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DEVONIAN-CARBONIFEROUS TRANSITION BEDS IN THE REGION OF HAMOIR-SUR-OURTHE (*)

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(3 figures et 2 planches dans le texte)

ABSTRACT

The drilling of a borehole in Tohogne allowed the study of Devonian — Carboniferous (« Strunian ») transition beds. A comparison of different sections in the Hamoir region shows a gradual and diachronous facies change, especially in the lower part of the Carboniferous transgressive sequence. The biostratigraphic range of *Polygnathus streeli* is discussed.

RÉSUMÉ

Le sondage de Tohogne a permis l'étude des couches de transition Dévono — Carbonifère (« Strunien »). Une comparaison de différentes sections dans la région d'Hamoir démontre l'existence d'un changement graduel et diachronique dans l'épaisseur et dans la lithologie du sud au nord. La distribution de *Polygnathus streeli* est discutée.

ACKNOWLEDGEMENTS

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INTRODUCTION

As a result of the drilling of a borehole between Houmart and Longueville, both hamlets of Tohogne, it has become possible to study the local stratigraphy of the Devonian-Carboniferous transition beds. Detailed lithological and micropaleontological information concerning this borehole section has been published by Bouckaert and Dusar (1976). Implications for systematic paleontology, biostratigraphy and paleogeography, and for correlations with reference sections will be found in a paper by Bouckaert, Conil, Dusar and Streel, to be published in this journal. An evaluation and correlation of outcrops from the corresponding time span in the

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Hamoir region is now possible, using the Tohogne borehole as the reference. These outcrops tend to be incomplete, badly preserved and partially decalcified as they are situated in a depression area compared to the surrounding compact masses of the Upper Famennian sandstones (« Psammites du Condroz ») and the Lower Carboniferous limestones. An exception can be made for a lower unit often consisting of quarried well-bedded sandstones. The sections studied are shown on the locality map fig. 1.

The region is situated in the eastern part of the Dinant tectonic basin, south of the Ourthe valley area which contains the main reference sections. All outcrops occur along western tributaries of the Ourthe : from north to south the Ruisseau de Blockai (158W 7 - 271 - 269), the Ruisseau de Rénale (158W 884 - 178), the Néblon (157E 2 - 4 - 60; 158W 694 - 693 - 158), and the Nanchnioule (158W 153). The last sections (158W 694 - 693 - 158 - 153) are situated within the Houmart-Hamoir syncline, as is the Tohogne borehole (158W 270); hence a close resemblance in their stratigraphic succession.

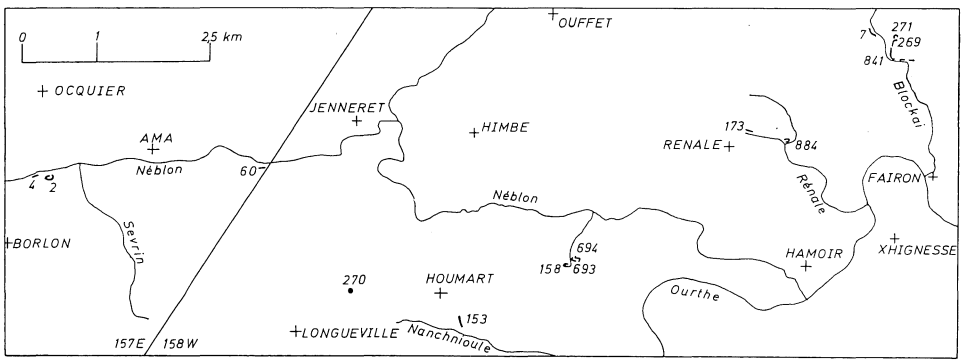


Fig. 1. — Locality map of Devonian — Carboniferous transition sections in the Hamoir region.

STRATIGRAPHIC DESCRIPTION

Fig. 2 gives a correlation chart between different sections using the Tohogne borehole section as a reference. Rock units from this borehole are indicated with corresponding thicknesses. For a justification of these units, we refer to publications directly related to the borehole, or to Conil (1964-1968).

Detailed descriptions are stored in the « Archives » of the Belgian Geological Survey under the numbers indicated.

a. — Section on the southern limb of the Houmart-Hamoir syncline (158W 153).

