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Mercury and arsenic in suspended particulate and sediments from the Fosso della Chiusa creek fed by the Galleria Italia mining drainage (Abbadia San Salvatore, central Italy).

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The Mediterranean area hosts three important mercury mining districts, which are presently abandoned and partially reclaimed: Almadén (Spain), Monte Amiata-Abbadia San Salvatore (Italy) and Idrija (Slovenia). The Galleria Italia (Italy) is the only mining drainage of the former mining area from Abbadia San Salvatore, which feeds the 2.5 km long Fosso della Chiusa. The Galleria Italia waters are circumneutral (pH \approx 6) and characterized by Ca(Mg)-SO₄ composition; TDS around 1000 mg/L; high concentrations of Fe, Mn and Al (18714.5, 493.3, 486.6 μ g/L, respectively) and dissolved CO₂. The high content of these elements is also present in the stream sediments. In the mining district area of Abbadia San Salvatore, the Galleria Italia-Fosso della Chiusa system is connected to a major riverine network: i.e. the Pagliola, Paglia and Tiber rivers. This work is aimed to (i) characterize the interaction of Hg and As between the water and sediment compartments in the Fosso della Chiusa by including the suspended particulate; (ii) estimate the total Hg and As mass load released by Galleria Italia and (iii) evaluate the total load discharged in the riverine network from the circumneutral mine drainage using the Igeo index. In 2020, during four sampling sessions, waters, sediments and suspended particulate were collected all along the Fosso della Chiusa creek. Each sampling station was located maintaining a relatively equidistance from the source to the confluence with the Pagliola river. Specific aliquots at 13 sites were collected to geochemically characterize the creek waters. Also, stream sediments were collected for determining the mineral composition and As, Hg, Sb while at the source and the mouth 2 L of waters were filtered at $<0.45 \mu$ m to measure the suspended material and the concentration of three chalcophile elements. A general decrease of the As content was observed along the creek in both waters and sediments, i.e. from 336 to 2 mg/kg and from 12 to 0.3 μ g/L, respectively whereas no a clear trend was recognized for Hg, where the higher contents being up to 105 mg/kg and 2.8 μ g/L, respectively. It is to mention that the reddish-whitish colour of the waters and sediments (due to the presence of oxy-hydroxide of Fe and, subordinately, Al and Mn) decreasing down to

about 1 km from the source, suggesting, as supported by the analytical data, that the presence of the toxic elements in both the solid and aqueous phase. This implies that the environmental impact by the Galleria Italia waters and related sediments is limited spatially at least for As, as also evidenced by the Igeo index applied to sediments for As and Hg, the former showing a general decrease from Class 6 ("extremely contaminated") to 1 ("non to moderately contaminated"). Differently, Hg in each sampling site belongs to Class 6. Nevertheless, the Igeo ranking suggests that As tends to be preferentially partitioned in the liquid phase whilst Hg is mainly enriched in the solid fraction. This contrasting behaviour of As and Hg is also analytically observed when the suspended particulate is considered.