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Stratigraphy and additional rugose corals from the Givetian Mont d'Haurs Formation in the Ardennes

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Abstract

Acanthophyllum simplex (WALTHER, 1929), *Grypophyllum denckmanni* WEDEKIND, 1922 and *Disphyllum semenoffi* n. sp. are described in detail and have been mainly collected in the lower part of the Givetian Mont d'Haurs Formation, on the south side of the Dinant Synclinorium. They are associated with *Argutastrea tenuiseptata* COEN-AUBERT & LÜTTE, 1990, *Sociophyllum isactis* (FRECH, 1886) and *S. wedekindi* COEN-AUBERT, 1999. Several of these taxa are also present in the same lithostratigraphic unit at Cour-sur-Heure as well as near the base of the Névremont Formation at Gerpinnes and Aisemont. The holotypes of *Acanthophyllum simplex* and *Grypophyllum denckmanni* are revised and refigured whereas the relations of these two taxa with the synonymous species introduced by WALTHER (1929) and WEDEKIND (1925) are discussed.

Key-words: Rugose corals, Givetian, Taxonomy, Stratigraphy, Belgium.

Résumé

Acanthophyllum simplex (WALTHER, 1929), *Grypophyllum denckmanni* WEDEKIND, 1922 et *Disphyllum semenoffi* n. sp. sont décrits en détail et ont été récoltés principalement dans la partie inférieure de la Formation givetienne du Mont d'Haurs, au bord sud du Synclinorium de Dinant. Ils y sont associés à *Argutastrea tenuiseptata* COEN-AUBERT & LÜTTE, 1990, *Sociophyllum isactis* (FRECH, 1886) et *S. wedekindi* COEN-AUBERT, 1999. Plusieurs de ces taxons sont présents dans la même unité lithostratigraphique à Cour-sur-Heure ainsi que près de la base de la Formation de Névremont à Gerpinnes et Aisemont. Les holotypes d'*Acanthophyllum simplex* et de *Grypophyllum denckmanni* sont revus et refigurés tandis que les relations de ces deux taxons avec les espèces synonymes introduites par WALTHER (1929) et WEDEKIND (1925) sont discutées.

Mots-clefs: Rugueux, Givetien, Taxinomie, Stratigraphie, Belgique.

Introduction

This work continues the investigation of the rich rugose coral fauna occurring in the Mont d'Haurs Formation from the south side of the Dinant Synclinorium and initiated by COEN-AUBERT (1999). It should be remembered that the Givetian Mont d'Haurs Formation belongs to the Lower *Polygnathus varcus* conodont Zone and lies in the upper part of the stage between the Terres d'Haurs and Fromelennes Formations as it was mentioned by COEN-AUBERT (1999, fig. 7). As in the earlier paper, the present study concerns mainly the area between Beauraing and Han-sur-Lesse located to the east of Givet (Fig. 1). However, a few samples come from Glageon at the west end of the southern part of the Dinant Synclinorium. Moreover, some sections at Cour-sur-Heure and Gerpinnes on the north side of the Dinant Synclinorium as well as at Aisemont on the south side of the Namur Synclinorium have also been surveyed in detail. According to BULTYNCK *et al.* (1991), the very reduced Givetian of these two structural units is characterized by the succession of the Névremont and Le Roux Formations. But, at the poorly known locality of Cour-sur-Heure, it appears that the Givetian facies are still similar to those from the south side of the Dinant Synclinorium.

This paper also includes systematic descriptions of *Disphyllum semenoffi* n. sp., *Acanthophyllum simplex* (WALTHER, 1929) and *Grypophyllum denckmanni* WEDEKIND, 1922. For the last two taxa, it was necessary to revise their holotypes and to discuss their relations with their synonymous species, that is to say *Acanthophyllum concavum* (WALTHER, 1929) and *A. inchoatum* (WALTHER, 1929) for *A. simplex* as well as *Grypophyllum normale* WEDEKIND, 1925, *G. regressum* WEDEKIND, 1925 and *G. tenue* WEDEKIND, 1925 for *G. denckmanni*.

The main part of the material was collected by the author *in situ* during geological surveys made bed by bed. This sampling is supplemented for two of the species by old thin sections referred in this paper to the "Old collection from the Institut royal des Sciences naturelles de Belgique". The types of the new species and the figured specimens are also stored in the collections of the Institut royal des Sciences naturelles de Belgique (IRScNB).

Description of the outcrops

NORTHERN LES LIMITES QUARRY AT AVE-ET-AUFFE (Wellin MC-1988-6; Fig. 2)

This active quarry has been located and described in detail by COEN-AUBERT (1999, p. 27, figs 2 and 3). It is excavated in the upper part of the Terres d'Haurs Formation and nearly all the Mont d'Haurs Formation. *Sociophyllum wedekindi* COEN-AU-

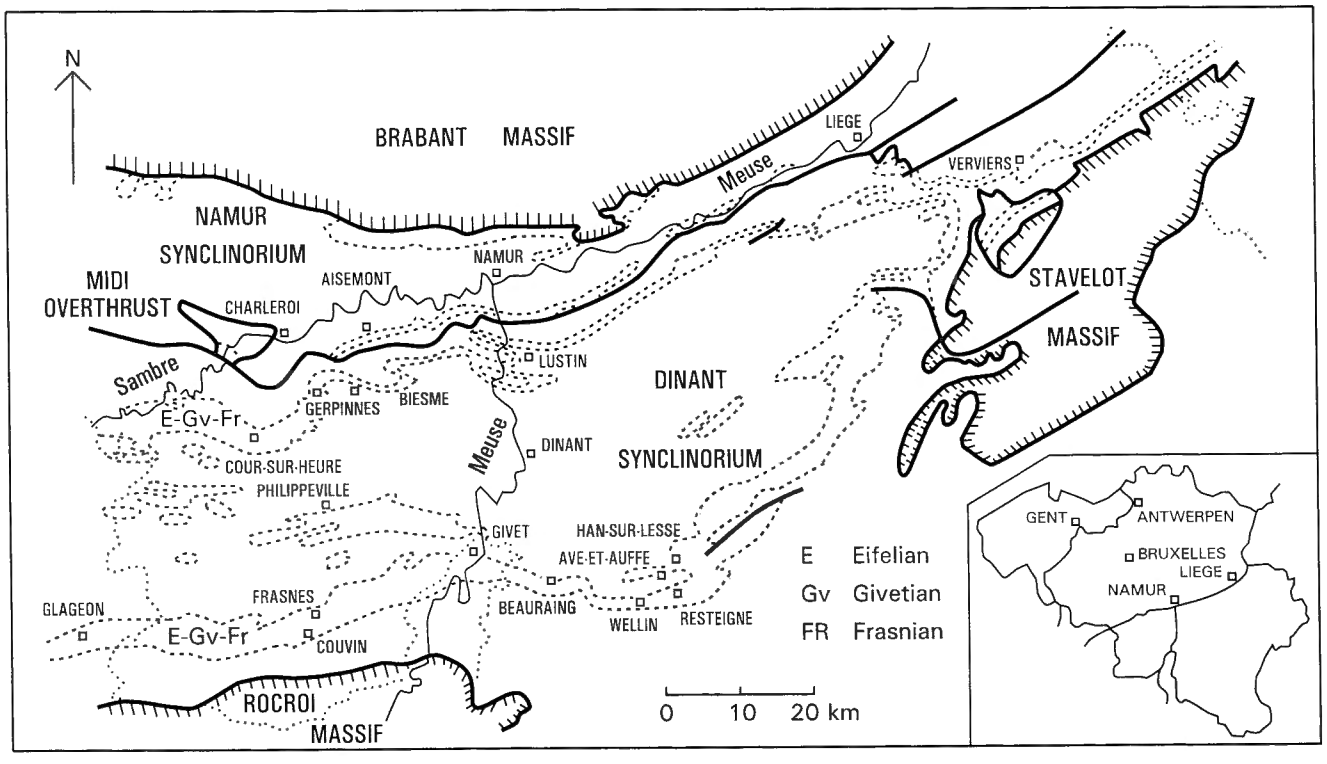

Fig. 1 — General situation in the south of Belgium.

BERT, 1999 and *Acanthophyllum simplex* are already present at the top of the Terres d'Haurs Formation which consists of coarsely crinoidal limestone.

The Mont d'Haurs Formation reaches a thickness of about 180 m and can be divided into two parts. At the top of the lower part, there is a double level of thin-bedded limestone which is a key bed in the area between Beauraing and Han-sur-Lesse; it is 10 m thick and includes a layer of biostromal limestone in the middle. Below the key bed, the limestone is rather argillaceous, but is often very rich in corals and stromatoporoids with a highly diversified fauna; as a whole, the lower part of the Mont d'Haurs Formation is 91 m thick. *A. simplex* and *Sociophyllum wedekindi* occur throughout these 91 m. *S. isactis* (FRECH, 1886) is also observed up to the second level of thin-bedded limestone, but appears only 17 m above the Terres d'Haurs Formation; this species forms locally beautiful fasciculate colonies (Pl. 3, fig. 10). *Disphyllum semenoffi* has only been found between 16 m and 28 m above the base of the Mont d'Haurs Formation. *Grypophyllum denckmanni* is rather rare in the northern Les Limites quarry whereas *Argutastrea tenuiseptata* COEN-AUBERT & LÜTTE, 1990 is very common in the upper 45 m from the lower part of the Mont d'Haurs Formation.

Above the double level of thin-bedded limestone, the upper part of the lithostratigraphic unit is 89.5 m thick and is characterized by pure limestone containing locally reef building organisms. The rugose corals are less abundant and are represented by a different fauna with *Argutastrea wangi* (TSIEN, 1978), *Wapitiphyllum laxum* (GÜRICH, 1896) and *Sunophyllum beichuanense* HE, 1978.

RESTEIGNE QUARRY (Wellin MC-1974-95; Fig. 2)

The disused quarry at Resteigne shows a complete succession from the top of the Jemelle Formation in the Eifelian to the base of the Mont d'Haurs Formation in the Givetian. The transition between the Terres d'Haurs and Mont d'Haurs Formations has already been investigated by BIRENHEIDE *et al.* (1991, p. 11) and COEN-AUBERT (1999, p. 29).

As it is the case in the northern Les Limites quarry, *Acanthophyllum simplex* is present at the top of the Terres d'Haurs Formation which is again characterized by coarsely crinoidal limestone. The species occurs also at the base of the Mont d'Haurs Formation represented by 13.5 m of dark limestone often rich in varied stromatoporoids, rugose and tabulate corals. *Sociophyllum wedekindi* and several coralla of *Grypophyllum denckmanni* have been collected in this part of the section.

