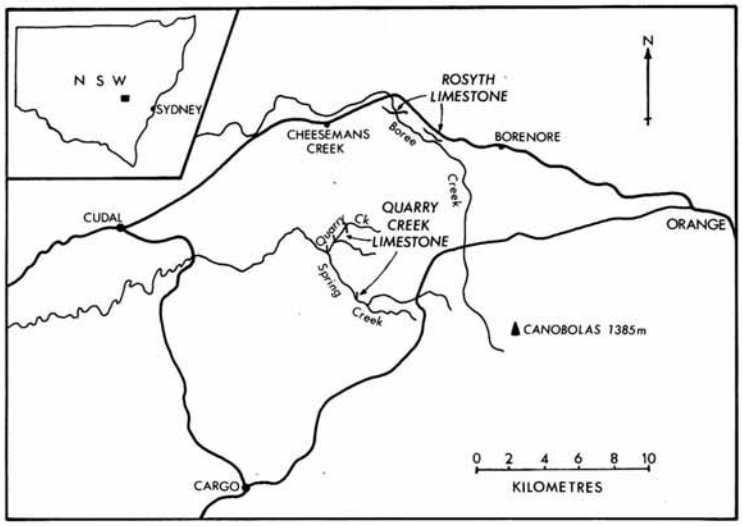
CHONOPHYLLINID CORALS FROM THE SILURIAN OF NEW SOUTH WALES

by R. A. MCLEAN

ABSTRACT. *Ketophyllum attenuatum* sp. nov. from the Rosyth Limestone (Upper Llandovery) of central N.S.W. is described. *Mictocystis endophylloides* Etheridge 1908, from the Quarry Creek Limestone (Upper Llandovery) in central N.S.W. is redescribed and a lectotype chosen. Paralectotype material of *Yassia enormis* (Etheridge 1913) from strata of Ludlow age in the Yass district, southern N.S.W. is reviewed and illustrated. The close affinities of the genera *Ketophyllum*, *Mictocystis*, and *Yassia* are emphasized and their taxonomic status and relationships reviewed.

STRATIGRAPHY AND AGE

Ketophyllum and *Mictocystis* occur separately in two extremely fossiliferous horizons in the area west of Orange in central N.S.W. (text-fig. 1). The Quarry Creek Limestone (Packham and Stevens 1955), from which *Mictocystis endophylloides* was described by Etheridge (1908), is best exposed in Quarry Creek (Bed 'A' of Süssmilch 1906). At this locality approximately 9 m of coarsely bedded, massive limestone overlie Upper Ordovician weathered, red, tuffaceous beds with marked unconformity. Two other horizons of massive limestone outcrop in Quarry Creek (Beds 'B' and 'C' of Süssmilch 1906) and were considered by Packham and Stevens (1955,



TEXT-FIG. 1. Locality map.

[Palaeontology, Vol. 17, Part 3, 1974, pp. 655–668, pls. 94–95]

p. 58) as strike-faulted repetitions of this same horizon. Bed 'A' is exposed again to the south in Spring Creek (Packham and Stevens 1955, fig. 1).

The Rosyth Limestone (Walker 1959) is a unit of fossiliferous, marly limestones interbedded with shale and sandstone occurring in the Boree Creek area, south of the main Orange–Cudal road (text-fig. 1). This horizon also unconformably overlies Upper Ordovician volcanics. It reaches a thickness of about 35 m, but the most fossiliferous member, a yellow-grey nodular-weathering biomicrite occurring near the base of the sequence, is only approximately 6 m thick, and it is from this horizon that the specimens of *Ketophyllum* described here were obtained.

The Quarry Creek Limestone is immediately overlain by beds containing a graptolite fauna of late Llandovery age (Packham and Stevens 1955). Walker (1959) and Packham (1969) have correlated the Quarry Creek Limestone with the Rosyth Limestone mainly on the basis of similarities of the coral fauna. Preliminary studies of the conodont faunas from the Quarry Creek Limestone (Bed 'A', Quarry Creek) and the coral-rich beds of the Rosyth Limestone have also suggested close age similarities between the two formations (G. Bischoff, pers. comm. 1972). The conodonts suggest an assignment no older than the *celloni* Zone of Walliser (1964, 1971) for these horizons and hence it would appear that the age of the limestones does not extend below the Upper Llandovery.

The type material of *Yassia* reviewed here is from limestone at the 'escarpment north-east of Boonoo Ponds Creek, Hatton's Corner, Yass River, near Yass' in southern N.S.W. (Etheridge 1913, p. 37). The form is represented also in the Bowspring Limestone at Yass, considered to be an equivalent horizon by Jones (1932). The Bowspring Limestone was regarded as being of early to middle Ludlow age on the basis of conodont faunas by Link (1970) and hence a comparable age is likely for the type horizon of *Yassia*.

SYSTEMATIC PALAEONTOLOGY

Registration numbers of specimens in the University of Sydney Palaeontological Collections bear the prefix SUP, and where more than one section has been prepared from the one specimen, they have the suffix *a*, *b*, etc. Numbers of specimens from the palaeontological collections of the Australian Museum, Sydney, have the prefix AM.F and thin sections in these collections the prefix AM.

