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The Frasnian–Famennian Boundary in Belgium

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With 3 Textfigures

Summary: Paleontological evidence in the type section of Senzeille (Matagne Facies) is not sufficient to fix the Frasnian-Famennian boundary satisfactorily. Therefore sections across the Frasnian-Famennian boundary in the Barvaux Facies (Hony) and in the Matagne-Barvaux transitional facies are explored. Lithological and biostratigraphical aspects are discussed. On the basis of brachiopods, conodonts, goniatites and Acritarcha the respective sections are compared with one another. The presence of the Lower triangularis-Zone is demonstrated and according to all evidence it is suggested to establish a new boundary stratotype in the Barvaux Facies at Hony.

I. Introduction

In Belgium a series of dark coloured, soft, blackish to greenish shales with Buchiola palmata and B. retrostriata, described as "Schistes de Matagne", are considered to correspond to the uppermost part of the Frasnian Stage. The term "Schiste de Matagne" was introduced by J. Gosselet (1871) and subsequently used by the authors of the Geological Survey map of Belgium.

The facies of the "Schiste de Matagne" is well developed in the southern part of the country, but in the east it is replaced by the facies of the "Schiste de Barvaux", a more reddish and violet shale, with large specimens of Spirifer vermeulii. The superimposition of the Frasnian and Famennian sequences is well exposed in the section of Senzeille. The "Schistes de Matagne" are overlain by the "Schiste de Senzeille" with Pampoecilorhynchus lecomptei.

The boundary between the Frasnian and Famennian stages in the section of Senzeille could not be satisfactorily fixed with conodonts because the "Schistes de Matagne" below the base of the Famennian have not been investigated in that section as limestones are lacking. The lowermost beds of the Famennian of this section, according to Bouckaert & Ziegler (1965), yielded conodonts indicating the Middle triangularis-Zone. According to that zone the basal part of the Famennian can be correlated with the uppermost part of the Manticoceras-Stufe (Adorf-Stufe) of Germany (post dol, see Ziegler 1971). Hence, widespread usage of Frasnian as being equivalent to Manticoceras-Stufe and lower Famennian equivalent to the lowermost part of the Chelloceras-Stufe, must be considered with some hesitation.

A well established rhynochocelid succession of the Frasnian-Famennian transition beds was carefully studied by P. Sartenaer.

His studies include not only the "Barvaux"- and "Matagne"-facies but also the lateral transition-beds from the "Matagne" into the "Barvaux-facies".

His conclusions (1968–1970) are summarized in the following scheme:

<table>
<thead>
<tr>
<th>MATAGNE FACES</th>
<th>TRANSITION BEDS</th>
<th>BARVAUX FACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Famennian</td>
<td>Pampoecilor-</td>
<td>Paromoepygna</td>
</tr>
<tr>
<td></td>
<td>rhynchus lecomptei</td>
<td>belcastellana</td>
</tr>
<tr>
<td>Frasnian</td>
<td>Caryorhynchus</td>
<td>Car. tumidus</td>
</tr>
<tr>
<td></td>
<td>tumidus</td>
<td></td>
</tr>
</tbody>
</table>

In this paper the writers describe and discuss the conodont faunas that come from three sections across the Frasnian-Famennian boundary that are respectively typical for the same facies developments.
II. The Frasnian-Famennian boundary in the Matagne-facies

