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Understanding of Lithium Origin in High Enthalpy Geothermal Systems: A Case Study for Tuzla and Seferihisar Geothermal Power Plants, Western Anatolia, Türkiye

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In recent years, technological developments in electric cars and high-energy-density batteries have increased the importance of lithium-ion batteries. Salt Lake deposits, pegmatite, and clay minerals are the main sources containing significant amounts of lithium worldwide. Geothermal brines are of particular interest for lithium extraction because they contain a variety of salts and metals that can be extracted and used as high-value byproducts of power generation. . Combined extraction of heat and minerals from geothermal reservoirs has several benefits: Compared to conventional mining, it minimizes environmental impacts, avoids additional land use, has near-zero carbon footprint and contributes to the autonomy on the supply of CRM.

In this context we evaluate the Tuzla and Seferihisar geothermal fields in western Anatolia, which have high enthalpy geological settings and contain significant amounts of dissolved Li^+. While Tuzla geothermal field is hypersaline brine type, Seferihisar geothermal field is low saline to seawater type. There is volcanic reservoir rock in Tuzla geothermal field and metamorphosed flysch reservoir rock in Seferihisar geothermal field. The Li^+ concentration in the geothermal fields can be as high as 24 mg/l and 13.4 mg/l, respectively. Considering that Li concentrations higher than 5-7 mg/l in geothermal waters are important for Li recovery studies, it is clear that there are metal-rich brines in the Tuzla and Seferihisar geothermal systems whose commercial exploitation is important. The objective of this study is to determine the source of critical elements in the brine and their mobility in order to predict the sustainability of the recovery and provide guidance for future exploration of new critical raw materials (CRM)-rich geothermal systems. Creating a database with the goal of evaluating the CRM content in geothermal brines, gases, and scales in these geothermal fields forms the methodology of the study.