26.

NEW DALEJAN (EARLY DEVONIAN) RUGOSE CORALS FROM THE BLUE FIORD FORMATION OF SOUTHWESTERN ELLESMERE ISLAND, NORTHWEST TERRITORIES

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Abstract

The family Columnariidae Nicholson, 1879, is revised, so that it comprises the subfamilies Columnariidae Nicholson, 1879, Hexagonariinae Bul'vanker, 1958, Paradisphyllinae Jell, 1969, Utaratuiinae Spasskiy, Kravtsov and Tsyganko, 1975, Spongonariinae Crickmay, 1962, and Tropidophyllinae subfam. n.

Stereophyllum** Schluter, 1889, is likely to be a synonym of **Digonophyllum** Wedekind, 1923. However, **Digonophyllum**, which is a widely used generic name, is retained on the grounds that **Stereophyllum** appears to be a nomen oblitum. **Aulacophyllum** Milne Edwards and Haime, 1850, and its probable synonym **Pinnatophyllum** Grabau, 1922, are discussed, because of similarities between them and a new genus **Thoulelasma.

***Digonophyllum primitivum confertum** subsp. n. (Family Cystiphyllidae) and **Thoulelasma loewei** gen. et sp. n. (Family Halliidae) are described from high in the **inversus** Zone in the Sor Fiord section. **Paraspongonaria delicata** gen. et sp. n. (Family Columnariidae) is described from the same horizon and locality, as well as from the overlying **serotinus** Zone near Vendom Fiord. Newly prepared type material of **Paraspongonaria sverdrupi** (Loewe, 1913) is figured from the Zlichovian (Early Devonian) Db Series of Schei (1903; 1904) in the vicinity of Goose Fiord.*

Résumé

L'auteur modifie la famille Columnariidae Nicholson, 1879, de façon à ce qu'elle comprenne les sous-familles Columnariidae Nicholson, 1879, Hexagonariinae Bul'vanker, 1958, Paradisphyllinae Jell, 1969, Utaratuiinae Spasskiy, Kravtsov et Tsyganko, 1975, Spongonariinae Crickmay, 1962 et Tropidophyllinae subfam. n.

Stereophyllum** Schluter, 1889, est probablement synonyme de **Digonophyllum** Wedekind, 1923. Toutefois, le nom générique **Digonophyllum**, très répandu, a été conservé puisque **Stereophyllum** semblerait être un **nomen oblitum**. **Aulacophyllum** Milne Edwards et Haime, 1850 et son synonyme probable, **Pinnatophyllum** Grabau, 1922, sont étudiés en raison de leur ressemblance avec le nouveau genre **Thoulelasma.

*L'auteur décrit les coraux **Digonophyllum primitivum confertum** subsp. n. (famille des Cystiphyllidae) et **Thoulelasma loewei** gen. et sp. n. (famille des Halliidae) qui proviennent des couches supérieures de la zone **d'inversus** dans la coupe du fjord Sor. Il décrit les coraux **Paraspongonaria delicata** gen. et sp. n. (famille des Columnariidae) provenant du même horizon et de la même localité et de la zone susjacente de **serotinus** près du fjord Vendom. Il considère que le matériel type nouvellement préparé de **Paraspongonaria sverdrupi** (Loewe, 1913) provient de la série Db de Schei (1903; 1904) datant du Zlichovien (Dévonien ancien); cette série se situe près du fjord Goose.*

Introduction

The Blue Fiord Formation of Sor Fiord region is of considerable importance to the Devonian coral biostratigraphy of arctic Canada. This is due partly to the richness of the coral faunas in the formation, and partly to the refined correlation that has been achieved by conodont studies between the Blue Fiord Formation and the standard Lower Devonian sequence of Czechoslovakia (Uyeno and Klapper, 1980).

Although most of the coral species that occur in the Blue Fiord Formation have not been made known, **Zonophyllum sorense, Mesophyllum ellesmerense, M. kirki, Taimyrophyllum nolani baumannense** and **Cavanophyllum uyenoi** have been described from the Zlichovian part of the formation, and **Lekanophyllum pustulosum** has been established on material from the Dalejan part of the formation (Pedder and McLean, 1982; Pedder, 1982b). The present paper adds to the Dalejan fauna of the formation by describing **Digonophyllum primitivum confertum** subsp. n., **Thoulelasma loewei** gen. et sp. n. and **Paraspongonaria delicata** gen. et sp. n.

For reasons evident in the systemmatic paleontology section, it is necessary to consider carefully three poorly known genera, **Stereophyllum, Aulacophyllum** and **Pinnatophyllum,** that are not used in the paper, because of similarities between them and junior genera that are used. It is also necessary to revise the family Columnariidae, because study of newly acquired representatives of relevant genera shows that none of the previously proposed classifications of these genera is satisfactory.

I am grateful to David Worsley, University Paleontological Museum, Oslo, for arranging the loan of material collected by Per Schei on the Second Norwegian Arctic Expedition in the "Fram", and for permission to prepare new thin sections from it. Without this help, it would not be certain that the species described by Loewe (1913) as **Cyathophyllum sverdrupi** is also a species of the new genus **Paraspongonaria.**

Systematic Paleontology

Family CYSTIPHYLLIDAE Milne Edwards and Haime, 1850
Subfamily DIGONOPHYLLINAE Wedekind, 1923

Genus **Stereophyllum** Schlüter, 1889

Stereophyllum Schlüter, 1889, p. 339 (p. 81 in reprints).
not **Stereophyllum** Grabau, 1917, p. 199 (nomen nudum).
nor **Stereophyllum** Soshkina, 1937, p. 19, 20, 88, 89 (homonym replaced by **Astrictophyllum** Spasskiy, 1971, p. 24).

Type species. **Cyathophyllum goldfussi** Milne Edwards and Haime, 1851, p. 363, Pl. 2, figs. 3, 3a. Devonian, Eifel region, Germany. This is a homonym of **Cyathophyllum goldfussi** Castelnau, 1843, p. 47, Pl. 21, fig. 2 (=upper fig. 1; there is no labelled fig. 2), an unrecognisable species, believed to be from the Onondaga Limestone, near Buffalo, New York (Bassler, 1950, p. 133). Stumm (1949, p. 20) renamed **Cyathophyllum goldfussi** Milne Edwards and Haime **Plasmophyllum eifelense**, but according to Birenheide (1964, p. 19), it is a junior subjective synonym of the lectotype of **Cyathophyllum limbatum** Quenstedt, 1879, p. 465. This lectotype was chosen by Birenheide himself, and is reposited in the Geological Museum, University of Tübingen, where it is numbered Coe 3/158/37. It has been figured by Quenstedt (1881, Pl. 158, two views designated fig. 37) and Birenheide (1964, Pl. 23, figs. 105a, b), and appears to be only the distal part of the corallum. Quenstedt recorded the species as coming from Gerolstein; Birenheide noted that, to the time of his writing, authentic in-place specimens had been found only in the Gees trilobite horizon, Ahrdorf Schichten (Eifelian), in the Gerolstein and Prüm synclines of Germany.

Remarks. For present purposes, and in the absence of any contrary evidence, the species-level systematic treatment accorded to **Cyathophyllum limbatum** Quenstedt, 1879, and **Plasmophyllum eifelense** Stumm, 1949, by Birenheide (1964, p. 19-21) is accepted. However, his generic determination, which placed these species in **Plasmophyllum** Dybowski, 1873, is rejected, because, as Weyer (1971) pointed out, he and others wrongly interpreted **Plasmophyllum**, by regarding **Cyathophyllum goldfussi** Milne Edwards and Haime, 1851, and not **Cystiphyllum brevilamellatum** McCoy, 1850, as its type species.

In the light of Birenheide's revision, **Cyathophyllum limbatum** Quenstedt is a recognisable species, especially on the bases of Birenheide's (1964, Pl. 21, figs. 99a-101c; Pl. 22, figs. 102a-103; Pl. 23, figs. 105a-106; Pl. 24, figs. 113-116) and Ma's (1956, Pl. 63, figs. 1-3, 5a-c) figures. Clearly, Quenstedt's species is neither **Cyathophyllum** nor **Plasmophyllum** (see Hill, 1981, p. 255, 297 for these genera), but is **Stereophyllum** Schlüter, 1889, and is also probably **Digonophyllum** Wedekind, 1923, as that genus was defined by McLean (1976b, p. 14, 15).

