

CONTRIBUTION TO THE STRATIGRAPHY OF THE ORDOVICIAN RIGENÉE FORMATION (BRABANT MASSIF, BELGIUM) WITH A PRELIMINARY STUDY ON ACRITARCHS

Thomas SERVAIS¹

(8 figures and 1 plate)

ABSTRACT. – The Rigenée formation of supposed Llandeilian age is studied in the Thyle and Orneau Valleys at the southern border of the Brabant Massif.

In its type locality of the Thyle Valley the Rigenée formation consists of a monotonous succession of greyish-black mudstones, at least 400 m thick. It overlays conformably the Tribotte formation, but its top is unobserved yet.

The acritarch species recorded in 22 samples indicate an Ordovician (Arenig-Llanvirn and/or Llandeilo) age. The sections at Tilly (Gentissart Valley) and Gembloux (Orneau Valley) can be correlated with parts of the section described in the Thyle Valley which provides several distinct assemblages.

1. INTRODUCTION

This work deals with the Rigenée formation ("assise de Rigenée") in the valleys of the Thyle and Orneau in the Belgian Brabant Massif. The aim of this work is to contribute to a future formal description of this formation.

First an introduction to the terrain and a review of the evolution of the concept of the stratigraphy of the Ordovician in these valleys are given. The description of the outcrops respectively of the Thyle and Orneau Valleys is followed by the conclusions of our fieldwork. Another part of this work are the preliminary results of the acritarch investigations.

The Brabant Massif consists of an anticlinorium with NNW-SSE directed axes unconformably overlain at its borders by the Devonian and Carboniferous and covered nearly completely by Mesozoic and Cenozoic sediments. Therefore it shows only discontinuous outcrops in its southern border in different valleys of which the Thyle and the Orneau Valleys will be studied partially in this work (fig. 1).

The major difficulties of the study of the stratigraphy of the Brabant Massif are the facts that in previous works only punctual informations were given and that in most of the valleys each formation has its own name. The result is that actually we have a great number of different names used in the literature which provides a lot of confusion.

The rarity or the absence of macrofossils and unfavourable facies or poor conservation of microfossils are the reasons why several formations do not possess at the moment an exact age.

2. EVOLUTION OF THE CONCEPT OF THE STRATIGRAPHY OF THE ORDOVICIAN IN THE THYLE AND ORNEAU VALLEYS

The fig. 2 shows the evolution of the concept of the stratigraphy of the Ordovician and the lower Silurian in the Thyle and Orneau Valleys considering selected

1. Grant-holder I.R.S.I.A.

Université de Liège, Services associés de Paléontologie;
7, place du XX Août - B-4000 LIEGE (Belgium)

