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FOSSIL ALGAE, VICTORIA, AUSTRALIA

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ABSTRACT

The meagre literature on the fossil algae suggests that these plants occurred infrequently in Victoria in the past, but checking of biological and stratigraphical papers and examination of old and new collections shows that they were in fact much more widely distributed than indicated. This paper endeavours to put the fossil alga record into better perspective, and is principally a resumé of recent discoveries and re-interpretation of old material. It is to be remembered that in the older rocks in particular the nature of the algae makes it difficult to be sure of identification, and that many of the markings and structures discussed might well be the result of bioturbation, burrowing, or the remains of nondescript animals.

However, in several instances where the evidence strongly indicates the presence of fossil algae, the remains are figured, and affiliations discussed. Again it will cause no surprise to note that most records are from marine beds.

Key-words — Fossil algae, Victoria, Australia.

सारांश

विक्टोरिया (ऑस्ट्रेलिया) से शैवालाश्म — जे० जी० डॅग्लस

शैवालाश्मों पर अल्प साहित्य यह संकेत करता है कि अतीत में ये पौधे विक्टोरिया में अनभीक्षणिक रूप में पाये जाते थे परन्तु स्तरिक एवं जैव-शोध-पत्रों का निरीक्षण तथा प्राचीन व नवीन संग्रहों का परीक्षण यह व्यक्त करता है कि पूर्व निदर्शन की अपेक्षा वास्तव में ये बड़ी दूर-दूर तक फैले हुए थे। प्रस्तुत शोध-पत्र शैवालाश्मों के अभिलेखों को अधिक अच्छे स्वरूप में प्रस्तुत करने का एक प्रयास है तथा मुख्यतया: वर्तमान अन्वेषणों एवं प्राचीन संग्रह की पुनर्व्याख्याओं का सार है। यह स्मरणीय है कि विशेषतया प्राचीन चट्टानों में शैवाल की प्रकृति अभिनिर्धारण की निश्चितता को कठिन बना देती है तथा बहुत से विवेचित चिह्न एवं संरचनायें कदाचित् जैव-चक्रण, बिलकरण अथवा अवर्णित जन्तुओं के अवशेष के परिणाम भी हो सकते हैं।

तथापि, कई उदाहरणों में जहाँ प्रमाण शैवालाश्म की उपस्थिति को दृढ़ता से प्रदर्शित करते हैं वे अवशेष चित्रित किये गये हैं तथा उनके सहसंबंध विवेचित किये गये हैं। इसके अतिरिक्त यह आश्चर्यजनक न होगा कि अधिकतर अभिलेख समुद्री संस्तर से उपलब्ध हैं।

PRE-CAMBRIAN

There are no rocks of this age known in Victoria.

CAMBRIAN

Well-preserved impressions averaging 5 mm in width (Pl. 1, fig. 1a, b) from Middle Cambrian beds at Kilmore Gap showing prominent and regular dichotomous branching may be algal in origin, and are the oldest remains in Victoria that can with any certainty be referred to the Plant Kingdom.

Chapman (1917) called a leaf-like impression from Knowsley East *Sphenothallus filicoides* after comparison with specimens from New York. It was later (Chapman & Thomas, 1936) shown to be not a plant but a colonial animal of the group Hydroida.

ORDOVICIAN

No algae have previously been recorded from Victorian Ordovician rocks. Traces of organic material, usually in the form of irregular dark patches are, however, present in many places, and almost certainly represent algae in some instances. Illustrated (Pl. 1, fig. 2) are dark bands and masses in shale obtained as bore core from Phosphate Hill, near Mansfield.

EARLY SILURIAN

Buthotrephis Hall (sometimes spelt *Bythotrephis* after an emendation by Eichwald) is the only plant so far described from the older (Llandovery) part of the Silurian section in the Melbourne Trough. *B. gracilis*, *B. tenuis* and *B. intermedia* were described from the Melbourne area by Lucas (1927), and other fragments have been collected more recently from the Dolodrook River and elsewhere. Although the name *Buthotrephis* has in several instances been applied to animal traces (Edwards, 1977), Victorian specimens are undoubtedly plants.

