PSEUDOCYMOPOLIA, A MESOZOIC TETHYAN ALGA (FAMILY DASYCLADACEAE)

by GRAHAM F. ELLIOTT

ABSTRACT. *Pseudocymopolia* gen. nov. is proposed for certain dasycladaceae ranging from Portlandian to Maestrichtian in age, and from Spain to Borneo geographically. *P. orientalis* sp. nov. is described, and the relationship of the genus to *Cymopolia* discussed.

IN 1959 I described a very distinctive dasyclad alga from the Maestrichtian of Iraqi Kurdistan as *Cymopolia anadyomenea* (Elliott 1959). This alga showed the essential branch-structure seen in *Cymopolia*, but the calcareous segments or units were remarkable externally in swelling periodically into conspicuous annular projections or flanges: at these levels the internal branch-structure was coarser than at the inter-flange levels. These distinctive segments set *C. anadyomenea* apart from all other species of the genus, which ranges from Upper Cretaceous to Recent, but it seemed reasonable to regard the species as an early development before the very conservative morphology of the Tertiary and Recent species was achieved.

During later reporting on the algal microflora of the Bau Limestone of Borneo, random sections of an alga like *C. anadymomenea* were considered to indicate Upper Cretaceous age for the appropriate samples. This was disputed by the field-geologists, for the Bau Limestone is of Upper Jurassic and Lower Cretaceous age, and there was no evidence that the disputed samples were anomalous in position. At this point Praturlon (1964) figured a rare alga from the undoubted Lower Cretaceous of Italy as *C.* aff. *anadyomenea*, and Dr. Radoičić of Belgrade sent me a thin-section of Yugoslav Lower Cretaceous containing fragments of a similar alga. There is a similar record from the Lower Cretaceous of Spain (Champetier, 1967 p. 148). In re-describing *C. anadyomenea* along with other Middle East Dasycladaceae (Elliott 1968), I referred to the Italian Borneo and Yugoslav fossils as examples of 'an apparent homoeomorph' of *C. anadyomenea*.

Recently Dragastan described *Cymopolia jurassica* from the Portlandian of Rumania (Dragastan 1968). This is yet another flanged species, based on good material and carefully distinguished in detail by its author from *C. anadyomenea* Elliott and '*C.* aff. *anadyomenea* Elliott' of Praturlon, the two species available to him in the literature.

It is clear that these flanged forms range from Upper Jurassic to Upper Cretaceous and have a wide Tethyan distribution: Spain, Italy, Yugoslavia, and Rumania in Europe, and Iraq, Afghanistan (Kaever 1965), possibly Tibet (Morellet 1916; Elliott 1968, p. 40), and Borneo in Asia.

A re-examination of the relation of these flanged forms to normal *Cymopolia* spp. is facilitated by the recently described *C. eochoristosporica* (Elliott 1968). This is a key species in dasyclad evolution, for it shows an intermediate stage in the fundamental reproductive evolution of the family. The segments are of normal cymopoliform morphology in proportions and as seen externally, but the internal branches show the

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transition from cladospore to choristospore organization (see Elliott 1968), making it a kind of missing link in algal evolution. This species, from Abu Dhabi in Arabia, is Maestrichtian in age. (It is not the earliest *Cymopolia* known, for the Texan *C. perkinsi* (Johnson 1968), is from the Cenomanian). In Mme Segonzac's recent review of the Pyreneen Thanetian *Cymopolia* spp. (Segonzac 1968), which reached me whilst this was being written, *C. inflataramosa* Segonzac shows a further intermediate stage between *C. eochoristosporica* and *C. elongata* (Defr.) Munier-Chalmas. This detailed study deals fully with the problem of the doubtful morphological validity of *Karreria* Munier-Chalmas, touched on by me in describing the Middle East occurrences of *C. tibetica* Morellet (Elliott 1968), and with the varying inflation of the primary branch in and between different Thanetian and other species.

Since flanged species precede and overlap the primitive true *Cymopolia* spp. in time, it seems doubtful that they are an aberrant early development of *Cymopolia*, as was thought when only the Maestrichtian *C. anadyomenea* was known. They are accordingly referred to *Pseudocymopolia* gen. nov., diagnosed below, and the opportunity is taken to describe the Borneo species, which differs from all the other species, including those not yet fully described.