Stereophyllum Schlüter was proposed conditionally, but like other names erected before 1961, is not invalid for this reason [International Code of Zoological Nomenclature, Articles 15, 17(8)]. On the other hand, it seems probable that it is technically a nomen oblitum and should not be used without direction from the International Commission on Zoological Nomenclature [I.C.Z.N., Article 23(b)(ii)].

Arguments for regarding **Stereophyllum** Schlüter as a nomen oblitum are: 1) Fifty-one years elapsed between publication of the name in 1889 and subsequent mention of it in primary zoological literature by Lang, Smith and Thomas (1940, p. 123), who, incidentally, regarded it as an objective synonym of **Plasmophyllum**. 2) Wedekind, his students, and Ma (1937) all had occasion to use **Stereophyllum** within the fifty year period after 1889, but did not do so. 3) Two coral workers, Grabau (1917) and Soshkina (1937) proposed homonyms of **Stereophyllum** for other Devonian corals during the same period.

Genus **Digonophyllum** Wedekind, 1923

Stereophyllum Schlüter, 1889, p. 339 (p. 81 in reprints) (nomen oblitum-see above).
Digonophyllum Wedekind, 1923, p. 27.

Type species. **Digonophyllum schulzi** Wedekind, 1923, p. 27, Fig. 1. Nohner Schichten (early Eifelian); Nohn, Hillesheim Syncline, Eifel region, Germany. This species is regarded (Birenheide, 1964, p. 45) as a junior subjective synonym of **Actinocystis pseudoorthoceras** Schulz, 1883, p. 240, 241 (84, 85), Pl. 22, figs. 3, 4. The holotype of **Digonophyllum pseudoorthoceras** is also from the Nohner Schichten, near Nohn.

Diagnosis. Solitary digonophyllinid corals with septal crests that are dilated to contiguity in early stages. In late stages of most species, septal dilation is confined to the periaxial region. Septal apparatus bilaterally symmetrical about the cardinal/counter plane. Discrete septal carinae absent or rare.

Remarks. The present concept of **Digonophyllum** is very close to McLean's (1976b, p. 14-18), but is slightly broader in that it admits to the genus corals like **Pseudozonophyllum primitivum** Kravtsov, in which most of the subcalicular part of the corallum is filled with skeleton. Development of horizontal skeletal elements is much retarded in such forms. Similar discoid species, such as **Combophyllum multiradiatum** Meek, **Palaeocyclus kirbyi** Meek and **Glossophyllum clebroseptatum** Kravstov, and others that are discoidal in early stages, for example **Glossophyllum discoideum** Soshkina, continue to be excluded from **Digonophyllum** even though there is no appropriate genus for them.

Digonophyllum primitivum (Kravtsov, 1963)

Pseudozonophyllum primitivum Kravtsov, 1963, p. 29, 30, Pl. 8, figs. 2-4v; Pl. 9, figs. 1a-3b; Pl. 10, figs. 1a, b.

Pseudozonophyllum primitivum Kravtsov; Kravstov in Besprozvannykh et al., 1975, p. 99, 100, Pl. 39, figs. 2a-v.

Remarks. The holotype and figured paratypes originally were said to have come from unit 4 of the Early Devonian Tareya Suite, 40 to 45 km above the mouth of Tareya River, central Taimyr, U.S.S.R. In terms of the stratigraphic scheme proposed for the area by Cherkesova et al. (1968), they are from the Yunkhodsk Beds. Lane (1974, p. 721) interpreted conodonts that Kuz'min (1967) had described from the Yunkhodsk Beds, as including **Icriodus taimyricus** and "in all probability" **Polygnathus dehiscens.** These species indicate an early Zlichovian age for the Yunkhodsk Beds.

The genus **Pseudozonophyllum** and its three syntypic species - **P. halli, P. logani** and **P. clarkei** - were established by Wedekind (1924, p. 25-29) on lower Middle Devonian material from the Eifel area of Germany. **Pseudozonophyllum halli,** which became the type species of the genus by designation of Lang, Smith and Thomas (1940, p. 110), and **P. logani** have identical type stratum and locality in the lower Nohn Schichten, in a railway cutting near Ahütte in the Hillesheim Syncline (Birenheide, 1968, p. 15, 18), and are likely to be conspecific. Birenheide (1964, p. 21) also considered them to be junior subjective synonyms of the species named **Cyathophyllum antilimbatum** by Quenstedt (1879, p. 467; 1881, Pl. 158, two views designated fig. 40). **Pseudozonophyllum clarkei** is possibly another synonym of **Cyathophyllum antilimbatum,** but the precise stratigraphic and geographic origin of the unfigured type specimen are unknown, and the specimen is lost (Birenheide, 1968, p. 5). On the basis of Wedekind's (1924, figs. 28-33) figures of **Pseudozonophyllum halli** and **P. logani,** and Birenheide's (1964, Pl. 4, figs. 5-7; Pl. 5, fig. 16; Pl. 17, figs. 82, 83; Pl. 18, figs. 84, 85) illustrations of **Cyathophyllum antilimbatum,** the

type species of **Pseudozonophyllum** appears to have relatively few septal spines that are not fused appreciably in adult stages to form lamellar septa. As such, it is a species of **Cystiphylloides** Chapman (1893, p. 46), as that genus was interpreted by McLean (1976b, p. 3-10) and by Pedder and McLean (1982, p. 63-65). In contrast, Kravtsov's (1963, Pl. 8, fig. 4b) excellent illustration of a transverse section through the distal part of the holotype of **Pseudozonophyllum primitivum** shows abundant and well formed, although largely contiguous, septal crests.

Digonophyllum primitivum confertum subsp. n.

Plate 26.1, figures 1-5

Type series. Holotype, GSC 71183, GSC loc. C-12472. Paratype, GSC 71184, GSC loc. C-12472.

Diagnosis. Subspecies of **Digonophyllum primitivum** Kravstov distinguished by its smaller size (maximum diameter <20 mm in **D. primitivum confertum**; >30 mm in **D. primitivum primitivum**), narrower septal crests (about 60 major septa at 17 mm diameter in **D. primitivum confertum**; 54 major septa at 32 mm diameter in **D. primitivum primitivum**) and almost totally suppressed horizontal skeletal elements.

Description. Corallum ceratoid to trochoid, with maximum known length and diameter of about 30 mm and 18 mm, respectively. Exterior smooth except for extremely faint septal furrows and interseptal ridges. Growth rings subdued; rejuvenescences not evident on exterior surface of corallum. Calice about as deep as it is wide, with rounded, or rounded to subconical base.

Septal apparatus is so strongly developed that it excludes horizontal skeletal elements from all but the most distal part of the corallum. Peripherally and periaxially it comprises laterally contiguous monacanthate septal crests, arranged pinnately in the cardinal quadrants, and radially in the counter quadrants. Adaxially, the septal crests normally fuse with septal crust which fills the axial region of the corallum. Locally, below rejuvenescences of the skeletal apparatus, septal crust may be absent; figure 3 depicts a transverse section cut from such a level. The cardinal septum is situated on the convex side of the corallum. In transverse sections, minor septal crests appear as triangular wedges, confined to the peripheral region of the corallum. Major septal crests are of variable length, but even the shortest are considerably longer than the minor septal crests. There are about 52 major septal crests at a diameter of 9 mm, and about 60 at maturity (16-20 mm diameter).

Some specimens have neither dissepiments nor tabulae; others have a few small, peripherally situated dissepiments in the distal part of the corallum.

Remarks. The distinctive form of the new subspecies is not likely to be confused with either the nominate subspecies, or any other described species.

The name of the subspecies is the Latin adjective, **confertus**, meaning compressed, dense, crowded, etc., a reference to the septal morphology of the subspecies.

Occurrence. Known only from very high beds of the **inversus** Zone (Dalejan) of the Blue Fiord Formation, Sor Fiord section, southwestern Ellesmere Island.

Family HALLIIDAE Chapman, 1893
Subfamily HALLIINAE Chapman, 1893

Remarks. The question as to whether the Halliinae would be better assigned to the Plasmophyllidae Dybowski (1873, p. 340) is not given serious consideration here, because it cannot be properly answered without revision of several genera based on Silurian material from Europe.

