MEDITERRANEAN PROTO-SAPROPELS IN THE MIDDLE MIOCENE: IMPLICATIONS FOR THE STRENGTH OF THE AFRICAN MONSOON AND LINK TO MIOCENE GLACIATIONS

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The strength of the African monsoon is known to have played a major role in determining sedimentation patterns in the Mediterranean during the Plio-Pleistocene. Increased meteoric water input by strong monsoons reduced surface water salinity, and the resulting slower water-mixing rate triggered the deposition of organic-rich layers called "sapropels". Here we present some proxy data coming from a mixed siliciclastic-carbonate section outcropping on the Maltese Islands that suggests that sapropels deposits already existed in the Middle Miocene. This implies that an enhanced monsoonal climate was likely active at that time. Our primary evidences for the existence of "proto-sapropels" are runoff proxies (clay mineral assemblages and abundance) coupled with oxygen isotopes. These indicate that a direct link existed between increased runoff Ű regarded here as a proxy for the strength of the Monsoon- and Miocene global climate (Antarctic glaciation). Each Miocene phase of glaciation is reflected in the section as an increased flux of continental-derived material. Moreover, stable isotopes of carbon and C_{org}:N_{org} ratio analyses of organic matter revealed a higher mixing rate of terrigenous and marine organic matters during times of increased sedimentation. This is in good agreement with a monsoon model where increased sedimentation is linked to increased continental runoff. Spectral analysis of the section revealed the presence of Milankovitch-scaled cycles with a strong 100 k.y. frequency. Astronomically calibrated age model for the section shows that the African

monsoon has probably initiated around 16.7 Ma and underwent a major strengthening around 13.8 Ma, a time corresponding to enhanced siliciclastic deposition on the Malta-Ragusa platform and to the global cooling phase of the Mi3 Antarctic ice-buildup phase. We argue that the strong coherence between Miocene glaciation phases and increased runoff into the Mediterranean is due to a link between Antarctic cooling, Northward migration of the ITCZ due to increased thermal gradient, and enhances precipitation over North Africa.