MINES and ENERGY RESOURCES SOUTH AUSTRALIA

REPORT BOOK 97/53

IDENTIFICATION OF A SINGLE WOOD FRAGMENT FROM THE GAWLER CRATON, SOUTH AUSTRALIA

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DEPARTMENT OF MINES AND ENERGY RESOURCES
SOUTH AUSTRALIA

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IDENTIFICATION OF A SINGLE WOOD FRAGMENT FROM THE GAWLER CRATON, SOUTH AUSTRALIA.

Rowett A.I.

Analysis of a single wood sample from a silicified low energy, poorly sorted, sandy, fluvial horizon within an apparent palaeovalley on the Gawler Craton is identified as a member of the Podocarpaceae, with a possible affinity to the genus *Phyllocladus*. The specimen is considered to be no older than Cretaceous, however, associated palynological and palaeobotanical data from the Eucla and Polda Basins would suggest a latest Eocene - Late Miocene age.

INTRODUCTION

A single silicified wood fragment was submitted for xylotomical analyses by Mr Malcolm Sheard, Team Leader, Regolith Terranes Project Team. The reasonably well preserved specimen was recovered from an apparent palaeovalley on the Gawler Craton.

METHODS

Observed patterning on one end of the specimen suggested the presence of possible growth rings and that some cellular structure had been preserved. To determine whether the state of preservation was enough to make an identification possible, at least to the family level and possibly to genus, three thin sections were required, a transverse, radial longitudinal and tangential longitudinal sections. By sectioning the specimen in this way the cellular arrangement can be viewed both in cross-section, i.e. across the wood, and longitudinal section, i.e. down through the wood. Two longitudinal sections are required if the features of both the wood fibres (tracheids) and ray cells are to be observed.
The sections were mounted on a 50x100mm microscope sides, then ground to a thickness of 30μ and covered with a glass coverslip.
Wood structure analysis was undertaken using a Zeiss Photomicroscope III.
Videovue and Paintshop Pro Image Capture software was used in conjunction with Corel Draw 5 to produce the following plates

Although the mineralization produced considerable distortion and disruption to the cellular structure, an identification to a plant family was possible. The poor preservation of intracellular features made only a tentative generic identification possible.

DESCRIPTION

Descriptions are based on the terminology and format used by Greguss (1955).

T.S. Wood rays evident. (Figures 1-2). Growth rings distinctive (Figure 3). No Wood parenchyma, Resin ducts evident. Tracheids in cross-section angular (4-6 sided)(Figure 4); bordered pits 1-2 (rarely 3) seriate, mainly opposite; no spiral thickening.
R.L.S. Cross-fields 1-2 large pits, possibly dacrydioid, pinioid (Figure 5).
T.L.S. Rays homogeneous, uniseriate 1 - 20 cells high (Figure 6).

IDENTIFICATION

Distinct growth rings, no wood parenchyma, no spiral thickening, opposite bordered pits, tracheids angular cross-section, uniseriate rays are indicative of Podocarpaceae.

Absence of wood parenchyma, number and type of bordered pits, cross field and height of rays suggest a possible affinity with *Phyllocladus.*

Phyllocladus no longer exists on mainland Australia, with only a single species *Phyllocladus aspleniifolius var. aspleniifolius,* a tree up to 10 metres tall, found in cool temperate rainforest and wet sclerophyll forests in Tasmania (Churchill and Dodson 1980) (Figures 11 & 12). The unique features of the genus are the phylloclades (leaves), which are considered to have evolved from the fusion, in one plane, of lateral branches and leaves (Quinn 1987,1988). The phylloclades are thick, robust with serrated lobes. The overall leaf-shape is quite variable. The genus is represented by six other species in New Guinea, New Zealand, Borneo, the Philippines and the Moluccas.

