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Original article

Late Devonian – Early Carboniferous vertebrate microremains from the Carnic Alps, northern Italy

Microrestes de vertébrés du Dévonien supérieur – Carbonifère inférieur des Alpes Carniques, en Italie du Nord

Carine Randon [a], Claire Derycke [a], Alain Blieck [a,*], Maria Cristina Perri [b], Claudia Spalletta [b]

[a] *Laboratoire de paléontologie et paléogéographie du paléozoïque (LP3), UMR 8014 du CNRS, université des sciences et technologies de Lille, UFR sciences de la Terre, 59655 Villeneuve-d'Ascq cedex, France*

[b] *Dipartimento di Scienze della Terra e Geologico Ambientali, Università di Bologna, Via Zamboni 67, 40126 Bologna, Italy*

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Abstract

Vertebrate microremains from the Late Devonian–Early Carboniferous of the Carnic Alps are predominantly chondrichthyan, with minor placoderm and actinopterygian remains. The faunas are sparse and, with very few exceptions, occur only in conodont-rich pelagic limestones (Pramosio Limestone) representative of the palmatolepid-bispathodid conodont biofacies. Phoebodont and jalodont chondrichthyans, also reflecting open-ocean environments, predominated during the Famennian, and eventually symmoriids seem to predominate during the Early Carboniferous. The presence of *Siamodus* in this assemblage gives a new locality for this genus known from few regions in the world and allows confirming its stratigraphical range (*limpidus* Zone) and its relation to deep-water environments. The Late Devonian vertebrate faunas are tropical and cosmopolitan, having much in common with coeval taxa from the North-Gondwanan margins and Asian terranes. Composition of the vertebrate faunas is consistent with the Carnic Alps terrane having occupied a position intermediate between Gondwana and Laurussia, as hypothesized by various authors, but because of sparsity of the taxa represented and the pronounced cosmopolitan nature of both the conodont and vertebrate faunas, the data are not compelling.

Résumé

Les microrestes de vertébrés du Dévonien supérieur–Carbonifère inférieur des Alpes Carniques sont essentiellement ceux de chondrichthyens, avec quelques restes de placodermes et d'actinoptérygiens. Les faunes sont rares et, à quelques exceptions près, proviennent de calcaires pélagiques à conodontes (Calcaire de Pramosio) correspondant au biofaciès à palmatolépides-bispathodides. Les chondrichthyens phœbodontes et jalodontes, qui témoignent aussi d'environnements marins ouverts, prédominent au Famennien et les symmoriides apparemment au Carbonifère inférieur. La présence de *Siamodus* dans cet assemblage fournit une nouvelle localité pour ce genre connu uniquement dans quelques régions dans le monde et permet de confirmer son âge (Zone à *limpidus*) et sa présence dans les environnements profonds. Les faunes de vertébrés néodévoniennes sont tropicales et cosmopolites, avec de nombreux éléments en commun avec les taxons pélagiques des marges nord-gondwanes et des blocs asiatiques. La composition de ces faunes est en accord avec une position du bloc des Alpes Carniques intermédiaire entre Gondwana et Laurussia, ainsi que cela a déjà été suggéré par plusieurs auteurs. Cependant, la rareté taxonomique du matériel représenté et le caractère profondément cosmopolite des faunes de vertébrés et de conodontes ne permettent pas de contraindre aussi fermement ces conclusions.

Keywords: Late Devonian; Early Carboniferous; Vertebrates; Conodonts; Biofacies; Palaeobiogeography

Mots clés : Dévonien supérieur ; Carbonifère inférieur ; Vertébrés ; Conodontes ; Biofaciès ; Paléobiogéographie

* Corresponding author.
E-mail address: Alain.Blieck@univ-lille1.fr (A. Blieck).

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1. Introduction and geologic setting

The Late Ordovician (Caradoc) to Early Carboniferous successions of the Carnic Alps, along the Italian–Austrian border in the easternmost part of the Southern Alps, consist predominantly of carbonate rocks representing shallow to open sea environments (Venturini, 2001–2002). Carbonate sedimentation persisted through into the earliest Viséan (Perri and Spalletta, 1998b), resuming during the Late Carboniferous. Carbonate build-ups, characteristic of the Middle Devonian, persisted into the Frasnian, but ceased during early Famennian transgressive tectono-eustatic events when sediments representing open marine environments, the late Frasnian–earliest Viséan Pramosio Limestone, accumulated. This unit consists of 0.5–3 cm layers of light grey, beige to pink biomicritic limestones (wackestones and packstones) interbedded with thin (mm–cm) calcisiltitic levels. The Pramosio Limestone was previously referred to in various ways, such as the ''Calcari a climenie'' (Gortani, 1907; Selli, 1963), clymenid limestone (Kreutzer, 1990; Perri and Spalletta, 1991; Venturini and Spalletta, 1998), clymenid- and goniatitid-bearing pelagic limestone (Perri and Spalletta, 1990, 1998a, 1998b, 2000, 2001). They are considered to equate with the combined Pal and Kronhof Limestones of Austrian colleagues (Schönlaub, 1998) and the ''Calcari a climenie'' *auctorum* outcropping in southwestern Sardinia (refs in Corradini et al., 2003).

