Geophysical Research Abstracts
Vol. 18, EGU2016-12955-1, 2016
EGU General Assembly 2016

Astronomical forcing on 'mid-Cretaceous' C isotopic record in the Western Tethys

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Simulated calcium carbonate content obtained from high-resolution sedimentological logs (Gambacorta et al., 2014) were used as input data for the probabilistic cyclostratigraphic analysis (slightly modified from Malinverno et al., 2010) of four upper Albian – lower Turonian Tethyan sections from the Umbria-Marche Basin (Furlo, Contessa, Le Brecce, Monte Petrano). The orbital tuning based on short eccentricity and obliquity shows synchronous sedimentation rate variations throughout all the studied sections. Sedimentation rate increases immediately after the Mid-Cenomanian Event I (MCE I) (5–6 m/Ma to 7–9 m/Ma) before progressively decreasing in the interval preceding the OAE2 (4–6 m/Ma) and reaching a minimum in the Bonarelli Level (about 3m/Ma). The estimated sedimentation rate model allowed to date the Cenomanian δ13C record from the four studied sections (Gambacorta et al., 2015), using as a tie point the absolute age of 93.55 Ma at the Cenomanian/Turonian boundary.
An astronomically dated composite δ13C record spanning the interval 94–112 Ma was obtained joining our Cenomanian δ13C record with the Albian δ13C record of Giorgioni et al. (2012) obtained at the same location and data from the Albian interval of the Piobbico core published by Tiraboschi et al. (2009). Giorgioni et al. (2015) noted high-amplitude cycles corresponding to the 400kyr period of long eccentricity associated with the Albian interval before the OAE1d. Such cyclicity terminates at the shift from the Scaglia Variegata mud-dominated to the Scaglia Bianca chalk-dominated sedimentation in the latest Albian. An evolutive wavelet spectrum of our composite δ13C record confirms the transition between long-eccentricity cycles in the Albian ($\sim$112–103.5 Ma) to the Cenomanian where these cycles are weak or absent ($\sim$103.5–94 Ma). We interpret this change as a consequence of the expansion of the Hadley Cell during a time of general warming, that induced a transition from an unstable humid climate with frequently changing fluxes between oxidized and reduced carbon reservoirs to more stable arid climatic conditions with reduced runoff and a chalk dominated sedimentation.