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Identifying depositional and post-depositional processes using high-resolution elemental distribution in sedimentary cores from the Eastern Mediterranean and Black Sea

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The Mediterranean Sea is an extremely complex system, subdivided in several basins interconnected by often very shallow straits and sills. As a result, its sediments can amplify the geochemical signal of both climate and sea level changes. Thus, together with its eastern marginal basins - the Marmara and Black Seas - the Mediterranean Sea provides us with a natural laboratory for paleoenvironmental studies.
Climatically-driven changes in paleoenvironmental conditions are often reflected in the relative abundance of major and minor elements (e.g., Wehausen and Brumsack, 1998). Hence, their variation in marine sedimentary sequences may provide high-resolution records of past environments.
Here we present two examples of ultra-high resolution geochemical studies on sedimentary cores from the upper Pleistocene-Holocene of the Eastern Mediterranean (core SIN97-01GC) and Black Sea (core MedEx05-10), and their application in paleoceanographic reconstructions. Ultra high-resolution qualitative analyses of major and minor elements (Mn, Fe, Ca, Mg, Al, Sr, Cl, Ti) were performed on macroscopic contiguous samples (average spacing between analytical points was 0.35 mm) by X-ray microfluorescence (µ-XRF), using an EDAX Eagle III XPL µprobe with an analytical spot size of 50 µm.
The geochemical characterization of core SIN97-01GC (Cretan Ridge, Eastern Mediterranean) provides evidence of the diagenetic alteration of sapropel S1. Spectral analysis on this very high-resolution proxy record further allowed us to identify high-frequency millennial to decennial-scale solar cycles. The latter suggests that climate in the Mediterranean region during sapropel S1 deposition was paced by solar variability even at short periodicities (Gennari et al., 2008).
The elemental distribution on core MedEx05-10 located in the south-western Black Sea shelf allows to separate two main intervals. According to the Ca and Ti/Ca contents, that reflect variations in biogenic/authigenic calcite versus siliciclastic terrigenous input (e.g., Bahr et al., 2005, 2006), these levels have been preliminary correlated to the classical basinal Units (I to III) of Hay et al., 1991. Although these lithological units are usually not recognizable in shelf sediments due to their high sedimentological variability, the feasibility of wide shelf-basin correlations in the Black Sea has already been proven by means of other proxies (e.g., calcareous nannoplankton, Giunta et al., 2007). Even if our results must be confirmed by the ongoing micropaleontological analysis and AMS 14C dating, the elemental distribution may possibly allow to track the shift from fresh/brackish to low-salinity marine conditions on the south-western shelf.

Our approach confirms the usefulness of µ-XRF scanning as a fast and non-destructive methodology for achieving detailed information on both depositional and post-depositional history of the sedimentary record. Furthermore, it suggests that the μ-XRF scanning technique can be used in order to obtain high-resolution records suitable for the identification of meaningful periodicities.

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References

Bahr A., Lamy F., Arz H., Kuhlmann H., Wefer G., 2005. Late glacial to Holocene climate and sedimentation history in the NW Black Sea. Marine Geology, 214, 309-322.

Bahr A., Arz H., Lamy F., Wefer G., 2006. Late glacial to Holocene paleoenvironmental evolution of the Black Sea, reconstructed with stable oxygen isotope records obtained on ostracod shells. Earth and Planet. Sci. Lett., 241, 863-875.

Gennari G., Tamburini F., Ariztegui D., Hajdas I., Spezzaferri S., 2008. Geochemical evidence for high-resolution variations during deposition of the Holocene S1 sapropel on the Cretan Ridge, Eastern Mediterranean. Palaeogeography, Palaeoclimatology, Palaeoecology. doi: 10.1016/j.palaeo.2008.06.007.

Giunta S., Morigi C., Negri A., Guichard F., Lericolais G., 2007. Holocene biostratigraphy and paleoenvironmental changes in the Black Sea based on calcareous nannoplankton. Marine Micropaleontology, 63 (1/2), 91-110.

Hay B.J., Arthur A.M., Dean W.E., Neff E.D., Honjo S., 1991. Sediment deposition in the Late Holocene abyssal Black Sea with climatic and chronological implications. Deep Sea Research, 38, 1211-1235.

Wehausen R., Brumsack H.J., 1998. The formation of eastern Mediterranean sapropels: constraints from high-resolution major and minor element studies. In: Robertson, A.H.F., Emeis K.-C., Richter C., and Camerlenghi A. (Eds.). Proc. ODP, Sci. Results, 160: College Station, TX (Ocean Drilling Program), 207-217.