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Solid-Phase Speciation and Mobility of Potentially Hazardous Elements (PHEs) in Tailings from European Lithium Mines: A Preliminary Assessment

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Lithium (Li) has become indispensable to our economies due to its role in Li-ion batteries used for electric mobility. Despite the anticipated 20-fold increase in demand for Li-based batteries [1], the EU relies on major Li producers such as Australia, Chile, and China. By 2025, two mines want to start Li production in Europe: one from the Barroso pegmatite in Portugal and the other from the Rapasaari pegmatite in Finland. Lithium recovery is also anticipated from the Beauvoir (France) and Saint-Austell (UK) rare-metal granites. Information regarding the solid-phase speciation and mobility of potentially hazardous elements (PHEs) in the tailings of these sites are crucial since they control the potential environmental risks associated to Li mining [2].

Here, we performed a series of leaching tests to characterize the mobility of metal(loid)s in ore and process samples of output streams (residues, tailings, concentrate) obtained from pilot-scale tests of Li beneficiation. Leaching tests conducted under variable pH indicated very low leaching under ambient environmental conditions. Strongly acidic conditions (0.5–2), result in a mobilisation of As, Cu and Zn, while strongly alkaline conditions (pH 13) result in the leaching of As in some samples. While these extreme pH conditions are not representative for ambient environmental conditions, they provide information on the solid-phase association of elements. The high correlation between the leached concentrations of P versus Cu and Zn ($R > 0.90$) combined with X-ray diffraction analyses on leaching residues suggests that the dissolution of apatite at low pH is responsible for their mobilization. Spatially-resolved chemical analyses will be conducted in order to identify the host phases for As. Additional leaching tests on process samples will also be performed in order to examine the impact of each stage of Li beneficiation on the mobility of PHEs.

[1] Xu et al., (2020), *Communication Materials* 1(1), 99 [2] Helser et al., (2022), *Journal of Hazardous Materials*, 424, 127313.