

COUVINIAN

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(2 figures)

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ABSTRACT. In the major part of the Dinant Synclinorium, the Couvinian is characterized by a mixed siliciclastic-carbonate sequence, about 750 m thick in the Couvin area. The stage is part of a major transgressive cycle that starts in the underlying upper Emsian Hierges Formation. In the southern part of the Namur Synclinorium, its base rests with an angular unconformity on Silurian rocks. In the past, it was internationally used as the lower stage of the Middle Devonian. However, the Eifelian which base is slightly younger was also internationally used in the same sense. In 1980, by a majority vote of the international Subcommittee on Devonian Stratigraphy, the base of the Eifelian was chosen as the base of the Middle Devonian Series.

KEYWORDS: Couvinian, Belgium, historical review, lithology, Eifelian versus Couvinian.

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1. Name

Couvinian (English), Couviniaan (Dutch), Couvinium (German), Couvinien (French).

2. Age

The base is slightly older than the base of the Eifelian (= 397.5 Ma) and the top is slightly younger than the base of the Givetian (= 391.8 Ma), dates from Gradstein & Ogg (2004).

3. Authors

Dupont & Purves (1885). Carte géologique de la Belgique à l'échelle du 1:20 000, feuilles Durbuy et Marche. Musée royal d'Histoire naturelle, Bruxelles. «Schistes grossiers gris-verdâtre ; banc de psammites ; nodules calcaires ;... *Spirifer speciosus*, *Calceola sandalina*...“.

4. Historical type area

The term Couvinian refers to “l'étage des schistes et calcaires de Couvin d'Omalius d'Halloy (1862)” and was based on a number of different outcrops in the Couvin area. Representative outcrops are located along the banks of the Eau Noire River south of Couvin, the “Cavernes de l'Abîme” cliff in the town centre and along the west side of the Eau Noire valley to the north of Couvin, topographic map 1: 10 000 Couvin 57/8 (Fig. 1).

Corresponding geological map: carte géologique de Wallonie to 1: 25 000, Chimay-Couvin 57/7-8 (Barchy & Marion, 1999).

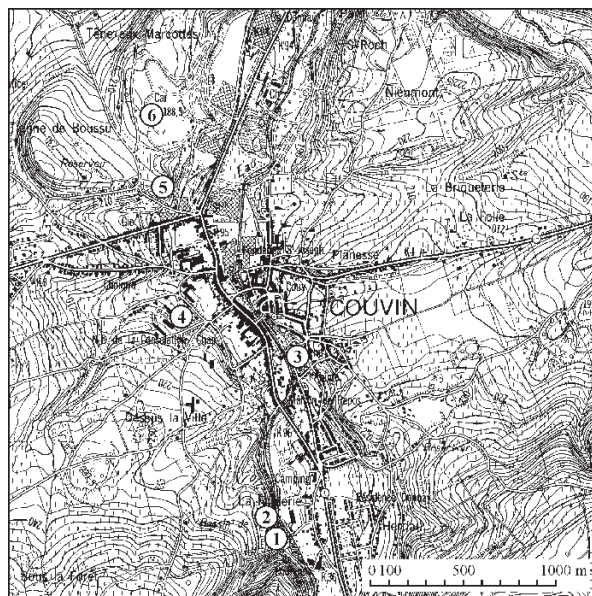


Figure 1. Part of topographic map 1: 10 000 Couvin 57/8 (slightly reduced) showing the locations with the most representative outcrops. 1= Saint-Joseph and Eau Noire Fms; 2= lower part of Couvin Fm; 3= upper part of Couvin Fm; 4= lower part of Jemelle Fm; 5= upper part of Jemelle Fm and La Lomme Fm; 6= Hanonet Fm.