WELLIN QUARRY (Wellin MC-1986-4; Fig. 2)

The disused quarry of Wellin, lying to the north of the active quarries from the Fond des Vaux, has been located by COEN-AUBERT (1999, fig. 2). The main part of the excavation is filled in with waste. However, three sections are still accessible at the entry of the quarry in the lower part of the Mont d'Haurs Formation. They show 40 m of biostromal limestone below the first level of thin-bedded limestone. In detail, the succession consists of:

— 2.4 m: thin beds of argillaceous or bioclastic limestone containing scattered reef building organisms: small massive stromatoporoids, favositids, platy alveolitids, thamnoporids, massive, fasciculate and solitary rugose corals including *Disphyllum semenoffi* and *Grypophyllum denckmanni*.

— 7.55 m: thin beds of limestone locally argillaceous; occurrence of laminar stromatoporoids and diverse corals at the top: massive and platy alveolitids, thamnoporids, scolioporids, solitary and a few fasciculate rugose corals including *G. denckmanni*, *Acanthophyllum simplex* and *Sociophyllum wedekindi*.

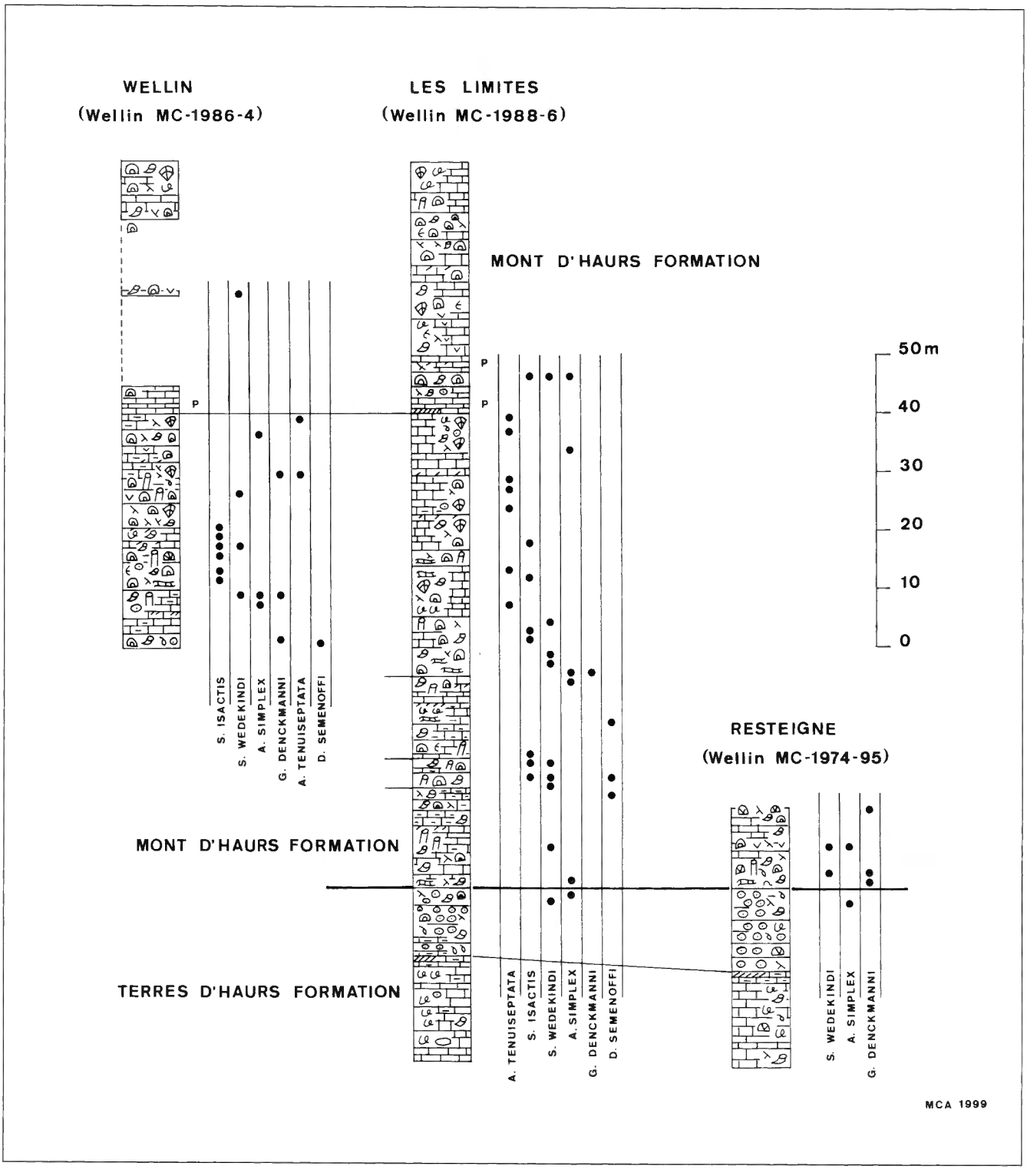

Fig. 2 — Comparative logs of the Wellin quarry, the northern Les Limites quarry at Ave-et-Auffe and the Resteigne quarry with the distribution of rugose corals. (For explanation of conventional signs, see Fig. 3).

— 8.2 m: limestone very rich in the same fauna as below accompanied by massive and dendroid stromatoporoids, stringocephalids, ramose alveolitids and *S. isactis* forming locally small thickets.

— 2.35 m: dark and fine limestone with gastropods at the base; occurrence of scattered corals and stromatoporoids.

— 19.65 m: limestone often argillaceous and locally dolomitised, more or less rich in the same varied reef building organisms as below associated with caliaporids and massive colonies of *Argutastrea tenuiseptata*.

— 4.65 m: very thin beds of fine limestone with a few massive stromatoporoids at the top; this is the first level of thin-bedded limestone.

— 28.5 m: lack of outcrop; in the middle, 0.85 m of argilla-

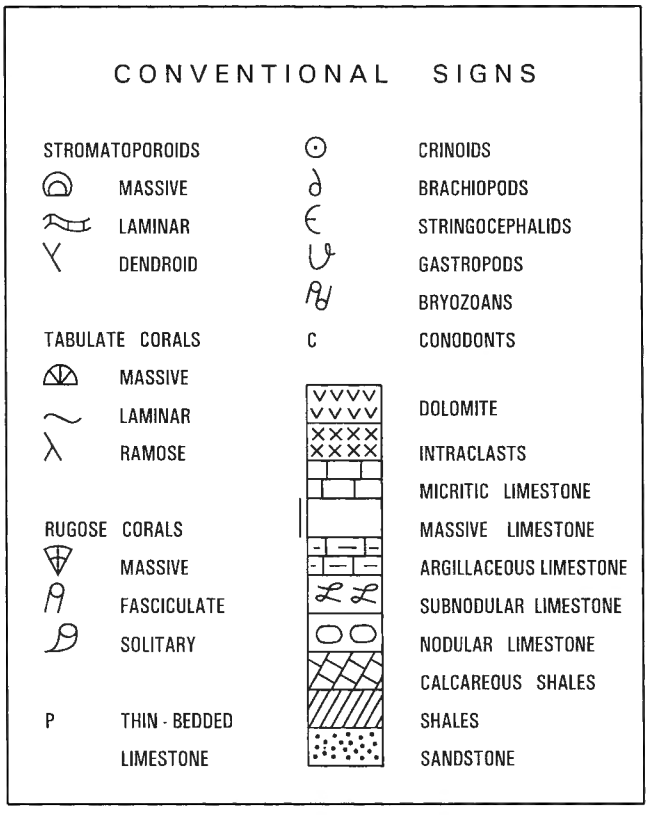

Fig. 3 — Explanation of conventional signs used in Figs. 2 and 5).

ceous or dolomitic limestone with massive stromatoporoids, solitary rugose corals and a few corallites of *Sociophyllum wedekindi*.

— 9.85 m: biostromal limestone with intercalations of fine limestone; occurrence of massive and dendroid stromatoporoids, solitary and massive rugose corals, thamnoporids, scoliporids and gastropods.

The last two outcrops in the filled part of the quarry belong to the upper part of the Mont d'Haurs Formation.

BEAURAING QUARRY (Beauraing MC-1975-3)

The quarry excavated in the Mont d'Haurs Formation, to the south of Beauraing and along the road to Winenne, has been located, described and figured by COEN-AUBERT (1999). Only one corallum of *Grypophyllum denckmanni* has been found at the base of the section, below the double level of thin-bedded limestone.

HAN-SUR-LESSE SECTION (Han-sur-Lesse MC-1975-15)

The Han-sur-Lesse section in the Mont d'Haurs Formation is situated along the road to Rochefort and has also been located, described and figured by COEN-AUBERT (1999). Only rare specimens of *Grypophyllum denckmanni* and *Acanthophyllum simplex* have been collected in this locality. The first species was found in the 5 m of biostromal limestone lying between the two levels of thin-bedded limestone. The second one was sampled 3 m above this key level.

GLAGEON QUARRY IN FRANCE

The active Bocahut quarry at Glageon lying to the west of Couvin has been investigated in detail by BOULVAIN *et al.* (1995). It shows a continuous succession in the Givetian from the upper part of the Hanonet Formation to the lower part of the Fromelennes Formation. In this locality, the Mont d'Haurs Formation has a thickness of 130 m. Several samples of *Disphyllum semenoffi* have been collected 23 m above the base of the lithostratigraphic unit.

SOUTHERN COUR-SUR-HEURE QUARRY (Gozée MC-47; Figs. 4 and 5)

Though Cour-sur-Heure belongs to the northern part of the Dinant Synclinorium, the facies of its very thick Givetian deposits are still similar to those from the south side of the same synclinorium. This surprising discovery was made recently by DELCAMBRE & PINGOT (2000) who were mapping this area and asked the author to help them for the regional correlations. The two quarries investigated (Fig. 4) are situated along the east side of the Eau d'Heure river and to the east of the railway track.

In the northern quarry (Gozée MC-59), the layers are dipping to the south. The Trois-Fontaines Formation whose base is not observed, is exposed with a thickness of 52 m. At about 2 m below its top, there is a small lens with several colonies of *Argutastrea quadrigemina* (GOLDFUSS, 1826). According to BULTYNCK *et al.* (1991, p. 54), this species is characteristic of the upper part from the Trois-Fontaines Formation and of the lower part from the Terres d'Haurs Formation.

At the south end of the northern quarry, the rather argillaceous limestones of the latter lithostratigraphic unit crop out with a thickness of 28 m. Then, the section becomes very discontinuous along the path between the two quarries; the thickness of this part is estimated to 11 m. Finally, the top of the Terres d'Haurs Formation is well exposed at the north-east corner of the southern quarry (Gozée MC-47) and partially along the path at the entry of the excavation. It consists of:

— 4 m: very thin beds of argillaceous limestone with rare fragments of solitary rugose corals.

— 6.5 m: argillaceous limestone with a few beds of shales; occurrence of crinoids, thamnoporids and solitary rugose corals at the base and at the top.

— 7.3 m: argillaceous limestone with very scattered crinoids and corals somewhat more numerous at the top where there are also some alveolitids.

