



Thermal pressurization of a fluid-saturated granular rock

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The phenomenon of thermal pressurization is studied theoretically and experimentally for a saturated granular rock, the Rothbach sandstone. It is shown that this phenomenon is controlled, on one hand by the discrepancy between the thermal behaviour of the pore fluid and of the solid phase, and on the other hand by the compressibility of the pore volume. The strong influence of stress and temperature on thermal pressurization of rocks is explained by the stress-dependent character of the compressibility of porous rocks and by the effect of temperature and pressure on the thermal and mechanical properties of water.

The experimental study consists in unjacketed and drained isotropic compression tests and drained and undrained heating tests. A stress-dependent elastic model has been calibrated on a drained compression test. The experimental results of an undrained heating test have shown clearly the stress and temperature dependent character of the thermal pressurization coefficient. In the analysis of the tests data, the effect of mechanical and thermal deformation of the drainage system has been accounted for. The results of the undrained heating test have been theoretically simulated and a good agreement with the experimental results has been obtained.

Reference:

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