RUB

PROJEKT MULTIFRAC

# Hydraulische Rissausbreitung in anisotropen und geschichteten Gesteinen

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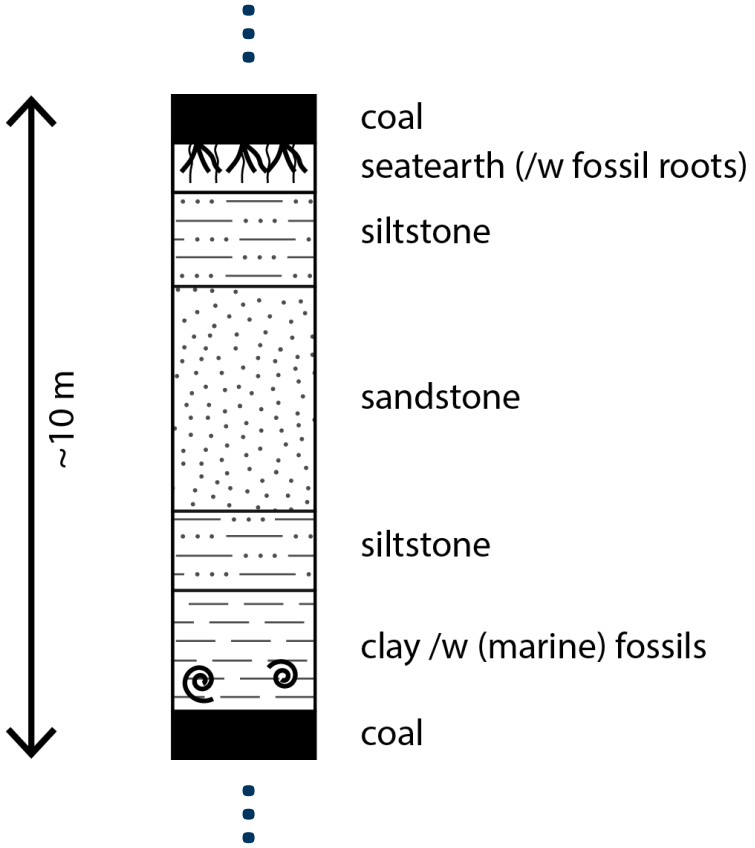
Gefördert durch:

Bundesministerium für Wirtschaft und Energie

aufgrund eines Beschlusses des Deutschen Bundestages

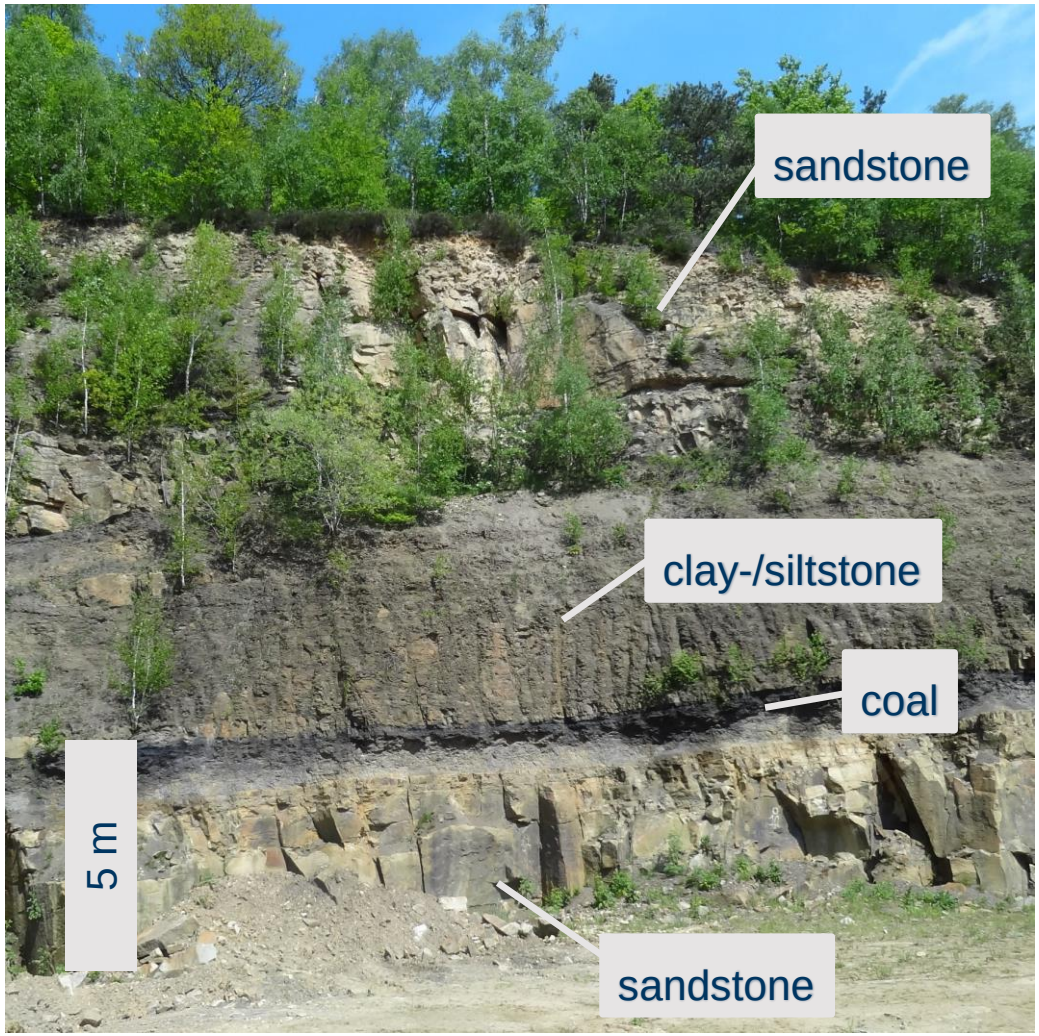
RUHR-UNIVERSITÄT BOCHUM

# Oberkarbon: Zyklotheme



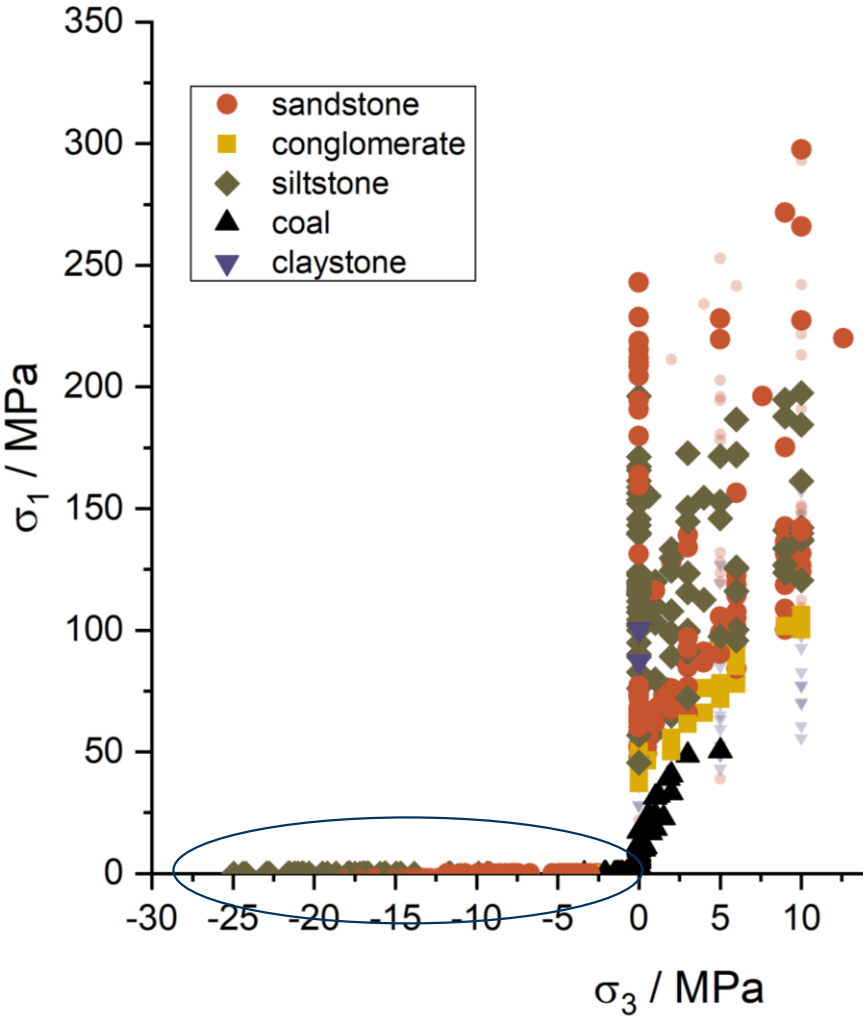

after Josten et al. (1984)

