[JJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG64]Brittle-Ductile Transition and Supercritical Geofluids for Crustal Energy in Island Arc

convener:Noriyoshi Tsuchiya(Graduate School of Environmental Studies, Tohoku University), Hiroshi Asanuma(AIST), Yasuo Ogawa(東京工業大学理学院火山流体研究センター)
Mon. May 21, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
Nature of rock mass below the brittle-ductile transition (BDT) is of great scientific interest to understand various phenomenon in the Earth's crust. We will review and discuss current understanding of characteristics the rock mass below the BDT, including composites, stress, failure mechanism induced by liquid injection and associates earthquake generation mechanism, and water rock interaction, considering engineered geothermal development in the BDT. Discussions on the possible phenomena in the geothermal development in the BDT will be followed in this session.
New drilling technology is key of issues. This session will cover advanced drilling technology under high temperature conditions for energy extraction.

[SCG64-P03]Flash Fracturing of Rock at Supercritical and Subcritical Conditions

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Artificial cracks creation in rocks can be applied to deep geothermal drilling. Thermal stress derived from rapid decompression is considered to be effective for crack creation of rocks (Tsuchiya et al., 2012). In this study, granite samples were heated to 500, 550 and 600 °C with water at up to 50 MPa confining pressure, then rapid decompression was carried out to investigate the effectiveness of flash fracturing. Temperature drop after decompression (defined as ΔT) is increased as pressure before decompression increases due to large amount of water in high pressure conditions causing large latent heat of evaporation. Porosity of specimens after experiments is significantly depending on pre-heated temperature and ΔT. Especially porosity is largely increased between 550 °C and 600 °C. As naturally cooled samples have similar porosity change between 550 °C and 600 °C, this significant increase is mainly caused by α-β transition of quartz, dominant mineral of granite, which occurs at 573 °C (Ohno, 1995). However, porosity of rapidly cooled (decompressed) samples is greater than that of naturally cooled samples at each pre-heated temperature. This difference of porosity increment, in other words crack creation, by cooling treatment is affected by cooling rate of rock sample. Moreover, specimens decompressed at vapor phase (from 4 MPa to atmospheric pressure) have more fractures than naturally cooled ones. This result implies that even if decompression from pressure condition in geothermal reservoir to atmosphere is not realized, decompression for several megapascals can generate fractures in rocks.

Tsuchiya, N., Yamamoto, K., &Hirano, N. (2012). Experimental approach for decompression drilling in high temperature geothermal conditions. *Geothermal Resources Council Transactions*, *36*, 561-564.
Ohno, I. (1995). Temperature variation of elastic properties of α-quartz up to the α-β transition. *Journal of Physics of the Earth*, *43*(2), 157-169.

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