Palaeogeography, Palaeoclimatology, Palaeoecology
Volume 232, Issue 1, 8 March 2006, Pages 1-35

doi:10.1016/j.palaeo.2005.08.009 Cite or Link Using DOI

Sequence biostratigraphy and paleoenvironmental reconstruction in the Early Eocene Figols Group of the Tremp–Graus Basin (south-central Pyrenees, Spain)

Stefano Torricelli, **Gabriella Knezaurek and Ulderico Biffi**
ENI S.p.A. Exploration & Production Division, via Emilia 1, 20097 San Donato Milanese, Italy
Received 15 September 2004; revised 26 August 2005; accepted 30 August 2005. Available online 2 November 2005.

Abstract

The dinoflagellate cyst, palynofacies and foraminiferal records from the Early Eocene Figols Group of the Spanish Pyrenees exhibit major changes associated with relative sea-level fluctuations and variations in efficiency of the fluvial systems. The mixed siliciclastic–carbonate marine succession exposed in the Merli–Esdolomada area was deposited on the shelf in a tectonically active basin, under oxic conditions, in shallow to moderately deep marine waters (close to the lower boundary of the photic zone) influenced by river discharge from adjacent emerged lands. Sedimentary cycles are mainly recorded by fine-grained deposits. The paleoenvironmental interpretation of palynological and calcareous microfaunal records allows the definition of depositional sequences and enables to trace basinward surfaces identified in more proximal settings by means of sedimentological facies analysis. At the same time, the solid regional stratigraphic framework already available for the Figols Group allows new insights on the paleoecology of extinct taxa.

The Merli–Esdolomada section (ME) spans two 3rd order sequences. The upper sequence reflects more marginal marine conditions than the lower one, thus pointing to an overall shallowing trend with time. In the lower sequence the maximum flooding interval is characterised by a rich and diverse microfauna, highest relative abundances of marine phytoplankton and typically neritic dinoflagellate cyst (dinocyst) assemblages dominated by *Spiniferites* and *Cordosphaeridium*. The final phase of the highstand systems tract, in proximity of the main sequence boundary, is characterised by a decrease in abundance and diversity of dinocysts, with the dominance of the lagoonal genus *Polysphaeridium*, and by decreased microfaunal diversity (discorbids, miliolids, larger foraminifers).

Palynological records permit the reconstruction of activation and deactivation phases of the fluvial systems, variations in runoff from the hinterland, nutrient delivery to the sea and productivity in surface waters of the Tremp–Graus Basin. The overall abundance of *Spiniferites* and the scarcity of peridinioid cysts, *Lingulodinium*, *Pediastrum* and *Botryococcus* algae are interpreted to indicate oligotrophic conditions during the deposition of the investigated succession. Recurrent intervals where the temporary disappearance of *Spiniferites* corresponds to highest relative abundances of *Operculodinium* and herbaceous debris are the main evidence for river plumes and denote periods of enhanced fluvial discharge reflecting a Milankovitch-type cyclicity. The *Rotalia* group, which shows abundance peaks of *Cuvillierina* spp. in the shallower intervals, is often associated with these episodes, thus suggesting for this taxon more tolerance to turbidity than larger foraminifera. Within the maximum flooding zone, a *Thalassiphora patula* acme corresponding to the local disappearance of *Homotryblium* is deemed to record the distal expression of a fluvial activation which triggered water salinity stratification. Despite broad morphological similarities, *Homotryblium* exhibits more cosmopolitan preferences than *Polysphaeridium*, which is instead confirmed as a lagoonal euryhaline taxon. The increase of *Spinizonocolpites* pollen toward the top of the Figols Group records the northwestward migration of *Nypa* mangrove-palms from southern Europe during the mid Early Eocene.

Keywords: Dinoflagellate cysts; Foraminifers; Paleoecology; Sequence stratigraphy; Early Eocene; Spanish

Pyrenees

Corresponding author. Tel.: +39 02 52056916; fax: +39 02 52061804.

Palaeogeography, Palaeoclimatology, Palaeoecology
Volume 232, Issue 1, 8 March 2006, Pages 1-35