

Laborexperimente zur Spannungsprofilierung in EGS Projekten

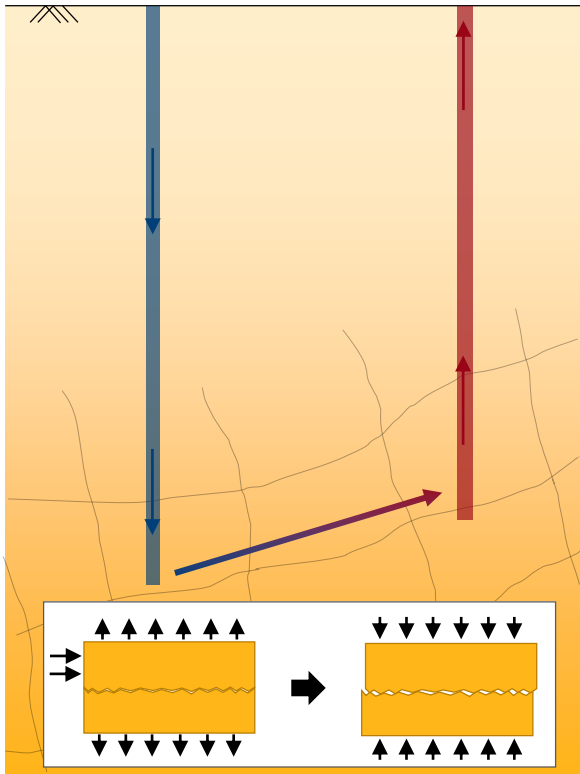
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*Institut für Geotechnik im Bauwesen und Lehrstuhl für Geomechanik und Untergrundtechnologie (GUT), RWTH Aachen

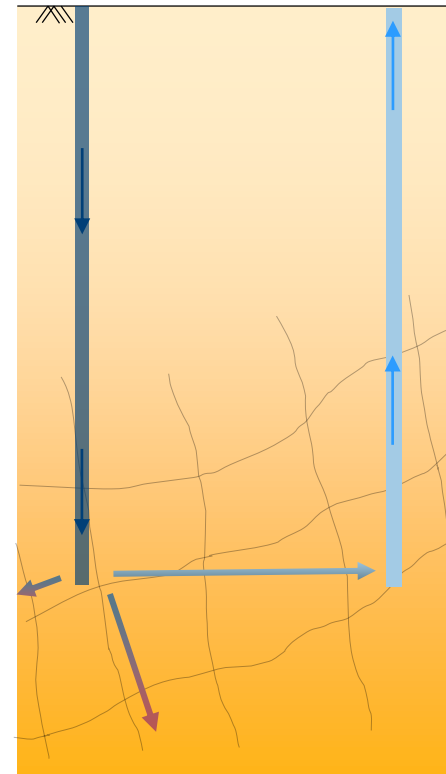
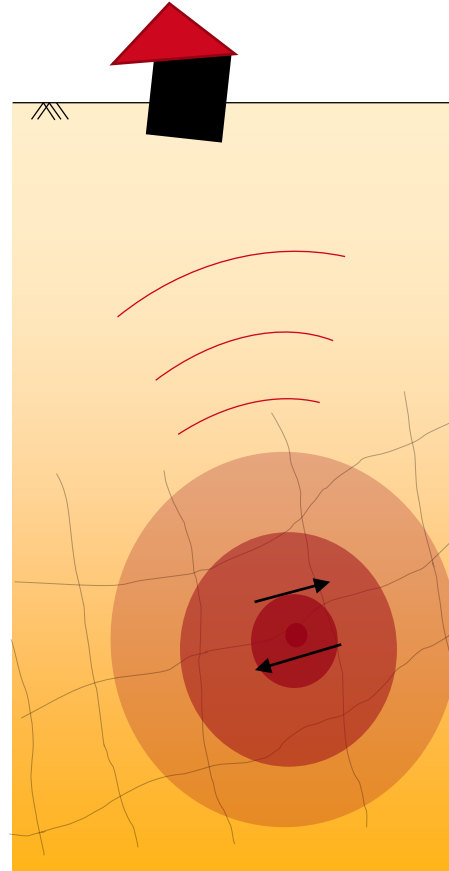
+ Institut für Ingenieurgeologie und Hydrogeologie, RWTH Aachen

