

WOOD STRUCTURES PRESERVED IN HIGH RANK BITUMINOUS AND SEMI-ANTHRACITIC COAL, CENTRAL QUEENSLAND

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ABSTRACT

Araucarian wood structures are readily observable in vitrinites of low rank coals in the Permian Rangal Coal Measures, Central Queensland, but in the higher rank coals of the same measures, the vitrinites are typically homogeneous in texture. However, wood structures are apparent in fusinites, and are herein recorded within syngenetic siderite nodular growths associated with the high rank coals. Petrified wood remains are also preserved within tuff material associated with the coal seams.

The recognition of similar wood structures within the various ranks of coal allows the conclusion that a similar flora was dominant in all coals within the Rangal Coal Measures, and that gross differences in coal properties must be attributed to variations in peat accumulation and coalification.

Key-words — Bituminous coal, Semi-anthracitic coal, Wood structures, Rangal Coal Measures, Australia.

सारांश

केन्द्रीय क्वींसलैंड के ग्रैंड-एन्थासाइटिय एवं उच्च कोटि के विटुमेनी कोयले में परिरक्षित काष्ठ-संरचनायें —
जे० डब्ल्यू० बीस्टन

केन्द्रीय क्वींसलैंड के पर्मियन युगीन रांगल कोयला मेज़र्स में निम्न कोटि वाले कोयलों के विट्रिनाइटों में अंराके-रियन संरचनायें सरलता से देखी जा सकती हैं। परन्तु उसी मेज़र्स के उच्चतर कोटि के कोयलों में विट्रिनाइटों का गठन सामान्यतया सजातीय होता है। तथापि फ्यूजीनाइटों में पाई जाने वाली काष्ठ संरचनायें बहुत स्पष्ट होती हैं। उच्च कोटि के कोयलों से सहयुक्त सहजात लौह-उल्का ग्रथियों में इनका अभिलेख किया गया है। कोयला-सीमों से सहयुक्त टफ़ पदार्थ में अश्लीभूत काष्ठ-अवशेष भी परिरक्षित हैं।

विभिन्न कोटि के कोयलों में एक जैसी काष्ठ-संरचनाओं से यह निष्कर्ष निकलता है कि रांगल कोयला-मेज़र्स के सभी कोयलों में एक ही प्रकार के वनस्पतिजात का बाहुल्य था तथा कोयले के गुणों में सभी विषमतायें पीट संचयन एवं कोयलाभवन की विभिन्नताओं के कारण होनी चाहियें।

INTRODUCTION

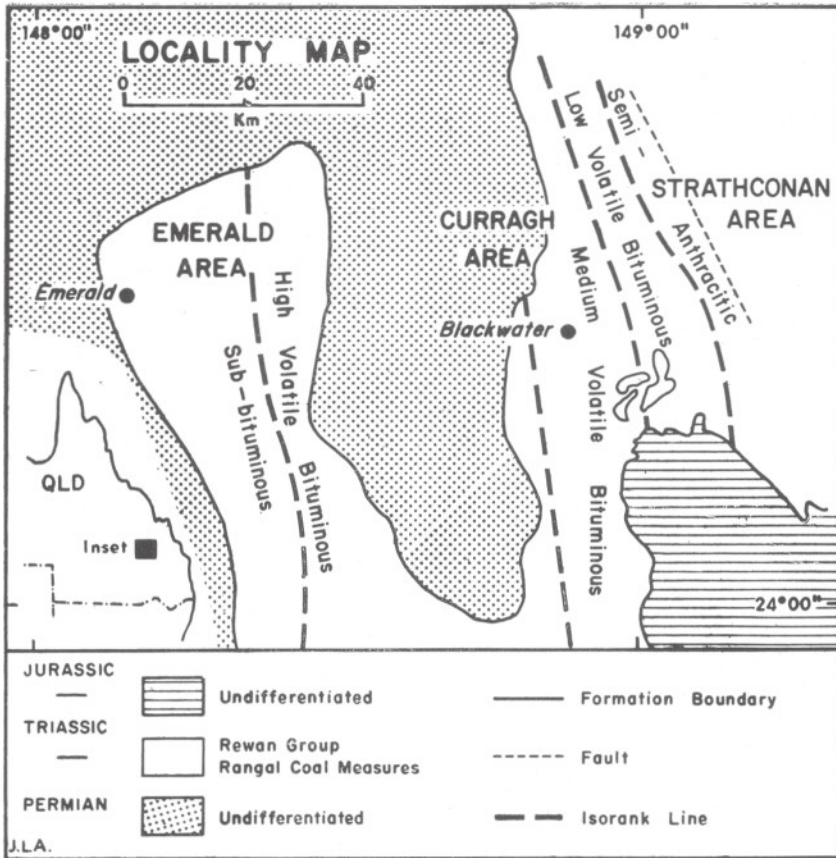
FOSSILISED wood remains occur in abundance within the Permian Rangal Coal Measures of Central Queensland (Beeston, 1972; Gould, 1975). Araucarian wood structures are readily observable in vitrinites (telocollinites) within low rank coal seams in the measures and can be identified as a major component of these seams. Vitrinite of this type exhibits a high degree of preservation of cell structures, including pitting in the cell walls (Pl. 1, fig. 1).