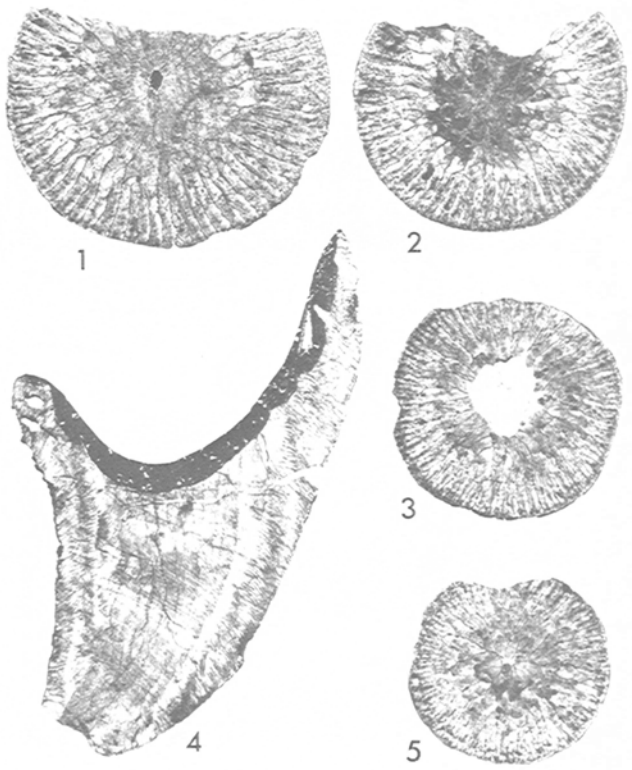


Plate 26.1

Figures 1-5. **Digonophyllum primitivum confertum** subsp. n.

1-3, 5. Holotype, GSC 71183, series of transverse thin sections, X3; GSC loc. C-12472.
4. Paratype, GSC 71184, longitudinal thin section, X3; GSC loc. C-12472.

Genus **Aulacophyllum** Milne Edwards and Haime, 1850

Aulacophyllum Milne Edwards and Haime, 1850, p. lxvii.
?**Pinnatophyllum** Grabau, 1917, p. 199 (nomen nudum).
?**Pinnatophyllum** Grabau, 1922, p. 13, 66.
?**Pinnatophyllum** Grabau ms. Bassett, 1935, p. 444.

Type species of **Aulacophyllum**. **Caninia sulcata** d'Orbigny, 1850, p. 105. Devonian; "Etats-Unis, failles de l'Ohio (Cincinnati), lac Erié". A lectotype for this species was chosen when Thevenin (1906, p. 196) wrote "ils (Milne Edwards and Haime) en ont décrit et figuré le type (Polyp. foss. des terr. paléoz., 1851, p. 355, Pl. VI, fig. 2)". Thevenin (1906, Pl. 21, figs. 29, 30) published beautiful figures of the exterior of this specimen and in the following year (Thevenin 1907, p. 89) stated that the specimen came from "l'Ohio". It is believed to have come from the Eifelian part of the Jeffersonville Limestone at the Falls of the Ohio, Louisville, Kentucky, or from bluffs on the north side of the Falls of the Ohio, which are in Indiana.

Type species of **Pinnatophyllum**. **Cyathophyllum scyphus**; authorship not specified, presumed to be Rominger, 1877, p. 103, Pl. 35, two right hand specimens of lower tier. Devonian, lower beds of Hamilton Group; Long Lake, north of Alpena, Michigan. According to Stumm (1951, card 70; 1963, p. 148), these specimens are from the lower part of the Genshaw Formation (Givetian). The upper specimen on Rominger's plate has been refigured, and chosen as lectotype, by Stumm (1963, Pl. 3, figs. 6, 7).

Diagnosis. Inadequately known ceratoid to trochoid halliid corals with long narrow cardinal fossula on convex side of corallum, and weakly to moderately well developed alar fossulae. Cardinal septum short. Septa in cardinal quadrants pinnately arranged; septa in counter quadrants radially arranged and, on the whole, shorter than those of the cardinal quadrants. Type species has few dissepiments and short minor septa. It is assumed that the septa are dilated in early stages and that during ontogeny the dilation decreases from periphery to axis, first in counter quadrants and later in cardinal quadrants (Stumm, 1963, p. 140, 141). It is also assumed that incomplete tabulae form broadly arched tabularial floors (Hill, 1981, p. 259). Fine septal structure is not known, but Thevenin's (1906, Pl. 21, fig. 29) excellent figure of the exterior of the lectotype of **Aulacophyllum sulcatum** shows no sign of either carinae, vepreculae, or denticles on the septa.

Remarks. Topotypic specimens of **Aulacophyllum sulcatum** are heavily silicified and interior structures have not been made known. Any interpretation of the genus must be tentative until this situation is rectified. The provisional interpretation adopted here is based largely on Stumm's (1965, p. 29) monography of the type species, with the reservation that specimens identified doubtfully by Stewart (1938, p. 31, Pl. 5, figs. 4-6) as **Odontophyllum convergens** (Hall), and accepted into the synonymy of **Aulacophyllum sulcatum** by Stumm, are likely to be specimens of **Hallia insignis** Milne Edwards and Haime.

The lectotype and paralectotype of **Pinnatophyllum scyphus** are unprepared silicified specimens. Figures of the lectotype show a narrow cardinal fossula, situated on the convex side of the corallum, enclosing a thin, moderately short, cardinal septum. Arrangement of the septa and development of alar fossulae are the same as in **Aulacophyllum sulcatum.**

Transverse and longitudinal sections of specimens, identified as **Aulacophyllum scyphus** (Rominger), have been figured from the Ferron Point Formation (also Givetian) of Alpena County, Michigan, as well as from the lower Genshaw Formation. Those from the Ferron Point Formation (Stumm, 1963, Pl. 8, figs. 2-5) appear to match the lectotype, whereas those from the Genshaw Formation (Stumm, 1963, Pl. 7, fig. 1; Pl. 8, figs. 6, 7) do not. This is surprising, because the latter come from roadside ditches at the south end of Long Lake, which must be close to the type locality. Transverse sections of the Ferron Point material reveal distinct pinnate symmetry and greater adaxial septal dilation in the cardinal quadrants than in the counter quadrants. The only longitudinal section of the Ferron Point material shows elevated tabularial surfaces. In contrast, Stumm's figures of Genshaw material display little evidence of either fossulae or septal dilation. Furthermore, tabularial surfaces are distinctly depressed in the distal part of the figured longitudinal section.

Grabau did not figure or formally describe **Pinnatophyllum** in 1922, but his brief statement on page 66 satisfies articles 11, 12 and 16 of the International Code of Zoological Nomenclature, which are the only requirements necessary to validate a genus-group name published before 1931. This is a point of note, because Bassett (1935, p. 444-446) published excerpts from a manuscript by Grabau, that purport to establish **Pinnatophyllum** as a new genus, based on **P. dundeense** Grabau ms. from the Eifelian Dundee Limestone of Michigan. The assumption, made here, that **Pinnatophyllum** Grabau, 1922, and **Pinnatophyllum** Grabau in Bassett, 1935, are conceptually the same, despite differences in type species, is supported by the inclusion of a form called **Pinnatophyllum scyphus** from the Traverse Group, which is presumed to be **Cyathaophyllum scyphus** Rominger, 1877, in **Pinnatophyllum** Grabau in Bassett, 1935.

Bassett's (1935, Pl. 34, figs. 1-4) illustrations include good figures of transverse and longitudinal thin sections of **Pinnatophyllum dundeense.** The transverse section reveals prominent cardinal and alar fossulae, a cardinal septum that is short but longer than the adjacent major septa, and strong dilation of all septa in the cardinal quadrants. It also shows the septa of the cardinal quadrants to be pinnate about the cardinal/counter plane, and those of the counter quadrants to be radial in arrangement. The longitudinal section shows a narrow dissepimentarium with numerous small dissepiments, and a flat to slightly elevated tabularium. In the proximal region of the corallite, septa of both quadrants appear to be strongly dilated.

Genus **Thoulelasma** nov.

Type species. **Thoulelasma loewei** sp. n.

Diagnosis. Trochoid to ceratoid halliid corals with a moderately long cardinal fossula situated on the convex side of the corallum. Alar fossulae not developed. Septa of cardinal quadrants pinnate about a cardinal septum that is shorter than the neighboring major septa on either side of it. Septa radially arranged in counter quadrants. In early stages, septa inside the outermost row of dissepiments are dilated by coating with apparently structureless stereome; typically, the dilation is sufficient to bring adjacent septa in lateral contact with each other. In subsequent ontogeny, septal dilation is lost progressively in the usual halliid manner, that is, it reduces first in the counter quadrants. Trabeculae are fine and apparently monacanthate. Immediately inside the periphery, trabeculae make angles of more than 70° with the horizontal. This angle decreases progressively toward the axis, as far as the inner dissepimentarium, and then increases abruptly, before decreasing again, in the area of transition from dissepimentarium to tabularium. In late stages, some fibre fascicles project from the sides of the unthickened septa to form very short vepreculae. At first, the dissepimentarium typically comprises a single row of somewhat rhomboid shaped dissepiments; as septal dilation decreases, many rows of normal dissepiments are added. At maturity, tabularial surfaces are more or less flat, except for the depression in the cardinal fossula.