EGS Systeme und Spannungsmessungen

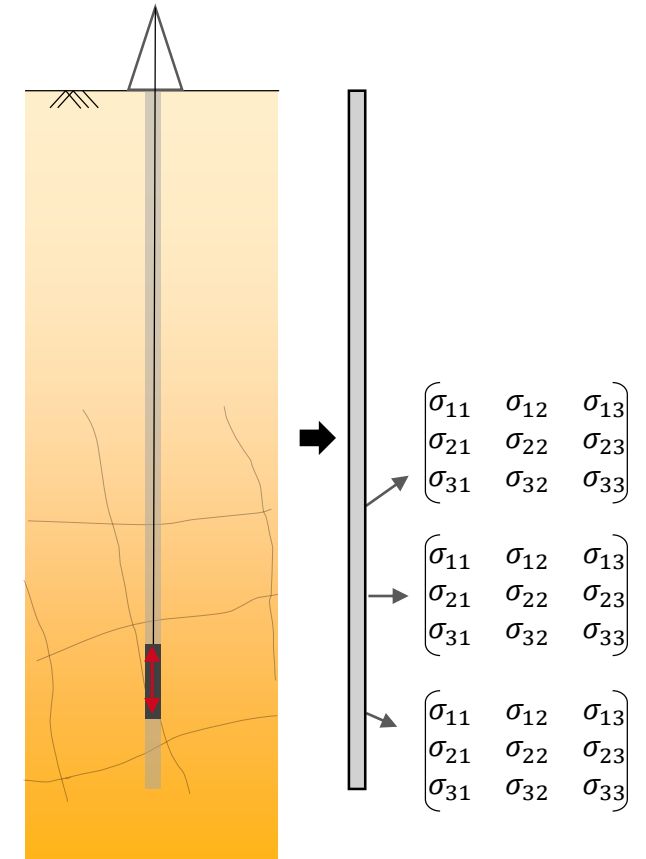
PRINZIP: HYDRAULIC SHEARING



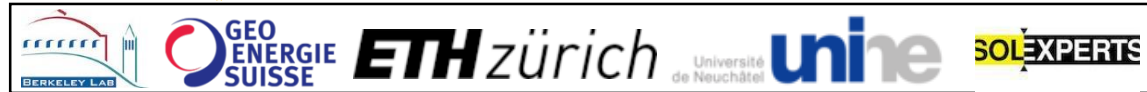
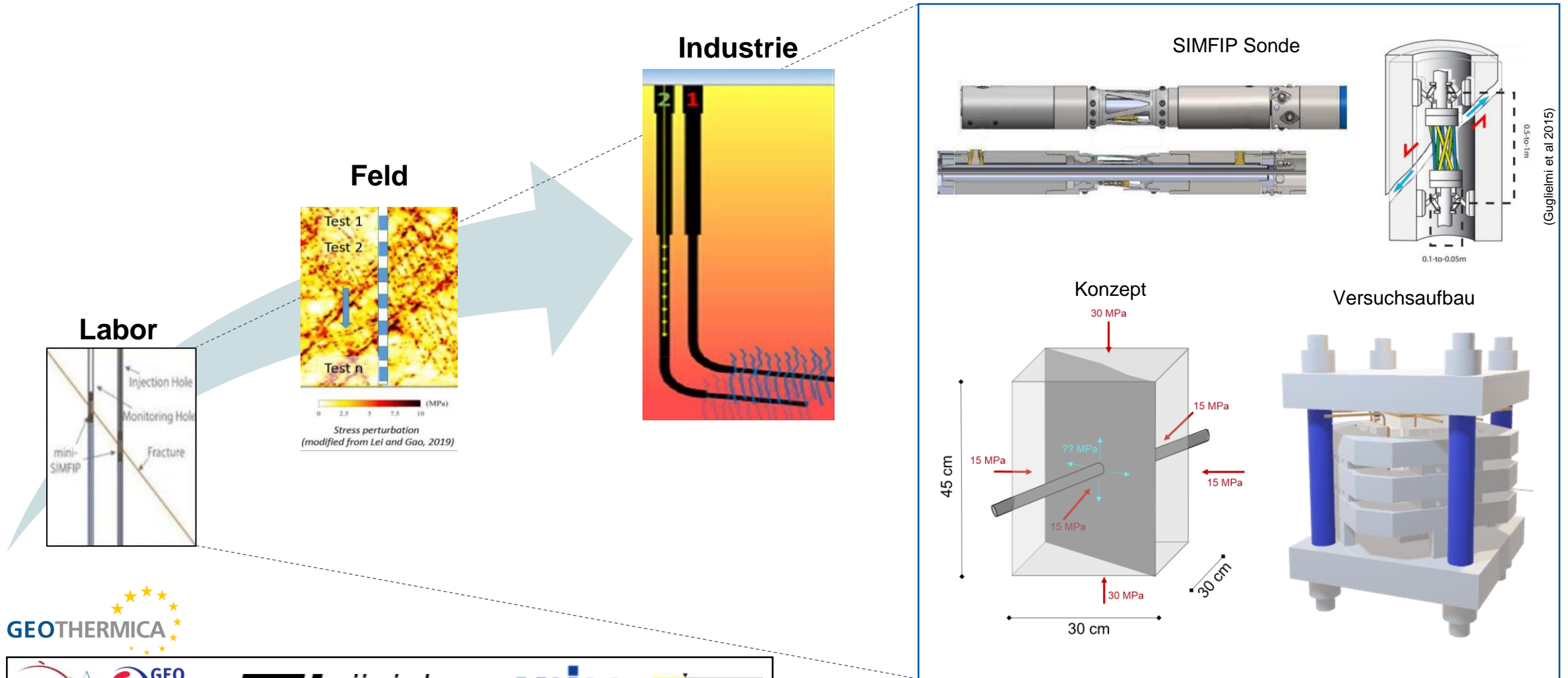
SCHWIERIGKEITEN: INDUZIERT SEISMIZITÄT ENERGIEEFFIZIENZ



VORSORGE: SPANNUNGSMESSUNG



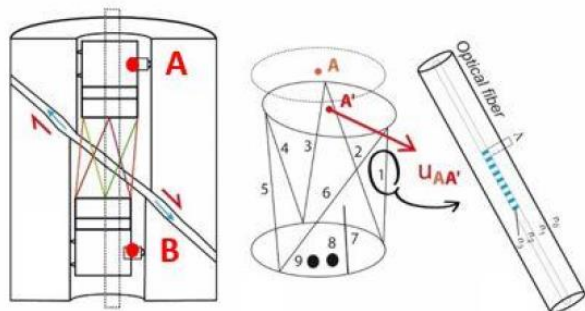
Projekt – SPINE (Stress Profiling in Enhanced Geothermal Systems)



MECHANIK

- Verschiebungen

→ SIMFIP



(Guglielmi et al 2015)