The base of the Mont d'Haurs Formation is placed at the first pure and more or less coralliferous limestones. So the total thickness of the Terres d'Haurs Formation at Cour-sur-Heure is 57 m. This is nearly the same thickness as in Resteigne and Les Limites quarries described by BIRENHEIDE *et al.* (1991).

The structure of the southern quarry (Gozée MC-47) is characterized by two synclines separated by an anticline. The base of the Mont d'Haurs Formation is exposed in continuity with the Terres d'Haurs Formation, along the northern limb of the northern syncline (section A; Figs. 4 and 5) where it is represented by:

— 23.7 m: dark limestone, often bioclastic with more or less scattered corals: massive, platy and ramose alveolitids, thamnoporids, syringoporids, solitary and fasciculate rugose corals, the latter represented by *Disphyllum semenoffi* near the base and *Sociophyllum isactis* at the top; occurrence of massive stromatoporoids in the upper part of the sequence.

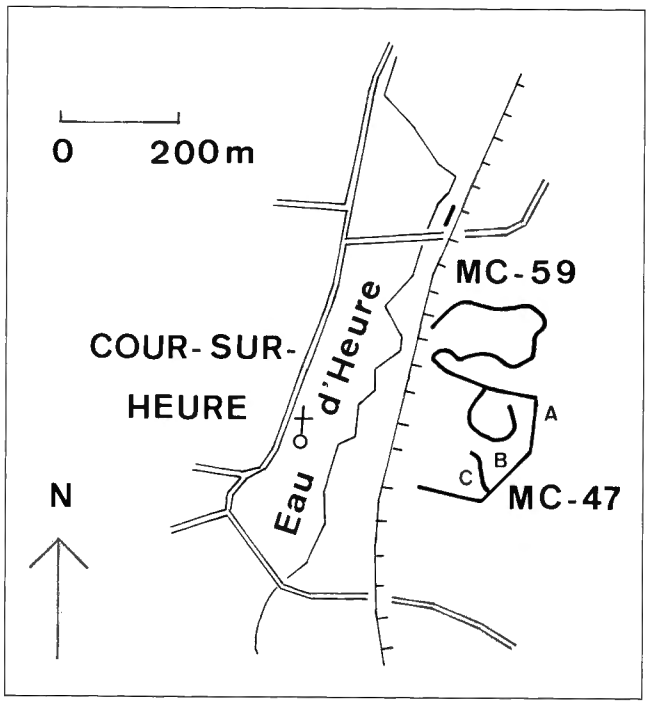

Fig. 4 — Location of the Cour-sur-Heure quarries.

— 3.25 m: subnodular limestone with some corals including a few colonies of *Argutastrea tenuiseptata* near the base.
— 5 m: argillaceous limestone and shales with a level rich in *A. tenuiseptata* in the middle.
— 5 m: bioclastic limestone with a few thamnoporids and fragmented solitary rugose corals.
— 3.15 m: argillaceous limestone with layers of shales at the base and at the top.
— 2.5 m: limestone inaccessible.
— 4.5 m: subnodular, bioclastic or crinoidal limestone; in the upper part, several beds containing *A. tenuiseptata*, solitary rugose corals, thamnoporids and alveolitids.

The same beds with *A. tenuiseptata* are found again along the southern limb of the northern syncline whose core is hidden by screes. On a very short distance, these layers are folded in an anticline and are overlain on its southern flank (section B; Figs. 4 and 5) by:
— 8.9 m: thin beds of limestone locally argillaceous or bioclastic with rare corals.
— 13.8 m: argillaceous limestone with several intercalations of shales; occurrence of some crinoids, alveolitids, thamnoporids and solitary rugose corals.

Then, there is a striking change to pure limestones which form the core of the southern syncline. This bedded level is 8 m thick and contains scattered massive and dendroid stromatoporoids, caliaporids, alveolitids, thamnoporids, solitary and fasciculate rugose corals. Below this level, section C (Figs. 4 and 5) corresponds to the southern limb of the southern syncline. In this place, the underlying unit with argillaceous limestones and shaly intercalations has yielded some conodonts identified by Bultynck and represented by *Icriodus obliquimarginatus* and *Polygnathus timorensis*. According to Bultynck (1987, fig. 9), this association indicates the Lower *Polygnathus varcus* Zone without reaching its top.

In conclusion, the southern quarry at Cour-sur-Heure exposes mainly the lower part of the Mont d'Haurs Formation that is about 70 m thick. Of course, the corals and stromatoporoids are not so abundant as at Wellin and in the northern Les Limites quarry. But there are also at Cour-sur-Heure several levels of argillaceous limestones with thin beds of shales. Moreover, the presence of *Disphyllum semenoffi* near the base of the lithostratigraphic unit and the occurrence of *Argutastrea tenuiseptata* higher in the sequence confirm the lithologic correlation proposed herein.

DISUSED RAILWAY SECTION AT GERPINNES (Nalinnes MC-1975-2; Figs. 5 and 6)

The section of Gerpinnes along the disused railway line is situated to the east of the village (Fig. 6) and has been investigated by Lecompte (1960 and 1963). It shows a nearly complete succession from the Névremont Formation in the Givetian to the base of the Neuville Formation in the Frasnian. The Névremont Formation is exposed at the southern end of the outcrop. The section starts in the core of an anticline with 16 m of argillaceous and bioclastic limestone, locally dolomitic at the base and rather rich in brachiopods, crinoids and corals: colonies of *Argutastrea tenuiseptata*, solitary rugose corals including *Acanthophyllum simplex*, massive alveolitids and thamnoporids accompanied by a few massive and laminar stromatoporoids. On the northern limb of the anticline, these layers are succeeded by:
— 33 m: alternation of thin beds of fine dolomite and fine, argillaceous or crinoidal limestone.
— 3.85 m: dark limestone with a bed of oolites in the upper part.
— 2.5 m: gap.
— 5.45 m: interbedded shales and argillaceous limestones often containing crinoids associated with a few brachiopods and thamnoporids.

This argillaceous unit seems to be equivalent to the argillaceous limestones observed in the southern quarry of Cour-sur-Heure, at the top of the lower part from the Mont d'Haurs Formation (Fig. 5, dotted line). Then the sequence continues with:
— 50.5 m: dark and well-bedded limestone with several layers containing a few scattered corals: massive and solitary rugose corals, alveolitids, thamnoporids and scolioporids.
— 6.5 m: dark limestone with scattered massive stromatoporoids accompanied by a few alveolitids, thamnoporids and solitary rugose corals; this limestone is locally nodular at the top and is overlain by the same rock after an interruption.

After that, the section becomes very discontinuous and tectonically complicated. On the northern limb of a second anticline appear again the limestones with massive stromatoporoids where they are capped by 11 m of nodular and argillaceous limestones containing some crinoids. Then the Le Roux Formation starts with 12.5 m of shales.

Although Gerpinnes is only situated 11 km to the north-east of Cour-sur-Heure, its equivalent Givetian deposits to the Mont d'Haurs Formation have very different facies. This is mainly due to the scarcity of corals and stromatoporoids throughout the sequence. Therefore, these sediments, though rather thick, are better assigned to the Névremont Formation whose stratotype at Aisemont is described hereafter. As it is the case for the Mont d'Haurs Formation, the Névremont Formation can be subdivided into two parts at Gerpinnes. In its lower part, there are of course some levels with argillaceous limestones and shales, but there are also many beds of fine dolomite which contribute to give a particular look to the lithostratigraphic unit. The occurrence of *Argutastrea tenuiseptata* and *Acanthophyllum simplex*

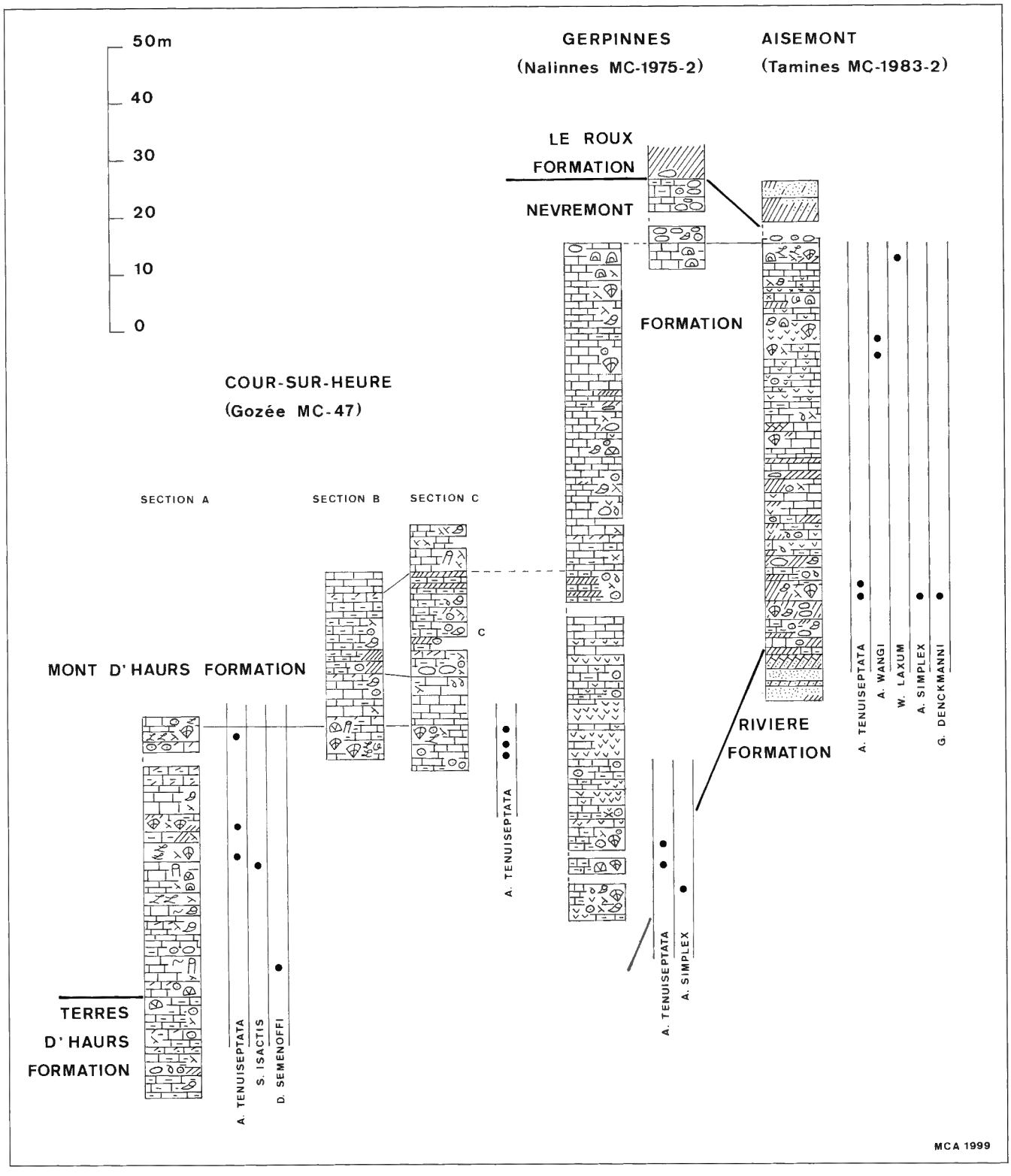

Fig. 5 — Comparative logs of the southern Cour-sur-Heure quarry and the railway sections at Gerpinnes and Aisemont with the distribution of rugose corals. (For explanation of conventional signs, see Fig. 3).

at the base of the section supports the detailed correlations between the Névremont and Mont d'Haurs Formations. Moreover, *Wapitiphyllum laxum* was found near the top of the Névremont Formation at Biesme, a locality lying 5 km to the east of Gerpinnes and belonging also to the north side of the Dinant Synclinorium.

