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CORALS AND STROMATOPOROIDS FROM THE ORDOVICIAN AND SILURIAN OF KRONPRINS CHRISTIAN LAND, NORTHEAST GREENLAND

BY

COLIN T. SCRUTTON

WITH 2 FIGURES AND 10 PLATES

KØBENHAVN
C. A. REITZELS FORLAG
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Abstract

Corals and stromatoporoids are described from the Centrum Formation, Drømmebjerg Formation and the boulder conglomerate at the base of the Profilfjeldet Formation in the Lower Palaeozoic sequence at the southern end of Kronprins Christian Land, northeast Greenland. The coral faunas strongly suggest an Upper Ordovician (Cincinnatian) age for the upper half of the Centrum Formation. The Drømmebjerg Formation has brachiopods in common with the Offley Island Formation of northwest Greenland and is therefore considered to be, at least in part, of Upper Llandovery age. Lower and Middle Llandovery sediments may be missing. Corals from the boulder conglomerate at the base of the Profilfjeldet Formation suggest that limestone deposition may have persisted into the early Wenlock. In the systematic section, two new tabulate coral species are named – *Saffordophyllum troedssoni* and *Paleofavosites cowiei*. The collections contain representatives of two genera of stromatoporoids, eight genera of rugose corals, eight genera of tabulate corals and two genera of heliolitids. Specific North American and Eurasian elements can be recognised in the faunas.

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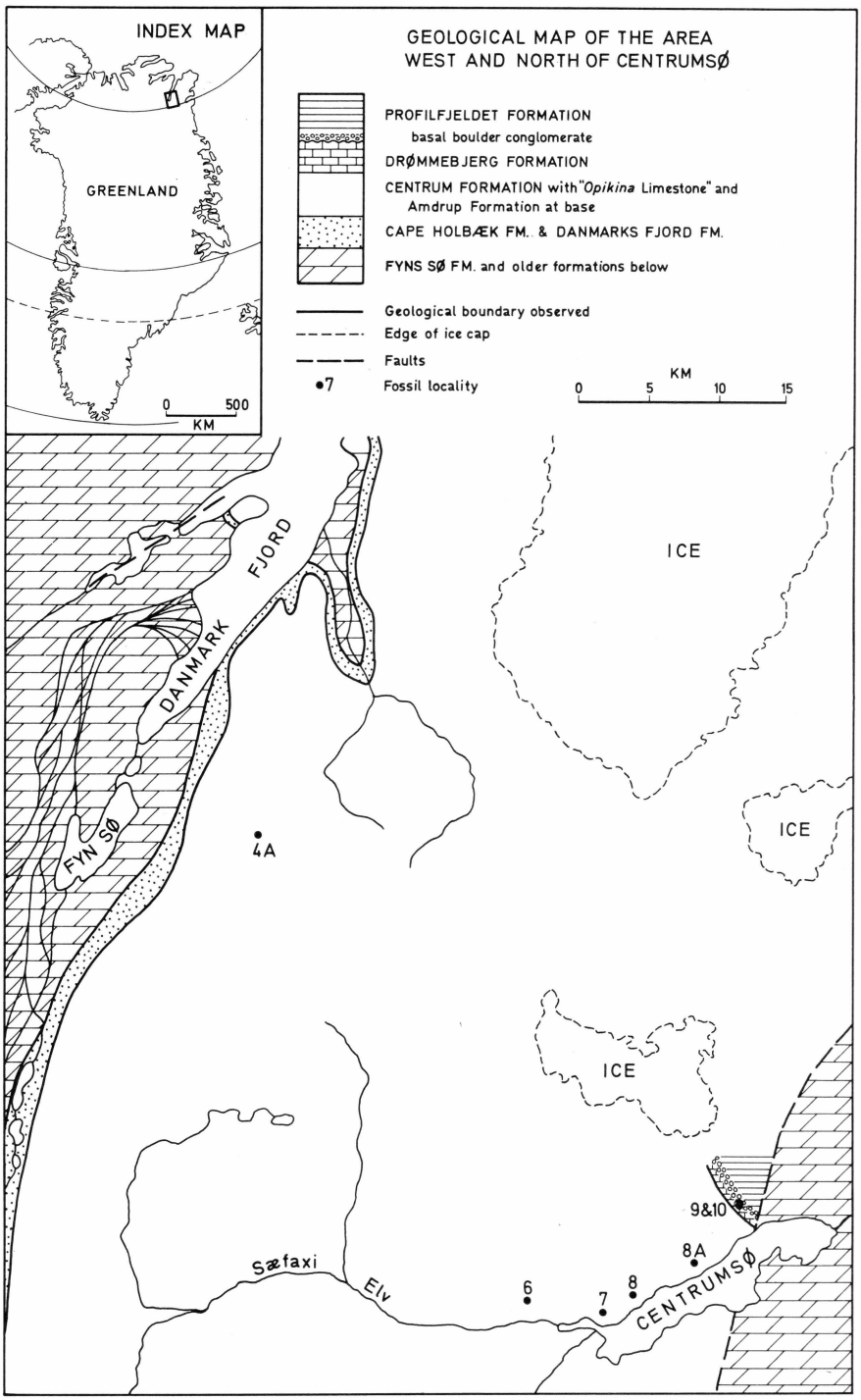

Fig. 1. Geological map of the area west and north of Centrumsø, Kronprins Christian Land, showing sample locations. The area enlarged is outlined on the index map.

INTRODUCTION

This paper describes a small collection of corals and stromatoporoids from Ordovician and Silurian limestones outcropping between Danmark Fjord and Centrumsø at the southern end of Kronprins Christian Land, northeast Greenland (Fig. 1). The material is part of a collection made by JOHN COWIE and PETER ADAMS in 1952 and 1953 when members of Danish expeditions to East Greenland under the leadership of Dr. LAUGE KOCH. Preliminary indentifications of some of the palaeontological material appeared in a report of their work by ADAMS & COWIE (1953).

The bulk of the coral material and the stromatoporoids come from the Centrum Formation of Ordovician age. In addition, a few specimens each are available from the overlying Drømmebjerg Formation and a boulder conglomerate on the eroded surface of this limestone at the base of the Profilfjeldet Formation (see Fig. 2). Both of these horizons are dated Silurian. LANE (1972) has recently redescribed trilobites from the Silurian part of this sequence. One important aspect of the coral faunas described here is that they strongly indicate an Upper Ordovician age for the upper part of the Centrum Formation which had previously been assigned to the Silurian.

Two previous papers describe important coral faunas from Greenland. These are by TROEDSSON (1928) on Ordovician corals and POULSEN (1941) on Silurian corals, both from northwestern Greenland. Several species described by TROEDSSON have been identified in the present fauna. There has been some uncertainty as to the date of publication of TROEDSSON's coral paper but SØREN FLORIS has confirmed that copies of it were available in 1928.

The material described here is housed in the Mineralogisk Museum, Copenhagen.

STRATIGRAPHY

The Lower Palaeozoic stratigraphy of northeast Greenland is outlined by ADAMS & COWIE (1953) and FRÄNKL (1954, 1955), and is summarised by COWIE (1961, p. 164). Additional observations on the Cambrian and Lower Ordovician part of the succession are made by COWIE (1971, p. 365 *et seq.*). Thicknesses quoted for the various formations are approximations throughout and may be modified by future work.

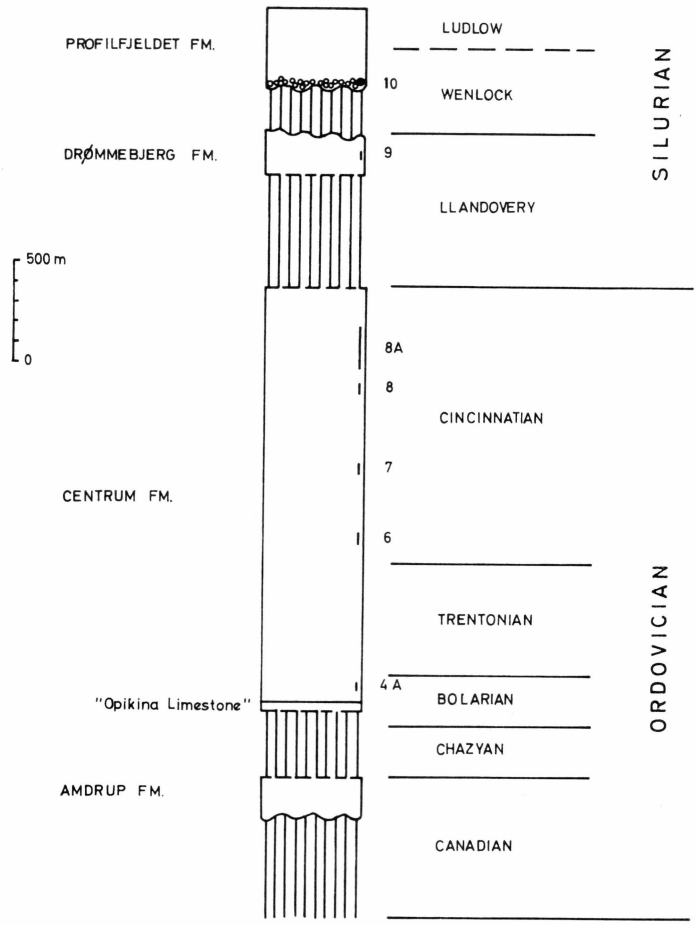

Fig. 2. The Ordovician and Silurian succession for the southern part of Kronprins Christian Land. The approximate stratigraphic horizon sampled at each locality is indicated by a vertical bar.

The lower units in the sequence have proved virtually unfossiliferous so far and they are dated by lithological correlation and structural evidence. The limestones and dolomites of the Danmarks Fjord Formation (10 m), originally the basal 10 m of the Centrum Limestone of ADAMS & COWIE (1953, p. 13), are correlated with the lithologically similar Lower Cambrian Brønlund Fjord Formation of Peary Land (COWIE, 1961, p. 165) and rest unconformably on the Cape Holbæk Formation (135 m). The sandstones of the latter contain *Skolithos* and this formation is also provisionally assigned to the Lower Cambrian. The Cape Holbæk Formation rests on the stromatolitic dolomites of the Fyns Sø Formation (324 m) with the possibility of a slight intervening break in the Danmark Fjord region, although towards the east this junction becomes a clear

unconformity. The Fyns Sø Formation and the conformably underlying Campanuladal Formation (250 m), consisting of 150 m. of sandstones and shales succeeded by limestones, are both provisionally placed in the Lower Cambrian on the basis of correlations with northwestern Greenland and Ellesmere Island (Cowie, 1971, pp. 368, 378). Dolerite and porphyrite dykes in the underlying Precambrian Norsemandal Formation do not penetrate higher beds.

A considerable stratigraphic break separates these lower units from the overlying fossiliferous limestones and dolomites of the Amdrup Formation (190 m). This formation was set up by Cowie (1971, p. 366) for 240 m of the lower Centrum Limestone of Adams & Cowie (1953, p. 13, localities 1 to 3), above the basal 10 m now separated off as the Danmarks Fjord Formation. In this form, however, the Amdrup Formation included a lower 190 m yielding Upper Canadian faunas (localities 1 and 2) and an upper 50 m with brachiopods and trilobites indicating a Blackriverian age (locality 3). No Chazyan faunas are recorded. Because of this faunal hiatus it is now proposed to limit the Amdrup Formation to the basal 190 m of this sequence and to designate a new formation for the upper 50 m, here informally called the "*Opikina* Limestone" (Dr. J. W. Cowie, *in litt.* 1973).

The very thick Centrum Formation (2050 m), consisting of limestones and dolomites, rests conformably on the "*Opikina* Limestone". The lowest fossiliferous horizon, 50 m above the base, yields a cephalopod (the record of *Calapoecia* cf. *borealis* has not been confirmed) indicating a Blackriverian to Lower Trentonian age (Adams & Cowie, 1953, pp. 13,20) and about 20 m higher than this a single coral also indicates a Blackriverian age. There is then a vertical gap of some 700 m which has yet to yield fossils. The major part of the coral faunas described in this paper comes from the upper half of the Centrum Formation, between 800 m and approximately 1750 m above the base. No other macrofossils have yet been collected from this interval (except from sample 1511, see below) but bryozoans and the fragments of various molluscs occur in the limestone matrix containing the corals. The original determinations of the corals indicated a Silurian (Niagaran) age for this interval (Adams & Cowie, 1953, pp. 12, 13, 21; Cowie, 1961, p. 165) with the possibility of a non-sequence cutting out Upper Ordovician to Lower Silurian levels in the middle of the Centrum Formation. The present work, however, shows these determinations to have been seriously incorrect. The corals of the upper 1000 m or so of the Centrum Formation are of Upper Ordovician aspect and there seems to be no need to postulate a major break within this part of the sequence.

A problem is posed by sample 1511 which is recorded as being collected 100 m below the top of the Centrum Formation. Lane (1972)

has described trilobites from this sample identical with elements in the fauna from the Drømmebjerg Formation, and which are therefore likely to be of Upper Llandovery age (see below). Such an age is difficult to reconcile with the evidence of the coral faunas unless there is a stratigraphic break approximately 100 to 200 m below the top of the Centrum Formation, or the age of sample 1511 or its loction is incorrect. This problem needs to be investigated by further fieldwork and for the moment no account of this sample is taken in the stratigraphic column (Fig. 2).

The coral faunas compare most naturally with those of northern Greenland, Arctic and North America and are thus interpreted in terms of North American stratigraphy. One particular problem that affects the present work is the age of the Red River Formation in North America. According to TROEDSSON (1928, p. 156) the bulk of his corals came from below the trilobite zone in the *Halysites* Limestone of the Cape Calhoun Formation, that is from horizons yielding a fauna of Red River affinities (FLOWER, 1961, p. 17). FLOWER (*op. cit.*) goes on to discuss the problems of dating the Cape Calhoun Formation consequent upon the lack of clear stratigraphical provenances for TROEDSSON's faunas. Because of this there must remain some doubt as to the precise ages of the corals TROEDSSON describes.

In North America, comparisons with the corals from the Centrum Formation are found generally in faunas dated as either Red River or Richmondian in age. There are some workers who have regarded the Red River Formation to be of Richmondian age but various correlations have been suggested ranging between this and a Middle Ordovician age. The controversy has been much discussed. Recent opinion, however, seems to accept a pre-Richmondian, Cincinnatian age for the Red River Formation (NORFORD *et al.*, 1970, tab XI–2) and on this basis the upper half of the Centrum Formation can be dated Cincinnatian. According to WHITTINGTON & WILLIAMS (1964, tab. 1) the Cincinnatian is equivalent to the uppermost Caradoc and Ashgill Series of the British and the Harju Series (stages E to F) of the Baltic areas respectively.

The top 200 m of the Centrum Limestone of ADAMS & COWIE (1953, p. 12) has been separated off as the Drømmebjerg Formation (FRÄNKL, 1955, p. 22; COWIE, 1961, p. 164). A rich trilobite – brachiopod fauna collected about midway through this limestone was originally considered to indicate a Niagaran age, possibly middle or late Clintonian (= late Llandovery to Wenlock), by ADAMS & COWIE (1953, p. 21). LANE (1972, p. 336) has recently described the trilobites from the Drømmebjerg Formation but the fauna proved not to be of great value stratigraphically; he considered it not inconsistent with a Wenlock age. Corals are rare from this limestone and likewise do not contribute significantly to the determination of its age. The brachiopods, however, are nearly all recorded

in addition from the Offley Island Formation of northwestern Greenland (see ADAMS & COWIE, 1953, p. 20 *et seq.*). This formation has recently been dated Upper Llandovery by NORFORD (1972, p. 19) and a similar age seems most likely for the Drømmebjerg Formation. According to LANE (pers. comm.) the trilobite evidence would not conflict with this.