Family CHONOPHYLLIDAE Holmes, 1887
Subfamily CHONOPHYLLINAE Holmes, 1887

1927 Omphymatidae Wedekind, p. 46.
1937 Omphymatidae; Soshkina, p. 64.
1949 Chonophyllinae; Stumm, p. 48 (*nom. transl.*, *ex* Chonophyllidae Holmes 1887).
1952 Chonophyllidae (*part.*); Lecompte, p. 465.
1952 Ketophyllidae (*part.*); Lecompte, p. 467.
1956 Chonophyllinae; Hill, p. F300.
1962 Chonophyllidae (*part.*); Soshkina, *et al.*, p. 300.
1962 Dokophyllidae Soshkina, *et al.*, p. 319.
1963 Chonophyllidae (*part*); Ivanovskiy, p. 108.
1965 Spongophyllidae (*part.*); Ivanovskiy, p. 85 (*non* Dybowski 1873).
1965 Ketophyllidae (*part.*); Ivanovskiy, p. 96.

Diagnosis: Coralla solitary or compound. Septa typically amplexoid, tabulae flat and commonly grouped in series.

Genus KETOPHYLLUM Wedekind, 1927

1851 *Omphyma* (*part.*); Edwards and Haime, p. 400.
1854 *Omphyma* (*part.*); Edwards and Haime, p. 287.
1876 *Omphyma* (*part.*); Rominger, p. 117.
1901 *Omphyma*; Lambe, p. 177.
1902 *Omphyma*; Počta, p. 137.
?1919 *Heterolasma* Ehlers, p. 461.
1927 *Ketophyllum* Wedekind, p. 48.
1927 *Dokophyllum* Wedekind, p. 48.
1927 *Omphyma* (*part.*); Wedekind, p. 58.
?1937 *Dokophyllum* (*part.*); Soshkina, p. 65.
1937 *Omphyma* (*part.*); Butler, p. 87.
1939 *Omphyma*; Northrop, p. 143.
1944 *Ketophyllum*; Wang, p. 26.
1945 *Ketophyllum*; Smith, p. 26.
1947 *Cetophyllum* (? *part.*); Wang, p. 181.
1950 *Ketophyllum* (? *part.*); Wang, p. 226.
1952 *Dokophyllum*; Bulvanker, p. 22.
1956 *Ketophyllum*; Hill, p. F300.
1960 *Ketophyllum*; Nikolaeva *in* Bulvanker *et al.*, p. 225.
1960 *Dokophyllum* (*part.*); Zheltonogova, p. 76.
1961 *Ketophyllum*; Minato, p. 29.
?1962 *Dentilasma* (*part.*); Ivanovskiy, p. 128.
1965 *Ketophyllum*; Stumm, p. 47.
1965 *Dokophyllum*; Strelnikov, p. 42.
1965 *Dokophyllum*; Zheltonogova, p. 42.
1971 *Ketophyllum*; Lavrusevich, p. 90.
non 1937 *Ketophyllum*; Soshkina, p. 67.
non 1959 *Ketophyllum*; Ivanovskiy, p. 135.
non 1965 *Ketophyllum*; Ivanovskiy, p. 123.

Type species. K. elegantulum Wedekind, 1927. Klinteberg Beds (Ludlow), Gotland.

Diagnosis. Solitary corallum with fossula typically present. Septa amplexoid, often dilated peripherally, continuing over tabulae as low ridges. Dissepiments usually large, tabulae flat, mainly complete and grouped in series.

Discussion. There has been some confusion in the past as to the nature of the septa of *Ketophyllum*. Wedekind's original description (1927) refers to septal 'leistes' or ridges on the dissepiment and tabular surfaces. Wang (1944), however, refers to both discrete and partly contiguous septal spines in his discussion of the genus. There is no mention by Wedekind (1927) of such structures in the Gotland material, nor can they be detected in his illustrations, although in some cases septa may be notched or denticulated on their upper surfaces, possibly related to the trabecular structure of the septal lamellae (e.g. *K. richteri* Wedekind, 1927, pl. 10, fig. 7). Such a feature can be detected in *K. attenuatum* sp. nov. described below. Wang later (1947, p. 181 and 1950, p. 226) described the septal structure of *Ketophyllum* as consisting of slender holacanthine trabeculae embedded in lamellar tissue, and he placed the genus in the Cystiphyllidae on this basis. In his restudy of the type material of several of Wedekind's species, Minato (1961) made no mention of septal spines in *Ketophyllum*, referring in fact to 'septal lamellae' (p. 90). The species described by Wang (1944, p. 27) as *K. equitabulatum* from the ?Wenlock of Yunnan, China, was considered to contain 'typically discrete septal spines', but there is no evidence of them in the illustrated longitudinal section (ibid., pl. 1, fig. 4*b*). In all other respects the form appears to be a typical example of *Ketophyllum* bearing short septa and is probably a representative of that genus.

Ivanovskiy (1965, p. 96 and p. 124) referred to *Ketophyllum* as possessing septal 'leistes', but in his description of *K. similis* sp. nov., he mentioned the presence of septal spines, and included it in the family Ketophyllidae Lecompte.