Remarks. Unprepared, but freely weathered silicified specimens of **Aulacophyllum** suggest that this essentially Eastern North Americas Realm genus does not have the same vepreculae-producing trabecular structure as **Thoulelasma.** In any event, the genera are distinguished by the absence of alar fossulae in **Thoulelasma.**

Moravophyllum, erected by Kettnerová (1932, p. 27-30, 79-81) for Givetian species from Czechoslovakia, is similar to **Thoulelasma,** but, in adult stages, has much finer septa that show no tendency to become vepreculate.

Bethanyphyllum was proposed by Stumm (1949, p. 18) before the interior morphology of the type species, which is **Cyathophyllum robustum** Hall (1877, Pl. 22, figs. 1-9, 14), was known. Since Stumm's proposal, thin sections of the type lot of **Bethanyphyllum robustum** have been prepared. W.A. Oliver, Jr. has kindly made available photographs of these and other sectioned specimens in his collection from the Givetian Centerfield Formation of New York. On the basis of these photographs, **Bethanyphyllum** is distinguished from **Thoulelasma** in having much more pronounced vepreculae and a periaxially elevated tabularium that forms a calical boss.

Houershanophyllum Yu and Liao in Kong and Huang (1978, p. 54) is based on **H. involutum** Yu and Liao in Kong and Huang (1978, p. 54, Pl. 17, figs. 1a-f) from the Eifelian Longdongshui Formation of Guizhou Province, China. Septal microstructure is not visible in published figures of the type species, and in the translation of the Kong and Huang (1978)

available to the present author, it is said, only, that the septa are "composed of feathery fascicles". The Canadian species most resembling **H. involutum** is **Zaphrentis mcfarlanei** Meek (1867, p. 83, Pl. 11, figs. 2-2b) from the Eifelian Hume Formation of northwestern District of Mackenzie. This species has coarse monacanthate trabeculae that are directed inwards from the periphery at a low angle to the horizontal. For the purpose of the present paper, this is assumed to be the essential trabecular morphology of **Houershanophyllum.** Other differences between **Houershanophyllum involutum** and **H. mcfarlanei,** and **Thoulelasma loewei,** are that the septa in the first two species are commonly, adaxially, both dilated and rotated somewhat, at maturity.

Oliver and Pedder's (1979) record of **Glossophyllum** in the Zlichovian (Dalejan Stage was not available when the work was prepared) of their area 1, which is western and arctic Canada and Alaska combined, was based on the initial identification of **Thoulelasma loewei** as a species of **Glossophyllum.** Birenheide (1978, p. 82-84) considered **Glossophyllum** Wedekind (1924, p. 76, 77) to be a junior synonym of **Ceratophyllum** Gurich (1896, p. 163). Both genera are based on inadequately known type species and cannot be used with certainty at present (Pedder, 1982a, p. 562-564). Provided Birenheide's interpretation of the genera is correct, it can be seen from his illustrations (Birenheide, 1978, Pl. 11) that **Thoulelasma** has a different early ontogeny, longer septa at maturity and a flatter tabularium.

The generic name is derived from the Greek words, **thoule,** meaning farthest north, and **elasma,** a plate. The elision is deliberate.

Thoulelasma loewei gen. et sp. n.

Plate 26.1, figures 6-10; Plate 26.1, figures 11-20

Glossophyllum; Oliver and Pedder, 1979, p. 240 (in part; column 1 occurrence only).

Glossophyllum; Pedder, 1982a, p. 564 (in part; Ellesmere Island specimens only).

Glossophyllum sp. nov.; Pedder and McLean, 1982, p. 80.

Type series. Holotype, GSC 68839, GSC loc. C-12473. Paratypes, GSC 68840-68843, GSC loc. C-12473; GSC 68844, GSC loc. C-12472.

Diagnosis. Only known species of **Thoulelasma.**

Description. Corallum solitary, mostly ceratoid, less commonly trochoid. Length of largest specimen (GSC 68842) before preparation, 9.5 cm measured over the exterior of the most convex part of the corallum, 7.5 cm measured from proximal tip to the centre of the plane enclosed by the lip of the calice. Greatest diameter 3.9 cm. Adult calice 2.0 to 2.5 cm deep and bell-shaped. Unabraided exterior surfaces of the corallum bear narrow, shallow septal furrows, broad, flat interseptal ridges and fine growth rings. Typically, reductions of diameter due to rejuvenescences are small.

A distinct cardinal fossula, that normally extends a little more than one half of the distance from the periphery to the axis of the coral, is situated slightly to one side of the line of greatest convex curvature of the corallum. In the cardinal quadrants, septa are pinnately arranged about the cardinal/counter plane. In the counter quadrants the arrangement is radial. Despite these differences, and because the cardinal fossula does not reach the axis, alar fossulae are either not present, or are extremely indistinct. Major septa are long, and many extend to the axial region, especially on the upper surfaces of certain tabularial surfaces. The cardinal septum, although prominent, is shorter than neighboring major septa. The counter septum is normally longer than the major septa next to it. In early stages of development, minor septa are mostly about one third to two fifths as long as the major septa; in later ontogeny, their length increases to about half that of the major septa. Minor septa are commonly much reduced, or absent, in the cardinal fossula, especially in early stages. The earliest pattern of septal development is not known. At a diameter of 8 to 9 mm there are about 26 major septa, and at 12 mm diameter there are about 30 major septa. At 15 mm diameter the number of major septa has increased to about 33. At 20 and 25 mm diameter the numbers of major septa are about 40 and 45, respectively. In these early stages, some or all of the septa inside the outermost dissepiments are dilated. Commonly the dilation is sufficient to fill all but the most peripheral region of the corallum. If the degree of septal dilation is less, it is invariably greater in the cardinal than in the counter quadrants. Much of the early dilation of the septa is caused by apparently structureless stereome. Where adjacent septa are not contiguous, stereome extends over dissepimentarial surfaces between neighboring septa. As the diameter increases beyond 25 mm, septal dilation ceases to be more pronounced in the cardinal quadrants, and in both pairs of quadrants is confined to the tabularium. At 30 mm diameter there are 48 or 49 major septa. The full adult count of 50 to 54 major septa is attained at a diameter of about 35 mm. At maturity, there is virtually no septal dilation, even in the tabularium.

Fine septal structure is partly obscured by recrystallization. Trabeculae are apparently finely monacanthate, and are unusual, in that some fibre fascicles project from the plane of the septum, where there is no stereome, to produce incipient vepreculae. Because they are so short, the vepreculae are seen best in longitudinal sections, such as the one shown in figure 10. Next to the periphery, the trabeculae are vertical, or nearly so. Adaxially they become progressively more inwardly inclined in the dissepimentarium, but return to a more erect attitude in the outer tabularium.

A single row of small rhomboid shaped dissepiments appears as the corallum attains a diameter of 3 to 5 mm. Globular, inwardly inclined dissepiments are added as the corallum enlarges, so that, at maturity, the dissepimentarium typically comprises 15 to 20 rows of dissepiments. Some of the inner dissepiments are elongate, although most are small. The transition from dissepimentarium to tabularium is not well defined. Tabulae are vesicular, sinuous as viewed in longitudinal section, or flat; only very rarely are they complete. Tabularial surfaces tend to be elevated around the margin of the tabularium, and are either flat or somewhat depressed axially and periaxially.

Remarks. **Thoulelasma loewei** bears some resemblance to a form described as **Aulacophyllum sulcatum** d'Orbigny by Lavrusevich (1971b, p. 48, 49, Pl. 10, figs. 1a-3b), from the Lochkovian Kshtut Horizon of Tyan' Shan, as well as to the species **Desmophyllum densatoseptatum** Goryanov in Bul'vanker et al. (1968, p. 30, Pl. 12, figs. 1a-v), from the Pragian Talbulak Horizon of the same region, and **Aulacophyllum trizonatum** Hill (1942, p. 160, Pl. 3, figs. 10-12), from Dalejan levels in the Sulcor Limestone of New South Wales.

Aulacophyllum sulcatum of Lavrusevich (1971b) and **Desmophyllum densatoseptatum** are likely to be conspecific. They are larger (diameter as much as 6.0 cm in **A. sulcatum**) than **Thoulelasma loewei,** and have a relatively narrower dissepimentarium with no more than ten rows of dissepiments. Their cardinal fossula is longer and more profoundly affects the tabularial morphology. In both forms, counter septa are weakly pinnate about a shortened counter septum. Fine septal structure has not been figured or described in any of the Tyan' Shan material, but does not appear to be vepreculate.