- Veränderung der Oberfläche

→ Scannen

HYDRAULIK

- Injektionsdruck
 - Pumprate
- Injektionspumpe

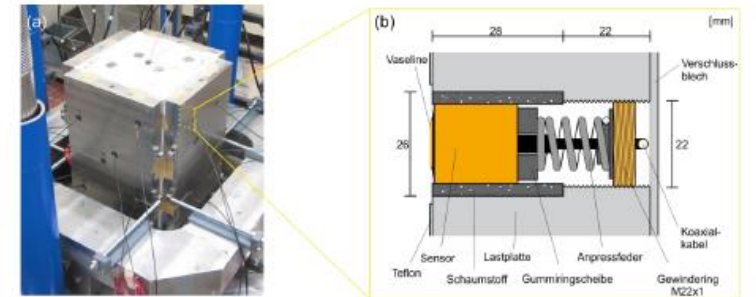


(Philip Siebert)

SEISMIK

- Riss- / Bruchevents

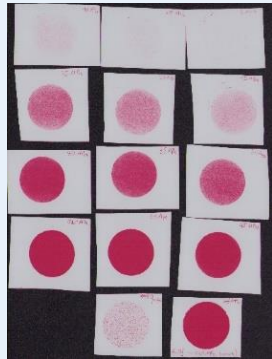
→ Akustik Sensoren



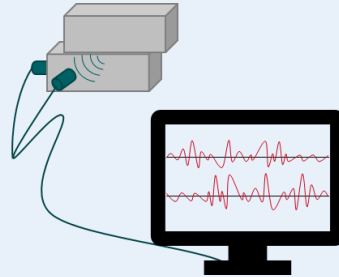
(Philip Siebert)

Konzeption und Vorversuche

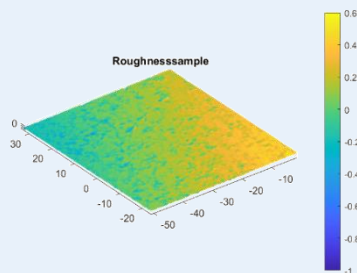
KLUFT CHARAKTERISIERUNG



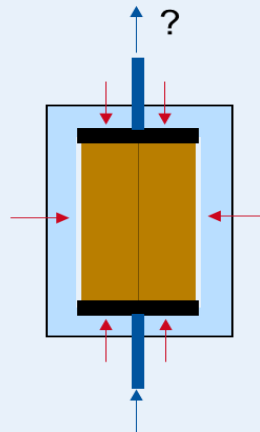
Visualisierung der Spannungsverteilung auf der Kluft



Bestimmung der Scherspannung und Lokalisierung von Rissen

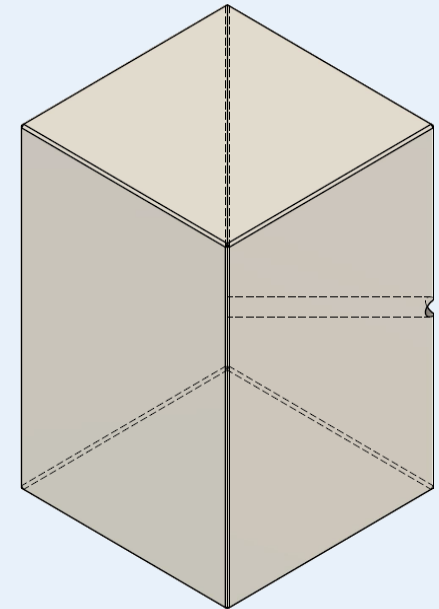


Messung der Veränderung der Kluftrauigkeit durch den Versuch



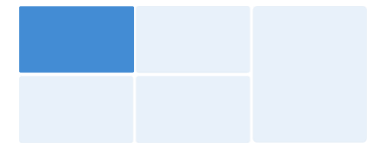
Permeabilitätsmessung der Kluft und des Gesteins