If an Upper Llandovery age is correct for at least the upper 100 m or so of the Drømmebjerg Formation, then it seems reasonable to suspect that some of the earlier Llandovery must be cut out. It is unlikely that the whole of the Lower and Middle Llandovery could be represented by the basal 100 m of these limestones.

The Drømmebjerg Formation is overlain by the shales of the Profilfjeldet Formation, approximately 400 m thick. At the base of these shales is a boulder conglomerate composed of blocks of the underlying limestones which have yielded trilobites and corals. The trilobites are much the same as those from the Drømmebjerg Formation as would be expected and do not indicate a precise age (LANE, 1972). The corals are not abundant but suggest on rather weak evidence an early Wenlock age for the limestone boulders. Thus deposition of the Drømmebjerg Formation may have persisted into the Wenlock although this cannot be considered as established on the present evidence. The interval represented by the erosion surface at the base of the Profilfjeldet Formation appears to be relatively short as STRACHAN (*in* LANE, 1972, p. 336) has identified Upper Wenlock graptolites from 50 m above the base of the shales. The shales themselves probably extend into the Ludlow but there is no direct evidence as yet to support this.

With the revised dating of the top of the Centrum Formation proposed here, it is interesting to compare the modified Silurian sequence for northeast Greenland with NORFORD's (1972) recent revision of the Silurian of northwest Greenland. NORFORD has shown that the carbonate complex of the Cape Schuchert Formation and Offley Island Formation is in part the lateral equivalent of and in part overlain by the shaley, graptolite bearing Cape Phillips Formation. In sections studied at Kap Schuchert, Kap Tyson and Offley Ø, these beds are all of Upper Llandovery age although the Cape Phillips Formation may extend into the Lower Wenlock where it overlies the Offley Island Formation at Kap Tyson. At the base of this Silurian sequence, conglomeratic beds of the Cape Schuchert Formation were reported by KOCH (1929, p. 237) to rest disconformably on the Cape Calhoun Formation, the upper part of which is dated Richmondian. Thus rocks of Lower and Middle Llandovery age appear to be missing in this area, although on the basis of unpublished brachiopod determinations, Lower to Middle Llandovery strata may be present elsewhere in northwest Greenland, in northernmost Hall Land and central Nyeboe Land (Dr. J. S. PEEL, pers. comm.).

This stratigraphic situation now seems to be paralleled to some extent in northeast Greenland although the beds are less well dated and lateral facies changes have not yet been reported from the latter area. The top of the Centrum Formation is now considered to be Upper Ordovician and similar in age to the top of the Cape Calhoun Formation. The Drømmebjerg Formation appears to be at least approximately coeval with the Offley Island Formation and there are thus grounds for suspecting the earlier part of the Llandovery to be cut out. Furthermore, the graptolite bearing Profilfjeldet Formation can be considered an eastern representative of the Cape Phillips Formation as NORFORD (1972, p. 18) notes that this formation ranges in age from Upper Ordovician to Lower Devonian in the Canadian Arctic and that a similar stratigraphic range may be expected in Greenland.

AGES AND RELATIONSHIPS OF THE CORAL FAUNAS

The material comes from seven different localities collected in stratigraphic sequence across the outcrops of the Centrum Formation, the Drømmebjerg Formation and the Profilfjeldet Formation. The faunas are considered here locality by locality in ascending stratigraphic order and sample numbers are noted in parentheses. Distances above formation base, quoted for each locality, are approximate although the relative stratigraphic locations of the samples are not in doubt (*fide* Dr. J. W. COWIE). Locality details are given in the appendix.

(a) Centrum Formation.

(i) Locality 4A, 70 m above base. Only one coral, *Tetradium tubifer* (1445), has been collected here. The species was previously recorded by TROEDSSON (1928, p. 137) from northwest Greenland, probably from the Gonioceras Bay Formation considered to be of Blackriverian age by TROEDSSON (1926, p. 111).

(ii) Locality 6 (ADAMS & COWIE, 1953, p. 13), 800 m above base. The collection from this locality includes *Streptelasma* sp. cf. *S. primum* (1203), *Helicelasma* sp., *Cyathophylloides* sp., *Calapoecia* sp. cf. *C. coxi*, *Catenipora agglomeratiformis* (all 1204) and *Wormsipora* sp. (1240). *Calapoecia* ranges from the Blackriverian to Richmondian and *C. coxi* is a Cincinnatian species. *Wormsipora* is recorded from the Upper Ordovician (F_1) of the Baltic area and the U. S. S. R., and *Catenipora* appears for the first time in Red River faunas and equivalents elsewhere. The only species recorded previously and positively identified here is *Catenipora agglomeratiformis*, known from the Cape Calhoun Formation (*Halysites* Limestone) of northwestern Greenland and beds of Red River age in the

Hudson Bay Lowland. Thus the age of this fauna is fairly certainly Upper Ordovician (Cincinnatian) and probably to be correlated with Red River equivalents.

(iii) Locality 7 (ADAMS & COWIE, 1953, p. 13), 1150 m above base. Two samples from this locality have yielded *?Paleophyllum* sp., *?Foerstephyllum* sp., *Catenipora approximata* (all 1232), *Favosites wilsonae*, *Favosites* sp. A and *Catenipora* sp. (all 1233). *Favosites wilsonae* is recorded from the Richmondian of the Hudson Bay Lowland and thus appears to be the earliest record anywhere of a true *Favosites* whereas *Catenipora approximata* is known from the Lower Llandovery (G_{1-2}) of Estonia. The possible presence of *Foerstephyllum* in the fauna tends to favour an Ordovician age but a more reliable indication is the occurrence of Upper Ordovician faunas at higher levels in the Centrum Formation. Thus it appears that *Catenipora approximata* enters earlier in northeast Greenland than in Estonia.

(iv) Locality 8 (ADAMS & COWIE, 1953, p. 12), 1550 m above base. This is the only locality to yield stromatoporoids in the present collection. The fauna includes *?Stratodictyon* sp., *?Syringostroma* sp., *Helicelasma* sp., *Propora* sp. (all 1230), *Saffordophyllum troedssoni* sp. nov. and *Favosites* sp. B (both 1235). *Saffordophyllum troedssoni* is the only species to offer useful evidence of age here. This coral was previously recorded as *Columnaria franklini* from the Cape Calhoun Formation of northwestern Greenland. An Upper Ordovician (Cincinnatian) age is thus most likely for this fauna.

(v) Locality 8A ca. 1750 m above base. The fauna here includes *Helicelasma* sp. A (1514), *Paleophyllum halysitoides*, *?Tetradium* sp. (1517), *?Troedssonites* sp. (1518), *Favosites* sp. C (1519), *Paleofavosites cowiei* sp. nov. (1520) and *Streptelasma* sp. (1523). This fauna also suggests an Upper Ordovician (Cincinnatian) age. *Paleophyllum halysitoides* has been recorded from the Cape Calhoun Formation in northwest Greenland and fairly widely from beds of Red River and Richmondian age in North America. *Helicelasma* sp. A seems to be most closely related to an Ordovician species of *Helicelasma*. Little weight can be placed on the doubtful records of *Tetradium* and *Troedssonites* although both if confirmed would support an Ordovician age.

(b) Drømmebjerg Formation.

Locality 9 (ADAMS & COWIE, 1953, p. 12), ca. 100 m above base. Only two specimens are available from this locality, *?Tabularia* sp. and *Favosites gothlandicus*. *Tabularia* has been previously recorded from the Wenlock of the Urals. *Favosites gothlandicus* has been widely reported from rocks of Upper Ordovician to Upper Silurian age but many of these records must be suspect in view of the loose interpretation of this species.

The most that can be said of this locality on the basis of the coral fauna is that the age is probably Silurian.

(c) Profilfjeldet Formation.

Locality 10, boulder conglomerate at base. Three corals are described from limestone boulders derived from the Drømmebjerg Formation. They are *Dinophyllum* sp. nov., *Tryplasma* sp. and *Microplasma lovenianum* (all 1418). *Dinophyllum* is considered to be restricted to the Upper Llandovery and early Wenlock (HILL, 1959, p. 154; the Upper Visby is now considered to be Wenlock), whereas *Microplasma* enters in the Wenlock and continues through the Ludlow (WHITE, 1966, p. 150). The overlap of two generic ranges does not constitute very strong evidence and it is possible that these specimens may not have all originated from the same horizon. They tentatively suggest, however, the erosion of levels of early Wenlock age during the formation of the conglomerate.

(d) Faunal relationships

Too few determinations at the species level can be made for much to be said in detail of the faunal relationships and remarks made here will concern only the Cincinnatian faunas. Not unexpectedly, several members of the Centrum Formation faunas are conspecific or closely related to species recorded by TROEDSSON (1928) from the Gonioceras Bay Formation and the Cape Calhoun Formation of northwest Greenland. What is striking is the apparent lack of favositids in TROEDSSON's faunas although elsewhere in northwest Greenland favositids are reported from Upper Ordovician horizons in northern Hall Land which are considered likely to be younger than the Cape Calhoun Formation (Dr. J. S. PEEL, pers. comm.). The upper part of the Centrum Formation may similarly post date the Cape Calhoun Formation.

On a larger geographical scale, there is some evidence of mingling of American and Eurasian elements. *Paleophyllum halysitoides*, *Favosites wilsonae* and *Catenipora agglomeratiformis* are North American species whereas *Catenipora approximata* is European. The genus *Wormsipora* has not yet been recorded from North America but otherwise the genera concerned are known on both sides of the Atlantic. Three of the named species recorded, which includes one species described for the first time, are known only from Greenland but their ranges could be extended by future work. In general, it appears that migration between North America, Greenland and Eurasia allowed most genera to be held in common. At the species level, the evidence is weak but connexions appear stronger between North America and Greenland than between Europe and Greenland at this time.

SYSTEMATIC DESCRIPTIONS

A particular difficulty presented by this fauna, apart from the variable preservation, is that in most cases a taxon is represented by a single specimen only. Thus in some instances where a specimen does not appear to belong to a described species it is felt that the limited material does not justify the erection of a new species. This, together with some material of insufficient quality to allow specific assignment explains the high number of unnamed species in these descriptions.

The classification of the Rugosa followed here is essentially that of HILL (1956) and the terminology used in the descriptions is largely that proposed by MOORE, HILL & WELLS (1956). Classification of the Tabulata and Heliolitida is after SOKOLOV (1962).

All the specimens described here (unless otherwise indicated) are registered in the collections of the Mineralogisk Museum in Copenhagen. The register number is followed in parentheses by the sample number. Locality details are given in full in the appendix.

Order **STROMATOPOROIDEA** NICHOLSON & MURIE 1878

Family **Labechiidae** NICHOLSON 1879

Genus *Stratodictyon* WEBBY 1969

1969 *Stratodictyon* WEBBY, p. 647.

?Stratodictyon sp.
Plate 1, Figs. 1–4

Material. MMH 12957 (1230). Centrum Formation, 1550 m above base; locality 8.

Description. A small fragment of one coenosteum only is available.

In longitudinal section the galleries are enclosed by laminae in the form of a series of low, flat-topped cysts, founded on the lamina below. Cyst length is variable up to 1mm. Latilaminae are defined by fairly regularly alternating zones of closer spaced laminae with about 10 galleries per mm and wider spaced laminae with 6 to 7 galleries per mm.

Occasionally, laminae arch over cavities in the coenosteum of oval to irregular shape. Vertical pillars, about 0.08 mm thick, are scattered through the coenosteum and may cross up to 7 or 8 laminae.

In cross-section, the structures are not clear and the cyst-like nature of the laminae can only occasionally be distinguished. Spots of tissue in interlaminar spaces appear to represent the pillars. No astrorhizae can be distinguished in the present material.

Discussion. The exact nature and distribution of the vertical pillars are obscured by the effects of recrystallisation. Nevertheless pillars can be quite clearly seen in places and thus the overall structure of this specimen seems to agree best with that of the genus *Stratodictyon.*

On the other hand, there is very close agreement between this specimen and *Clathrodictyon lennuki* NESTOR (1964, p. 55, pl. 19, figs. 4, 5; pl. 22, figs. 3, 4) from the early Llandovery (G_{1-2}) of Estonia. *C. lennuki* does not possess vertical pillars continuous across several galleries but the structure is such that this appearance might result from poor preservation and recrystallisation (see NESTOR, 1964, text-fig. 24). The possibility must be admitted that the Greenland specimen could be closely related to *C. lennuki.*

Family **Stromatoporoidae** WINCHELL 1867

Genus *Syringostroma* NICHOLSON 1875

?Syringostroma sp.
Plate 1, Figs. 5–8.

Material. MMH 12958 (1230). Centrum Formation, 1550 m above base; locality 8.

Description. Several fragments, probably of one coenosteum.

In longitudial section the structure is dominated by vertical pillars, about 0.2 mm thick midway between laminae and spaced 6 to 7 in 2 mm. Vertical continuity for 2 mm can be measured but is probably greater as the pillars move out of the plane of section. They appear to branch. Laminae are normally very thin, more or less continuous and slightly irregular in appearance. Galleries average 0.5 mm high. The pillars usually thicken towards the laminae so that they have a waisted appearance in the galleries. Occasionally the laminae may also be thickened between adjacent pillars when the enclosed gallery takes on a circular section. Latilaminae are present.

In cross-section, isolated pillars are very rarely seen. Usually the pillars are joined to form an incomplete and somewhat irregular reticulate

meshwork. Cavities in the meshwork are smallest and most regularly circular adjacent to laminae. Between laminae they are larger and more irregular in shape. Astrorhizae appear to be well developed.

Discussion. This specimen does not appear to match any described species of Ordovician stromatoporoid. The general organisation of the coenosteum seems closest to that of *Syringostroma* but this genus has not previously been recorded from the Ordovician. The generic assignment is thus regarded as provisional.

Order **RUGOSA** Edwards & Haime 1850

Suborder **Streptelasmatina** Wedekind 1927

Superfamily Zaphrenticae Edwards & Haime 1850

Family **Streptelasmatidae** Nicholson 1889

Genus *Streptelasma* Hall 1847

1969 *Streptelasma;* Neuman, p. 8.
1971 *Streptelasma;* Scrutton, p. 207.

Streptelasma sp. cf. *S. primum* (Wedekind 1927)
Plate 2, Fig. 1

cf. 1927 *Dybowskia prima* Wedekind, p. 18, pl. 1, figs. 10–11.
cf. 1969 *Streptelasma primum* (Wedekind) Neuman, p. 11, figs. 7a–h, 8a–f, 9a–h, 10a–b.

Material. MMH 12959 (1203), ? 1973.1410 (1203). Centrum Formation, 800 m above base; locality 6.

Description. Both specimens are incomplete and embedded in fine grained dark brown limestone.

The cross-section (MMH 12959) is circular, 20 mm in diameter with 50 major septa. Peripheral stereozone thin, up to 1.2 mm wide. Minor septa short, normally projecting slightly less than 1 mm beyond the stereozone. Major septa withdrawn from axis, half to three-fifths the radius in length, slim and tapering. They may extend further towards the axis on the upper surfaces of tabulae. There is a weak cardinal pseudofossula.

There is no longitudinal section but the cross-section, cut slightly obliquely, shows the tabulae to be arched peripherally with a wide, flat, slightly depressed central area.

