Using coal and heavy minerals content for identifying fine sediments sources in Jiu River Basin (Romania)

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The research focuses on the hydro-sedimentary dynamics of the Jiu River basin (10,070 km^2), a tributary of the Danube River, originating in the Romanian Carpathians. The main objective is to identify the most contributing subwatersheds and sediment sources involved in the hydro-sedimentary transfer. A special feature of the study area is the presence of still operating coal mines and quarries (hard coal exploitation in the upper part of the river basin and lignite in the middle sector), contributing to the fine sediments production. The research is based on the geochemical analysis of sediment samples collected from a vertical profile on a Jiu River's point bar close to Podari hydrometric station (downstream from any sediment source, 50 km upstream from the outlet). Using the stage - discharge approach combined with granulometric and colorimetric analyzes, we identified 11 sediment relatively homogenous layers.

We assumed that each of these layers corresponds to an overflowing flood, which enabled us to investigate the source of these alluvial deposits, by means of geochemical methods. The collected samples were subjected to coal speciation by measuring the apparent density and volatile matter and to the identification of the heavy metal content by XRF spectrometry. The methodological hypothesis was that each subcatchment collects water and sediments from an area with a specific geological context.

By analyzing the coal and heavy elements content, valuable information has been obtained on the sources of fine sediments (i.e. the sub-basins or areas of origin of the sediments that are stored downstream on the main river). Based on the geochemical fingerprinting, it was possible to estimate the proportion of sediments from different sources in a given layer of the vertical profile. Along with coal, the most useful heavy elements for distinguishing between various source areas proved to be Ti, Zr, Fe, Cu, Zn, Pb, lanthanides and rare specimens.

The results showed that the variation in the hardcoal content and lignite is not linear, which highlights the different contributions from non-coal or coal-producing sub-basins. On a smaller scale, the analysis of heavy elements allowed us

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to identify areas marked by industrial activities or specific lithological patterns involved in the hydro-sedimentary dynamics.