LATE SILURIAN TO EARLY DEVONIAN

Several fine plant fossil localities have been found in the relatively well collected Late Silurian to Early Devonian marine sediments of the Melbourne Trough. Other areas such as the Grampians and far eastern Victoria contain less easily identifiable plant remains of this age, but a wide variety of algae seem to have lived in these ancient waters.

LATE SILURIAN

Specimens have been obtained from the Limestone Road Yea locality (Ludlow, Garratt 1978) and Grampians. Three forms are figured (Pl. 1, fig. 3; Pl. 2, figs 7, 8) from Limestone Road. The first (Pl. 2, fig. 7) consists of a fine strap like thallus with probably three main branches, each subsequently branching and much intertwined. Its length is over 150 mm and although part of the specimen is broken off, it is doubtful if it was much longer. Width of thallus is up to 1 mm and terminal branchlets have rounded apices. There appear to be rounded protruberances up to 1 mm in diameter in the main parts of the thallus and also perhaps on the branchlets. Affiliation with the Phaeophyta is suggested.

Very different is the second alga-like fossil. This (Pl. 1, fig. 3) consists of numerous small plants about 30 per 100 sq cm, maximum length about 3 cm, with very fine, much branched thallus in elongated rosette arrangement. Branchlets are often about 0·5 mm in width, finely divided and pointed at the apices, and may bear very small protruberances. They are reminiscent of some present day Rhodophyta and resemble other fossils of Early Devonian age from Turtons Creek (see Pl. 2, fig. 6).

The third Limestone Road fossil occurs as dark, oval to circular masses, is 5-10 mm along the major axis, and sometimes shows a concentric structure (Pl. 2, fig. 8b). Some distinctions between this and comparable Early Devonian forms are discussed below.

Log-like structures (Pl. 2, fig. 5a, b), in the Grampians, of unspecified Late Silurian-early Devonian age are very much larger than other remains discussed in this paper. They are up to 5 m in length, semi oval in cross section and 10-20 cm in ' diameter '. There is often a crescentic scaly ornamentation, and affiliation with the Nematophytales (Phaeophyta ?) was suggested (Douglas & Kenley, 1981).

EARLY DEVONIAN

Chapman (1912) described and figured *Bythotrephis* and *Confervites* Brongniart as Thallophyta, and *Haliserites* Sternberg tentatively as Lycopodiales.

I agree with his allocation of most of the " *Haliserites* " specimens (from several localities, some not sighted by me) to plant groups other than the algae. Having also not seen the *Confervites* I cannot comment on its allocation to the thallophytes, but the *Bythotrephis* is mentioned again below. Other Early Devonian fossils of possible algal derivation are many and varied.

Illustrated in Pl. 2, fig. 6 are the ' rosette ' remains from Turtons Creek mentioned above. They are a little larger than the specimens from Yea, and the thallus appears less dissected and less feathery.

Of even more dubious origin are small thalli (Pl. 3, fig. 11) with lumpy or irregular margins, from Dollar, on the same Palaeozoic inlier as Turtons Creek.

Cookson (1935) identified spherical carbonized bodies up to 4 mm in diameter with outer fine radial striations as the alga *Pachytheca*. These have been compared with the Limestone Road aggregations mentioned above, and other massed carbonaceous remains in the Wilson Creek Shale at Frenchmans Spur recorded by Tims (1974). These latter (Pl. 1, fig. 4), are often U-shaped, and show signs of internal organization.

" *Girvanella* " and nondescript remains from other areas may or may not have been

Early Devonian alga, but well-preserved specimens from the old goldfields town of Walhalla surely were. Never described, but stored in the National Museum of Victoria under the name *Thamnocladus*, the largest of these is over 200 mm in length, with the terminal part of the thallus (Pl. 3, fig. 10a) branching repeatedly, and identical to the *Bythotrephis* of Chapman. However, the base (Pl. 3, fig. 10b) shows closely appressed short, leaf-like appendages and if found detached from the spreading thallus section the fossil would without doubt have been identified as the famous lycophyte, *Baragwanathia longifolia* which occurs in the same beds.

