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Ongoing Cenomanian — Turonian heterozoan carbonate production in the neritic settings of Peru

J.P. Navarro-Ramirez [a,b,*], S. Bodin [a], A. Immenhauser [a]

[a] Ruhr-Universität Bochum, Institut für Geologie, Mineralogie und Geophysik, D-44870 Bochum, Germany
[b] Geological Survey of Peru (INGEMMET), San Borja-Lima, Peru

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ABSTRACT

The present paper reports on the sedimentological and geochemical record of Albian–Turonian neritic carbonates from the eastern subequatorial Pacific domain in Peru. The focus is on one of the most extreme carbon cycle perturbations of the Phanerozoic, the Oceanic Anoxic Event 2 (late Cenomanian–early Turonian). Thanks to the very expanded and well-exposed sections in Peru, the OAE2 interval was sampled at high temporal resolution for both bulk micrite and bulk organic matter carbon isotopes. Despite the scarcity of significant amounts of organic matter or evidence for oxygen deficiency, the $\delta^{13}C$ curve matches well with global published high-resolution data for coeval successions such as those reported from the English Chalk and the Portland # 1 core. Biostratigraphic data and the detailed sequence stratigraphic interpretation of these sections are combined with the carbon-isotope chemostratigraphy documented here. Applying the characteristic peak and trough chemostratigraphic terminology for OAE2 (A–C), the following main environmental and carbon isotope stratigraphic features are observed from the late Albian to the early middle Turonian in Peru: (i) An Albian to early late Cenomanian heterozoan ramp recording the pre-OAE2 $\delta^{13}C$ excursions, specifically the Mid-Cenomanian Event. (ii) A late Cenomanian trough of $\delta^{13}C$ values (B) showing a progressive deepening leading to the short-lived establishment of middle ramp type sedimentation. (iii) A late Cenomanian to early Turonian $\delta^{13}C$ plateau (C) characterised by benthonic inner ramp sedimentation during a sea-level highstand phase. (iv) A recovery of $\delta^{13}C$ values at the end of OAE2 associated to a trophic change, increased influx of argillaceous facies and reduced carbonate production. (v) A early to middle Turonian fluctuating $\delta^{13}C$ curve, linked to a maximum flooding phase in the *Mammites nodosoides* Zone and carbonate production during the *Collignoniceras woollgari* Zone. The data shown here are particularly relevant as they come from very expanded neritic sections in the sub-equatorial eastern Pacific. Many of the features recognized share important similarities with Tethyan and Atlantic sections whilst the ramp system as such did not suffer from a carbonate crisis during OAE2 as recorded, for instance, in Mexico and Tibet.

1. Introduction

The mid-Cretaceous strata recorded one of the most extreme carbon cycle perturbations of the Phanerozoic (Oceanic Anoxic Event 2 = OAE2), characterised by widespread organic-rich black shale deposition and a positive $\delta^{13}C$ excursion (Schlanger and Jenkyns, 1976; Jenkyns, 1980; Schlanger et al., 1987). Since four decades, a considerable amount of research has focused on the causes and consequences of OAE2. Previous studies were mainly focused on Tethyan and proto-Atlantic hemi-pelagic and pelagic settings (e.g., Arthur et al., 1985, 1988; Elder, 1985, 1989; Pratt, 1985; Pratt et al., 1985; Kennedy and Cobban, 1991; Cobban, 1993; Kauffman, 1995; Dean and Arthur, 1998; Bowman and Bralower, 2005; Gale et al., 2005; Friedrich et al., 2006; Jarvis et al., 2006, 2011; Sageman et al., 2006; Voigt et al., 2006, 2008; Mort et al., 2007a,2007b; Meyers et al., 2012; Du Vivier et al., 2014, 2015; Ma et al., 2014; Gambacorta et al., 2015). Despite a significant bulk of published data, the underlying controls of OAE2 are still debated, but during the two past decades a linkage between massive volcanism and OAE has been suggested (e.g., Larson, 1991; Larson and Erba, 1999; Mort et al., 2008; Du Vivier et al., 2014; Bodin et al., 2015).

The Cenomanian–Turonian OAE2 was preceded by the Mid-Cenomanian Event I (MCEI; Paul et al., 1994; Coccioni and Galeotti, 2003; Keller et al., 2004; Gertsch et al., 2010b; Giraud et al., 2013; Andrieu et al., 2015). The MCEI is defined by two positive $\delta^{13}C$ peaks separated by a trough (MCEIa, MCEIb; Mitchell et al., 1996; Gertsch et al., 2010b; Giraud et al., 2013; Andrieu et al., 2015). Contrary to OAE2, MCEI is not characterised by organic-rich black shale deposition, but is recorded in Tethyan and North Atlantic settings as a major perturbation in carbonate platform productivity (Giraud et al., 2013). The Mid-Cenomanian Event I is also linked to a major sea-level fall recorded

* Corresponding author at: Ruhr-Universität Bochum, Institut für Geologie, Mineralogie und Geophysik, D-44870 Bochum, Germany. Tel.: +49 234 32 2325.
E-mail address: Juan.NavarroRamirez@rub.de (J.P. Navarro-Ramirez).

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