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LATE DEVONIAN TO EARLY TOURNAISIAN RUGOSE CORALS

by

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(1 figure and 4 tables)

ABSTRACT. - The distribution of Rugose Corals between the end of the Frasnian and the early Tournaisian is reviewed in four selected regions (Belgium and surrounding areas, German cephalopod facies, Poland, Omolon). Four " paleontological events " are distinguished : extinction of most of the Devonian-type Rugose Corals at the end of the Frasnian; development of a new fauna at the beginning of the Upper Famennian; increase and diversification of corals during Strunian; extinction of most of the Strunian corals and replacement by a Tournaisian-type coral fauna at the Devonian-Carboniferous boundary. These seems to be the result of eustatic and probably also climatic fluctuations (variations in sea water temperature).

RESUME. - L'analyse de la distribution des Tétracoralliaires entre la partie supérieure du Frasnien et le Tournaisien inférieur pour quatre régions de l'Eurasie (Belgique et aires voisines, faciès à Céphalopodes de l'Allemagne, Pologne, Omolon), a permis de dégager quatre " événements paléontologiques " : extinction de la plupart des Tétracoralliaires à la fin du Frasnien; apparition d'une faune de type famennien au début du Famennien supérieur; expansion et diversification des coraux au Strunien; disparition de la plupart des coraux struniens et remplacement par une faune de type tournaisien à la limite Dévonien-Carbonifère. Ces événements sont liés à des fluctuations eustatiques et probablement aussi climatiques (variations de la température des mers).

A. - INTRODUCTION

The purpose of this paper is to review the main paleontological events affecting the Rugose Corals from the end of Frasnian to the early Tournaisian.

Corals from that interval have been recorded throughout the Northern hemisphere. Frequently, however, the stratigraphic data are either inexact or questionable, e.g. the so-called Etroeungt fauna from the Shaodong Formation (South China) described by Wu Wang-shi *et al.* (1981) which might be rather of Lower (and Middle ?) Tournaisian age. For these reasons, only four regions have been selected here for comparisons and conclusions :

- Belgium and surrounding areas, including the Western European basins from the Etroeungt area to the undeep water facies of Western Germany, and the southern part of the Campine Basin;
- the German Cephalopod facies;
- Poland;
- The Omolon Region (NE-U.S.S.R.).

B. - BELGIUM AND SURROUNDING AREAS
(Fig. 1, Table I)

In Belgium, the Frasnian yields the last rich and diversified Rugose Coral assemblages of the Devonian. These corals were subject to numerous papers by Coen-Aubert (1974, 1977, 1980a, b, c, 1982, . . .), Sorauf (1967), Tsien (1968, 1975, 1976, 1977a, b, . . .), etc. . . and their stratigraphic ranges are usually well known. So, these formed the basis of the Frasnian biozonation by Tsien (1977a) and Coen *et al.* (1977).

In the upper part of the Frasnian considered here (" F2j " and " F3 "), the main components of the coral faunas are massive compound corals - especially *Phillipsastrea* and relative genera - and dissepimented solitary corals of the genera *Tabulophyllum* and *Pterorrhiza.* In contrast, the fasciculate and the non-dissepimented solitary corals are less common or rare,

