

MIOCENE *WILKINSONIA* FRUITS (HICKSBEACHIINAE, PROTEACEAE) FROM THE BASE OF THE YALLOURN FORMATION, LATROBE VALLEY, VICTORIA

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(with two tables, one text-figure and one plate)

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Wilkinsonia bilaminata F. Muell., 1879 is recorded from interseam clays at the base of the Yallourn Formation, Latrobe Valley, Victoria. The genus was widely distributed throughout eastern Australia during the Oligo-Miocene. The palynological record for both Yallourn and the type locality has not suggested that either *Athertonia*, the most closely related extant taxon, or the subtribe Hicksbeachiinae were present in these localities. There are two inferences from these results; the suggested affinities of some of the pollen taxa may be in error, or the pollen of the *Wilkinsonia* plant may be under-represented in these sites and has been overlooked.

Key Words: Proteaceae, Hicksbeachiinae, *Athertonia*, *Wilkinsonia*, fossil fruit, Victoria, Australia, Tertiary, biostratigraphy.

INTRODUCTION

Wilkinsonia bilaminata was described by Mueller (1879, 1883) on the basis of woody fruits from deep leads, below basalts in the Orange and Gulgong gold-mining areas of New South Wales. Since then similar fruits have been collected from Glencoe, in Central Queensland, and the status of the genus has been re-examined following comparisons with the extant genera *Athertonia* and *Heliciopsis* in the subtribe Hicksbeachiinae (Rozefelds 1990a, 1992). *Wilkinsonia* was shown to be more closely related to the modern genus *Athertonia*, a rainforest endemic restricted to northeastern Queensland (Rozefelds 1992).

Fossil fruits referable to *Wilkinsonia* have been recently collected from the interseam clays at the base of the Yallourn Formation. Palynological studies of interseam clays at the base of the Yallourn Formation indicate a late early to middle Miocene age based on the presence of *Triporepollenites bellus* Zone and the first appearance of *Proteacidites symphyonemoides* (Sluiter 1984). Partridge (pers. comm.) in Macphail *et al.* (1994) gives an absolute date of 17.0 myrs BP for the base of the Yallourn Coal Seam. The interseam clays are approximately equivalent in age, based upon pollen, to the type locality for *Wilkinsonia bilaminata* at Gulgong (McMinn 1981). Potassium-argon dates of 14.8 ± 1.2 and 13.8 ± 1.1 myrs BP for basalts in the Gulgong area that overlie deep leads in this area (Dulhunty 1971) indicate a minimum mid-Miocene age for this flora.

The seed/fruit flora and other plant fragments occur in medium to fine-grained clastics of fluvial or lacustrine origin (Blackburn & Sluiter 1994). The associated seed/fruit flora from these interseam clays is diverse but remains unstudied. The seed/fruit flora from the base of the Yallourn Formation includes taxa with affinities to *Elaeocarpus* (Elaeocarpaceae), Vitaceae, Menispermaceae and *Glochidion?* (Euphorbaceae).

In this paper, *Wilkinsonia bilaminata* is recorded from the Miocene clays in the Latrobe Valley. The new material provides additional information on the morphology of the endocarps not evident from the neotype. The biogeographical significance of this new *Wilkinsonia* record is discussed. The biostratigraphic range of this taxon is also discussed, along with the potential for developing seed/

