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High Resolution Geochemical Investigation of Selected Late Pleistocene Sapropels of the Mediterranean Sea: Productivity versus Preservation

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Previous studies demonstrated that marine barite formation correlates with surface water productivity. Because of its relative resistance to degradation and dissolution during deposition and early diagenesis, barite (or the element barium) has been used successfully for reconstruction of paleoproductivity.

For this study, several cores have been recovered along an east-west transect in the Eastern Mediterranean Sea during two Meteor cruises. Sapropel S5 and S6 and homogeneous sediments above and below have been analysed by XRF for major, minor, and trace elements, and selected samples by ICP-MS for trace and rare earth elements. To characterise the main sources (catchment areas) of terrigenous components of the marine sediments during sapropel formation, we also analysed the isotopic composition of strontium ($^{87}Sr/^{86}Sr$) and neodymium ($^{143}Nd/^{144}Nd$).

Barium concentration is very high in sapropel layers and it covaries with total organic carbon contents. We find no indication of barium mobilisation and interpret the concentration curves as primary signals of accumulation from vertical transport. The ratios of Ti/Al, Zr/Al and Y/Al are lower in the sapropel than in adjacent calcareous muds. While redox-sensitive elements (V, Mo, Sb, Ni, Cu) are enriched in sapropel intervals, the rare earth elements (REE) are depleted. Light REE (LREE) are more depleted than heavy REE (HREE). Homogeneous sediments adjacent to sapropels are characterized by higher $^{87}Sr/^{86}Sr$ and lower $^{143}Nd/^{144}Nd$ ratios while the sapropel intervals show the opposite, i. e. lower strontium and higher neodymium isotopic ratios.

We conclude that sapropel formation was accompanied by enhanced productivity in the photic zone, as indicated by the very high barium concentration. At least the deeper water column was anoxic, enabling preservation of the enhanced organic matter flux. Because the borderlands were more humid, the eolian contribution to the terrigenous component was reduced during sapropel formation. This is shown by the ratios of Ti/Al, Zr/Al and Y/Al and strontium und neodymium isotope ratios. The pronounced influence of riverine particulate matter of basaltic composition is clearly indicated by isotopic signal of Sr and Nd. However, the lower concentration of the HREE suggests that river suspension was reduced at time of sapropel formation, which can be explained by denser vegetation cover of the catchment area.