Discussion. The material agrees quite closely with NEUMAN's (1969, p. 11) description of *S. primum* but is too poor to allow a definite identification.

Streptelasma sp.
Plate 2, Figs. 2, 3.

Material. MMH 12960 (1523). Centrum Formation, ca. 1750 m above base; locality 8A.

Description. The single specimen lacks the proximal end of the corallite. The calice is slightly more than 5 mm deep and flat bottomed. Major septa project up to 3 mm from the wall of the calice and continue as low ridges across the floor of the calice to the axis.

In subcalicular section, the corallite is circular, 19 mm in diameter with 38 major septa. There is a peripheral septal stereozone up to 1.3 mm thick to which the minor septa are confined. The major septa taper rapidly from the stereozone and continue in attenuate form to the axis where they meet and are twisted sharply in a weak counter-clockwise vortex. There is a clear cardinal pseudofossula with curved flanking metasepta defining an oval lumen containing a short cardinal septum about 3 mm long.

In longitudinal section, the tablulae are very closely spaced, averaging 10 in 5 mm. They are more or less flat across the axis and sharply downturned peripherally where many rest on preceeding tabulae, only one in four reach the wall of the corallite where this can be seen.

Discussion. This specimen cannot be referred to an existing species of *Streptelasma* and may belong to a new species.

Genus *Helicelasma* NEUMAN 1969

1969 *Helicelasma* NEUMAN, p. 28.

Helicelasma sp. A
Plate 2, Figs. 4, 5.

?1937 *Streptelasma corniculum* HALL; COX, p. 2, pl. 1, figs. 1–4.
non 1847 *Streptelasma corniculum* HALL, p. 69, pl. 25, fig. 1b.

Material. MMH 12961 (1514). Centrum Formation, ca. 1750 m above base; locality 8A.

Description. An incomplete coral embedded in fine grained, dark brown bioclastic limestone.

The coral is circular in cross-section, 13 mm in diameter with 41 major septa. The wall is a septal stereozone 1.6 mm thick to which the minor septa are confined. The major septa taper from the stereozone and continue towards the axis variably attenuate. They are about three-quarters the radius in length with their axial ends slightly swollen and often fused with or resting against neighbouring septa. The axial area is occupied by scattered spots of septal tissue partially invested with sclerenchyme. There is a clear, parallel sided cardinal pseudofossula in which the cardinal septum is half the radius in length.

In longitudinal section, the calice is deep with a low dome in the center of the floor. The tabulae, about 8 in 5 mm, are mainly complete plates with some subsidiary plates particularly at the corallite wall. They are arched or peaked in the axis where vertical pillars of septal material are prominent.

Discussion. This coral agrees closely in general appearance with *Streptelasma corniculum* Cox, *non* Hall, which Neuman (1969, p. 29) placed in *Helicelasma*. In detail, however, Cox's material appears to have a lower septal ratio, approximately 2.25 from his pl. 1, fig. 2b compared with 3.15 in the present material, so that specific identity is uncertain.

Helicelasma spp.

Material. 1973. 1411 (1204). Centrum Formation, 800 m above base; locality 6.

1973. 1412 (1230). Centrum Formation, 1550 m above base; locality 8.

Discussion. These two incomplete specimens, although inadequate for satisfactory description, can be assigned to *Helicelasma*.

Genus *Dinophyllum* Lindström 1882

Dinophyllum sp. nov.

Plate 2, Figs. 6–8.

Material. MMH 12962 (1418). Boulder conglomerate at base of Profilfjeldet Formation; locality 10.

Description. One incomplete specimen embedded in a pale grey limestone matrix. Two cross-sections are available, one 30 mm below the other.

In the lower section, the coral is 28 × 31 mm in diameter with 77 major septa. There is a peripheral septal stereozone varying from 1.25 to 2.75 mm thick from the counter area to the cardinal area. The major

septa taper from the stereozone, in some quadrants becoming immediately very thin, in others remaining about 0.5 mm thick for about one-third the radius before continuing in attenuate form towards the axis. The length of the major septa is very variable. Many reach the area of the axis but others may be as short as one-third the radius. There is a clear oval cardinal fossula in which the cardinal septum is one-third the radius in length. The septa are involved in a strong counter-clockwise vortex occupying most of the lumen within the stereozone. The twisted inner ends of the septa and the tabulae are involved in a loose, elongate axial structure orientated at right angles to the counter-cardinal plane. The minor septa are developed as very short triangular wedges up to 1 mm long and are confined to the stereozone.

In the higher section, the diameter is 42 × 38 (est.) mm with 86+ major septa. The cardinal fossula has disappeared and the cardinal septum cannot be distinguished. The axial vortex appears to be more intense, involving about 180° torsion. Around the axis, the longer major septa abut each other and the longest meet at a single point in the center. Septa in an axial area 6.5 mm × 4 mm are somewhat thickened. Peripherally some septa appear to be discontinuous immediately below tabulae.

In longitudinal section, the tabulae are incomplete wavy plates sloping axially and upwards with a pronounced peak in the axis corresponding to the loose axial structure. They are close-spaced, about 10 in 5 mm. Peripherally the ends of the tabulae are turned up against the corallite wall.

Discussion. This coral appears to differ markedly from described species of *Dinophyllum* but as only one specimen is available it seems inadvisable to erect a new species here. This specimen can be distinguished most readily by its very high septal ratio of 2.6 as opposed to about 1.6 for *Dinophyllum involutum* LINDSTRÖM, the type species of *Dinophyllum* (MINATO, 1961, p. 80) and about 1.5 for *D. lundarense* STEARN (1956, p. 87). In each case the ratio is calculated at a corallite diameter of approximately 30 mm.

Suborder **Columnariina** ROMINGER 1876

Family **Stauriidae** EDWARDS & HAIME 1850

Genus *Paleophyllum* BILLINGS 1858

1961 *Paleophyllum;* FLOWER, p. 88
1969 *Paleophyllum;* IVANOVSKII, p. 80.

Paleophyllum halysitoides (WILSON 1926)
Plate 3, Figs. 1, 2.

1926 *Diphyphyllum? halysitoides* WILSON, p. 18, pl. 2, figs. 8, 9.
1928 *Columnaria halysitoides* TROEDSSON, p. 113, pl. 28, figs. 1–5.
?1961 *Paleophyllum cateniforme* FLOWER, p. 91, pls. 49, 50.
1963 *Paleophyllum halysitoides* (WILSON) NELSON, p. 31, pl. 5, fig. 4.

Material. MMH 12963 (1517). Centrum Formation, ca 1750 m above base; locality 8A.

Description. One incomplete colony 120 × 100 × 90 mm embedded in dark brown, fine grained limestone.

Colony phaceloid to subcateniform. Corallites rarely isolated but usually in lateral contact to fom small groups or short chains which may be up to 8 or 9 corallites long. Isolated corallites are circular; grouped corallites tend to subquadrate, slightly elongated along the length of the chain. Corallite diameters range from 3.75 to 5.4 mm (minimum dimension) with 19 to 21 major septa. The epithecae average 0.2 mm in thickness. The major septa are uniformly attenuate, some reaching the axis but most ending just short of the axis. They are straight to slightly curved or sinous. Minor septa are thin and short, usually 0.5 mm in length. Increase is lateral.

In longitudinal section, corallites are subparallel. The tabulae vary somewhat in shape. Some have a wide, flat or slightly depressed axial area with downturned margins: others are strongly arched with a relatively narrow axial area which may be flattened or slightly depressed. There are usually 6 to 7 tabulae in 5 mm.

Discussion. NELSON (1963, p. 31) has placed TROEDSSON's species in synonymy with *Diphyphyllum? halysitoides* WILSON from the Richmondian Beaverfoot Formation of British Columbia. WILSON's description certainly conforms to that of TROEDSSON as far as it goes but the preservation of her material is poor and her figures show no structures at all. NELSON, however, has apparently seen the type specimen and is convinced that WILSON's species is a *Paleophyllum*. The synonymy is thus accepted here although it should be emphasised that the present material has been identified by comparison with TROEDSSON's description and illustrations of material from the Cape Calhoun Formation of northwest Greenland. NELSON himself records the species from the Portage Chute Formation of Red River age in the northern Hudson Bay Lowland.

FLOWER (1961, p. 91, pls. 49, 50) has described a new species of *Paleophyllum*, *P. cateniforme* from the Second Value Formation of New

Mexico, which seems to differ from TROEDSSON's material only in slightly higher corallite diameter and septal number (but approximately the same septal ratio) and in minor morphological features which are variable in the present material. Furthermore, *P. cateniforme* is considered to be of Red River age and thus falls within the known age range of *P. halysitoides*. It seems likely, therefore, that the study of further material will establish *P. cateniforme* as conspecific with *P. halysitoides*.

?Paleophyllum sp.
Plate 3, Figs. 3–7.

Material. MMH 12964–5 (1232). Centrum Formation, 1150 m above base; locality 7.

Description. Two incomplete colonies embedded in dark brown, fine grained limestone.

The colonies are fasciculate. The corallites are circular in cross-section, 6.5 to 8.5 mm in diameter with about 21 to 23 major septa. The epitheca is thin, approximately 0.2 mm wide. The major septa are thin, tapering very slightly towards the axis, straight or slightly sinuous. They are variable in length, some reaching the axis, others two-thirds the radius or more in length. Minor septa are well developed and reach half the radius in length.

In longitudinal section, the tabulae are arched, usually flat or slightly depressed in the axis and with downturned margins. They are mainly complete but subsidiary tabulae may occur both peripherally and towards the axis. There are 7 to 8 tabulae in 5 mm. A single series of small, usually elongate dissepiments may be sporadically developed at the corallite margin. There are signs that they may interrupt the septa but the presence of lonsdaleoid dissepiments could not be confirmed in cross-section.

Increase appears to be lateral.

Discussion. It is unfortunate that this material is rather poorly preserved so that the full range of morphological characters cannot be satisfactorily ascertained. The appearance is of a *Paleophyllum* with rather large corallites and a sporadic single series of dissepiments. It is thus interesting that KALJO (1958, pp. 112,122), in discussing *Strombodes middendorfi* from the uppermost Ordovician Porkuni horizon of Estonia, considered that *Paleophyllum* might be ancestral to *Strombodes*. The present species appears to be morphologically suitable and of approximately the right stratigraphic age to be a possible intermediary.

At the moment, this material presents a problem of generic assignment. It should not strictly be placed in either *Paleophyllum* or *Strombodes* as these genera are currently defined. As it appears more closely related to *Paleophyllum*, however, it is provisionally assigned, with a query, to that genus.

Genus *Cyathophylloides* Dybowski 1873

1961 *Cyathophylloides;* Flower, p. 83.
1965 *Cyathophylloides;* Browne, p. 1186, ? *pars.*
1969 *Cyathophylloides;* Ivanovskii, p. 73.

Discussion. Whether or not *Favistina* Flower (=*Favistella* of authors) should be considered a junior synonym of *Cyathophylloides* as suggested by Browne (1965, p. 1186), the specimen described below falls within the range of *Cyathophylloides sensu stricto* as employed by Flower and Ivanovskii. Thus interpreted, *Cyathophylloides* appears to be confined to the Ordovician.

Cyathophylloides sp.
Plate 3, Figs. 8, 9.

Material. MMH 12966 (1204). Centrum Formation, 800 m above base; locality 6.

Description. One incomplete colony, approximately 35 × 35 × 55 mm.

The colony is cerioid, composed of polygonal, usually hexagonal corallites up to 5 mm diameter. Corallite walls vary in thickness but are usually 0.2 mm across with a central thin dark axial plate, usually straight but rarely crenulate, separating adjacent corallites. Major and minor septa are present, both expanding in width where they meet the wall. There are 16 major septa on average, with a range of 14 to 18. They are thin, tapering gently towards the axis. Most reach or almost reach the axis where their ends are usually irregularly deflected and fused in small groups around slightly longer septa. This gives the impression of a loose axial structure. Minor septa are fairly regularly developed up to one-fifth the radius in length.

In longitudinal section, tabulae are usually thin and complete with few subsidiary plates. They are mostly gently arched across the axis and occasionally downturned peripherally. They are close spaced at 12 per 5 mm.

The mode of increase could not be determined.

Discussion. This specimen cannot be matched with any described species of *Cyathophylloides*. The combination of size, high septal ratio and very close spaced simple tabulae appears to be unique. The present material is insufficient, however, for the erection of a new species.

Genus *Tabularia* SOSHKINA 1937

?Tabularia sp.
Plate 4, Fig. 1

Material. MMH 12967 (1238). Drømmebjerg Formation, ca. 100 m above base; locality 9.

Description. A single small trochoid coral, 18 mm in diameter. The wall is 0.4 mm thick, crenulate, with septal grooves externally and short thorn-like septa internally. Major septa normally project up to 1 mm into the lumen but may reach 2.5 mm above a tabula, whilst the minor septa are very slightly developed.

In longitudinal section, tabulae are poorly seen but appear to be complete, slightly arched and well spaced about 1.5 mm vertically.

Discussion. This specimen is rather poorly preserved but appears to have the very simple structure of *Tabularia*. It is about twice the diameter of the type species *T. turiensis* SOSHKINA from the Wenlockian of the Urals (see SOSHKINA & KABAKOVICH, 1962, p. 320, fig. 61).

Suborder **Cystiphyllina** NICHOLSON 1889

Family **Tryplasmatidae** ETHERIDGE 1907

Genus *Tryplasma* LONSDALE 1845

1971 *Tryplasma;* SCRUTTON, p. 216.

Tryplasma sp.
Plate 4, Figs. 2, 3

Material. MMH 12968 (1418). Boulder conglomerate at base of Profilfjeldet Formation; locality 10.

Description. A small fragment of a corallite 6.7 mm in diameter with 22 major septa. It is not known whether it is solitary or part of a fasciculate colony.

In cross-section there is a broad peripheral septal stereozone up to 1.3 mm wide. Major and minor septa project beyond the stereozone but

both as thin discontinuous elements. Minor septa reach just over half the radius in length, the major septa continue to the axis.

In longitudinal section, contiguous trabeculae cross the stereozone axially and upwards. Beyond the stereozone they thin and become discrete, continuing as septal spines towards the axis. The tabulae are complete, dish-shaped and spaced 0.8 to 1.2 mm apart.

Discussion. This specimen appears not to belong to any described species of *Tryplasma* but much more complete material is needed to evaluate this coral properly.

Family **Cystiphyllidae** Edwards & Haime 1850

Genus *Microplasma* Dybowski 1873

Microplasma lovenianum Dybowski 1874
Plate 4, Figs. 4–6.

1874 *Microplasma lovenianum* Dybowski, p. 510, pl. 5, figs. 4, 4a.

1966 *Microplasma lovenianum* Dybowski; White, p. 149, pl. 22, figs. 1–11.

Material. MMH 12969 (1418). Boulder conglomerate at base of Profilfjeldet Formation; locality 10.

Description. A fragment of a single colony consisting of one corallite and part of a second.

The colony is fasciculate. One corallite is 8 mm in diameter with a lightly crenulate wall about 0.35 mm thick. Externally the wall bears septal grooves. Internally, trabeculae set in the wall form very short septal spines, 44 in number. The lumen is infilled by sections of vesicular tissue.

In longitudinal section, the trabeculae are set in the wall with a vertical spacing of 4 to 5 per 1 mm and are directed slightly downwards into the lumen. The vesicles infilling the lumen are small but variable in size, moderately inflated and slope downwards more or less uniformly into the axis. There are only occasional horizontal vesicles in the axis and a peripheral and axial series of plates cannot be distinguished.