Intensive sampling for conodonts in the Pramosio Limestone on the Italian side of the Carnic Alps, undertaken during the last two decades (MCP and CS) produced the vertebrate microremains described in this paper. Bandel (1972: pp. 77–78) was the first to mention Palaeozoic vertebrate remains from the Carnic Alps; he reported a rather rich fauna from the Devonian–Carboniferous succession in the Seekopf-Wolayer See-Rauchkofel-Cresta Verde areas of southern Austria: undetermined ''placoderm'' remains in ''Siegenian'' (Pragian *pro parte*), Emsian, Frasnian and Lower Carboniferous, ''fish teeth'' in Upper Devonian, fin spines (?) of ''selachians'' in Famennian and Lower Carboniferous and ''placoid scales'' in Eifelian, Upper Devonian and Lower Carboniferous sequences. Perri and Spalletta (1991: Fig. 2) reported ''fish teeth'' from the Famennian clymenid limestone of the Malpasso section and Sirna et al. (1994: Fig. 1) ''Placodermi indet.'' from the Frasnian clymenid limestone at Chianevate. Perri and Spalletta (1998a) reported vertebrate microremains from the Pramosio calcirudite (later named Freikofel Rudstones) in the Pramosio 327 section (op. cit., p. 192, sample PR327/17, Upper *falsiovalis* Zone, Frasnian), and from the clymenid- and goniatitid-bearing pelagic limestone (Pramosio Limestone) in the Rio Boreado section (op. cit., p. 206, sample RB4, Upper *expansa* Zone, Famennian), Malpasso section (op. cit., p. 220, samples ML1, Upper *trachytera* Zone and ML14, Upper *expansa* Zone, Famennian) and Pramosio Bassa section (op. cit., p. 228, sample PB7, Lower *expansa* Zone, Famennian). Late Carboniferous and Permian reports have been made from the Italian side of the Carnic Alps (refs in Sirna et al., 1994; Blieck et al., 1997; Vai and Venturini, 1997;

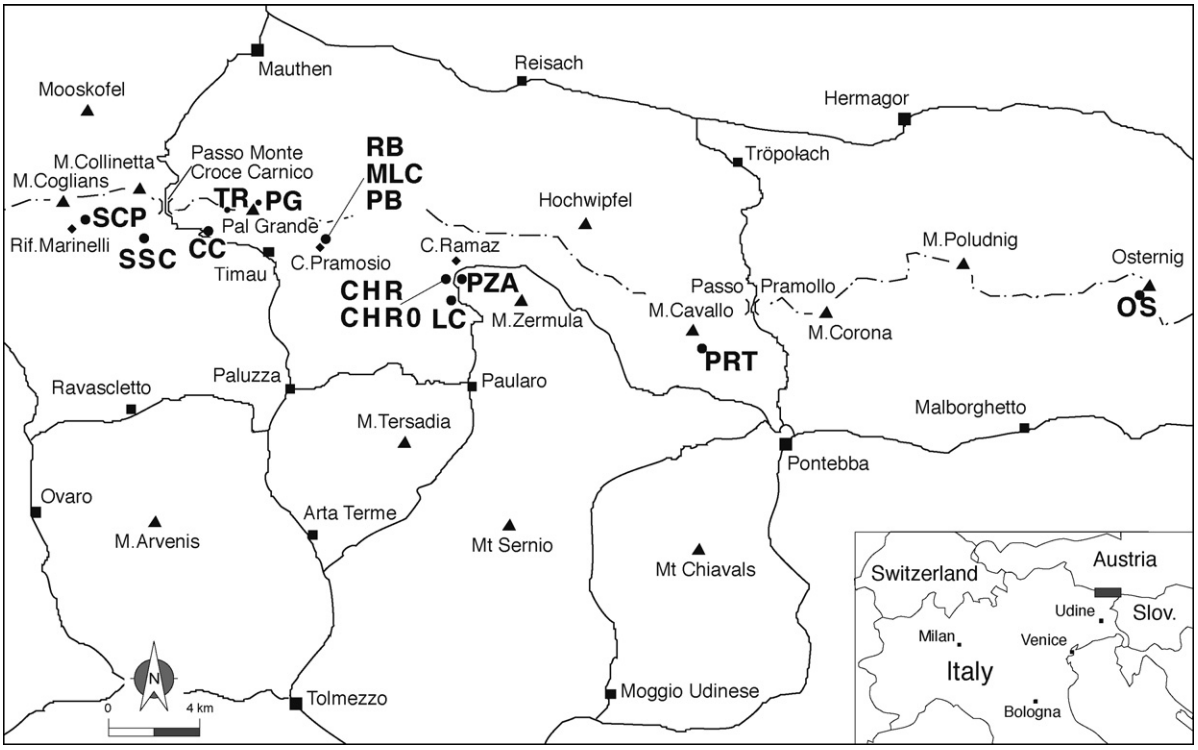

Fig. 1. Location of studied sections. A 1:25,000 synthesis of the geology area has been presented by Venturini (2001–2002). Abbreviations of the names of localities are in bold characters as in Table 1.

Fig. 1. Localisation des coupes étudiées. Une synthèse géologique au 1:25 000 de la région a été publiée par Venturini (2001–2002). Les abréviations des noms des localités sont en caractères gras comme dans le Tableau 1.