5. Description

According to the present lithostratigraphic nomenclature for the Middle Devonian formations of Belgium (Bultynck *et al.*, 1991) and as used on the map sheets Chimay-Couvin of the geological map of Wallonia (Barchy & Marion, 1999), the Couvinian of the type area is represented by the Saint-Joseph, Eau Noire, Couvin, Jemelle, La Lomme and Hanonet formations. The lower part consists mostly of calcareous coarse shales and nodular limestone beds, the middle part is mainly biostromal limestone beds the upper part mostly comprises shales and the uppermost part typically consisting of dark nodular limestone beds alternating with calcareous shale beds (Fig. 2).

6. Historical background

A historical review of the various concepts of the Couvinian is given in Lecompte (1955). In this contribution attention is paid to the most important stratigraphic units that result from the definition of a formal Couvinian stage and to the most important changes in the meaning of the term Couvinian. For describing these changes the current lithostratigraphic units mentioned above, will be used.

Gosselet (1860) introduced the term «étage des schistes à calcéoles». In the middle part of this unit he distinguished «le calcaire de Couvin... une grande lentille qui a son centre entre Couvin et Chimay». The «étage schistes à calcéoles» corresponds to the present Hierges, Saint-Joseph, Eau Noire, Couvin, Jemelle and La Lomme formations