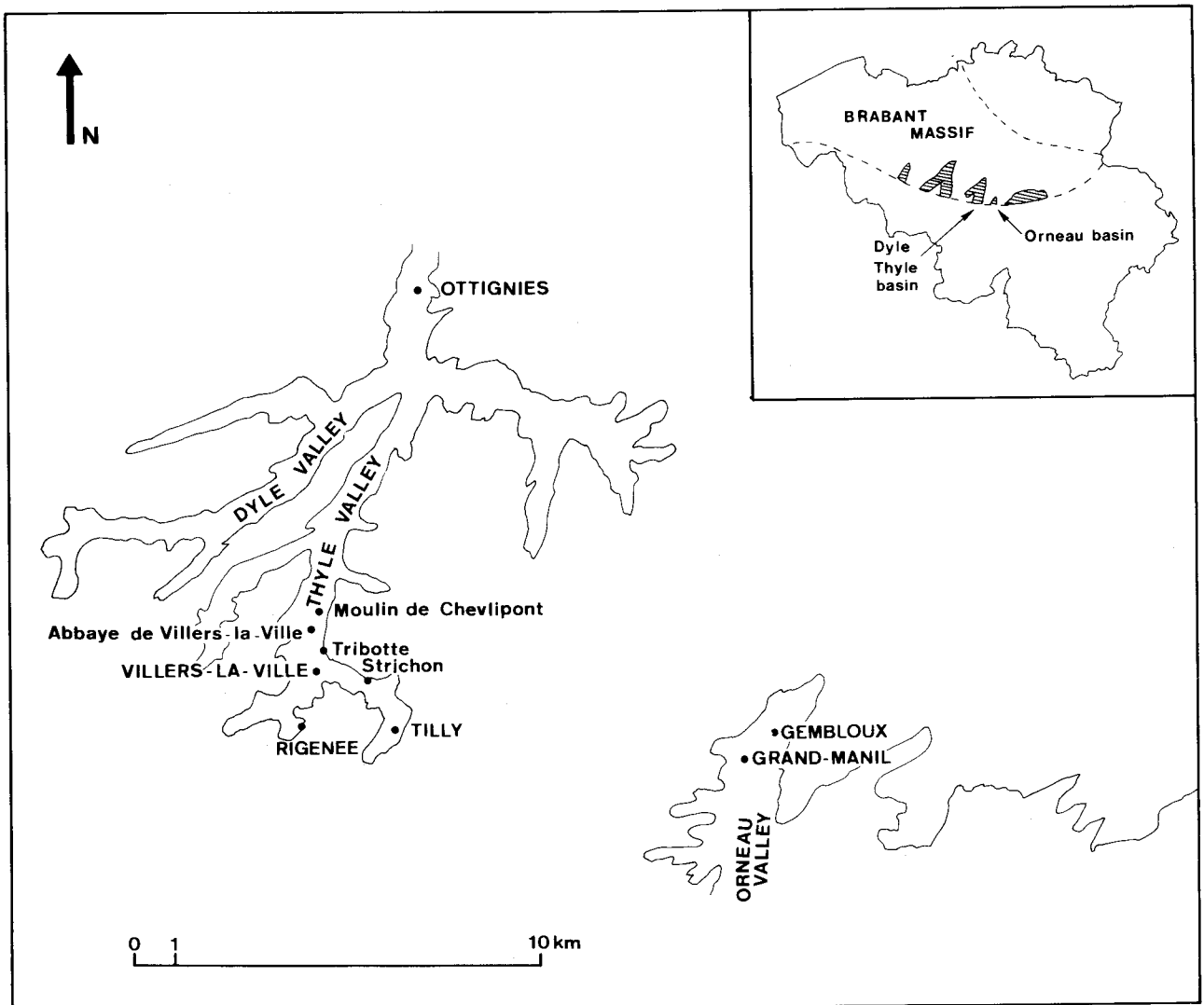


Fig 1 : Location of the Thyle and Orneau basins
(The line represents the limit of the outcrops under the Cenozoic cover).

papers. The scarcity of the outcrops lead to a discontinuous section in the field. It is at present impossible to find outcrops of all lithological units. Our lithological succession is a hypothetical succession joined together by the most important information in the literature. In the fig. 2 only the original terms from the authors are used.

The Dyle and Thyle Valleys provide from north to south outcrops of Cambrian ("ass. de Blanmont", "Tubize", "Mousty") and Ordovician age (formation "X", Chevlipont formation, Abbaye de Villers-la-Ville formation, Tribotte formation, Rigenée formation; HERBOSCH and JODART, 1989).

The classical terms used in the Orneau basin are from north to south the "assise de Gembloux" (Ordovician) and the "assises de Grand-Manil", "Corroy" and "Vichenet" (Silurian). The Caledonian rocks are limited to the South by the unconformity of the Devonian represented by the "poudingue d'Alvaux" (Givetian).

The figure is focused on the Rigenée formation which can serve as the connecting piece between the Thyle and Orneau Valleys.

The Rigenée formation

For MALAISE (1873) the "assise de Gembloux" represented all the Silurian and all the Ordovician. In 1883 MALAISE subdivided this "assise" in three parts:

"assise de Villers-la-Ville" (after locality in the Thyle Valley)

"assise de Gembloux" (Orneau Valley)

"assise de Ronquières" (Sennette Valley)

At the base of the "assise de Gembloux" (sensu MALAISE 1883) the same author identified greyish black siltstones and mudstones he placed in 1883, 1890 and 1900 in the lithological unit "S2a". In 1909 he called "assise de Rigenée" rocks of this lithology he observed between the "assise de Villers-la-Ville" and

the "assise de Gembloux". He observed these rocks (probably) in the gully ("chemin creux") which passes up to the hamlet Rigenée.

The concept of the stratigraphy of the Brabant Massif published by MALAISE (1909 and 1910) was generally accepted and used by FOURMARIER (1921) and DE LA VALLEE POUSSIN (1930) and for the Legend to the Geological Map of Belgium (1929).

After 1909 the terms "assise de Rigenée" and "assise de Gembloux" have often been confused. Applying the concept of MALAISE 1909 we use the name Rigenée formation for rocks of the lithology of this "black shales" and the name Gembloux formation for the fossiliferous layer at Grand-Manil (south of the town of Gembloux) revised recently confirming the Upper Ordovician age (upper Caradoc or Ashgill according to LESPERANCE and SHEEHAN, 1988).

The age of the Rigenée formation is not exactly known. MALAISE noted in 1901 a doubtful Llandeilian age on grounds of the presence of fossils he identified as *Primitia (Beyrichia) simplex* (ostracod) and *Iliaenus giganteus* (trilobite). He also correlated the Rigenée formation with the "assise d'Oxhe" of the Condroz ridge using lithological comparisons.

There were no other indications until 1969 when MARTIN used acritarchs from one level in the gully near the "Ferme du Châtelet" to give an (? lower) Arenigian age.

P. MICHOT (1980) supposed in his general overview of the "Belgian Caledonian Segment" an upper Llandeilian age for the Rigenée Formation (using questionable lithological comparison with the Condroz massif).

The Tilly fault

The Tribotte formation which is underlying the Rigenée formation is characterized by fine micaceous grey and green sandstones and siltstones often called "psammite micacé".

A review of the literature shows different interpretations at the contact between the two formations :

1921 : FOURMARIER (p. 12 and 26) admitted that the "assise de Villers-la-Ville" is conformably overlain in the South of Villers-la-Ville by the "assise de Rigenée". He recognized an insensitive transition between the two formations.

1930 : DE LA VALLEE POUSSIN (p.334-335) indicated a conformity without transition zone between the two "assises" ...

1943 : R. and P. ANTHOINE inverted partially the stratigraphical succession and placed for that reason a fault between the two formations ("Tilly Fault").

1955 : MORTELMANS (p. 191) attributed a great importance to that fault and relied it with the "Fauquez Fault" in the Sennette valley.

1979 : MICHOT accepted also the presence of the "Tilly Fault" for tectonical (p. 230-231) and for lithostratigraphical reasons (no lithological transition, p. 229).

