

March 26, 1874.

JOSEPH DALTON HOOKER, C.B., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

- I. "On the Organization of the Fossil Plants of the Coal-measures.—Part VI. Ferns." By W. C. WILLIAMSON, F.R.S., Professor of Natural History in Owens College, Manchester. Received March 18, 1874.

(Abstract.)

The author called attention to the various methods of classifying the fern-stems and petioles of the Coal-measures adopted by Cotta, Corda, Brongniart, and others, and to the difficulties which attend those methods. Some of those difficulties had been already felt and partially removed by M. Brongniart. All the generic distinctions hitherto adopted were based upon variations in the form, number, and arrangement of the vascular bundles. These elements vary so much, not only in different species of the same genus, but in different parts of the same petiole, as to make them most untrustworthy guides to generic distinctions. The consequence has been an enormous multiplication of genera; but, notwithstanding their number, the author found that if he adopted the methods of his predecessors he would have to establish additional ones for the reception of his new forms. Under these circumstances he decides that it will be better to include the entire series of these petioles, provisionally, under the common generic term of *Rachiopteris*. This plan dispenses with a number of meaningless genera, and is rendered additionally desirable by the circumstance that all the petioles to which these numerous generic names have been applied belong to fronds which have already received other names, such as *Pecopteris*, *Sphenopteris*, &c., only the structure of fronds found in the shales, and their respective petioles of which we have ascertained the structure, have not yet been correlated.

As a preparation for the present investigation, the author made an extensive series of researches amongst recent British and foreign fern-stems and petioles, with the object of ascertaining not only the modifications in their arrangements in different parts of the same plant, but especially of studying the modes in which secondary and tertiary vascular bundles were derived from the primary ones. This inquiry led him over the ground previously traversed by M. Trécul, and, so far as British ferns were concerned, by Mr. Church.

The most common general forms exhibited by transverse sections of

these bundles in recent petioles may be represented by the letters H, T, U, and X. As a general rule, the secondary bundles are given off from that part of the primary one which happens to be nearest to the secondary rachis to be supplied. Thus in some cases the upper arms of the X will merely be prolonged and their *ends* detached; in other cases a loop projects from the *side* of one or both arms of the U, and becomes detached as a ring.

The first petiole, described under the name of *Rachiopteris aspera*, is one in which transverse sections of the central vascular bundle exhibit modifications of the H form at its base, separating into two contiguous bundles higher up, and ultimately reverting to the V form—the gutter-shaped bundle (*en gouttière*) of M. Trécul. This is the plant to which, on a previous occasion, the author proposed to assign the generic name of *Edraxyton* (Proc. Roy. Soc. vol. xx. p. 438). The vessels are chiefly reticulate, with some of the barred and spiral types. The bark consists of a delicate inner parenchyma, the cubical cells of which are arranged vertically. This is enclosed in a coarser middle parenchyma, and the whole is surrounded by an outer layer, composed of intermingled parenchyma and prosenchyma, the latter being disposed in vertical fibrous bands, having wedge-shaped transverse sections, and being modifications of the sclerenchyma of authors. The outer surface of the bark is covered with innumerable little, obtuse, projecting cellular appendages, which are obviously abortive hairs. These appendages are relatively larger in the smaller rachis than in the larger petioles. In very young petioles transverse bands of small consolidated cells traverse the bark at numerous points, reminding us of the similar conditions seen in the *Heterangium Grievii*, described in a previous memoir. In the larger petioles these cellular bands have disappeared, and left in their places large intercellular lacunæ. Numerous fragments of the terminal rachis of the above plant have been obtained with the leaflets attached. For a long time the author believed that he could identify these with the detached leaflets of a *Pecopteris*, which are very abundant in the Oldham nodules; but later researches have led to the conclusion that the plant has been a *Sphenopteris*, closely allied to, if not identical with, the *S. Hoeninghausi* of Brongniart. The author proposes the provisional name of *Rachiopteris aspera* for the above plant.

