Abstract

This work is focused on the groundwater flow and transport of contaminants in the environment of granitic rocks. Mainly adjective and dispersive types of transport of contaminants are discussed in this work. Transport of contaminants by diffusion is mentioned only marginally in relation to porosity of rock matrix. The main aim of this work was to characterize hydraulic and mechanical-physical parameters of the granite. Partial objectives were to verify the sealing function of the laboratory grout mixture in fractured granite blocks, to characterize the porosity and hydraulic conductivity of the granite matrix at laboratory scale, to find connection between boreholes *in situ* and to establish a link between the structure of rocks and velocities of seismic waves.

Four bentonite and cement mixtures in different weight ratios have been selected as a grout mixture. Suitable injection mixture was selected based on the results of hydraulic conductivity coefficient, and other aspects, such as volumetric stability. The granite blocks were partially grouted by using of the selected grout mixture.

Hydraulic conductivity and porosity of the granite rock matrix from the Panské Dubenky test site was tested at three laboratory samples. Hydraulic conductivity was determined with different constant hydraulic gradients in the saturated environment. The results show that the tested granite has open porosity 1.05%, total porosity 1.13% of and coefficient of hydraulic conductivity 4.0×10^{-12} $m.s^{-1}$. Increase of the open porosity of the samples corresponds to the increase of the hydraulic conductivity.

Verification of the sealing function of the grout mixture was carried out on laboratory blocks with natural and artificial fractures from the Panské Dubenky test site. Tracer tests in open fractures were carried out with sodium chloride and sodium fluorescein. At the same time the flow rate based on a defined constant hydraulic gradient in a saturated environment was measured. The injection boreholes of the granite blocks were then grouted using bentonite-cement grout mixture. Subsequently, tracer tests were repeated. It was found that grout mixture decreases flow of water five times at the same hydraulic gradient. After application of grout mixture, even when the hydraulic gradient increased by three orders of value, the time of first arrival of tracers increased from seconds to tens of minutes and the time of peak concentration increased from minutes to hours.

The findings of connectivity between boreholes in the Panské Dubenky test site were realized by cross-hole (C-H) tracer tests with fluorescein. The results of C-H tests were used to create a geometric model of fracture net and to calibrate the hydrological model. The results of C-H test show that boreholes are most often connected by subhorizontal fractures. Vertical fractures had usually sealing function.

Relation between the structure of rocks and velocities of seismic waves was studied in laboratory samples from seven localities of granitoid rocks in the Czech Massif. Seismic wave velocities were measured in laboratory samples, which were unsaturated, saturated and dried. Velocities of seismic waves were compared with their bulk density, open porosity and coefficient of hydraulic conductivity. Furthermore, comparison of the Young's modulus evaluated from the velocity of seismic waves (dynamic) and from uniaxial compression tests (static) was made. Velocities of P-waves and S-waves in the dried samples were lower than in the saturated samples. Most of the samples showed moderate anisotropy of velocity. Relatively small inhomogeneities of the physical parameters of the monotonic profile of the borehole and gradual lithological transition were indicated by seismic measurements. Samples from four sites showed an increase in the velocities of seismic waves along the density increase. Samples from three locations showed decrease of seismic waves velocities along the increase of open porosity. The dried samples from six localities showed a trend of decreasing seismic velocity with increasing coefficient of hydraulic conductivity. Values of dynamic modulus of elasticity determined on naturally wet samples were higher than the static modules. Velocities of P-waves and S-waves measured across the sample increased during uniaxial compression. The difference between the dynamic and static modulus

decreased during loading. Saturated samples had lower unconfined compressive strength and static modulus of elasticity than dry samples from the same depth. Conversely modulus determined by ultrasound was higher in saturated samples than in the dried samples from the same depth.

The contribution of this work and published papers is a complex processing of the granitic rocks properties with use of all available measurement methods with a view to implementing the underground disposal site of radioactive waste.