ERSTER VORVERSUCH

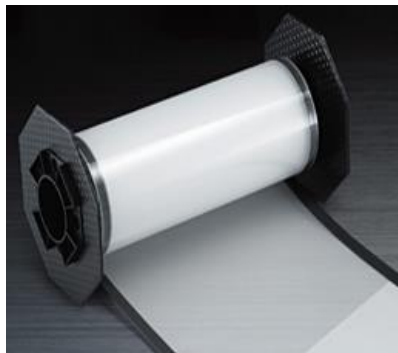


Validierung und Kalibrierung des Messsystems

Kluft Charakterisierung – Spannungsverteilung

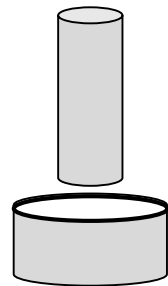
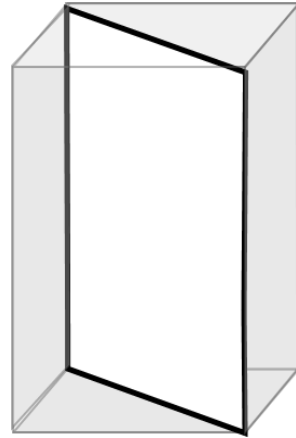


MATERIAL

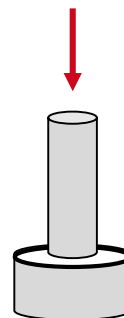
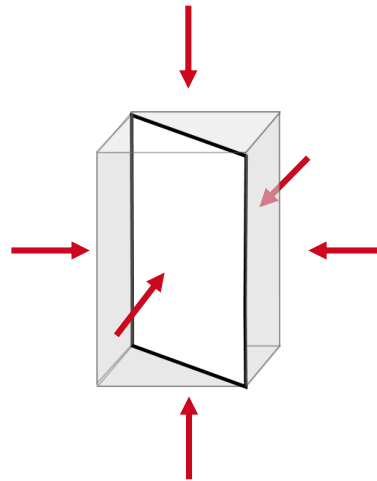


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POSITIONIEREN



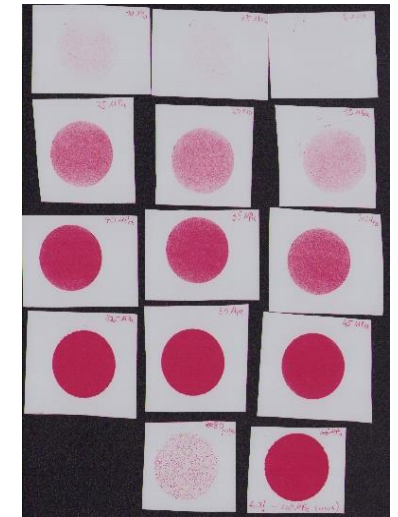
BELASTEN



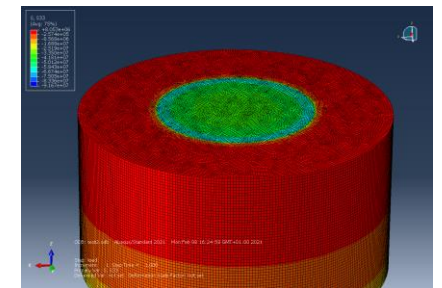
SCANNEN

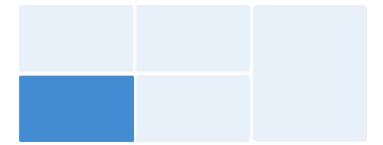


ANALYSIEREN



(Max Kewel)