The aim of our field work is to find at the base of the Rigenée formation arguments for a conformity or evidence for a fault at the contact between the Rigenée and Tribotte formations.

3. THE RIGENÉE FORMATION IN THE THYLE BASIN

The localisation of all outcrops and of our samples in the Dyle-Thyle basin is given in fig. 3. The section will first be described from the base to the top in the Thyle Valley and then in the Ri de Gentissart Valley (in the eastern part of the Dyle-Thyle basin).

Outcrops and samples in the Thyle Valley (fig. 3)

1. In this old quarry some small exposures of the top of the Tribotte formation shows beds with a strike of $\pm N 120^\circ E$ dipping $\pm 45^\circ SSW$.
2. This gully is the locality where (probably) MALAISE (1909) first described the "assise de Rigenée" and where MARTIN (1969) took the sample she studied to give a (? lower) Arenig age by acritarchs. In the gully a discontinuous section is present showing the top of the Tribotte formation and the base of the Rigenée formation. A small (± 10 m) transition zone (showing a gradual change in the colouration of the rock) is present but difficult to distinguish because of the poor quality of the outcrop. All the beds have generally the same dip ($50-60^\circ SSW$) and strike ($\pm N 110^\circ E$); some minor folds are present.
3. A new 230 m long profile (road section 1) in front of the Châtelet farm is illustrated in fig. 4. It provides from the West to the East regularly dipping beds ($\pm N 120^\circ E 25-40^\circ SSW$), a fold and a strongly disturbed zone. Several smaller isolated outcrops are found in the West of this long profile.
4. A 50m long profile (road section 2) provides regularly dipping beds ($\pm N 100^\circ E 40^\circ SSW$) strongly cleaved. Unidentifiable remains of macrofossils (? trilobites) have been found at the western extremity of this outcrop.

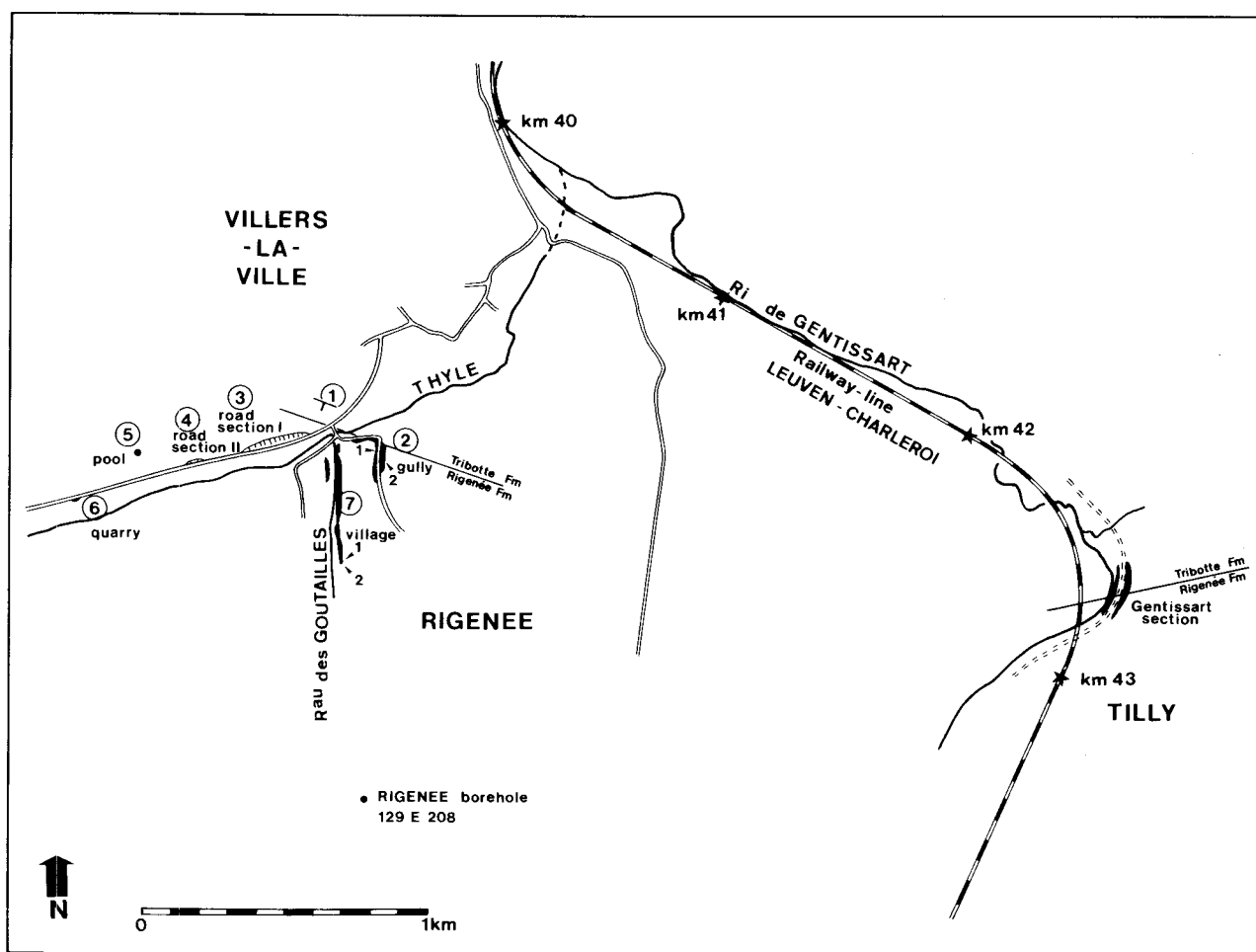


Fig 3 : Localisation of the outcrops, samples and borehole of the Rigenée formation in the Thyle basin (The fine line represents the limit between the Rigenée and Tribotte formations).

