Rare earth elements and Yttrium (REY) as fluid provenance tracers and geoindicators of reservoir processes in Bacman Geothermal Field, Philippines

VAL MAVERICK ABECIA[1]*, SIMONA REGENSPURG[2], MICHAEL BAU[3]

[1]Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany (*correspondence: abecia@uni-potsdam.de)
[2]Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences; Geothermal Energy Systems, Germany
[3]Department of Physics and Earth Sciences, Jacobs University Bremen, Campus Ring 1, Bremen, Germany

Current geochemical methods widely employed in geothermal exploration involve major element and stable isotope geochemistry, which proved to be effective tools to predict reservoir temperatures and characterize the deep geothermal fluids. However, their applicability and efficacy is limited by stringent chemical equilibria and steady state conditions.

The use of Rare Earths and Yttrium (REY) as potential geothermal exploration tools is still underexplored, although geothermal studies using REY are gaining momentum due to lower detection limits of new analytical technology and REY separation/pre-concentration protocols. REY geochemistry may be a supplementary exploration technique to determine the viability of geothermal resources for development, due to distinct REY fractionation patterns and REY anomalies corresponding to known temperature-, redox- and steady state equilibrium in water-rock interaction.

In this study, the potential of REY as natural tracers of fluid provenance and fluid migration, and as indicators of reservoir processes, physico-chemical environment and steady state equilibrium in water-rock interaction, are being investigated. Concentrations of major and minor elements and REY in samples from hotsprings, reservoir rocks, and deep well fluids from Bacman Geothermal Field, Philippines, are determined, and dissolved REY distributions are correlated to those of acid leachates of reservoir rocks from well core samples and to hotspring precipitates. The results may give an indication whether the hotsprings in the Bacman hydrothermal field are geochemically connected to geothermal wells using REY, how they reflect the processes during fluid outflow, and potentially narrow down the possible source rocks that the fluid had interacted with.