Discussion. Although only one corallite is preserved here, it clearly has the more crowded vesicular structure of *M. lovenianum* (see White, 1966, p. 150). The corallites of *M. gotlandicum* Dybowski, the type species, *M. schmidti* Dybowski and *M. flexuosum* Prantl all have a coarser

vesicular structure. PRANTL (1940, p. 107) considered it possible that these three forms may be conspecific but *M. gotlandicum* and *M. schmidti* appear to have a more prominent peripheral stereozone than *M. flexuosum.*

Order **TABULATA** EDWARDS & HAIME 1850

Suborder **Lichenariina** SOLOKOV 1962

Family **Billingsariidae** OKULITCH 1936

Genus *Saffordophyllum* BASSLER 1950

1950 *Saffordophyllum* BASSLER, p. 267.
1961 *Saffordophyllum;* FLOWER, p. 57.

Saffordophyllum troedssoni sp. nov.
Plate 4, Figs. 7–9

1928 *Columnaria franklini* (SALTER) TROEDSSON, p. 112, p. 29, figs. 3a–d.

1950 *Saffordophyllum franklini* (SALTER) BASSLER, p. 267, pl. 13, figs. 4, 5.

non 1852 *Favistella franklini* SALTER, p. 229, pl. 6, figs. 3, 3a.

Derivation of name. After GUSTAV TROEDSSON.

Diagnosis. *Saffordophyllum* with corallites up to 3 mm diameter and with 12 or more loci for short septal spines in mature corallites. Mural pores 0.25 mm diameter, about 0.8 mm vertically apart, one or two series per wall. Tabulae complete, flat or nearly so and close spaced up to 15 in 5 mm.

Holotype. MMH 12970 (1235). Centrum Formation, 1550 m above base; locality 8.

Paratype. MMH 3010. Cape Calhoun Formation; Kap Calhoun, northwest Greenland.

Description. The holotype, on which this description is chiefly based, is represented by four fragments from one colony.

The colonies are cerioid. Corallites are up to 2.8 mm diameter (3.0 mm diameter in MMH 3010) but mostly 2.3 to 2.5 mm. Corallite walls are thin, about 0.1 mm in thickness but somewhat variable and lightly

to strongly crenulate. Very short septal spines are developed, up to 0.15 mm long, usually where the face of the wall is convex to the lumen. There appear to be at least 12 and probably more such sites in mature corallites. Mural pores are commonly seen, usually close to wall junctions, occasionally two per wall.

In longitudinal section, the corallite walls show regular mural pores 0.25 mm in diameter and spaced vertically on average 0.8 mm or a little more apart. There may be two vertical series of pores per wall. Tabulae may continue from one corallite to the next through the pores. Corallite walls occasionally show septal spines clearly when they are directed into the lumen slightly above the horizontal and are close spaced vertically. The tabulae are complete, flat or nearly so and usually with slightly up- or down-turned margins. They are very regularly spaced 12 to 15 per 5 mm.

Discussion. SALTER's (1852, p. 229, pl. 6, figs. 3, 3a) figured specimen of *Favistella franklini* (British Museum (Natural History) R4956), the only one of the original syntypes that can be positively identified, is not conspecific with the *Columnaria franklini* of TROEDSSON (1928, p. 112, pl. 29, figs. 3a–d), neither is it a species of *Saffordophyllum*. Although permission to section SALTER's specimen could not be obtained, the broken surfaces show it to lack both crenulate walls and mural pores. It may be a species of *Trabeculites*, which FLOWER (1961, pp. 18, 58) noted as a possibility, but without sections this cannot be confirmed.

Despite TROEDSSON's (1928, p. 112) statement to the contrary, his specimen clearly does have mural pores (see his pl. 29, fig. 3c) and is a good species of *Saffordophyllum* (BASSLER, 1950, p. 267; FLOWER, 1961, p. 58). The present material agrees in all essential characters with TROEDSSON's specimen and is regarded as conspecific. A new name is now required for the species and it is designated here as *Saffordophyllum troedssoni*. The species is only definitely known so far from the Upper Ordovician of northwest and northeast Greenland, and it is distinguished by the large size of the corallites and the close spaced tabulae. *S. newcombae* FLOWER (1961, p. 60, pls. 24, 25), the species closest in general dimensions to *S. troedssoni*, has very faintly crenulate walls which appear rhythmically thickened in longitudinal section.

Genus *Foerstephyllum* BASSLER 1941

1950 *Foerstephyllum;* BASSLER, p. 269.

1961 *Foerstephyllum;* FLOWER, p. 69.

?Foerstephyllum sp.
Plate 5, Figs. 1,2

Material. MMH 12971 (1232). Centrum Formation, 1150 m above base; locality 7.

Description. One incomplete colony only is avilable.

The colony is cerioid. The corallites are polygonal, thin walled, about 1.7 to 2.0 mm in diameter. The septa are thorn-like, short, apparently variably developed but obscured by poor preservation. Mural pores rarely seen, usually near wall junctions.

In longitudinal section, the septa appear to be laminar with spinose margins. Tabulae complete, more or less flat, about 14 in 5 mm.

Discussion. This poorly preserved specimen appears to be a *Foerstephyllum* with the occasional development of mural pores. The character of the septa seems to be more in keeping with this genus than with *Paleofavosites* (see FLOWER, 1961, p. 69).

Suborder **Tetradiina** OKULITCH 1936

Family **Tetradiidae** NICHOLSON 1879

Genus *Tetradium* DANA 1848

1950 *Tetradium;* BASSLER, p. 277.

Discussion. See WEBBY & SEMENIUK (1971, pp. 249–251) for a discussion of the classification and stratigraphic range of *Tetradium.*

Tetradium tubifer TROEDSSON 1928
Plate 5, Figs. 3, 4.

1928 *Tetradium tubifer* TROEDSSON, p. 137, pl. 46, figs. 3a–b, pl. 47, figs. 1a–h.

1950 *Tetradium tubifer* TROEDSSON; BASSLER, p. 282, pl. 2, fig. 18; pl. 7, fig. 7; ? pl. 1, figs. 9, 10; ? pl. 5, fig. 5.

Material. MMH 12972 (1445). Centrum Formation, 70 m above base; locality 4A.

Description. One incomplete colony, 90 × 90 × 45 mm embedded in dark reddish-brown, fine grained limestone.

The colony is phaceloid to subcateniform. The corallites are small, ranging from 0.8 to 1.4 mm and mostly 1.0 to 1.1 mm in diameter. They are subcircular to subquadrate in cross-section and may be isolated or joined to form short chains. Corallites in chains are nearly always subquadrate and may be joined either side to side or corner to corner. The chains may be up to 10 corallites long and are usually geniculate and branching although no completely enclosed lacunae occur. Most corallites are infilled with sparry calcite. Corallite wall thickness and septa cannot be clearly identified even in corallites with matrix infill although ghost structures suggesting the presence of septa are seen in several corallites. Occasional corallites show stages in quadripartite increase.

In longitudinal section the corallites are slender subparallel tubes, with no sign of internal structures preserved.

Discussion. This specimen agrees well in the morphological details that can be seen with *T. tubifer* as described by Troedsson (1928, p. 137) from northwest Greenland. The preservation also appears to be similar. It is unfortunate that septa cannot be unambiguously identified in the present material but Troedsson remarked that they are only weakly developed in his material.

According to Troedsson (1928, p. 139) there was some doubt as to the location of the type material of *T. tubifer* although he considered it to come most probably from the Gonioceras Bay Limestone of Blackriverian age.

?Tetradium sp.
Plate 5, Fig. 5

Material. MMH 12973 on thin section MMH 12963 (1517). Centrum Formation, ca. 1750 m above base; locality 8A.

Description. A small fragment 4 × 3 mm in a fine grained dark brown limestone.

The fragment is cerioid, consisting of four subquadrate corallites, between 1.5 and 1.7 mm in diameter from side to side. Septa are short and blunt, up to 0.24 mm long. In most cases one prominent septum is present in the centre of each flattened side of the corallite; very short subsidiary septa may also occur.

Discussion. It is unfortunate that no more and better specimens of this coral could be found in the available material. Even so, it is fairly certainly identified as a species of *Tetradium*.

Suborder **Sarcinulina** SOKOLOV 1962

Family **Calapoeciidae** RADUGUIN 1938

Genus *Calapoecia* BILLINGS 1865

1936 *Calapoecia;* COX, p. 1

1950 *Calapoecia;* BASSLER, p. 275

1961 *Calapoecia;* FLOWER, p. 65.

Calapoecia sp. cf. *C. coxi* BASSLER 1950
Plate 5, figs. 6–9.

cf. 1936 *Calapoecia canadensis* BILLINGS; COX, p. 7, pl. 2, figs. 2a, b, ? figs. 5a, b, ? figs. 6a, b.

cf. 1950 *Calapoecia coxi* BASSLER, p. 276, pl. 17, fig. 20, pl. 20, figs. 5, 6.

Material. MMH 12974 (1204). Centrum Formation, 800 above base; locality 6.

Description. One incomplete colony only is available.

The colony is coenenchymal. Corallites are subpolygonal and in contact, or more frequently with a common wall between them, except in most cases at their rounded corners. Corallite diameters (internal cavity) are usually in the range 3.2 to 3.6 mm but may reach 3.8 mm. Corallite walls are formed by vertical trabeculate rods, usually subcircular to subrectangular in cross-section and mostly between 0.3 and 0.5 mm minimum dimension. Elongation is mainly but not exclusively across the line of the wall. The rods are either just in contact laterally, or separated by a gap of about 0.15 mm or less. Occasionally they are strongly fused together. Corallites are surrounded by 22 to 26 rods which are only exceptionally produced axially into very short wedge-shaped septal spines. Most corallites in the cross-sections available appear aseptate. Intercorallite walls are usually formed of a single linear or slightly alternating rank of rods. Occasionally, along short wall lengths and at most triple wall junctions, adjacent corallites each have their own walls, but these are always close together and no additional structures can be seen in the interwall cavity.

In longitudinal section, corallite walls show a variable appearance depending on the position and angle of section. Occasional sections in the plane of a wall show it to have a close, regular rectangular pattern of pores, 0.25 mm in diameter, spaced about 0.2 to 0.3 mm apart horizontally and about 0.25 to 0.4 mm apart vertically. This structure is built up by

the lateral expansion and fusion of adjacent trabeculae. Trabeculae in adjacent as opposed to common corallite walls are connected by horizontal bars of uncertain origin, 0.2 mm thick and 0.6 mm apart, defining rectangular lacunae. Tabulae are mostly complete, flat or sinuous. Incomplete tabulae are usually lateral rather than axial in location. There are 7 to 9 tabulae in 5 mm.

Discussion. Bassler erected *Calapoecia coxi* for specimens from the Richmondian of Akpatok Island with "more regularly polygonal and closely tabulated corallites" than those in typical *C. canadensis*. Two other specimens illustrated by Cox (1936, p. 2, figs. 5a, b, figs. 6a, b) from the Cape Calhoun Formation of northwest Greenland may also belong to this species.

The present specimen compares more closely with *C. coxi* than with any other described species of *Calapoecia* but the agreement is not complete. The most striking difference is the great rarity of septal processes in the material described here, together with a slightly larger corallite diameter. The importance of this aseptate condition cannot be judged on a single specimen and more material is required to determine if this factor is of specific importance.

Suborder **Favositina** Sokolov 1962

Family **Favositidae** Dana 1846

Genus *Paleofavosites* Twenhofel 1914

1951 *Mesofavosites* Sokolov, p. 59

1956 *Paleofavosites;* Stearn, p. 59

Discussion. The type species of *Paleofavosites*, *Favosites asper* d'Orbigny has been redescribed by Jones (1936, p. 15). Although the type specimen (*Favosites alveolaris* (Goldfuss) Lonsdale 1839, p. 681, pl. 15 *bis*, fig. 1) could not be traced, Jones considered *F. asper* to possess mural pores both in the corallite walls and at the corallite angles based on a study of other material. Indeed, Lonsdale himself (1839, p. 681) wrote that pores were sometimes found in the walls as well as at the corners of the corallites in his material.

Twenhofel (1914, p. 24) diagnosed *Paleofavosites* as possessing mural pores in the corners of the corallites only. More recently Sokolov (1951, p. 59), accepting this definition of *Paleofavosites*, has created a new genus *Mesofavosites* for those forms with pores in both wall and angle locations. From Jones' work, however, it seems that *Paleofavosites* interpreted on

the type species must include at least this morphological group and is therefore a senior subjective synonym of *Mesofavosites*. If favositids with pores exclusively at corallite angles are to be distinguished taxonomically from those with pores in both wall and angle locations, then it is the former group which requires the recognition of a new genus.

Paleofavosites cowiei sp. nov.
Plate 6, Figs. 1–4

Derivation of name. After Dr. J. W. COWIE, one of the collectors of the material.

Diagnosis. *Paleofavosites* with corallites 1.6 to 2.1 mm in diameter and septal spines well developed. Mural pores 0.2 mm diameter present in two columns in most walls, and also less commonly at wall junctions. Tabulae complete, more or less flat, 11 to 12 in 5 mm, with zones of more crowded tabulae 16 to 20 in 5 mm.

Holotype. MMH 12975 (1520). Centrum Formation, ca. 1750 m above base; locality 8A.

Paratype. MMH 12976 (1520). Same horizon and locality as holotype.

Description. The colonies are cerioid. The corallites are polygonal varying between 1.6 and 2.1 mm in diameter. Walls straight to slightly crenulate, slightly variable in thickness but usually 0.2 mm across in mid–wall positions with no rounding of corallite angles. Mural pores are commonly seen with pronounced flanges, usually one but sometimes two per wall. Single pores are normally positioned off center in the wall. Occasionally pores are also seen at corallite angles. Septal spines are prominently developed up to 0.5 mm in length. Although never seen fully developed in a single cross-section, there are probably up to 18 locations for septal spines in the larger corallites.

In longitudinal section the tabulae are complete and more or less flat, with 11 to 12 in 5 mm. There may be zones of crowded tabulae about 2.5 mm wide in which the numbers increase to 16 to 20 in 5 mm. Mural pores are arranged in two columns in most walls but are not necessarily at the same level in both columns. Pores are also present at wall junctions. Pore diameter is about 0.2 mm and their vertical spacing varies between 0.8 and 1.2 mm. The vertical columns are 0.5 to 0.8 mm apart. Septal spines project just above the horizontal into the lumen. Their vertical spacing is somewhat irregular but similar to that of the tabulae. Sections

close to the plane of a wall suggest that the spines are not rigidly ordered into vertical ranks and horizontal rows.

Discussion. *Paleofavosites cowiei* appears to be clearly distinguished from contemporary *Paleofavosites* in both North America and Europe. It is characterised by the mural pores predominating in the corallite walls rather than in the angles. Of species with a similar distribution of pores, *P. okulitchi* STEARN (=*Favosites intermedius* OKULITCH (1943, p. 70, pl. 1, fig. 16) *non* STEWART) from the Richmondian of Manitoba has larger corallites and lacks the well developed septal spines of *P. cowiei*. Both *P. dualis* (SOKOLOV, 1951, p. 61, pl. 22, figs. 1–5; pl. 23, figs. 1–2) and *P. nikitini* (SOKOLOV, 1951, p. 63, pl. 25, figs. 1–2) from the uppermost Ordovician F_2 (Porkuni horizon) of Estonia also lack well developed septal spines as well as differing from *P. cowiei* in corallite size and spacing of the tabulae.

