Geochemistry of superhigh-organic-sulfur Raša coal (Croatia), with an emphasis on the rare earth elements

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The Raša coal from Istria belongs to a special type of superhigh-organic-sulfur coals, with an organic sulfur content of 11%, preserved within the succession of marine carbonates. Previous studies attributed the formation of superhigh-organic-sulfur Raša coal to the seawater percolation [1]. However, recent geochemical data on the rare earth element distribution in Raša coal ashes [2,3] suggested that the Raša coal-bearing strata, representing the Upper Paleocene lacustrine and brackish facies, were also influenced by the hydrothermal solutions under conditions which led not only to sulfur enrichment but also to the rare earth elements accumulation.

To confirm the latter, geochemical and mineralogical analysis were performed on samples of Raša coal seam and surrounding carbonates. Multielement analysis was performed by High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS) using an Element 2 instrument (Thermo, Bremen, Germany). All samples were analyzed for total concentration of 19 elements (Al, Ti, Mn, Fe and the rare earth elements, including Y). Mineral composition of samples was investigated by X-ray diffraction (XRD) and electronic scanning microscopy (SEM).

The obtained geochemical and mineralogical data provided new insights into the processes influencing Raša coal formation, confirming the impact of both the seawater and the hydrothermal solutions.

[1] White *et al.* (1990). Geochemistry of sulfur in fossil fuels, ACS Symposium Series; American Chemical Society, Washington, DC, **429**, 261-286. [2] Fiket *et al.* (2016) *Environ Earth Sci* **7**, 598-1-598-9. [3] Fiket *et al.* (2018, under review) *Int J Coal Geol.*