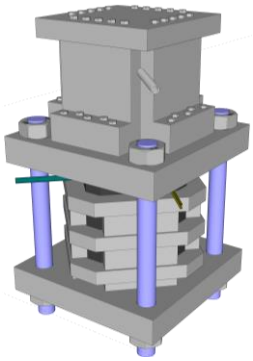
# Microstructural impact on reservoir integrity during production induced pressure release

**Aim of the research project**

Porous reservoir rocks are explored as hydrocarbon reservoirs and used as geothermal or intermediate gas reservoirs. They contain sedimentary interfaces and structures caused by compaction (pressure solution, deformation bands), which influence the reservoir integrity as permeability anisotropies during hydromechanical pressure changes.
At the same time, a two-phase flow (injected fluid vs. formation water, oil vs. formation water) flows through the rocks, whereby the relative permeabilities depend on the wetting properties of the mineralogical microstructures. The aim of the interdisciplinary project is to model the microstructural influence on the two-phase flow and reservoir integrity. In the integrated interdisciplinary project, grain-scale processes are applied for the first time in reservoir-scale processes. The results will be applied in the more efficient use of deep reservoirs.

**Approach**

The numerical models are based on investigations of aeolian sandstones from the uppermost Rotliegend, which are used as analogues for the rock formations of the reservoir rock. In addition to standard geomechanical parameters such as rock compressive strength, the permeability development during rock contraction is investigated. In order to minimize boundary influences, the analog rock is flowed through in a large triaxial test device in a dependency of variable σ1 and σ2/3 pressures, and the permeability is investigated taking into account the compaction and the resulting shear joints.



**Model of the large triaxial test device**

A coupling of microscopic models on grain-scale and macroscopic models on reservoir-scale shall simulate the dependencies between the compaction by reducing the pore pressure and the permeability of the reservoir rock. Input parameters for the simulation result from the experiments previously performed on the analog rocks, which among other things represent the grain structure and the permeability as a function of the contractance of the reservoir rock. The mechanical changes (compaction) resulting from the macroscopic simulation serve as a basis for the microscopic hydrological simulation in order to simulate the deformations of the grain structure. The result is the reduced permeability, which is transferred to the macroscopic model for a new iteration. The results obtained are then validated on the basis of existing reservoir data and the findings on reservoir integrity are applied.

<u>Partners:</u>

Hochschule Karlsruhe Technik und Wirtschaft
UNIVERSITY OF APPLIED SCIENCES

KIT Karlsruher Institut für Technologie

DGMK

DEA

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Chair of Geotechnical Engineering Institute of Foundation Engineering, Soil Mechanics, Rock Mechanics and Waterways Construction

Adress:
Mies-van-der-Rohe-Str. 1
52074 Aachen

Phone:
0241/80 25248

Fax:
0241/80 22384

Internet:
www.geotechnik.rwth-aachen.de