Genus *Favosites* LAMARCK 1816

Discussion. Recent statements (SOKOLOV, 1962, p. 221; KLAAMANN, 1964, p. 58; STASIŃSKA, 1967, p. 78) have given the impression that true *Favosites* does not appear until the Llandovery. It is clear, however, from NELSON (1963, p. 54) and this work that the genus is present at least in the Richmondian.

In addition to the named species, three different specimens of *Favosites* are briefly described for which satisfactory species assignments cannot be proposed at present. These specimens are designated A, B and C.

Favosites wilsonae NELSON 1963
Plate 6, Figs. 5–7

1963 *Favosites wilsonae* NELSON, p. 54, pl. 7, figs. 1–3.

Material. MMH 12977–8 (1233). Centrum Formation, 1150 m above base; locality 7.

Description. The colonies are cerioid. The corallites are polygonal, thin walled, 1.5 to 2.0 mm in diameter. Mural pores are occasionally seen, usually offset from wall centers and one or two per wall. There are no septal spines.

In longitudinal section, tabulae are complete and more or less flat, 8 to 11 in 5 mm. Mural pores are 0.2 mm in diameter (one measurement only) but their spacing cannot be determined.

Discussion. This material agrees well with NELSON's description and illustrations of *F. wilsonae* from the Richmondian Caution Creek Formation of Manitoba.

Favosites gothlandicus LAMARCK 1816
Plate 7, Figs. 1, 2

1936 *Favosites gothlandicus* forma *gothlandica* LAMARCK; JONES, p. 8, pl. 1, figs. 1–4.

1956 *Favosites gothlandicus* LAMARCK; STEARN, p. 54, pl. 4, fig. 7.

Material. MMH 12979 (1238). Drømmebjerg Formation, ca. 100 m above base; locality 9.

Description. The colony is cerioid. The corallites are polygonal, moderately large and rather variable in size from 2.8 to 4.0 mm diameter. Walls very thin, about 0.15 mm across the full width in mid-wall positions with corallite angles unrounded. Mural pores quite commonly seen, one or more usually two per wall. Single pores are usually offset from wall centers. There are no septa.

In longitudinal section the tabulae are complete, flat and quite regularly spaced 6 in 5 mm. Mural pores are 0.4 mm in diameter and spaced 0.8 mm vertically apart center to center. Corallite walls may be lined with poikiloplasm (FLOWER, 1961, p. 29).

Discussion. STEARN (1956, p. 54) has made some useful comments on the definition of this species which are accepted here. The very varied interpretations of *F. gothlandicus* used by different authors make it difficult to determine the true geographical and chronological range of this species. It has been reported from various parts of the world as occurring in rocks ranging in age from Upper Ordovician to Upper Silurian. Many of these records are in need of re-examination.

Favosites sp. A
Plate 7, Figs. 3, 4.

Material. MMH 12980 (1233). Centrum Formation, 1150 m above base; locality 7.

Description. The colony is cerioid. The corallites are polygonal, 2.0 to 2.3 mm in diameter. The walls are thin, 0.16 mm across the full width of the intercorallite walls in mid-wall positions. Corallite corners are angular to very slightly rounded. Mural pores occur one or two per wall, usually with well marked flanges: single pores may be central or offset

from wall centers. Maximum pore diameter seen 0.25 mm. No septal spines.

In longitudinal section, the tabulae are complete, more or less flat and widely spaced, up to 2 mm apart and usually 3 to 4 in 5 mm. The size and spacing of mural pores cannot be seen in this section.

Favosites sp. B
Plate 7, Figs. 5, 6.

Material. MMH 12981 (1235). Centrum Formation, 1550 m above base; locality 8.

Description. The colony is cerioid. The corallites are polygonal, large, usually 4.0 to 4.8 mm in diameter. Corallite walls are thin, 0.3 to 0.35 mm across full width at mid-wall positions with very little rounding of corallite corners. Mural pores are occasionally seen, usually offset from wall centers and with maximum diameter 0.4 mm. There are no septal spines.

In longitudinal section, the tabulae are complete and usually arched or flat in the axis, with downturned margins. They are evenly spaced 5 to 7 in 5 mm. Mural pores appear to be 0.4 mm + in diameter and in one instance were measured 1 mm vertically apart center to center.

Favosites sp. C
Plate 8, Fig. 1.

Material. MMH 12982 (1519). Centrum Formation, ca. 1750 m above base; locality 8A.

Description. The colony is small and cerioid. The corallites are polygonal, mostly 1.0 to 1.2 mm in diameter but interspersed with frequent immature corallites. The walls are relatively thick, 0.10 to 0.18 mm across full width in mid-wall positions but with only the slightest rounding of corallite angles. Mural pores are quite common, usually one per wall close to the mid-wall position. Short septal spines are occasionally seen.

In longitudinal section, the tabulae are complete, more or less flat and regularly spaced 12 to 14 in 5 mm. Mural pores are between 0.15 and 0.2 mm diameter and spaced 1.1 to 1.2 mm vertically apart center to center. There appears to be only a single series in most walls. Septal spines are clearly seen projecting up to 0.25 mm into the lumen at variable angles above the horizontal. No regularity in their spacing can be distinguished.

Suborder **Syringoporina** SOKOLOV 1962

Family **Syringoporidae** NICHOLSON 1879

Genus *Troedssonites* SOKOLOV 1947

1965 *Troedssonites;* BOLTON, p. 24

?Troedssonites sp.
Plate 8, Figs. 2–5

Material. MMH 12983 (1518). Centrum Formation, ca. 1750 m above base; locality 8A.

Description. One incomplete colony 75 × 43 × 40 mm.

The colony is phaceloid. The corallites are circular to subcircular in cross-section and vary from 1.8 to 2.7 mm in diameter, although most are 2.2 to 2.4 mm diameter. The corallites are variably but closely spaced and are sometimes in contact, or each individual may be connected with up to three neighbours by short hollow tubules resulting in small local groups or short chains. There are signs of a thick corallite wall but otherwise internal structures have been destroyed by recrystallisation. Increase appears to be quadripartite.

In longitudinal section, the corallites are subparallel and straight to slightly sinuous. Interconnecting pores sometimes occur where the curvature on adjacent corallites brings them into contact but elsewhere connecting tubules may form. They are spaced 2.5 mm vertically apart center to center and are arranged in vertical series. Corallite walls are more clearly seen and are 0.25 to 0.30 mm thick. No septal structures can be recognised. Corallite interiors are filled by sparry calcite and no tabulae can be distinguished.

Discussion. This is undoubtedly a rather simple syringoporoid tabulate coral but with the internal structures completely obliterated by recrystallisation, generic assignment is difficult. Thus, the specimen is placed provisionally in *Troedssonites* although members of that genus normally posses well developed tabulae. Tabulae apart, there are reasonable grounds for this decision. General corallite size and colonial organisation are comparable and the intercorallite tubules are arranged in vertical series as in *Troedssonites*. More and better preserved material is necessary, however, to confirm this identification.

Suborder **Halysitina** Sokolov 1962

Family **Halysitidae** Edwards & Haime 1850

Genus *Catenipora* Lamarck 1816

1961 *Catenipora;* Flower, p. 47.

Discussion. Flower (1961, p. 42 *et seq.*) has published a useful review of Ordovician cateniform corals.

Catenipora agglomeratiformis (Whitfield 1900)
Plate 9, Figs. 1–3

1928 *Halysites agglomeratiformis* Whitfield; Troedsson, p. 133, pl. 46, figs. 1a–d.

1963 *Catenipora agglomeratiformis* (Whitfield); Nelson, p. 58, synonymy *pars*, pl. 14, figs. 10–11.

Material. MMH 12984 (1204). Centrum Formation, 800 m above base; locality 6.

Description. One incomplete colony, 90 × 65 × 50 mm embedded in dark brown limestone.

The colony is cateniform, composed of linked chains of monomorphic corallites (autocorallites). Lacunae are of variable size and shape, the smallest surrounded by only 6 corallites. Large lacunae tend to be elongate in a preferred direction. Corallites are oval, rarely subquadrate; walls of the chain are usually slightly constricted where corallites adjoin. Corallite size is relatively invariate, 1.20 to 1.30 mm at their widest across the chain, with corallites repeated 1.25 to 1.50 mm along the chain. Internal dimensions of corallites are between 0.85 × 0.95 mm and 0.90 × 1.10 mm, rarely equal in size across and along the chain. Corallite walls are thick, 0.25 mm or slightly less, except where corallites are in lateral contact. Here combined wall thickness varies from 0.25 to 0.30 mm and rarely up to 0.4 mm. The walls are fibronormal; rarely an axial plate appears to separate adjacent corallites but indifferent preservation has obscured the structure. Occasionally the corallite wall appears to be drawn out in a short septal spine. These structures have a very uneven distribution.

In longitudinal section, an axial plate can often be clearly seen separating adjacent corallites. The corallite walls also show irregular projections into the lumen which can be equated with the spines seen in

cross-section. Tabulae are almost all complete, flat to slightly dish-shaped and fairly regularly spaced 12 per 5 mm.

Discussion. The present specimen appears to be conspecific with the material described by TROEDSSON from the *Halysites* Limestone of the Cape Calhoun Formation, northwest Greenland and that described by NELSON from the Portage Chute Formation of Red River age in the northern Hudson Bay Lowland. As FLOWER (1961, pp. 43, 44) has pointed out, however, there must be some doubt as to whether WHITFIELD's species has been correctly interpreted by later authors in the absence of adequate descriptions of the type material.

Catenipora approximata EICHWALD 1829
Plate 9, Figs. 4–6

1966 *Catenipora approximata* EICHWALD; KLAAMANN, p. 46, p. 11, figs. 1–4; pl. 12, figs. 1, 2; text-figs. 22, 23.

Material. MMH 12985 (1232). Centrum Formation, 1150 m above base; locality 7.

Description. A fragment of one small colony, about 40 mm diameter.

The colony is massive, labyrinthiform. The corallites are 1.5 to 2.0 mm in diameter, circular to quadrate and occasionally polygonal in cross-section. Corallites are in contact at their corners in quadrate corallites, or along two or more sides, leaving square to irregular lacunae throughout the colony. Free corallite walls are up to 0.2 mm thick; corallites in contact are divided by a distinct common wall 0.10 to 0.15 mm thick. Septal spines are present but rarely seen. There appear to be no pores in the walls between corallites in contact.

In longitudinal section, common walls between adjacent corallites appear at least in some cases to have an axial plate. Tabulae mostly complete, flat, sometimes sinuous, averaging 10 in 5 mm.

Discussion. This specimen agrees very closely with KLAAMAAN's redescription of *Catenipora approximata* EICHWALD from the Lower Llandovery (G_{1-2}) of Estonia (see KLAAMANN *in* KALJO, 1970, p. 117).

Catenipora sp.
Plate 9, Fig. 7

Material. MMH 12986, 1973. 1513 (1233). Centrum Formation, 1150 m above base; locality 7.

Description. Two small fragments embedded in dark brown, fine grained limestone.

The colonies are cateniform, composed of linked chains of monomorphic corallites (autocorallites). The lacunae are variable in size, the smallest surrounded by four corallites but most much larger than this and elongate. Corallites are oval and the chain is markedly constricted at corallite junctions. The chain is 1.5 to 1.75 mm across at its widest and corallites repeat 2.0 to 2.5 mm along its length. Corallite internal dimensions are between 1.10 × 1.85 mm and 1.20 × 2.00 mm. Corallite walls are 0.2 mm or slightly less in thickness; the common wall between adjacent corallites is difficult to measure but seems little if at all thicker. Scattered short septal spines are doubtfully identified but their form and distribution are uncertain due the poor preservation.

In longitudinal section, the tabulae are complete, flat or slightly dish-shaped. There are 7 in 5 mm.

Discussion. The preservation of this material leaves the presence or absence of septal spines open to doubt, but their tentative identification favours assignment to *Catenipora* rather than to *Quepora*.

Order **HELIOLITIDA** Abel 1920

Family **Heliolitidae** Lindström 1876

Genus *Wormsipora* Sokolov 1955

1955 *Wormsipora* Sokolov, p. 80.

Wormsipora sp.
Plate 10, Figs. 1–3

Material. MMH 12987 (1240). Centrum Formation, 800 m above base; locality 6.

Description. One small colony, about 40 mm diameter, embedded in dark brown peletal limestone.

The colony is coenenchymal. The corallites are small, circular and uniform in size, averaging 1.2 mm diameter with a range of 1.1 to 1.3 mm. The corallite wall may be smooth or scalloped; it is about 0.08 mm thick. 12 spinose septa are present in each corallite, usually not exceeding one-third the radius in length. The coenenchyme is very limited. Corallites are sometimes in lateral contact but usually they are separated at their closest by up to one-third their radius. Subdivision of the coenenchyme is irregular and incomplete. The major and possibly only vertical elements involved appear to be septal extensions into the coenenchyme which, like the septa within the corallites, are probably spinose.

In longitudinal section, the tabulae in the corallites are almost exclusively complete, flat to slightly dish-shaped; there are 16 in 5 mm. The coenenchyme is also crossed by complete, flat to slightly dish-shaped tabulae but much more closely spaced at 34 to 48 in 5 mm. Increase is coenenchymal. An intercorallite area expands gradually in size and the spacing of the tabulae changes quite abruptly from coenenchymal to corallite spacing at a diameter of about 0.8 mm. The indifferent preservation does not allow the septal elements to be clearly distinguished in longitudinal section.

Discussion. This specimen is similar in general aspect to *Heliolites hirsutus* LINDSTRÖM (1899, p. 64, pl. 11, figs. 18–22) from the Upper Ordovician of Öland, the type species of *Wormsipora.* In *Wormsipora hirsuta*, however, the septa are better developed and the tabulae are more distant, particularly in the coenenchyme. *W. karasuensis* DZYUBO (1960, p. 383, pl. 0–8, figs. 4a–b), from the Upper Ordovician of the Altai Mountains, although of similar corallite size and appearance, also has much more distantly spaced tabulae. The present specimen may belong to a new species but further material needs to be studied before this can be confirmed.

Family **Proporidae** SOKOLOV 1950

Genus *Propora* EDWARDS & HAIME 1849

1899 *Propora;* LINDSTRÖM, p. 87.

Propora sp.
Plate 10, Figs. 4–6.

Material. MMH 12988, 1973.1414 (1230). Centrum Formation, 1550 m above base; locality 8.

Description. Two small fragments only are available.

The colonies are coenenchymal. The corallites are circular, ranging in diameter from 1.4 to 1.65 mm. The corallite wall is strongly scalloped with 12 inwardly directed projections which occasionally bear short, spinose septa. Otherwise spots of septal tissue can sometimes be distinguished beyond the ends of the projections. The corallites are close spaced, 1.65 to 2.20 mm center to center. There are short (up to 0.5 mm long), radial processes developed from the corallite walls and projecting into the coenenchyme; they appear to be completely independent of the septa. Their distal ends are free or they abut processes from adjacent

corallites. There is no aureole of tubuli. Other coenenchymal structures are the irregular sections of horizontally arranged vesicular tissue.

In longitudinal section, tabulae in the corallites are almost exclusively complete, flat and close-spaced or slightly dish-shaped, irregular and wider spaced. There are between 14 and 20 tabulae in 5 mm. The coenenchyme is highly vesicular. Individual vesicles vary in size up to 0.6 mm across and 0.4 mm high. Occasional short vertical spines (isolated trabeculae) are present in the coenenchyme.

Discussion. It has not proved possible to assign this material to an existing species of *Propora*. However, because of the poor quality and limited amount of material available it seems inadvisable to erect a new species here.

