

Assessment of co-production of Geothermal Energy and Critical Raw Materials in the East African Rift

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The CRM-Geothermal research project investigates the sustainable co-production of critical raw materials (CRM) and geothermal energy. The East African Rift System (EARS), offers significant geothermal potential due to Quaternary volcanism and fault-controlled fluid migration. In 2022 and 2023, expeditions in Tanzania and Malawi assessed the presence of e.g. Sr, Li, Mg, REE and He in geothermal waters, gases, and solids [1,2].

The surveys covered 44 sites from Lake Natron in Tanzania to the Malawi-Mozambique border, sampling hot springs, lakes, boreholes, and rocks. Physical and chemical parameters were measured in situ, and geological observations, infrastructure and land use documented. Geothermal boreholes in Tanzania were sampled for gas, water, and drill core rocks. In Malawi, only drinking water boreholes were drilled so far, with one suffered damage due to 55°C geothermal fluids.

Hot springs (26-78°C) across both countries exhibit alkaline pH (7.6-10.0), elevated carbonate alkalinity, chloride, fluoride, and potassium. The analysis of gas and noble geochemistry revealed He concentrations up to 7vol% in southern Tanzania and a maximum of 1vol% at two sites in Malawi. The basement geology comprises gneisses and granulites of the Tanzanian Craton, silica-undersaturated alkaline volcanics, and Karoo sedimentary rocks.

These cratonic geothermal fluids are suitable for extraction of geothermal heat. However, their low CRM concentrations render potential co-extraction economically challenging. Producing geothermal heat is a mature technology for local applications such as greenhouses, poultry farms, and drying kilns, potentially transforming local economies. The Mbaka Fault in southern Tanzania produces Sr-rich hot fluids, worth harvesting in addition to power and heat. In Malawi, the geothermal potential remains underutilized although local communities like in Mawira

take the advantage of 59°C hot water for bath, spa activities and laundry.

Harnessing this energy could provide sustainable local heating and diversify national energy sources, easing pressure on hydropower during climate extremes.

References

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[2] Wilke, Franziska D. H.; Gondwe, Kondwani; et al...(2025): Survey for critical raw materials in Malawi East African Rift geothermal areas. GFZ Data Services. <https://doi.org/10.5880/GFZ.DMJQ.2025.001>