Geophysical Research Abstracts
Vol. 16, EGU2014-5742-1, 2014
EGU General Assembly 2014

Precession-driven cyclicity in the northern part of the Guadalquivir Basin (SW Spain) before and during the Messinian Salinity Crisis: Chronostratigraphic framework for Mediterranean-Atlantic exchange

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The volume of evaporite deposits in the Mediterranean during the Messinian Salinity Crisis (MSC) requires an on-going supply of sea water from the Atlantic. The location of the connecting corridor(s) at this time however remains elusive. One possibility is that the Guadalquivir Basin at the western end of the Betic Strait linked the Atlantic and Mediterranean during the MSC. The Messinian sediments deposited here are largely preserved in the sub-surface. Recent results based on paleobathymetric and magnetostratigraphic data from two boreholes indicate that this region accumulated marine sediments continuously, right up until the Miocene-Pliocene boundary (Larrasoaña et al., 2008; Pérez-Asensio et al., 2012a). These boreholes, located at the north-western margin of the Guadalquivir Basin, have been dated in a low resolution chronostratigraphic framework using magneto- and biostratigraphy (Larrasoaña et al., 2008) and by extrapolation using global, obliquity-driven, glacial records (Pérez-Asensio et al., 2012b).

We hereby present a high-resolution chronostratigraphic framework for these two boreholes (Montemayor and Huelva) using cyclostratigraphy and additional bio-events. Cyclostratigraphic results were obtained using high resolution XRF data. We correlate patterns in the elemental composition of the sediments between the two boreholes and subsequently tune them to the astronomical solution. From these results we have interpreted that the cyclic sedimentary features are the result of oscillations in carbonate input and dilution, forced by precession and obliquity. Remarkably, we see the phase relation between various proxies change throughout the core, which we try to explain by a gradual change in the sedimentary setting. Besides, we can accurately locate the position of the Miocene-Pliocene boundary within these boreholes, and relate changes in sedimentation rate and phase relation to major events within the Mediterranean Basin (e.g. onset of the MSC and deposition of halite).

This study will provide a high resolution chronostratigraphic framework for further research on these boreholes, e.g. environmental magnetism and geochemical analyses, which will hopefully result in a better understanding of the flow of water masses through this potential corridor.

Keywords:
Betic Corridor, Guadalquivir Basin, Cyclostratigraphy, XRF, Messinian Salinity Crisis.

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