AISEMONT RAILWAY SECTION (Tamines MC-1983-2; Fig. 5)

This section is the stratotype for the Névremont Formation introduced by LACROIX (1974a and b) and revised by BULTYNCK *et al.* (1991). The top of the underlying Rivière Formation is

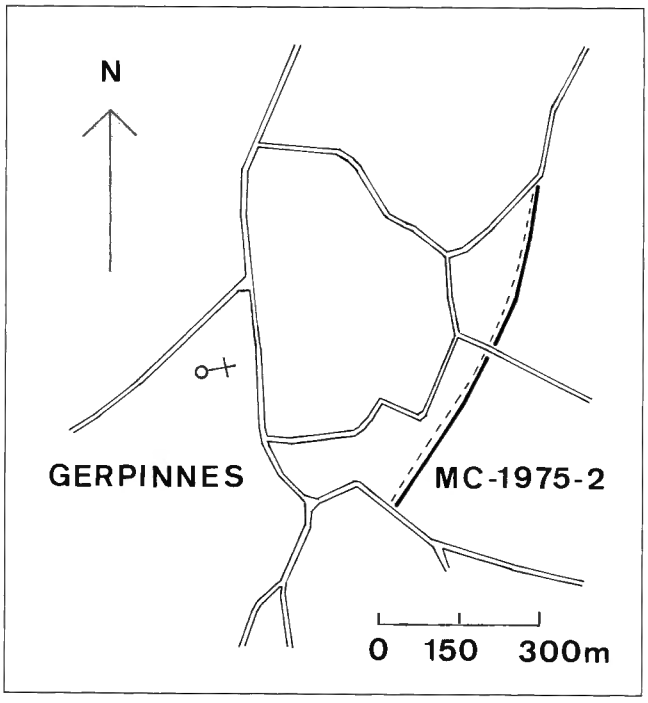

Fig. 6 — Location of the disused railway section at Gerpinnes.

represented by sandstones and sandy shales, both rocks being locally calcareous; however, thin-bedded limestone with some nodules is already present in the last 0,7 m of the lithostratigraphic unit. Then the Névremont Formation starts with:
— 2.5 m: fine limestone with fragments of crinoids at the base; occurrence of several beds of shales.
— 2.3 m: argillaceous limestone with crinoids and rare corals.
— 12 m: argillaceous limestone and shales with brachiopods, crinoids and several levels rich in corals: colonies of *Argutastrea tenuiseptata*, solitary rugose corals including *Acanthophyllum simplex* and *Grypophyllum denckmanni*, massive alveolitids and thamnoporids.

These three subdivisions were placed at the base of the Névremont Formation by LACROIX (1974a and b) and COEN-AUBERT (1988, fig. 3), but were excluded from it by BULTYNCK *et al.* (1991). However, it is better to return to the original boundary between the two lithostratigraphic units from a mapping, industrial and hydrological point of view as there is a marked difference between the strongly terrigenous deposits of the Rivière Formation and the mainly carbonate sediments of the Névremont Formation.

At Aisemont, it is again possible to divide the Névremont Formation into two parts. The rest of its lower part is 26 m thick and corresponds to units B, C, D and E distinguished by LACROIX (1974b). It is characterized by an alternation of shales and limestone which is fine, bioclastic or locally argillaceous and contains a few brachiopods and crinoids or even rare thamnoporids, solitary rugose corals and fragments of massive rugose corals; some beds of dolomite are present at the base of these 26 m. Then the upper part of the Névremont Formation is 27.5 m thick and is equivalent to units F and G of LACROIX (1974b). Here, the layers of shales and argillaceous limestone have nearly disappeared and the rather pure limestones are often dolomitised. There are also several intercalations with corals and stromatoporoids, especially near the top. *Argutastrea wangi* occurs in the middle of this sequence and *Wapitiphyllum laxum* at its top. Finally, one meter of nodular and crinoidal limestone is observed before the Le Roux Formation described by BULTYNCK *et al.* (1991).

Stratigraphic correlations

On the south side of the Dinant Synclinorium, the lower part of the Mont d'Haurs Formation, up to a double level of thin-bedded limestone, is characterized by an alternation of biostromes and more or less argillaceous limestones which represent fore reef facies. It contains a rich fauna of rugose corals that has been partly investigated by COEN-AUBERT (1999). *Acanthophyllum simplex*, *Sociophyllum wedekindi*, *S. isactis* and *Grypophyllum denckmanni* occur throughout this sequence. The first two species are also present at the top of the Terres d'Haurs Formation and somewhat higher than the thin-bedded limestones. *Disphyllum semenoffi* is restricted to the base of the Mont d'Haurs Formation whereas *Argutastrea tenuiseptata* is very abundant in the upper half of its lower part.

Several of these species are also found on the north side of the Dinant Synclinorium and on the south side of the Namur Synclinorium. At Cour-sur-Heure, the Mont d'Haurs Formation is still clearly recognizable. In the lower part of the lithostratigraphic unit, *Disphyllum semenoffi* has been collected near its base, *Sociophyllum isactis* in the middle of the sequence and *Argutastrea tenuiseptata* in its upper half. At Gerpinnes and Aisemont, the Mont d'Haurs Formation passes laterally into the Névremont Formation where the corals and stromatoporoids are much less common. However, it is also possible to divide the Névremont Formation into two parts: a lower one rather argillaceous and an upper one with pure limestones and some back reef facies. *Acanthophyllum simplex*, *Grypophyllum denckmanni* and *Argutastrea tenuiseptata* have been locally observed in the lower part of the Névremont Formation whereas *A. wangi* and *Wapitiphyllum laxum* are reported in its upper part at Biesme and Aisemont. The last two species are characteristic of the upper part of the Mont d'Haurs Formation, on the south side of the Dinant Synclinorium.

Systematic Palaeontology

Family PTENOPHYLLIDAE WEDEKIND, 1923
Genus *Acanthophyllum* DYBOWSKI, 1873

= *Mesophylloides* WEDEKIND, 1922
= *Ptenophyllum* WEDEKIND, 1923
= *Astrophyllum* WEDEKIND, 1924
= *Rhopalophyllum* WEDEKIND, 1924
= *Leptoinophyllum* WEDEKIND, 1925
= *Stenophyllum* WEDEKIND, 1925

Type species
By subsequent designation of SCHLÜTER (1889, p. 296), *Cyathophyllum heterophyllum* MILNE-EDWARDS & HAIME, 1851.

DIAGNOSIS
Large solitary rugose corals. Septa of two orders, rarely discontinuous at the periphery, thin to more or less dilated throughout their length. Major septa, sometimes thicker in the outer or in the inner part of the dissepimentarium, carinate in the tabularium and reaching usually the axis of the corallum. Minor septa traversing the entire dissepimentarium. Wide dissepimentarium composed of numerous rows of inclined dissepiments which are occasionally subhorizontal at the periphery. Tabulae incomplete and closely spaced, forming concave floors.

Acanthophyllum simplex (WALTHER, 1929)
Plate 1, Figures 1-8, Plate 2, Figures 10, 11

v *	1929	*Neostringophyllum simplex*- WALTHER, p. 113, fig. 7.
v	1929	*Neostringophyllum concavum*- WALTHER, p. 114, fig. 8.
v	1929	*Neostringophyllum inchoatum*- WALTHER, p. 112, figs. 4, 5.
p.	1961	*Acanthophyllum (Neostringophyllum) concavum* (Walther 1928)- BIRENHEIDE, p. 125 (non pl. 7, figs. 23, 24).
p.	1964	*Acanthophyllum (Neostringophyllum) concavum* (Walther)- WEBBY, p. 12, figs. 4b, c (non fig. 4a).
non	1966	*Acanthophyllum (Neostringophyllum)* aff. *concavum* (Walther 1928)- FLÜGEL, p. 102, pl. 1, fig. 1.
?	1976	*Acanthophyllum (Neostringophyllum) concavum* (Walther)- FLÜGEL & HÖTZL, fig. 6.
v	1978	*Acanthophyllum concavum* (Walther 1928)- BIRENHEIDE, p. 150, figs. 94a, b.
	1984	*Acanthophyllum concavum* (Walther, 1928)- LÜTTE, p. 196, fig. 6, pl. 4, figs. 5, 6.
	1988	*Acanthophyllum concavum* (Walther 1929)- ROHART, p. 247, pl. 29, fig. 6.
	1990	*Acanthophyllum concavum* (Walther 1928)- BIRENHEIDE, pl. 4, fig. 12.
?	1990	*Acanthophyllum* sp., Gruppe *vermiculare/concavum*- BIRENHEIDE & LÜTTE, p. 15.
non	1992	*Acanthophyllum concavum* (Walther, 1928)- OEKENTORP-KÜSTER & OEKENTORP, p. 238, pl. 2, fig. 1.
non	1994	*Acanthophyllum concavum* (Walther), 1928- WANG, p. 399, pl. 5, figs. 3, 4.
non	1996	*Acanthophyllum concavum simplex* (Walther 1928)- MAY & BECKER, p. 215, pl. 1, figs. 1-3.
non	1998	*Acanthophyllum concavum* (Walther 1928)- SCHRÖDER, p. 57, pl. 12, fig. 80.

Holotype
Fig. 7 *in* WALTHER (1929), fig. 94a *in* BIRENHEIDE (1978) and pl. 1, figs. 4, 5 figured herein. Specimen SMF WDKD 7118 and thin sections SMF WDKD 7116 and 7117 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Upper Givetian Schwelm Formation at Hofermühle, in the Bergisches Land, Germany

Material and localities
Thirty-two specimens with 48 thin sections. Personal sampling: Wellin MC-1988-6-A702, A704, A728, A773, B111D, B111E, B130, B151, B152, B154 and B253, Wellin MC-1986-4-A510B, A528A, A531D and A577, Wellin MC-1974-95-Z846, Z848 and Z909, Han-sur-Lesse MC-1975-15-120, Nalinnes MC-1975-2-X31, Tamines MC-1983-2-Z55210, Z55219 and Z55225. Old collection from the Institut royal des Sciences naturelles de Belgique: Agimont (Mont d'Haurs at Givet)-Gi-28390, 28423 and 28800, Hamoir 7856-Gid-12756, Seloignes 8260-Gib-11363 and 11486, Senzeilles 6848-Gid-12614, Tamines 14d (= Tamines MC-1983-2)-GiIIa-13040, Wellin 6264 (= Wellin MC-1986-4)-Gid-12581.