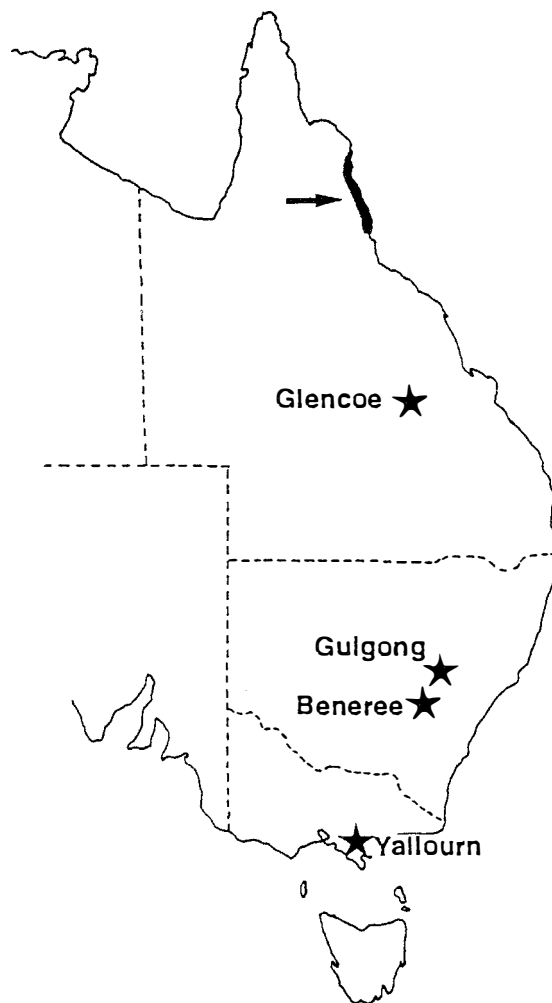


FIG. 1 — Localities mentioned in text and distribution (arrowed) of modern *Athertonia* in Australia.

fruit-based biostratigraphies. Yallourn fossils described in this paper have been deposited in the Museum of Victoria.

SYSTEMATIC PALAEOBOTANY

Family PROTEACEAE
 Tribe MACADAMIEAE
 Subtribe HICKSBEACHIIINAE
Wilkinsonia F. Muell., 1879

Type species: *Wilkinsonia bilaminata* F. Muell., 1879.

Wilkinsonia bilaminata F. Muell., 1879.

1879 *Wilkinsonia bilaminata* F. Muell., p. 170, pl. 3, fig. 4a, b.

1883 *Wilkinsonia bilaminata* F. Muell., p. 7, pl. 3.

1992 *Wilkinsonia bilaminata* F. Muell., emend. Rozefelds, p. 196.

Material examined

NMVP199574–NMVP199578, Base of Yallourn Formation, interseam clays from between the Yallourn and Morwell coal seams, collected from near the top of the Morwell Open Cut Coal Mine, Latrobe Valley, Victoria. *Triporopollenites bellus* Zone (pl. 1A–H).

Description of Yallourn material

The endocarps from Yallourn are large, irregularly round to oval in outline, with reticulate lacunose ornamentation. The size of the endocarp varies from 38.5–42 mm long and 36.7–41 mm wide (table 1). Endocarps appear slightly compressed but are elliptical in lateral view. A prominent incipient lateral ridge extends from the apex to the base on either side of the endocarp (pl. 1A–H). A relatively broad lateral field occurs between the incipient ridge and the edge of the endocarp, with minor accessory lateral ridges and irregular rows of small depressions (pl. 1A–H). The width of this region may be different on one side of the endocarp from that on the other within the one specimen (table 1). This lateral field in the Yallourn material extends beyond the rest of the endocarp, forming a slight notch (pl. 1A–H). Multiple irregular rows of depressions and poorly defined ridges occur between the lateral ridge and the edge of the endocarp. The endocarp wall, which is 2–3 mm in thickness, consists of tangentially oriented interweaving fibres. The bases of additional, weakly lignified fibres occur in the lacunae. These fibres extend outwards into what was the fleshy mesocarp of the fruit. Fragments of endocarp examined with the SEM failed to provide additional data on the microstructure in these endocarps.

