



Application of hydrologic-tracer techniques to the Rio Montevecchio (SW-Sardinia, Italy)

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Rio Montevecchio (Arbus, Sardinia, Italy), is a stream severely affected by highly impacting mine wastes (Piccalinna Impoundment) and its course is characterised by little vegetation and a rocky and pebbled streambed. The application of hydrologic-tracing techniques, in cooperation with the USGS, allowed to calculate large daily loads of mine-related constituents, exceeding 1700 kg/day

, 300 kg/day Zn, 55 kg/day Fe, and 45 kg/day Mn. Along the study reach, the cumulative loads reached 2045 kg/day for

, 356 kg/day for Zn 60 kg/day for Mn and 65 kg/day for Fe. Unsourced underground sources are responsible for more than 50% of

and Fe cumulative loads but only for 33% of Zn load.

Instream attenuation processes account for a 14% loss of Zn and

, and 89% and 77% for Al and Fe loads respectively. Powder X-ray diffraction analysis of stream precipitates coupled with geochemical modelling allowed to identify the newly-formed mineral phases responsible for heavy metals abatement but that could also be potential secondary sources of pollution; in particular, this study has identified alunite ($\text{KAl}_3(\text{SO}_4)_2(\text{OH})_6$) and K-jarosite $\text{KFe}^3_3(\text{OH})_6(\text{SO}_4)_2$ as the major players in SO_4^{2-} , Al and Fe loads attenuation. In comparison with nearby watersheds (Rio San Giorgio and Rio Naracauli), Rio Montevecchio features less effective biogeochemical barriers, but also contaminants sources that are not localised but widespread along the entire study reach. The discrepancy between discharge measured at the end of the study reach and at a slug injection point performed several kilometers downstream suggests that along that segment the stream might actively recharge underground water reservoirs.