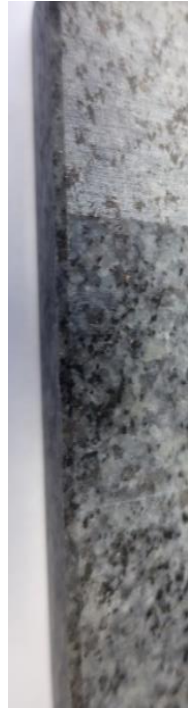




HERSTELLEN

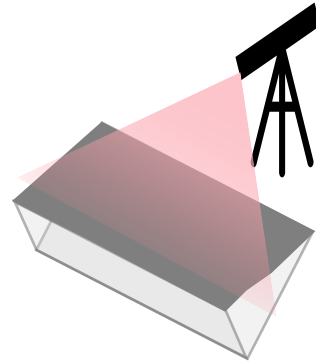
DIGITALISIEREN

ANALYSIEREN

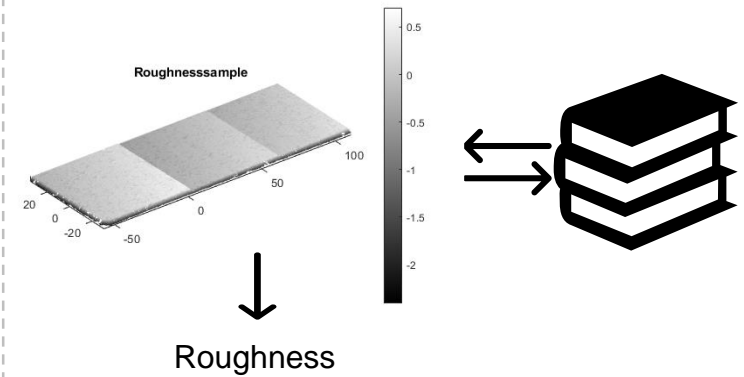
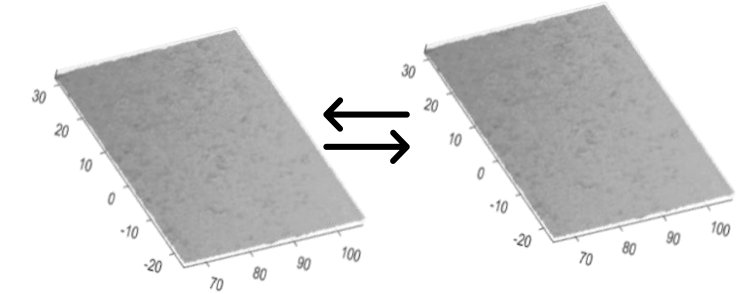
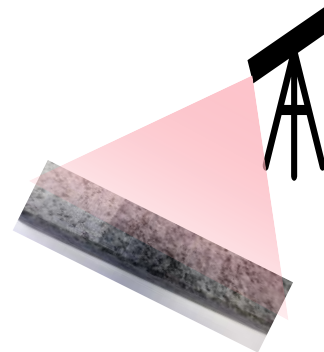


- Sägeschnitt
- “Schruppschliff”
- “Schlichtschliff”
- Poliert

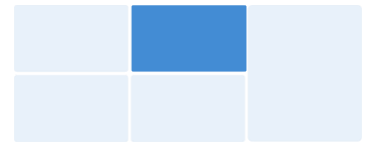
rau
↓
glatt



(isac RWTH Aachen)