Comparison with *Thamnocladus* shows that the type *T. clarkei* from New York* (White, 1901), has no such distinguishable basal area, and this name cannot be applied. An additional fossil plant almost certainly algal, is associated on the same rock specimen. It is represented by thallus extremities and at about 6 mm in width is considerably larger than the main specimen.

Algal biostromes have been recorded from the Early Devonian Buchan Group in eastern Victoria. Talent and Philip (1960) noted the wide distribution of algal pisolites in the oldest beds, the Buchan Caves Limestone.

LATE DEVONIAN — CARBONIFEROUS

No algae have been observed or recorded from the beds of Late Devonian or Carboniferous age.

PERMIAN

There is no record of algae from Permian beds, but fine involute markings on specimens from marine beds just north of the Council Trench Bacchus Marsh may be of algal origin.

TRIASSIC — JURASSIC

Again, no algae are recorded from the very small outcrops of early Mesozoic beds in Victoria.

CRETACEOUS

In 1973, I suggested that microscopic net-like objects (Pl. 2, fig. 9) might be of algal origin. All the Cretaceous outcrop in Victoria is regarded as non-marine, so the absence of algal records from the very large number of localities is not remarkable. Even so, markings and faint compressions on several specimens from the Moonlight Head beds might originate from the algae.

TERTIARY

Algae have not been recorded from the very extensive Middle Tertiary non-marine section including the brown coal measures, but Cookson (1953) described the colonial alga *Botryococcus braunii* from Oligocene beds at Anglesea, Pliocene beds at Daylesford, and elsewhere. *Pediastrum boryanum* a fresh-water green alga was also described from near Campbell town in Late Tertiary beds.

Baker (1944) tentatively referred sinuous and concentric markings in blue grey clays of middle Miocene age near Port Campbell, to the algae but the persistence and three dimensional nature of these suggests sedimentary structures rather than fossil origin.

QUATERNARY

Cookson found both *Botryococcus* and *Pediastrum* in Quaternary sediments as well as Tertiary, and there is little doubt that other algae are present in deltaic and river bed silts.

To conclude then, the algae have a long history in the plant fossil record in this State, and further research in some cases should establish more conclusive connections with present day groups. Certain of the new forms merit more detailed study and comparison, and ultimately proper description and naming. Likewise those previously collected, such as "*Thamnocladus*" from Walhalla.

ACKNOWLEDGEMENTS

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*The status of this fossil is (Edwards, 1977) currently under investigation.

Berg, Geological Survey of Victoria, for specimens from the Cambrian beds of Kilmore Gap, and Ordovician bore core, Phosphate Hill.

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EXPLANATION OF PLATES

(All approximately natural size, except fig. 9. ×500)

PLATE 1

1a,b. Dichotomizing thallus. Kilmore Gap. Middle Cambrian. NMV P56006, 56013. Outline of 56006 specimen defined by inking.

2. Bore core, showing dark patches. Phosphate Hill near Mansfield. Middle Ordovician. NMV P56004.

3. Elongated rosettes with feathery branches, possibly affiliated with the Rhodophyta. The exceedingly fine thalli are difficult to distinguish in the specimen, much less in the photograph, and two rosettes are indicated by inking. Limestone Road, Yea. Late Silurian (Ludlow). NMV P56023.

4a,b. Dark oval-circular masses. **a.** Smaller specimens NMV P56019. **b.** Larger and slightly enlarged specimens showing U-shape. NMV P56020. Frenchmans Spur. Early Devonian. J. Tims photographs.

PLATE 2

5a,b. Large log-like structures possibly derived from the Phaeophyta showing scaly ornamentation. Arrow in 5b. indicates continuation of specimen. Mount William, Grampians. Late Silurian or Early Devonian. (P. R. Kenley photographs).

6. Finely branched remains comparable with rosettes shown in fig. 3. Turtons Creek. Early Devonian. NMV P56015.

7. Long strap-like thalli and branches attributed to Phaeophyta. Protruberance indicated by arrow. Limestone Road, Yea. Late Silurian (Ludlow). NMV P56014.