This outcrop along an old path is poorly exposed and strongly weathered. It shows some beds of the Etroeungt Limestone and further the rhythms with small girvanellids and underlying sandstones passing into the Condroz Psammites (Montfort Formation).

Samples 9 to 6 (in ascending order) belong lithologically to the sequence of the rhythms with small girvanellids; samples 2 and 1 to the Etroeungt Limestone. The rhythms with small girvanellids (lower part of the Strunian, Fa2d) contain

Pseudopolygnathus conili (lowermost occurrence recorded so far) as well as *Polygnathus streeli* (highest occurrence recorded). Transitional forms between different types of *Pseudopolygnathus* and *Bispathodus* are also present.

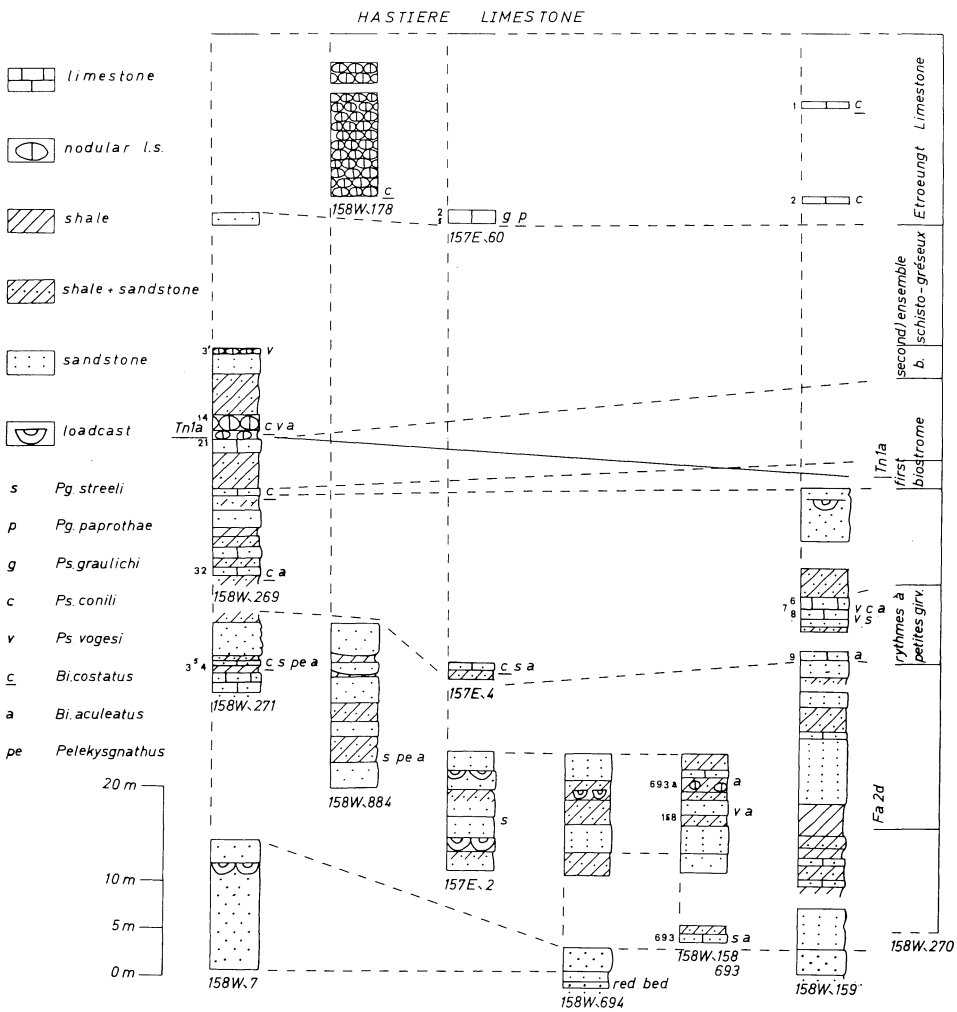


Fig. 2. — Correlation chart between Devonian — Carboniferous transition beds in the Hamoir region.

b. — Sections on the northern limb of the Houmart-Hamoir syncline, 1.5 km east of the Tohogne borehole, showing quarried well-bedded sandstones of the final Famennian; total thickness 21 m (158W 694 - 693 - 158).