Ivanovskiy also placed the spine-bearing forms *Dentilasma* Ivanovskiy, *Nipponophyllum* Sugiyama, and *Spinolasma* Ivanovskiy (? = *Hedstroemophyllum* Wedekind, see Ivanovskiy 1970*a* and *b*) in the Ketophyllidae although these genera are generally considered representative of the Cystiphyllidae. He subsequently (1970*b*) referred *K. similis* to *Dentilasma*. There is no evidence of discrete septal spines being present in any N.S.W. representatives of the genus, nor are they apparent in specimens of *Ketophyllum* from Gotland in the palaeontological collections of the Geology Department, University of Sydney. Therefore, it appears best to retain the most widely accepted classification of the genus, that of Hill (1956) and others, namely with the Chonophyllidae (see Hill 1956, p. F300).

In proposing the family Omphymatidae, Wedekind (1927) included in it the new genera *Dokophyllum* and *Ketophyllum* together with *Omphyma* Rafinesque and Clifford, 1820. He considered *Dokophyllum* could be distinguished by having short septa not extending into the tabularium and not cutting any dissepiment layers vertically. *Ketophyllum*, on the other hand, was regarded as having septa longer than in *Dokophyllum*, although still being generally restricted to the dissepimentarium, and the septa being vertically continuous, cutting dissepiment layers. *Ketophyllum* was further distinguished from *Dokophyllum* by greater development of dissepiments, particularly early in ontogeny. Lastly, *Omphyma* was characterized by having septa similar in nature to *Ketophyllum* but extending into the tabularium towards the axis. Many later authors, particularly in the U.S.S.R., have followed this taxonomic scheme (e.g. Soshkina 1937; Bulvanker 1952; Strelnikov 1965). However, as was pointed out by Lang, Smith and Thomas (1940, p. 90) the type material of the genus *Omphyma* is lost and the position of the original locality and horizon is uncertain. Hence, since the specific description is not sufficient for certain identification, 'the name *Omphyma* cannot be used' (Lang, Smith and Thomas 1940, p. 91). It is evident that features ascribed by many authors to species of '*Omphyma*' are very close to those described by Wedekind (1927) for representatives of *Ketophyllum*, the length of the septa being a variable feature (see Hill 1956, p. F300). Hence, several forms described as belonging to *Omphyma* may be included in *Ketophyllum*, e.g. *O. tenuistriata* Wedekind, 1927, *O. turbinata* (Linnaeus, 1758), *O. grande* Barrande *in* Počta 1902, and *O. eriphyle* Billings, 1862. Kaljo (1970) listed the compound species '*Omphyma kutscheri*' Wedekind, 1927 as a representative of *Ketophyllum*. This form shows internal characteristics typical of *Ketophyllum* (see Wedekind 1927, pl. 17, figs. 1, 2) differing only in its compound growth form; its taxonomic position remains uncertain for the present.

The position of *Dokophyllum* is still debated, many Russian workers still preferring to consider the genera *Dokophyllum* and *Ketophyllum* as distinct (e.g. Soshkina 1937; Bulvanker 1952; Zheltonogova 1960, 1965; Soshkina *et al.* 1962; Strelnikov 1965). However, other authors consider differences between the two genera to be merely gradational and that forms cannot be consistently grouped into the two categories (see Wang 1944; Smith 1945; Hill 1956; Minato 1961; Ivanovskiy 1962, 1965). Minato (1961), in particular, restudied the material of the type species of *Dokophyllum*, *D. annulatum*, from Gotland and stated (p. 91) that 'there are no significant structural differences between *Dokophyllum* and *Ketophyllum*'. Consequently, it seems more justified to consider *Dokophyllum* a junior synonym of *Ketophyllum*.

Several species previously assigned to either *Ketophyllum* or *Dokophyllum* appear more likely to be representatives of other genera. The two species referred to *Ketophyllum* by Soshkina (1937), *K. intermedium* (Chernyshev, 1893) and *K. amplexoidum* (Chernyshev, 1893), both from the Upper Wenlock of the Urals, were considered synonymous and placed in *Dentilasma* by Strelnikov (1971). Septal 'leistes' were described from both forms by Soshkina (1937), those of '*K. intermedium*' occasionally showing denticulation (Soshkina 1937, p. 70). It cannot be determined from the illustrations of Soshkina (1937, pl. XIII, figs. 1, 2) or Strelnikov (1971, pl. XIX, fig. 4 and pl. XX, fig. 1) whether discrete septal spines are actually present. However, the weak development of septa and incomplete nature of the tabulae are atypical of *Ketophyllum* and the form may belong to *Dentilasma*.

The type species of *Dokophyllum*, *D. annulatum* Wedekind, 1927, from the ?Upper Llandovery of Gotland, was not figured in longitudinal section by Wedekind. While dissepiments are lacking in early growth stages, up to five rows of large elongate dissepiments can be determined from figured transverse sections (Wedekind 1927, pl. 9, fig. 15 and Minato 1961, pl. 19, fig. 6). After restudying Wedekind's material, Minato (1961, p. 91) included *D. annulatum* in *Ketophyllum*. Until its tabular structure is described, its inclusion in *Ketophyllum* is not certain but it is most probably a representative of that genus. The material from the Lower Wenlock of the Urals referred to '*D. annulatum*' by Soshkina (1937) appears to have short spinose septa mainly confined to the periphery and lacks typical ketophyllid tabular and dissepiment structure. It does not appear to be conspecific with Wedekind's species and appears to show greater similarities to *Dentilasma*. *Dokophyllum sociale* Soshkina, 1937, also from the Lower Wenlock of the Urals, appears to lack dissepiments and is a fasciculate form. It does not seem to be a representative of *Ketophyllum*.