5. The rocks of the outcrop at the east of the pool show a strike of $\pm N 120^\circ E$.
6. In a quarry the subhorizontal beds of the Rigenée formation are cut by the unconformity of the Tertiary showing a basal conglomerate.
7. Along the brook "Ri des Goutailles" a long but discontinuous profile shows the same rocks observed along the road with the same strike of the beds. Foldings can be observed. This profil continues up to the village of Rigénée.

In all outcrops apart from the quarry (6) the cleavage has a $\pm N 110^\circ E$ strike and a 65-85° SSW dip.

Ri de Gentissart Valley

The 140m long section of the by-road ("boucle du Vicinal") is at the moment the only outcrop in the Ri de

Gentissart Valley in the south-eastern part of the Dyle-Thyle basin near the village of Tilly (see R. & P. ANTHOINE, 1943, page 147-148).

The discontinuous section shows (fig. 5) the top of the Tribotte formation and the base of the Rigenée formation with a transition zone (± 30 m thick) characterized by a gradual passage from one lithology to the other. This section provides regularly dipping beds ($\pm N 80^\circ E 60^\circ S$). The cleavage always dips ($\pm 80^\circ$) to the South.

Rigenée borehole

A borehole (localisation in fig. 3) drilled in 1979 (Geological Survey number : 129 E 208) was studied by LEGRAND & NEYBERGH (1981). Under the unconformity of the Middle Devonian they suggested (by lithological comparison) rocks of Silurian (Wenlock and Ludlow) age.

However, the two samples we analysed (depths 60,0 and 90,5 m) show a clear lithological similarity with the outcrops of the Rigenée formation.

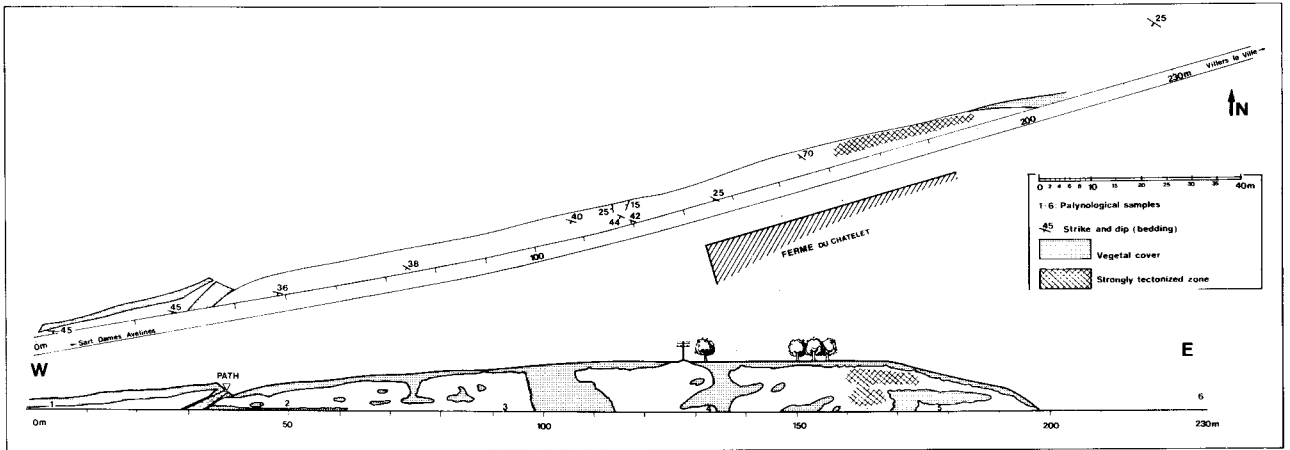


Fig 4 : The Rigenée road-section I near the "Ferme du Chatélet".

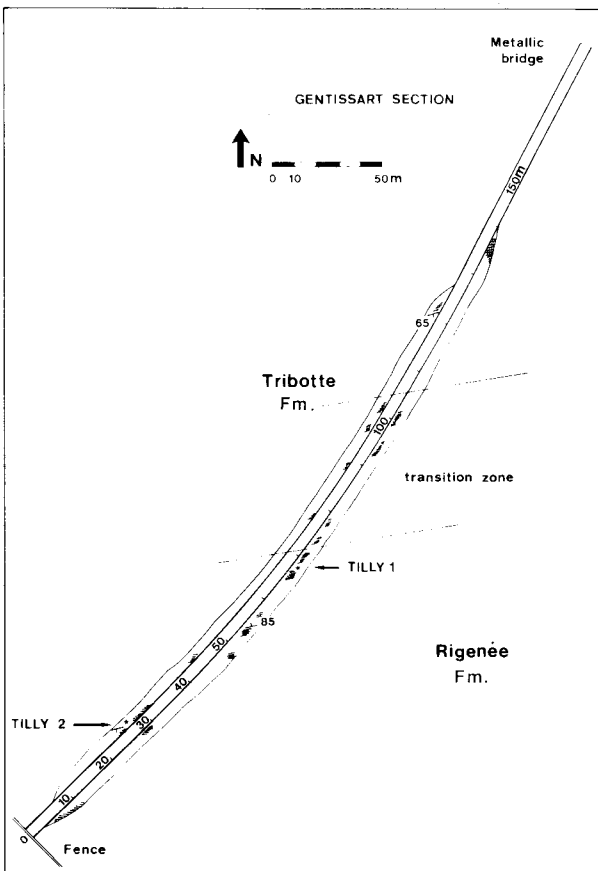


Fig 5 : The Gentissart section.