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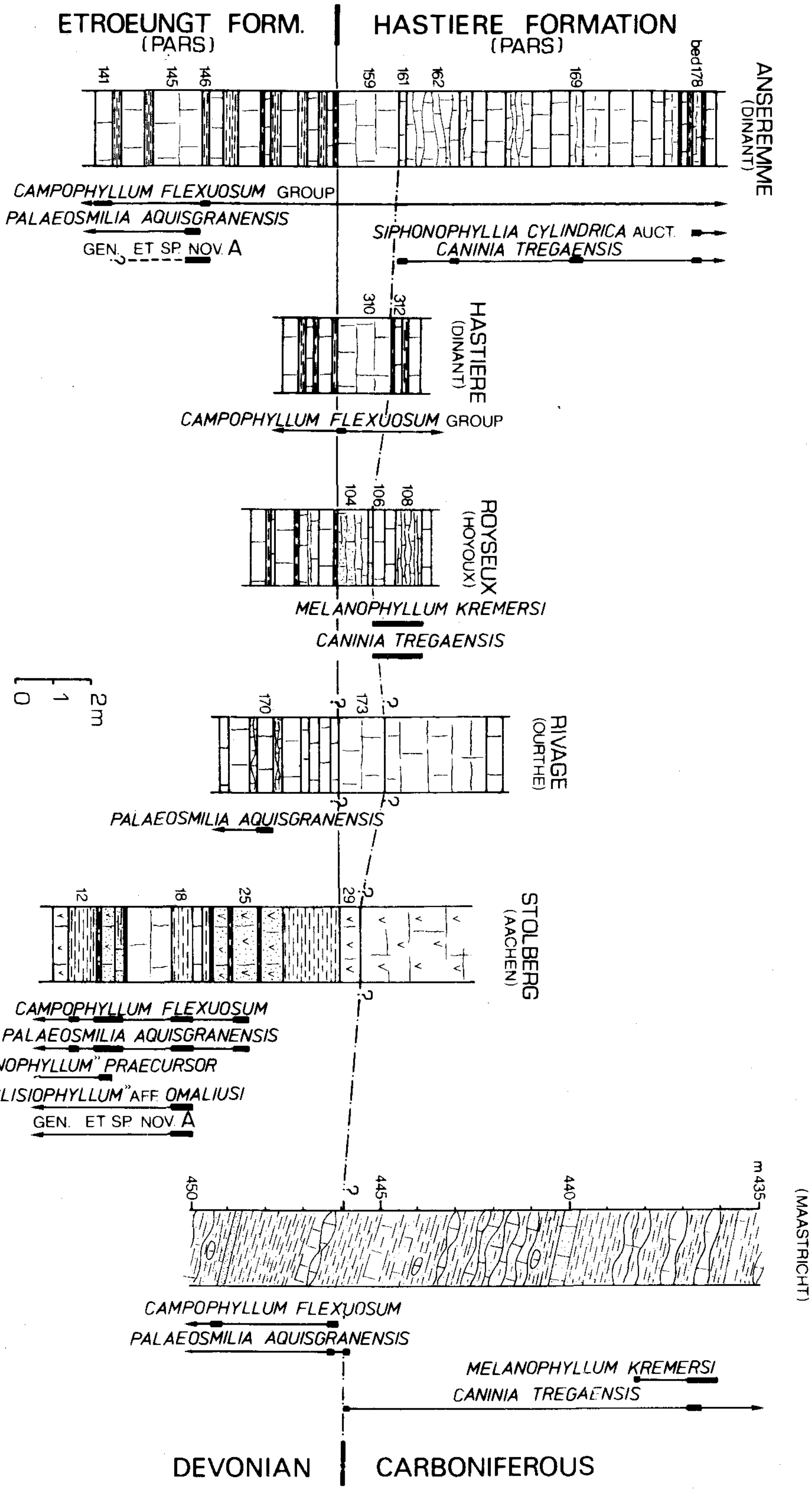


Figure 1. - Rugose Corals near the Devonian-Carboniferous boundary between Dinant (Belgium) and Aachen (Federal Republic of Germany), and in the Maastricht borehole (The Netherlands).

except for the fasciculate genus *Phacellophyllum* in some "F2j" bioherms, and for the non-dissepimented solitary coral genera *Metriophyllum* and *Neaxon* in thin non-biohermal beds. Practically all these corals tolerated muddy waters and adapted to different environments by changing their morphology (shape, form of the calyx, . . .). Therefore, they occur in biohermal limestones, in the surrounding shales or in the shelf facies (Coen-Aubert, 1980c).

Three assemblage zones have been defined by Coen *et al.* (1977) in the upper part of the Frasnian. The lower one is characterized by *Frechastraea carinata* and matches the upper *A. triangularis* conodont zone (sensu Coen, 1973). The second one includes *F. pentagona micrastraea, F. limitata* and *Phillipsastrea ananas ananas,* and ranges in the lower part of the upper *gigas* conodont zone. The third (upper) zone is characterized by *F. pentagona pentagona* and ranges in the middle part of the upper *gigas* zone (Coen-Aubert, 1980c). The third zone is the youngest one recognized in the Frasnian and includes species of the genera *Frechastraea, Phillipsastrea, Iowaphyllum, Hankaxis* and *Pterorrhiza.* These genera become extinct just below the Frasnian-Famennian boundary, whereas only some small dissepimented solitary corals (not yet described) range until that boundary. In Belgium, these extinctions mark the worldwide crisis that affected and practically exterminated the rich Devonian Rugose Coral fauna near the Frasnian-Famennian boundary. Here this coincided with the acme of the Frasnian transgression resulting in a deepening of the basin and a predominantly clay deposition. This crisis also matches the extinction of the biohermal build ups (Coen-Aubert, 1980c; Biron *et al.,* 1983).

From the base of the Famennian to the Lowermost Strunian, the Rugose Corals are very rare because of unfavourable conditions for their development : argillaceous deep water deposits succeeded by coarse terrigenous regressive sediments. The "Fa1" has only yielded some specimens of *Neaxon* sp. But corals showing resemblances with those belonging to the "*Campophyllum flexuosum* group" (1) appear during the Fa2a and mark the first occurrence of the "Strunian-type" coral fauna. They form the first indications of a renewal after the extinction of the Frasnian-type coral fauna. Note also the presence of *Tabulophyllum ?* sp. in the lowest *velifer* conodont zone, and of Heterocorals (*Heterophyllia* cf. *famenniana* Różkowska, 1969) in the Fa2c of the southern part of the Dinant Synclinorium.

