Geophysical Research Abstracts
Vol. 18, EGU2016-18054, 2016
EGU General Assembly 2016

Bridging the Middle Eocene timescale gap: astronomical tuning from IODP Expedition 342 North Atlantic basin

Slah Boulila (1), Maximilian Vahlenkamp (), Jacques Laskar (), David De Vleeschouwer (), Heiko Paelike (), and Yuhji Yamamoto ()

(1) Pierre et Marie Curie University, (2) University of Bremen, (3) Paris Observatory, (4) University of Bremen, (5) University of Bremen, (6) Kochi University

Abstract

The Middle Eocene timescale is not definitively, orbitally tuned because of the paucity of cyclic carbonate-rich sediments in deep-marine sections. The Middle Eocene (Magnetochrons C21 through C18n) equivalent sediments in the North Atlantic Southeast Newfoundland Ridge (IODP 342, Sites U1408 and U1410) exhibit carbonate-rich sequences, that are not present in a large part of the global ocean. This was because the very shallow carbonate compensation depth (CCD) during this period of time, when IODP 342 sites were sediment drifts, deposited at paleodepths above the CCD.

Carbonate-rich cyclic sequences at Sites U1408 and U1410 are expressed as prominent alternations (couplets) of greenish nannofossil clay and white nannofossil ooze, fingerprinted in several physical and chemical proxies. The principal lithologic couplet has an obliquity origin, and are strongly modulated by low-frequency cyclicities. These long-period modulations are well expressed throughout all the cores, and high-resolution (2 cm) XRF (X-ray fluorescence) Ca/Fe data proxy of these cores has significant signal-to-noise ratio, and digitally reveal and magnify such modulations, thus principally used for time-series analysis and orbital tuning.

We first tested the stability of low-frequency obliquity modulation cycles s3–s6 (∼173 kyr) and s4–s3 (∼1.2 Myr period) using several recent astronomical solutions. Results show that these orbital components are very stable upto ∼56 Ma, and are powerful geochronometer for this portion of Cenozoic timescale. We then used the s3–s6 frequency to perform a semi-absolute astronomical tuning.

We first tuned Ca/Fe variations to a 173 kyr period, then we anchored the 173 kyr tuned Ca/Fe time-series at an age of a well-defined magnetochron boundary (e.g., C19r age base), finally we refined the tuning age at the s3–s6 astronomical component. Such procedure resulted in unprecedented resolution of Magnetochrons C21n through C18 timescales. Comparison with previous studies points towards a stable Middle Eocene timescale.

Keywords

Middle Eocene timescale, North Atlantic, SE Newfoundland Ridge, obliquity forcing, s3–s6 modulation cycle, astronomical timescale.