In the upper part shaley sandstones contain limestone nodules and small loadcast structures. The lowermost part is poorly exposed except for the contact with the underlying Montfort sandstones characterized by coarse red sandstone beds covered by a quartzitic bed (thickness 2.5 m), considered as the base of a lithostratigraphically defined transgression.

TABLE I

Conodont distribution in sectioàn 158 W 153

Conodonts \ Sample nos.	9	8	7	6	2	1
Icriodus costatus	×		×			
Bispathodus aculeatus	×		×			
Polygnathus communis		×	×			
Spathognathodus strigosus		×	×	×		
S. supremus		×				
Polygnathus streeli		×				
P. delicatulus		×	×	×		
Pseudopolygnathus vogesi		×	×			
P. cf. *P. brevipennatus*			×			
P. conili			×		×	
Polygnathus collinsoni			×			
P. inornatus						×
Bispathodus jugosus — B. costatus						×

These beds yielded 3 conodont bearing levels :

TABLE II

Conodont distribution in sections 158 W 693 — 693a — 158

Conodonts \ Sample nos.	693	158	693a
Icriodus costatus	×	×	×
Polygnathus streeli	×		
Bispathodus aculeatus	×	×	×
B. stabilis		×	×
Polygnathus communis		×	
Pseudopolygnathus vogesi		×	

The presence of *Girvanella ducii* and *G. wetheredi* (no. 158) or badly preserved foraminifera (no. 693) is noteworthy. Corresponding beds in outcrop 158W 271 on the northern part of the sheet Hamoir contain *Girvanella nicholsoni*, associated with thick rimmed *Umbellinas*. The first small girvanellids thus occur near the lithological base of the transgression, well below the lithostratigraphic unit of the rhythms with small girvanellids (Conil, 1964). This constitutes clear paleoecological evidence for the existence of a north-south oriented facies change, resulting from the more marine facies in the south at the end of the Devonian, less influenced by the Upper Famennian regression.

For geometrical and lithological reasons, the lithological base of the Carboniferous transgression as described here, falls not more than 5 m. below the termination of the Tohogne borehole. The limestone beds immediately above contain a conodont

fauna with typical representatives of the *costatus* conodont-Zone (*Pseudopolygnathus vogesi, Bispathodus aculeatus*).

c. — Sections in the western part of the Néblon valley on the territory of Borlon.

Section 157E 2 is situated in a quarry showing 13 m. of well-bedded sandstones, often with impressive loadcast structures, interbedded with tiny sandy shale layers (sandy lower part of the transgressive sequence).

Section 157E 4 is a small road outcrop showing some calcareous beds, belonging to the rhythms with small girvanellids unit (compared to the Tohogne borehole section).

Section 157E 60, also a road outcrop, shows 1.2 m. of nodular crinoidal limestone, often sparitic, in a shaley matrix, and attributed to the Etroeungt Limestone.

TABLE III

Conodont distribution in sections 157 E 2 — 4 — 60

Conodonts \ Sample nos.	2	4	60-2	60-3	60-5
Polygnathus streeli	×	×			
Icriodus costatus		×			
Bispathodus aculeatus		×			
B. costatus		×			
Polygnathus inornatus			×	×	×
P. paprothae			×		
Pseudopolygnathus graulichi			×		
Bispathodus stabilis			×		
Polygnathus communis				×	
P. delicatulus				×	
Spathognathodus amplus				×	
S. strigosus evolved					×

d. — Sections along the Ruisseau de Rénale, Ouffet.

Sandstone quarry (158W 884) with fine-psammitic to psammoquartzitic sandstone (thickness of exposed beds 17 m.), containing a lens of sandy biosparite with *Cryptophyllus*, small girvanellids (sandy lower part of the transgressive sequence).

Conodonts : *Spathognathodus strigosus, Pelekysgnathus* sp., *Polygnathus communis, P. streeli, Bispathodus stabilis, B. aculeatus aculeatus, B. aculeatus plumulus.*

Clayey nodular Etroengt Limestone (158W 173) with calcite veins; petrographically biomicrite to biopelmicrite and biopelsparite. Containing small girvanellids, numerous *Umbellinas, Archaesphaera, Bisphaera,* solitary corals foraminifera : *Paracaligelloides antropovi florennense, Earlandia, Septaglomospiranella, Chernyshinella* (determinations R. Conil).

