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Reservoir-river-sea system sediment geochemistry in Fiumi Uniti catchment from Apennines to Adriatic Sea

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Sediment samples were collected in 2019 from Fiumi Uniti catchment in Italy in an area between the Romagna Apennines and the Adriatic Sea. The sampling phase included the collection of sediments from the Ridracoli reservoir, a large artificial basin located at 480 m a.s.l. made by construction of a dam on the Bidente river and used as the main drinking water supply of the region and for hydropower production, as well as river sediments within the whole catchment that includes the dam (Bidente, Ronco and Fiumi Uniti rivers and tributaries) and marine sediments from the Adriatic sea. In addition, we collected in the reservoir area rock and soil samples to define the element behaviour during weathering and transport.

Here we report data on chemical concentrations from different matrices within the area of Ridracoli reservoir as well as chemical characterization of sediments downstream the dam along the rivers. The chemical analyses were carried out at the State Key Laboratory of Marine Geology in Shanghai, where samples underwent a two-step digestion to assess the mobile and residual fraction using a first leaching step with 1N HCl and a second one with pure HNO_3 and HF, respectively.

The chemical differences between rock, soils and sediments inside the reservoir showed a system of element mobility that can be compared to the geochemistry of surrounding sediments to assess pathways of geochemical cycles of elements. The ratio between concentrations of different matrices shows an enrichment in soils compared to rock for some elements (>1.3; Li, V, Cr, Mn, Sr, Cd, U) and slightly depletion in lake sediments compared to rocks (0.8-0.9). The REE ratio between lake sediments and other matrices (i.e., rocks, soils, and stream sediments) equals to 0.7-0.8, while for other trace elements (Li, V, Mn, Fe, Ni) is 1.1-1.2 showing an opposite behaviour.

More mobile elements assessed using the ratio between the first step of leaching and the total composition, are Mn (0.7 of extractability) and Sr (0.8) followed by Co, Cu, Se Cd and Pb (around 0.3-0.4). The more stable elements (higher in the residual) are Ti, Rb, Zr, Cs (max 0.015). Cu and Pb seems to be more mobile in sediments than rock and soil, whereas the mobility of other analytes

doesn't seem to be affected by the different matrices. REE are quite mobile showing good extractability for Eu, Gd, Tb, Dy. Spider diagrams of REE were normalized to PAAS (Post Archean Australian Shale) and show similar shapes with Gd peaks. A difference can be seen between rocks (values around 0.8 and 1.2) and sediments, with the latter showing higher values (1.2 and 1.4).

The importance of this study relies on the implications that human activities have on river systems thanks to sediment quality and on the functioning of the river-sea system in Romagna and specifically in Ridracoli reservoir catchment.

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