As the coal rank increases, the wood structures in the vitrinite become less distin-

guishable. Around 0.9 per cent vitrinite reflectance, the telinite cell walls and the collinite cell fillings coalesce to form a homogeneous telocollinite. In order to make palaeobotanical observations within high rank coal seams such as those that occur in Central Queensland (Text-fig. 1), we need to turn to the other forms of preservation within the coal; the inertinites and the minerals.

WOOD STRUCTURES IN HIGH RANK COALS

Araucarian wood structures can be observed in fusinite particles, in siderite nodules, and within petrified wood remains



TEXT-FIG. 1 — Map showing the geology of the sample areas and iso-rank trends in the Rangel Coal Measures, Central Queensland.

preserved in tuff bands closely associated with the coal seams. These forms of preservation are observable in high rank coal seams, where structures are no longer preserved within the vitrinites.

FUSINITE

Pyrofusinite is a fusinite formed from the incomplete incineration of plant material during fires which occurred in the peat swamps. Because of this early oxidation, pyrofusinites are resistant to coalification changes. Although many specimens tend to be particularly thin-walled and brittle, causing collapse of the cell structure, others are sufficiently stable to retain initial cell form. All plant forms are amenable to pyrofusinitisation, but secondary wood

tracheids are the most commonly observed, with rarer occurrences of medullary rays (Pl. 1, figs 2, 3).

Pyrofusinites commonly only make up one or two per cent of coals including those that are inertinite-rich, but their preservation and characteristic high reflectivity make them readily observable, and a useful indicator of the wood material which was later to form the bulk of the coal.

SIDERITE

Siderite, a common constituent of many coals, typically forms in concentrated bands of concentric or spherical nodules, which occur most abundantly in vitrinite bands. Where maceral band definition is apparent, the bands appear draped around the

nodules, suggesting a syngenetic relationship, with the nodules resisting subsequent compaction.

Examination of many siderite nodules in Queensland coals has shown remnant cell structures such as tracheids and medullary rays preserved within the siderite crystal structure (Pl. 1, figs 4-6). This mode of siderite formation is quite unlike the spherulitic growth normally encountered. The nodules have irregular borders, and the preserved cell forms are undistorted. It is uncertain whether any remnant organic material is preserved within the siderite, or whether replacement by crystal growth has been complete. In polarized light, the siderite shows random to irregular extinction. It is commonly associated with secondary pyrite growths.

CLAY

Clay minerals are a common constituent of coal seams, in discrete bands and lenses, and isolated inclusions within macerals. In some instances, clay has become contained within wood cell structures prior to vitrinitization and a remnant cell pattern is preserved within the vitrinite. Clay is rarely associated with fusinite (Mackowsky, in Stach, 1975).

