Geophysical Research Abstracts
Vol. 12, EGU2010-13245, 2010
EGU General Assembly 2010

Petrophysical properties of granite from the Melechov Massif, Czech Republic

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The Melechov Massif is a granitic massif constituting the northernmost part of the Central Moldanubian Pluton, which belongs to the Moldanubian zone of the variscan belt in the Bohemian Massif. On an area of cca 100 km^2 it is formed by 4 types of granite which are disposed in a concentric manner and are distinguished mainly by their grain size. All the granites are two-mica S-granites considered to be product of polyphase intrusion of magma issued from partial melting of the surrounding variscan metasediments. Relative to the variscan orogeny, the granites are considered to be post-orogenic and are related to isothermic decompression of upper- to middle-crust during collapse of the orogeny-thickened lithosphere. Ages of cooling derived from radiometric dating on monazites give values for all of the types 315 $\pm$ 10 Ma. The granite massif suffered brittle deformation related to cooling and induced volume contraction creating systems of joints and, in a lesser measure, faults. The Melechov massif was intensely studied during the last two decades, mainly because it has been established as a testing locality by the radioactive waste repository authority (RAWRA) of the Czech Republic. We have the intention to complement the studies done so far by detailed petrophysical and microstructural analysis of samples taken with respect to macroscopic brittle structures. Several methods are employed to reveal important differences in rock samples collected from distinct geological setting from surface outcrops, quarries and a borehole. The concerned petrophysical properties and/or related experimental methods are namely: thermal conductivity, permeability, porosity, P-wave velocity measurements; in most cases the anisotropy of these quantities is crucial. Preliminary analyses of permeability and porosity show low porosity ranging from 3,8 % for coarse-grained variety to 1,3 % for fine-grained variety and very low permeability ranging from $X.10^{-18}$ m^2 for fine-grained variety to $X.10^{-20}$ m^2 for coarse-grained variety. Preliminary analyses of P-wave velocity at low confining pressures ($<$ 100 MPa) show values of more than 10 % of anisotropy for coarse-grained samples and 4-10 % of anisotropy for medium- to fine-grained samples. Analyses of thermal conductivity (TC) using high resolution optical scanning show several distinct phenomena affecting this quantity. Joint- or fissure-related oxide alteration in samples from outcrops and at shallow levels of borehole gives relative rise to TC values by cca 10 %, closed fissures reduce the TC by up to 20 %, mineralogy inhomogeneities result into increase of about 10 %. To specify and to increase the confidence of our results on borehole samples, which are suspect to be critically too small relative to the prerequisities of the used TC method, we will investigate the influence of volumetric dimensions of sample on the TC values as well as the possible error induced by measurement on a cylindrical surface as compared to measurement on an „infinite“ sample.