The Section of Senzeilles (fig. 1)
(For basic information see: J. Gosselé 1877, 1888; P. Sartenaer 1960; J. Bouckaert & W. Ziegler 1965)
The base of the Famennian at the type section of Senzeilles is situated at Km 101,026; there it was defined by Gosselé (1877) based on the appearance of "Cythia murchisoniana" in "Schistes contenant de grosses plaques solides", 6 m thick. Four meters above this boundary, P. Sartenaer (1960) discovered the first occurrence of Pampoeocilichnus lecomptei.
The first limestone layer appears at Km 101,045 and contains a conodont fauna of the Middle triangularis-Zone (Bouckaert & Ziegler 1965).
Immediately below the classical boundary 14 m of black shales are exposed. They have yielded no conodonts because of the lack of limestones. P. lecomptei has not been found as yet in the facies of these black shales. P. Sartenaer (1968) demonstrates that Caryophyllum tumidus is present at the base of these 14 m of black shales, more precisely at Km 101.
It is thus possible that a part of this black shales could represent totally or partially the equivalent of the upper part of the Upper gigas-Zone, recognized below (Mouraviev 1970) the Lower triangularis-Zone or a part of the Middle triangularis-Zone.

III. The Frasnian-Famennian boundary in the Matagne-Barvaux transitional facies (fig. 2)
(See P. Sartenaer 1970 for basic information)
The region where the transitional facies occurs was especially studied by P. Sartenaer (1968–1970). He defined the base of the Famennian with the appearance of Paramosopogyna bellicastellana, name-bearing of a new rhyconellid-zone developed in this region “where other rhyconellid zones are poorly represented” (Sartenaer 1968:1).
Further geological investigations carried out by the Belgian Geological Survey by means of numerous boreholes and galleries permit the general stratigraphical scheme as follows (see also fig. 2): The association of Frasian goniatites with C. tumidus, the appearance of P. bellicastellana and Pampoeocilichnus nux praenex about 30 m above, and the first recognized occurrence of conodonts belonging to the Middle triangularis-Zone in the P. bellicastellana-Zone, do not permit to trace an accurate boundary between the Frasian and the Famennian.

IV. The Frasnian-Famennian boundary in the Barvaux-facies
The Section of Hony (fig. 3)
(See J. Bouckaert & J. Thorez 1965 for basic information)
At layer 50 and above, Palmatolepis triangularis and Ancyrognathus cryptus indicate the Middle triangularis-Zone (Bed no. 10 of Bouckaert & Thorez 1965). This zone is the first conodont zone to occur above the Famennian/Fransian limit in the Senzeilles stratotype.
At layer 48 and below, Ancyrognathus asymmetricus indicates the Upper gigas-Zone (Bed no. 9 of Bouckaert & Thorez 1965).
Between these two layers, bed 48b yielded more than thousand conodonts from 14.2 kg of limestone. The presence of Palmatolepis triangularis, Ancyrognathus cryptus, and A.
of the conodont association. It is to be noted that *Palma
tolepis delicatula* is lacking among the *Palmatolepis* species
collected in the Middle *triangularis*-Zone.
On the other hand, the change between the Upper gigas-Zone
and the Lower *triangularis*-Zone is marked by:
1. The total lack of the 3% of *Ancyrodella evo"ra"ta and the
   2% of *Ancyrognathus asymmetricus* recovered below.
2. The replacement of all *Palmatolepis subrecta* by *Palmatolepis
   triangularis*.
3. The dominant *Polygnathus* fauna changes from a majority
   of *P. normalis* into the majority of *P. brevislaminata*.
4. There is also a change in the *Icriodus* fauna but a detailed
   study is necessary before specific identifications can be given.
5. The 1% of *Spathognathodus graulatus* changes into a dif-
   ferent species.
In summary, all the rapidly evolving conodont genera show
an important change which affects more than half of the total
conodont population in contrast to the 0.1% of change
between the Lower and the Middle *triangularis*-Zones.
The studies of the brachiopod and conodont faunas allow to
draw the following conclusions:
1. The inadequacy of the Frasnian/Famennian contact at
   Senzeilles for a precise paleontological definition of this limit.
2. The small thickness of rocks in the Lower *triangularis-
   Zone.
3. The important change of conodont-population at the base
   of the Lower *triangularis*-Zone.
4. The appearance of *P. nux praenex* in the Lower *triangu-
   laris*-Zone.
According to these conclusions the authors regard the Lower
*triangularis*-Zone as Famennian in age. They also strongly
suggest to establish a new boundary stratotype for the
Frasnian/Famennian limit in the Hony section with the
boundary to be placed at the base of layer 48b (see fig. 3).