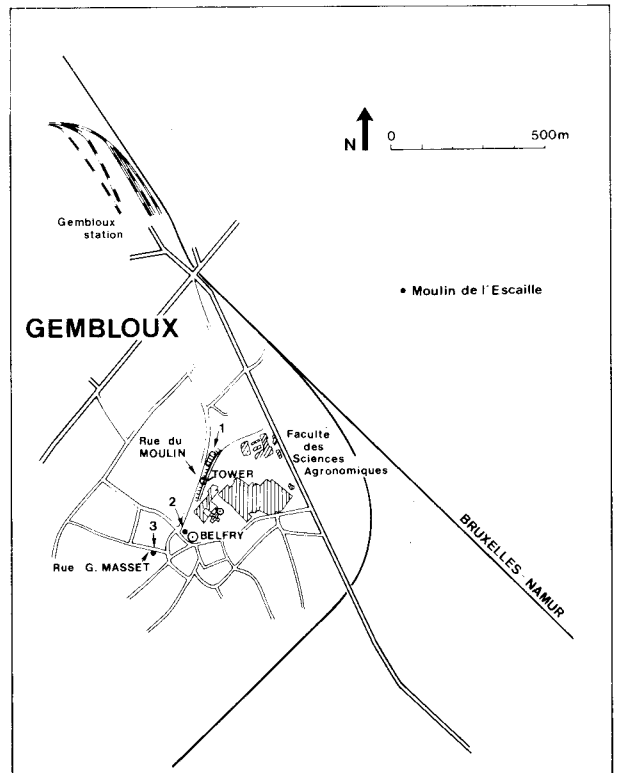


Fig 6 : Outcrops and samples of the Rigenée formation at the town of Gembloux (Orneau valley).

Lithostratigraphical results

Two sections (the gully near the "ferme du Châtelet" and the Gentissart-section) show that the Tribotte formation is conformably overlain by the Rigenée formation.

We observe a small transition zone in both sections confirming the observations of FOURMARIER (1921). There is no evidence that the fault placed by R. & P. ANTHOINE (1943) and accepted by

MORTELMANS (1955) and MICHOT (1979) exists (at least at the contact between the Tribotte and Rigenée formations).

The top of the Rigenée formation is unknown because it disappears under the Cenozoic cover . We estimate that the Rigenée formation in the Thyle valley is at least 400 m thick. We note the presence of a strongly pronounced cleavage generally dipping to the South.

4. THE RIGENÉE FORMATION IN THE ORNEAU BASIN

North of the town of Gembloux, several authors indicate outcrops of "quartzophyllades" of the assise de Villers-la-Ville (sensu MALAISE) at the "Moulin de l'Escaille" (MALAISE, 1873, p. 29 ; MALAISE, 1900, p. 193 ; FOURMARIER, 1921, p. 41, ...). Today these outcrops have disappeared.

The first outcrops of the Orneau Valley are found in the town of Gembloux (fig. 6) in the "rue du Moulin" : under the wall of the Abbey grey siltstones and sandstones crop out discontinuously over ± 300 m. These rocks have great lithological similarities to the outcrops of the Rigenée formation in the Thyle basin but here in the Orneau Valley they have mostly been placed in the "assise de Gembloux".

The next known outcrop to the South is the fossiliferous layer at Grand-Manil (= "assise de Gembloux" sensu Malaise 1909).

Outcrops studied in the Orneau Valley

- 1) In the "rue du Moulin" between n° 42 and 44, at ± 75 m in the North of the "tour des Sarrasins", an outcrop of ± 25 m length provides grey mudstones at three different levels.

The fig. 7 shows that the cleavage (which is strongly developed and which obscures the bedding) dips (70 - 80 °) to the South.

The beds are dipping more or less regularly to the South (mostly with an angle of 65 °) but foldings could be recognized.

MARTIN (pers. comm.) in VERNIERS (1983) indicates an Arenigian-Llanvirnian age established by organic-walled microfossils.

- 2) In the corner of the steps passing up to the Belfry of Gembloux, a small outcrop (1 m) shows the same grey siltstones-mudstones.
- 3) In the "rue G. MASSET", in front of the supermarket, a sample was taken during the construction of the foundations of a house (between n° 15 and 17).