8a,b. Dark oval masses. Note concentric markings arrowed on 8b. specimen (slightly enlarged). Limestone Road, Yea. Late Silurian (Ludlow). NMV P56021, 56022. J. Tims photographs.

9. Microscopic net-like object. Possibly of algal derivation. Foot of Racecourse Steps. Moonlight Head. Early Cretaceous (Albian). GSV 63595.

PLATE 3

10a,b. Large thallus. **a.** Whole plant. Rock specimen shows contorted bedding, and base is not on the same plane as remainder of thallus, making photography difficult. This photograph shows terminal portions of thallus. Note, on right, dark thalli twice the thickness of the main specimen (one branch outlined by inking). These are terminal branches of another, larger alga, mentioned in the text. **b.** Basal section. Closely appressed branchlets give this portion a remarkable similarity to the Lycophyte *Baragwanathia longifolia*, found in the same beds. Long Tunnel Mine, Walhalla. Early Devonian. NMV P52501.

11. Small lobed thalli. Early Devonian. Dollar NMV P56024.

1a

1b

2

4a

3

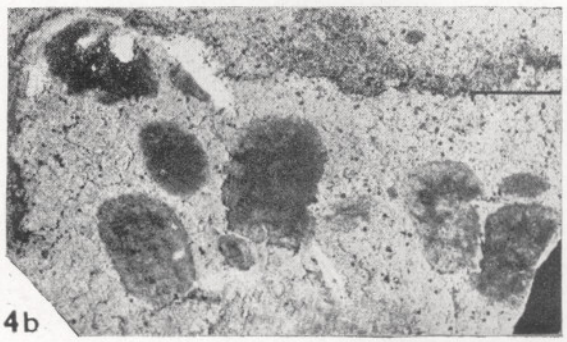

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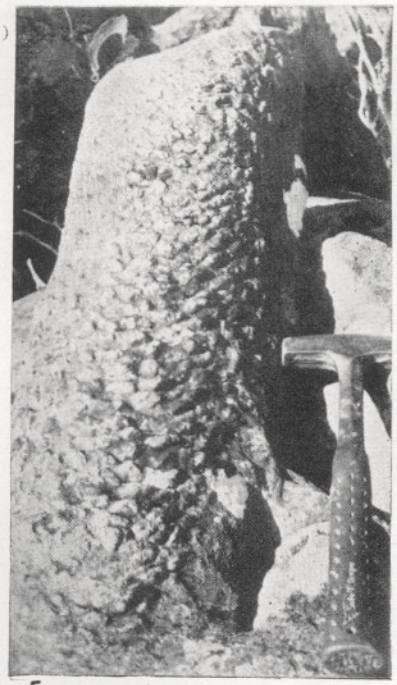
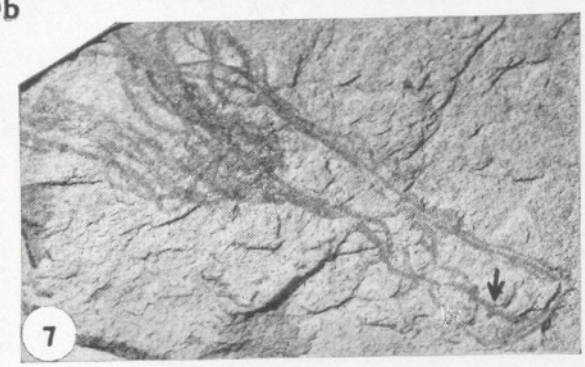
PLATE 1



5a

5b

6



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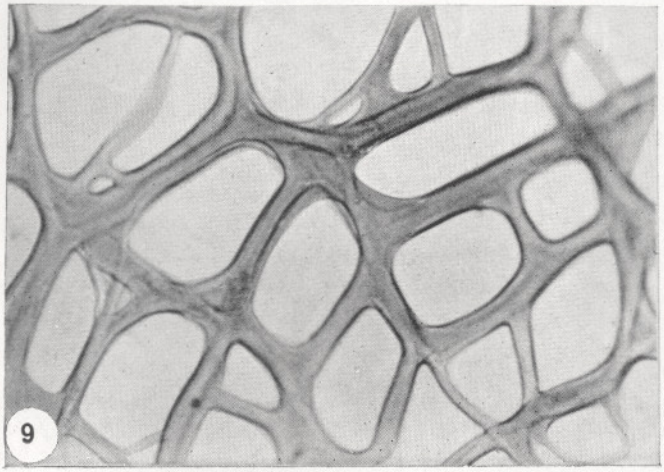

