Geochemical indicators of the fine sediments sources in a coal-bearing Danubian Watershed. Application to Jiu river basin, Romania

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The paper aims to investigate the provenance of riverine sediments within Jiu River basin (10,070 km^2), located in SW Romania, on the basis of a geochemical approach. The study area stands out for its complex morphology and lithology, as well as for the existence of extensive mining areas (both bituminous coal and lignite).

With regard to the upstream-related sediment sources and intermediate storages, the field strategy involved sampling the subsurface bed material from dam reservoirs and from Jiu River and its main tributaries, complemented by with bulk coal sampling from quarries and tailings dumps. Further downstream, a bank deposit on Jiu River was sampled. The sediment layers deposited during the greatest floods were distinguished by granulometric and geochemical analyses.

In a first step, about 30 geochemical tracers determined by Rigaku Supermini X-ray Fluorescence Spectrography were used to characterize the geochemical composition of sediment samples. Concentrations of the most relevant elements were then retained for descriptive statistics. Based on their abundence, the main indicators (Zr/Si, Ti/Fe, Cu/Fe, Cu/S, Ca/Mg, Na/K, different Lanthanides/P ratios) were further correlated with the underlying lithology by means of non-parametric statistical tests. To illustrate this point, titanium distribution revealed ilmenite-rich sediment sources, with the Ti/Fe ratio noticeably higher for sediments collected from the Motru and Jilț tributaries draining mining basins. This evidence also made it possible to correlate the distribution of heavy metals and lanthanides with the different proportions of the two coal species, determined by densimetric separation. As to the downstream riverbank deposit, information gathered from the geochemical indicators helped associating the sediment layers with historical hydrological events.

The results can serve as a basis for the next stages of management planning of Jiu River Basin, to ensure compliance with the EU Water Directive, particularly with its provisions concerning the prioritization and inclusion of measures for controlling the mobilization and delivery of riverine sediments to the Danube River.