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Integrated Stratigraphy and Paleoceanographic Reconstruction for the Messinian Sedimentary Sequence in a Marginal Sector of the Eastern Mediterranean: Agios Myron Section (Crete Island)

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The Messinian was a period of drastic paleoenvironmental and paleoceanographic changes in the Mediterranean. During this time interval, tectonic processes together with glacio-eustatic sea level oscillations led to the Mediterranean isolation from the Atlantic Ocean triggering the formation of thick evaporite successions during the so-called "Messinian Salinity Crisis" (MSC, 5.97-5.33 Ma; Krijgsman *et al.*, 1999; Roveri *et al.*, 2014). Studies of Messinian sediments preserved in marginal and/or peripheral Mediterranean sub-basins have provided much information on the sedimentology, cyclostratigraphy, palaeontology, and geochemistry of that period (Karakitsios *et al.*, 2017a,b; Moissette *et al.*, 2018; Antonarakou *et al.*, 2019; Vasiliev *et al.*, 2019). Especially the cyclic bedded biosiliceous deposits of the Tripoli Formation that preceded the MSC (6.96-5.98 Ma) records an important depositional change that occurred after the monotonous deposition of Tortonian to lowermost Messinian marls in deep open marine conditions, and consists of lithological alterations of marls, limestones, diatomites and organic-rich sapropelitic layers. Overall, this typical Late Miocene cyclic succession likely resulted from orbitally-driven variations in freshwater input due to the African Summer Monsoon modifications, reflects precessionally-controlled dry-wet climate fluctuations influencing the hydrological budget of the entire Mediterranean Sea (Rohling *et al.*, 2015).