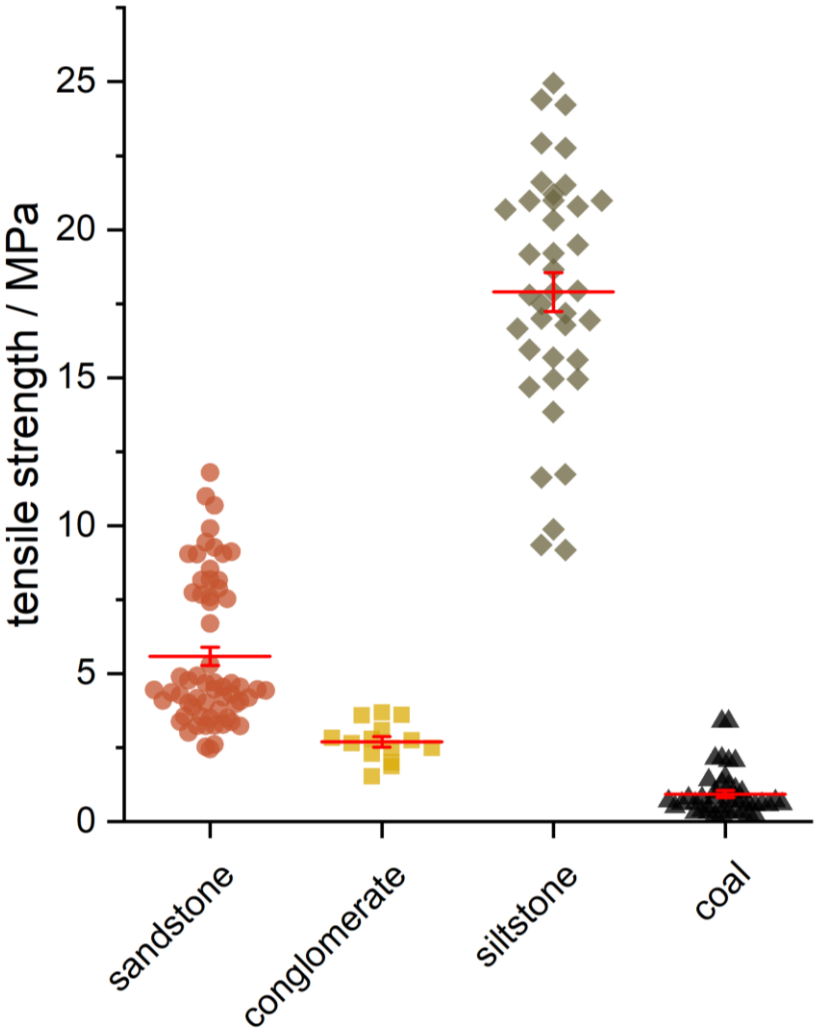
Woitzel quarry - Ibbenbüren



# Laborversuche: Festigkeiten

large symbols = current study
small symbols = previous work

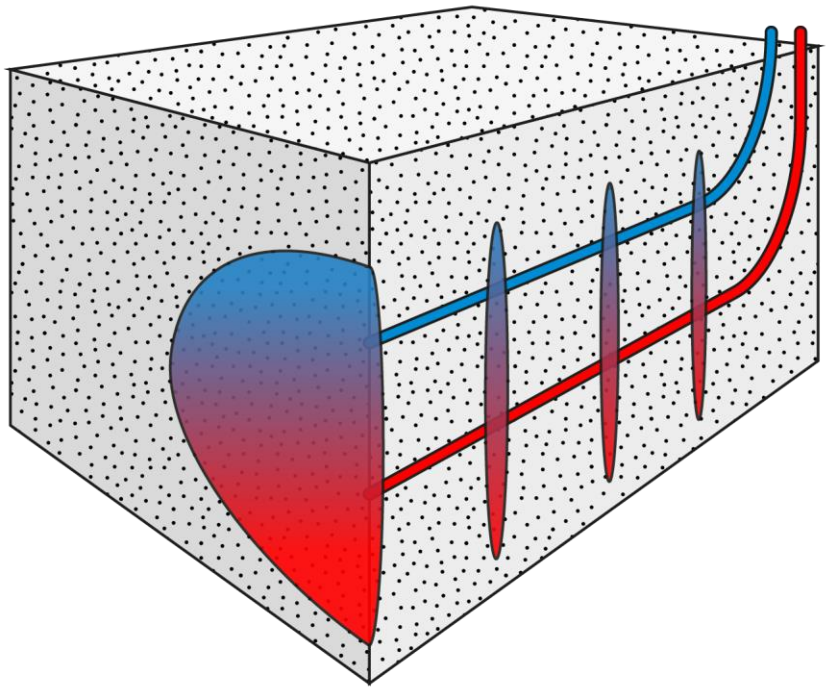


