

THE CONES OF *WALKOMIELLA AUSTRALIS* (FEIST.) FLORIN

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ABSTRACT

Male and female cones of *Walkomiella australis* (Feist.) Florin are described. The large number of microsporangia borne on the scales of the male cones show closer relationship to the male cone *Squamella* of the Glossopteridales or to the Cycadales than to the microsporophylls of families of conifers which exist today. They are also distinct from the arrangement found in Early Permian Lebacniaceae, or in the Voltziaceae which followed in the Late Permian, and represent a most interesting evolutionary stage in the Coniferae. Female cones have papery scales with apparently single seeds, resembling the arrangement in Araucariaceae, but they are fundamentally "tuft flowers" and once again distinct from the Lebacniaceae or the Voltziaceae.

Key-words — *Walkomiella*, Conifers, *Squamella*, Araucariaceae.

सारांश

वालकोमियेला ऑस्ट्रेलिस (फायटस्टमॅन्टेल) फ्लोरिन के कोन — मेरी ई० ह्लाइट

वालकोमियेला ऑस्ट्रेलिस (फायटस्टमॅन्टेल) फ्लोरिन के नर एवं मादा कोन वर्णित किये गये हैं। नर कोनों के शल्कों पर बहुत संख्या में विद्यमान लघुबीजाणुधानीयाँ वर्तमान कोनिफर कुलों के लघुबीजाणुपर्णों की अपेक्षा ग्लॉसॉप्टेरिडेलस के स्वामेला के नर कोन अथवा साइकेडेलस से घनिष्ठतर बंधुता व्यक्त करती हैं। ये प्रारंभिक पर्मियन के लैबेकियेसी कुल अथवा इसके बाद आने वाले उत्तर पर्मियन के वोल्टजियेसी कुल में पाये जाने वाले क्रम से भिन्न हैं तथा कोनिफेरी में एक विशिष्ट विकासीय अवस्था का निरूपण करती हैं। मादा कोनों पर पत्र-सदृश शल्कों से लगे शायद एक-एक बीज विद्यमान हैं जो अँराकेरियेसी कुल के क्रम से समानता प्रदर्शित करते हैं, परन्तु ये मूलतः "चूड़ा पुष्प" हैं तथा लैबेकियेसी अथवा वोल्टजियेसी से पुनः भिन्न हैं।

INTRODUCTION

"*B*RACHYPHYLLUM (?) AUSTRALE" was described by Feistmantel (1890) from the Upper Coal Measures of New South Wales. He illustrated specimens from the Upper Permian at Bowenfels. The holotype on pl. 22, p. 162 had been considered lost (Florin, 1940, p. 8) but it is in the collection of the Australian Museum and on display in the Fossil Gallery (AMF 35786). Feistmantel's other specimen AMF 35658, illustrated on his pl. 15, is re-illustrated by Florin (1940, pl. 4, fig. 5).

This conifer, which is common in association with *Glossopteris* in Late Permian assemblages in Australia, has small, closely adpressed, triangular leaves clothing its branches. Many of its branchlets are terminated by ovate, cone-like swellings

also covered by small, triangular leaves (Pl. 1, figs 1-3). Florin (1940) created the genus *Walkomia* for it and re-described Feistmantel's (1890) *Brachyphyllum* (?) *australe* as *Walkomia australis* (Feist.). When it was found that the name *Walkomia* was pre-occupied, it was changed to *Walkomiella australis* (Feist.) Florin.

Florin's account of the vegetative structure of the species is very comprehensive, but he was unable to reach any conclusion on the nature of the terminal swellings on the branchlets which had been assumed by Feistmantel to be male cones. When *Walkomiella indica* was described by Surange and Prem Singh in 1951 from India, only vegetative fragments were identified, and when *Walkomiella transvaalensis* was described by le Roux (1964) from South Africa, no evidence was found to enable determination of the organs.

A large number of specimens were collected from Illawarra Coal Measures at Ulan, near Gulgong, New South Wales by Mr H.O. Fletcher, the then Curator of fossils at the Australian Museum, in 1954. *Walkomiella australis* occurs in most of the specimens, usually alone, but in some cases associated with *Glossopteris* leaves. The rock is a white mudstone, and the fossils occur as impressions showing fine detail. No tissue or cuticle is preserved, but some carbon is present in the deeper impressions of some cone casts. The "terminal swellings" are seen to be cones and detail of both male and female cones is clear. Mature cones of both sexes attain similar size and outward appearance, with the small, triangular, foliage leaves covering the swollen stem part of the cone, and more elongated leaves surrounding the cone scales of the upper half.

