Supplement of

An Open-Access Stress Magnitude Database for Germany

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Within the SpannEnD project, a comprehensive stress estimation, magnitude ratios are crucial (Figs 1&2). For stress orientations already exists, but for stability assessment of the borehole breakout is crucial. The schematic illustration of the borehole slotter is based on a drawing by Prof. Fecker & Partner.

**1 The impact of rock stresses on deep geological repositories**

The crustal stress field plays a major role in the characterization of a deep geological repository for nuclear waste. It influences factors such as:

- the excavation zone in the vicinity of the underground structures,
- the hydraulic permeability of the host rock,
- the occurrence of earthquakes and reactivation of faults as migration paths for fluids and radionuclides.

With the World Stress Map (WSM), a database of stress orientations already exists, but for stability assessment, magnitude ratios are crucial (Figs 1&2).

Within the SpannEnD project, a comprehensive stress magnitude database was built and published for the first time (Morawietz & Reiter, 2020).

**2 The role of geomechanical-numerical modeling**

In the comparative evaluation of potential repository sites, the estimation of the subsurface stress state is essential. However, the available point stress data are usually incomplete, since most stress indicators do not allow deriving the full 3D stress tensor. In addition, the data are distributed spatially unevenly. Therefore, a continuous and complete description of the 3D stress state can only be obtained by estimating a 3D geomechanical numerical model calibrated with available stress data.

**3 The project**

The main objective of the SpannEnD project is the development of a 3D geomechanical-numerical model for the whole of Germany. This model contains assumptions about the geological structure as well as the elastic properties of the modelled lithologies. In order to reproduce the stress state as realistically as possible, the kinematic boundary conditions are adjusted to provide the best possible approximation of the data points used for calibration. The compiled stress magnitude database is thus the prerequisite for a meaningful model calibration.

**4 Where the data come from**

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As mechanical stress cannot be measured directly, components of the reduced stress tensor are derived from measurements of other quantities that are physically linked to stress. This results in a number of methods for the quantification of stress magnitudes. Abbreviations: HTPF - hydraulic testing of pre-existing fractures, HTPF - hydraulic testing of pre-existing fractures, RFT - hydraulic fracturing test, FIT - formation integrity test, BO - borehole breakout.

**5 Depth distribution of the data in the stress magnitude database**

- No data available for depths below 2 km.
- Data are concentrated between 0 and 1 km.
- A few data points are available for depths between 2 and 3 km.
- No data for depths greater than 3 km.

**References**

- SpannEnD project: http://www.spannend-projekt.de/