Corals become abundant and diversified in the lower part of the LV spore zone (which coincides with the lower part of the Strunian stage) in the Etroeungt area. Following the "Strunian transgression", they progressively extended into the other areas of the Dinant Synclinorium and to the Vesder Massif which were fully colonised in the upper part of the Strunian ("Tn1a").

The Strunian coral fauna is almost exclusively composed of dissepimented solitary corals (of the "Caninid-Clisiophyllid fauna" type of Hill, 1938) and includes (Poty, 1984) :

- a few species which can be attributed to genera surviving the latest Frasnian crisis such as *Tabulophyllum* (2);
- corals which can be related to an Upper Frasnian ancestor; e.g. "*Dibunophyllum*" *praecursor* and "*Clisiophyllum*" *omaliusi* show resemblances with respectively "*Tabulophyllum*" *implicatum* from the Upper Frasnian of Belgium and with *Fedorowskicyathus similis* from the Upper Frasnian of Poland (for the latter, see particularly Różkowska, 1979, pl. 6, fig. 1, 2), and might have evolved from them. Both these Strunian and Upper Frasnian species possess an axial structure of Carboniferous type;
- species attributed to Dinantian genera such as *Palaeosmilia aquisgranensis;*
- peculiar corals such as *Campophyllum flexuosum, Campophyllum ?* sp. nov. (Poty, 1984, pl. 2, fig. 4), gen. & sp. nov. A (ibid., pl. 2, fig. 5) or "*Caninia*" *dorlodoti.*

The Rugose Coral zone 0 defined by Poty (1984, 1985) is characterized by this assemblage.

In the Dinant Synclinorium, the Strunian coral fauna disappears at the top of the Etroeungt Formation, but a few species *(Campophyllum flexuosum, Palaeosmilia aquisgranensis)* persist in the lower part of the massive limestone bed which marks the base of the Hastière Formation ("Tn1b") and which contains also Strunian-type foraminifera, brachiopods and trilobites (Conil *et al.,* 1986). The upper part of that bed did not yield any corals and separates these Strunian-type assemblages from the level with the first appearance of *Caninia tregaensis* (type-species of the Rugose Coral zone 1) and *Melanophyllum kremersi.* But in the Kastanjelaan-2 borehole (Maastricht, The Netherlands, situated in the Campine-Brabant Basin) - where no important lithological change occurs at the Famennian-Tournaisian transition - *Caninia tregaensis* appears slightly earlier, in a bed with the last *Palaeosmilia aquisgranensis.*

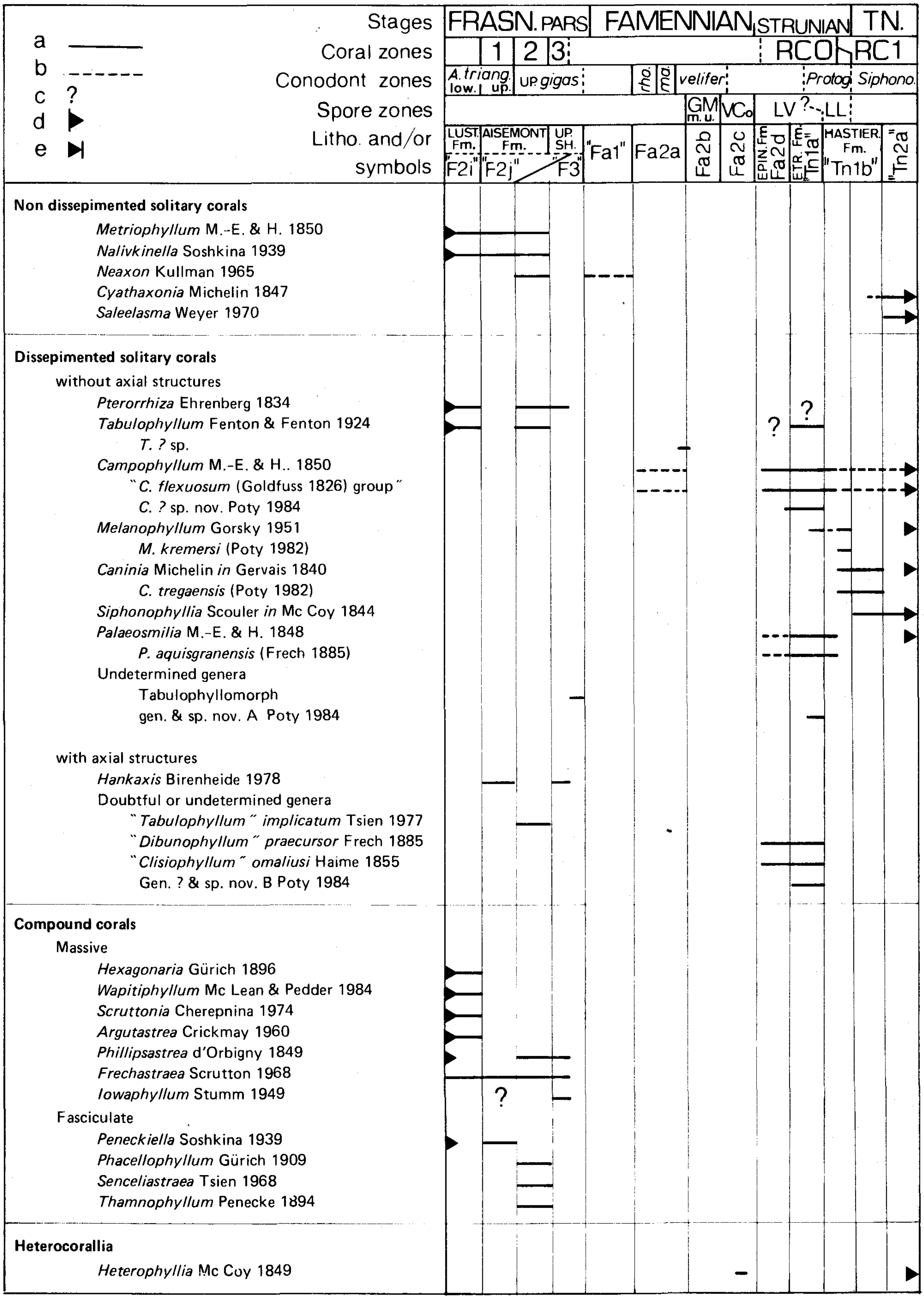
Melanophyllum kremersi dissapears quickly above the base of the Tournaisian, and a little higher *Siphonophyllia cylindrica* auct. appears.