FOSSIL RECORD

The Australian macrofossil record for *Phyllocladus* is restricted to Tertiary occurrences mainly in Victoria and Tasmania where they are relatively common (Hill 1989). Leaf compressions are known from the Oligocene of Morwell (Deane 1925, Cookson and Pike 1954), and Yallourn Open Cut (Hill 1989), Victoria and leaf impressions from Sentinel Rock, Victoria (Deane 1904). In Tasmania, organic fossil leaf material has been recovered from the Late Pliocene - Early Pleistocene Regatta Point, Late Oligocene Little Rapid River (Figure 10), Oligocene Pioneer and Middle - Late Eocene Loch Aber localities (Hill 1989).
In the Eucla Basin, a single dispersed cuticle parataxon (OR5 003) from the latest Eocene Pidinga Formation (Ooldea Range 6, 56.0m) has been identified as having a possible affinity to *Phyllocladus*.
Fossil wood is known from two localities in Victoria, stumps in Upper Pliocene soils near Hamilton, Victoria (Gill 1964) and the described wood *Phyllocladoxylon annulatus* (Patton 1958) from Oligocene coal at Yallourn Open Cut in the Gippsland Basin.

The microfossil record is far more extensive, ranging from the Lower Cretaceous (Cookson and Pike 1954) through to the late Quaternary, 1100B.P. (Churchill and Dodson, 1980). The trisaccate pollen grain *Trichotomosulcites subgranulatus* (Figure 9) identified as having a probable affinity to *Phyllocladus* is known from as far back as the Lower Cretaceous in south-eastern, South Australia, i.e. Comaum No.2 (Harris 1964). This species is synonymous with *Trisaccites micropterus* (Cookson and Pike 1954), *Trisaccites microsaccatus* (Couper 1960) and *Podosporites microsaccatus* (Dettmann 1986). *Phyllocladidites paleogenicus* (Figure 8) encompasses all Tertiary pollen grains of the *Phyllocladus*-type. Both palynomorphs often occur together in Tertiary palynofloras throughout southeastern and central Australia.

AGE

The fossil record suggests that the specimen is either Cretaceous or Tertiary in age.

The discovery of the wood sample on the Gawler Craton, within an apparent palaeovalley, closely associated with a silicified layer of poorly sorted, sandy, fluvial sediment would indicate the specimen, which is reasonably well preserved, had not travelled very far. This would tend to suggest that it has not been weathered out of older Cretaceous sediments, i.e. Bulldog Shale, found some distance to the north within the Eromanga Basin, but of a local source and therefore Tertiary in age. Palynological and dispersed cuticle evidence from the Eucla and Polda Basins would support this age (Table 1).
Trichotomonosulcites subgranulatus, Phyllocladidites paleogenicus and ?*Phyllocladus* cuticle are present in the Middle - latest Eocene sediments of the Pidinga Formation in the Eucla Basin and Middle - Late Eocene sediments of the Pidinga Formation and Early - Middle Miocene sediments of the Garford Formation within the Polda Basin indicating that *Phyllocladus* grew within and/or near to both depocentres during this time. With both the Pidinga and Garford Formations associated with palaeochannels that drained off surrounding uplands including the Gawler Craton (Alley & Benbow 1989, Alley & Beecroft 1993), it may also be concluded that the wood specimen is probably of the same age and derived from the same source vegetation.