V. Correlation of the Senzeilles and Hony sections using
   palynological methods

An attempt has been made to correlate this newly proposed
Frasnian/Famennian limit at Hony with the shaly part of
the classical section of Senzeilles using the quantitative
variations of presumed planktonic plant-microfossil assem-
bles. For that purpose, both sections have been sampled in
a rather great detail, and particular focus was put on those
portions of shales which underly the limestone beds contain-
ing the fauna of the Middle *triangularis*-Zone. The aim was
to correlate the limestone beds of the Lower *triangularis*-Zone
of Hony with the equivalent part of the section at Senzeilles
which is devoid of any limestone beds.
The quantitative data are presented in details on fig. 1 and
fig. 3. Most of the samples are extremely rich in well preserved
acritarchs (a few thousands specimens on each micro-
scopical slide). Spores are poorly preserved. The systematic
position is briefly mentioned in the legend of the fig. 1 and 3.
We refer to Dricot (1971) for a taxonomic discussion of
these taxa. Our data are preliminary and a more complete
study is planned including various other sections of the same
stratigraphical interval.
Nevertheless, we would already now like to emphasize the
similarity of the general trends of variations that occur in the
acritarch assemblage from the bottom to the top of both
sections especially regarding: 1. the ratio *Micryhystridium/
Leiosphaeridia* and *Lophosphaeridium*, 2. the abundance of
*Vetrabium ceratoideae* and *Baltisphaeridium cf. longi-
pinosum* increasing upwards in the section, 3. the occurrence
in the upper part of both sections of the genera *Daillydium*
If it can be extended downward to the top of layer 4a it is consistent with the thin occurrence of Pseudophacops in Zone b and c. The few layers that contain a single fragment (representative of the lower Trilophosaurus Zone) from the base of layer 4b to the base of layer 5a. The upper Upper Zone (c) occurs from layer 5a down to 2b. The lower Lower Zone (d) also occurs in that interval. The section at the left demonstrates the Middle Trilophosaurus-Zone (e) to range from layer 2a to 5a. The section on the right is drawn to larger scale.
and *Euvitia* and the species *Baltisphaeridium ramospinosum*. We tend to believe that this more or less correlative variation might represent a biostratigraphic feature that is not too much subjected to facies control. We therefore assume that the time equivalent of the limestone beds of the Lower *triangularis*-Zone at Hony has to be searched in that part of the Senzeilles section where the ratio *Micbystridium/Leiosphaeridia* and *Lophsphaeridium* is rather high. This means that the newly proposed base of the Famennian at Hony would have to be located not below the classical limit of Gosselet at Senzeilles, but between this limit and the first occurrence of conodonts of the Middle *triangularis*-Zone.

The petrographical analysis of a few samples containing *Acritarcha* at Senzeilles has revealed a great homogeneity of the finely recrystallised pelitic material. Samples 11 to 13 yield very small quartz-grains, a few frambooidal pyrite crystals and are fairly calcitic. These shales (11–13) contain also fragments of vegetal material surrounded by a thin coherent layer of cryptograined kaolinite which does not occur in samples 14 to 16.

All samples (11–16) show a few disarticulated ostracods. At Hony all samples are also pelitic but sample 1 in addition contains heterogrannular quartzite material. This material is better sorted in samples 3 to 5 and is lacking in the successive samples 7 to 14.

A mineral fraction insoluble in the fluoridic acid treatment required for palynological analysis is present in the slides corresponding to samples 1 to 8.

We therefore assume that a change at least in the velocity of the marine currents at the time during which the investigated sediments were deposited is of the same rate and might be related to the quantitative change in the phytoplanktonic association.

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**Literature**


