Geophysical Research Abstracts
Vol. 21, EGU2019-5725-2, 2019
EGU General Assembly 2019

Thermo-mechanical behavior of the granodiorite at the Liquiñe fractured geothermal system in the Southern Volcanic Zone of the Andes

Josefa Sepúlveda (1,2), Gloria Arancibia (1,2), Eduardo Molina (1,2), Jan Paul Gilbert (3), Mandy Duda (4), John Browning (1,5), Tomás Roquer (1,2), Diego Morata (2,6), Benedikt Ahrens (4), and Rolf Bracke (4)

(1) Department of Estructural and Geotechnical Engineering, Engineering School, Pontificia Universidad Católica de Chile, Santiago, Chile, (2) Andean Geothermal Centre of Excellence (CEGA, FONDAP-CONICYT), Universidad de Chile, Santiago, Chile, (3) Institute for Geology, Mineralogy, and Geophysics, Ruhr-Universität Bochum, 44780 Bochum, Germany, (4) International Geothermal Centre, Bochum University of Applied Sciences, 44801 Bochum, Germany, (5) Department of Mining Engineering, Engineering School, Pontificia Universidad Católica de Chile, Santiago, Chile, (6) Department of Geology, Universidad de Chile, Santiago, Chile

Fractures and faults in granitic rocks allow the circulation of hot fluids and therefore play an important role in geothermal systems. The fractures are affected by extrinsic factors such as confining pressure and temperature. An example of a granitic geothermal reservoir is located in the Southern Volcanic Zone (Chile, 33-46 ºS) where the North Patagonian Batholith (NPB) is composed of tonalitic to granodioritic rocks of Jurassic, Cretaceous and Miocene Age. The NPB is cut by the Liquiñe Ofqui Fault Sytem (LOFS) and the Andean Transversal Faults (ATF). The LOFS is an active intra-arc 1200 km long fault system with dextral and dextral-normal faults that strike NS-NNE to NE-ENE. The ATF include a group of active NW-striking sinistral faults and morphotectonic lineaments. In Liquiñe (39 ºS), several hot springs are located above granitoids of the NPB and they are spatially related to the LOFS and ATF. The aim of this study is to estimate how reservoir depth, low temperature thermal stressing and the rate and amount of mechanical loading influences the geomechanical and hydromechanical properties of granitoids typical for that region. For this, a sample of the Miocene granodiorite was selected, and different mechanical tests partially comprising heat-treatment at temperatures below 300 ºC were performed. Additionally, X-ray microtomography images were analyzed to estimate the permeability of the fractures.

The results indicated that triaxial compressive strength and Young's modulus tend to decrease with increasing temperature and decreasing strain rate. The numerically estimated permeability of developed fractures was similar between heated and non-heated samples, but a larger strain rate increased the macroscopic permeability. We conclude that the Liquiñe Geothermal fractured System hosts fluids which circulate through stress-induced fractures that are held open and further propagate when a critical limit stress is applied to the rocks.

This research was supported by projects FONDECYT #1180167 project, FONDAP #15090013 project "Centro de Excelencia en Geotermia de los Andes" (CEGA) and the VRI-PUENTE #P1703/2017 Project.