Dokophyllum tabulatum Bulvanker, 1952, from the Upper Silurian (Skala Horizon) of Podolia, has almost no development of dissepiments and the septa are strongly trabeculate, in some cases almost consisting of isolated spines. The tabulae, however, are typically ketophyllid and so the taxonomic position of the species is uncertain. It may perhaps be a representative of *Dentilasma* as suggested by Ivanovskiy (1962, p. 128).

Of the original twenty species and varieties from Gotland included in the genera *Dokophyllum* and *Ketophyllum* by Wedekind (1927), it is evident that many are synonymous. However, revision of these forms must await detailed study of the type material.

The genus *Heterolasma* Ehlers, 1919 (type species *H. foerstei*, Ehlers 1919, Manistique Formation, Upper Llandovery–Lower Wenlock, Michigan) has been generally included as a synonym of *Ketophyllum* (Hill, 1956). Unfortunately, the genus has not been studied in thin section and the internal morphology is unclear. Ehlers (1919,

p. 466) stated that true dissepiments probably do not occur although the tabulae tend to become incomplete peripherally. Until the genus is studied in thin section its taxonomic position cannot be clarified.

The genera *Chonophyllum* Edwards and Haime, 1850, *Pilophyllum* Wedekind, 1927, and *Lindstroemophyllum* Wang, 1947 show similarities to *Ketophyllum*. *Chonophyllum* differs in possessing very strongly dilated septa in the peripheral region. Hill (1956, p. F300) referred the species of '*Omphyma*' described by Wedekind (1927) to this genus and '*O.*' '*flabellata* Wedekind is certainly a representative of *Chonophyllum*, having a characteristic narrow tabularium. '*O.*' *tenuistriata* Wedekind, however, has far less strongly dilated septa and appears to be closer to *Ketophyllum*, in which it is included here. It seems that the extent to which the septa are peripherally dilated is a very variable feature, ranging from the very heavily dilated forms in *Chonophyllum* to very thin and undilated types in some species of *Ketophyllum* such as *K. pseudoannulatum* Wedekind. As there seems to be a much greater preponderance of forms in *Ketophyllum* bearing generally weakly or only moderately dilated septa, it seems useful to distinguish *Chonophyllum* for forms bearing heavily dilated septa.

Pilophyllum Wedekind, 1927 also has generally strongly dilated septa at the periphery but forms showing less dilation (e.g. *P. progressum* Wedekind, 1927) may be distinguished from *Ketophyllum* by having an arched series of incomplete tabulae, as compared to the series of flat complete tabulae in *Ketophyllum*. *Pilophyllum* also tends to show a more convolute arrangement of the septa axially.

Lindstroemophyllum Wang, 1947 has a septal structure comparable to *Ketophyllum* but the septa are strongly convolute axially. There are also no true dissepiments in *Lindstroemophyllum*. Although Ivanovskiy (1965, p. 96) included it as a synonym of *Ketophyllum*, the lack of dissepiments, apparently throughout ontogeny, seems sufficient to distinguish it from that genus.

Range. Upper Llandovery of Britain, ?north-east U.S.S.R., ?Michigan, N.S.W.; Wenlock of Britain, Gotland, ?Estonia, ?Podolia, ?north-east U.S.S.R., Vaygach I., Tadzhikistan, China, Indiana–Kentucky, Quebec; Upper Silurian of Gotland, Czechoslovakia, Kazakhstan, south-west Siberia.

Ketophyllum attenuatum sp. nov.

Plate 94, figs. 1, 2, 5–8; Plate 95, fig. 3

Derivation of name. Latin *attenuatus* = reduced, referring to marked thinning of septa in tabularium.

Material. Holotype SUP 46190; paratypes SUP 46191–46193, 46195–46200. Additional material doubtfully referred to this species—SUP 46194, 46201–46203.

Distribution. Rosyth Limestone, Upper Llandovery.

Diagnosis. Trochoid-turbinate *Ketophyllum* having septa moderately dilated peripherally, the septa extending as very low ridges over tabulae to corallite axis where they may be somewhat twisted. Tabulae complete and incomplete, grouped in series to varying degrees. Dissepiments large, elongate, steeply inclined.

Description. Corallum solitary, trochoid to turbinate, with epitheca showing rather weakly developed septal grooves and transverse wrinkling. Most specimens show corrosion with epitheca not preserved. Corallite diameter ranges from approximately 30–55 mm with one specimen (SUP 46203), doubtfully referred to this species, reaching diameter of at least 85 mm. Corallite height ranges up to at least 70 mm, although all specimens are incomplete. Large specimen (SUP 46203) has height of at least 150 mm. Calice shallow. Prominent tabular fossula developed.

