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# Astronomical forcing in the Eocene-Oligocene boundary stratotype section, Massignano, Italy

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The Massignano section located in the Umbria-Marche region, in the Monte Conero area on the Adriatic coast of central Italy is the Global Stratotype Section and Point (GSSP) for the Eocene-Oligocene (E/O) boundary. The 23-m thick exposed section consists of alternating reddish/greenish-gray marls and calcareous marls of the upper part of the *Scaglia Variegata Formation* and lower part of the *Scaglia Cinerea Formations* (the E/O boundary is placed at the 19-m level). The cyclic lithological succession is punctuated by three iridium-rich impactoclastic layers and some biotite-rich levels of volcanic origin (Montanari *et al.*, 1993 and references therein). A high-resolution environmental magnetic record has recently been retrieved from the E/O section at Massignano (Jovane *et al*, 2004) suggesting that the existence of alternating intervals with high and low magnetic mineral concentration might be primarily related to a climatic modulation or external forcing mechanism that appears to correspond to the 400-ky long-term eccentricity cycle. As a similar pattern of rock magnetic property variations was observed for the CIROS-1 sediment core from Antarctica, it is thought that the global climate change prior to the major Oi-1 cooling event at the E/O boundary is paced by astronomical forcing.

Here we use some of the rock magnetic parameters in addition to the CaCO3 content from the Massignano high-resolution record (samples taken at 5 cm intervals) to investigate in more detail the full relationship between astronomical forcing and apparent lithologic cyclicity. Data is analyzed both at the depth and the time domains using magnetobiostratigraphic chronological constraints through standard spectral analysis and the continuous wavelet transform technique. A recent integrated paleoceanographic study (Coxall *et al.*, 2005) from classic equatorial Pacific Ocean Deep Sea Drilling Project sites encompassing the E/O transition indicates that Earth's orbital

configuration was the ultimate trigger for Oi-1 and the pacemaker for ice-sheet growth in Antarctica. In that study, the initiation of a steep change on the isotope records marking the E/O boundary occurs during an interval of low eccentricity and low-amplitude change in obliquity as defined by the latest Earth's long-term astronomical solutions (Varadi et al., 2003; Laskar et al., 2004). This offers us the possibility to assess in further detail the lithological cyclicity from the E/O interval from Massignano and to attempt a detailed tuning.

Coxall *et al.* (2005). Nature, 433, 53-57.
Jovane et al. (2004). Geophys. Res. Lett., 31, L15601, doi:10.1029/2004GL020554
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Montanari *et al*. (1993). Palaios, 8, 420-437.
Varadi *et al*. (2003). Astrophys. J., 592, 620-630.