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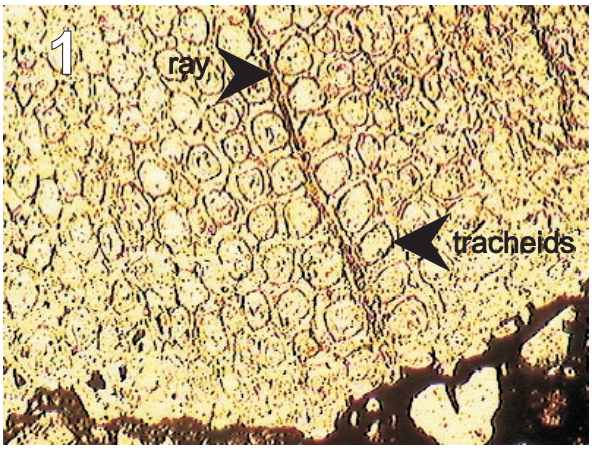
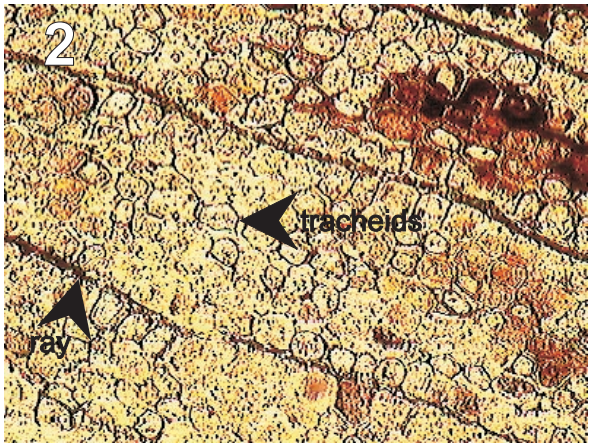
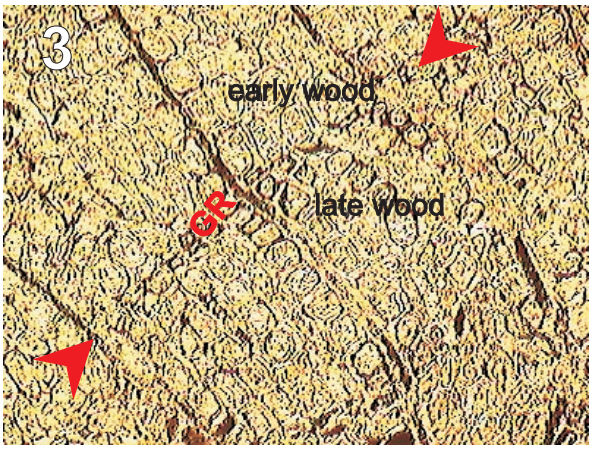
TABLE 1 Occurrences of *Phyllocladus* - related fossils from Tertiary localities within the Eucla and Polda Basins.

Drillhole	Macro/Micro Fossil	Location	Formation	Age
Pidinga Bore		Eucla Basin	Pidinga	Middle - Late Eocene
Ooldea Range 6	*Phyllocladidites paleogenicus*, *Trichotomosulcites subgranulatus* OR5 003 *?aff. Phyllocladus*	Eucla Basin	Pidinga	late Middle Eocene - early Late Eocene
Wilkinson 1	*T. subgranulatus*	Eucla Basin	Pidinga	latest Eocene
CRAE 2	*P. paleogenicus*	Eucla Basin	Pidinga	Middle - Late Eocene
Zanthus 6	*P. paleogenicus*	Eucla Basin	Pidinga	Late (latest) Eocene
Nullarbor 6	*P. paleogenicus*	Eucla Basin	Pidinga	Middle Eocene
Malbooma 1	*P. paleogenicus*	Eucla Basin	Pidinga	Middle Eocene
DH6/BM036		Polda Basin	Pidinga	Middle-Late Eocene
E04-1	*T. subgranulatus*	Polda Basin	Pidinga	Middle Eocene
Port Kenny A	*P. paleogenicus*	Polda Basin	Pidinga	Middle Eocene
Port Kenny B	*P. paleogenicus*	Polda Basin	Pidinga	Middle Eocene
LDH 41,	*P. paleogenicus*	Polda Basin	Pidinga	Late Eocene
P/N23068	*P. paleogenicus, T. subgranulatus*	Polda Basin	?Pidinga	?Early Oligocene
VB07	*P. paleogenicus, T. subgranulatus*	Polda Basin	Garford	Early-Middle Miocene
VB09	*T. subgranulatus*	Polda Basin	Pidinga	?Middle Eocene
VB10		Polda Basin	Pidinga	?Middle Eocene

