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Permeable-Impermeable or Elastic-Plastic Transition of Granite

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Recently, geothermal energy is attractive in the fields of developing sustainable energy. Conventionally, geothermal reservoirs have some troubles which are loss of injection water or induced earthquakes because of brittle dynamics zone. On the other hand, creating geothermal reservoir at the temperature-pressure zone of supercritical fluid can resolve these troubles and bring high power-producing potential. However, evaluating flow characteristics such as permeability is very difficult because of ductile dynamics zone from the high temperature-pressure zone.

In this presentation, we reported the temperature-pressure condition which shows dynamically semi-brittle or ductile zone and the flow characteristics in each condition for Inada granite. Firstly, we developed experimental system which can carry out hydraulic test at the selectable environment. Secondly, we set experimental condition to temperature was 350, 380, 400, and 450 ℃, effective confining pressure was 5, 10, 20, 30, 40, 50, 60, 70, 80, and 90 MPa. Pore fluid pressure was controlled 1 or 2 MPa in constant pressure. As a result, we revealed that the rapid decreasing permeability clarified stress dependency of the brittle-ductile (or elastic-plastic) transition was different on each temperature condition. In addition, decreasing permeability rate at the brittle and ductile zone provided a way to predict permeability at various combinations of temperature and pressure.

Keywords: geothermal reservoir, granite, elastic-plastic transition, predicting permeability