Thus, the replacement of the Strunian corals by Tournaisian ones matches or is near the conodont-defined Devonian-Carboniferous boundary.

(1) including *Campophyllum flexuosum* (Goldfuss 1826), "*Caninia*" *dorlodoti* Salée 1913, and comparable species.

(2) Dehée (1929, p. 47, pl. VII, fig. 6) has described and figured a specimen of *Pterorrhiza* aff. *rozkowskae* (Coen-Aubert 1982) from the Strunian of Etroeungt under the name of *Cyathophyllum* sp. It is the only report of that genus in the Strunian and it needs a confirmation by collecting other specimens.

Table I. – Late Frasnian to early Tournaisian Rugose Corals in Belgium and surrounding areas (from Coen, Coen *et al.*, Coen-Aubert, Tsien and Poty).
a. observed distribution; b. possible or unspecified distribution; c. questionable occurrence; d. recorded at a lower level; e. recorded at a higher level.



The Tournaisian fauna is less diversified than the previous one [e.g. among the Strunian fauna were numerous dissepimented corals having an axial structure of Carboniferous-type ("*Clisiophyllum*", "*Dibunophyllum*", . . .) or belonging to the large-sized Carboniferous genus *Palaeosmilia.* However, such corals are uncommon or absent in Tournaisian coral assemblages, being reintroduced only in the Uppermost Tournaisian or Lower Visean assemblages]. This impoverishment suggests an important change in the marine environments from the Devonian-Carboniferous boundary until the upper part of the Tournaisian.

So, four main paleontological events affecting the Rugose Corals can be distinguished from the Upper Frasnian to the Lower Tournaisian.

1. Extinction of the majority of the Devonian-type corals just below the Frasnian-Famennian boundary.
2. Appearance of the first Strunian-type corals during the Fa2a.
3. Diversification of Strunian corals from the lower part of the LV zone onwards.
4. Replacement of the Strunian-type corals by Tournaisian-type corals at or near the Devonian-Carboniferous boundary.

C. - FAMENNIAN AND LOWER TOURNAISIAN GERMAN CEPHALOPOD FACIES
(Table II)

All the Rugose Corals recorded from the Famennian Cephalopod facies of Germany are small horned, not or poorly dissepimented, solitary corals (deep water corals of the "*Cyathaxonia* fauna" type of Hill, 1938). Two assemblages have been recognized by Weyer (1984) in the Variscan Thuringian Mountains. The first one includes only 3 genera *(Neaxon, Thecaxon* and *Kozlowskinia)* and marks the *Cheiloceras* Stufe (do II). The second assemblage includes 8 genera among which the "Carboniferous" *Cyathaxonia.* It characterizes the *Clymenia-Wocklumeria* Stufe (do V, VI). Practically no coral occurs in the *Platyclymenia* Stufe (do III, IV).

