Geophysical Research Abstracts, Vol. 9, 02801, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02801

The contribution of calcareous nannofossils to the understanding of the origin of marl-limestone alternations

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Calcareous nannoplankton, and in particular coccolithophorids, is one of the major producer of pelagic carbonates in modern oceans. Before planktic forams become significantly abundant in the Mid Cretaceous, coccoliths and nannoliths (e.g., *Schizosphaerella* in the Jurassic and *Nannoconus* in the Cretaceous) did account for the whole pelagic carbonate production. In order to unravel the role of nannoplankton in the formation of marl-limestone alternations, different sections of various age were analysed. In particular we present here data from the Toarcian of Peniche (Lusitanian Basin, Portugal), the Oxfordian of Plettemberg (SW Germany), and the Valanginian of Vergol (SE France). The results show that whatever the age of analysed sediments, nannofossil abundance per gram of rock is systematically higher in marls with respect to limestones. This pattern is here considered as primary and not controlled by a differential diagenesis occurring in the two lithologies. Evidences for this assumption are: (1) in the studied sections, preservation degree was similar in the two lithologies; (2) the composition of the assemblages in marls with respect to limestones is different, with small coccolith taxa being more abundant in marls, and limestone assemblages bearing larger coccolith species and nannoliths in higher proportions; (3) the size of *Schizosphaerella* is significantly larger in the limestones than in the marls of the Peniche section.

Although the larger coccolith species and the larger size measured for a single taxon, the carbonate fraction produced by nannofossils in limestones is limited. Conversely, nannofossils may produce significant amounts of carbonates in marls (up to 50-60% of the measured wt%$CaCO_3$). These results indicate that, although producers are clearly

different passing from marls to limestones, nannoplankton production is not responsible in the Jurassic and Early Cretaceous for the genesis of marl-limestone alternations in the studied epicontinental basins.

A continuous SEM analysis of micritic sediments from the Toarcian of the Dotternhausen core (SW Germany) shows that nannofossils are unevenly distributed, with discrete layers enriched in both coccoliths and nannoliths alternating with large, abiotic intervals. In the micrite, small (0.5-2μm) particles, without any peculiar morphology, are common (Bour et al., accepted). These particles, that often form the bulk of the micrites, might have been produced in the shallow platforms and exported towards the adjacent basins. This interpretation is further confirmed by their isotopic signature (Minoletti et al., 2005). Further evidence of this export mechanism derives from the study of several sections, Valanginian in age, distributed along a transect from the Provence plate-form to the Vocontian basin (SE France). Limestone beds can be followed over long distances, and their thickness decreases progressively basinwards. All this set of information indicates that marl-limestone alternations are the product of cyclic export of carbonate muds produced in platform environments towards the epicontinental basins. Such exports dilute the pelagic carbonate fraction (i.e., calcareous nannofossils) that is actually limited in limestones. Nannoplankton production, although it is not responsible for the marl-limestone genesis, changes in tune with the carbonate export from platforms, as indicated by a different assemblage composition in limestones with respect to marls. Carbonate production in shallow seas and open oceans seem therefore to react at the same time to environmental/climatic changes.

Bour et al. (accepted). Nannofacies analysis as a tool to reconstruct palaeoenvironmental changes during the Early Toarcian anoxic event. Palaeogeography, Palaeoecology, Palaeoclimatology.

Minoletti et al. (2005). Changes in the pelagic fine fraction carbonate sedimentation during the Cretaceous–Paleocene transition: contribution of the separation technique to the study of Bidart section. Palaeogeography, Palaeoclimatology, Palaeoecology 216, 119-137.