Conodonts : *Bispathodus spinulicostatus* displaying tendency toward *Pseudopolygnathus* cf. *P. brevipennatus* (in the basal beds).

e. — Sections along the Ruisseau de Blockai, Comblain-Fairon. At a crossroads near the Ancien Moulin de Blockai, an important outcrop along the main

road in the direction of Fairon (158W 841) shows the Hastière Limestone, separated by a depression on the Pont d'Arcole Shales from the Landelies Limestone, passing into the Royseux Limestone and Dolomite and finally into the cherty Yvoir Limestone.

In a turn of the secondary road, « Strunian » rocks are visible (158W 269) : the « Ensemble schisto-gréseux de l'Ourthe » (Conil, 1964) containing a third biostromal level, two biostromes and the « Rhythms with small girvanellids » (Conil, 1964). The thickness is reduced to almost half that of the Tohogne borehole section. The limestone beds from the second biostrome are rich in foraminifera which indicate a Tn1a age (sample nos. 158W 269-14 to 21),

with *Quasiendothyra kobeitusana*, *Q. concavacamerata*, *Q. konensis*, *Q. communis radiata*, *Plectogyra* gr. *parakosvensis*, *Septaglomospiranella*, *Glomospiranella* (determinations by R. Conil).

Section 158W 269 is also completely situated in the PL (*pusillites-lepidophytus*)-Sporozone, indicating a Fa2d or younger age (communication by M. Streel).

This section is separated by the secondary road from a small sandstone quarry (158W 271). The calcareous beds of section 158W 271 contain Fa2c — type microfossils such as *Girvanella nicholsoni*, *Umbellina cutis*, *U. bykovae*, *Cryptophyllus*.

The conodonts indicate the *costatus* — Zone with abundant *Polygnathus streeli*. These clearly marine beds already belong to a « Strunian » transgressive sequence, of which they form the lower part. They cover 14 m. of barrier type sandstones with a facies analogous to the facies of the Montfort Formation (158W 7). These barrier type sand deposits gradually decrease in thickness towards the south; they are reduced to 2.5 m. in the Houmart-Hamoir syncline.

TABLE IV

Conodont distribution in sections 158 W 269 — 271

Conodonts \ Sample nos.	3+4	271/5	32	18	269/17	3′
Polygnathus streeli	×					
P. delicatulus	×		×			
P. communis	×	×	×	×		
Pelekysgnathus sp.	×					
Icriodus costatus	×		×			
Spathognathodus strigosus				×		
Bispathodus costatus	×		×	×		
B. aculeatus	×		×	×		
B. stabilis			×			
Pseudopolygnathus vogesi				×	×	×
P. cf. *P. brevipennatus*				×		

The samples from 158W 271 belong to the sandy lower part of the transgressive sequence, sample 32 to the Rhythms with small girvanellids unit, samples 18 and 17 to the second biostrome, sample 3′ to the third biostrome contained in the « Ensemble

schisto-gréseux de l'Ourthe ». Section 158W 269 roughly corresponds to the section « Tavier » described by CONIL, 1968. These sections are separated only by an anticlinal crest.

CONCLUSIONS

Considerable differences in thickness and facies are perceived in the lower part of the Carboniferous transgressive sequence. The thickness of the shaley strata below the Etroeungt Limestone diminishes from south to north, whereas the thickness of the basal sandstone beds increases. The base of the PL-sporozone in Tohogne is situated only 15 m. above the basal beds of the transgression which surmount a formation related to the Montfort Formation as described by THOREZ.

Southern sections generally consist of a less sandy facies, as shown by the microfossil content : thus there is no *Girvanella nicholsoni* — thick rimmed *Umbellina* association in the south where it is replaced by small girvanellids characteristic for a more marine facies. The occurrence of *Polygnathus streeli* (Fig. 3) is also facies-controlled : it is confined to the Fa2c-Fa2d transition beds and persists into the Rhythms with small girvanellids unit, but is better represented in sections which like the Yves-Gomezée road type section (DREESEN, DUSAR and GROESSENS, 1976) are composed of more sandy strata.

