

# Effect of the hydraulic stimulation on hydraulic fracturing characteristics and gain in permeability of high-temperature ductile granite

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The creation of geothermal reservoirs in high temperature ductile rock has recently been suggested. However, the fracturing characteristics by the hydraulic stimulation under ductile condition of rock are not yet clear. In this study, hydraulic stimulation experiments on granite at temperatures of 200-450°C have been conducted by injecting water into cylindrical granite having a borehole at a confining pressure of 40 MPa. Formation of fractures was observed at all temperatures, but fractures were formed in different manner depending on temperature, perhaps due to different water viscosities. At the lowest temperature fractures propagated linearly from the borehole, and the borehole pressure required for the fracturing was much larger than confining pressure, similarly to hydraulic stimulation at room temperature. However, these fracturing characteristics disappeared with increasing temperature. With increasing temperature, fracturing pattern shifted to formation of a larger number of shorter fractures, and the required borehole pressure became smaller with increasing temperature. Porosity and permeability increased significantly by hydraulic stimulation at all temperature, where permeability gain was high even at the highest temperature that exceeded the Brittle-Ductile Transition temperature.

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