Aulacophyllum trizonatum is also larger (greatest observed diameter 5.0 cm) than **Thoulelasma loewei,** and has a narrower dissepimentarium, comprising less than ten rows of dissepiments. Unlike **T. loewei,** its counter septum is much shorter than the major septa on either side of it, and its tabularium is strongly elevated to form a prominent calicular boss. The septal microstructure of **A. trizonatum** has not yet been described, but is dissimilar from that of **T. loewei,** in that it does not seem to produce vepreculae.

The trivial name of the new species is a patronym dedicated to Stephan Loewe, in recognition of his work on Per Schei's Devonian corals from Ellesmere Island.

Occurrence. Known only from very high beds of the **inversus** Zone (Dalejan) of the Blue Fiord Formation, Sor Fiord section, southwestern Ellesmere Island.

Family COLUMNARIIDAE Nicholson, 1879

Remarks. Classifications by Pickett (1967), Jell (1969), Birenheide (1978) and Hill (1981) of **Disphyllum** and related Devonian genera differ remarkably. Large collections, not available to previous authors, of several key genera, including **Planetophyllum, Utaratuia, Zelolasma** and **Tropidophyllum,** have been studied in connection with the present work. These studies suggest that none of the classifications alluded to above is entirely satisfactory. Appraisal of all the family- and genus-group names involved is neither possible, nor within the scope of this article. Nevertheless, seven measures regarding family-level classification are adopted, which lead to a new classification of the Columnariidae.

These measures are: 1) The family Columnariidae, which in Birenheide's (1978) work was demoted to subfamily rank within the Cyathophyllidae, is retained at full family rank. 2) The family Disphyllidae, which in Hill's (1981) classification stands apart from the Columnariidae, is merged in the Columnariidae. 3) The subfamily Spongonariinae, which was apparently overlooked by Birenheide (1978) and was regarded by Hill (1981) as a subfamily of the Disphyllidae, is transferred to the Columnariidae. 4) The family Utaratuiidae, which was proposed on the mistaken belief that its type genus is a colonial cystimorph (see Pedder and McLean, 1982) is relegated to subfamily rank within the Columnariidae. 5) A new subfamily is proposed for **Spongonaria**-like genera that have arched dissepiments or dissepimentarial surfaces. Genera referred to this subfamily had been assigned, previously, to the Phillipsastreidae by Pickett (1967), to the Disphyllinae of the Phillipsastraeidae by Jell (1969), to the Zaphrentinae and Neocolumnariinae of the Cyathophyllidae by Birenheide (1978), and to the Spongonariinae of the Disphyllidae by Hill (1981). 6) The subfamily Paradisphyllinae, which was assigned to the Phillipsastraeidae by Jell (1969), was synonymised with the Cyathophyllinae in the Cyathophyllidae by Birenheide (1978), and classified in the Disphyllidae by Hill (1981), is removed to the Columnariidae. 7) The Marisastridae, which was demoted to a subfamily of the Phillipsastraeidae by Jell (1969), merged in the Columnariinae of the Cyathophyllidae by Birenheide (1978), and placed under the Hexagonariinae of the Disphyllidae by Hill (1981), is synonymised with the Hexagonariinae, and tentatively retained as a subfamily of the Columnariidae. Jell (1969) placed the type genus of the Hexagonariidae in the Disphyllinae of the Phillipsastraeidae.

The subfamily classification of the Columnariidae that emerges from these measures is as follows.

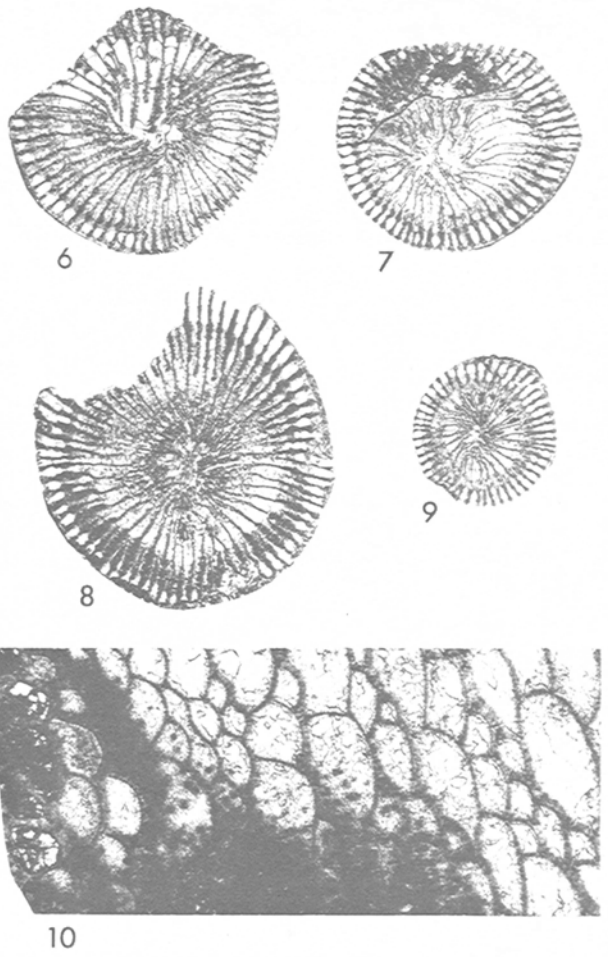


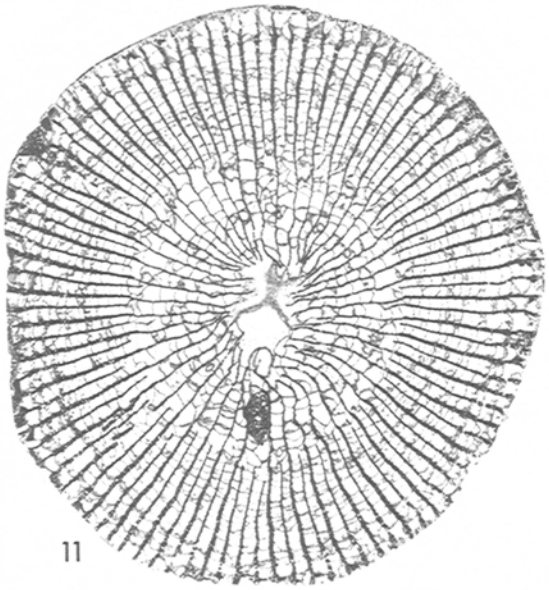
Plate 26.1 (cont.)

Figures 6-10. **Thoulelasma loewei** gen. et sp. n.

6, 7, 9. Paratype, GSC 68843, series of transverse thin sections of a specimen with early rejuvenescence, X2; GSC loc. C-12473.
8. Paratype, GSC 68842, transverse thin section, X2; GSC loc. C-12473.
10. Paratype, GSC 68841, part of longitudinal thin section showing incipient vepreculae, X10; GSC loc. C-12473.

Figures 11-20. **Thoulelasma loewei** gen. et sp. n.

11, 14, 16. Paratype, GSC 68841, two transverse and a longitudinal thin section, X2; GSC loc. C-12473.
12, 17. Holotype, GSC 68839, transverse and longitudinal thin sections, X2; GSC loc. C-12473.
13, 20. Paratype, GSC 68842, longitudinal and transverse thin sections, X2; GSC loc. C-12473.
15. Paratype, GSC 68840, transverse thin section, X2; GSC loc. C-12473.
18, 19. Paratype, GSC 68844, longitudinal and transverse thin sections, X2: GSC loc. C-12472.



