

Occurrence of rock fracture under the rapid decompression condition of hot water

*Nobuo Hirano¹, Satoshi Aoshima¹, Noriyoshi Tsuchiya¹

1. Graduate School of Environmental studies, Tohoku University

In our previous water-rock interaction experiments under the various hydrothermal conditions using granite or artificial quartz samples, clear cracks or fractures in the samples were observed under the specific hydrothermal condition. This phenomenon was derived by heat stress of cooling by evaporation of water. And, this cooling effect is caused by latent/sensible heat of water. So, it is possible to generate heat stress by rapid decompression of high pressure hot water around the rock samples. Understanding of details and application of this fracturing mechanism may be useful for technological development of geothermal reservoir usage or clarification of vein formation mechanism in the Earth crust. We tried to rapid decompression experiment using granite sample. Experimental sample has a borehole, and rapid decompression is started in borehole bottom. Experimental conditions are from 500 C - 30 MPa to 600 C - 45 MPa. After the experiments, we confirmed the fracturing around the borehole by X-ray CT. In addition, we observed porosity and p-wave velocity of experimental samples. As a result, Fracture and porosity were increased with temperature rising. Maximum porosity was 3.3 %. P-wave velocity was decreased with temperature rising. And, some sample's has a very low P-wave velocity that it is below water's P-wave velocity 1.5 km/s. These results indicate that it is possible to make fracture in rocks under the hydrothermal conditions with rapid decompression.

Keywords: rapid decompression fracturing, Water-Rock Interaction, granite, Hydrothermally Derived Fracture