A MILANKOVITCH CLIMATE CONTROL ON THE MIDDLE MIOCENE MEDITERRANEAN INTERMEDIATE WATER: EVIDENCE FROM BENTHIC MICROFAUNA AND ISOTOPE GEOCHEMISTRY OF THE RAS IL-PELLEGRIN COMPOSITE SECTION (MALTA ISLAND, CENTRAL MEDITERRANEAN)

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The marly sediments of the Blue Clay Formation in the upper part of the Middle Miocene Ras il-Pellegrin composite section (Malta island, central Mediterranean) have been investigated by integrated analysis of benthic microfauna and planktonic and benthic oxygen isotopes. The astronomical calibration of the whole section, obtained by using the astronomical solution of Laskar et al. (1993), indicates for deposition of the analysed sediments a time interval ranging between 13.75 and 12.32 Ma (Sprovieri et al., 2002). This time interval is useful to investigate the oceanographic evolution of the (paleo)Mediterranean after the interruption of communications between the Mediterranean and Indo-Pacific areas. This important paleogeographic event, estimated at about 16 Ma by Johnson (1985) and at about 14.5 Ma by Woodruff and Savin (1991), represented the first step of a progressive oceanographic evolution of the Tethys region water masses towards present Mediterranean conditions. A comparison of long-term planktonic and benthic d18O trends suggests that the
intermediate outflowing Mediterranean water (proto-MIW), originated in the surface eastern zone of upper Langhian – lower Serravallian (paleo)Mediterranean, had hydrographic and hydrodynamic features similar to those of the present Levantine Intermediate Water (LIW).

Focusing our attention on benthic species which can be considered the best recorders of variation of proto-MIW production, we elaborated benthic data by Q-mode vari-max principal factor analysis. Spectral analysis was carried out only on two factors which have a clear paleoecological significance: Factor 1 (loaded by Cibicidoides ungerianus and Siphonina reticulata) indicative of oxic bottom waters and Factor 2 (loaded by Bulimina elongata group) indicative of oxygen stressed conditions. Results of these analyses show that Factor 1 and Factor 2 curves are respectively in and out of phase with maxima of the eccentricity (100 and 400 kyr). Factor 1 is interpreted as a tracer of high production of proto-MIW, during periods of high eccentricity and, probably, precession minima, characterized by coldest winter seasons.

These results point out a direct link between selected benthic species, long term astronomical forcing, and deep water response and provide an useful tool for astronomical calibration of geological time and paleoceanographic reconstructions.

REFERENCES