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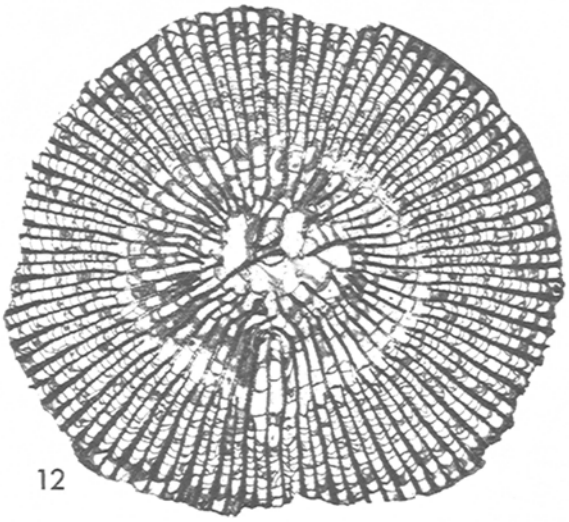

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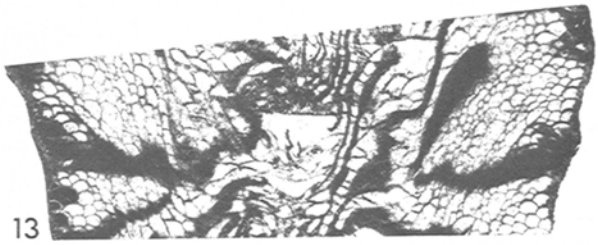

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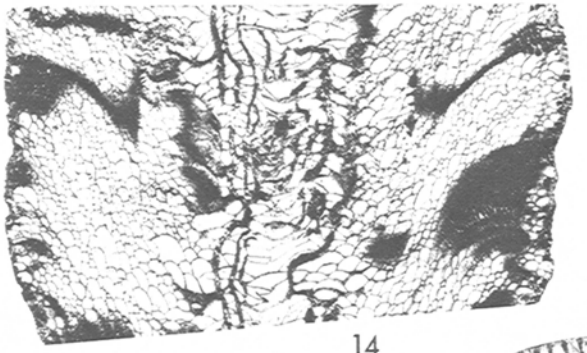

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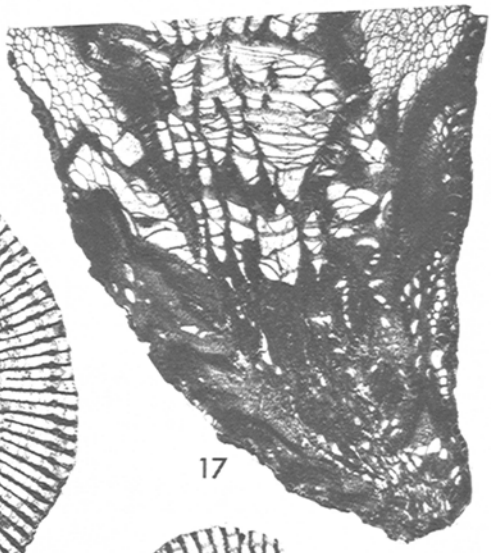

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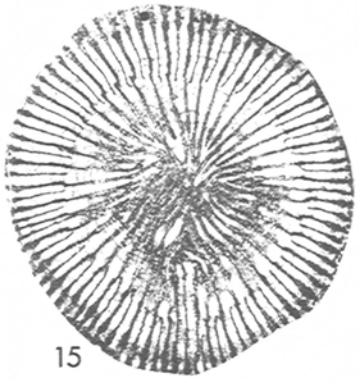

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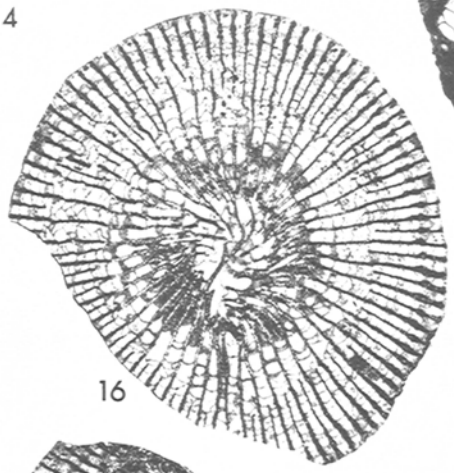

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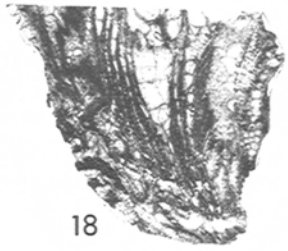

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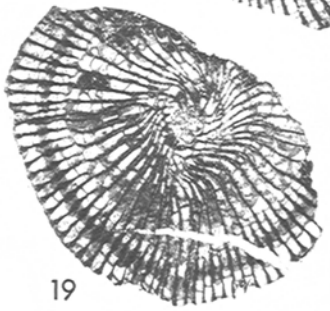

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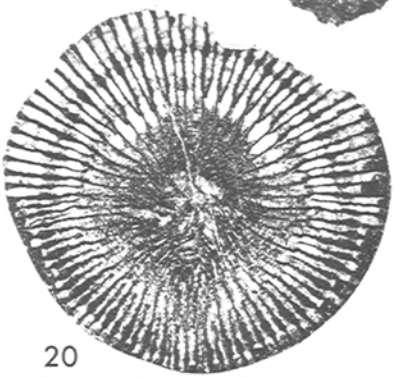

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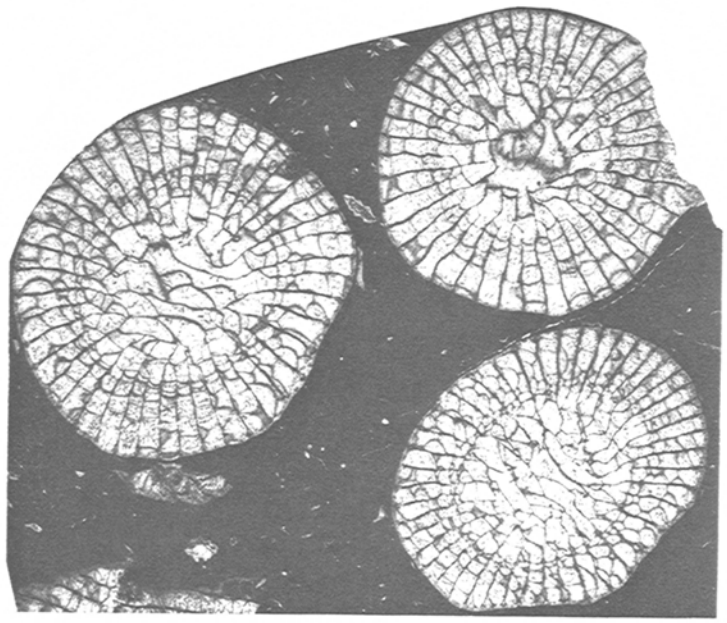

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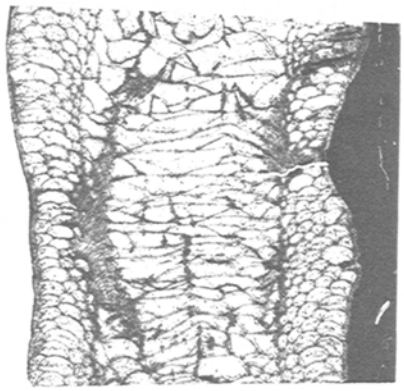

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Plate 26.1 (cont.)

Figures 21, 22. **Paraspongonaria sverdrupi** (Loewe) gen. n.

Paratype?-previously unprepared specimen, Paleontological Museum, Oslo, A 12097, transverse and longitudinal thin sections, X3; Db Series of Schei (1903; 1904), now believed to be a Zlichovian part of the Blue Fiord Formation; Vestre Borgen, Goose Fiord, southwestern Ellesmere Island. Collected by Per Schei, geologist on the second Norwegian Polar Expedition, 1898-1902.

Subfamily COLUMNARIINAE Nicholson, 1879

Columnariadae Nicholson, 1879, p. 17, 18.
Disphyllidae Hill, 1939, p. 224.
Columnariidae Hill, 1939, p. 240 (correction of original spelling).

Diagnosis. Columnariidae with well developed, lightly carinate major septa, and small dissepiments forming flat to inwardly sloping dissepimentarial surfaces.

Assigned genera. **Columnaria** Goldfuss, **Disphyllum** deFromentel, **Pseudocampophyllum** Ivanovskiy, **Disphyllia** He.

Remarks. The species **Spongophyllum pax**, named by Smith (1945, p. 56, 57, Pl. 11, figs. 6a-c) on the basis of a single boulder specimen from Peace River, British Columbia, and the very similar form, **Columnaria columbia**, described by Norford (1962, p. 28, 29, Pl. 10, figs. 1, 2; Pl. 11, fig. 1; Pl. 12, fig. 1) from the late Llandovery Nonda Formation (Norford et al., 1966, p. 512) of the same region, have elongate dissepiments, and are separated from definite species of **Columnaria** by a considerable time gap. It is possible that they are phylogenetically closer to the seemingly aberrant, Middle Silurian, entelophyllid genus **Strephophyllum** Lavrusevich (1971a, p. 77), than they are to **Columnaria.**

Subfamily HEXAGONARIINAE Bul'vanker, 1958

Hexagonariidae Bul'vanker, 1958, p. 178.
Marisastridae Różkowska, 1965, p. 261, 262.