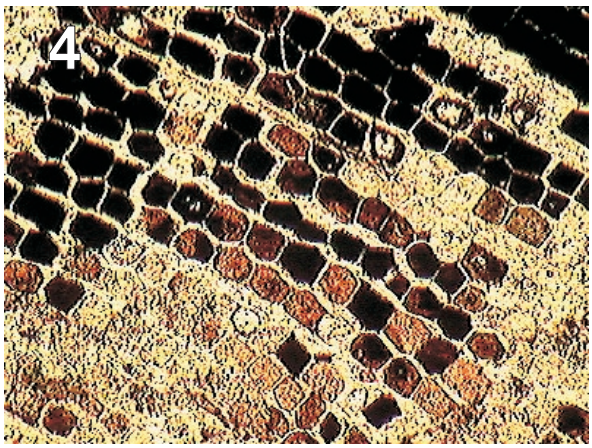




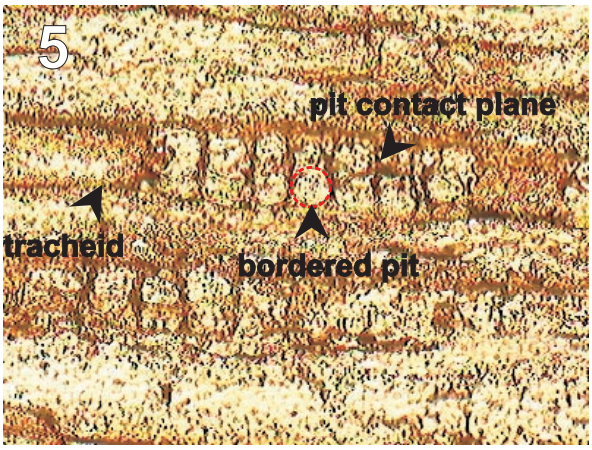
Two transverse sections showing angular tracheids in cross-section with dark staining, thin radially arranged wood rays. 80x



Transverse section showing a single growth ring (between arrows), marked by the narrowing of the latewood cells, succeeded by the larger early wood cells. 80x

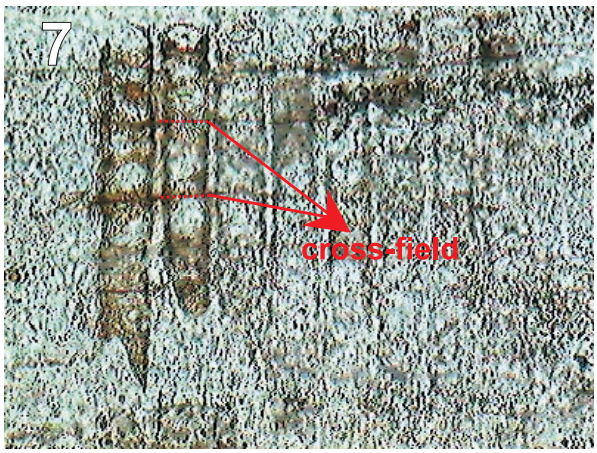


Transverse view showing angular cross-section of tracheids. Tracheids are arranged in uniseriate radial rows. 80x



Radial longitudinal section showing bordered pits (---) in the long wall of a tracheid.The two circular pits are oppositely arranged across the width of the tracheid. The contact plane between pit pairs appears as a dark band. 200x

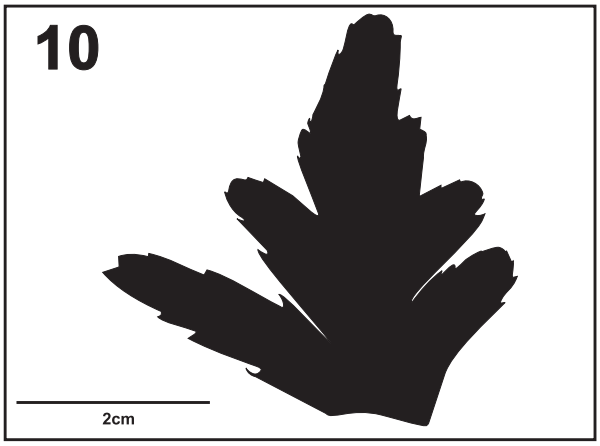
Tangential longitudinal section showing uniseriate, homogeneous wood ray, 8 cells high. Ray cells are barrel-shaped. 200x



Radial longitudinal section with number of cross-fields showing 1-2 pits with circular apertures, i.e. dacryioid pitting. 200x

Phyllocladidites paleogenicus **500x**
CRAE 2, 39 - 40m, Pidinga Formation

Trichotomosulcites subgranulatus 500x
CRAE 2, 39 - 40m, Pidinga Formation.



Late Oligocene fossil leaflet of Phyllocladus aberensis, Little Rapid River, Tasmania (drawn from Hill 1989)

Figure 11:*Phyllocladus aspleniifolius*

Figure 12: *P.aspleniifolius* (front three trees) in western Tasmania.