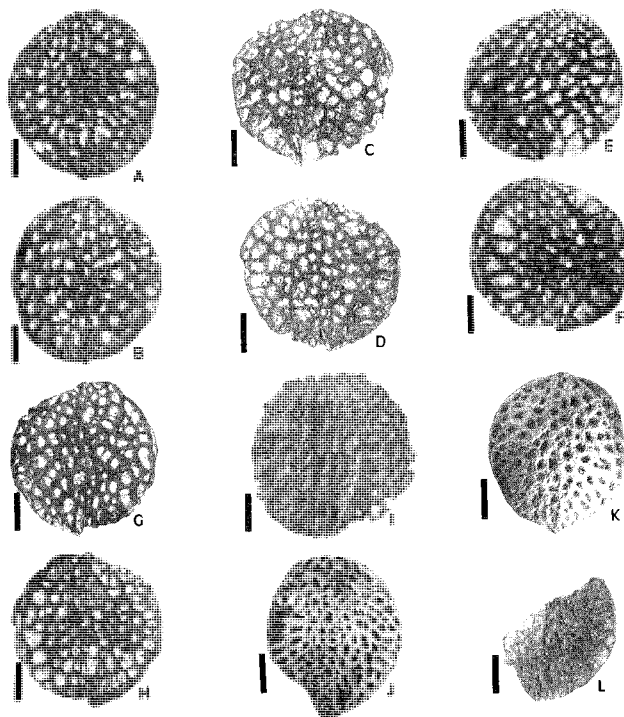


PLATE 1

Wilkinsonia and *Athertonia* endocarps. (A–H, L) *Wilkinsonia bilaminata* F. Muell. from the interseam clays at the base of the Yallourn Formation.

(A, B) NMVP199577. (C, D) NMVP199574. (E, F) NMVP-199576. (G, H) NMVP-199575. (I) Neotype of *Wilkinsonia bilaminata* (NMVP-53092) from the Black Lead, approx. 43–52 m below basalt, Gulgong, New South Wales. (J, K) Extant endocarps of *Athertonia diversifolia* (C. T. White) L. Johnson and B. Briggs. (L) Fragment of *W. bilaminata* (NMVP 199578) from Yallourn. Scale bars = 10 mm.

Remarks

The features that allow referral of these fossil endocarps to *Wilkinsonia* are the lacunose ornamentation and the continuous lateral ridge that extends from the apex to the base of the endocarp. The new material from Yallourn is closely comparable to the neotype (NMVP53902) of *W. bilaminata* from the Gulgong locality. Additional material of *W. bilaminata*, figured or mentioned by Mueller (1879, 1883) from Beneree in New South Wales, has not been located.

TABLE 1
 Measurements of Yallourn *W. bilaminata* F. Muell.

Registration Number (NMV)	Length (mm)	Width (mm)	Maximum width of lateral fields (mm)	
			one side	other side
P199574	38.6	40	10.7	9.7
P199575	38.5	36.7	9.0	8.4
P199576	39.2	41	10.8	10.5
P199577	42	37.4	10.8	8.0

Two species of *Wilkinsonia* are recognised (Rozefelds 1992). Both taxa share multiple irregular rows of small depressions, with accessory ridges occurring between the incipient ridge and the edge of the endocarp. The two species differ in the width of the lateral field between the incipient ridge and the edge of the endocarp. In *W. bilaminata* this zone is broad, while in *W. glencoensis* it is relatively narrow (Rozefelds 1992). The additional material from Yallourn shows variation in the width of this region. The new material from Yallourn also provides additional differences between these taxa. The base of the endocarp in *W. bilaminata* is slightly notched, and the lateral field extends further than the main region of the endocarp (pl. 1A–H). The notch is absent from *W. glencoensis*. The neotype of *W. bilaminata* from Gulgong was also strongly flattened, as well as damaged, due to pyritic deterioration in storage; this made comparison with *W. glencoensis* difficult. The new material of *W. bilaminata* does not show the weakly defined longitudinal ridges seen in the neotype. These longitudinal ridges were initially considered to be due, in part, to compression (Rozefelds 1992). This interpretation is supported by the new material from Yallourn, as the lacunose ornamentation of the endocarps is irregular and does not form ridges. The weakly defined longitudinal ridges in the neotype are considered to be preservational artifacts.

The Proteaceae pollen taxa described from both the Home Rule site and the interseam clay between the Yallourn and Morwell Coal Measures are recorded (table 2). The Proteaceae pollen taxon shared between these sites is *Proteacidites symphyonemoides*, which has been considered by Martin (1978) to have affinities with *Symphionema* (subfamily Proteoideae). The other Proteaceae pollen taxa known from either the Yallourn Formation or Home Rule locality are not considered to have affinities with *Athertonia* or *Hicksbeachiinae*. There is no evidence for linking any of the known pollen taxa and endocarps to the same parent plant (table 2).

The fossil distribution of *Wilkinsonia* demonstrates that proteaceous plants with endocarps closely comparable to extant *Athertonia* were widespread in eastern Australia during the Oligo–Miocene (fig. 1). *Athertonia*, the extant taxon most closely related to *W. bilaminata*, occurs in the tropical rainforest communities of northeastern Queensland (Rozefelds 1992). The discovery of *W. bilaminata* at the

base of the Yallourn seam, and *Elaeocarpus* and *Menispermaceae* endocarps, Vitaceae seeds, and possibly *Glochidion* fruits (Rozefelds 1990b, pers. obs.) indicates that forests with affinities to tropical-warm temperate closed forests occurred in the Yallourn area during the mid-Miocene.

