Geophysical Research Abstracts
Vol. 13, EGU2011-8753-1, 2011
EGU General Assembly 2011

Evolution of petrophysical properties of Spanish building granites at high temperatures

Zuzana Kompaníková (1), Miguel Gomez-Heras (2,3), Patricia Vázquez (4), and Jan Vlčko (1)

(1) Comenius University in Bratislava, Faculty of Natural Sciences, Department of Engineering geology, (2) Universidad Complutense Madrid, Spain (mgh@geo.ucm.es), (3) Instituto de Geología Económica / Instituto de Geociencias (CSIC/UCM), (4) Departamento de Geología. Universidad de Oviedo, Spain

Fire can severely damage cultural heritage and historical buildings are very sensitive to its destructive effects; one of the main damage causes being the temperature increase during fires. Eight types of Spanish building granites were tested in the laboratory to evaluate the change of petrophysical properties after heating at 200, 400, 600, 800 and 1000 °C. The rate of sample heating or cooling was set at 6°C/min and 3 h dwelling. The changes of the physical properties, such as coefficient of the linear thermal expansion were examined by ultrasonic velocity, water absorption, spectrophotometry, OSR analyses, thermodilatometer. Non-destructive testing (NDT) was used to evaluate a quantitative measure of pores and cracks within a rock volume before and after heating. Standard recommendations were defined by UNE-EN 14579:2005. Water absorption in evacuation vessel was performed to determine the real density, apparent density, open porosity and saturation defined by UNE-EN 1936:2007. Spectrophotometry was used to measure the chromatic parameters on the surface of the stone specimens before and after heating. OSR analyses were done, before and after heating, on the surfaces of the specimens to evaluate the change in surface roughness due to the heating. The roughness parameters analyzed were calculated by the software and defined by DIN EN ISO 4287 standard. To characterize the linear thermal expansion behavior of the rocks two parameters were chosen: thermal expansion coefficient α and residual strain ε. Five short-term temperature cycles (+20°C to +70°C) were carried out during the tests with the hermodilatometer. The linear thermal expansion behaviour of the rocks was defined by DIN EN ISO 14581:2005. The thermally induced fracturing appeared mainly in the boundaries of mineral grains of stones at the lower temperatures due to the different thermal expansion of different minerals while heating the stones. At higher temperatures more complex patterns of cracking appear. Our results show a major episode of cracking in the 500-600°C when the quartz α-β transition is reached, to the extent that at 800°C some of the granite types disintegrated. These investigations in thermal decay may lead to an improved assessment of natural building stones that have been damaged by fire.

Research funded by Geomateriales S2009/MAT-1629