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Larger foraminiferal and coralline algal facies in an Upper Eocene storm-influenced, shallow-water carbonate platform (Colli Berici, north-eastern Italy)

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Abstract

Facies analysis of Priabonian shallow-water carbonate successions in the outcrops near Mossano (eastern Colli Berici, north-eastern Italy) and the subsequent integration of palaeoecological data have been used to produce a detailed palaeoenvironmental model. The facies distribution and the processes, which controlled the larger benthic foraminiferal and coralline algal assemblages in the study Priabonian storm-influenced, carbonate ramp, are discussed in detail.

In the middle-ramp trough, cross-bedded small *Nummulites* and rhodolith packstones pass laterally into coralline algal crust wackestones. These rhodoliths exhibit two well-differentiated growth-phases: the first occurring during low-water energy periods, followed by a second developed during high-energy events during which they were reworked and partially destroyed. These facies pass laterally into orthophragminid rudstones and packstones characterised by orthophragminid tests and channel structures. The latter were formed by storm-induced return currents, which swept the middle-ramp creating distal middle-ramp channel structures. Further toward the distal part of the middle-ramp the return currents decreased in energy and discharged nutrients allowing the coralline crustose pavement to develop. This is characterised by rhodoliths typically discoidal in shape (up to 10 cm in diameter) with a loose inner arrangement consisting of encrusting-to-foliose growth-forms.

The occurrence of the channel structures in orthophragminid rudstones and in the coralline crustose pavement appears to be unique in Upper Eocene carbonate ramp depositional systems. During the erosive events associated with the return currents, these shallow-water carbonates were unlithified or only weakly lithified and were, therefore, easily transported into deeper water ramp settings. The model suggests that the significant changes of the middle-ramp benthic communities with depth could have formed, at least in part, by offshore return currents, which played an important role in both controlling substrates and in supplying nutrients.

Keywords: Larger foraminifera; Coralline red algae; Shallow-water carbonates; Palaeoecology; Late Eocene; Colli Berici; North-eastern Italy

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1. Introduction

Larger foraminifera and coralline red algae are important constituents of shallow-water carbonates from the Early Eocene to Early Miocene of Venetian Prealps (north-eastern Italy). In particular, during the Middle and Late Eocene, nummulitids, alveolinids and orthophragminids are both important biostratigraphic markers and rock formers. During this time span, coralline algae represent important sediment contributors. The palaeoenvironmental models of these Eocene assemblages so far described in literature refer to a "bank" of larger foraminifera (especially made up of *Nummulites* and *Alveolina*), which forms significant relief or even sheet geometries (e.g., Loucks et al., 1998; Racey, 2001), and therefore produces a variety of environments in a depositional platform system within the photic zone (e.g., Arni, 1965; Luterbacher, 1984; Eichenseer and Luterbacher, 1992). Such ecosystems developed during the late Early and Middle Eocene reaching an optimum state of sustainable benthic foraminiferal communities within the Eocene Global Community Maturation cycle (see Hottinger, 1997). At the Middle–Upper Eocene boundary, larger foraminifera suffered an important biological crisis.

The present study focuses on larger foraminiferal and coralline algal facies from the Upper Eocene (Priabonian) Marne di Priabona formation. Excellent outcrops of this formation are exposed on the eastern part of the Colli Berici (Province of Vicenza, northeastern Italy; Fig. 1), which reveal 3-D facies distribution. In this example, most of the detailed stratigraphic heterogeneities are below the resolution of seismic and wireline logs and they could, therefore, be utilised to assist in building realistic depositional architecture models for some Eocene shallow-water larger foraminiferal-coralline algal carbonates. Coralline red algae and orthophragminids dominate the benthic assemblages in the study part of the Marne di Priabona formation.

Orthophragminids are common larger benthic foraminifera in Paleocene–Eocene Tethyan shallow-water carbonate platforms (e.g., Less, 1987; Ferrández-Cañadell and Serra-Kiel, 1992; Ferrández-Cañadell, 1999). Although the orthophragminids are among the most characteristic Palaeocene–Eocene larger foraminifera, they are poorly understood and have no present-day representatives. Available knowledge on the palaeoecology of orthophragminids refers mainly to their mode of life, their palaeobathymetric distribution and faunal associations (Fermont, 1982; Less, 1987; Ferrández-Cañadell and Serra-Kiel, 1992; Geel, 2000; Romero et al., 2002).

Since the beginning of the Eocene, the orthophragminids occupied the characteristic habitats localised in the distal parts of the nummulite buildup-bearing

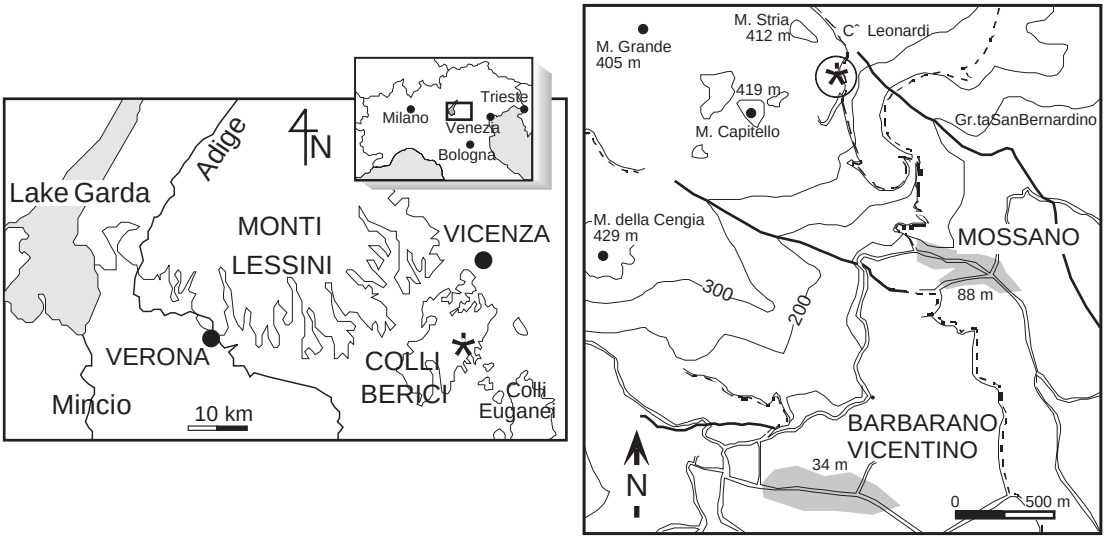

Fig. 1. Location of the studied section (Mossano area, eastern Colli Berici, north-eastern Italy).