## Reactive transport modeling in peralkaline salic volcanic complex, caldera-hosted geothermal system; a case of Menengai volcano, Kenya

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Menengai geothermal area is one of high temperature caldera-hosted geothermal systems located in central part of Kenyan rift valley. The caldera together with local rift floor tectono-volcanic axes is considered essential in controlling the local movement of geothermal fluids in the area. Fluid-rock chemical interaction has gained more acceptance in recent years in geothermal application and there has been a growing particular attention in the coupled processes involved in reactive chemical transport in porous media. The current study attempts to develop a 1-D reactive transport model to assess fluid flow conduits and fluid interaction processes of Menengai geothermal field in Kenya. The model incorporates geothermal fluids, modeled from wellhead discharge chemistry to obtain the initial aquifer fluids feeding the reservoir. The resultant fluid was then injected into the model along an ascending porous media as the 'parent' fluid. Water chemical data from adjacent water borehole was included as the initial media fluid while pressure and temperature information are taken from well downhole measurements. The reservoir rocks are predominantly peralkaline, silica-oversaturated trachytes, with few lenses of tuffs, rhyolite, and basalt, thus, the initial mineral assemblage of the model taken to be of trachytic composition. The model was calibrated using observed field hydrothermal minerals. The simulation was performed using the parallelized version of TOUGHREACT v3 code that employs a sequential iteration approach that solves the solute transport and reaction equations separately. Flow and transport are based on space discretization by means of integral finite differences. An implicit time-weighting scheme is used for individual components of the model, consisting of flow, transport, and kinetic geochemical reaction. This study demonstrates the relationship between fluid flow, chemical reactions, and mass transport in a peralkaline salic volcanic complex, caldera-hosted geothermal system with a view of explaining the occurrence of hydrothermal minerals in up-flow zones in such systems.

Keywords: Menengai volcano, reactive transport, geochemical modeling, fluid-rock interaction, geothermal fluid