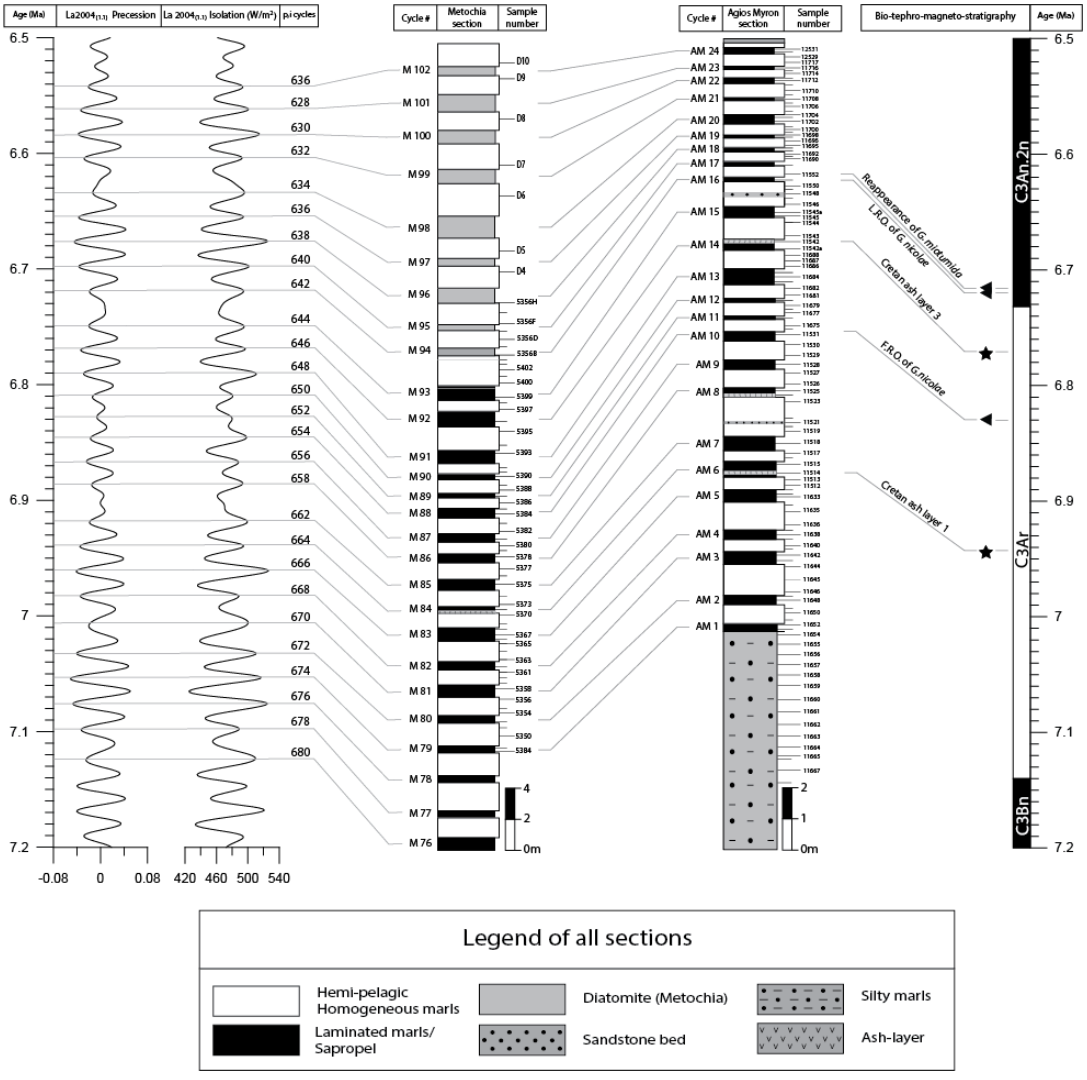

Figure 1. Cyclostratigraphic correlation between Metochia and Agios Myron sections

We present the first continuous non-diatomaceous Messinian record in eastern Mediterranean based on the combined sedimentological, micropaleontological, and geochemical approach, recovered from sampling the Agios Myron section.

The study section, is located in the north-central Crete, and consists of a continuous, pelagic sedimentation (alternations of hemipelagic homogenous marls and sapropels) covering the ~7.2-6.5 Ma time interval. To ascertain the potential correlation between the increase in calcareous sediments on Crete and the beginning of the diatomite sequences on Gavdos, we further compare our results from the time-equivalent interval with one of the most suitable, well-astronomically dated, and complete Miocene sections in the Mediterranean Sea, the Metochia section (Schenau *et al.*, 1999; Drinia *et al.*, 2007). An integrated correlation between Agios Myron and Metochia sections is shown in Figure 1. The sections were correlated using their characteristic sedimentary cyclic pattern, planktonic foraminiferal biostratigraphy and the ash layers. Both sections were characterized by the same sedimentary cluster pattern, with the only difference of the presence/absence of the diatomite sequence at the top. The characteristic sedimentary cycles have been also correlated to the astronomical target curve, in particular the precession interference pattern in isolation curve. Astronomically calibrated biostratigraphic events were used as reference points in order to check the correct sequence of sedimentary cycles. We have identified 3 planktonic foraminiferal bioevents: the First and the Last Common Occurrence (FCO and LCO) of *Globorotalia nicolae* and the re-appearance of *Globorotalia miotumida* group (Fig. 1). We also detected two different tephra layers in the Agios Myron section: the Cretan ash-layers 1 and 3 which have an astronomical age of 6.941 Ma and 6.771 Ma respectively (Hilgen *et al.*, 1997; Kuiper *et al.*, 2004).

The resulting integrated stratigraphy for the lower Messinian at Agios Myron, including biostratigraphy, cyclostratigraphy, and tephrostratigraphy, is consistent with both bio- and magneto-stratigraphic dated pre-MSC sections in eastern Mediterranean Sea. Finally, we further complement this study with stable isotope ($\delta^{18}O$, $\delta^{13}C$) and distributional planktonic foraminiferal data with the aim to monitor the mutual interplay between paleoclimatic/paleoceanographic evolution and the sedimentary environment across the pre-MSC time interval in this marginal setting.

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