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Revue de micropaléontologie

Revue de micropaléontologie 58 (2015) 287–308

Review article

Late Eifelian and Early Givetian ostracod assemblages from Wellin, Hotton and On-Jemelle (Ardenne, Dinant Synclinorium, Belgium). Paleoenvironmental implications

La faune d'ostracodes du sommet de l'Eifelien et de la base du Givétien à Wellin, Hotton et On-Jemelle (Ardenne, Synclinorium de Dinant, Belgique). Implications paléoenvironnementales

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Abstract

The study of 3430 ostracods collected in the Lomme, Hanonet and Trois-Fontaines formations (Late Eifelian/Early Givetian) in four sections of the Dinant Synclinorium (Ardenne) allowed the recognition of more than 75 taxa. Their study displays the progressive evolution from an external mixed siliciclastic-carbonate ramp to a carbonate platform around the Eifelian/Givetian boundary. Ostracods from the Lomme Fm are published here for the first time. The leperditicopid ostracods are probably indicative of brackish water environments during the deposition of the Trois-Fontaines Fm, and consequently point to wet and warm climatic conditions during Early Givetian times in the Dinant Synclinorium. Their absence in widespread lagoonal environments in the upper part of the Givetian may be on the contrary related to very arid climate conditions. That important climatic change is probably in relation with the Taghanic Biocrisis.

Keywords: Ostracods; Devonian; Sedimentology; Paleoecology; Paleoclimatology; Dinant Synclinorium

Résumé

L'étude de 3430 ostracodes recueillis dans les formations de La Lomme, d'Hanonet et de Trois-Fontaines (sommet de l'Eifelien/base du Givétien) affleurant dans de quatre coupes situées dans le Synclinorium de Dinant (Ardenne) a permis de reconnaître plus de 75 taxa. Leur étude montre une évolution progressive d'une rampe externe mi-siliciclastique mi-carbonatée vers une plate-forme carbonatée à proximité de la limite Eifelien/Givétien. Les ostracodes présents dans la Formation de la Lomme sont signalés pour la première fois. Les Leperditicopida témoignent probablement de la présence constante d'eaux saumâtres lors du dépôt de la Formation de Trois-Fontaines, et par conséquent ils indiqueraient que les conditions climatiques étaient chaudes et humides au début du Givétien dans la région étudiée. Leur absence dans les environnements lagunaires très présents dans la partie supérieure du Givétien pourrait par contre témoigner de conditions climatiques très arides. Ce changement climatique important pourrait être lié à la crise biologique du Taghanic.

Mots clés : Ostracodes ; Dévonien ; Sédimentologie ; Paléoécologie ; Paléoclimatologie ; Synclinorium de Dinant

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http://dx.doi.org/10.1016/j.revmic.2015.04.002
0035-1598/

1. Introduction

Ostracods are small aquatic bivalve micro-crustaceans, known with certainty from the Ordovician (Williams et al., 2008), but probably present as early as the Middle Cambrian (Williams et al., 2011). If Paleozoic ostracods are essentially marine and brackish-water taxa, these small crustaceans also colonized freshwater, at least since the Carboniferous (Bennett, 2008); they can also be found nowadays in more extreme environments (e.g. temporary ponds, thermal springs, forest humus, deep sea; Whatley, 1983; Guernet and Lethiers, 1989; Brandão, 2013). Due to the small size of their carapace (sub-millimeter in general) and their abundance, a small amount of sediment is usually enough to study the entire assemblage. Besides this, ostracods are excellent environmental indicators both in recent and deep-past time (e.g. Maillet et al., 2013b; Trog et al., 2013) as their carapace is able to record fine fluctuations of their living water environment. The high sensitivity of ostracods to environment is related to their ontogenetic growth, presenting several molting stages as usual in arthropods, but during which chemical elements constituting the new carapace are directly picked-up in the water (Turpen and Angel, 1971). Moreover, as this group is still extant, comparison between past and present ecosystems is possible. Many ostracod taxa are also good stratigraphical markers (e.g. Lethiers, 1984; Shanin and Elbaz, 2013) and some lineages are used in biostratigraphy, as the genus *Polyzygia* and the Entomozoaceans in the Devonian (e.g. Groos-Uffenorde et al., 2000).