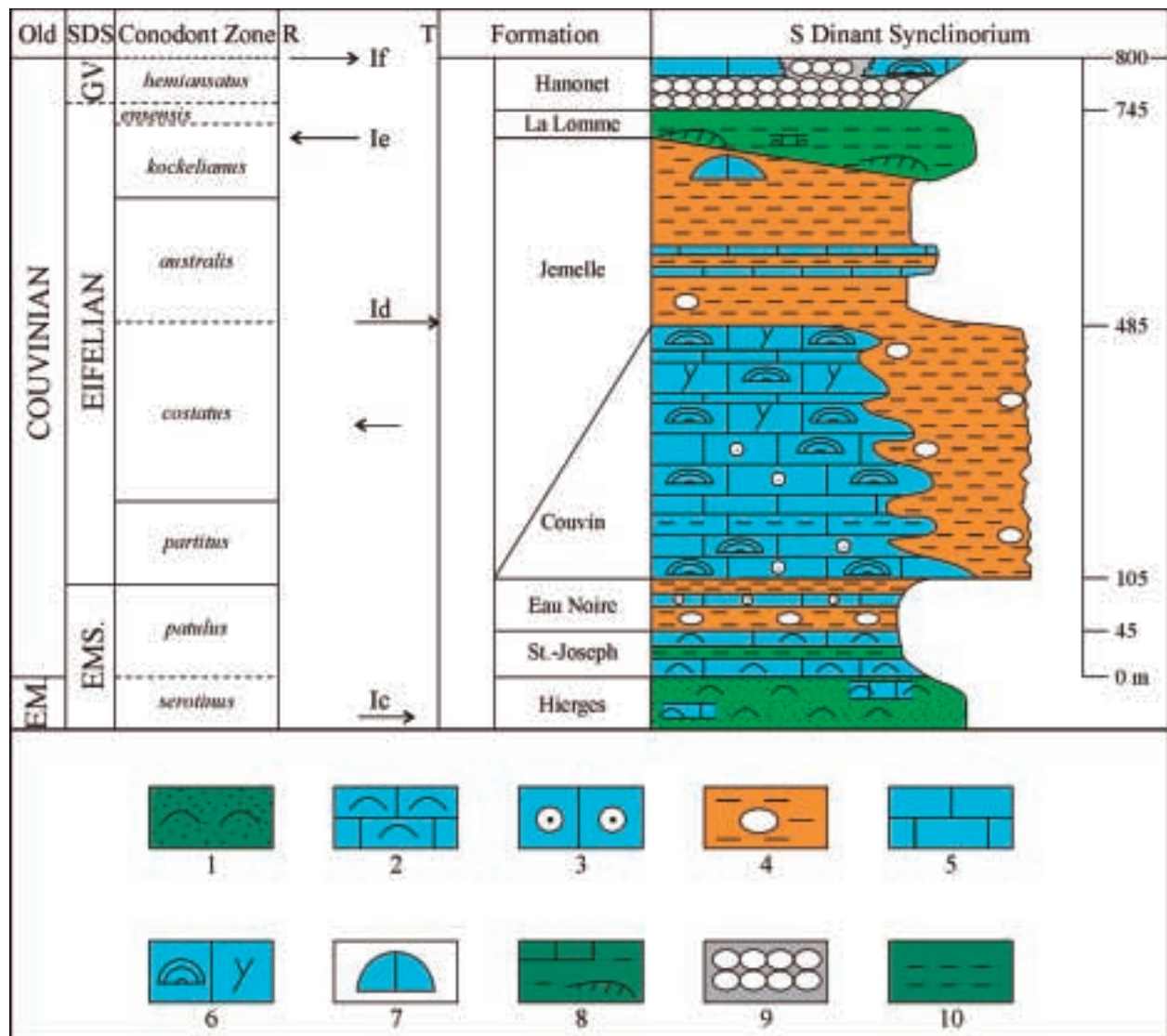


Figure 2. Generalized lithostratigraphic column of uppermost Emsian, Couvinian and lowermost Givetian for the southern border of the Dinant Synclinorium (after Bultynck & Dejonghe, 2001). R-T column: numbering of T-R cycles of Johnson *et al.* (1985). Lithological symbols: 1, silty shales, siltstones, calcareous siltstones and coquinas; 2, shelly and crinoidal limestones; 3, crinoidal limestones; 4, shale with nodules; 5, micritic limestones; 6, biostromal beds with stromatoporoids and corals; 7, small biohermal lenses; 8, sandy or silty shales and calcareous siltstones, occasionally with fine cross-laminations; 9, dark nodular limestone beds; 10, silty shales.

and probably also includes the Hanonet Formation. From 1879 Gosselet used the term «Schistes à calcéoles» in a stratigraphically more restricted sense including only the Couvin, Jemelle, La Lomme and Hanonet formations and assigned the «schistes à calcéoles» to the Eifelian, representing the uppermost stage of the Lower Devonian, the Middle Devonian Series including only the Givetian.

d'Omalius d'Halloy (1862) defined «l'étage des schistes et calcaires de Couvin», between «l'étage du Poudingue de Burnot» and «l'étage du calcaire de Givet». Its stratigraphic extent corresponds to Gosselet's (1860) «étage des schistes à calcéoles» and includes the Hierges, Saint-Joseph, Eau Noire, Couvin, Jemelle, La Lomme and Hanonet formations in the Couvin area.

Dewalque (1868) used the term «Le système du calcaire de Couvin» for approximately the same stratigraphic interval, excluding the Hanonet Formation. The «système du calcaire de Couvin» represents the lower part of the middle stage of the Devonian, the upper part being represented by «le système du calcaire de Givet». Dewalque (1874) introduces the term «l'étage de Couvin» for «le système du calcaire de Couvin».

The term «Couvinien» first appears on the map sheets Durbuy and Marche (Dupont & Purves, 1885) of the Geological Map of Belgium 1: 20 000. According to the explanatory notes on the mapsheet Marche, the Couvinian in that area is represented by coarse grey-greenish shales, arenitic beds and calcareous nodules with *Spirifer speciosus* and *Calceola sandalina*, currently mapped as Jemelle (Station Mbr, Cimetière Mbr, Chavées Mbr), La Lomme and Hanonet formations. In the Couvin area this stratigraphical interval is represented by the Couvin, Jemelle (without the Station Mbr), La Lomme and Hanonet formations (Bultynck *et al.*, 1991). Obviously the Couvinian of Dupont & Purves (1885) covers the same stratigraphical interval as the Eifelian of Gosselet (1879).