An association of clay and fusinite occurs within a tuff at the top of the Permian, Burngrove Formation, Central Queensland. The tuff, in the Curragh area, is directly overlain by the Pisces seam of the overlying Rangal Coal Measures (Galligan, 1977). A Queensland Department of Mines

cored borehole penetrated the Pisces seam and bottomed in the tuff. The lower 0.45 m of coring partly penetrated a fusinised tree preserved in growth position (Pl. 2, fig. 7). The tree has been partly intruded by the surrounding tuff material, which has penetrated the outer bark layer (Pl. 2, fig. 8). The internal structure of the stem has been replaced mainly by clay minerals, with only fragments of fusinitic material remaining. The initial cell structures of the stem, however, have been preserved within the clay material (Pl. 2, figs 9-11). The nature of preservation of the stem suggests that the tree was fusinised in growth position by the engulfing tuff ash, and later replaced by clay mineral growth from solution and deposition of the tuff material.

DISCUSSION AND CONCLUSIONS

The occurrence of Araucarian wood structures within the high rank coals of the Rangal Coal Measures confirms the similarity in floral genesis of these coals and the low rank coals in the same formation. Any gross differences in coal properties must therefore be attributed to variations in peat accumulation and the over-riding effect of coalification.

ACKNOWLEDGEMENT

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EXPLANATION OF PLATES

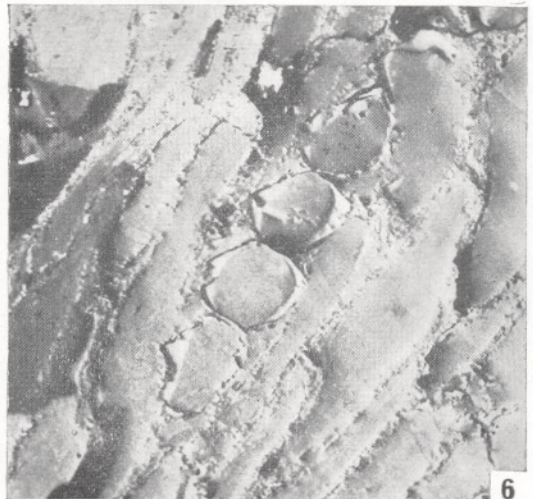
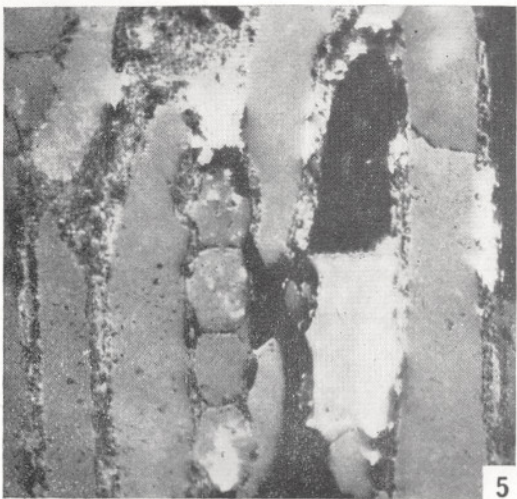
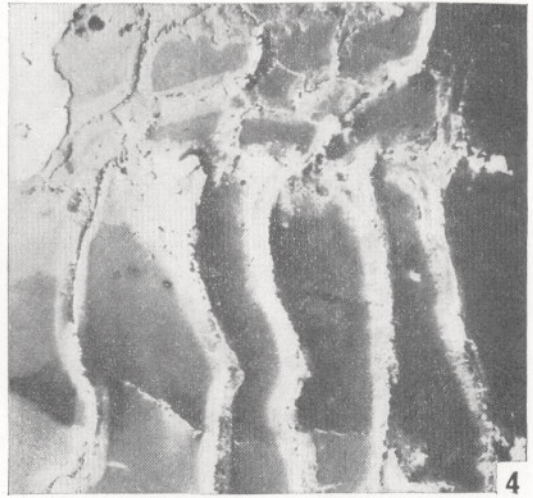
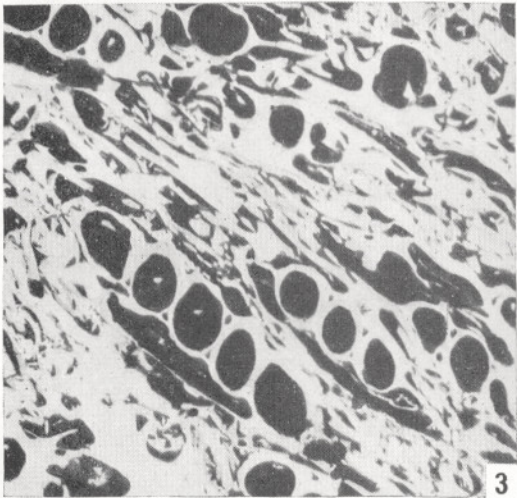
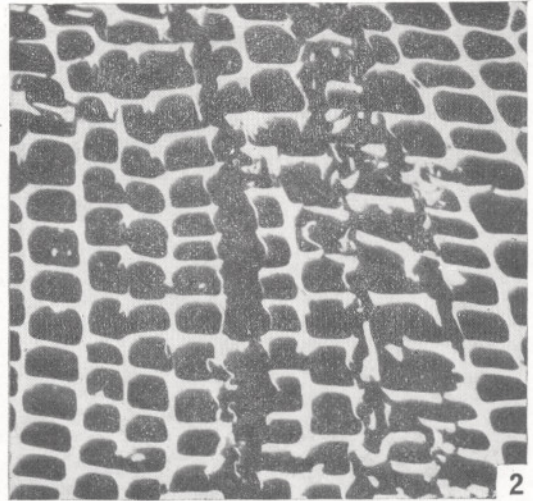
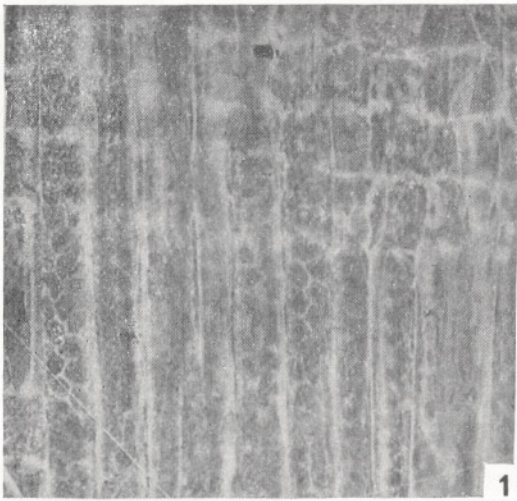
PLATE 1

