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Ammonoid biostratigraphy of the Middle Triassic Latemar platform (Dolomites, Italy) and its correlation with Nevada and Canada

Biostratigraphie des ammonoïdes de la plate-forme triasique moyenne du Latemar (Dolomites, Italie) et sa corrélation avec le Nevada et le Canada

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Abstract

An extensive study of the ammonoid fauna occurring in the lagoonal facies of a Middle Triassic isolated carbonate platform (Latemar platform, Dolomites, Italy) has been undertaken, and ammonoids from selected coeval successions (Punta Zonia, Marmolada, Rio Sacuz) have been illustrated. Ammonoids from Latemar have been collected in 20 distinct horizons (storm deposits) within the ca. 500 m thick lagoonal succession of the platform, thus providing a biostratigraphy of a series which is unusually expanded for this time interval, close to the Anisian–Ladinian boundary. Contrary to general opinion, some ammonoids of the Latemar and other coeval carbonate platforms of the Dolomites (Marmolada, Cernera), in particular *Aplococeras avisianum*, *Lecanites misanii*, *Celtites* spp., and *Paranevadites* sp., are also present in nearby basinal series. The same taxa have been found in North American localities deposited at the opposite margin of Panthalassa. The homotaxis of these ammonoids in North America and Latemar allow to establish a global scale correlation between the Southern Alps and North America with the highest resolution to date possible. In the context of this study, *Aplococeras transiens* n. sp. and *Esinoceras nerinae* n. sp are established.
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Résumé

La faune d'ammonoïdes trouvée dans les faciès de lagon d'une plate-forme carbonatée isolée (plate-forme du Latemar, Dolomites, Italie) est ici étudiée, et certains choisis dans les successions contemporaines ont été illustrés. Les ammonoïdes ont été recueillies dans 20 horizons différents (dépôts de tempête) dans la succession épaisse de 500 m, fournissant une biostratigraphie d'une série exceptionnelle pour cet intervalle de temps près de la limite Anisien–Ladinien. Contrairement à l'opinion général, quelques ammonoïdes du Latemar et d'autres plates-formes comparables des Dolomites (Marmolada, Cernera), *Aplococeras avisianum, Lecanites misanii*, *Celtites* spp. et *Paranevadites* sp. ont été trouvés aussi dans les séries proches de faciès de bassin. Les mêmes sont aussi connus dans les localités nord-américaine de la marge opposée de la Panthalassa. L'homotaxie de ces ammonoïdes au nord de l'Amérique et au Latemar permet d'établir une échelle de corrélation globale parmi les Alpes Méridionales et l'Amérique du Nord avec la plus haute résolution possible. Dans cette étude sont décrits *Aplococeras transiens* n. sp. et *Esinoceras nerinae* n. sp.
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Keywords: Southern Alps; Middle Triassic; Biostratigraphy; Ammonoids; Carbonate platforms

Mots clés : Alpes méridionales ; Triasique moyen ; Biostratigraphie ; Ammonoïdés ; Plate-forme carbonatée

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1. Introduction

The uppermost Anisian–lowermost Ladinian sedimentation in the Dolomites (Northern Italy) is characterized by the rapid growth of isolated carbonate platforms hundreds of meters thick, whereas coeval basinal deposits are up to 100 times thinner (e.g. Bosellini and Stefani, 1991; De Zanche et al., 1993; Brack and Muttoni, 2000). Both carbonate platforms and basins sometimes yield abundant and fairly well preserved ammonoid faunas (e.g. Mojsisovics, 1882; Salomon, 1895; Tommasi, 1895; Wilckens, 1909; Von Bubnoff, 1921; Brack and Rieber, 1986, 1993; De Zanche et al., 1995); data from the platforms, however, are usually considered less representative, due to the lack of a continuous record and to the peculiar faunal associations, interpreted as the result of ecological controls (Brack and Rieber, 1993, 1996).

This apparent dichotomy has led to the underevaluation in some biostratigraphic works of platform successions, and to inconsistencies between proposed platform-to-basin correlations (e.g. De Zanche et al., 1993, 1995 versus Brack et al., 1996; Brack and Muttoni, 2000). Furthermore, elements of the "platform faunal associations", which appear to be less common, or absent, in the basinal series, proved to be present in the North American Eastern Panthalassa (e.g. *Aplococeras avisianum*, see Assereto, 1969). Their use in the biostratigraphic studies might increase the correlation potential of the Southern Alps series.

