Available online at www.sciencedirect.com
ScienceDirect
PALAEO
Palaeogeography, Palaeoclimatology, Palaeoecology 248 (2007) 145–168
www.elsevier.com/locate/palaeo

The Campo section (Pyrenees, Spain) revisited: Implications for changing benthic carbonate assemblages across the Paleocene–Eocene boundary

C. Scheibner [a,*], M.W. Rasser [b,1], M. Mutti [c,2]

[a] *Universität Bremen, FB5, P.O. Box 330440, 28334 Bremen, Germany*
[b] *Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart, Germany*
[c] *Universität Potsdam, Institut für Geowissenschaften, P.O. Box 601553, 14415 Potsdam, Germany*

Received 19 May 2006; received in revised form 17 November 2006; accepted 4 December 2006

Abstract

The Campo section is a parastratotype section for the shallow-water Ilerdian and Cuisian stages. Although a lot of work has been concentrated during the last years on biostratigraphy, sequence stratigraphy, magnetostratigraphy, and geochemistry, surprisingly little work has been published on the facies development. Here we evaluate the facies evolution with particular emphasis on the biogenic assemblages of the latest Paleocene (shallow benthic zonation 4) to the earliest Eocene (shallow benthic zonations 5 and 6) of the Campo and the nearby Serraduy section. Overall, the facies show a deepening in the Paleocene and the Eocene, interrupted by a terrestrial interval across the newly defined Paleocene/Eocene boundary. In the late Paleocene altogether seven microfacies types were distinguished. These are dominated by various algal taxa and subordinate corals and larger foraminifera. The lower Eocene carbonate platform is characterised by twelve microfacies types, which are dominated by larger foraminifera such as alveolinids, orbitolitids and nummulitids and subordinate corals. This facies dichotomy recognized in the Campo and Serraduy sections can be extrapolated to the whole Pyrenean region in the early Paleogene and is even found in Egypt. The comparison of the two regions shows that the facies dichotomy is less pronounced in the Pyrenean region. This is interpreted to reflect a latitudinal trend, where corals are absent in the low latitudes, while in the middle latitudes they occur subordinately. This gradient within the facies distribution can be explained by latitudinal temperature changes and by the long-time warming in the early Paleogene and the short-time warming of the Paleocene Eocene Thermal Maximum. Hot temperatures in the low latitudes hamper the growth of temperature sensitive corals, while in the middle latitudes the temperatures were still in a favourable temperature range.

Keywords: Paleocene; Eocene; Campo; Serraduy; Platform evolution; Larger foraminifera; Corals; Microfacies

1. Introduction

During the last few years, the Paleocene/Eocene boundary time interval has been the focus of several studies, which have dealt mainly with the timing of the Paleocene/Eocene Thermal Maximum (PETM) (Norris

* Corresponding author. Fax: +49 421 218 4515.
E-mail addresses: scheibne@uni-bremen.de (C. Scheibner), rasser.smns@naturkundemuseum-bw.de (M.W. Rasser), mmutti@geo.uni-potsdam.de (M. Mutti).
[1] Fax: +49 711 8936 100.
[2] Fax: +49 331 977 5060.

0031-0182/$ - see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.palaeo.2006.12.007

and Röhl, 1999; Röhl et al., 2000) and its impact on marine and terrestrial environments. The PETM is associated with a sharp negative δ^{13}C excursion (carbon isotopic excursion, CIE; e.g., Dickens, 1999) that probably resulted from rapid dissociation of methane at the sea floor (Dickens et al., 1995; Bains et al., 1999). Open marine microfossils (planktic and benthic foraminifera, dinoflagellates, calcareous nannofossils) show extinction and diversification patterns (e.g., Thomas, 1998; Crouch et al., 2001; Kelly, 2002; Bralower, 2002), the most prominent being the benthic foraminifera extinction event (BEE; Pak and Miller, 1992), during which approximately 40% of all smaller benthic foraminifera became extinct. On land the terrestrial vertebrates show a well-documented rejuvenation (Maas et al., 1995).