These strata also contain *Pseudopolygnathus vogesi* and *Bispathodus aculeatus*, both related to *Bispathodus costatus* but occurring earlier, and characterizing the *costatus* conodont-Zone. A recent revision of the *Bispathodus* group (ZIEGLER, SANDBERG and AUSTIN, 1974) has resolved taxonomic problems in the *costatus* stock, but has raised new questions concerning the lower limit of the *costatus*-Zone, established by ZIEGLER, 1962. *Bispathodus costatus* appears in the Rhythms with small girvanellids unit in the south, though in an earlier sequence in the north (associated with *Girvanella nicholsoni*). There is a sign of possible diachronism in the lithostratigraphical units from south to north. The first appearance of *Pseudopolygnathus conili*, phylogenetically related to *P. vogesi*, is lowered to the Rhythms with small grivanellids unit.

Another indication for diachronism is given by the first appearance of *Quasiendothyra kobeitusana*, which in Tohogne already occurs in the first biostrome but in Fairon only from the second biostrome upwards. Fig. 2 clearly shows the crossing of biostratigraphic correlations and the northward thinning lithostratigraphic unit limits.

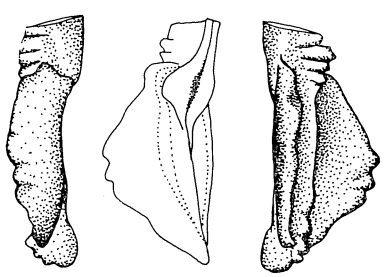


Fig. 3. — *Polygnathus streeli* DREESEN, DUSAR and GROESSENS, 1976. 158 W 271-4, 35 ×.

PLATE I

Pseudopolygnathus vogesi RHODES, AUSTIN and DRUCE, 1969

Fig. 1. 158 W 153-8; LSEM 448/14; 55 ×; C 1416

Fig. 2. 158 W 153-7; LSEM 450/26; 60 ×; C 1417

Fig. 3. 158 W 158; LSEM 434/30; 60 ×; C 1418

Fig. 5. 158 W 153-8; LSEM 448/17; 58 ×; C 1420

Pseudopolygnathus cf. *brevipennatus* ZIEGLER, 1962 transitional to *P. vogesi* RHODES, AUSTIN and DRUCE, 1969

Fig. 4. 148 W 269-18; LSEM 448/26; 50 ×; C 1419

Bispathodus costatus (E. R. BRANSON, 1934)

Fig. 6. 158 W 269-32; LSEM 448/31; 90 ×; C 1421

Bispathodus aculeatus aculeatus (BRANSON and MEHL, 1934) displaying tendency toward *Pseudopolygnathus*

Fig. 7. 158 W 153-7; LSEM 450/27; 120 ×; C 1422

Bispathodus spinulicostatus (E. R. BRANSON, 1934) transitional to *Pseudopolygnathus* cf. *P. brevipennatus* ZIEGLER, 1962

Fig. 8. 158 W 173; LSEM 449/1; 92 ×; C 1423

Bispathodus costatus (E. R. BRANSON, 1934) displaying tendency toward *B. jugosus* (BRANSON and MEHL, 1934)