1. Telocollinite in low rank coal, showing traces of medullary rays and tracheids with radial wall pits. Incident light, oil immersion. $\times 300$.

2. Pyrofusinite showing tracheidal cells in cross-section, with trace of medullary ray left of centre. Incident light, oil immersion. $\times 375$. Curragh Emerald area, Aries seam, vitrinite reflectance in oil 0.5 per cent (high volatile bituminous).

- area, Aries-Castor seam, vitrinite reflectance in oil 1.4 per cent (medium volatile bituminous).
3. Pyrofusinite showing crushed tracheids and resistant medullaries in tangential section. Incident light, oil immersion. $\times 375$. Strathconan area, Main seam, vitrinite reflectance in oil 1.6 per cent (low volatile bituminous).
 4. Siderite nodule cell pseudomorph showing tracheids and medullaries in tangential section. Incident light, oil immersion. $\times 375$. Curragh area, Pollux seam, vitrinite reflectance in oil 1.2 per cent (medium volatile bituminous).
 5. Siderite nodule cell pseudomorph showing tracheids and medullaries in radial section. Incident light, oil immersion. $\times 375$. Strathconan area, B seam, vitrinite reflectance in oil 2.2 per cent (semi-anthracite).
 6. Siderite nodule cell pseudomorph showing a medullary ray in relief, tangential section. Incident light, oil immersion. $\times 375$. Strathconan area, Main seam, vitrinite reflectance in oil 2.2 per cent (semi-anthracite).
 7. Core of Yarrabee tuff member with stem in near growth position. Incident light, in air. $\times 0.4$. Curragh area, tuff associated with Pisces seam, vitrinite reflectance 1.3 per cent (medium volatile bituminous).
 8. Above, in cross section. $\times 1.5$.
 9. Above, showing bark structures in outer layer. $\times 150$.
 10. Above, showing pith structures. $\times 150$.
 11. Above, showing secondary wood structures. $\times 150$.

