



Late Miocene lake-level fluctuations and phase-relation with orbital parameters: a sediment petrographic study of the Cascante del Rio section, Teruel Basin (NE Spain)

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During the Miocene, a long record of alternating siliciclastic and lacustrine carbonate sediments was deposited in the hydrologically closed basin of Teruel (NE Spain). The studied succession displays lithological sequences on metre to formation scale. In a siliciclastic interval, meter-scale lithological variations between red to green floodplain mudstones and palustrine to lacustrine limestones in the Cascante section are precession controlled, as proven by the bio- and magnetostratigraphy. Lithological characteristics based on outcrop observations, however, do not show convincing eccentricity related variations and therefore phase relations with the orbital parameters could not be unambiguously determined and an astronomical tuning established.

To solve this problem, detailed microfacies analysis of the palustrine and lacustrine limestones was performed. Two facies groups, related to the relative depth and energy of the lake system, were distinguished, which in turn could be subdivided into several sub-facies. The limestone beds from the lower part of the section indicate a very shallow 'unstable' lake with fluctuating water levels. A clear 100- and 400-kyr eccentricity signal could be distinguished implicating an orbital control on the depositional system of the lacustrine and palustrine limestones. These data confirmed the inferred phase relations with the orbital parameters and the astronomical tuning based on the magnetostratigraphy.

Towards the top of the siliciclastic interval, the limestone beds show more stable lake environments with higher lake levels. Moreover, the intercalated floodplain mudstones gradually disappear in between thicker limestone beds and finally the succession grades into a thick lacustrine unit. A detailed sedimentological and stratigraphical study of the lacustrine unit is required to reconstruct the dominant tectonic or climatic forcing mechanism of this major transition.