High Resolution Investigation of the Geochemical and Mineralogical Composition of 1 Ky Old Euxinic Sediments of the Western Black Sea

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Introduction: The euxinic (anoxic) sediments, due to the absence of any bioturbation, represents an excellence storage medium for the past environmental changes. It is the case of the Black Sea, the greatest meromictic basin of the world, whose water, below a thin layer of oxygenated water, is completely devoid in oxygen and saturated in hydrogen sulfide. Consequently, to get more information concerning the recent evolution of the western Black Sea catchment basin, a 50 cm core containing unconsolidated euxinic sediments was thoroughly analyzed for its geochemistry and mineralogy.

Methods: The core was collected eastward of the Romanian city of Constanta, a depth of 600 m, by using a using a Mark II-400 type corer. After being collected, the 12 cm diameter core was examined by means of a Siemens Somatom HQ Computer Tomograph and sliced into about 45 segments, 5 mm to 5 cm thick. The digital radiography showed an alternation of 254 horizontal, millimeter thick and almost parallel laminae of coccolithic and argilaceous mud, undisturbed by biotic activity. Each segment was dehydrated, homogenized and divided in more aliquots, for further Epithermal Neutron (ENAA) and Prompt Gamma-ray (PGAA) Activation Analysis, radiometric assay as well as mineralogical investigations.

Results: Both ^{137}Cs and ^{210}Pb absolute geochronology suggested a sedimentation rate of 0.46 ± 0.04 cm/y which allowed estimating the age of the oldest sediments at 1.08 ± 0.06 ky. Detailed investigation of the sediment mineralogy has showed that carbonates (40 to 80 %) and clay (8 to 57 %) represent the major components while quartz, gypsum, glauconite and infrequently microorganism tests (1 to maximum 3 %) were the minor ones. Traces of other minerals such as titanite, rutile, and zircon were also identified. Both ENAA and PGAA allowed determining the content of eight major (Na, Cl, Al, Si, K, Ca, Ti, Fe) and 33 trace elements (S, Sc, V, Cr, Mn, Co, Ni, Zn, As, Se, Br, Rb, Sr, Zr, Mo, Sn, Sb, Cs, Ba, La, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Yb, Hf, Ta, W, Th and U).

Discussion: Major components distribution shows that, excepting Cl and CaO, the contents of all other elements are very close to Upper Continental Crust while Principal Component Analysis evidenced three clusters consisting of Na, K and Cl, Al, Ti and Fe and respectively Ca. The distribution of 33 trace elements showed similarities to the UCC, excepting for redox sensitive metals U, Mo and at a lesser extent Fe whose contents were 4 to 10 times higher, reflecting the relative stability of the euxinic conditions during the last 1 ky. A chondrite normalized plot of nine REE evidenced the presence of a significant Eu negative anomaly, confirming the continental origin of sedimentary material. At the same time, the vertical profile of Zn, As, Sb, Se, Br as well as of the La/Th ratio presented increased content towards the sediment surface suggesting the development of the anthropogenic influence in the past 150-200 y, *i.e.* the period of accelerated industrialization of both European countries and Russia, all of them partially or totally belonging to the Black Sea catchment basin.

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