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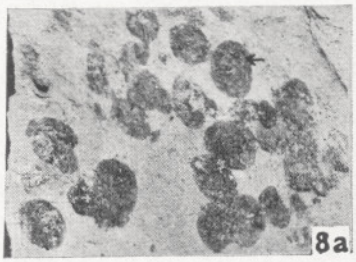

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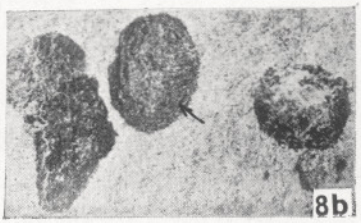
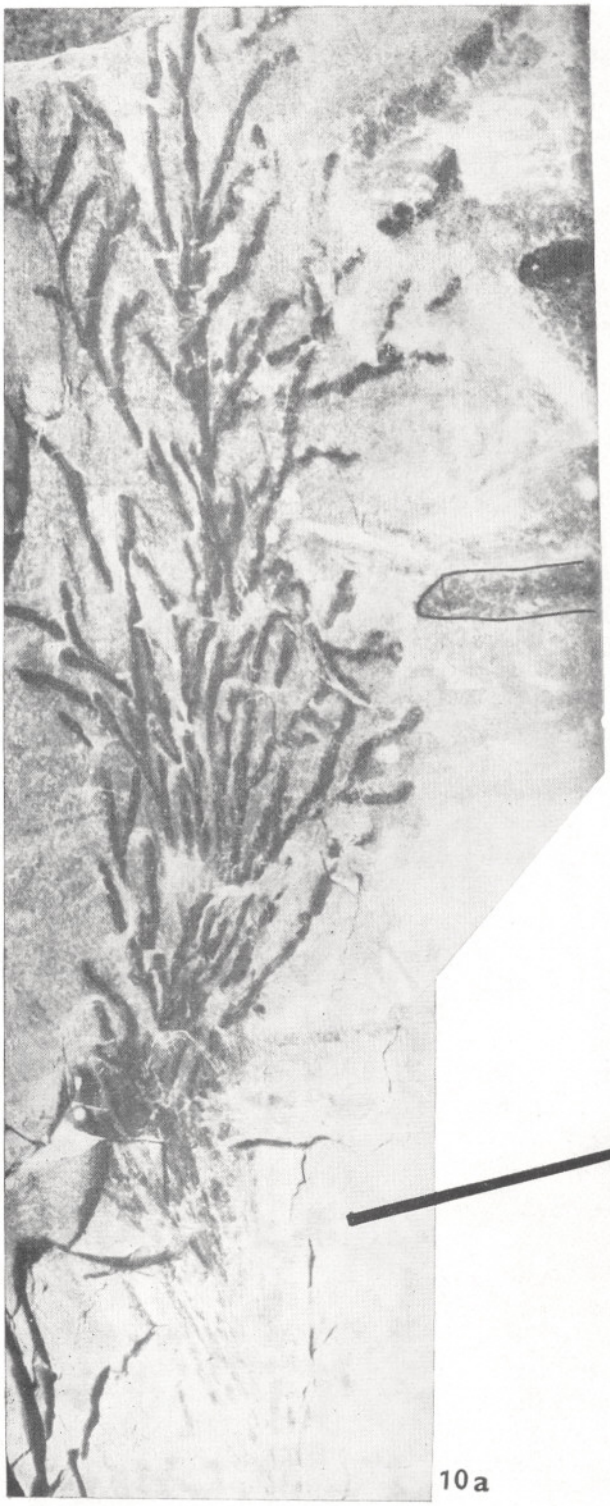


8b

PLATE 2



10a

11

10b

PLATE 3