Septa long, typically reaching axis, where they may show some twisting. Septa thin in tabularium, occurring as low ridges on tabular floors. Vertically, septa may be seen to be peripherally based on dissepiment crests, rarely cutting dissepiment layer. Upper surface of septum may be notched (see Pl. 94, fig. 8) reflecting trabeculae in septum. State of preservation is insufficient to determine nature of trabeculae, but bundles of fibres based vertically on dissepiment crests may be discerned. Trabeculae

closely spaced and wrapped in indeterminate tissue to give appearance of complete lamellar septum. Septal number difficult to determine owing to irregularity of septal development, but 75–80 septa present in holotype (SUP 46190), ranging to 100–120 septa in largest specimen (SUP 46203), doubtfully referred to this species. Major and minor septa not generally clearly differentiated, although they can be detected in SUP 46191 (Pl. 95, fig. 3).

Tabulae mainly flat or slightly concave, with downturned edges, complete and incomplete, typically grouped in closely spaced series of approximately 2–5 tabulae. Tabular spacing ranges generally from 0·2 to 2 mm, with average of 0·4–0·8 mm. Tabularium diameter varies from about 17 to 22 mm, i.e. approximately 0·4–0·5 of corallite diameter.

Dissepiments large, strongly elongate, very steeply inclined towards axis. Average dimensions 5–10 mm wide and 1–1·5 mm high. Approximately six rows of dissepiments developed in distal part of corallum. Dissepiments developed at all growth stages preserved, but proximal portions not found intact and corrosion has typically removed outer dissepiment layers.

Remarks. Several specimens are rather atypical of the form described above. The large specimen (SUP 46203) has been mentioned and it is doubtfully placed in *K. attenuatum*. It differs in having more dilated septa in the tabularium and a generally narrower tabularium as well as its greater size (Pl. 94, figs. 3, 4). Further material would be necessary to confirm its inclusion in *K. attenuatum*.

Several rather smaller specimens are also only doubtfully placed in *K. attenuatum*. They differ from the typical *K. attenuatum* in having reduced septa which are weakly dilated peripherally and apparently extend just a short distance into the tabularium. Only one small specimen (SUP 46194) shows these features in section (Pl. 95, figs. 1, 2), together with two fragmentary etched silicified specimens (SUP 46201, 46202). Whether the reduced septa represent merely less silicification in these specimens, giving the appearance of weaker dilation of the septa, or whether the septa are genuinely thinner, is not certain and until further better-preserved material can be found, these specimens are tentatively included in *K. attenuatum*.

Of the described species of *Ketophyllum*, none is very close in structure to *K. attenuatum*. Most species have relatively short septa and the only forms with septa approaching the length typical of *K. attenuatum* are *K. tenuistriatum* (Wedekind), *K. hoegbomi* (Wedekind), and *K. intertrium* (Hall).

K. tenuistriatum (Wedekind, 1927) from the Mulde Beds (Upper Wenlock) of Gotland may be distinguished by having separation of the tabulae into groups and clearer distinction of major and minor septa. *K. hoegbomi* (Wedekind, 1927) from the Wenlock of Gotland differs in having fewer rows of dissepiments and more widely spaced

EXPLANATION OF PLATE 94

Figs. 1, 2, 5–8. *Ketophyllum attenuatum* sp. nov., ×2, Rosyth Limestone. 1, SUP 46190a, holotype, transverse section. 2, SUP 46192, paratype, longitudinal section. 5, SUP 46190b, holotype, longitudinal section. 6, SUP 46191a, paratype, transverse section. 7, SUP 46193a, paratype, transverse section. 8, SUP 46193b, paratype, longitudinal section.

Figs. 3, 4. *Ketophyllum attenuatum*? sp. nov., ×1·5, Rosyth Limestone. 3, SUP 46203b, longitudinal section. 4, SUP 46203a, transverse section.

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tabulae. Finally, *K. intertrium* (Hall 1882) from the Upper Llandovery—Wenlock of Michigan (Manistique Dolomite) and Upper Wenlock—?Lower Ludlow of Indiana–Kentucky (Louisville Limestone) has generally weaker dilation of the septa and a greater number of dissepiments, which are generally smaller and less elongate than in *K. attenuatum* (see Stumm 1965).

Genus MICTOCYSTIS Etheridge, 1908

1908 *Mictocystis* Etheridge, p. 18.
1956 ?*Mictocystis*; Hill, p. F300.
1962 ?*Mictocystis*; Soshkina *et al.*, p. 311.
1965 ?*Mictocystis*; Ivanovskiy, p. 87.

Type species. M. endophylloides Etheridge, 1908. Quarry Creek Limestone, Spring Creek, N.S.W. Upper Llandovery.

Diagnosis. Aphroid corallum with large, widely spaced tabularia set in lonsdaleoid dissepimentarium. Septa confined to tabularium and surface of dissepiments adjoining tabularium. Tabulae mainly flat, complete, often with downturned edges. Dissepiments very large, mainly elongate.

Discussion. The genus *Mictocystis* Etheridge was originally grouped with the cystiphyllids by Etheridge (1908) on the basis of its having abundant dissepimental tissue typical of members of that family. Hill (1956), however, included the genus doubtfully in the subfamily Chonophyllinae Holmes. Re-examination of the syntype material and additional specimens of *Mictocystis* has shown that the septal structure consists of lamellae based on the dissepiments adjacent to the tabularia and on the tabulae themselves. In the tabularia the septa may or may not pierce the overlying tabula in the peripheral region. Such a septal structure is typical in the subfamily Chonophyllinae.