DIAGNOSIS
A species of *Acanthophyllum* with 62 to 72 septa at a diameter of 17 mm to 30 mm. Major septa often thicker in the dissepimentarium, especially in its outer part where some stereoplasmic thickenings may occur. Numerous rows of inclined dissepiments.

DESCRIPTION OF THE HOLOTYPE
From the holotype, there remains one transverse section, one longitudinal section and a cylindrical fragment 8 cm long. The outer wall is rather well preserved in the cross section and is encrusted by lamellar alveolitids and Bryozoa and even by a thin laminar stromatoporoid.

The septa are non-carinate and dilated throughout their length. The major septa are often thicker in the dissepimentarium and extend close to the axis of the corallum where their inner ends may be rhopaloid or discontinuous. The minor septa traverse the entire dissepimentarium; a few of them are shorter or hardly enter into the tabularium.

The wide dissepimentarium consists of 10 to 12 rows of inclined dissepiments; some spots of stereoplasma have been observed. The tabulae are incomplete and typically vesicular; they are occasionally disrupted by axial ends of major septa.

The number of septa is 64 for a diameter of 25 mm to 27 mm whereas the width of the tabularium measures 9.7 mm to 10 mm.

DESCRIPTION OF THE BELGIAN MATERIAL
The material consists of conical, trochoid, ceratoid or cylindrical coralla which are frequently fragmentary; their height varies between 1.8 cm and 9 cm. The outer wall is not well preserved, but is often encrusted by thin laminar stromatoporoids or even by auloporids and alveolitids.

Normally, the septa are non-carinate; however, a few vepreculae occur in the inner dissepimentarium or in the tabularium of several specimens. The septa are dilated throughout their length though they are sometimes less thick in the tabularium. The major septa may be more dilated than the minor ones in the dissepimentarium, especially in its outer part. A stereoplasmic thickening is locally present between the septa, against the wall and near it where it affects a layer of dissepiments. The septa are rarely thinner or discontinuous at the periphery; in

some specimens, they are occasionally characterized by a dark median line in the dissepimentarium.

The major septa extend close to the axis of the corallum; their inner ends may be rhopaloid, curved, discontinuous, forked or twisted in a whorl. The minor septa traverse all the dissepimentarium or even enter into the tabularium where they are sometimes contratingent; in a few cases, they are somewhat shorter or discontinuous at their axial ends and at the periphery.

The wide dissepimentarium consists of 10 to 19 rows of small inclined dissepiments which are rarely subhorizontal at the periphery; some spots of fine stereoplasma have been locally observed. The tabulae are incomplete and intersecting laterally or vesicular with a generally concave pattern; they are often interrupted by axial ends of more or less thick major septa with spinose carinae.

There are 50 to 74 septa per corallum. The diameter of the corallum ranges from 13 mm to 36 mm. The width of the tabularium varies commonly between 7 mm and 10.5 mm and more generally between 5.5 mm and 12 mm.

DISCUSSION

Acanthophyllum simplex and *A. concavum* were erected by WALTHER (1929) as two different species. From the first taxon, the author figured only a longitudinal section and from the second one only a transverse section. This transverse section shows a continuous outer wall and 62 septa. In his description however, WALTHER (1929) noted 72 septa and described a second transverse section that was not illustrated. Later on, *A. simplex* was placed in synonymy with *A. concavum* by BIRENHEIDE (1961 and 1978). In his second paper, BIRENHEIDE (1978) figured the transverse section of the holotype of *A. simplex* (fig. 94a) and the longitudinal section of the holotype of *A. concavum* (fig. 94b) whereas in his first paper, he identified the thin section SMF WDKD 7114 and 7115 as coming from the holotype of *A. concavum*; moreover, he stated that the thin section SMF WDKD 7114 corresponds to the transverse section figured by WALTHER (1929, fig. 8). But, this is certainly not the case as this thin section illustrated herein (Pl. 1, fig. 1) has no outer wall and counts 70 septa. Nevertheless, it is sure that the section SMF WDKD 7114 belongs to the same species as *A. concavum* and *A. simplex*. As there is some doubt about the holotype of *A. concavum*, the name *A. simplex* is retained in this paper; it fact, it was again used by MAY & BECKER (1996), but as a subspecies of *A. concavum*. Among the material of WALTHER (1929), the holotype of *A. inchoatum* refigured herein (Pl. 1, fig. 3) is also assigned to *A. simplex* though it is represented by a rather juvenile specimen.

The Belgian sampling described as *A. simplex* is very similar to that of WALTHER (1929) although it shows a wider variability which is mainly characterized by some stereoplasmic thickenings against the outer wall and near it. However, these stereoplasmic thickenings can be seen in the transverse section of *A. concavum* illustrated by WALTHER (1929, fig. 8) and have been mentioned by this author. They have also been noted or figured by BIRENHEIDE (1978), LÜTTE (1984) and ROHART (1988).

As regards the references excluded from the synonymy of *A. simplex*, a wide stereozone is typically developed in the Givetian specimens from the Carnic Alps in Italy, investigated by OEKENTORP-KÜSTER & OEKENTORP (1992). In the material of WANG (1994) collected at the Givetian-Frasnian boundary in the Yunnan Province, China as in the material of MAY & BECKER (1996) collected in the Upper Givetian from the Sauerland in Germany, the septa are rather thin especially in the tabularium and the coralla are somewhat broader with a few more septa. This is also more or less the case for the sampling of SCHRÖDER (1998), which comes from the Givetian Cürten Formation of the Eifel Hills in Germany, though the author suggests affinities with *A. heterophyllum* (MILNE-EDWARDS & HAIME, 1851). Indeed, some specimens illustrated by BIRENHEIDE (1961, pl. 7, fig. 24) and WEBBY (1964, fig. 4a) seem to be close to *A. heterophyllum*. But, this species, whose holotype has been revised by COEN-AUBERT (1997), differs from *A. simplex* by its larger size and more septa, by major septa strongly dilated in the inner part of the dissepimentarium and by numerous dissepiments which are in horizontal layers at the periphery; moreover, it was found near the Eifelian-Givetian boundary on the south side of the Dinant Synclinorium.

A. tortum (TSIEN, 1969) is a Belgian taxon recorded in the same geographic and stratigraphic context by COEN-AUBERT (1998) that resembles *A. simplex*. However, it is separated from it by septa less dilated in the dissepimentarium and slightly fewer. The holotype of *A. frasniense* ROZKOWSKA, 1979 from the Lower or the Middle Frasnian of the Lublin region in Poland is also very similar to *A. simplex* though it has fewer dissepiments. According to the transverse section figured by ROZKOWSKA (1979, pl. 10, fig. 1b), the septal number is 60 and not 48 as mentioned by the author. It is not sure that the fragmentary paratype of *A. frasniense* illustrated by ROZKOWSKA (1979, pl. 10, fig. 2) belongs to the same species or even to the same genus. Finally, *A. confusum* BIRENHEIDE & SOTO, 1992 from the Upper Givetian of the Leon Province in Spain has several features in common with *A. simplex*, but is characterized by a smaller corallum with fewer dissepiments.

GEOGRAPHIC AND STRATIGRAPHIC OCCURRENCE

The material sampled by the author comes mainly from the top of the Terres d'Haurs Formation and from the lower part of the Mont d'Haurs Formation at Wellin, Resteigne, Ave-et-Auffe and Han-sur-Lesse, on the south side of the Dinant Synclinorium. Some specimens have also been collected in the lower part of the Névremont Formation at Gerpinnes, on the north side of the Dinant Synclinorium and at Aisemont, on the south side of the Namur Synclinorium.

Outside Belgium and Givet in France, *Acanthophyllum simplex* occurs in the lower part of the Givetian Blacourt

Formation from the Boulonnais in France, in the Givetian from West Somerset in Great Britain, in the Givetian Rodert and Kerpen Formations from the Eifel Hills and in the Upper Givetian from the Bergisches Land, both areas in Germany. In the same country, it may also be present in the Givetian Schwelm Formation from the Sauerland.

Genus *Grypophyllum* WEDEKIND, 1922

= *Hooeiphyllum* TAYLOR, 1951

Type species
By original designation, *Cyathophyllum denckmanni* WEDEKIND, 1922.

DIAGNOSIS
Solitary rugose corals bordered by a rather thick wall. Septa of two orders, non-carinate, thin or sightly dilated throughout their length, occasionally discontinuous or disrupted by lonsdaleoid dissepiments at the periphery. Major septa extending to or almost to the axis of the corallum. Minor septa variable in length and development. Dissepimentarium moderately wide with several rows of inclined dissepiments. Tabulae incomplete and closely spaced, commonly forming concave floors.

Grypophyllum denckmanni WEDEKIND, 1922
Plate 2, Figures 1-9, Plate 3, Figures 6-9

