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Trace metal patterns in Black Sea sapropels as a chemostratigraphic tool

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During R/V Meteor expeditions M51/4 (2001) and M72/5 (2007) several gravity cores and multicorer cores were recovered with complete and well-preserved Holocene sediment. These sediments comprise the last glacial stage (Unit III), the transition to the interglacial/marine stage (Unit II) and the recent sapropel (Unit I), which represents the today's marine stage. The sapropels were sub-sampled in high resolution (millimeter scale) and analyzed by XRF and ICP-AES for major and minor elements. Ages of surface sediments were estimated by Pb-210, verified by Cs-137, and served to calculate sedimentation rates, which vary from 0.02 to 0.15 cm/yr. We found well defined peaks in enrichments patterns of redoxsensitive elements (e.g. Co, Cr, Cu, Fe, Mo, Ni, U, and V) during deposition of sapropels indicating special events in the history of the Black Sea. For example, the Fe/Al depth profiles show several independent peaks above the Unit III-Unit II-boundary, indicating the movement of the suboxic redoxcline in the Black Sea basin during the transition from the limnic to the marine stage. High Fe/Al ratios seem to document that the redoxcline impinged the broad shelf area, where Fe can be mobilized from the sediment. A low Fe/Al ratio on the other hand implies that the redoxcline was situated at a deeper level at the slope, thus preventing Fe mobilization and creation of Fe-peaks. The Fe-peaks may serve as chemostratigraphic age markers for the recent sapropel because they are present in almost all cores we investigated. Our geochemical data as well show increasing trace metal enrichments with increasing water depth during Unit I, but almost constant basin-wide enrichments in several trace metals in Unit II. This presumably is due to limited inflow of marine water, which serves as a trace metal source and a not fully established redoxcline. On basis of excess-Ca, bulk Sr/Ca and Ti/Ca the paleoclimate can be reconstructed and shows the alternating warm and cold events during the glacial period and the transition to the Holocene interglacial in the Black Sea. This can parallelized with the paleoproductivity, as represented by TOC, Ba, P, Ni and Cu, which shows increased deposition/preservation of organic matter during the warmer periods in the Black Sea.