Fig. 9. 158 W 153-1; LSEM 448/12; 50 ×; C 1424

PLATE I

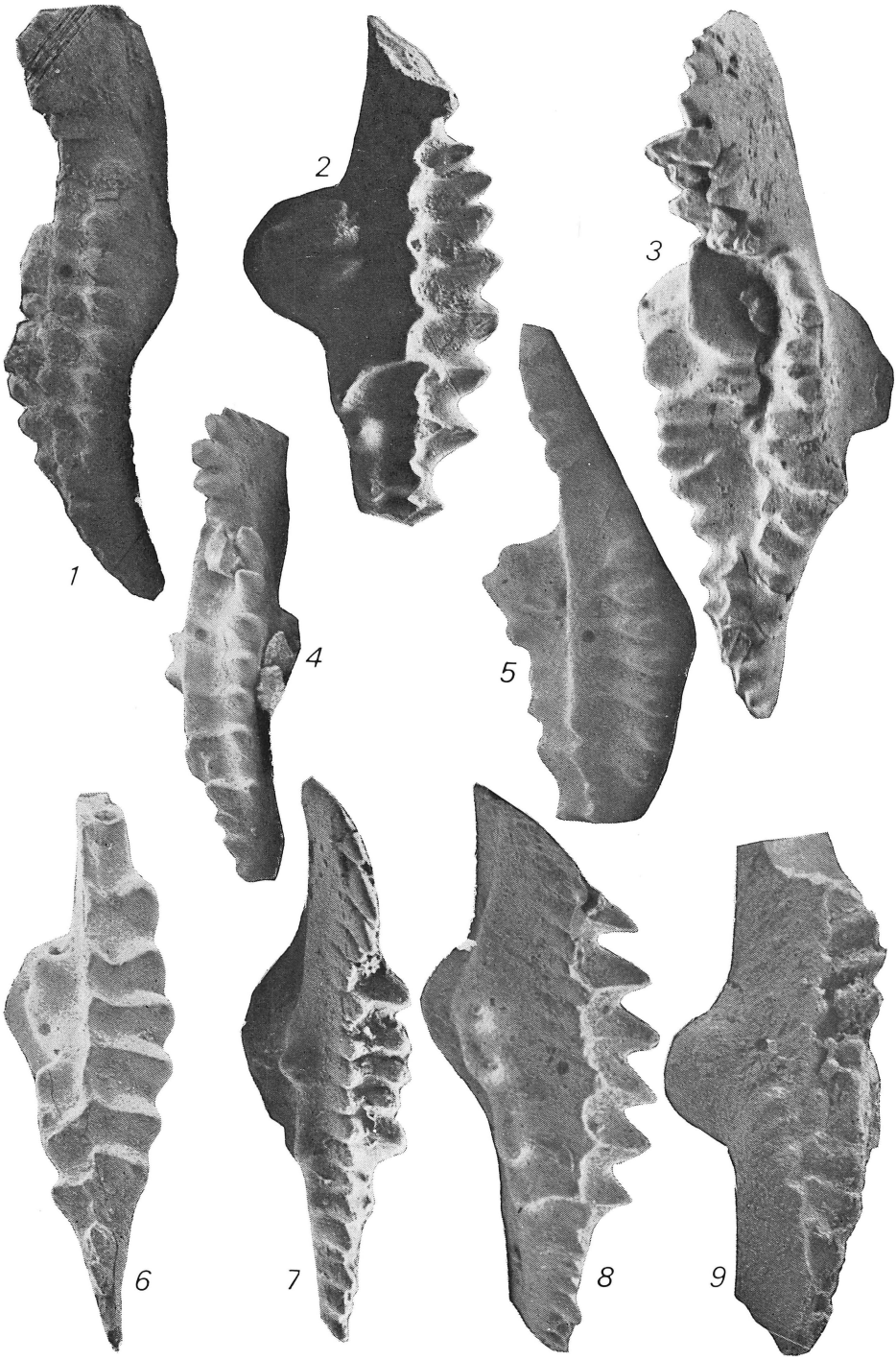


PLATE II

Pseudopolygnathus graulichi Bouckaert and Groessens, 1976

Fig. 1. 157 E 60-2; C 1425
a. upper view; LSEM 461/11; 65 ×
b. lower view; LSEM 450/18; 55 ×

Polygnathus paprothae Bouckaert and Groessens, 1976

Fig. 2. 175 E 60-2; LSEM 435/3; 50 ×; C 1426

Bispathodus aculeatus aculeatus (Branson and Mehl, 1934)

Fig. 3. 158 W 693a; LSEM 450/29; 63 ×; C 1427

Fig. 4. 158 W 153-7; LSEM 450/25; 60 ×; C 1428

Polygnathus inornatus E. R. Branson, 1934

Fig. 5. 157 E 60-3; LSEM 448/20; 50 ×; C 1429 (lower view)

Fig. 6. 157 E 60-2; LSEM 435/2; 50 ×; C 1430 (upper view)

Pseudopolygnathus vogesi Rhodes, Austin and Druce, 1969

Fig. 7. 158 W 153-8; LSEM 448/18; 58 ×; C 1431

Polygnathus sp.