Diagnosis. Tentatively recognized subfamily of the Columnariidae with long, strongly carinate, slightly fusiform septa, and numerous small dissepiments that form gently arched dissepimentarial surfaces.

Assigned genera. **Hexagonaria** Gürich (includes **Marisastrum** Różkowska), **Hapolothecia** Frech, **Spinophyllum** Wedekind.

Subfamily PARADISPHYLLINAE Jell, 1969

Paradisphyllinae Jell, 1969, p. 67.

Diagnosis. Columnariidae with variably carinate and fusiforme septa, numerous small dissepiments forming gently arched to prominently everted dissepimentarial surfaces, and a tabularium that is commonly differentiated into an inner series of elevated plates, and an outer series of downturned and depressed plates.

Assigned genera. **Paradisphyllum** Strusz, **Radiastraea** Stumm (possibly a polyphyletic genus as currently interpreted) **Tipheophyllum** Hill, **Gurievskiella** Zheltonogova, **Martinophyllum** Jell and Pedder, **Ivdelephyllum** Spasskiy, **Xystrigona** Yu, **Xystriphylloides** Yu, Liao and Deng, **Xiangzhouphyllum** Yu and Kuang.

Subfamily UTARATUIINAE Spasskiy, Kravtsov and Tsyganko, 1975 [1]

Utaratuiidae Spasskiy, Kravtsov and Tsyganko, 1975, p. 171.

Diagnosis. Columnariidae with considerably to greatly reduced major septa and moderately large dissepiments forming a moderately wide and inwardly sloping dissepimentarium.

Assigned genera. **Utaratuia** Crickmay, ?**Breviseptophyllum** Ermakova.

Subfamily TROPIDOPHYLLINAE nov.

Diagnosis. Columnariidae with adaxially withdrawn and variably carinate septa formed of subparallel to weakly divergent monacanths. Adaxial terminations of septa are commonly dilated and spinose; short, isolated septal spines are also commonly developed on tabularial surfaces. Dissepimentarium slightly to moderately everted at some levels, even in forms having only one row of dissepiments. Tabulae broad, commonly quite, or almost, complete.

Assigned genera. **Tropidophyllum** Pedder (1971, p. 374-376) (type genus), **Zelolasma** Pedder, **Variseptophyllum** Kong.

Remarks. Corals interpreted as primitive species of **Zelolasma** are known from rocks of Ludlow age in New South Wales and the western slopes of the southern Urals, and from Middle or Upper Silurian beds in the Kolyma River regions of northeast Soviet Union (references given by McLean, 1976a, p. 187, 188). These would be the oldest known members of the family Columnariidae, if the British Columbian species, currently referred to **Columnaria**, are members of the Entelophyllidae, as discussed in the remarks concerning **Columnaria**.

Subfamily SPONGONARIINAE Crickmay, 1962

Spongonariinae Crickmay, 1962, p. 2.

Diagnosis. Columnariidae with septa that are thin, notably in the outer dissepimentarium, and vary considerably in length. If present in the tabularium, septa there are typically undulant, or largely reduced to discrete, ribbon-like fragments. Septa are also commonly undulant in the inner dissepimentarium, and in one genus (**Exilifrons**) bear mostly weak, zig-zag carinae. Dissepiments large relative to size of corallite, forming inwardly sloping to flat, or only slightly arched, dissepimentarial surfaces.

Assigned genera. **Spongonaria** Crickmay, **Planetophyllum** Crickmay, **Exlifrons** Crickmay (includes **Pinyonastraea** Merriam), **Paraspongonaria** gen. n.

Remarks. Crickmay proposed the Spongonariinae as a subfamily of the Silurian family Acervulariidae, and diagnosed it simply as "acervulariids with diminished septa". The proposal was not supported by discussion of any kind, nor was indication given as to whether any genus, other then the newly erected **Spongonaria**, was to be included in the subfamily.

Subsequently, the family-group name was abandoned by its author (Crickmay, 1968, p. 1), and has been overlooked or disregarded by most other workers, exceptions being Hill (1981, p. 276-280), who regarded it as a subfamily of the Disphyllidae, and Pedder and McLean (1982, p. 76), who placed it in the Cyathophyllidae, used in a broad sense.

Systematic treatment of the type genus has also varied considerably since it was first erected. Latypov (in Besprozvannykh et al., 1975, p. 42) is the only worker to have both accepted it as a valid genus and retained it in its original family. Jell (1969, p. 70, misspelled **Spongaria**) regarded it as a doubtful representative of the Phillipsastraeidae, broadly interpreted. Birenheide (1978, p. 90) questionably synonymized it with **Disphyllum** in the subfamily Columnariinae and family Cyathophyllidae, broad sense. Kong and Huang (1978, p. 61, 62) recognized it as a valid genus in the family Columnariidae, but included in it a form, identified as **Spongonaria parallexa** (Glinski), that seems certain to be a columnariinid.

Genus **Paraspongonaria** nov.

New genus 34; Oliver and Pedder, 1979, p. 242.

Type species. **Paraspongonaria delicata** sp. n.

Diagnosis. Phaceloid to locally subcerioid genus of spongonariinid corals with adaxial ribbon-like septal fragments and a narrow dissepimentarium of two or more rows of dissepiments.

Description. Corallum phaceloid; corallites cylindrical, locally in contact, although the growth form is never cerioid. Budding marginarial and nonparricidal.

Outer wall thin, but continuous. Septa radially arranged, smooth and thin. Trabeculae, if present, exceedingly slender. Major septa lamellar in the dissepimentarium and the outer region of the tabularium, reduced to ribbon-like fragments adaxially. Minor septa lamellar in the dissepimentarium, mostly absent from the tabularium, represented locally there by rare ribbon-like fragments.

Dissepimentarium narrow. Outer dissepiments moderate size, flat lying, or only slightly inwardly inclined; inner dissepiments smaller and more steeply inclined. Tabularium well differentiated from the dissepimentarium, comprises peripheral tabellae, and axial and periaxial tabulae.

Remarks. **Paraspongonaria** is closely allied to **Spongonaria** Crickmay (1962, p. 2) and probably also to **Planetophyllum** Crickmay (1960, p. 4). The first of these genera is typified by **Spongonaria filicata** Crickmay (1962, p. 2, 3, Pl. 1, figs. 1, 2; Pl. 3, figs. 6, 7), whose type horizon is known now to be in the Zlichovian/Dalejan Landry Formation of the Mackenzie Mountains, northwestern District of Mackenzie. The type and only named species of the second genus is **Planetophyllum planetum** Crickmay (1960, p. 4, Pl. 1, figs. 1-5) from the Zlichovian/Dalejan Fitzgerald Formation of northeastern Alberta. Differences between these genera and **Paraspongonaria** are that **Spongonaria** is cerioid, and **Planetophyllum** is solitary, lacks septal fragments and has a discontinuous dissepimentarium, typically comprising only a single row of dissepiments.

In addition to the type species, **Cyathophyllum sverdrupi** Loewe (1913, p. 11, Pl. 1, fig. 3; Pl. 2, figs. 4a, b) from Schei's (1903; 1904) Db Series (now considered to be Zlichovian, Blue Fiord Formation) of the Goose Fiord region of southwestern Ellesmere Island, is referred to the new genus. It is refigured in Plate 26.1, figures 21 and 22 of the present work.

The name **Paraspongonaria** is compounded from the Greek prefix **para-**, meaning close to, and the genus name **Spongonaria**.

Paraspongonaria delicata sp. n.

Plate 26.1, figures 23-30

Phaceloid species of **Spongonaria**; Pedder and McLean, 1982, p. 59.

Spongonaria(?) sp. nov. (phaceloid form); Pedder and McLean, 1982, p. 80.

Type series. Holotype, GSC 68648, GSC loc. C-12473. Paratype, GSC 68649, GSC loc. C-76823.

Diagnosis. Species of **Paraspongonaria** in which adult corallites have diameters of 8.5 to 10.0 mm, 16x2 to 20x2 septa, abundant septal fragments, and a narrow dissepimentarium, mostly comprising two or three rows of dissepiments.

Description. Corallum large, consisting of many free and loosely attached, long cylindrical corallites, produced by nonparricidal, marginarial budding. Corallites normally produce only one offset at a time; new corallites rapidly enlarge to their full adult diameter of 8.5 to 10.0 mm. Adult calice about 5 mm deep, with steep sides and a broad, low calical boss. Exteriors of corallites bear fine growth rings. Septal furrows and interseptal ridges are not visible on most corallites. Where they are present, the septal furrows are finer than the growth rings, and the interseptal ridges are flat.

