Letters to the Editor.

Grammatopteris, a Link between the Osmundaceæ and Zygopterideæ.

THE well-known theory that the Osmundaceæ and Zygopterideæ arose from a common stock was one of the main results of Kidston and Gwynne-Vaughan's classical work on the Fossil Osmundeceæ.[1] This view was based chiefly upon a comparison of the genera *Thamnopteris* and *Zalesskya*, both from the Upper Permian of Russia, with certain Palæozoic Zygopterideæ. It is unfortunate that during the life-time of these authors the Lower Permian genus *Grammatopteris* of Renault[2] was only very imperfectly known; for, as they acutely suggested in 1907, this genus "possesses a type of structure that may be regarded as primitively Osmundaceous".[3] In 1918 the present writer ventured the opinion that in rocks older than those which have yielded the most primitive known Osmundaceæ (*Zalesskya* and *Thamnopteris*) "forms may yet be discovered which it would be difficult to assign to one or the other of these families. Indeed, it may be that we already have one such form in *Grammatopteris Rigolloti*".[4] Our knowledge of the type-specimen still remains where it was thirty-seven years ago, but my reinvestigation of an allied species, *G. Baldaufi*,[5] discovered in the Lower Permian of Chemnitz (Saxony), has shown that *Grammatopteris* is indeed a synthetic type of great interest, simpler in structure as well as geologically older than both *Thamnopteris* and *Zalesskya*. While a full description of *G. Baldaufi* will shortly appear elsewhere,[6] a few of the main features of theoretical interest may be summarised here. The type-specimen was originally described by Beck under a new generic name, *Protothamnopteris* in ignorance of Renault's work. The habit was that of a small tree-fern with the base of the stem clothed in a felt of adventitious roots. The petioles were cylindrical, as in the Zygopterideæ; they were devoid of the stipular expansions so constantly found in the Osmundaceæ, both recent and fossil. The stem had a solid protostele, consisting only of tracheids, but faintly differentiated into a stellate central xylem, composed of mixed ordinary and parenchymatous tracheids, and a relatively thin outer xylem. The periphery of the outer xylem was more or less deeply invaginated by narrow vertical slits which no doubt represent rudimentary leaf gaps homologous with those of the Osmundaceæ. The protoxylem cannot be located with certainty but was probably represented by scattered groups of narrow tracheids in the central xylem. The leaf traces arose in spiral sequence, the phyllataxis varying from about 5/13 near the base to a more crowded arrangement, like that of *Thamnopteris* and other Osmundaceæ, higher up. The foliar trace was at first elliptic in cross-section, but finally assumed the form of a straight tangential band with the two marginal protoxylems characteristic of the genus. It is probably a fact of some phylogenetic significance that this simple type of foliar bundle fits in readily with the zygopterid ground-plan. Diarch roots arose from the abaxial sides of the leaf-traces in the region of the cortex.

Thus, while in its foliar characters *Grammatopteris* clearly approaches the Zygopterideæ, its stem structure is paralleled by members of both the Osmundaceæ and the Zygopterideæ. On the whole there seems to me to be a somewhat stronger case for regarding the genus as azygopterid than for referring it to the Osmundaceæ. Professor A. C. Seward, F.R.S., to whom I am deeply indebted for opportunities of discussion, is inclined to think that the affinities are rather more on the side of the Osmundaceæ. I am prepared to confess that the balance is very nearly even and that my choice may have been largely influenced by the personal factor. But the main point is that we cannot with full confidence assign the genus to either of these families, and this is perhaps the strongest proof of their affinity and their common ancestry.

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1 *The Fossil Osmundaceæ*, Pts. I-V. Trans. Roy. Soc. Edinb., Vols. XLV–XLVII, L. Pt. 3, pp. 663–664; Pt. 4, pp. 466–473 (1907–1914).

2 *Bassin houiller et permien d'Autum et d'Epinac*, II (1896).

3 *loc. cit.*, Pt. 1, p. 778.

4 *Ann. of Bot.*, **32**, 374, 1918.

5 Beck, R., "Ueber *Protothamnopteris*", *Abh. Sächs. Akad. Wiss.*, **36**, V, 1920.

6 *Ann. of Bot.* (Current volume).