



Suggested methods for swelling tests – a critical review

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Argillaceous and anhydritic rocks as well as rocks containing pyrite are prone to swelling, i.e. to adsorb water, which either increases their volume or, in the case of deformation constriction, causes an external pressure. The swelling process can also lead to a significant reduction of shear strength and stiffness. In tunneling, swelling rock can lead to big deformations or to excessive stress on the lining, thus leading to severe damages.

Until now, the only adequate way to quantify the swelling potential of rocks is via swelling tests on undisturbed rock samples. The testing technique has been developed since the 1970's. The first suggested methods for swelling tests were published by the International Society of Rock Mechanics (ISRM) in 1979. Updates of these recommendations were published in 1989 and 1999. In Germany recommendations were published by the DGGT (now DGEG) in 1986. The Swiss recommendations published by VSS in 2006 are based on the ISRM recommendations from 1999.

Some of the testing procedures described in the recommendations mentioned above can lead to an overestimation of the swelling potential. This is particularly the case for weak argillaceous rock. For rocks associated with high swelling pressures the proposed apparatuses can lead to an underestimation of the swelling potential. In general, a main flaw of the above mentioned recommendations is that they only propose the apparatus which should be used instead of the requirements which need be satisfied by the apparatus. However, several tests are being run with newer, improved apparatuses over the past decade; i.e. the recommendations are often being ignored. Furthermore, the suggested methods according to the recommendations are completely inadequate for evaluating the swelling potential of rock containing pyrite. This is due to the fact that the knowledge on swelling of rock containing pyrite was insufficient at that time. .

This contribution will give an insight into the most important aspects concerning the testing technique of swelling rocks, which need to be modified for future testing.