The do V/VI corals (except *Cyathaxonia*) do not cross the *Wocklumeria-Gattendorfia* boundary and are replaced by a Tournaisian similar "*Cyathaxonia* fauna" including 7 genera among which the dissepimented *Caninia tregaensis* Poty 1982 [= *Guerichiphyllum priscum* (Munster, 1840) of Weyer, 1979, 1984; and Bartzsch & Weyer, 1982]. In the Saalfeld area (Thuringia), *C. tregaensis* appears in the *Protognathodus* conodont zone, at the base of the "Obersten Kalkknollenschiefer" (the lateral equivalent of the "Hangenberg Kalk"), and ranges into the *sandbergi* zone. This is exactly the same range as in Belgium.

Table II. - Famennian and Lower Tournaisian deep water Rugose Corals of the German cephalopod facies (from Weyer, 1979, 1984; Bartzsch & Weyer, 1982).

	Cheiloce	Platycly	Cly-Wock	Gattend.
Neaxon richteri (Ludwig 1865)	+			
N. thuringiacus (Weissermel 1939)	+			
N. cheilos Weyer 1984	+			
N. regulus (Richter 1848)			+	
N. bartzschi Weyer 1978			+	
N. sp.			+	
Thecaxon rozkowskae Weyer 1978	+			
Kozlowskinia sp.	+			
Neaxonella n. sp.			+	
Famennelasma rhenanum Weyer 1973			+	
F. sp.			+	
Petraia cf. *decussata* Munster 1839			+	
Metriophyllum ? n. sp.			+	
Cyathaxonia sp.			+	+
C. n. sp.			+	
Famaxonia reuteri Weyer 1971			+	
Pentaphyllum ? n. sp.			+	
P. (Commutia) sp.				+
Laccophyllum n. sp.				+
Thuriantha muelleri Weyer 1981				+
Bathybalva crassa Weyer 1981				+
Caninia tregaensis Poty 1982				+
Drewerelasma schindewolfi Weyer 1973				+
D. sp.				+

D. - POLAND (Table III)

The Frasnian Rugosa of Poland were recently revised by Rózkowska (1979) and their ranges have been recorded with regard to the *P. asymetricus* and *P. gigas* conodont zones recognized by Sculczewski (1971) in the Frasnian of Poland. Their exact succession in these zones has not been defined.

Despite some differences, the corals of the *P. gigas* zone are similar to those found in the Belgian "F2j"-"F3". The majority of these does not cross the Frasnian-Famennian boundary in Poland which is marked by a change in the marine environment : the "clean, well-aerated, transparent water of the Frasnian seas" is replaced by "a turbid, calm and poorly aerated water" (Rózkowska, 1969, 1981).

In the lower part of the Famennian, only *Petraiella* has been recorded in the *triangularis* and *crepida* conodont zones, and *Guerichiphyllum* in the *rhomboidea* conodont zone. But, the *marginifera* to *costatus* conodont zones have yielded rich, peculiar, Rugose Coral faunas (Rózkowska, 1969).

Table III. - Upper Frasnian to early Tournaisian Rugose Corals in Poland (from Rózkowska, 1969, 1979; Fedorowski, 1973 and Szulczewski, 1973). Legend see Table I.

Stages	FRASN. pars	FAMENNIAN							LOW. TOURN.
Conodont zones	*gigas*	*triang.*	*crepid.*	*rhom.*	*marg.*	*velifer*	*styria.*	*costa.*	
Dissepimented solitary corals									
Without axial structures									
Craterophyllum Foerste 1909	—								
Debnikiella Rózkowska 1979	—								
Trigonella Rózkowska 1979	—								
Charactophyllum Simpson 1900	—								
Piceaphyllum Rózkowska 1979	▶—								
Temnophyllum Walther 1928	▶—								
Mictophyllum Lang & Smith 1939	—								
? *Chonophyllum* M.-E. & H. 1850	—								
Pterorrhiza Ehrenberg 1834	▶—				—				
Tabulophyllum Fenton & Fenton 1924	▶—				—			—	
Guerichiphyllum Rózkowska 1969	▶			—	—			—	
Kielcephyllum Rózkowska 1969					—				
Kozlowskinia Rózkowska 1969					—				
Prosmilia Koker 1924					—				
Pseudomicroplasma Soshkina 1949					—	—	—	—	
Hillaxon Rózkowska 1969					?	—	?	—	
Pseudoclaviphyllum Vassiljuk 1964								—	
? *Caninophyllum* Lewis 1929								—	
with axial structures									
Federowskicyathus Rózkowska 1979	—								
Hankaxis Birenheide 1978	—								
Compound corals									
Marisastrum Rózkowska 1965	▶—								
Disphyllum De Fromentel 1861	▶—								
Aristophyllum B., Sp. & Kr. *in* Iv. 1975	▶—								
Sudetia Rózkowska 1960	—								
Smithicyathus Rózkowska 1979	—								
Frechastraea Scrutton 1968	—								
Iowaphyllum Stumm 1949	—								
Rachaniephyllum Rózkowska 1979	—								
Thamnophyllum Penecke 1894	▶—				—				
Peneckiella Soshkina 1939	▶—							— cf.	
Phillipsastrea d'Orbigny 1849	—								
Smithiphyllum Birenheide 1962					—				
Pseudamplexus Weissermel 1897								—	
Heterocorallia									
Oligophylloides Rózkowska 1969					—	—	—	—	
Heterophyllia Mc Coy 1849					- - -	—	- - -	—	▶