v *	1922	*Grypophyllum Denckmanni* n. sp. - WEDEKIND, p. 13, figs. 13, 14.
v	1925	*Grypophyllum Denckmanni* Wedekind- WEDEKIND, p. 22.
v	1925	*Grypophyllum normale* Wedekind- WEDEKIND, p. 22, pl. 5, figs. 25-26.
v	1925	*Grypophyllum regressum* Wedekind- WEDEKIND, p. 22, pl. 5, figs. 30-31.
v	1925	*Grypophyllum tenue* Wedekind- WEDEKIND, p. 22, pl. 5, fig. 27.
non	1929	*Neostringophyllum regressum*- WALTHER, p. 116, fig. 10.
?	1936	*Grypophyllum regressum* Wdkd.- SOSHKINA, p. 25, fig. 5.
?	1948	*Grypophyllum tenue* Wedekind- WANG, p. 29, pl. 4, fig. 26.
	1951	*Grypophyllum regressum* Wedekind- TAYLOR, p. 177, pl. 2, fig. 2.
	1951	*Hooiephyllum tenue* (?) (Wedekind)- TAYLOR, p. 175, pl. 2, fig. 1.
?	1951	*Hooiephyllum* cf. *tenue* (Wedekind)- TAYLOR, p. 174, pl. 2, fig. 3.
v	1958	*Grypophyllum denckmanni* Wedekind 1922- ENGEL & VON SCHOUPPÉ, p. 103, pl. 9, figs. 18-25.
	1959	*Grypophyllum tenue* Wedekind- MIDDLETON, p. 143, fig. 2f, pl. 27, fig. 1.
	1959	*Grypophyllum tenue* Wedekind var.- MIDDLETON, p. 145, fig. 2b, pl. 27, fig. 2.
non	1959	*Grypophyllum* sp. cf. *G. tenue* Wedekind- MIDDLETON, p. 144, fig. 2e.
	1959	*Grypophyllum* sp. cf. *G. normale* Wedekind- MIDDLETON, p. 146, figs. 4e, f.
?	1959	*Grypophyllum* sp. cf. *G. regressum* Wedekind- MIDDLETON, p. 146, fig. 2a.
?	1965	*Grypophyllum denckmanni* Wedekind- SCRUTTON, fig. 2.
v non	1969	*Grypophyllum denckmanni* Wedekind, 1922- TSIEN, p. 121, fig. 28, pl. 27, figs. 1, 2, pl. 46, fig. 7, pl. 47, figs. 3-5.
non	1970	*Grypophyllum* sp. cf. *G. denckmanni* Wittekindt- PEDDER *et. al.*, pl. 20, figs. 1, 2.
p.	1972	*Grypophyllum tenue* Wedekind, 1925- SHURIGINA, p. 107, pl. 39, fig. 2 (non fig. 1).
v	1973	*Grypophyllum denckmanni* Wedekind- PEDDER, figs. 37, 38, pl. 12, fig. 5.
p.	1975	*Grypophyllum denckmanni* Wedekind 1922- JOSEPH & TSIEN, p. 190, pl. 3, fig. 5 (non pl. 3, fig. 6, pl. 5, figs. 5, 6).
v	1978	*Grypophyllum denckmanni* Wedekind 1922- BIRENHEIDE, p. 136, fig. 80.
non	1978	*Grypophyllum denckmanni* Wedekind- KONG & HUANG, p. 113, pl. 38, fig. 5.
	1978	*Neostringophyllum normale* (Wedekind)- KONG & HUANG, p. 115, pl. 38, fig. 8.
?	1978	*Neostringophyllum tenue* (Wedekind)- KONG & HUANG, p. 115, pl. 38, fig. 4.
?	1980	*Grypophyllum denckmani* Wedekind- GUO, p. 143, pl. 51, fig. 5.
	1980	*Grypophyllum tenue* Wedekind- GUO, p. 143, pl. 51, fig. 4, 6.
v	1981	*Grypophyllum denckmanni*- HILL, fig. 146, 2a, b.
v	1981	*Grypophyllum normale* Wedekind- HILL, fig. 146, 2c, d.
non	1981	*Grypophyllum denckmanni* Wedekind, 1922- TSYGANKO, p. 119, pl. 18, fig. 2, pl. 19, fig. 3.
?	1984	*Grypophyllum denckmanni* Wedekind, 1922- LÜTTE, p. 189, fig. 3, pl. 3, figs. 3, 4.
non	1989	*Grypophyllum tenuie* Wedekind 1925- WANG *et al.*, p 102, pl. 5, fig. 7, pl. 35, figs. 11, 12, pl. 36, figs. 1-5.
?	1990	*Grypophyllum denckmanni* Wedekind 1922- BIRENHEIDE & LÜTTE, p. 13.
p.	1991	*Grypophyllum tenue* Wedekind, 1925- LIAO & LI, p. 606, pl. 1, figs. 6, 7 (non figs. 2-5).
non	1992	*Grypophyllum* cf. *denckmanni* Wedekind 1922- MAY, pl. 21, fig. 1.
	1993	*Grypophyllum denckmanni* Wedekind 1922- MAY, p. 43.
non	1993	*Grypophyllum* cf. *denckmanni* Wedekind 1922- MAY, p. 44, pl. 6, fig. 5.
	1994	*Grypophyllum denckmanni* Wedekind, 1922- GALLE, p. 45, pl. 2, figs. 3-5.
	1998	*Grypophyllum denckmanni* Wedekind 1922- SCHRÖDER, p. 50, pl. 9, figs 59-61.
non	1998	*Grypophyllum* sp. aff. *denckmanni* Wedekind 1922- SCHRÖDER, pl. 8, fig. 58.

Holotype
Figs. 13, 14 *in* WEDEKIND (1922b), figs. 37, 38 and pl. 12, fig. 5 *in* PEDDER (1973), pl. 2, figs. 1, 2 figured herein. Thin sections SMF WDKD 3949 and 3949a stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Givetian Büchel Formation at Hand near Bergisch Gladbach, in the Bergisches Land, Germany. The

longitudinal section SMF WDKD 3949a considered as lost by BIRENHEIDE (1962, p. 105) was found again by LÜTTE in Köln during the year 1990.

Material and localities
Sixteen samples with 23 thin sections. Personal sampling: Wellin MC-1988-6-B111N, Wellin MC-1986-4-A502, A526D, A528C and A572, Wellin MC-1974-95-Z883, Z886, Z895, Z898, Z903, Z912 and Z913, Beauraing MC-1975-3-Z697, Han-sur-Lesse MC-1975-15-117, Tamines MC-1983-2-Z55218 and Z55222.

DIAGNOSIS

A species of *Grypophyllum* with 46 to 62 septa at a diameter of 13 mm to 20 mm. Septa rarely discontinuous at the periphery. Minor septa rather well developed.

DESCRIPTION

The material consists of fragments of solitary coralla which are sometimes cylindrical or conical, with a height between 1 cm and 4 cm; rare growth lines and longitudinal ribs have been observed. The outer wall is thick and is usually well preserved. It forms a narrow stereozone in several specimens though its thickness may change within a single corallite. The wall is often encrusted by a laminar stromatoporoid and is locally split up into this stromatoporoid or even in the sediment. The beginning of an offset is present in the external dissepimentarium of one corallum.

Normally, the septa are non-carinate; however, a few vepreculae occur in the dissepimentarium or in the tabularium of some specimens. The septa are thin or slightly dilated throughout their length. Occasionally, they are thinner in the tabularium or somewhat thicker at the periphery; a triangular thickening may also appear against the outer wall. In some cases, the septa are discontinuous at the periphery or interrupted by a few lonsdaleoid dissepiments.

The major septa extend close to the axis of the corallum; their inner ends are sometimes curved, discontinuous or rhopaloid. The minor septa are highly variable in length, traversing all, nearly all or half the dissepimentarium or hardly entering into the tabularium where they are rather often contratingent. They may also be shorter, lacking, confined to the inner part of the dissepimentarium or reduced to spines and isolated fragments.

The dissepimentarium consists of 6 to 9 or even 3 to 14 rows of inclined dissepiments. The tabulae are incomplete with a concave pattern.

There are 42 to 66 septa per corallum. The diameter of the corallum ranges from 6.6 mm to 20 mm. The width of the tabularium varies commonly between 4 mm and 6.5 mm and more generally between 3.3 m and 7.5 mm.

DISCUSSION

After revising the holotypes of *Grypophyllum normale*, *G. regressum* and *G. tenue*, which are partly refigured herein (Pl. 2, figs. 3-5), I agree with ENGEL & VON SCHOUPPÉ (1958) and BIRENHEIDE (1962) that these three species are conspecific with *G. denckmanni*. Consequently, the Belgian material is very similar to the German one though it is characterized on average by narrower coralla with slightly fewer septa; it must also be mentioned that the outer wall is locally thicker in some of my specimens.

Some of the references to the four synonymous species introduced by WEDEKIND (1922 and 1925) are questionable or excluded from the synonymy list for various reasons:
— minor septa systematically long in WALTHER (1929) and TSYGANKO (1981);
— minor septa short or lacking in SOSHKINA (1936) and WANG *et al.* (1989) as in the specimen illustrated by SCHRÖDER (1998) as *G.* sp. aff. *denckmanni*;
— occurrence of lonsdaleoid dissepiments or septa typically discontinuous at the periphery in the coralla reported to *G. denckmanni* by KONG & HUANG (1978), GUO (1980) and TSYGANKO (1981) and to *G.* cf. *denckmanni* by MAY (1992 and 1993);
— septa rather thick throughout their length in SCRUTTON (1965) and MAY (1992 and 1993);
— carinate septa in the dissepimentarium of the corallum assigned to *G. tenue* by KONG & HUANG (1978);
— lack of a stereozone in LÜTTE (1984);
— a small open space in the centre of the corallum referred to *Hooiephyllum* cf. *tenue* by TAYLOR (1951);
— small dissepiments and tabulae with a convex pattern in PEDDER *et al.* (1970).

The material of TSIEN (1969), which comes from the Eifelian Couvin Formation and from the Lower Givetian Hanonet Formation on the south side of the Dinant Synclinorium, is heterogeneous and is often characterized by long minor septa; one of the specimens illustrated by this author (pl. 47, fig. 3) belongs to *Acanthophyllum tortum*.

As it was already mentioned by MAY (1993) and GALLE (1994), *Grypophyllum subnormale* YU & KUANG, 1982 from the Givetian of the Guangxi Province in China and *G. postprimum postprimum* BIRENHEIDE & LÜTTE, 1990 from the Givetian Shwelm Formation of the Sauerland in Germany are very close to *G. denckmanni*. It is also possible that the specimen from the Blacourt Formation in the Boulonnais, France, described by ROHART (1988, p. 247) as *Ellesmerellasma*? sp. cf. *diluvianum* (WEDEKIND, 1925), belongs to *Grypophyllum denckmanni*. *G. arcticum* BULVANKER, 1968 *in* BULVANKER *et al.* (1968) from the Givetian of Novaya Zemlya in Russia is another species that resembles *G. denckmanni*; however, it is distinguished from the latter by shorter minor septa. Finally, *G. clarifundatum* IVANIA, 1965 from the Givetian of the Kuznetsk Basin in Russia is qualitatively similar to *G. denckmanni*, but is represented by smaller coralla with slightly fewer septa.

GEOGRAPHIC AND STRATIGRAPHIC OCCURRENCE

The species comes mainly from the lower part of the

Mont d'Haurs Formation at Wellin, Resteigne, Ave-et-Auffe and Han-sur-Lesse, on the south side of the Dinant Synclinorium. A few specimens have also been collected at the base of the Névremont Formation from Aisemont, on the south side of the Namur Synclinorium.

Outside Belgium, *Grypophyllum denckmanni* occurs in the Givetian from the Pyrenees in France, from the South Devon in Great Britain, from the Eifel Hills (Rodert Formation), the Bergisches Land (Büchel Formation) and the Sauerland (Unterhonsel and Schwelm Formations) in Germany, from the Urals in Russia and from the Guizhou Province in China. The species is also known from the Eifelian of Bohemia in the Czech Republic as well as from the Middle Devonian of Northeast China and the Gansu Province in the same country. Moreover, it may be present in the Givetian from the Yunnan Province in China.

Family DISPHYLLIDAE HILL, 1939
Genus *Disphyllum* DE FROMENTEL, 1861

Type species
By subsequent designation of LANG & SMITH (1934, p. 80), *Cyathophyllum caespitosum* GOLDFUSS, 1826.

DIAGNOSIS
Fasciculate rugose corals. Septa of two orders, occasionally carinate, more or less dilated in the dissepimentarium and thin in the tabularium. Major septa reaching the axis of the corallites or leaving an open space in the centre of the tabularium. Minor septa traversing the entire dissepimentarium. Dissepimentarium composed of several rows of globose dissepiments, often arranged in horizontal layers in its outer part and inclined towards the axis of the corallites in its inner part. Tabulae usually incomplete or compound.