The next petiole described is one to which Mr. Binney proposed ('Proceedings of the Literary and Philosophical Society of Manchester,' Jan. 9, 1872) to give the name of *Stauropteris Oldhamia*. This is one of the plants of which the vascular bundle, when seen in transverse section, exhibits the appearance of the letter X. The vessels composing this bundle are barred ones; they are sometimes grouped in four slightly coherent clusters, with some delicate, vertically elongated cells in or near their central point of conjunction. The same kind of cellular tissue surrounds the bundle, forming a thin layer, which passes rapidly into a very

thick layer, of coarse prosenchyma, and which has evidently been hard and woody, as in many of the recent *Adiantums*. Towards the upper part of the petiole the vascular bundle becomes distinctly consolidated into a single cluster of crucial form; it then passes into a somewhat trifid form, and ultimately into a small cylindrical one. This petiole has branched much more freely than any of the others described. Two of the extremities of the crucial arms of the vascular bundle become first enlarged and then detached as two secondary bundles, which generally have an irregularly triangular transverse section, with long arms to the triangle. These triangular bundles are altogether different from the central axis of *Asterophyllites* described in a preceding memoir. The ultimate subdivisions of these secondary branches look more like the terminations of cylindrical rootlets than of petioles—which fact, combined with the circumstance that no traces of leaflets have been found associated with any of these ultimate twigs, renders the petiolar nature of this plant open to question, though the arguments in favour of its being a branching fern-petiole preponderate over those which militate against that conclusion. The author designates this plant *Rachiopteris Oldhamia*.

The next plant described is an exquisitely beautiful petiole from Burnt-island, to two detached portions of which the author has already assigned the names of *Arpeuxylon duplex* and *A. simplex**, but which two forms he now proves to belong to the same plant. In the matured petiole the vascular bundle is always a double one. There is a central bundle, exhibiting a transverse section shaped like an hour-glass, one side of which is truncated and the other rounded, with a free, narrow, crescentic band at the more truncate of its enlarged extremities. At each of these extremities of the central bundle there is a longitudinal groove, which is shallow on the truncated side nearest to the crescentic bundle, but so surrounded by small vessels at the opposite convex side as often to become converted into a longitudinal canal. The hour-glass bundle always reappears in various specimens under the same aspect; but the crescentic one divides into two lateral halves, and the ends of each of these two subdivided parts curl under their more central portions. We thus obtain two of the crescentic structures previously designated *Arpeuxylon simplex*. These crescents are traced outwards through the bark to lateral secondary rachides. The vessels thus detached from the truncated side of the central hour-glass bundle now reappear at its opposite and more convex side, whence, in turn, they again become detached; so that the truncate surface with its crescentic appendage, and the more oblate one with its almost closed canal, have alternately reversed their positions in the petiole as each secondary rachis was given off. Alternating distichous tertiary rachides spring from these secondary ones.

Two plants which appear to be identical with those described by M. Renault, under the names of *Zygopteris Lacattii* and *Z. vibractiensis*, are next

* Proceedings of the Royal Society, vol. xx. p. 438.

examined*. In these plants the section of the central bundle exhibits a form of the letter H. The vessels of the large central transverse bar are all reticulated ones: the greater part of those of the terminal vertical bars are of the same character; but the outermost vessels of those latter structures are barred or quasi-scalariform. As in the case of *R. duplex*, already described, these outermost layers of barred vessels, accompanied by a few reticulated ones, become detached alternately from opposite sides of the H-shaped central bundle. Passing quickly through a thin delicate cellular inner bark, they enter the coarser parenchyma of a middle one, as two irregular clusters of vessels with one common investment prolonged from the innermost bark. On reaching the outer bark they become two distinct cylindrical bundles, each with its own delicate cortical investing layer; and thus invested, they emerge from the primary petiole to supply the secondary rachis.

The Oldham specimens of *Rachiopteris bibractiensis* agree with those described by M. Renault in having all their vessels of the barred type. The outer bark projects at numerous points in large conical abortive hairs, which almost assume a spinous aspect.

The author further figures and describes the section of a vascular axis, with a central cellular medulla surrounded by five contiguous crescentic masses of vascular tissue, whose concavities are directed outwards. This plant appears identical with the *Anarchopteris Decaisnii* of Renault.

II. "On the Motions of some of the Nebulæ towards or from the Earth." By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S. Received January 26, 1874.

The observations on the motions of some of the stars towards and from the earth which I had the honour to present to the Royal Society in 1872 appeared to show, from the position in the heavens of the approaching and receding stars, as well as from the relative velocities of their approach and recession, that the sun's motion in space could not be regarded as the sole cause of these motions. "There can be little doubt but that in the observed stellar movements we have to do with two other independent motions—namely, a movement common to certain groups of stars, and also a motion peculiar to each star"†.

It presented itself to me as a matter of some importance to endeavour to extend this inquiry to the nebulæ, as it seemed possible that some light might be thrown on the cosmical relations of the gaseous nebulæ to the stars and to our stellar system by observations of their motions of recession and of approach.

Since the date of the paper to which I have referred, I have availed

* Annales des Sciences Naturelles, 5^e série, Bot. tome xii.

† Proceedings of the Royal Society, vol. xx, p. 392.