Results of the fieldwork

The Rigenée formation is not only present in the Thyle Valley but also in the Orneau Valley and it crops out in the centre of the town of Gembloux. At present the top of this formation and the "green shales" ("pierre de Gembloux", Michot 1980) between the Rigenée and

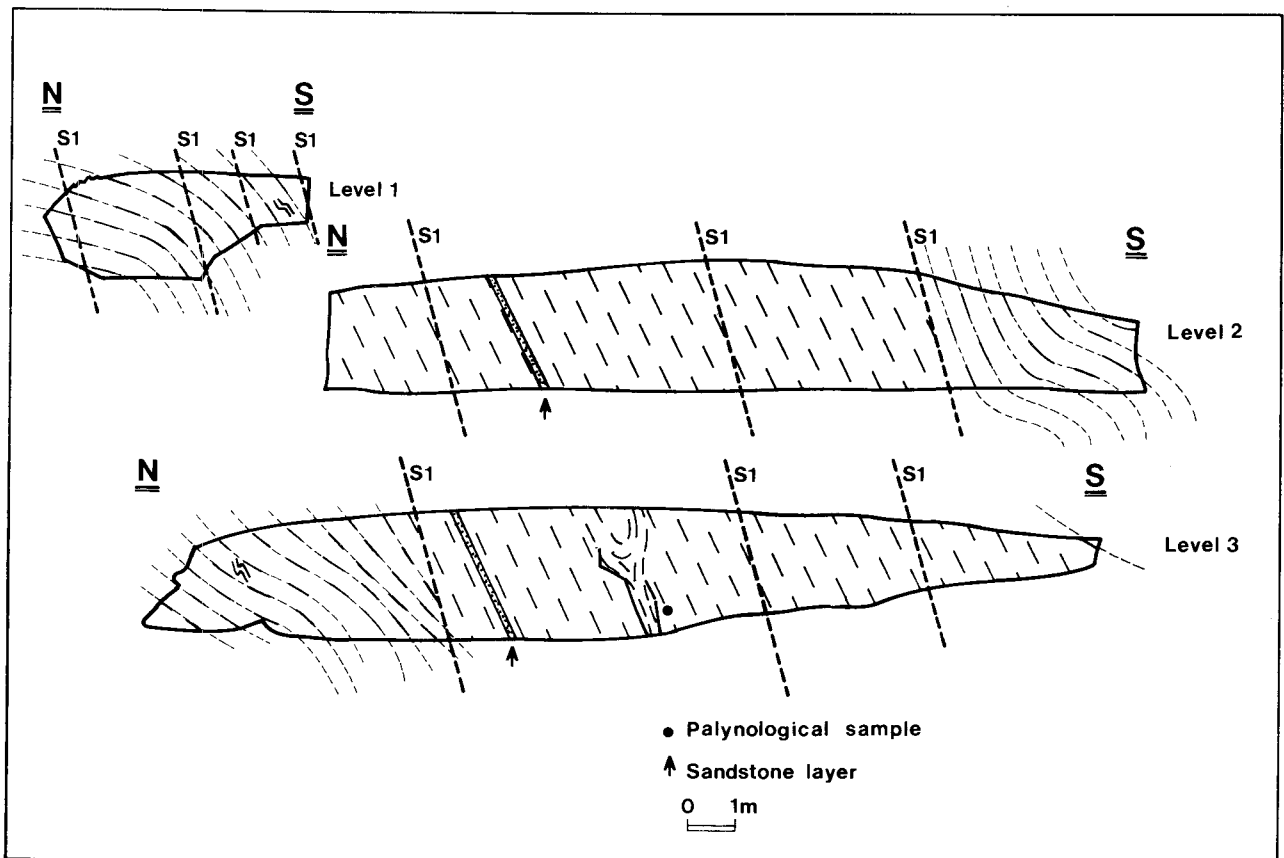


Fig 7 : The "rue du Moulin" section in the centre of the town of Gembloux (S1 represents the cleavage dipping regularly to the South).

Gembloux formations do not provide outcrops.

The cleavage is strongly pronounced and dips to the South.

The Brabant Massif is characterized by folds inclined and overturned to the South and by a cleavage dipping generally to the North. But the Rigenée formation shows in both the Orneau and in the Thyle Valleys rocks affected by a cleavage dipping always to the South. This anomaly has until now never been described in the Brabant Massif.

5. PRELIMINARY PALYNOLOGICAL RESULTS

22 samples from the different outcrops of the Rigenée formation have been analyzed. They contain acritarchs and chitinozoa, rare melanosclerites and some graptolite fragments. All the samples yield acritarchs in variable amounts. The conservation of the material is very poor, all the specimens are moderately to heavily carbonized and commonly fragmented. It is rare to find unbroken appendices.

