Obliquity pacing of the hydrological cycle during the Oceanic Anoxic Event 2

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The Oceanic Anoxic Event 2 (OAE2, ca. ~93.5 Ma) represents a major phase of environmental change during the Mesozoic, and is associated with a pronounced positive excursion in the carbon-isotope record. Short-term climate oscillations within the OAE2 are recorded as Milankovitch cycles, which have been used to establish a precise temporal framework for the OAE2. However, few studies discuss the sedimentary expression of Milankovitch cycles during the OAE2, and its paleoenvironmental implications. Here we present carbonate and organic-carbon isotope data from a biostratigraphically well-dated, organic-rich OAE2 interval in a sedimentary succession outcropping in the Briançonnais Domain at Roter Sattel (Fribourg Prealps, Switzerland). We sampled the OAE2 interval (4.28 m) for proxies of detrital sediment quantification (Al, Ti, magnetic susceptibility) at ultra-high resolution (1 cm). Time-series analysis of multiple detrital proxies permits the construction of an orbital timescale for the OAE2 based, for the first time, on the stable 173 kyr (s3–s6) obliquity modulation cycle. The resulting OAE2 orbital timescale at Roter Sattel is consistent with previous timescales obtained in the Western Interior Basin, and in southern Tibet (China). Our cyclostratigraphic results show an unusually strong obliquity signal during the initiation of OAE2. Previous studies have demonstrated that the onset of OAE2 was associated with magmatic pulses coupled with increases in atmospheric pCO_2, followed by an overall, gradual drawdown of CO_2. Accordingly, we suggest that detrital input during the OAE2 was the result of intensified continental weathering related to magmatic activity, the substantially release of greenhouse gases, and an accelerated hydrological cycle modulated by obliquity cycles.

Keywords: OAE2, s3–s6 orbital timescale, obliquity forcing, continental weathering, hydrological cycle.

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