Table III (continued) — a. maximum stratigraphic interval where the Corals from Dalnia are recorded.

a: ◁——▷ Stages	FRASN. pars	FAMENNIAN							LOW. TOURN.
Conodont zones	*gigas*	*triang.*	*crepid.*	*rhom.*	*marg.*	*velifer*	*styria.*	*costa.*	
Non dissepimented solitary corals									
Petraiella Rózkowska 1969		—	—		—	—			
Neaxon Kullmann 1965		?			—	—	—	—	
Nalivkinella Soshkina 1939				?	—			?	
Metriophyllum M.-E. & H. 1850					—	—	—	—	
Syringaxon Lindstroem 1882					—	—	—	—	
Cyathaxonia Michelin 1847					—	—		—	▶
Amplexocarinia Soshkina 1941					—			—	
Gorizdronia Rózkowska 1969					—	cf.		—	
Ufimia Stuckenberg 1895					- -	- -	- -	—	- -
? *Metrioplexus* Glinski 1963							—	—	
Czarnockia Rózkowska 1969								—	
Friedbergia Rózkowska 1969								—	
Amplexus Sówerby 1814								—	
Amplexizaphrentis Vaughan 1906								—	
Fasciculophyllum Thomson 1883								—	
Euryphyllum Hill 1938								—	
Duplophyllum Koker 1924								—	
Asthenophyllum Grubb 1939								—	
Calophyllum Dana 1846								◁—	—▷
Soshkineophyllum Grabau 1928								◁—	—▷
Bradyphyllum Grabau 1928								◁—	—▷
Plerophyllum Hinde 1890								◁—	—▷
Pentaphyllum De Koninck 1872								◁—	—▷
Antikinkaidia Fedorowski 1973								◁—	—▷
Commutia Fedorowski 1973								◁—	—▷
Dalnia Fedorowski 1973								◁—	—▷
Saleelasma Weyer 1979								◁—	—▷

Two assemblages have been distinguished. The first one developed in and above the *marginifera* conodont zone and characterized a calm, turbid water environment. The second one occurs in the *costatus* conodont zone and presumably lived in a shallow, pure and well-aerated water. These assemblages include mainly small, horned solitary, dissepimented or not, species which belong to long lived genera such as *Metriophyllum*, peculiar Famennian genera such as *Petraiella, Kielcephyllum, Kozlowskinia,* and "Carboniferous" genera such as *Cyathaxonia.* They also include a few species of Frasnian-type solitary or compound genera.

However, some remarks should be made about the species listed by Rózkowska (1969) and/or about their stratigraphic ranges :

- Some corals may have been misidentified. For example, *Pseudamplexus granulatus* Rózkowska 1969 is probably not a Rugosa but a Tabulata of the family Palaeacidae Roemer 1883. Moreover, the recognition of Carboniferous or Permian genera such as *Amplexus, Amplexizaphrentis, ? Caninophyllum, Duplophyllum, Prosmilia, . . .* seems doubtful particularly because of the low number of the studied specimens (often only one) and sometimes their bad conservation.
- Some corals may have been reworked from older deposits. Thus, the rare specimens of *Peneckiella* and ? *Phillipsastrea* from the Upper Famennian (*costatus* conodont zone) of the very condensed Galezice section might have been reworked from the Frasnian as suggested by their fragmentary shape and the nature of the deposits (3).

(3) The Galezice section includes within an only about 2 m thick sequence the four late Famennian conodont zones (*marginifera, velifer, styriacus* and *costatus*) and a Tournaisian clayey bed. It overlies Givetian (or Lower Frasnian?) and has been considered by Rózkowska (1981) as deposited on a submarine threshold in a shallow water environment. Maybe it is the result of a turbiditic type sedimentation ?

