodiaceous character.

The synthetic nature of the Sphenophyllales, indicated clearly enough in the type-genus *Sphenophyllum* itself, comes out still more obviously in the new genus *Cheirostrobis*. Here the general morphology of the strobilus, the form and structure of the sporangiophores and of the sporangia themselves, are all of a Calamarian type, while the anatomy of the axis is as clearly Lycopodiaceous in character.

So far, nothing has been found to bridge the gulf which separates the anatomy of the Calamariae (Palaeozoic Equisetales) from that of the Sphenophyllales or the Lycopods. The most ancient known genus of Calamariae—*Archaeocalamites*—approaches the Sphenophyllales in the superposition of the foliar whorls and in the dichotomous subdivision of the leaves, points on which Professor Potonié, especially, has laid stress. Anatomically, however, according to the researches of Dr. Renault and Count Solms-Laubach, it was an ordinary Calamite, differing in no essential respect from those of the Coal-measures. The stem of *Archaeocalamites*, like that of its later allies, had a large pith, surrounded by a ring of collateral vascular bundles, the wood of which, primary as well as secondary, was wholly *centrifugal* in development, the first-formed tracheides lying on the border of the pith, at the points marked by the carinal canals. In *Sphenophyllum*, on the other hand, the whole of the primary wood was *centripetally* developed, and there was no pith. In *Cheirostrobis* the same holds good, except that an insignificant portion of the primary wood may possibly have been added in a centrifugal direction. In Lycopods there may or may not be a pith, but the whole (*Lycopodium*, *Psilotum*,

¹ Abstract of paper read before the Botanical Section of the British Association, Glasgow, September, 1901.

Lepidodendron) or the greater part (*Tmesipteris*) of the primary wood is centripetal.

The Calamite which forms the subject of the present communication occurs in the well-known Burntisland beds of the Calciferous Sandstone Series, at the base of the Carboniferous Formation. The material is calcified, and the structure excellently preserved, though the specimens so far discovered are small and fragmentary. Their interest depends on the fact that each vascular bundle possesses a distinct arc of centripetal wood on the side towards the pith. The carinal canals are present, as in an ordinary Calamite, and contain, as usual, the remains of the disorganized protoxylem. They do not, however, as in other Equisetales, form the inner limit of the wood, but xylem of a considerable thickness, and consisting of typical tracheides, extends into the pith on the inner side of the canal, which is thus completely enclosed by the wood. Hence, starting from the spiral tracheides of the protoxylem, there was here a considerable development of xylem in a centripetal as well as in a centrifugal direction. That the organ was a stem, and not a root, is proved, not only by the presence of the carinal canals, but by the occurrence of nodes, at which the outgoing leaf-traces are clearly seen.

This appears to be the first case of centripetal wood observed in a Calamarian stem, and thus serves to furnish a new link between the Palaeozoic Equisetales and the Sphenophyllales, and through them with the Lycopods.

The specimens have not as yet supplied any evidence as to the superposition or alternation of the verticils, so we are not at present in a position to determine the genus to which they belonged. Provisionally, until further investigation has cleared up this question, the new stem may bear the name of *Calamites pettycurensis*, from the locality where it occurs.

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REMARKS UPON THE NATURE OF THE STELE OF EQUISETUM¹.—The vascular bundles of *Equisetum* are usually compared with those of a monostelic Phanerogam both in structural detail and with regard to their course out into the leaf. The following

¹ Abstract of paper read before the Botanical Section of the British Association, Glasgow, September, 1901.



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