

Stratigraphic completeness of the Bonarelli Level (OAE 2, central Italy) constrained by high-resolution $\delta^{13}\text{C}_{\text{org}}$ records

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Oceanic Anoxic Event 2 (OAE 2; ~94 Ma) represents a major global carbon-cycle disturbance, although its stratigraphic signature shows marked variability across different depositional environments (Jenkyns, 2010). Within the Umbria-Marche Basin (central Italy), OAE 2 corresponds to the Bonarelli Level, a carbonate-depleted interval that limits the use of carbonate-based isotopic proxies as well as calcareous microfossil and nannofossil biostratigraphy. Consequently, both the duration and the stratigraphic completeness of this unit remain contentious (Tsikos et al., 2004; Voigt et al., 2007; Gambacorta et al., 2015).

In this study, we present a new high-resolution organic carbon-isotope ($\delta^{13}\text{C}_{\text{org}}$) dataset obtained from two Bonarelli Level sections, and we compare these records with coeval, well-constrained OAE 2 successions from other basins. The resulting isotope profiles indicate that the full carbon-isotope excursion characteristic of OAE 2 is preserved within the Bonarelli Level, albeit in a condensed stratigraphic interval. This interpretation differs from previous models that proposed a significant hiatus near the top of the unit.

Consistent trends in total organic carbon (TOC) and lithofacies across the studied sections indicate a basin-wide depositional signal. Altogether, our results support an updated palaeoceanographic framework in which the Tethyan Umbria-Marche Basin during OAE 2 was characterized by persistently anoxic to euxinic conditions, favouring the preservation of marine organic matter and intermittent reworking of radiolarian-derived biogenic silica.

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