Pseudocymopolia shows fully developed choristospore organization, at an earlier geological period than the intermediate or developing choristospore structure of the Upper Cretaceous *C. eochoristosporica*. Still earlier, with *Eodasycladus* of the Lias (Cros and Lemoine 1966, 1967), the authors suggest that choristospore organization was apparently achieved by sporangial swelling of one secondary branch in each branch system i.e. a specialized form of cladospory. And Elias (1947) claimed a presumed choristospory in *Permopora* which is Permian in age, though the condition is not apparent from the figures given. Evidently the transition from cladospory to choristospory took place in different genera in different ways at different times geologically.

The relationship of *Pseudocymopolia* to *Cymopolia* is thus not necessarily close, though for taxonomic purposes both genera are placed in the Neomereae Pia 1920 (*Neomeris* appears in the Lower Cretaceous).

Genus *Pseudocymopolia* gen. nov.

Diagnosis. Thick-walled calcified dasyclad units or segments showing prominent external consecutive annular swellings or flanges: numerous crowded verticils of branches which are coarser at flange-levels; each branch showing one short primary giving rise to a globular sporangium and four or more long secondaries. Upper Jurassic to Upper Cretaceous.

Type species. Cymopolia anadyomenea Elliott (Maestrichtian of Iraq).

EXPLANATION OF PLATE 60

Fig. 1. *Pseudocymopolia orientalis* gen. et sp. nov. Longitudinal thin section of slightly distorted segment, ×40. Lower Cretaceous, Bau Limestone; Tebedu Road, Tubiti, Kuching, Sarawak, Borneo. Syntype, reg. no. V.54126.

Fig. 2. *Pseudocymopolia orientalis* gen. et sp. nov. Oblique transverse thin section through terminal thickening of slightly crushed segment, to show branch-structure, ×40. Same locality and horizon. Syntype, reg. no. V.54127.

Other species. C. jurassica Dragastan (Upper Jurassic of Rumania), *C.* aff. *anadyomenea* (Praturlon, Lower Cretaceous of Italy), *C.* cf. *anadyomenea* (Radoičić, Lower Cretaceous of Yugoslavia), 'isomorfos de *Cymopolia anadyomenia* Elliott' (Champetier, Lower Cretaceous of Spain), and *P. orientalis* sp. nov. (Lower Cretaceous of Borneo).

Pseudocymopolia orientalis sp. nov.

Plate 60, figs. 1, 2

Description. A *Pseudocymopolia* with dumb-bell-shaped segments showing prominent rounded annular terminal thickenings connected by a much thinner shaft: the diameter of the stem-cell cavity is approximately constant. A small example has a length of 2·86 mm., external diameter at terminal thickening 1·82 mm. (d/D ratio 34%), and external diameter between thickenings 0·78 mm. (d/D ratio 66%). A larger but fragmentary example shows an external diameter across the thickening of 2·76 mm. (estimated length from this 4·33 mm.). In this large fragment the diameter of a primary branch is 0·065 mm., of a secondary branch 0·045 mm., and of a globular sporangium 0·091 mm. The matrix appears to have been stressed and the fossils show slight signs of distortion: some associated organic fragments, presumably more rigid than the alga when buried, show fracturing. The material does not permit a full tabulation of detailed structure dimensions for comparison with *P. anadyomenea* and *P. jurassica*, but the two terminal thickenings only per segment, seems characteristic.

Comparison. P. orientalis differs from *P. anadyomena* in that its thickenings are rounded and not keeled to form a flange. In this it resembles the other Lower Cretaceous and the Jurassic species. The narrow portion of the segment between thickenings is proportionally longer than is normal in other species, and these all differ in showing several thickenings per segment. As with the Italian and Jugoslav Lower Cretaceous species, the Borneo fossil is associated with the problematic non-dasyclad alga *Lithocodium aggregatum* Elliott.

Syntypes. The specimens figured in Plate 60, figs. 1, 2, from the Bau Limestone (Lower Cretaceous) of the Tebedu Road, near Tubiti, 32 miles SSE. of Kuching, Sarawak, Borneo. Brit. Mus. (Nat. Hist.), Dept. Palaeont., reg. nos. V.54126, V.54127.

