



Limestone-marl alternations : Preservation of primary environmental variation records

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The limestone-marl alternations are usually interpreted to reflect cyclic paleoenvironmental fluctuations linked to Milankovitch-scale climate variations. However, uncertainty in such interpretations is related to the impact of diagenesis in the lithological differentiation. In order to evaluate the environmental variations prevailing during the deposition of these sedimentary cycles, we have applied a multi-proxy approach (carbonate geochemistry, micropaleontology and mineralogy) on four Tethyan and Mediterranean sections from Lower Cretaceous to Mid-Pliocene, displaying various lithological expressions and deposited in different sedimentary contexts : The Mid-Pliocene Punta Piccola section (South Sicily), the Danian cycles of Zumaya (Spain) and the Campanian ones of Bidart (SW France) and the Aptian deposits from La Marcouline (SE France).

The originality of this work lies in the use of a method of granulometric separation of the main carbonate particles which, (1) allows the characterization and quantification of the compositions of the carbonate phases of both lithologies and (2) gives access to the geochemical signatures of similar carbonate (bio-) particles in each lithologies.

The quantifications showed quite important proportions (up to 70% of the carbonated phases) of particles without specific microstructures (carbonate macrocrystals and micarb). Their geochemical signatures show that they mainly result from fine fragmentation of biogenic producers (Punta Piccola, Zumaya, La Marcouline) except in the campanian section of Bidart sediments in which they correspond to allochthonous particles.

Based on these interpretations, we have separated two groups of limestone-marl alter-

nations:

(1) Those dominated by the biogenic particles, in which we distinguish two cases:

- Both lithologies are dominated by a single taxa (Punta Piccola, La Marcouline).
- Each type of lithology display distinct biological assemblages (Zumaya).

(2) Those dominated by micarb (Bidart). In that case, micarb are present in equivalent proportions in both lithotypes.

The calcareous nannofossil geochemical signatures clearly show that in all the studied sections (biogenic and micarb dominated) environmental variation records have been preserved. However, the fluctuations of the ocean surface conditions have differed from a section to another according to each paleogeographic contexts, biological species and climates.

Moreover, differential diagenesis processes did not have significant impact on the geochemical signature of bulk carbonate.