Geophysical Research Abstracts
Vol. 14, EGU2012-7212-1, 2012
EGU General Assembly 2012

Effect of Hydrothermal Alteration on Rock Properties in Active Geothermal Setting

P. Mikisek (1), G. Bignall (2), F. Sepulveda (3), and I. Sass (1)

(1) Technische Universität Darmstadt, Chair of Geothermal Science and Technology, Darmstadt, Germany (mikisek@geo.tu-darmstadt.de), (2) GNS Science, Wairakei Research Centre, Taupo, New Zealand (g.bignall@gns.cri.nz), (3) Contact Energy Limited, Wairakei Power Station, Taupo, New Zealand (fabian.sepulveda@contactenergy.co.nz)

Hydrothermal alteration records the physical-chemical changes of rock and mineral phases caused by the interaction of hot fluids and wall rock, which can impact effective permeability, porosity, thermal parameters, rock strength and other rock properties. In this project, an experimental approach has been used to investigate the effects of hydrothermal alteration on rock properties. A rock property database of contrastingly altered rock types and intensities has been established. The database details horizontal and vertical permeability, porosity, density, thermal conductivity and thermal heat capacity for ∼300 drill core samples from wells THM12, THM13, THM14, THM17, THM18, THM22 and TH18 in the Wairakei-Tauhara geothermal system (New Zealand), which has been compared with observed hydrothermal alteration type, rank and intensity obtained from XRD analysis and optical microscopy. Samples were selected from clay-altered tuff and intercalated siltstones of the Huka Falls Formation, which acts as a cap rock at Wairakei-Tauhara, and tuffaceous sandstones of the Waiora Formation, which is a primary reservoir-hosting unit for lateral and vertical fluid flows in the geothermal system. The Huka Falls Formation exhibits argillic-type alteration of varying intensity, while underlying Waiora Formations exhibits argillic- and propylithic-type alteration.

We plan to use a tempered triaxial test cell at hydrothermal temperatures (up to 200°C) and pressures typical of geothermal conditions, to simulate hot (thermal) fluid percolation through the rock matrix of an inferred "reservoir". Compressibility data will be obtained under a range of operating (simulation reservoir) conditions, in a series of multiple week to month-long experiments that will monitor change in permeability and rock strength accompanying advancing hydrothermal alteration intensity caused by the hot brine interacting with the rock matrix. We suggest, our work will provide new baseline information concerning fluid-rock interaction processes in geothermal reservoirs, and their effects on rock properties, that will aid improved understanding of the evolution of high-temperature geothermal systems, provide constraints to parameterization of reservoir models and assist future well planning and design through prediction of rock properties in the context of drilling strategies.