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Water quality in a legacy lithium mining district of North Carolina

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As the search for new lithium deposits continues and new mines become permitted, understanding the potential environmental impacts of lithium mining is important to enable sustainable lithium extraction. Here we present new data on water quality of surface water and groundwater in a legacy lithium pegmatite mining district in North Carolina, USA. Analyses of groundwater and surface waters in the region (n=125) reveals trace elements concentrations typically below the U.S. EPA drinking water standards, while Li (mean: streams 9.2 µg/L, groundwater 127 µg/L), Rb (5.3 and 6.8 µg/L), and Cs (0.5 and 14.8 µg/L) levels are relatively high, consistent with their high concentrations in lithium-rich pegmatites. In particular, the streams draining a legacy lithium mine and a processing plant show marked increases in these elements above even the local background levels (Li>750 µg/L, Rb >25 µg/L, Cs >1-10 µg/L). Leaching experiments of rocks from the local geology including the lithium rich pegmatites and amphibolite demonstrate similar leaching geochemical characteristics with low contaminant (e.g., As) output yet large quantities of Li, Rb, and Cs are mobilized. The results from the leaching experiments indicate that Li is dominantly leached from phosphate minerals and spodumene, while Rb and Cs appear to be derived from K-rich micas and feldspars. While mining and processing have clearly increased the concentrations of these elements in local streams, none of these elements are regulated as contaminants and are often not reported in water quality studies. Given the increase in Li mining further investigations into the occurrence of Li, Rb, and Cs should be considered for areas of active or legacy lithium hard rock mining.