Kluft Charakterisierung – Scherspannung



SCHERSPANNUNGSMESSUNG



Scherversuche mit unterschiedlichen Klufttrauhigkeiten

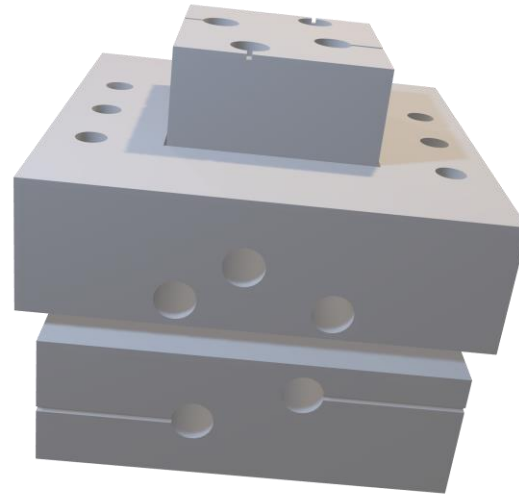


AKUSTISCHE MESSUNG

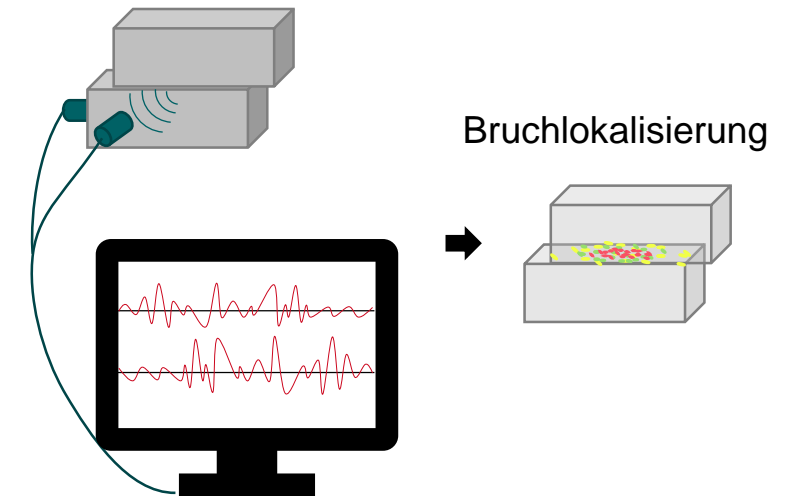
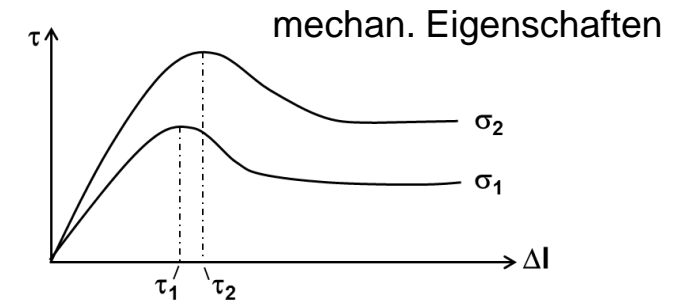
Messungen der bei Schervorgang erzeugten akustischen Signale

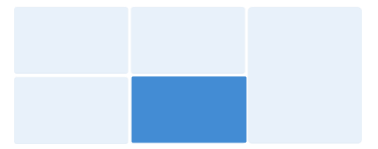


(Paul Selvadurai)