Disphyllum semenoffi n. sp.
Plate 1, Figure 9, Plate 2, Figure 12, Plate 3, Figures 1-5

non 1851 *Cyathophyllum aequiseptatum*- MILNE-EDWARDS & HAIME, p. 389.
1970 *Disphyllum aequiseptatum* (Ed. et H.), 1851- TSIEN, p. 168, fig. 8.
1975 *Disphyllum aequiseptatum*- TSIEN, fig. 9g (appendice).
1977 *Disphyllum aequiseptatum*- TSIEN, fig. 4g-j.

Derivatio nominis
The species is dedicated to Pierre SEMENOFF-TIAN-CHANSKY, a distinguished French specialist of Carboniferous rugose corals.

Holotype
I.R.Sc.N.B. a11069 (= Pl. 3, Figs 3-5). Specimen Wellin MC-1988-6-B192 collected by COEN-AUBERT in 1990, 16 m above the base of the Mont d'Haurs Formation.

Locus typicus
Northern Les Limites quarry at Ave-et-Auffe located in figure 2 of COEN-AUBERT (1999). Map sheet Wellin IGNB 59/6, Lambert coordinates: x = 205,15 and y = 87,7, south side of the Dinant Synclinorium, Belgium.

Stratum typicum
Base of the Mont d'Haurs Formation, middle part of the Givetian.

Material and localities
Thirty-seven colonies with 54 thin sections. Personal sampling: Wellin MC-1988-6-B191, B192, B224 and B240, Wellin MC-1986-4-A499 and A500, Gozeé MC-47-B866 and C498, Glageon quarry in France B501, B502 and B503. Old collection from the Institut royal des Sciences naturelles de Belgique: Agimont (Mont d'Haurs at Givet)-Gi-28315, 28319, 28323, 28324, 28326, 28327, 28329, 28330, 28334 and 28338, Surice 14-Gi-8593 and 8594, Surice 16-Gi-8584, 8586, 8587 and 8591, Surice 18-Gi-8663, 8664 and 8677, Surice 51e-Gi-8883, 8886, 8904, 8905, 8911, 8912 and 8916.

DIAGNOSIS
A species of *Disphyllum* with 44 to 54 septa at a diameter of 7 mm to 15 mm. Septa rather thin or slightly dilated in the dissepimentarium. Dissepiments often inclined towards the axis of the corallites.

DESCRIPTION
The material consists of fragments of fasciculate colonies whose height varies between 2 cm and 7.5 cm; the largest piece reaches an area of 11 cm x 9.5 cm. The outer wall is often preserved; it is characterized by a dark median line when the cylindrical corallites are locally in contact. Marginal and lateral offsets occur in several colonies.

The septa are non-carinate or bear some zigzag carinae; a few yardarm carinae have been observed in two colonies. The septa are slightly dilated in the dissepimentarium and become thinner in the tabularium. But they may also be slender throughout their length. A triangular thickening is sometimes present against the wall; in rare cases, the septa are thinner in the external or in the internal part of the dissepimentarium whereas an inner stereozone appears very locally in rather young corallites.

The major septa leave a more or less extensive open space in the centre of the tabularium. But they may also reach the axis of the corallites and in a few of them, they are hardly projecting into the tabularium; their inner ends are sometimes discontinuous or curved. The minor septa traverse the entire dissepimentarium or even enter into the tabularium where they are occasionally contratingent; they are rarely shorter or discontinuous.

The dissepimentarium consists of 2 to 8 or even 0 to 10 rows of small inclined dissepiments which are more or less often in horizontal layers at the periphery. The tabulae are mostly incomplete and intersecting laterally, frequently with broad axial flat-topped tabellae; sometimes, they are also horizontal or concave.

There are 40 to 60 septa per corallite. The diameter of the corallites ranges from 5.2 mm to 17.5 mm. The width

of the tabularium varies commonly between 3.8 mm and 8 mm and more generally between 3 mm and 9.5 mm.

DISCUSSION

Disphyllum semenoffi has been identified as *D. aequiseptatum* (MILNE-EDWARDS & HAIME, 1851) by TSIEN (1970, 1975 and 1977). For the holotype of the second species coming from Ilfracombe in North Devon, Great Britain, only an external view has been given by MILNE-EDWARDS & HAIME (1853, pl. 52, fig. 2). According to LANG & SMITH (1935, p. 572), the corallites of this specimen are much crushed and their internal structures are thoroughly destroyed by recrystallization. However, these two authors described and figured colonies of *D. aequiseptatum* collected near the type locality, in the Ilfracombe Beds from North Devon and West Somerset; these layers have been reported to the Givetian by SCRUTTON (1975, p. 132). But the material of LANG & SMITH (1935) differs from *D. semenoffi* in having shorter minor septa that do not traverse the entire dissepimentarium.

Three Givetian species of South China have several features in common with *D. semenoffi*. However, *D. breviseptatum* YOH, 1937 from the Guangxi province and *Pseudodisphyllum qiannanense* KONG, 1978 from the Guizhou province are characterized by septa which are more carinate and thicker in the dissepimentarium. In *Disphyllum gemmiferum* LIAO & BIRENHEIDE, 1985 from the latter province, the septa are less dilated, but this taxon is distinguished from *D. semenoffi* by slightly narrower corallites, by an extensive open space in the centre of the tabularium and by axial offsets. Another similar species, *Amaraphyllum amoenum* PEDDER, 1970 from the Givetian of New South Wales in Australia, which is the type species of *Amaraphyllum* PEDDER, 1970, has rather thin septa without carinae and is also separated from *D. semenoffi* by dissepiments systematically arranged in horizontal layers at the periphery. It seems probable that the genera *Amaraphyllum* and *Pseudodisphyllum* KONG, 1978, whose type species is *P. jiangzhaiense* KONG, 1978 from the Givetian of the Guizhou Province, are synonyms of *Disphyllum* DE FROMENTEL, 1861.

GEOGRAPHIC AND STRATIGRAPHIC OCCURRENCE

The species is only known in the middle part of the Givetian from Belgium and from Givet and Glageon in France. The material sampled by the author comes mainly from the south side of the Dinant Synclinorium where it has been found near the base of the Mont d'Haurs Formation at Ave-et-Auffe and Glageon. Some specimens have been collected at the base of the same lithostratigraphic unit from Cour-sur-Heure, on the north side of the Dinant Synclinorium. The colonies figured by TSIEN (1970, 1975 and 1977) come from the Mont d'Haurs Formation at Givet

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E. SCHINDLER (Frankfurt am Main) lent me the holotypes of *Acanthophyllum simplex*, *Grypophyllum denckmanni* and of their synonymous species. B. DELCAMBRE and J.L. PINGOT (Louvain-la-Neuve) introduced me to the Cour-sur-Heure quarries. P. BULTYNCK (IRScNB) identified the conodonts from this locality. W.A. OLIVER, Jr. (Washington, D.C.) and B. MISTIAEN (Lille) kindly reviewed the manuscript. The thin sections were prepared by R. CREMERS (IRScNB) and by the Laboratory of E. POTY (Liège).

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Explanation of the plates

All specimens are figured at magnification x 3.

PLATE 1

Acanthophyllum simplex (WALTHER, 1929)

Figs. 1, 2 — Holotype of *Acanthophyllum concavum* (WALTHER, 1929). Thin sections SMF WDKD 7114 and 7115 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse and longitudinal sections.

Fig. 3 — Holotype of *Acanthophyllum inchoatum* (WALTHER, 1929). Thin section SMF WDKD 7102 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse section.

Figs. 4, 5 — Holotype. Thin sections SMF WDKD 7116 and 7117 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse and longitudinal sections.

Fig. 6 — IRScNB a11059. Wellin MC-1986-4-A531D. Transverse section.

Fig. 7 — IRScNB a11060. Wellin MC-1988-6-B130. Transverse section.

Fig. 8 — IRScNB a11061. Wellin MC-1988-6-A773. Transverse section.

Disphyllum semenoffi n. sp.

Fig. 9 — Paratype. IRScNB a11070. Glageon B502. Transverse section.

PLATE 2

Grypophyllum denckmanni WEDEKIND, 1922

Figs. 1 ,2 — Holotype. Thin sections SMF WDKD 3949 and 3949a stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse and longitudinal sections.

Fig. 3 — Holotype of *Grypophyllum regressum* WEDEKIND, 1925. Thin section SMF WDKD 3855 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse section.

Fig. 4 — Holotype of *Grypophyllum normale* WEDEKIND, 1925. Thin section SMF WDKD 3864 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse section.

Fig. 5 — Holotype of *Grypophyllum tenue* WEDEKIND, 1922. Thin section SMF WDKD 3880 stored in the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany. Transverse section.

Fig. 6 — IRScNB a11063. Wellin MC-1986-4-A528C. Transverse section.

Figs. 7, 8 — IRScNB a11064. Han-sur-Lesse MC-1975-15-117. Transverse and longitudinal sections.

Fig. 9 — IRScNB a11065. Wellin MC-1974-95-Z886. Transverse section.

Acanthophyllum simplex (WALTHER, 1929)

Figs. 10, 11 — IRScNB a11062. Wellin MC-1986-4-A528A. Transverse and longitudinal sections.

Disphyllum semenoffi n. sp.

Fig. 12 — Paratype. IRScNB a11071. Wellin MC-1988-6-B240. Transverse section.

PLATE 3

Disphyllum semenoffi n. sp.

Figs. 1, 2 — Paratype. IRScNB a11072. Glageon B501. Transverse and longitudinal sections.

Figs. 3-5 — Holotype. IRScNB a11069. Wellin MC-1988-6-B192. Transverse and longitudinal sections.

Grypophyllum denckmanni WEDEKIND, 1922

Fig. 6 — IRScNB a11066. Wellin MC-1986-4-A526D. Transverse section.

Figs. 7, 8 — IRScNB a11067. Wellin MC-1988-6-B111N. Transverse and longitudinal sections.

Fig. 9 — IRScNB a11068. Wellin MC-1974-95-Z898. Transverse section.

Sociophyllum isactis (FRECH, 1886)

Fig. 10 — IRScNB a11073. Wellin MC-1988-6-B72. Transverse section.