APPENDIX

Location of samples

The material described in this paper was collected during a rapid reconnaissance survey and as a result the stratigraphic position and geographic location of each sample should be treated as approximate rather than exact. All the localities are in the area between Centrumsø and Danmark Fjord, Kronprins Christian Land, northeast Greenland.

Locality 4A. Centrum Formation, 70 m above base. 11.5 km SE of the southern end of Danmark Fjord and 15 km ENE of the southwestern end of Fyn Sø.

Locality 6. Centrum Formation, 800 m above base. 1.5 km N of Sæfaxi Elv and 4 km WNW of the western end of Centrumsø.

Locality 7. Centrum Formation, 1150 m above base. 0.5 km N of the northern shore of Centrumsø and 2.25 km ENE of the western end of Centrumsø.

Locality 8. Centrum Formation, 1550 m above base. 0.5 km N of the northern shore of Centrumsø and 5 km ENE of the western end of Centrumsø.

Locality 8A. Centrum Formation; a thickness of limestone and dolomites ca. 1750 m above base. 0.5 km N of the northern shore of Centrumsø and between 8 km and 11.5 km ENE of the western end of Centrumsø.

Locality 9. Drømmebjerg Formation, 100 m above base. 2.5 km NNW of the northern shore of Centrumsø and 6.75 km WNW of the eastern end of Centrumsø.

Locality 10. Boulder conglomerate at the base of the Profilfjeldet Formation. About 0.2 km N of locality 9.

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Dr. Colin T. Scrutton
Department of Geology,
The University,
Newcastle upon Tyne, NE1 7RU.

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Færdig fra trykkeriet den 16. juni 1975

PLATES

Plate 1

?Stratodictyon sp.

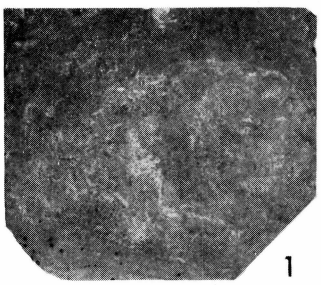
Figs. 1, 2. Cross-section, Fig. 1, ×3; Fig. 2, detail, ×10. MMH 12957a.

Figs. 3, 4. Longitudinal section, Fig. 3, ×3; Fig. 4, detail, ×10. MMH 12957d.
Centrum Formation, 1550 m above base; locality 8.

?Syringostroma sp.

Figs. 5, 6. Cross-sections, Fig. 5, ×3, MMH 12958a; Fig. 6, detail ×10, MMH 12958j.

Figs. 7, 8. Longitudinal sections, Fig. 7, ×3, MMH 12958c; Fig. 8, detail, ×10, MMH 12958d.
Centrum Formation, 1550 m above base; locality 8.



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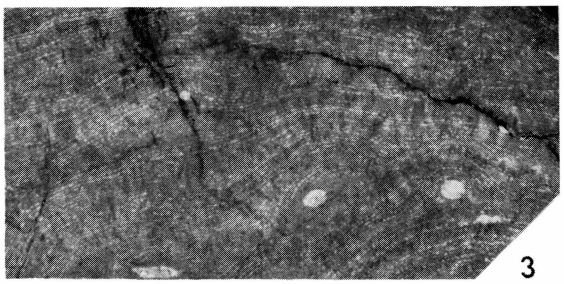

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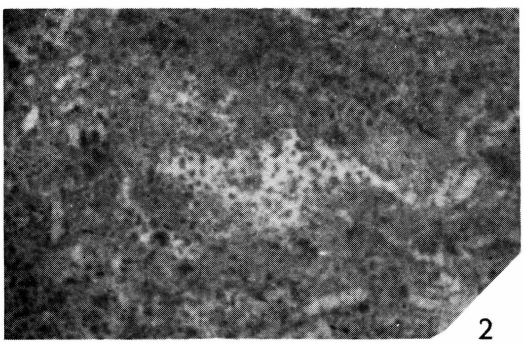

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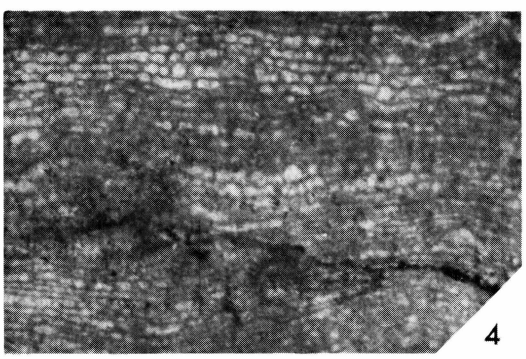

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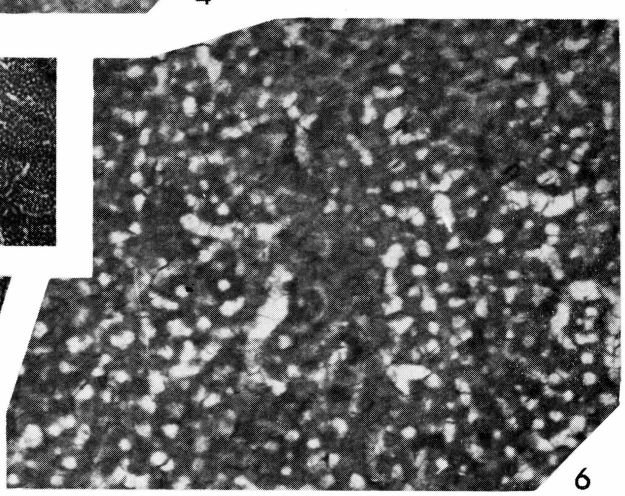

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Plate 2

Streptelasma sp. cf. *S. primum* (WEDEKIND 1927)

Fig. 1. Oblique cross-section, ×2, MMH 12959a.
Centrum Limestone, 800 m above base; locality 6.

Streptelasma sp.

Fig. 2. Cross-section, ×2. MMH 12960a.

Fig. 3. Longitudinal section, ×2. MMH 12960d.
Centrum Limestone, ca 1750 m above base; locality 8A.

Helicelasma sp. A

Fig. 4. Cross-section, ×2.5. MMH 12961a.

Fig. 5. Longitudinal section, ×2.5. MMH 12961e.
Centrum Limestone, ca 1750 m above base; locality 8A.

Dinophyllum sp. nov.

Fig 6. Cross-section, cardinal septum at top center, ×1.5. MMH 12962a.

Fig. 7. Cross-section, 30 mm higher than Fig. 6, ×1.5. MMH 12962b.

Fig. 8. Longitudinal section, ×1.5. MMH 12962c.
Boulder conglomerate at base of Profilfjeldet Formation; locality 10.

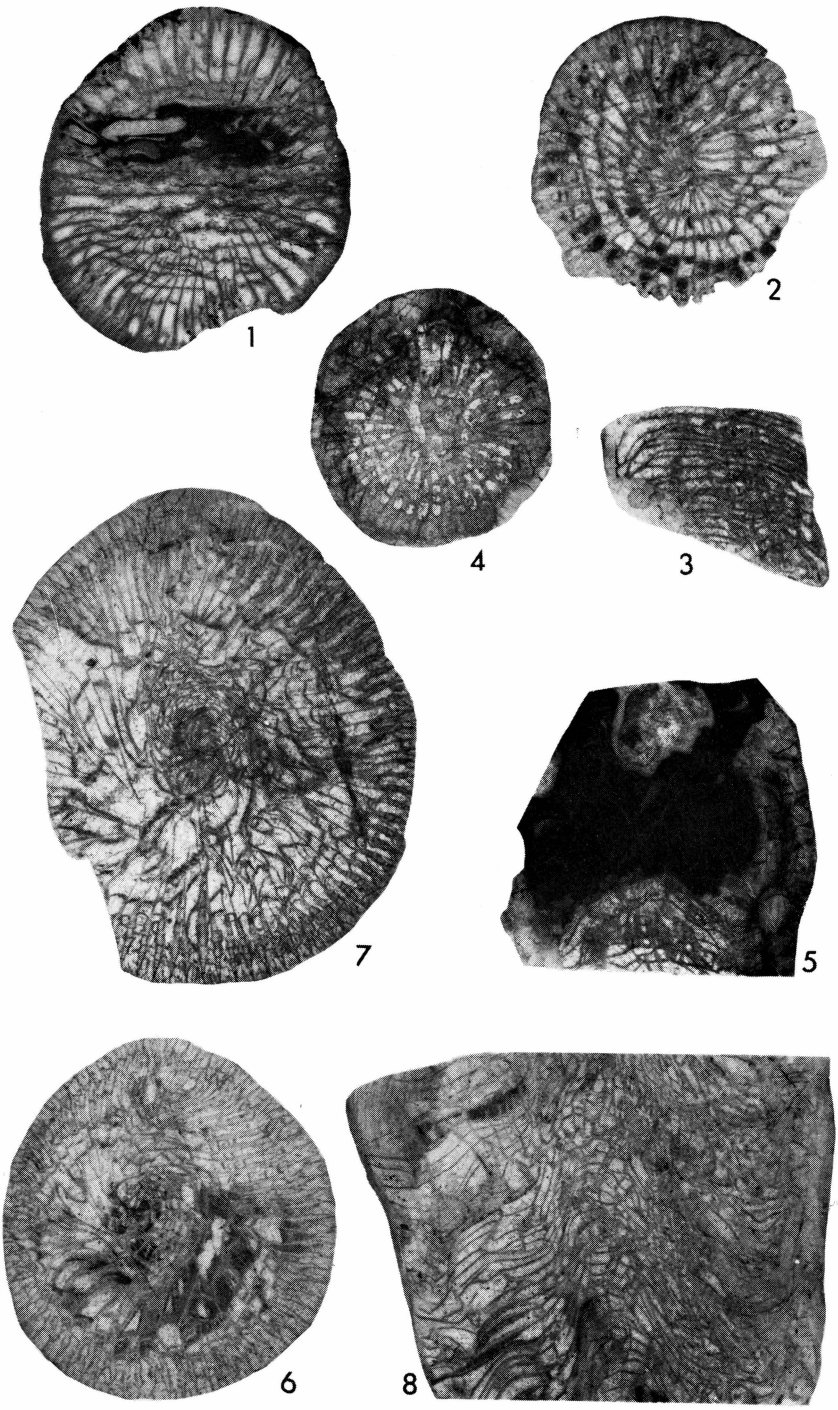
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Plate 3

Paleophyllum halysitoides (WILSON 1926)

Fig. 1. Cross-section, ×2. MMH 12963a.

Fig. 2. Longitudinal section, ×2. MMH 12963e.
Centrum Formation, ca 1750 m above base; locality 8A.

?Paleophyllum sp.

Figs. 3, 4. Cross-sections, ×2. Fig. 3, MMH 12964a; Fig. 4, MMH 12965a.

Fig. 5. Cross- and longitudinal sections, ×2. MMH 12965d.

Figs. 6, 7. Longitudinal sections, ×2. MMH 12964b, c.
Centrum Formation, 1150 m above base; locality 7.

Cyathophylloides sp.

Fig. 8. Cross-section, ×3. MMH 12966a.

Fig. 9. Longitudinal section, ×3. MMH 12966b.
Centrum Formation, 800 m above base; locality 6.

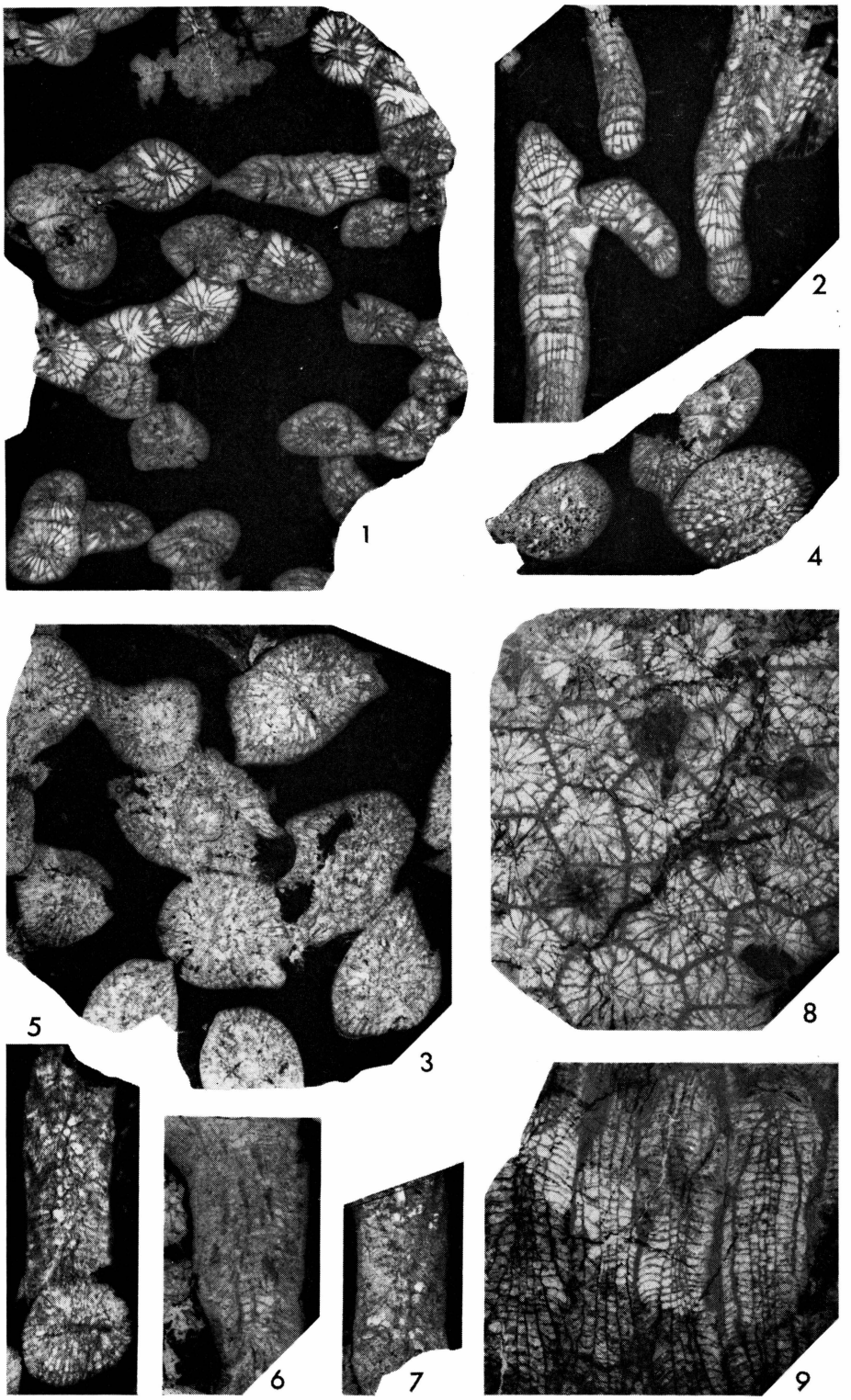
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Plate 4

?Tabularia sp.

Fig. 1. Cross-section, ×2. MMH 12967a.
Drømmebjerg Formation, ca 100 m above base; locality 9.

Tryplasma sp.

Fig. 2. Cross-section, ×3. MMH 12968a.

Fig. 3. Longitudinal section, ×3. MMH 12968b.
Boulder conglomerate at base of Profilfjeldet Formation; locality 10.

Microplasma lovenianum Dybowski 1874

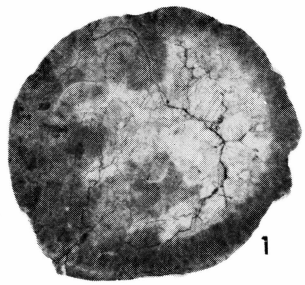
Fig. 4. Cross-section, ×2. MMH 12969a.

