Effect of mineral size and anisotropy of rock on the propagation of hydraulic fracture in supercritical geothermal environment

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In recent years, the importance of renewable energy has increased, and attention has been focused on supercritical geothermal resources in the field of geothermal power generation. Supercritical geothermal resources are fracture type reservoirs with supercritical water or superheated steam having a high specific enthalpy. In addition, recent studies have shown that supercritical geothermal resources can exist even in granitic ductile crust, which has traditionally been considered to have no supercritical geothermal resources [Watanabe et al., 2017]. However, considering the possibility that fractures are scarce and water permeability is insufficient, it is necessary to consider a method of artificially creating a reservoir. For example, methodology for fracture generation artificially includes a hydraulic fracturing method. From this, it is necessary to know in advance how fractures will be formed by hydraulic fracturing in a supercritical geothermal environment and what kind of fractures will be formed. In previous studies, hydraulic fracturing experiments were performed on granite specimens under the conditions from subcritical and brittle conditions to supercritical and ductile. According to the results of this study, in a supercritical geothermal environment or in an environment similar to it, the viscosity of the injected water decreased as the temperature increased and penetrated into existing fractures in the rock, and the existing fractures were opened as the pressure increased. It was suggested that network type fractures were generated by the process. However, there is concern that the mechanical anisotropy and the difference in particle size of granite may affect this process. Therefore, in this study, we focused on the difference in mechanical anisotropy and particle size of granite. As a result, it was clarified that the difference in mechanical anisotropy and particle size affects the fracture process and the morphology of the formed hydraulic fracture. The results also indicate that it is necessary to study the fracturing method according to the conditions of the reservoir formation site.