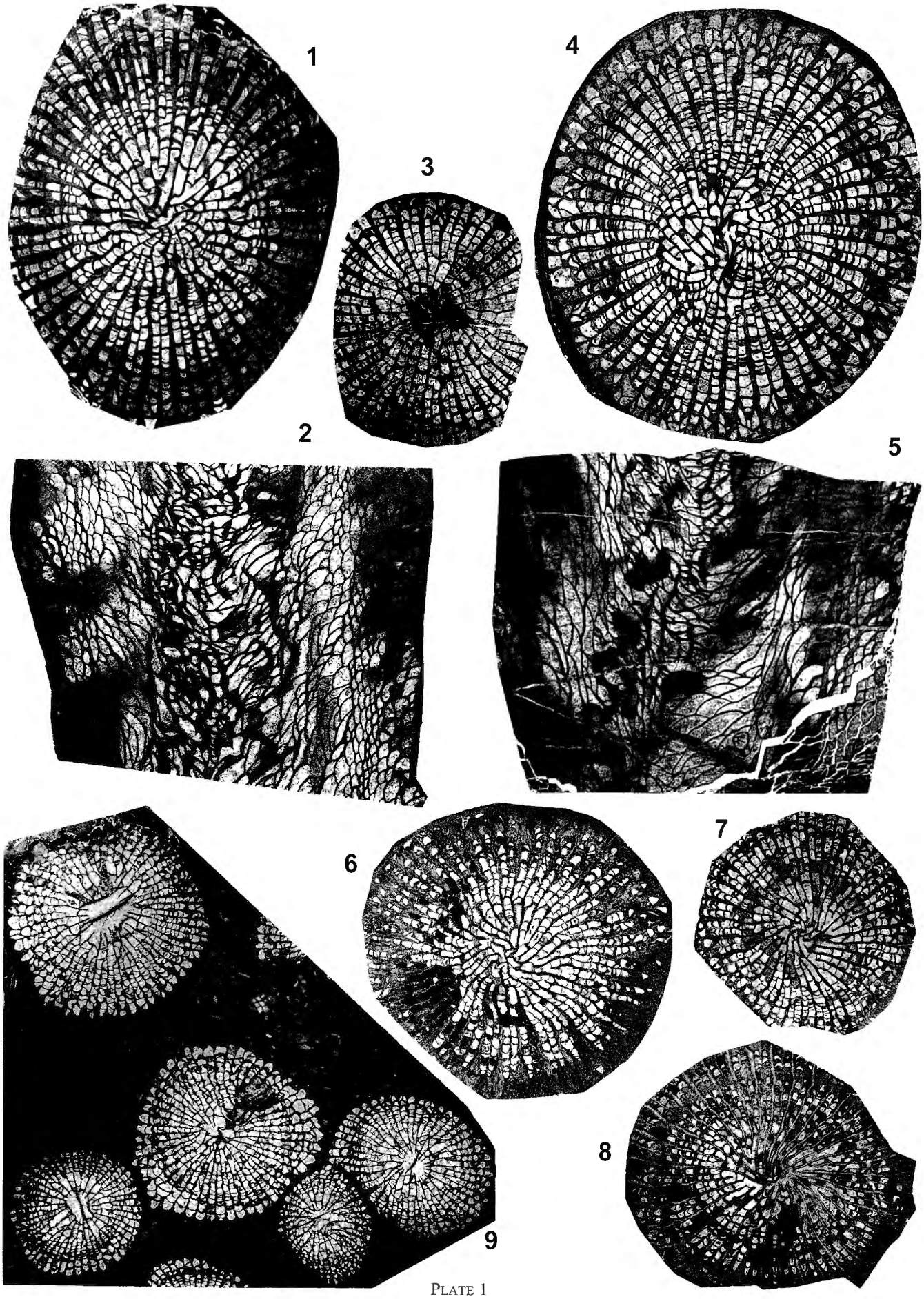

PLATE 1

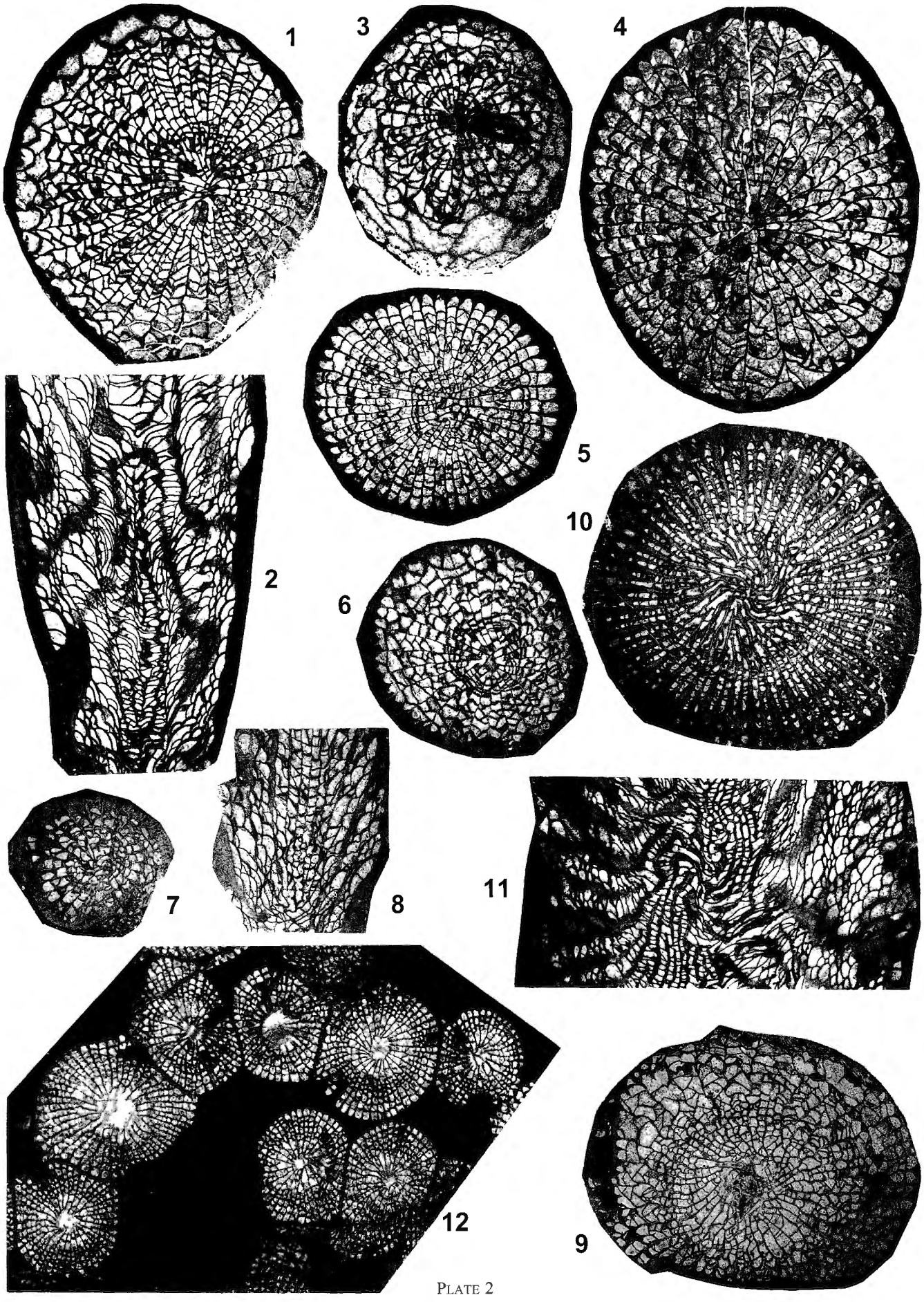

PLATE 2

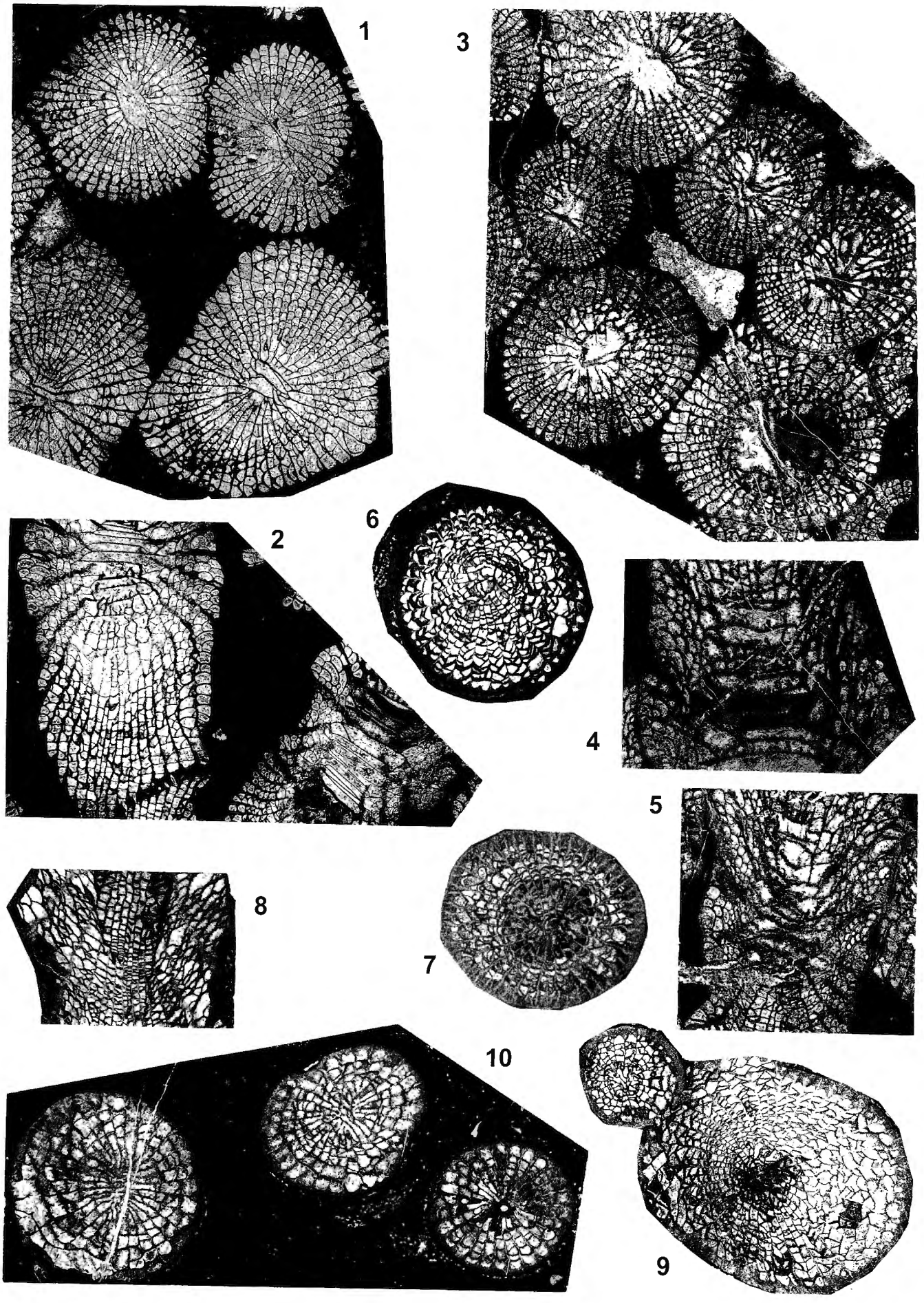

PLATE 3