Discussion

While considerable advances have occurred in palynological studies of the Latrobe Valley Coal Measures (Luly *et al.* 1980, Sluiter & Kershaw 1982, Macphail *et al.* 1994), the megafloora and local plant communities that gave rise to these units remain poorly known (Blackburn & Sluiter 1994). The new megafloreal material allows recognition of the subtribe *Hicksbeachiinae* in these units, something not suggested by the existing pollen studies. This failure to identify plants with affinities to *Athertonia* and the *Hicksbeachiinae* in the pollen flora could be due to either the pollen of these trees being under represented in the palynofloras or, alternatively, to the proposed generic affinities of some Proteaceae pollen being in error. Some support for the earlier proposition comes from Kershaw (1973) and Walker & Flenley (1979), who considered the Proteaceae to be equally or under-represented in fossil units, and this is consistent with the low mobility of Proteaceae pollen (Kershaw & Strickland 1990). Kershaw (1973) and Walker & Flenley (1979) also considered that the source of Proteaceae pollen was from locally growing trees. The possibility of locally growing source trees for pollen is consistent with the unabraded condition of the fruits. It is somewhat surprising, therefore, that pollen of these trees has not been identified in the palynofloras. Hence, it is considered equally likely that the supposed generic affinities of at least one of these pollen types may be in error.

The palynomorph *Propylipollis reticulosabratus* (Harris) was considered by Dettmann & Jarzen (1991) to be closely comparable to pollen of *Hicksbeachia/Gevuina*. Specht *et al.* (1992) recorded the stratigraphic range of *Hicksbeachia/Gevuina* pollen type from the Campanian through to the Pliocene in southeastern Australia. This pollen type was considered morphologically distinctive by Dettmann & Jarzen (1991). Johnson & Briggs (1975), however, placed these extant genera in two separate subtribes, i.e. *Hicksbeachia* (subtribe *Hicksbeachiinae*) and *Gevuina* (subtribe *Gevuininae*). The significance of this pollen type

TABLE 2
Proteaceae pollen taxa recorded

Home Rule Deposit, Gulgong*	Core LY1279, Latrobe Coal Measures †	Suggested affinity ‡
<i>Proteacidites ivanhoensis</i>	–	<i>Orites, Helicia, Macadamia</i>
<i>P. symphyonemoides</i>	<i>P. symphyonemoides</i>	<i>Symphionema</i>
	<i>P. tuberculatus</i>	
	<i>P. obscurus</i>	<i>Agastachys</i> type
	<i>P. sp. cf. callosus</i>	
	<i>Beauprea</i>	<i>Beauprea</i>
	<i>Banksia/Dryandra</i>	<i>Banksia, Dryandra</i>

* From the *Triporopollenites bellus* Zone at Gulgong (McMinn 1981).

† From the base of the Yallourn Formation (Sluiter 1984).

‡ Martin (1978) and Macphail *et al.* (1994).

in relation to the existing tribes recognised by Johnson & Briggs (1975) is unclear and requires further study.

The new record of *Wilkinsonia*, unpublished results for *Elaeocarpus* (Elaeocarpaceae) (Rozefelds 1990b) and *Rhytidocaryon wilkinsonii* (Menispermaceae) (Rozefelds, pers. obs.), and their relationship to existing palynological biostratigraphic zones demonstrate the potential for developing seed/fruit biostratigraphic-based systems for the Tertiary of southeastern Australia. There is a relative paucity of records of pollen/spores and megafossil material in organic connection in the Australian Tertiary (Christophel 1984, Rozefelds *et al.* 1992). The development of fruit/seed taxa, or leaf and dispersed cuticle zones, in conjunction with palynological studies would provide the opportunity to test the biostratigraphic framework proposed by either palynologists or megafossil workers. The association of different organ taxa in the same geological units would also allow the parent plant and plant communities to be more accurately reconstructed. Systematic data from a number of organ taxa of the same parent plant would also permit more rigorous comparisons with the extant flora and better phylogenetic conclusions to be drawn.

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