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Experimental Leaching Study of Lithium Ores in Various Environmental Acids

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Transitioning to a carbon-neutral future requires an increase in mining of metals used in the green infrastructure, such asLi [1]. Lithium production has nearly doubled between 2016 and 2020 [2]. There is limited information on the aqueous geochemical signatures near Li deposits and the changes due to their mining [3]. Elevated Li concentrations have been reported in creeks and rivers near Cínovec, Czech Republic, a Li-mica deposit [4], in fresh waters near a spodumene deposit in SE Ireland [5], and high Li concentrations are observed in a stream running through an active Portuguese spodumene mine [6]. Here, we expose four different Li ores (zinnwaldite; lepidolite; spodumene pegmatite; greisen rich in Li-mica) to four different environmentally common acids (dilute sulfuric acid; acetic acid; oxalic acid; deionized water as control solution) with the goal of understanding the potential Li release from these materials under these conditions. The experiment is set up to run for nine months.

After three months of the experiment (7/10 samples collected), we observe an apparent peak in Li (~4 mg/L) concentrations at the 1-month point. It is of note that the lepidolite sample behaves opposite to the other samples, having a minimum Li value (~0.6 mg/L) at the 1-month point. We interpret the decline in Li concentrations post peak value as being caused by the precipitation of secondary minerals such as clays, as shown in [7]. Our study also aims to include Si isotope analysis to understand the weathering rates, SEM and XRD analysis to characterize the precipitates, and PHREEQC thermodynamic modeling of the potentially precipitating secondary phases.

Our results will be applicable to hard-rock Li deposits as they showcase the potential release of significant amounts of Li into the environment, but also hint at the natural remediation process via secondary mineral precipitation.

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