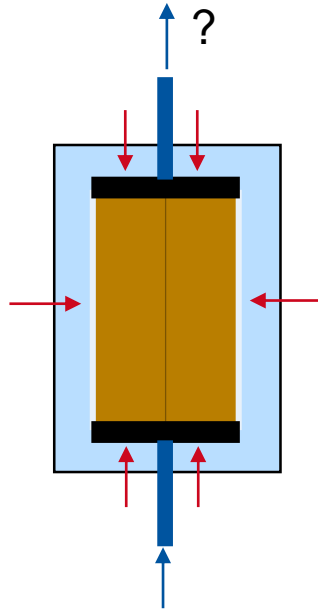


ANALYSIEREN



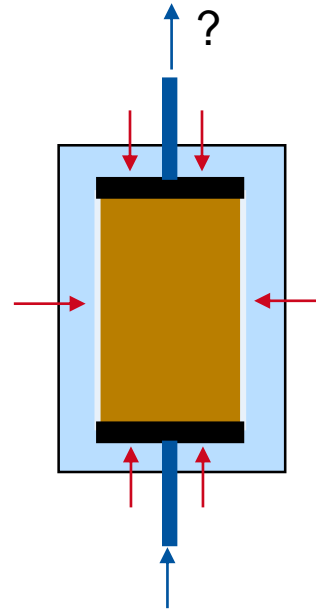


PERMEABILITÄT KLUFT



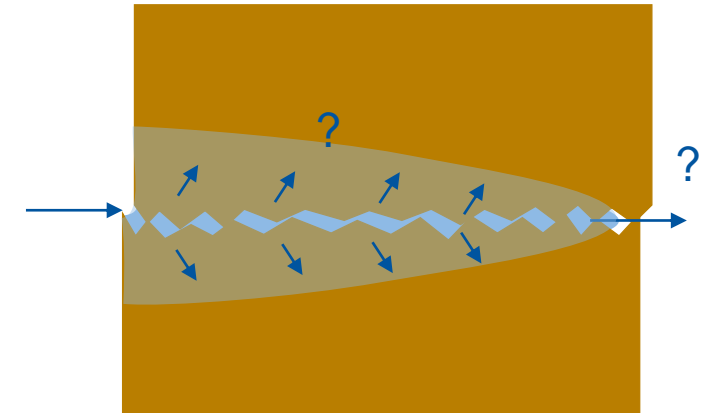
Zylindrische Gesteinsprobe mit vertikaler Kluft im Durchflussversuch

PERMEABILITÄT GESTEIN

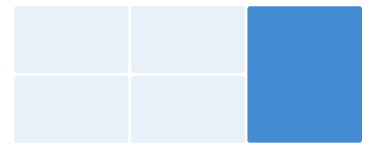


Zylindrische Gesteinsprobe im Durchflussversuch

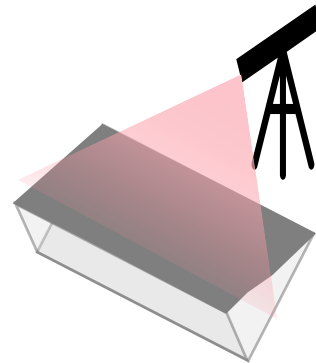
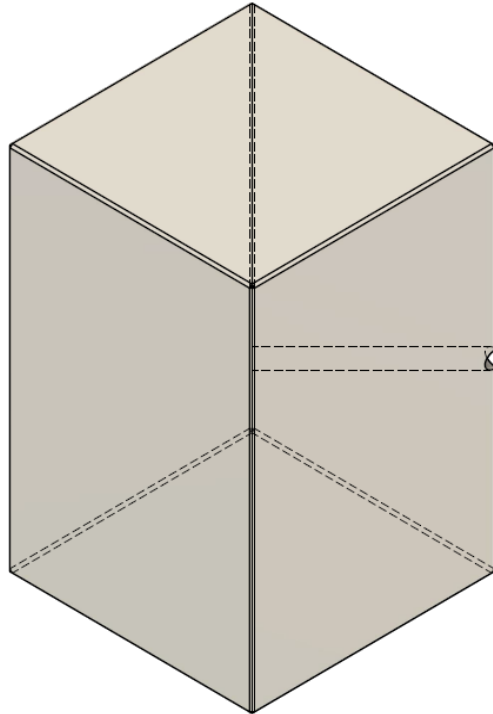
ANALYSIEREN



Welches Volumen geht im Gestein „verloren“ ?



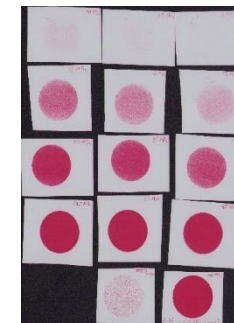
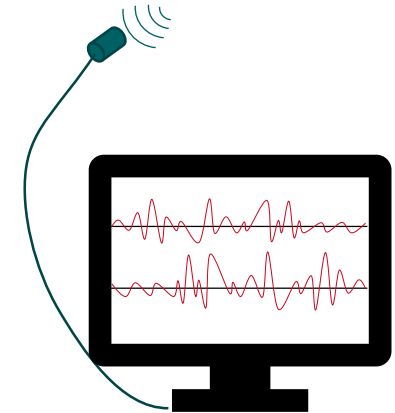
VALIDIERUNG UND KALIBRIERUNG DES MESSSYSTEMS



(Paul Selvadurai)



(Philip Siebert)



(Max Kewel)

**Vielen Dank
für Ihre Aufmerksamkeit**