The mapping for the Geological Map of Belgium 1: 20 000 was stopped in 1885 and was succeeded by a new mapping project for a 1:40 000 Geological Map of Belgium. In the four first editions of the explanatory notes to this map (e.g. 1896) the term Couvinian (= base of Middle Devonian) corresponds to «l'étage des schistes et calcaires de Couvin» of d'Omalius d'Halloy (1862), thus including the Hierges, Saint-Joseph, Eau Noire, Couvin, Jemelle, La Lomme and Hanonet formations in the Couvin area.

Dorlodot (1900) argued that the «Grauwacke de Hierges» with *Spirifer arduennensis* belongs to the uppermost stage of the Lower Devonian (Emsian).

Maillieux (e.g. 1912) followed de Dorlodot's proposal concerning coincidence of the the Lower-Middle Devonian boundary with the Emsian-Couvinian boundary. He also elaborated a subdivision for the Couvinian: Co1a, Co1b, Co1c, Co2a, Co2b, Co2c, Co2d. This stage definition and its subdivision were formalized by the publication of the fifth edition of the explanatory notes

to the Geological Map of Belgium 1: 40,000 (1929). However, different acronyms were used, Co1a, b, c = Coa and Co2a, b, c, d = Cob.

7. Lithology

The Couvinian of the southern part of the Dinant Synclinorium is characterized by a mixed siliciclastic-carbonate sequence about 750 m thick west of the Meuse River and more than 800 m in the Wellin area. In the former area a biostromal formation, the Couvin Limestone up to 380 m thick, occurs in the lower part of the Couvinian. Small mounds occur in the upper part of the Jemelle Formation and massif or bedded crinoidal-coral limestones (X Formation) are locally developed close to the Couvinian- Givetian boundary. On the south-eastern flank of the Dinant Synclinorium, north of the Xhoris Fault and in the Vesdre Nappe the Couvinian is about 70 m to more than 200 m thick and consists of conglomerates, sandstones, silstones and shales belonging to the Vicht and Pepinster formations. In the northern part of the Dinant Synclinorium and the southern part of the Namur Synclinorium the Couvinian consists of a 50 m thick clastic succession (Rivière Formation) overlying mostly red conglomerates (Burnot Formation). The stage is part of a major transgressive cycle that starts in the upper Emsian Hierges Formation. A regressive phase occurs in the upper part (e.g. Lomme Formation).

8. Why the Couvinian is no longer considered as an international stage name

Between 1973 and 1981 the international Subcommittee for Devonian Stratigraphy (SDS) discussed the level for defining the base of the Middle Devonian and its lower stage. After four years of discussion and field trips four potential levels based on conodonts, were proposed.

- 1.- The base of the *Polygnathus debiscens* Zone.
- 2.- The base of the *Polygnathus costatus patulus* Zone, close to the base of the Couvinian in the Couvin-Nismes area.
- 3.- The base of the *Polygnathus costatus partitus* Zone, close to the base of the Eifelian in the Eifel region.
- 4.- The base of the *Polygnathus costatus costatus* Zone.

It was also obvious that in case that level 2 should be chosen then the name Couvinian would be used for the lower stage of the Middle Devonian and conversely Eifelian if level 3 was selected. At an SDS meeting (1979) in Sigüenza (Spain) it was decided that levels 1 and 4 should be no longer considered as potential levels. At the same meeting an informal vote was taken concerning levels 2 and 3. Seven voting members preferred the base of the *partitus* Zone and three the base of the *patulus* Zone. The final and formal vote was conducted during 1980 and at that time eleven members supported the base of the *partitus* Zone and three the base

of the *patulus* Zone. During an SDS meeting (1981) at Binghamton (New York) the Wetteldorf Richtschnitt in the Eifel region was chosen as boundary stratotype.

So the result of that vote was the only reason why Couvinian is no longer considered as an international stage name and this shouldn't exclude its use for local practical purposes. Acritarchs, spores, brachiopods and conodonts characterizing the base of the Couvinian have been incorporated in a Middle Devonian Composite Standard using the graphic correlation method (Gouwpy & Bultynck, 2003).

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