Figs. 5, 6. Longitudinal section, Fig. 5, ×2; Fig. 6, showing details of septal spines, ×10. MMH 12969b.
Boulder conglomerate at base of Profilfjeldet Formation; locality 10.

Saffordophyllum troedssoni sp. nov.

Figs. 7, 8. Cross-section, Fig. 7, ×3; Fig. 8 detail, ×5. MMH 12970a (holotype).

Fig. 9. Longitudinal section, ×5. MMH 12970b (holotype).
Centrum Formation, 1550 m above base; locality 8.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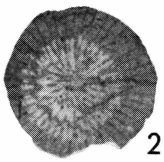
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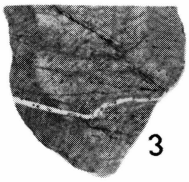
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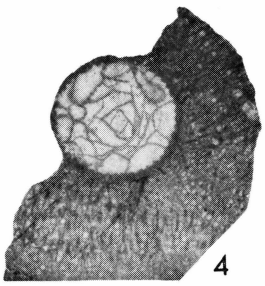
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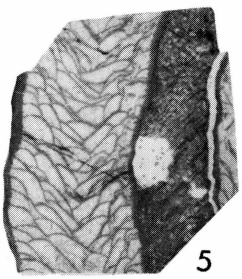
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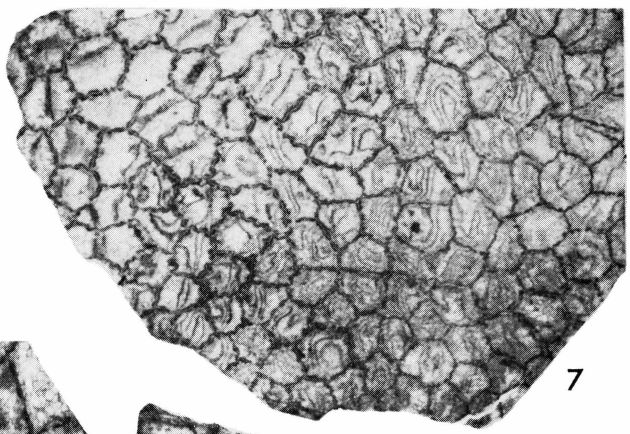
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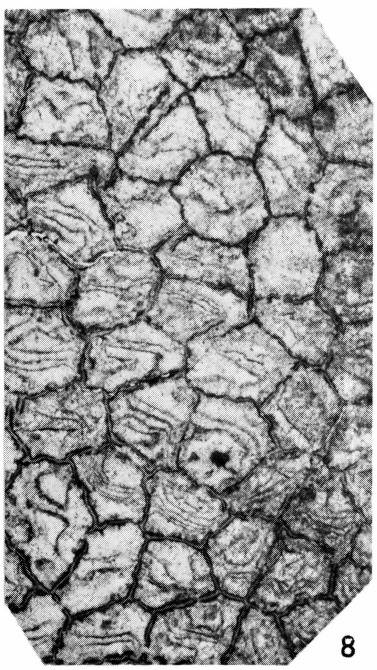
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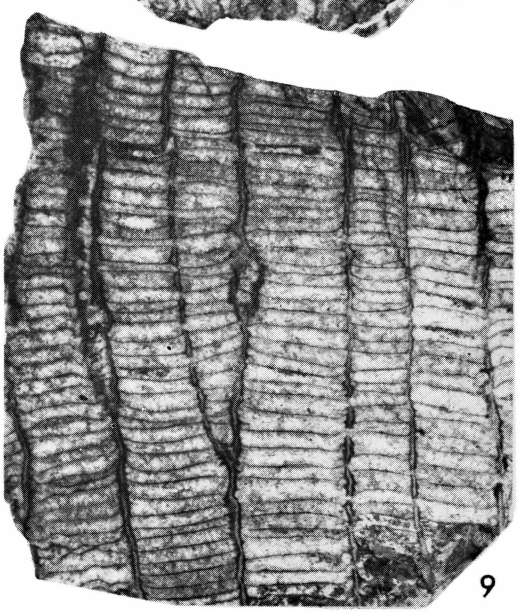
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Plate 5

?Foerstephyllum sp.

Fig. 1. Cross-section, ×3. MMH 12971a.
Fig. 2. Longitudinal section, ×3. MMH 12971b.
Centrum Formation, 1150 m above base; locality 7.

Tetradium tubifer Troedsson 1928

Fig. 3. Cross-section, ×3. MMH 12972a.
Fig. 4. Longitudinal section, ×3. MMH 12972c.
Centrum Formation, 70 m above base; locality 4A.

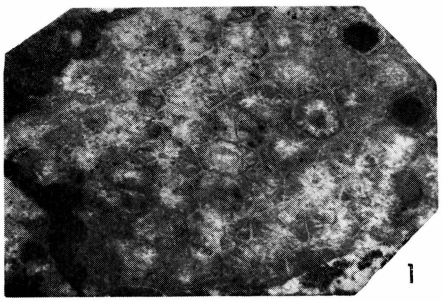
?Tetradium sp.

Fig. 5. Cross-section on slide MMH 12963c, ×5. MMH 12973.
Centrum Formation, ca 1750 m above base; locality 8A.

Calapoecia sp. cf. *C. coxi* Bassler 1950

Figs. 6, 7. Cross-section, Fig. 6, ×2; Fig. 7, detail, ×6. MMH 12974a.

Figs. 8, 9. Longitudinal sections, Fig. 8, ×3, MMH 12974e; Fig. 9, ×3, MMH 12974f.
Centrum Formation, 800 m above base; locality 6.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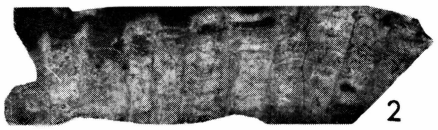
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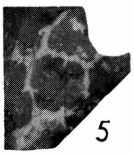
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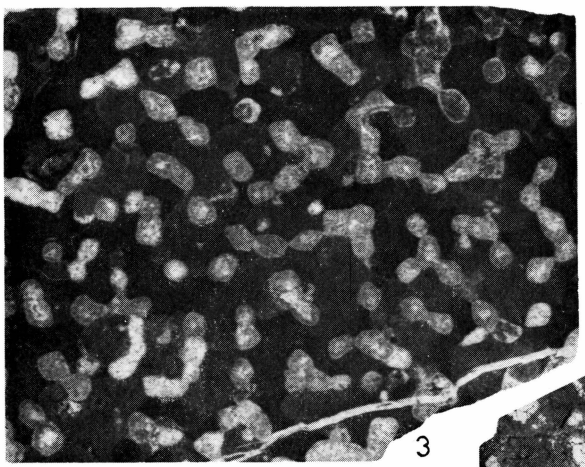
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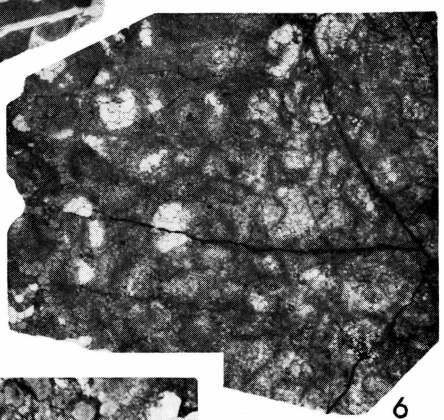
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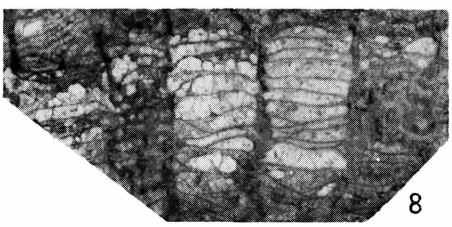
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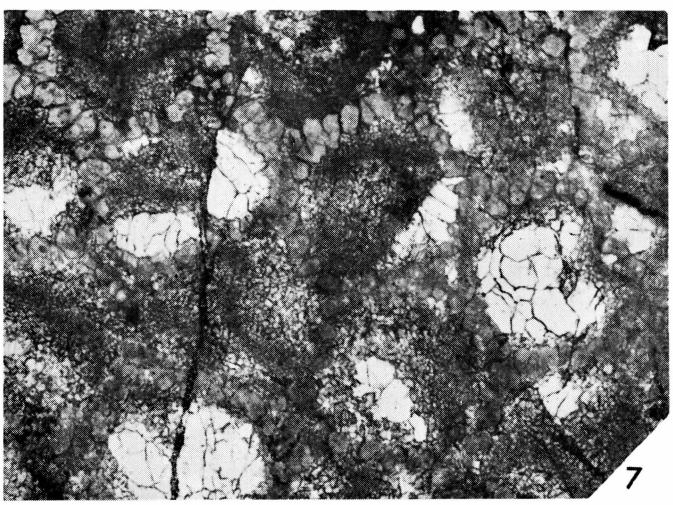
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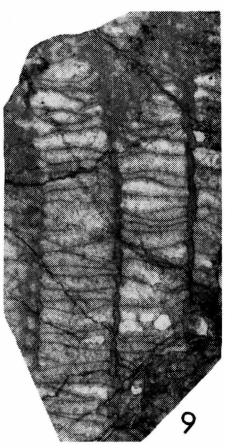
9

Plate 6

Paleofavosites cowiei sp. nov.

Figs. 1, 2. Cross-sections, Fig. 1, ×3, MMH 12975a; Fig. 2, ×3, MMH 12975b (holotype).

Figs. 3, 4. Longitudinal section, Fig. 3, ×3; Fig. 4, detail, ×5. MMH 12975d (holotype).
Centrum Formation, ca 1750 m above base; locality 8A.

Favosites wilsonae Nelson 1963

Figs. 5, 6. Cross-sections, ×3. Fig. 5, MMH 12977a; Fig. 6, MMH 12978a.

Fig. 7. Longitudinal section, ×3, MMH 12978c.
Centrum Formation, 1150 m above base; locality 7.

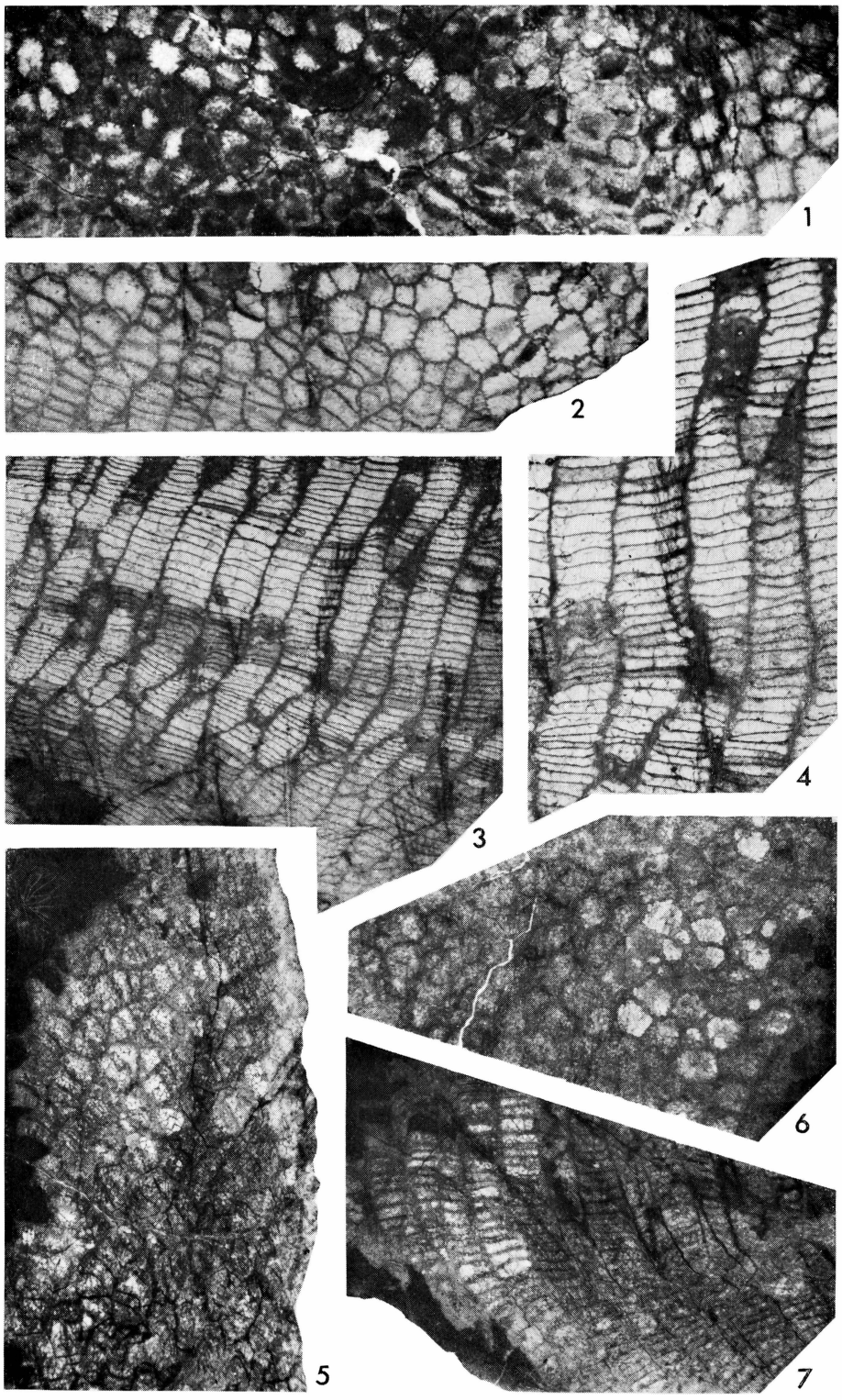
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Plate 7

Favosites gothlandicus LAMARCK 1816

Fig. 1. Cross-section, ×3. MMH 12979a.

Fig. 2. Longitudinal section, ×3. MMH 12979b.
Drømmebjerg Formation, ca 100 m above base; locality 9.

Favosites sp. A

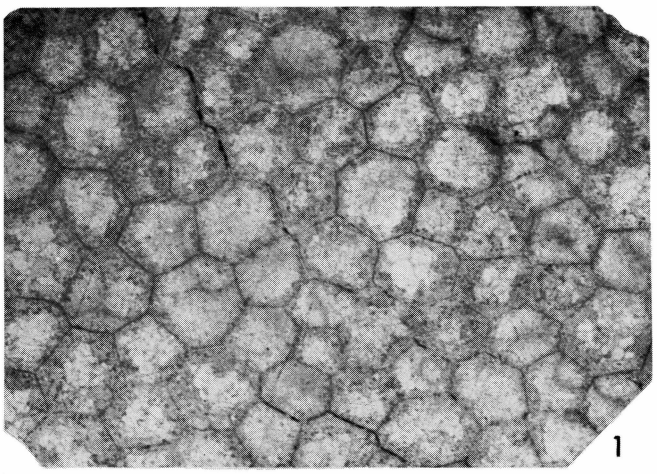
Fig. 3. Cross-section, ×3. MMH 12980a.

Fig. 4. Longitudinal section, ×3. MMH 12980c.
Centrum Formation, 1150 m above base; locality 7.

Favosites sp. B

Fig. 5. Cross-section, ×3. MMH 12981a.

