Geophysical Research Abstracts
Vol. 14, EGU2012-7210, 2012
EGU General Assembly 2012

The role of the clay matrix on the swelling of anhydritic rocks

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Swelling rocks exhibit the characteristic property of increasing their volume when absorbing water. This process constitutes a significant problem in many engineering fields. Tunnelling in swelling rocks in particular is one of the engineering tasks still associated today with great inherent uncertainties, despite the fact that numerous tunnels have been excavated in rock of this kind for more than a hundred years. Among the significantly problematic types of swelling rock are anhydritic claystones, i.e. rocks composed of a clay matrix comprising finely distributed anhydrite. This kind of rock is widely distributed in Switzerland and South-West Germany and has caused severe damage, operational problems and very high repair costs in several tunnels. A number of processes such as seepage flow, ionic diffusion, dissolution of anhydrite, growth of gypsum crystals, swelling of clay and evaporation are involved in the swelling of anhydritic claystones. The present paper investigates the role of the clay matrix on the swelling process. The interactions of the sulphate with the clay phase are probably manifold. In the absence of cracks and fissures the clay matrix governs the transport of water, while the clay minerals affect the equilibrium of the anhydrite-gypsum-water system.