The neptunian dykes of Dalnia have yielded (Szulczewski, 1973) numerous small, horned solitary corals (some of these were described by Fedorowski, 1973) both with a mixed conodont fauna ranging from the *costatus* to the *crenulata* zone. The presence of *Saleelasma* (Lower and Middle Tournaisian) suggests that a part of the coral assemblage encompasses the Lowermost Tournaisian to the *crenulata* conodont zone. In contrast, other corals (not checked on the table) such as *Petraiella, Kielcephyllum, Kozlowskinia,...* are only known in lower conodont zones than those recognized with the corals in the dykes. The lack of other informations concerning the Rugose Corals around the Devonian-Carboniferous boundary does not allow to fix their stratigraphic position more exactly. Even taking into account the above problems, we can recognize the following main paleontological events in the Upper Frasnian to the Upper Famennian of Poland :

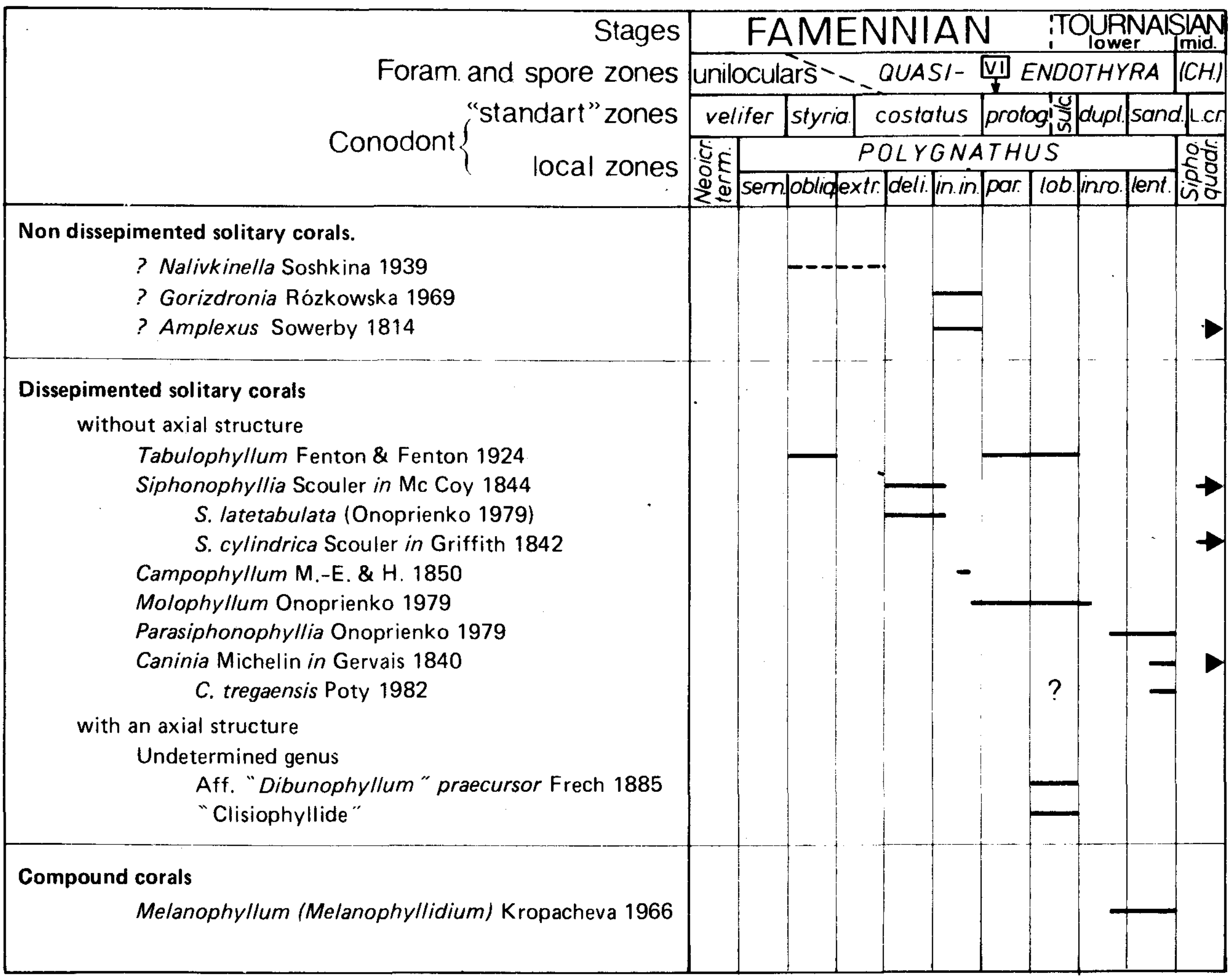
- extinction of the Frasnian-type corals at the end of the Frasnian;
- development of two distinct rich faunas of small, horned solitary corals in respectively the *marginifera* conodont zone and in the *costatus* conodont zone.

