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Evidences for paleoproductivity and paleoceanographic conditions in Eastern Mediterranean based on C and N isotopic composition

D. Gallego-Torres (1), F. Martínez-Ruiz (1), A. Paytan (2), O. Romero (1), F.J. Jiménez-Espejo (1), M. Ortega-Huertas (3)

(1) Instituto Andaluz de Ciencias de la Tierra CSIC-Universidad de Granada, Spain, (2) Geological and Environmental Sciences Department, Standford University, USA, (3) Departamento de Mineralogía y Petrología, Universidad de Granada, Spain (davidgt@ugr.es / Fax: +34958243384 / Phone: +34958248535)

The sedimentary record of the Mediterranean Sea is characterized by the cyclic deposition of sapropels and organic rich layers. Sapropels contain higher than 2% of organic carbon, and represent very different conditions from the present day oligotrophic condition. These sapropels, as a whole, show evidences of being deposited during periods of significantly higher primary productivity, which could also be the reason for the lower dissolved oxygen content in the water column, as evidenced by different proxies. However, the comparison between sapropels from different time spans confirms that there is a progressive shift toward lower productivity since the Pliocene to Holocene. A co-evolution of progressively better oxygenated waters is also observed. In this paper we present evidences for these paleoceanographic conditions mainly based in bulk organic matter C and N isotopic compositions, and C:N ratios, for a transect along eastern Mediterranean, combined with data minor and trace elements. The organic matter mostly shows marine characteristics for the Holocene sapropel layer. Isotopic composition of C and N, as well as redox and productivity proxies indicate relatively higher primary productivity and lower oxygen availability compared to present day conditions. However C:N values tend to disperse towards higher values for Pleistocene and Pliocene equivalents, suggesting terrestrial organic matter input. On the other hand, this is coincident with the tendency of very low values of N isotopic composition for progressively older sapropels. These evidences point toward a high productivity related to cyanobacteria and N-fixing organism, normally

linked to sub-oxic waters. Under these conditions, a selective degradation of the settling organic matter would increase the C:N values, all of which is consistent with inorganic proxies, such as Ba excess (for productivity) or redox-sensitive trace metals. Carbon isotopic composition also evidence marine organic matter, with minor influence of terrestrial organic matter input. Besides, a slight increase in the C isotopic ratio during sapropel formation suggests a higher rate of utilization of dissolved CO2, and thus, higher productivity, consistent with N-isotopes data. This behaviour is consistent along this transect and during the whole analyzed time period. Considering that sapropels are deposited during climatic periods of higher precipitation, all mentioned evidences are coherent with a higher river runoff and extra input of N and other nutrients to the basin, allowing an increase of productivity that would mean a higher oxygen use, and thus lower oxygenation along the water column.