Fig. 8. 158 W 269-32; LSEM 448/30; 90 ×; C 1432

Polygnathus delicatulus Ulrich and Bassler, 1926

Fig. 9. 157 E 60-3; LSEM 448/19; 98 ×; C 1433

Fig. 10. 157 E 60-3; LSEM 435/5; 105 ×; C 1434

Spathognathodus strigosus (Branson and Mehl, 1934), forms displaying incipient platform

Fig. 11. 158 W 153-7; LSEM 450/28; 60 ×; C 1435

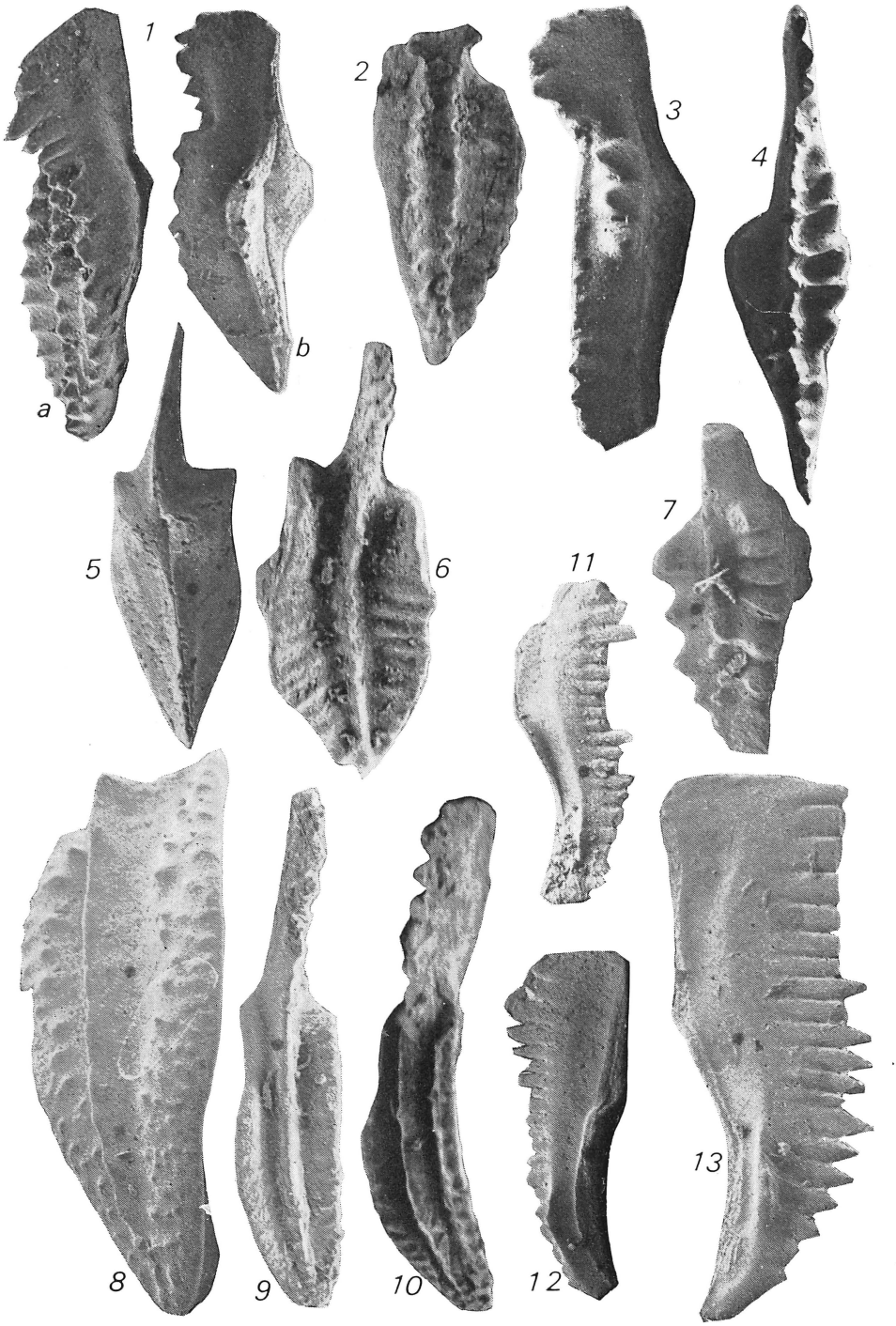
Fig. 12. 158 W 231; LSEM 450/6; 60 ×; C 1436

Polygnathus cf. *P. delicatulus* Ulrich and Bassler, 1926, displaying reduced platform

Fig. 13. 158 W 153-6; LSEM 449/2; 48 ×; C 1437

LSEM = *Louvain scanning electron microscope number*

PLATE II



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