Fig. 6. Longitudinal section, ×3. MMH 12981b.
Centrum Formation, 1550 m above base; locality 8.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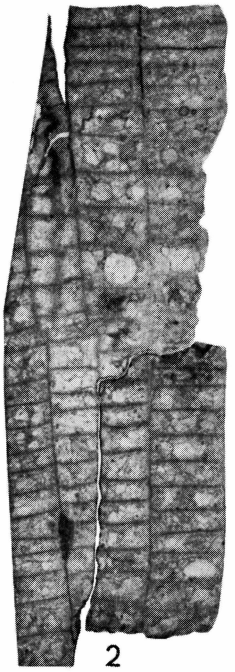
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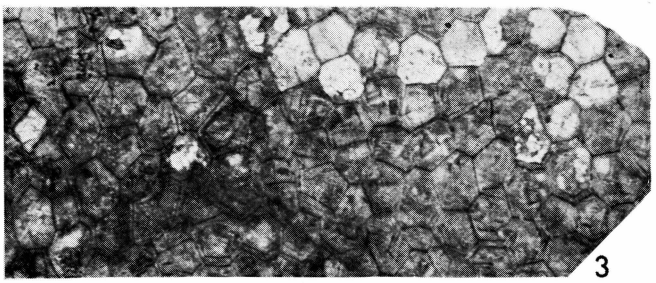
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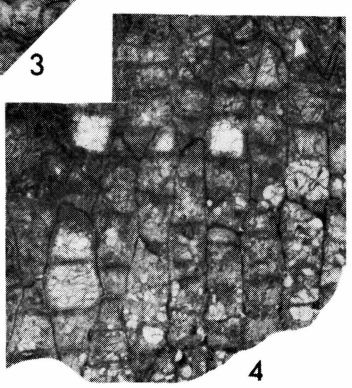
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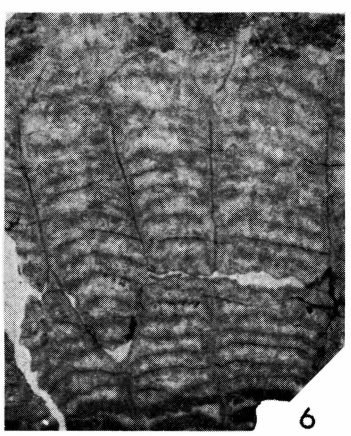
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Plate 8

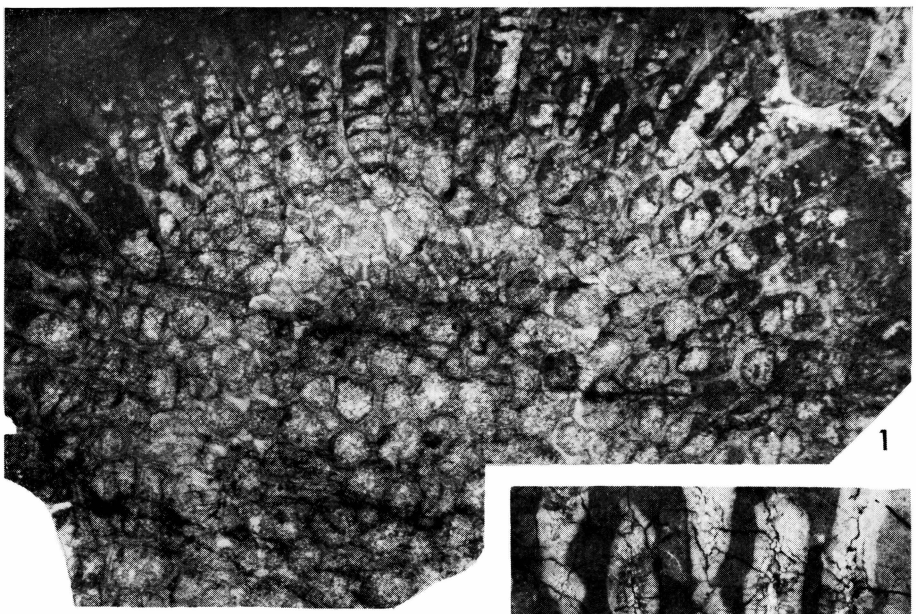
Favosites sp. C

Fig. 1. Cross- and longitudinal sections, ×5. MMH 12982a.
Centrum Formation, ca 1750 m above base; locality 8A.

?Troedssonites sp.

Figs. 2, 3. Cross-sections, ×3. Fig. 2, MMH 12983a; Fig. 3, MMH 12983b.

Figs. 4, 5. Longitudinal sections, ×3. Fig. 4, MMH 12983d; Fig. 5, MMH 12983f
Centrum Formation, ca 1750 m above base; locality 8A.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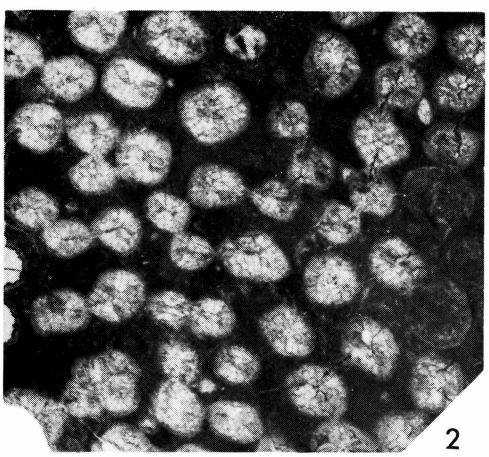
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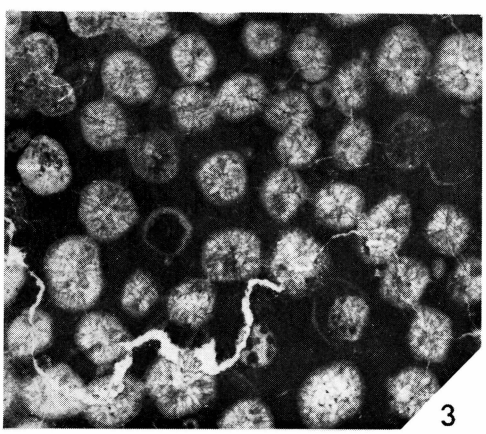
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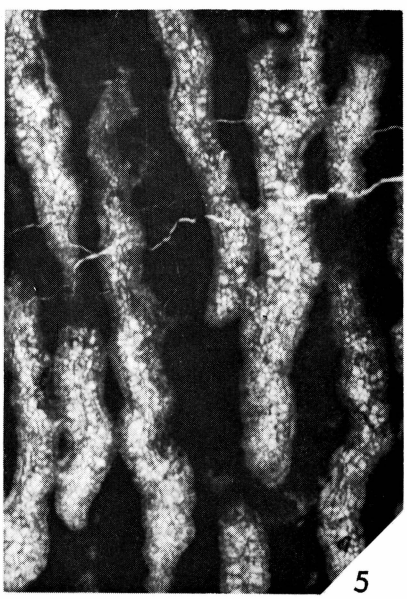
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Plate 9

Catenipora agglomeratiformis (WHITFIELD 1900)

Figs. 1, 2. Cross-section, Fig. 1, ×2; Fig. 2, detail, ×5. MMH 12984a.

Fig. 3. Longitudinal section, ×5. MMH 12984c.
Centrum Formation, 800 m above base; locality 6.

Catenipora approximata EICHWALD 1829

Figs. 4, 5. Cross-section, Fig. 4, ×2; Fig. 5, detail, ×5. MMH 12985a.

Fig. 6. Longitudinal section, ×2. MMH 12985c.
Centrum Formation, 1150 m above base; locality 7.

Catenipora sp.

Fig. 7. Cross-section, ×2. MMH 12986a.
Centrum Formation, 1150 m above base; locality 7.

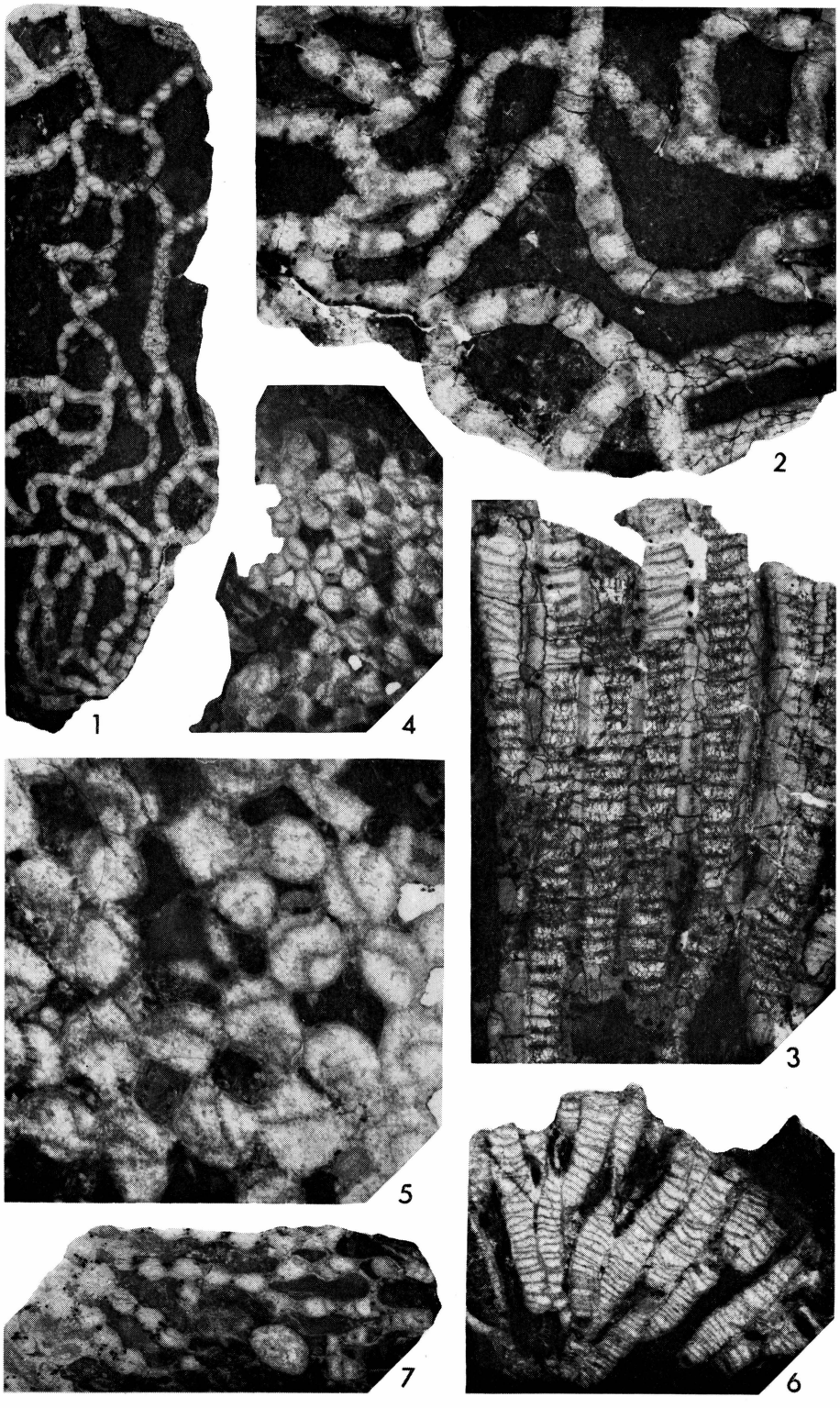
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Plate 10

Wormsipora sp.

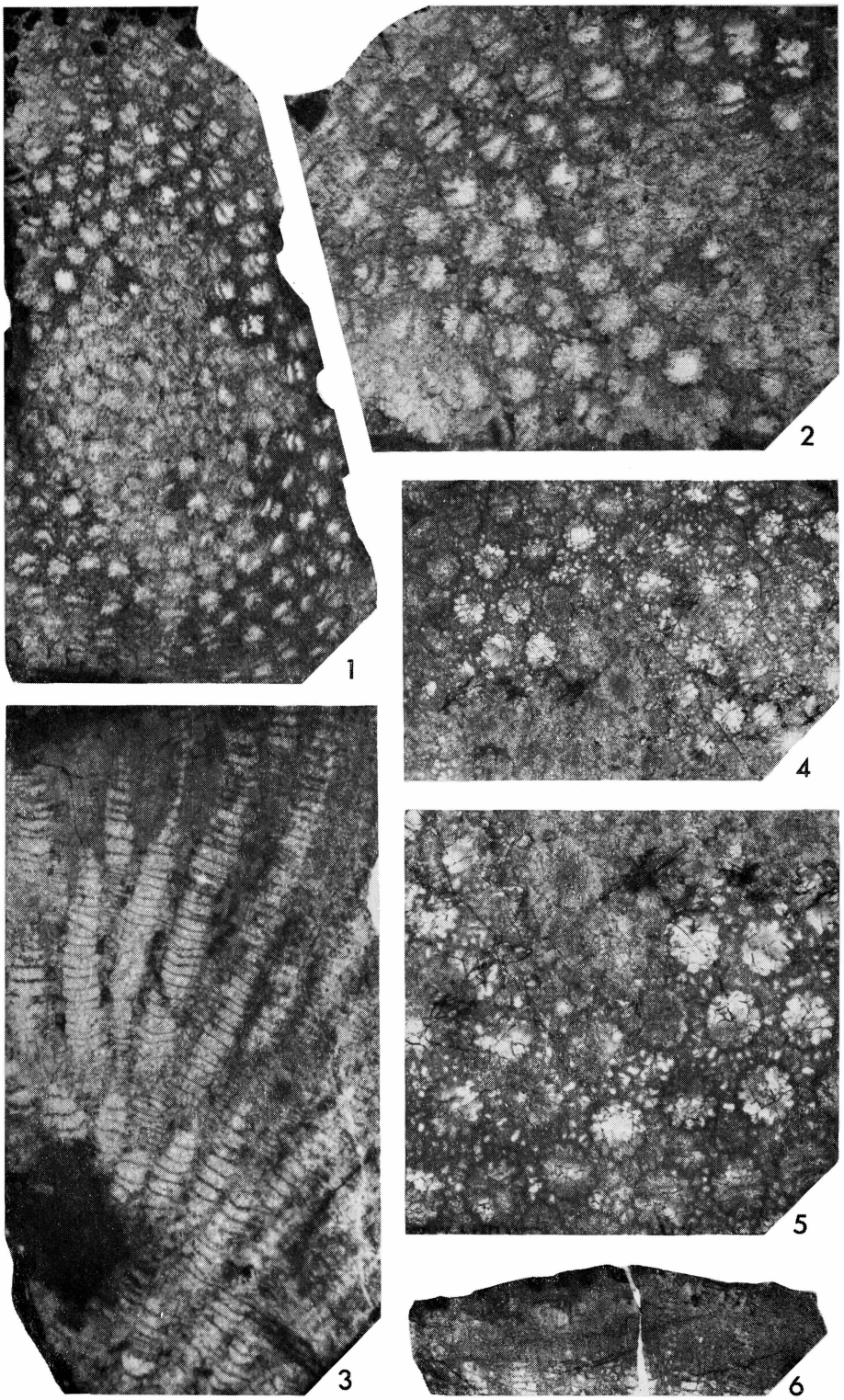
Figs. 1, 2. Cross-section, Fig. 1, ×3; Fig. 2, detail, ×5. MMH 12987a.

Fig. 3. Longitudinal section, ×5. MMH 12987b.
Centrum Formation, 800 m above base; locality 6.

Propora sp.

Figs. 4, 5. Cross-section, Fig. 4, ×3; Fig. 5, detail, ×5. MMH 12988a.

Fig. 6. Longitudinal section, ×3. MMH 12988b.
Centrum Formation, 1550 m above base, locality 8.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