

## An Eifelian story of reefs and reef builders: the Belgian case re-investigated

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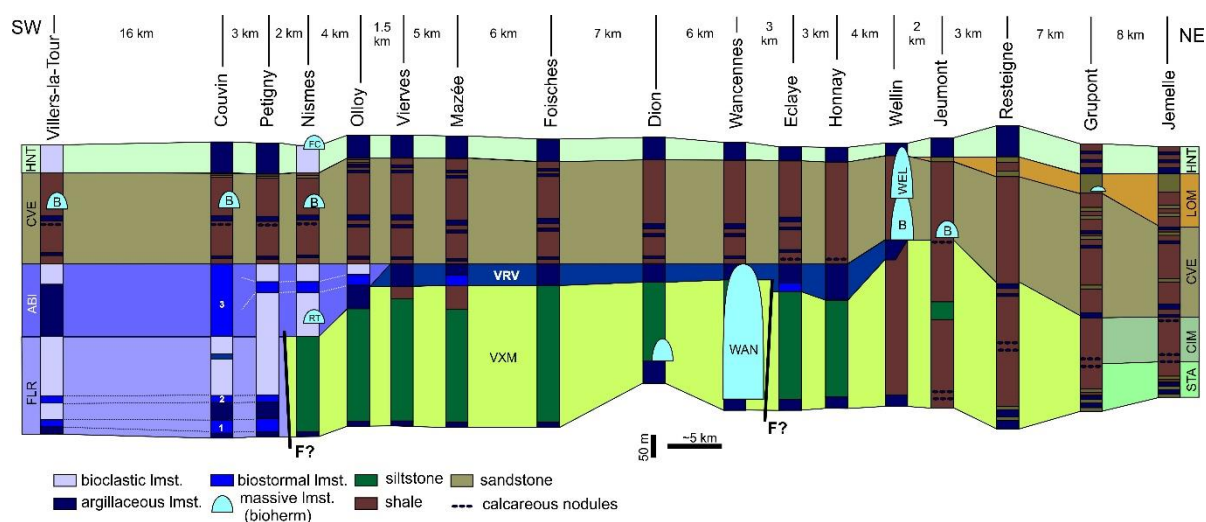
The Eifelian is well exposed in southern Belgium where it displays facies ranging from stromatoporoid biostromes (SW) to outershelf fine siliciclastics to proximal redbeds (NE). The carbonate factory started already in the Late Emsian with the deposition of mixed siliciclastic-bioclastic units, progressively purer as the transgression progressed. There is no reef *sensu stricto* in these St-Joseph and Eau Noire formations but local accumulation of tabulate corals and stromatoporoids acknowledges the occurrence of environmental conditions suitable for their growth. The oldest reef in the Devonian of Belgium is the “premier biostrome” of the Couvin Formation (Fm) (Foulerie member (Mbr), Bultynck, 1970, fig. 1): a succession of <1m-thick autobiotromes with lamellar stromatoporoids and tabulate corals, stabilising crinoidal rudstones. Rugose corals are uncommon: some fasciculate colonies of *Sociophyllum* and rare solitaires. Up-section, these beds are often made of broken skeleton suggesting higher hydrodynamic conditions, and appear as parabiostromes. This first complex is c. 15-20 m-thick in Villers-la-Tour and Couvin and covered with mostly bioclastic beds. The “deuxième biostrome” comprises a 50-m-thick succession of c. 1-m-thick parabiostromes with large domal and bulbous stromatoporoids, massive tabulate corals and heliolitids with abundant large solitary corals (*Mesophyllum*, *Cystiphyllum* and *Acanthophyllum*). Each parabiostrome is separated from the next one by 10-20 cm of bioclastic argillaceous limestone beds. The upper part of the Foulerie Mbr comprises mostly bioclastic, often dolomitised limestone displaying a shallowing-upwards trend. It is rich in fauna, including brachiopods, large solitary rugosa, delicate ramose tabulate corals and tubular stromatoporoids. The “troisième biostrome”, exposed in the Abîme Cliff of Couvin comprises several thin stromatoporoid biostromes and two thicker parabiostrome made of large bulbous stromatoporoids and tabulate corals. These biostromes alternates with “lagoonall” limestone made of debris of fasciculate tabulate and rugose corals and of tubular stromatoporoids, in a fine-grained matrix. The Couvin Fm is overlaid by the shales and calcareous shales of the Jemelle Fm in which are developed small (c. 300 m-large, 150 m-thick) bioherms in Macon, Salles, Boursiers, Couvin and Nismes. These lense-like bioherms are made of lamellar and massive stromatoporoids covering crinoidal gravel, passing to framestone of tabulate corals still rich in crinoids, with some large colonies of the rugose coral *Cyathophyllum*. This succession is regarded as the “classical Couvinian” (Bultynck, 1970; Godefroid, 1968).