E. - UPPER FAMENNIAN AND LOWER TOURNAISIAN RUGOSE CORALS OF THE OMOLON REGION (NE-U.S.S.R.)

(Table IV)

The Upper Famennian and Tournaisian deposits of the Omolon Region have yielded numerous Rugose Corals (Onoprienko, 1979, . . .; Conil *et al.*, 1982; Simakov *et al.*, 1983; Poty & Onoprienko, 1984). Collaboration between European and Soviet specialists enabled accurate comparisons between Omolon and Europe. The ranges of the Omolon corals are defined here by using the local conodont zonation established by Gagiev (1979) and tentatively correlated with European stratigraphic zonation.

Table IV. - Upper Famennian to Middle Tournaisian Rugose Corals in the Omolon Region (Conodont zones from Gagiev *in* Shilo *et al.*, 1984). Legend, see Table I.



The oldest Famennian Rugosa occur in the *obliquicostatus* conodont zone. These are either (locally abundant) small, dissepimented solitary corals probably belonging to only one species (*Tabulophyllum simakovi* Poty & Onoprienko 1984), or (rare) small, non-dissepimented solitary corals determined as *Nalivkinella ?* sp. by Poty & Onoprienko (1984).

The corals become common in the *delicatus* and *inornatus inornatus* conodont zones, and among them are various small non-dissepimented solitary corals, numerous *Siphonophyllia latetabulata* (Onoprienko 1979) which are the oldest representatives of this "Carboniferous" genus (*delicatus* and *inornatus inornatus* zones), and *Campophyllym cylindricum* (Onoprienko, 1979), a species close to the European *C. flexuosum* group (*inornatus inornatus* zone). The differences observed in the lateral and/or vertical distribution of these corals are partly controlled by the diversity of the facies (ranging from relatively deep subtidal to shallow subtidal or even intertidal environments). Within the *inornatus inornatus* zone this fauna is replaced by a new assemblage, which is mainly composed of numerous big, dissepimented solitary corals belonging to a few species of *Molophyllum* Onoprienko 1979, and includes also caninomorphic (*Tabulophyllum* sp. Poty & Onoprienko 1984) and rare columnate corals. This second assemblage ranges until the *inornatus rostratus* conodont zone.

The next (third) coral assemblage ranges from the upper part of the *inornatus rostratus* zone until the top of the *lenticularis* zone. It mainly includes the big dissepimented *Parasiphonophyllia,* colonies of *Melanophyllum (Melanophyllidium)*, and *Caninia tregaensis* (4) in the upper part of the *lenticularis* zone.

Siphonophyllia cylindrica appears above this assemblage at the base of the *Siphonodella quadruplicata* zone.

Thus, after the development of an Upper Famennian fauna, there is a first renewal of the Rugosa in the upper part of the *inornatus inornatus* zone. Possibly this renewal coincides with (or is below) the Devonian-Carboniferous boundary, as suggested by the occurrence of spores of the VI zone some meters higher up, in the lower part of the *parapetus* zone.

A second change is in the upper part of the *inornatus rostratus* zone which is tentatively correlated with the upper part of the *duplicata* standard conodont zone.

F. - CONCLUSIONS

1. The worldwide crisis producing the extinction of most of the Devonian-type corals takes place during the acme (Uppermost Frasnian-Lowermost Famennian) of the Frasnian marine transgression. This acme was marked by a deepening of the seas and predominantly clayey deposits. This environment only permitted the development of a *Cyathaxonia*-type fauna (sensu Hill, 1938) such as that in the *Cheiloceras* Stufe in the German Cephalopod facies. However, the scarcity of corals at that time, even in the shallow water environments of the sea margins, suggests that possibly also another phenomenon - along with the effects of the positive eustatic fluctuations - prevented the development of corals (fall in sea water temperature ?).
2. This period of crisis persisted until about the *rhomboidea* or the *marginifera* conodont zone in which corals tend to be more common and show the development of new, typical Famennian species (Belgium, Poland). The first Carboniferous representatives appear at this time. During the Fa2bc (*velifer-styriacus* zones, *Platyclymenia* Stufe) the regressive terrigenous facies are unfavourable for corals which become uncommon even in the deep water environments.
3. Rugosa become abundant and diversified during the Strunian transgression both in the shallow water environments of Belgium and in the deeper water facies of Germany and Poland. Their acme is in the upper part of the Strunian ("Tn1a"). A similar distribution can be observed in the Upper Famennian of the Omolon Region.
4. The majority of the Strunian corals disappears not far below or at the Devonian-Carboniferous boundary (Belgium, Germany, Omolon and probably Poland), and is replaced by an usually common but not so diversified Tournaisian fauna which suggests that there is an important impoverishment of the coral niches possibly because of a climatic change (fall in sea water temperature as in the end of the Frasnian ?).

(4) *C. tregaensis* might be present as early as the *lobatus* zone as suggested by dolomitized samples.

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