THE MALE CONE

Specimen AMF 46262 and counterpart F 46259 are types for the male cone of *Walkomiella australis* (Feist.) Florin (Pl. 2, figs 4, 5). The cone is 2.5 cm from apex to point of separation from the stem and has a maximum width of 1.5 cm (1 cm from the base), 1.5 cm from the apex. A complete scale can be seen in the upper section of the cone, its apex forming the cone apex. The venation is outlined in carbon and gangamopteroid in appearance. Carbon aggregated in sporangial masses lies down its edge near its base and carbonized sporangial masses also lie at the edges of the less well-defined scales of the lower half of the cone, indicating that the whole of the cone "swelling" was filled with fertile scales. Groups of displaced sporangia "ms" are clearly seen as impressions at the apex of the cone and near it in the rock matrix, and very large numbers of microsporangia are seen in the cone. Figure 6 in Plate 2 is an enlargement of the part of Pl. 2, fig. 5 showing the microsporangia more clearly and also showing the gangamopteroid venation of a scale.

Specimen AMF 46315 and counterpart are illustrated (Pl. 2, figs 7, 8). In these, isolated sporangial groups have been fossilised outside the cone and details of the microsporangia can be seen. Sporangia are borne in pairs on very thin pedicels,

each sporangium being about 1.5 mm long, maximum width 1 mm, and pear-shaped. The sporangia are very like those of *Squamella australis* White, 1978, a glossopteridalean cone of the Upper Permian, but four to five times larger. Dr P. R. Evans, University of New South Wales, is examining some of the coaly material removed from AMF 46259 to see whether spores are preserved and to establish which spore known in dispersed state is produced in *Walkomiella australis* cones.

THE FEMALE CONE

Specimen AMF 46260 and counterpart AMF 46261 are types for the female cone (Pl. 3, figs 9, 10). The cone is again 2.5 cm in length, with maximum width about 1.5 cm, but its widest part is 1 cm from the apex and 1.5 cm from the base, making its shape slightly different from the male cone. On AMF 46260, clear indentations of oval seeds are in a row across the widest part of the cone "s" (Pl. 3, fig. 9). The seeds were about 4 mm long, maximum width 3 mm. Less clearly defined seeds are visible in AMF 46263 (Pl. 3, fig. 11), also forming a row across the widest part of the cone.

The female cone scales appear to have been longer and narrower than the male cone scales. The lower half of the female cone "swelling" appears to have been a peduncle expanded from the stem, with the female scales inserted on its flattened top in the manner of a "tuft flower". This is in contrast to the male cone in which the whole "swelling" was filled with fertile scales.

CONCLUSION

The cones of *Walkomiella australis* confirm that this early conifer was unique and cannot be fitted into the families to which other Permian conifers are assigned. Both male and female cones are unlike the Lebachiaceae or the Voltziaceae. Male cones are close in structure to *Squamella* of the Glossopteridales (White, 1978). The female cone is a "tuft flower", and the scales, each with a single seed, resemble Araucariaceae.

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EXPLANATION OF PLATES

PLATE 1

Twigs and Cones

1. Specimen AMF 46320. $2/3 \times$ natural size. Branches, branchlets and female cone.
2. Specimen AMF 46282. $2 \times$ natural size. Female cone.
3. Specimen AMF 46086. $2 \times$ natural size. Small ?male cone.

PLATE 2

Male Cone and Microsporangia

4. Specimen AMF 46262. $\times 3$. Male cone. Gannopteroid scale forming apex. Microsporangia "ms".
5. Specimen AMF 46259. Counterpart AMF 46262. $\times 3$. Microsporangial masses "ms".

6. Enlargement of part of Figure 5 (AMF 46259) showing microsporangia and venation of gannopteroid scale. $\times 9$.

- 7, 8. Specimen AMF 46315 and counterpart. $\times 10$. Microsporangia free in matrix near cone. Microsporangia in pairs on forked, thread-like pedicels.

PLATE 3

Female Cones

9. Specimen AMF 46260. $\times 3$. Female cone. Seeds at "s".
10. Specimen AMF 46261. $\times 3$. Counterpart of AMF 46260.
11. Specimen AMF 46263. $\times 3$. Female cone. Seeds in row at "s".



PLATE 1