Eastwards, between Petigny and Nismes, the Foulerie Mbr disappears and is replaced by the siltstone and shale of the Vieux-Moulin Mbr (Dumoulin & Coen, 2008), possibly along a syndimentary fault. The Abîme Mbr disappears as well but in a continuous manner between Nismes and Givet. In Nismes, the member includes the same thin stromatoporoids-tabulate corals biostromes alternating with fine-grained facies but the main biostrome is replaced by a c. 20-m-thick bioherm made of fasciculate coral framestone and stromatoporoid coverstone with abundant fauna. Several smaller biostrome and coral beds cover it and the succession is capped by a *Spongophyllum* bed that can be traced to Olloy eastwards. Whereas the limestone member thins progressively (160 m in Nismes, 60 m in Olloy, 45 m in Vierves, < 30 m in Mazée), the biostrome is replaced by argillaceous limestone (Vierves) then by

calcareous siltstone (Foisches). East of Olloy, this unit is considered as a different member, the name Vierves Mbr is proposed.

After the local disappearance of limestone facies in the Meuse valley (probably the deepest part of the basin), limestone re-appears in Fromellennes with argillaceous facies. In Dion, the siliciclastic Vieux Moulin Mbr displays surprising facies with the development of small (c. 350 m-long, c. 50 m-thick) biohermal lenses made of lamellar stromatoporoids and fasciculate rugose corals. This reef is covered by shales and siltstones passing upwards to dark argillaceous limestone that possibly corresponds to the Abîme Mbr. Between Wancennes and Pondrôme, an anomaly in thickness of the “Couvin Fm” was noted by Dumoulin & Blockmans (2008) and on their geological map. This anomaly is due to the development of a massive bioherm c. 3 km-long and 250 m-thick laterally to the Vieux Moulin and Vierves members. This reef starts with large lamellar stromatoporoids stabilising lenses of crinoidal gravel extremely rich in brachiopods, gastropods, trilobites and tabulate corals. It passes upwards to a framestone of ramose tabulate and fasciculate rugose corals with stromatoporoids then to a framestone comprising large bulbous stromatoporoids and heliolitids in the reef crest. The upper part of the reef, reef crest excepted comprises a rich and very diverse coral fauna with large solitary (*Cystiphyllum*, *Mesophyllum*, *Acanthophyllum*, *Stringophyllum*), fasciculate (*Fasciphyllum*, *Lyrielasma*, *Dendrostella*, *Sociophyllum*, *Thamnophyllum*) and massive rugose corals (*Spongophyllum*, *Xystriphyllum*, *Beugniesatsraea*) together with massive and ramose tabulate corals. The top of the reef is not exposed but it seems to be very clear-cut, suggesting an emersion (sequence boundary?) before deposition of the shaly Jemelle Fm. The bioherm is again replaced by the siliciclastics of the Vieux Moulin Mbr east of Wancennes. However, a c. 40-m thick unit of bedded dark limestone with tabulate corals and stromatoporoids persist up to Wellin with an increasing dolomitisation eastwards.

In Wellin another abnormality is developed in the Jemelle Fm where small bioherms in the upper part of the formation evolved into massive crinoidal limestone with stromatoporoids yielding an abundant coral fauna (Coen-Aubert et al., 1991). East of Wellin, the Eifelian succession is dominated by the siliciclastic Jemelle and Lomme formations with some rare occurrences of thin corals and stromatoporoids beds that can be traced from the Jemelle area up to the Aisne valley.



**Figure 1.** Lateral facies changes between Villers-la-Tour and Jemelle. Modified from Dumoulin & Blockmans (2008) with additions from Bultynck (1970), Godefroid (1968), Coen-Aubert et al. (1991). Legend: ABI: Abîme Mbr (Couvin Fm), B: Bioherm (Jemelle Fm), CIM: Cimetière Mbr (Jemelle Fm), CVE: Chavées Mbr (Jemelle Fm), FC: Fondry des Chiens bioherm, HNT: Hanonet Fm, LOM: Lomme Fm, RT: Roche Trouée bioherm, STA: Station Mbr (Jemelle Fm), VXM: Vieux Moulin Mbr (Jemelle Fm): WAN: Wancennes bioherm, WEL: Wellin bioherm (Formation X in Coen-Aubert et al., 1991); F?: putative synsedimentary fault; 1-3 in Couvin section: 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> biostrome of Bultynck (1970).

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