In contrast to studies on the impact of the PETM on open marine and terrestrial environments, only few studies exist regarding its impact on shallow marine environments. Orue-Etxebarria et al. (2001) and Pujalte et al. (2003a) investigated this time interval in the Pyrenees (northern Tethys) and concluded that the impact of the PETM on the evolution of the benthic faunas in shallow-water environments may have been greater than previously thought, but did not state any possible causes for this relationship. Recently, Scheibner et al. (2005) analysed Paleocene/Eocene sections in the Galala Mountains in Egypt (southern Tethys) and suggested an interplay between rising temperatures and changes in the trophic resource regime and their effects on biota (especially corals and larger foraminifera) and long-term evolutional changes in larger foraminifera as the main causes for the changes in shallow-water facies. Furthermore, for the Egyptian platform they postulated an evolution of the shallow-water platform across the Paleocene/Eocene boundary in three successive stages, characterised by changing biota. The two Paleocene stages are characterised first by a coralgal-dominated platform and second by a larger foraminifera-dominated platform (mainly *Miscellanea* and *Ranikothalia*). The boundary between the second and the third stage is the newly defined Paleocene/Eocene boundary. The third platform stage is characterised by abundant alveolinids, nummultids and orbitolitids (Scheibner et al., 2005).

Apart from studies on the ecological impact of the PETM, several old and new sections around the world, especially in Spain, have been investigated over the last few years to establish the Global Stratotype Section and Point (GSSP) for the Paleocene/Eocene boundary. Particularly, the Campo section in the Spanish Pyrenees has been investigated in great detail concerning this potential selection. The Campo section in Spain is the Ilerdian and Cuisian parastratotype (Schaub, 1966; Molina et al., 1992; Schaub, 1992): Hottinger and Schaub (1960) described the Larger Foraminiferal Turnover (LFT, Orue-Etxebarria et al., 2001) for the first time in Campo. The LFT marks the base of the Ilerdian (Hottinger and Schaub, 1960; Hottinger, 1998) and is characterised by the start of adult dimorphism and a large shell size in the larger foraminifera especially the nummulitids and alveolinids. Because of the importance of this shallow-marine section and the search for a GSSP, the Campo section was recently re-examined magnetostratigraphically by Pujalte et al. (2003b),

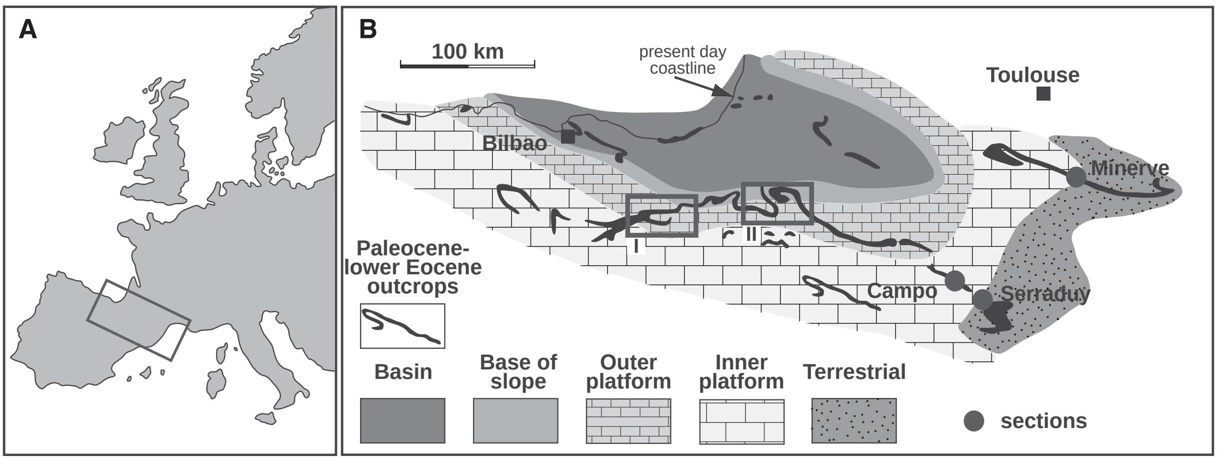

Fig. 1. Location and paleogeography of the Pyrenean area, modified after Orue-Etxebarria et al. (2001); A: recent location of the Pyrenees, the rectangle marks the position of the Pyrenees; B: paleogeographic reconstruction of the Pyrenean basin. I: Reefs of the Urbasa–Andia plateau (Baceta et al., 2005; see Fig. 6), II: location of the Urrobi and Mintxate sections of Pujalte et al. (2003a). The two sections of this study, Campo and Serraduy and the section of Minerve from Rasser et al. (2005) are indicated by dots.