	TILLY Gentisart section 1	TILLY Gentisart section 2	RIGENEE gully 2	RIGENEE gully 1	RIGENEE road-section I 6	RIGENEE road-section I 5	RIGENEE road-section I 4	RIGENEE road-section I 3	RIGENEE road-section I 2	RIGENEE road-section I 1	RIGENEE road-section II 2	RIGENEE road-section II 1	RIGENEE pool	RIGENEE village 1	RIGENEE village 2	RIGENEE quarry 2	RIGENEE quarry 1	RIGENEE borehole 90,5 m	RIGENEE borehole 60,0 m	GEMBLoux "rue du Moulin"	GEMBLoux Bellry, steps (escalier)	GEMBLoux "rue G. MASSIET"
<i>Acanthodiacrodium</i> spp.	●	●	●	●	●	●	?	●	?	?	●	?	●	?	●	●	●	●	●	●	●	●
<i>Arkonia tenuata</i> Burmman 1970	●	●	●	●	●	●	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	?
<i>Arkonia triangulata</i> (Cramer, Kanes et al.) Vavrdova 1978	●	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Arkonia virgata</i> Burmman 1970	●	●	●	●	●	●	●	●	●	●	●	●	●	?	●	●	●	●	●	●	●	●
<i>Baltisphaeridium</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Comasphaeridium</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Coryphidium australe</i> Cramer et Diez 1976	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	?
<i>Coryphidium bohemicum</i> Vavrdova 1972	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Cymatogalea</i> sp.1	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Dicrodiacrodium</i> sp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Frankea hamata</i> var. B	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Frankea hamulata</i> Burmman 1970	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Frankea sartbernardensis</i> var. B	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Frankea ? breviscula</i> Burmman 1970	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Gontosphaeridium</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Marrocanium simplex</i> Cramer et al. 1974b	●	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Micrhystridium</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Micrhystridium robustum</i> Downie 1958	●	●	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Multiplicisphaeridium .raspa</i> (Cramer) Lister 1970	●	●	●	●	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Stellechinatum</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Stelliferidium</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Striatotheca</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Striatotheca quieta</i> (Martin) Raucher 1974	●	●	●	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	?	?
<i>Striatotheca cf. rarirugulata</i> (Cramer, Kanes et al.) Eis., Cram. et Diez 1976	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	?	●
<i>Veryhachium</i> spp.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Veryhachium minutum</i> Downie 1958	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Voglandia cf. multiradialis</i> Burmman 1970	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Fig 8 : Distribution of selected acritarch species and genera in the Rigenée formation.

The fig. 8 shows the distribution of selected acritarch genera and species in the Rigenée formation. 15 samples come from the sequence in the Thyle Valley, 2 from the borehole, 2 from the Gentissart-section and 3 from the Orneau Valley.

In this paper some preliminary results of our acritarch research are given. Detailed systematic studies will be provided in further publications.

Specimens of the genera *Goniosphaeridium*, *Micrhystridium*, *Stellechinatum*, *Stelliferidium*, *Striatotheca* and *Veryhachium* are present in nearly all samples. With other well represented genera like *Arkonía*, *Coryphidium* and *Frankea* they constitute typical Ordovician assemblages. Our assemblages are dominated by trispinose forms like the trispinose *Veryhachium* (smooth and granulated specimens), *Arkonía* and *Frankea*.

Two new subspecies of the genus *Frankea* have been found. *Frankea sartbernardensis* var. B and *Frankea hamata* var. B are distinguished from the type materials by a finely striate vesicle wall. In the literature twice a striation of specimens of *Frankea* has been indicated, in VAVRDOVA, M. (1977) : Acritarchs of the Sarka Formation (Llanvirnian), page 113, fig. 3 : *Frankea* sp. indet. and in RUSHTON, A.W.A. and MOLYNEUX, S.G. (1989) : The biostratigraphic age of the Ordovician Skiddaw Group in the Black Combe Inlier, English Lake District, page 272, fig. J,K : *Frankea hamata*.

In the Rigenée formation all the specimens of the species *Frankea sartbernardensis* and *Frankea hamata* are striated (var. B).

It is important to note that in other parts of the Brabant Massif, for example in the underlying Villers-la-Ville formation, these species have a smooth vesicle wall (var. A in VANGUESTAINE, CHAKIR and SERVAIS, 1989).

Acritarchs of the Thyle Valley

Our field observations indicate that the oldest levels in the Thyle sequence are the outcrops in the gully overlain successively by the beds of the road-sections I and II and the outcrop of the "pool". The youngest outcropping parts of the Rigenée formation are found near the village. The position in this succession of the horizontal beds of the quarry is problematical.

In the gully (at the base of the Rigenée formation) we note a high content in acritarchs with the best conservation of all samples from the Rigenée formation. The following species are characteristic :

Marrocanium simplex CRAMER et al. 1974b, *Vogtlandia cf. multiradialis* BURMANN 1970 and *Cymatiogalea* sp. 1, a form which shows great resemblance with the lower Ordovician species *Cymatiogalea cuvillieri cuvillieri* (DEUNFF 1961) DEUNFF 1964 and *Cymatiogalea cuvillieri fucata* MARTIN 1972.

In the road sections appear successively *Striatotheca quieta* (MARTIN 1969) RAUSCHER 1974 (Rigenée road section I 5), *Frankea hamata* var. B. and *Arkonía virgata* BURMANN 1970 (Rigenée road section I 3) and *Frankea hamulata* BURMANN 1970 (Rigenée road section II).

The two samples of Rigenée quarry yield the most diversified acritarch assemblage from the Rigenée formation. We find not only the forms appearing in the road-sections but also the typical species of the base of the formation, which are missing in the middle of the sequence in the Thyle valley.

The different acritarch species indicate for the base of the section (gully) an age of (late) Arenig to Llanvirn or younger age. The apparition in the middle part of the sequence of *Arkonía virgata* BURMANN 1970 exclude an Arenig age. This taxa is known only from rocks of Llanvirn and younger age (COOPER and MOLYNEUX 1990).

The presence of *Frankea hamulata* BURMANN 1970 in higher levels of the formation in the Thyle valley seems to indicate (at least) a late Llanvirn or younger age. This species was until now never found in rocks older than the upper Llanvirn (Downie 1984).

The acritarchs of the Ri de Gentissart section

The acritarch assemblage of the two samples of the Gentissart-section at Tilly contains the characteristic forms of the base of the sequence observed in the Thyle Valley (*Marrocanium simplex*, *Vogtlandia cf. multiradialis*, ...). Thus, the gully and the Gentissart-section showing both the transition from the Tribotte to the Rigenée formation are equivalent, not only litho- but also biostratigraphically.