Ostracods are particularly common in the Devonian carbonate deposits of the Ardenne, where they have been intensively studied in Givetian to Late Devonian deposits (e.g. Milhau, 1983; Lethiers, 1984; Casier, 1987, 2008; Casier and Préat, 2003; Casier et al., 2011, 2013; Maillet, 2013; Maillet et al., 2013a). Herein, ostracods in the Lomme, Hanonet and Trois-Fontaines formations exposed in four sections located in three quarries in the Dinant Synclinorium (Ardenne) are studied in order to complete their inventory across the Eifelian/Givetian transition in the type regions of these two stages, and before the Taghanic Biocrisis (House, 1985; Aboussalam, 2003).

Ostracods of the Hanonet and Trois-Fontaines formations were previously the subject of several studies. In the French Ardennes, ostracods have been studied at the Mont d'Haurs close to Givet (Milhau *in* Hubert et al., 2007; Casier et al., 2011) and in the Glageon quarry, close to Trélon (Casier et al., 1995). In Belgium, they have been studied in the "La Couvinoise" quarry at Couvin (Casier et al., 1992) and in the Resteigne quarry (Casier and Préat, 1990, 1991). These studies demonstrated that ostracods were particularly abundant and diversified close to the Eifelian/Givetian boundary in the Dinant Synclinorium. Ostracods present in the Lomme Formation (= Fm) have never been previously published. All these localities are reported in Fig. 1.

The sections investigated herein were the subject of several sedimentological studies (Kasimi, 1993; Préat and Kasimi, 1995; Kasimi and Préat, 1996; Mamet and Préat, 2005). Ostracods from the Wellin East section, and of the Hotton and

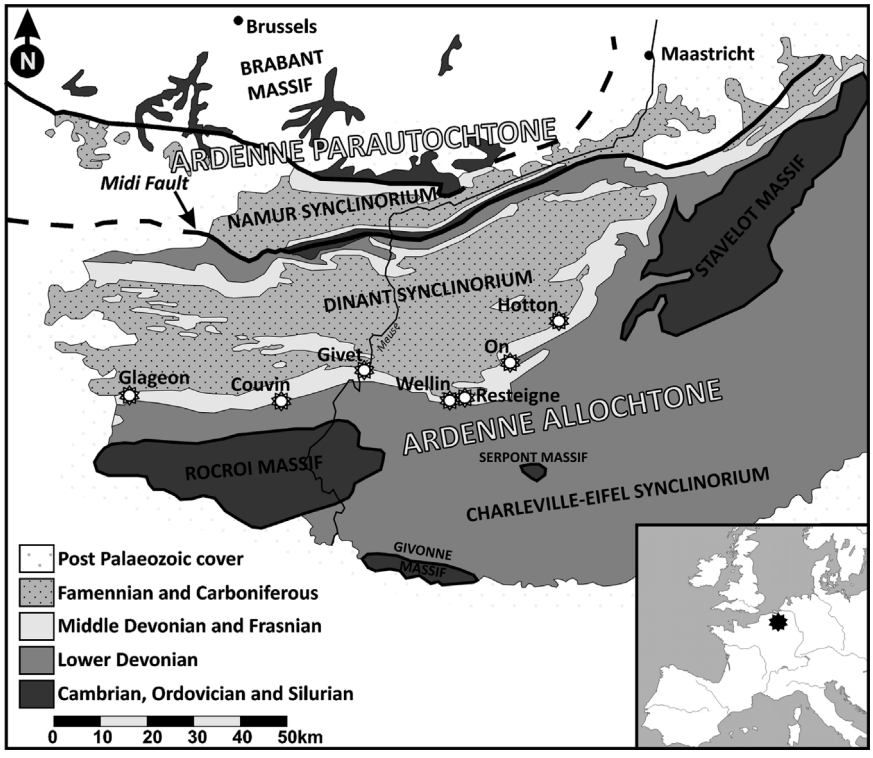

Fig. 1. Localisation of the Wellin, On-Jemelle and Hotton quarries and other localities cited in the text and structural setting of Devonian formations of the Ardenne. Adapted from Bultynck et al. (2001).