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Potentially Toxic Elements (PTE) mobility assessment in stream and floodplain sediments in the Baiut Mining Area, Romania. Mass balance modelling using sediment chemistry and mineralogy data.

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Fluvial sediments have the capacity to concentrate chemical components and thus act as a sink for pollutants in the environment. Sediment monitoring is expected to offer cost efficient alternatives to conventional water monitoring for Hazardous Substances listed in EU Water Framework Directive (WFD), Guidance Document Nº 25. Direct exposure to acid mine drainage (AMD) and contaminated sediments discharged from abandoned metal mines poses a serious hazard to aquatic biota and to humans due to the adverse biological effects at all levels of biological organization from cellular to ecosystem-level responses. This study evaluated the mobility of trace elements (As and Pb) and major elements (Fe, Al, Mn and S) in stream and floodplain sediments as contamination receptors, and waste rock and rock formations as contamination sources in the catchment located at the historic Baiut mining area in Romania. Mineralogical composition determined with X-ray diffraction (XRD), particle size (Köhn method) and total element concentration (ICP-OES) were analysed, in addition to soil pH in floodplain sediments. Mineralogical examinations showed the weathering and eroding andesitic and sedimentary rock (marl) geochemical background is well represented by the dominating quartz (30-50%) together with some feldspar and plagioclase (3-15%) and some clay minerals (chlorite and illite). Typical to weathering polymetallic ores, waste dumps are abundance in illite and kaolinite, with pyrite, goethite, and hematite. Descriptive data analysis reported concentrations in the fluvial sediments between 0.6-2285 mg.kg-1 As, 13.20-7990 mg.kg-1 Pb, 35390-388000 mg.kg-1 Fe, 8200-86270 mg.kg-1 Al, 30-21530 mg.kg-1 Mn and 600-393000 mg.kg-1 S. The medians of enrichment factor (EF; contaminant concentration/background concentration) were in order of Pb (14.4) > As (11.1) > S (4.81) > Fe (1.59) > Mn (1.4) > Al (0.8). The total metal concentrations were higher in the stream sediments than in the waste rock dumps, in general. This suggests that the heavy metals accumulate in the stream sediments, most likely adsorbed to secondary minerals like goethite. Unlike in the active oxidizing stream channel sediments, arsenic had strong negative correlation with pH (0.76) and the clay fraction, while Pb had strong correlation with the silt fraction and no correlation with pH in the reducing floodplain sediments. This shows, that As is in a mobile form in the studied floodplain while Pb is immobile and most probably found in the physically weathered and transported original ore sulfide (eg. PbS) forms. Sediment contamination mixing models were also calculated for the stream confluences in the studied catchment.