Acritarchs of the Rigenée borehole

The two samples of the borehole (90,5 and 60,0 m) provide very few acritarchs (fig. 8) which nevertheless prove that these rocks are Ordovician in age (and not Silurian as supposed by LEGRAND and NEYBERGH, 1981).

Consequently, the borehole section (see LEGRAND and NEYBERGH) shows that the unconformity of the Devonian-Carboniferous cover cuts Ordovician rocks in the Thyle Valley and not Silurian levels like in the Orneau and Sennette Valleys.

Acritarchs of the sequence of the Orneau Valley

The three samples collected in the Rigenée formation in the Orneau Valley provides the same acritarch species as observed in the Dyle-Thyle basin. The richest specimen comes from the rue du Moulin section. The presence of *Arkonina virgata* BURMANN 1970 and *Frankea hamulata* BURMANN 1970 indicates respectively a Llanvirn and an upper Llanvirn or younger age. Further all individuals of *Frankea sartbernardensis* and *Frankea hamata* have a finely striate vesicle wall (*var. B*). Accordingly, the rue du Moulin section can be correlated with the middle to upper part of the formation in the Thyle valley.

Comparison with other assemblages

The acritarch content of the samples of the Rigenée formation is different to the assemblage found in the Villers-la-Ville formation (Arenig-Llanvirn, VANGUESTAINE, CHAKIR and SERVAIS, 1989).

It is interesting to note that the size-range of the acritarchs in our samples is very restricted. The mean of the maximum diameter of the individuals is only between 20 and 25 microns. Larger forms are missing. MARTIN noted also a small size-range (MARTIN, 1969, p. 161) which may be explained by special ecological conditions.

The assemblages with the greatest similarities to our material have been described in England and Wales.

Comparisons with the forms of the unpublished Ph.D. thesis of BOOTH (University of Sheffield, 1979) can easily be drawn.

Other similar assemblages are described in the English Lake District by TURNER and WADGE (1979) and by RUSHTON and MOLYNEUX (1989) and in the Isle of Man by MOLYNEUX (1979). This latter author indicates in the Lady Port Banded Group of the Manx Group of the Isle of Man an acritarch content with a relatively high proportion of trispinose forms which is very comparable with our assemblage. Further he mentioned that extreme caution is necessary to interpret the significance of this high proportion of trispinose forms, but that there are arguments to suggest that lower Ordovician acritarch assemblages with this high proportion are more typical of Llanvirn than Arenig strata.

Biostratigraphical conclusion

The Rigenée formation provides acritarchs of Ordovician age. At its base an late Arenig age can

(until now) not be excluded. In the other parts of the Formation different species indicate a Llanvirn or younger age. We suppose that a Caradoc age can be excluded, because no typical Caradocian forms appear.

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PLATE 1 : ACRITARCHS OF THE RIGENÉE FORMATION (BRABANT MASSIF, BELGIUM)

(All figures 1250 X)

- Fig 1 : *Multiplicisphaeridium raspa*, Rigenée quarry 2, 22187, Q 48/4-Q 49/3
 Fig 2 : *Coryphidium bohemicum*, Tilly 2, 22178, T 33/2
 Fig 3 : *Coryphidium sp.*, Rigenée quarry 2, 22187, N 46/4
 Fig 4 : *Coryphidium sp.*, Rigenée quarry 2, 22187, S 49/3-T 49/1
 Fig 5 : *Frankea hamulata*, Gembloux "rue du Moulin", 21781, X 36/2-4
 Fig 6 : *Micrhystridium robustum*, Rigenée quarry 2, 22187, K 43/2-K 44/1
 Fig 7 : *Striatotheca cf. rarirrugulata*, Rigenée road section I 3, 21835, E 46
 Fig 8 : *Striatotheca quieta*, Rigenée road section I 5, 21847, V 55/1-2
 Fig 9 : *Frankea hamulata*, Gembloux "rue du Moulin", 21781, F 33/2-4
 Fig 10 : *Dicrodiacrodium sp.*, Rigenée road section I 1, 21797, O 38/2
 Fig 11 : *Marrocanium simplex*, Rigenée gully 1, 21872, O 36/4
 Fig 12 : *Stelliferidium sp.*, Rigenée road section I 5, 21847, N 39/2
 Fig 13 : *Frankea ? breviuscula*, Rigenée road section I 1, 21797, O 47/3
 Fig 14 : *Vogtlandia cf. multiradialis*, Rigenée gully 1, 21871, L 39/3
 Fig 15 : *Comasphaeridium sp.*, Rigenée road section I 5, 21847, O 49/2-4
 Fig 16 : *Cymatiogalea sp. 1*, Rigenée road section I 5, 21847, R 56/2
 Fig 17 : *Frankea sartbernardensis*, Gembloux "rue du Moulin", 21781, T 37/4
 Fig 18 : *Arkonion tenuata*, Rigenée road section I 5, 21847, O 44-45
 Fig 19 and 20 : *Arkonion triangulata* (reflected and transmitted light), Gembloux "rue du Moulin", 21781, N 37/3
 Fig 21 and 23 : *Frankea sartbernardensis* (reflected and transmitted light) Rigenée gully 1, 21872, U 36/3- V 36/1
 Fig 22 : *Arkonion virgata*, Rigenée road section I 3, 21834, W 46

