Dieser Beitrag behandelt die vergleichende Auswertung der Ergebnisse aus In-Situ-Großversuchen (Radialpressenversuch) mit Dilatometerversuchen. Weiters erfolgt eine Zusammenschau der Radialpressenversuche mit einer strukturgeologischen Detailkartierung im Sondierstollen Längental. Die Untersuchungen liefern Erkenntnisse über die Anisotropie des Gebirges und lassen einen Maßstabseffekt zwischen den Radialpressenversuchen und den Dilatometerversuchen ableiten.

Das Projektgebiet liegt ca. 34 km östlich von Innsbruck zwischen den Ötztaler- und Stubaier Alpen, wo die TIWAG - Tiroler Wasserkraft AG eine Erweiterung der Kraftwerksgruppe Sellrain-Silz mit der Errichtung des Speicherkraftwerks Kühtai plant. Der 735 m lange Sondierstollen Längental wurde 2010 zur Klärung der Gebirgsverhältnisse aufgefahren.
Für die Radialpressenversuche wurden im Erkundungsbereich zwei Stichstollen mit einem Durchmesser von je 2,5 m hergestellt. Bei dem Großversuch wird die mit Beton ausgekleidete Stollenwand mit Hilfe von Druckkissen mit Drücken bis zu 100 bar beansprucht. Auftretende Deformationen gegenüber einer festen Bezugsachse werden mittels hochpräziser elektronischer Wegaufnehmer gemessen und digital aufgezeichnet.
Dilatometerversuche (Bohrlochaufweitungsversuche) dienen zur Bestimmung des Verformungs- und des E-Moduls des Gebirges im kleineren Maßstab. In Summe standen 43 Dilatometer-Versuchsergebnisse aus nahegelegenen Bohrungen zur Verfügung.
Die Erkenntnis über den Maßstabseffekt lässt möglicherweise für zukünftige Projekte eine genauere Interpretation der Gebirgskennwerte für die Planung und Optimierung der felsmechanischen Versuchsabläufe zu.

Underground Gas Storages: Modeling subsurface geobodies - fiction versus reality

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Exploration, production and in particular underground gas storage (UGS) departments all over the world have an increasing demand for 3D geo-cellular static models. In the UGS department of RAG these models are needed for the dynamic modelling of flows with which we forecast injection and production cycles and optimize well spacing.
RAG´s gas storage reservoirs are situated in Oligocene deep water turbidites with complex geometries and connectivities. Seismic imaging is often below resolution and wells are sparsely distributed with often bad quality well data. So how do we create a realistic subsurface model with few data that meets geological complexity and computable size?
Several practical problems will be addressed and solutions offered. We will cover subjects as diverse as imaging of sedimentary features, multipoint statistics, FMI logs, seismic attributes, how to update static models without the need for a new dynamic framework, simple quality checks, working with old data, connectivity issues, fault framework modelling, upscaling problems and the use of geostatistics.
Clear improvements are made over the past decade, but we’re not there yet. Furthermore, the question remains as to what extent we want a model to actually capture reality.

Deformation of anhydrite in a rock salt matrix in Alpine rocksalt deposits

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The evaporitic series of the Alpine Haselgebirge Formation served as one of the principal detachment levels during Alpine nappe stacking (Neubauer et al. 2000; Missoni et al. 2011). Lenses of anhydrite rock were emplaced within a tectonite of rock salt and mudrock. Within undeformed mudrock, in nodules of anhydrite, the fabric of anhydrite is shape-preferred, hypidiomorphic-equigranular with straight grain boundaries (grain size ca. 0.2 mm). But most anhydrite rocks are foliated. There, the average grain size is 0.2-0.3 mm. The grains exhibit lobate grain boundaries and a shape preferred orientation is visible. The rocks have undergone several stages of recrystallisation, comprising twinning, grain boundary migration, stylolite formation and subgrain rotation recrystallisation. Single, large anhydrite grains up to 2.0 mm, suffered subgrain rotation recrystallisation, whereby the subgrains are between 0.1 and 0.5 mm in average size. The peak temperature of overprint was at ca. 180°C in Berchtesgaden (vitrinite reflectance, fluid inclusions) and >240°C in Altaussee (fluid inclusion study). Illite crystallinity indicates around 200°C for both deposits. This is in good correlation with existing data (e.g. Rantitsch and Russegger, 2005). From field observations, like ductile boudinage of anhydrite bodies, a deformation of anhydrite together with rock salt is supposed. However, the conditions of isotropic pressure (burial depth) and shearing (differential stress) of anhydrite rock are not yet exactly known.

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40Ar/39Ar ages of crystallisation and recrystallisation of rock-forming polyhalite in Alpine rocksalt deposits

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To assess the potential of the mineral polyhalite [$K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$] as a new geochronometer, the $^{40}Ar/^{39}Ar$ method was combined with microstructural analysis. Polyhalite rocks of the Alpine Haselgebirge Formation expose various diagenetic fabrics of polyhalite - intergrown with anhydrite, crystallized in mudrock and vein infills. The crystals developed between c. 235 and 210 Ma. Mylonites of fine-grained polyhalite rock indicate several subsequent stages of tectonothermal overprint between c. 155 and 105 Ma. The latter ages fit roughly to previously measured $^{40}Ar/^{39}Ar$ ages of feldspar and muscovite (Spötl et al., 1998, Frank & Schlager, 2006). Illite crystallinity indicates temperatures of around 200°C. The peak temperature of overprint was at c. 180°C in the Berchtesgaden mine (vitrinite reflectance, fluid inclusions) and > 240°C in the Altaussee mine (fluid inclusions). The data is in good correlation with existing data (e.g. Rantitsch & Russegger, 2005). These temperatures are below the value of 255°C, where polyhalite starts to dehydrate (Wollmann, 2008). Disturbed age spectra pattern result from multiphase polyhalite growth, but single phases yielded good results. In future studies, polyhalite may characteristically serve as a geochronometer for diagenetic and very low-grade metamorphic processes.

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