The outer wall is consistently only 0.05 to 0.25 mm thick. Apart from some dilation at the periphery, the septa, which are radially arranged and number 16x2 to 20x2 in

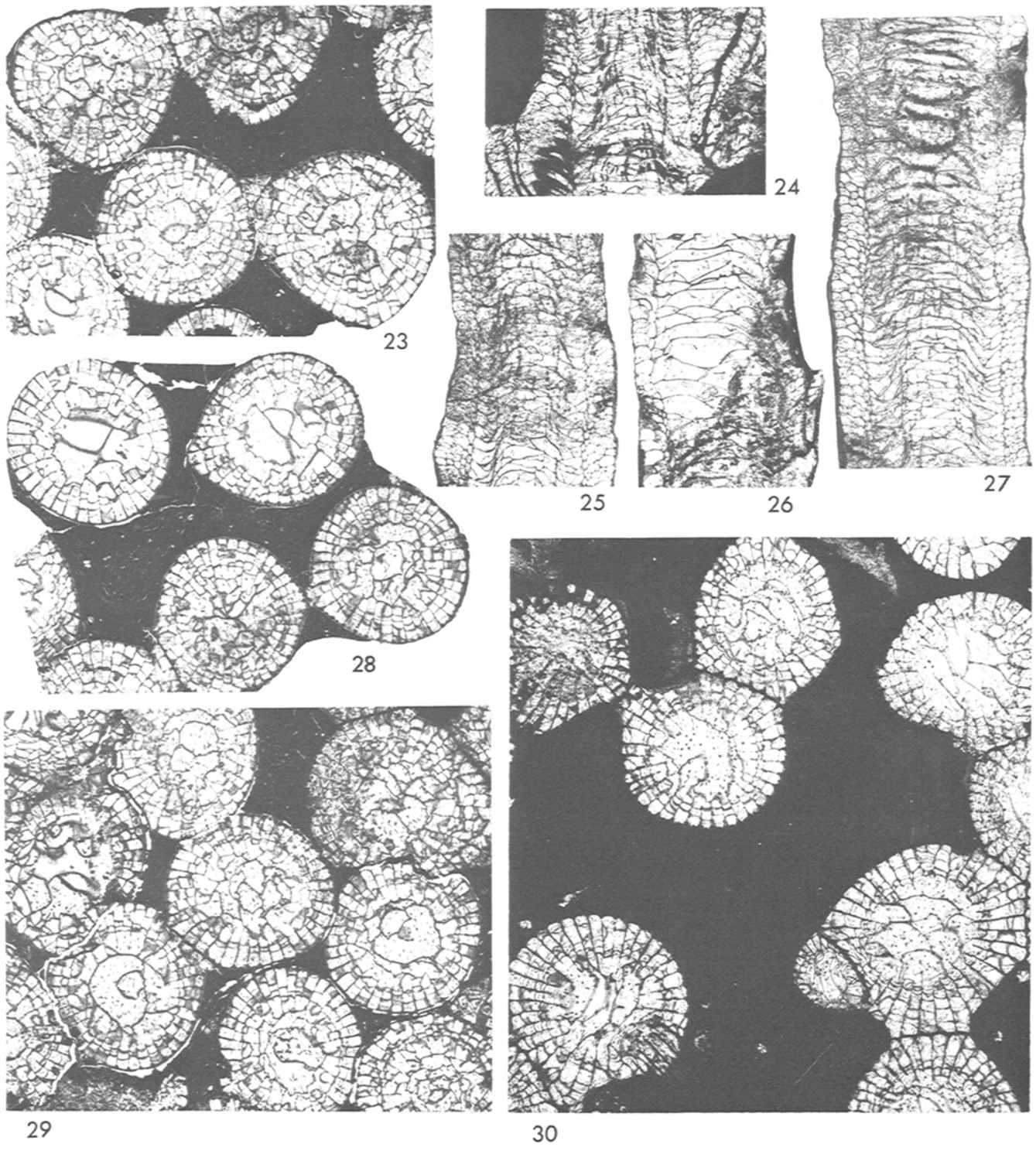

Plate 26.1 (cont.)

Figures 23-30. **Paraspongonaria delicata** gen. et sp. n.

23, 25-29. Holotype, GSC 68648, three transverse and three longitudinal thin sections, X3; GSC loc. C-12473.
24, 30. Paratype, GSC 68649, longitudinal and transverse thin sections, X3; GSC loc. C-76823.

mature corallites, are extremely thin and lack carinae. Most major and minor septa are continuous lamellae in the dissepimentarium; a few are withdrawn from the periphery, or have gaps in them. Minor septa typically only just penetrate the tabularium. The lamellar parts of the major septa are a little longer than the minor septa. Most of the ribbon-like septal fragments in the tabularium are remnants of major septa. The longest septal remnants pierce ten or more tabularial surfaces. Third order septa, represented by low ridges, occur in some corallites. Fine septal structure is not well preserved in the type series. Trabeculae, if present, are extremely fine.

Dissepiments appear early in the development of an offset, and in fully grown corallites, are generally arranged in two or three rows. Locally, this number is reduced to one, or increased to four, rarely as many as five rows. Outer dissepiments are flatter and larger than the innermost ones, which may be very small and steeply inclined towards the axis. Diameter of adult tabularium normally between 7 and 8 mm. Tabularia and dissepimentaria are clearly differentiated from each other. The predominantly incomplete tabulae form broadly elevated tabularial surfaces with sharply rounded peripheral shoulders.

Remarks. **Paraspongonaria sverdrupi** is a similar, slightly older Zlichovian species. It differs from **P. delicata** in being larger (corallite diameter as much as 14.5 mm), having more septa (as many as 22x2). Furthermore, the septa are less fragmented.

The trivial name is the Latin adjective, **delicatus**, meaning dainty, delicate, etc., and refers to the fine skeletal structure of the coral.

Occurrence. **Serotinus** and possibly the topmost **inversus** Zones (Dalejan), Blue Fiord Formation, Sor Fiord and Vendom Fiord regions of southern Ellesmere Island.

Locality Register

GSC loc. C-12472. Blue Fiord Formation, 905.9-908.0 m above base of section, 154.6-157.7 m below top of formation; Dalejan (incoming of **Polygnathus serotinus** 915.9 m above base of section). Sor Fiord section, southwestern Ellesmere Island, District of Franklin; base of section 77°17'12"N latitude, 85°07'00" W longitude; top of section 77°15'48"N latitude, 85°03'30"W longitude. Collected by A.E.H. Pedder, 1971. **Favosites** sp. cf. **F. goldfussi** sensu Jell and Hill (1970) infested with **Streptindytes** sp., **Digonophyllum primitivum confertum** Pedder, **Thoulelasma loewei** Pedder, biaxial crinoid ossicles.

GSC loc. C-12473. Blue Fiord Formation, 911.6-914.0 m above base of section, 148.6-151.0 m below top of formation; Dalejan (incoming of **Polygnathus serotinus** 915.9 m above base of section). Same section as above., Collected by A.E.H. Pedder, 1971. **Stellarispongia aspera** Rigby, **Favosites** sp., **Mariusilites** sp., **Lekanophyllum pustulosum** Pedder and McLean, **Thoulelasma loewei** Pedder, **Paraspongonaria delicata** Pedder, **Warrenella franklini praefranklini** Brice transverse form, **Ozarkodina** sp., **Pelekysgnathus** sp. nov., single axis and biaxial crinoid ossicles [conodonts (GSC loc. C-12474) collected and identified by Gilbert Klapper from 0.3 m above base of C-12473].

GSC loc. C-76823 and C-76831 (two numbers assigned to same collection). Blue Fiord Formation, 311 m above base of upper siltstone and carbonate member, 58 m below top of upper siltstone and carbonate member (i.e. 58 m below top of formation and base of Strathcona Fiord Formation); Dalejan, **serotinus** Zone. Northwest side of Vendom Fiord, 6.3 km from mouth, southern Ellesmere Island, District of Franklin; 77°32'30"N latitude, 83°45'30"W longitude. Collected by R.F. Roblesky, 1977. **Favosites** sp., **Alveolites** sp., **Roemeripora** sp., **Paraspongonaria delicata** Pedder, **Athyrhynchus sverdrupi** (Meyer), **Atrypa** sp., **Warrenella** sp., **Orthonychia** sp., ostracode and trilobite fragments, single axis and biaxial crinoid ossicles.

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