Other material. Specimens and fragments in thin-sections from the same formation and area.

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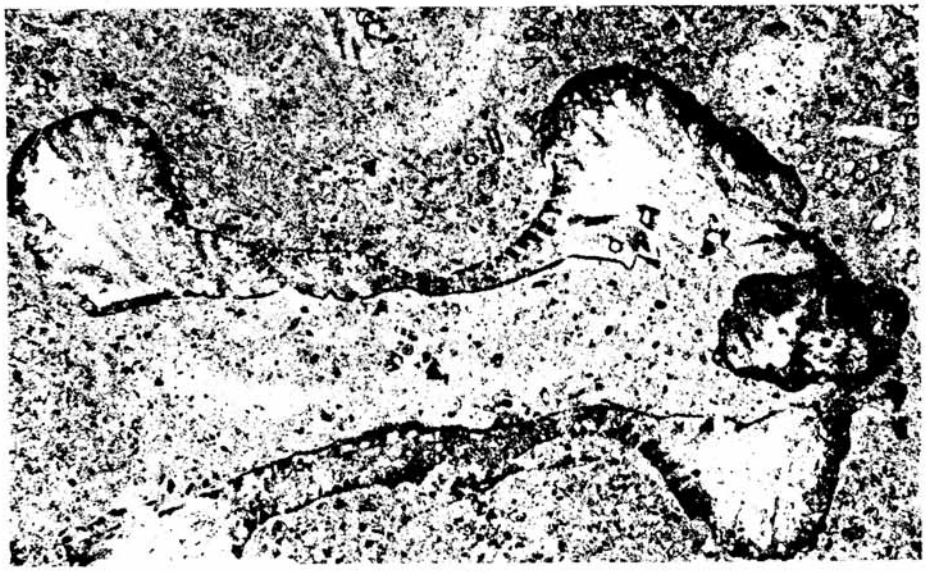

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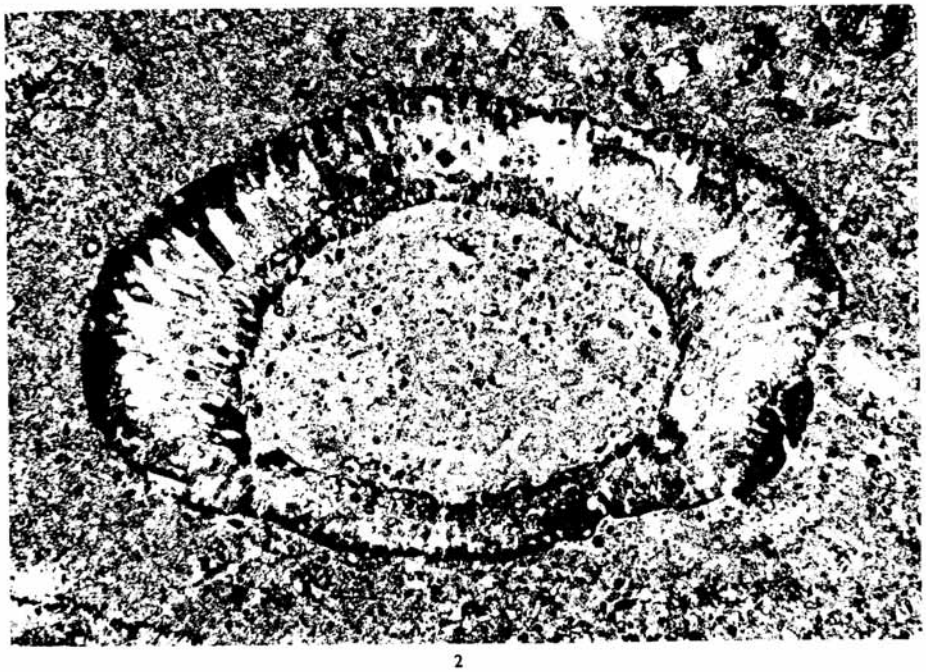

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ELLIOTT, Mesozoic Dasycladaceae (Algae)