The ca. 500 m thick shallow lagoonal facies of the Middle Triassic Latemar platform (see Fig. 1) provides a long record of sedimentation in the crucial time interval close to the Anisian–Ladinian boundary. Subaerial exposure surfaces are common at top of sedimentary cycles, but should represent minor gaps, with a duration of either less than a 20 kyr precession cycle (cf. Preto et al., 2001), or less than a ca. 4 kyr sub-

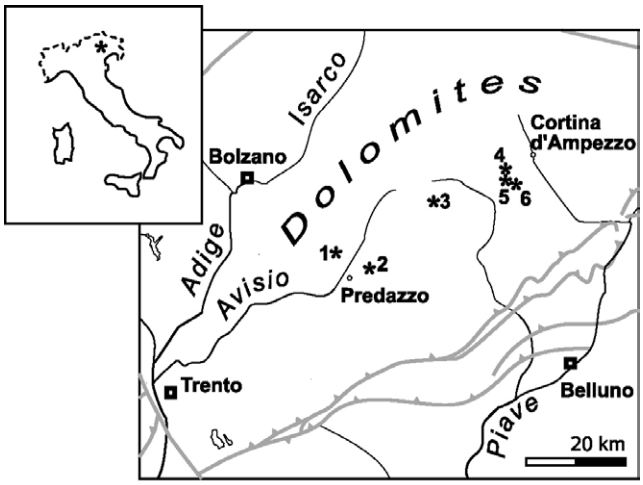

Fig. 1. Map of the study area (north eastern Italy); major rivers are represented in black, major faults in gray. **1**: Latemar; **2**: Viezzena; **3**: Pian dei Fiacconi, Marmolada; **4**: Punta Zonia section; **5**: Cernera; **6**: Rio Sacuz section.
Fig. 1. Carte de la région étudiée (Italie du Nord Est) ; les fleuves plus grands sont représentés en noir, les failles plus importantes sont représentées en gris. **1** : Latemar ; **2** : Viezzena ; **3** : Pian dei Fiacconi, Marmolada ; **4** : coupe de Punta Zonia ; **5** : Cernera ; **6** : coupe de Rio Sacuz.

Milankovitch cycle (Zühlke et al., 2003). The expansion of the series should guarantee that all biostratigraphic events can potentially be recorded. In opposition, in coeval basins the reduced sedimentation rates may suggest that condensation occurred, thus precluding some time intervals to be represented, or included at all. The issues of potential biostratigraphic resolution and global scale correlations for this stratigraphic interval are still matter of intense discussion (e.g. Silberling and Nichols, 1982; Brack and Rieber, 1986, 1993, 1996; Bucher and Orchard, 1995; Manfrin and Mietto, 1995; Vörös et al., 1996). We undertook an extensive study of the ammonoid biostratigraphy of the Latemar platform, and a re-examination of previously published biostratigraphic data (Brack and Rieber, 1993; De Zanche et al., 1995) and will discuss the results in this paper. We will especially focus on the contribution of the "platform ammonoid faunas" to a high resolution correlation at the global scale.

2. Geological setting

2.1. Stratigraphy of the Dolomites at the Anisian–Ladinian boundary

The GSSP of the base Ladinian is currently under discussion, but a decision on its position is still far to be reached. In this paper, we adopt the informal proposal included in Mietto and Manfrin (1995), who place this boundary at the base of the Crassus Subzone. The reader should be aware that the GSSP of this boundary may eventually be placed at a significantly different stratigraphic position.

Prior to the deposition of the Latemar platform, an extensive carbonate bank (Contrin Fm.) was forming in the western Dolomites, whereas a basinal succession of hemipelagic marls and carbonate turbidites (lower Ambata Fm.) characterized the eastern Dolomites. At the same time, extensional tectonics produced isolated intra-platform basins within the Contrin carbonate bank, filled with laminated black platy limestones, and swarms of carbonate breccias and megabreccias (Moena Fm., Masetti and Neri, 1980).

Afterwards, sedimentation in basinal areas and above the slopes of the Contrin platform continued, with the turbiditic siliciclastic successions of the upper Ambata Fm. (so-called "*Daonella* marls"). The following formation in basinal areas (which also partly comprises the area formerly occupied by the Contrin Fm.) is represented by cherty, laminated, black limestones (the Plattenkalke of De Zanche et al., 1993; Lower Plattenkalke of Brack and Rieber, 1993) and gray-green, nodular limestones with chert nodules or beds and intercalations of tuffs (lower Knollenkalke). Coeval deposits in platform areas consist of thick platform carbonates, strongly aggrading or backstepping, which later become prograding. The Latemar, Marmolada, Viezzena and Cernera platforms, all known to yield abundant ammonoids, belong to the generation of aggrading/backstepping carbonate platforms. The stratigraphy of the Dolomites at the Anisian–Ladinian boundary is illustrated in Fig. 2.

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