PLATE 2



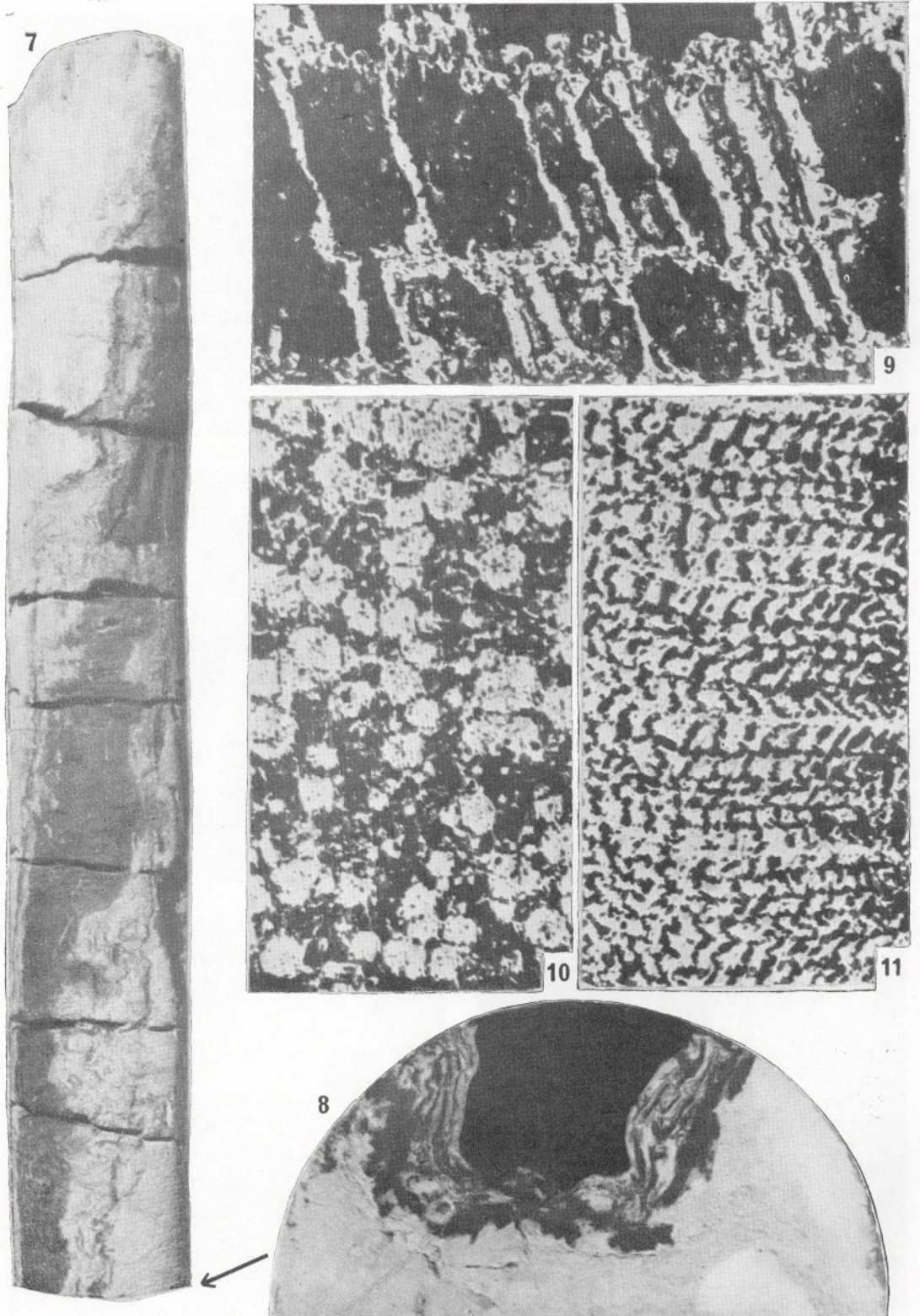


PLATE 2