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Coccolithophores, CO_2, Sapropels and Climate: clues from a core in the Ionian Sea.

Alessandra Negri (1) and Alan Maria Mancini (2)

(1) Scienze della Vita e dell'AmbienteUniversita' Politecnica delle Marche , Ancona, Italy (a.negri@univpm.it), (2) Scienze della Terra, Università degli Studi di Torino, Torino, Italy (alanmariamancini@gmail.com)

A high-resolution abundance and biometrical Coccolithophore study was performed in core M25/4-12 (Ionian Sea) containing the sapropel S1. By comparison of these data to $\delta^{18}O$, the main climatic events characterizing this period have been recognized, such as the Last Glacial Maximum (LGM), the Younger Dryas and the Max Monsoon.
Some clues can be depicted after the study of the assemblage. In fact an important feature reported in literature is the correlation existing among the five younger sapropel (S1-S5) deposition and the increase in atmospheric CO_2 content (Negri et al., 2012). The authors hypothesized a local response of the systems to carbon removal from the oceanic water masses during the interglacial periods (CO_2 uptake in ocean increases during glacial periods).
According to the literature, the CLT account for the 10% of phytoplankton biomass and the shift observed in the assemblage characterizing S1 indicate that across this event 90 % of the assemblage consisted of E. huxleyi. Mesocosm study demonstrated that this specie is furthermore able to secrete Trasparent Exopolymers Particles (TEP), and as all the forms characterized by a calcareous test they promote the so-called Ballast effect. We suggest that enhanced TEP production increasing the aggregation of organic carbon, the protection offered by $CaCO_3$ platelets to avoid the organic matter degradation and the ballast function for the organic matter sinking were crucial for the S1 formation and for the decrease of the atmospheric CO_2 level at the end of S1 deposition. This because model studies (Klaas and Archer, 2002) suggest that 33% increase in organic matter was sufficient to draw down the CO_2 in the seawater by approximately 60 ppm. Then Coccolithophore possibly played a key role in this process and in agreement with the Gaia hypothesis (Lovelock 1979), when the atmospheric CO_2 level increases, the biotic component of the ecosystem attenuates the effects sequestering organic carbon (Sapropel) in the sediment whose fate otherwise was to re-enter in the global carbon cycle.

References

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