Ivanovskiy (1965) has suggested that the genus *Evenkiella* Soshkina, 1955, may be a synonym of *Mictocystis*. However, *Evenkiella* is a cerioid form in which the septa extend much further into the dissepimentarium and are apparently not of amplexoid type (see Soshkina 1955 and Ivanovskiy 1963). *Evenkiella* is possibly a synonym of the genus *Strombodes* Schweigger.

In septal development within the tabularium and in the nature of tabulae and dissepiments, *Mictocystis* is closely similar to *Ketophyllum* Wedekind, discussed above. *Ketophyllum* is, however, a solitary form and has more strongly developed septa in the dissepimentarium.

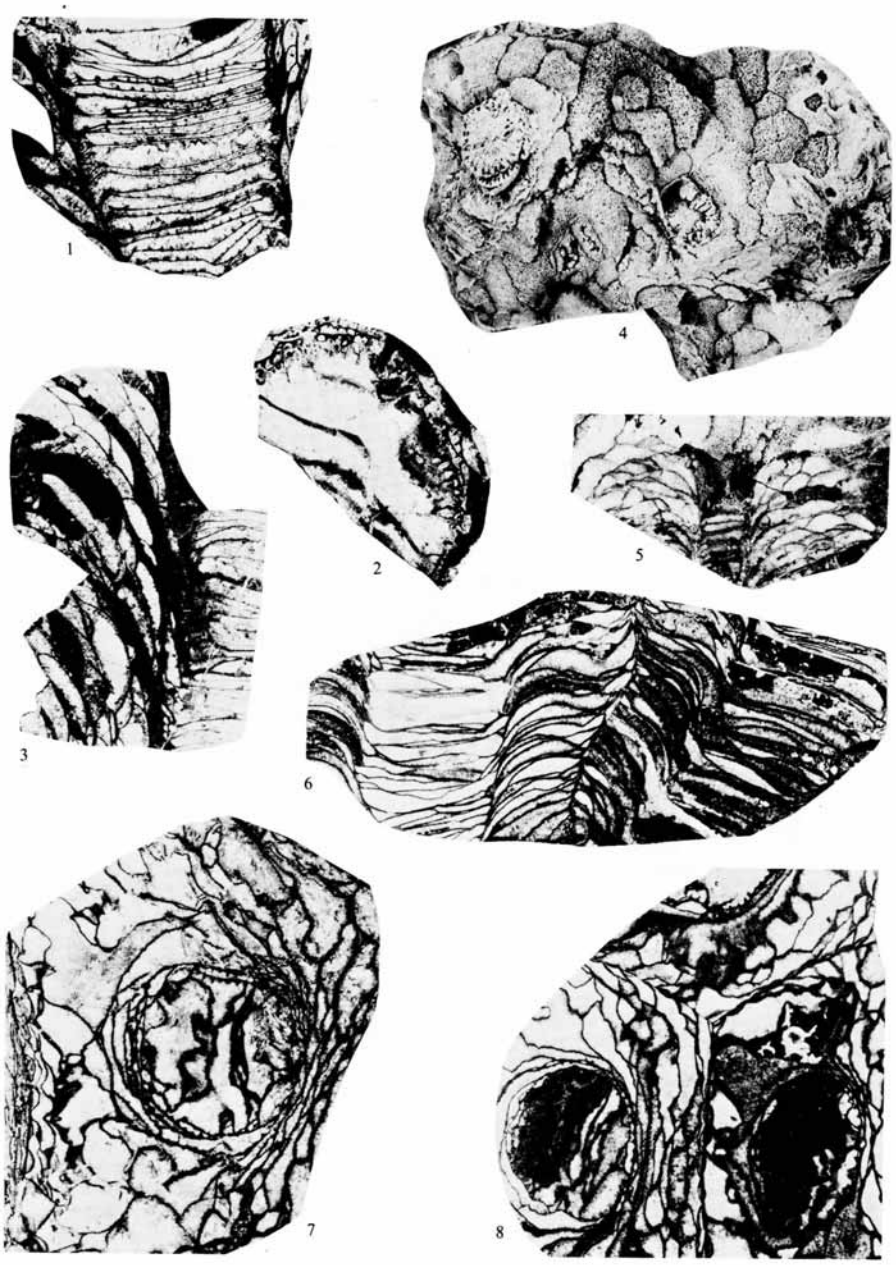
EXPLANATION OF PLATE 95

Figs. 1, 2. *Ketophyllum attenuatum*? sp. nov., × 2, Rosyth Limestone. 1, SUP 46194b, longitudinal section. 2, SUP 46194a, transverse section.

Fig. 3. *Ketophyllum attenuatum* sp. nov., Rosyth Limestone. SUP 46191b, paratype, longitudinal section, × 2.

Figs. 4, 5. *Mictocystis endophylloides* Etheridge, × 1, Quarry Creek Limestone. 4, AM.F 13616, lectotype, distal surface. 5, AM.F 13616, lectotype, weathered surface showing portion of a tabularium and adjacent dissepimentarium.

Figs. 6–8. *Yassia enormis* (Etheridge), × 1·5, limestone at escarpment north-east of Boonoo Ponds Creek, Hatton's Corner, Yass River. 6, AM 847, paralectotype, longitudinal section. 7, AM 869, paralectotype, transverse section. 8, AM 674, paralectotype, transverse section.



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Mictocystis endophylloides Etheridge, 1908

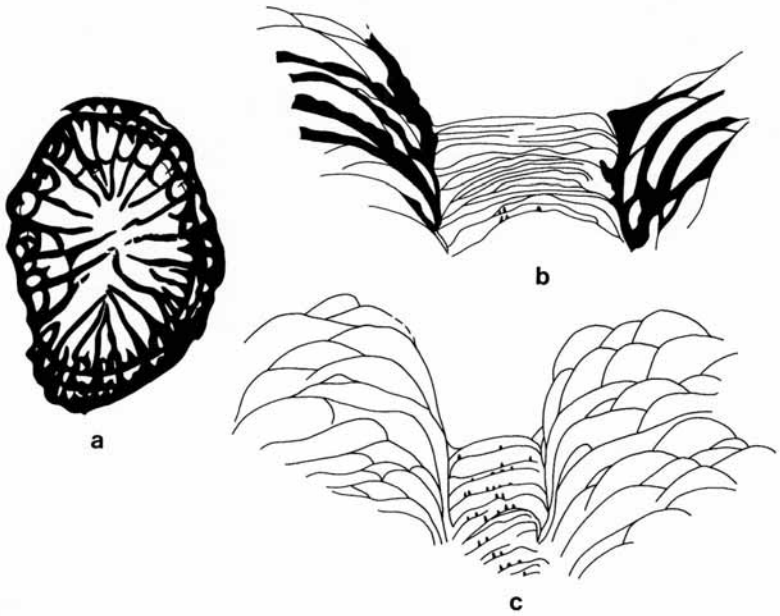
Plate 95, figs. 4, 5; text-fig. 2*a–c*

1908 *Mictocystis endophylloides* Etheridge, p. 20, pl. 4, figs. 1–4; pl. 5.
1956 *Mictocystis endophylloides*; Hill, p. F300, fig. 204, 1.

Material. Lectotype (here designated) AM.F 13616; paralectotype AM.F 13617. Additional material SUP 27154, 63256, 63272.

Distribution. Lectotype and paralectotype, Quarry Creek Limestone (Bed 'A'), Spring Creek. Additional material, Quarry Creek Limestone (Bed 'C'), Quarry Creek. Upper Llandovery.

Description. Corallum aphroid, large, with incomplete width 130 mm and height 80 mm. Spacing of tabularia in dissepimentarium ranges from 25 to 30 mm in small specimen (lectotype AM.F 13616, Etheridge 1908, pl. 4, fig. 1) to more commonly 30–50 mm, although this value varies greatly within the one colony. Calicular pits generally deep (10–15 mm, see text-fig. 2*c*). External morphological features are illustrated by Etheridge (1908, pl. 4) and herein (Pl. 95, fig. 4). Septa mainly confined



TEXT-FIG. 2. *Mictocystis endophylloides* Etheridge. *a*, SUP 63272a, transverse section of a tabularium and part of dissepimentarium, ×3; *b*, SUP 27154, longitudinal section of a tabularium and adjacent dissepimentarium, ×2; *c*, AM.F 13616, lectotype, tangential longitudinal section of a tabularium and adjacent dissepimentarium, drawn from a weathered surface (note deep calice), ×2. The surface illustrated is shown also in Plate 95, fig. 5.

to tabularia, occurring as broad, low ridges on surface of tabulae, generally not piercing overlying tabulae except near periphery of tabularium. Septa extend on to dissepiments adjacent to tabularia in some cases and are apparently lamellar, although material is mainly silicified and recrystallized and detail of septal structure is obscured. Septal number approximately 44–50, with major septa almost reaching axis and minor septa very short, approximately 0·2 of length of major septa. Septa decrease slightly in width towards axis. Tabularium diameter ranges from approximately 8 to 12 mm in lectotype (AM.F 13616, text-fig. 2*c*) to more commonly 12–15 mm. Tabulae mainly complete, flat or slightly arched, with downturned edges and average spacing 0·8–1·5 mm. They may be weakly grouped in series (text-fig. 2*b*). Dissepiments large, elongate, in gently arched series between tabularia, becoming strongly downturned at margins of tabularia. Dissepiment size variable with average of 7–12 mm in width and 2–4 mm in height. Thin coating of ?lamellar sclerenchyme present on some dissepiment surfaces although recrystallized calcite obscures this in most cases.

Remarks. No type specimens of *Mictocystis* were designated by Etheridge. From the syntype material now housed in the Australian Museum, Sydney, the specimen of *Mictocystis endophylloides* figured by Etheridge (1908, pl. 4, figs. 1–4, AM.F 13616) is here chosen as the lectotype and the other specimen illustrated by Etheridge (1908, pl. 5, AM.F 13617) is designated paralectotype. Etheridge's syntype material is almost entirely silicified and is unsuitable for thin-section study. However, additional material collected is somewhat less silicified although extensively recrystallized, and it was possible to prepare drawings from the thin sections obtained. These are illustrated in text-fig. 2*a*, *b*. The genus is at present known only from the Quarry Creek Limestone of N.S.W.

Genus YASSIA Jones, 1930

1913 *Spongophyllum*; Etheridge, p. 35 (*non* Edwards and Haime 1851).
1930 *Yassia* Jones, p. 36.
1932 *Crinophyllum* Jones, p. 61.
1940 *Yassia*; Hill, p. 409.
1963 *Yassia*; Ivanovskiy, p. 111.
1965 *Yassia*; Lavrusevich and Ivanovskiy *in* Ivanovskiy, p. 119.
1970 *Yassia*; Ivanovskiy, p. 15.
1971 *Yassia*; Lavrusevich, p. 92.
?1972 *Klamathastraea* Merriam, p. 40.

Type species. Spongophyllum enorme Etheridge, 1913. Limestone at escarpment north-east of Boonoo Ponds Creek. Hatton's Corner, Yass River, N.S.W. Ludlow.

Diagnosis. (Modified after Hill 1940, p. 409.) Cerioid or fasciculate Rugosa with septa developed weakly as low crests on dissepiments and tabulae. Tabulae typically complete, flat or sagging; dissepiments large, strongly elongate, steeply inclined towards corallite axis.

Discussion. The genus *Klamathastraea* Merriam, 1972 was described from the Gazelle Formation (Unit 2), (?Ludlow) of the Klamath Mountains, California and was considered to differ from *Yassia* by the latter having narrower tabulae and a lack of septa (Merriam 1972, p. 40). However, *Yassia* may show well-developed septa at the

tabularium–dissepimentarium boundary, as can be seen from the type species, *Y. enormis* (Etheridge 1913, pl. VII, figs. 2, 3, and herein, Pl. 95, figs. 7, 8). The septa continue as very low ridges over the dissepiments, as illustrated in external view by Etheridge (1913, pl. V), but in this region are rarely apparent in thin section. Hence there do not appear to be any significant differences between *Klamathastraea* and *Yassia*, and the two genera are most probably synonymous.

Similarities between *Yassia* and *Ketophyllum* were noted by Jones (1932). However, *Yassia* differs in its colonial growth form and weaker septal development, particularly in the tabularium. *Mictocystis* shows closer similarities to *Yassia*, but may be distinguished by its lack of corallite walls and stronger septal developments in the tabularium. It is possible that a form such as *Yassia* could have arisen from *Mictocystis* by development of corallite walls and reduction of septa, or have been derived from *Ketophyllum* by formation of colonial coralla together with reduction of septa.

Range. Upper Llandovery of the Siberian Platform; Lower Wenlock of the Siberian Platform and Tadzhikistan; Ludlow of N.S.W. and ?California.

Yassia enormis (Etheridge, 1913)

Plate 95, figs. 6–8

1913 *Spongophyllum enorme* Etheridge, p. 35, pls. IV–VII.
1930 *Yassia enormis* Jones, p. 36.
1932 *Crinophyllum enorme* Jones, p. 61, pl. IV, figs. 2, 3.
1940 *Yassia enormis*; Hill, p. 409, pl. XIII, fig. 6*a*, *b*.
1963 *Yassia enormis*; Ivanovskiy, p. 111, pl. XXXII, fig. 2.

Material. Lectotype (chosen Hill 1940) AM.F 8572. Paralectotypes AM.F 8769, 8770; thin sections AM 674, 847, 869.

Distribution. Limestone equivalent to Bowspring Limestone, escarpment north-east of Boonoo Ponds Creek, Hatton's Corner, Yass River, N.S.W. Ludlow.

Diagnosis. Cerioid *Yassia*, with septa occurring as very low ridges on dissepiments, but only weakly developed in tabularium. Tabulae mainly flat and complete.

Description. See Etheridge (1913) and Jones (1932).

Remarks. The two other described species of *Yassia* appear closely similar to *Y. enormis*. *Y. fasciculata* Lavrusevich and Ivanovskiy *in* Ivanovskiy 1965, occurs in the Upper Llandovery of the Siberian Platform and Lower Wenlock (Horizon K) of Tadzhikistan. It differs mainly in its fasciculate growth form and the tabulae appear generally to be rather more incomplete (Ivanovskiy 1965, pl. XXXI, fig. 1 and Lavrusevich 1971, pl. XXIV, fig. 2*b*). *Y. cystifera* Ivanovskiy, 1965, from the Lower Wenlock of the Siberian Platform, was subsequently considered a variety of *Y. enormis* by Ivanovskiy (1970*b*). It appears to have a narrower dissepimentarium and more incomplete tabulae than *Y. enormis* (Ivanovskiy 1965, pl. XXX, fig. 2). Furthermore, Ivanovskiy (1965, p. 120) considered septa to be entirely lacking in *Y. cystifera*.

'*Klamathastraea*' *dilleri* Merriam, 1972, appears to differ from *Y. enormis* in having smaller corallites and more strongly developed septa in the tabularium, although the

septa do not extend more than one-third the radius of the tabularium (Merriam 1972, pl. 5, figs. 1–5).

Y. enormis has been described also by Ivanovskiy (1963) from the Wenlock of the Siberian Platform.

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