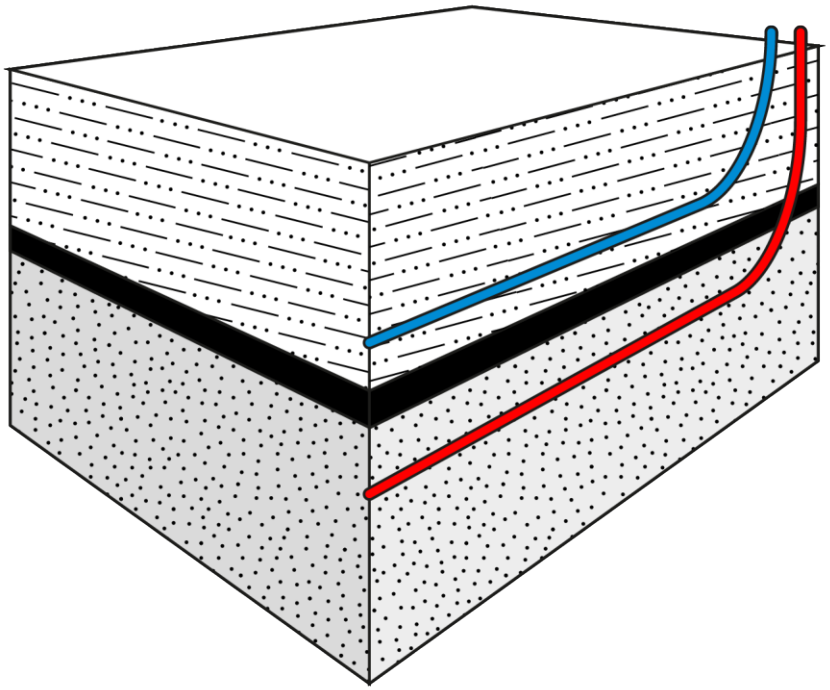



# MultiFrac

Herausforderungen:

- horizontale Trennflächen / Kohleflöze
- Materialkontrast
- Anisotropie





# Trennflächen

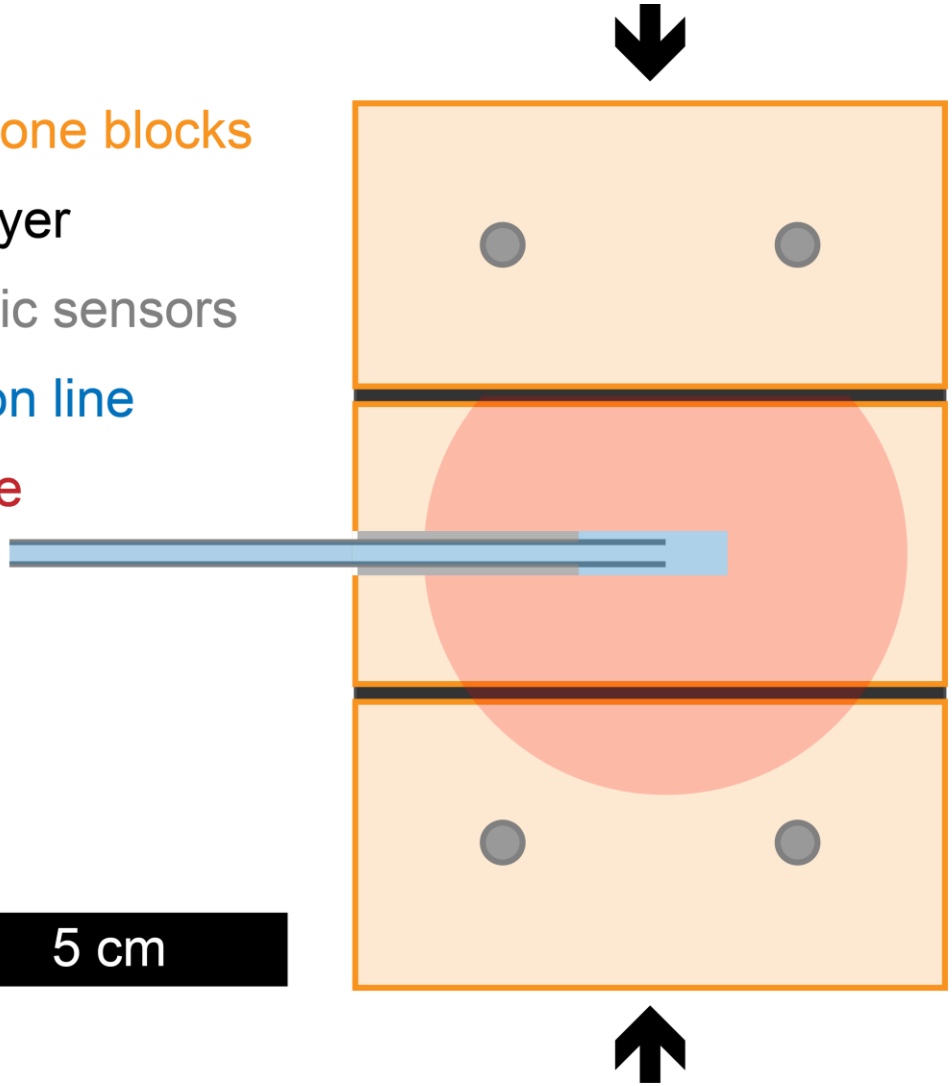
sandstone blocks

coal layer

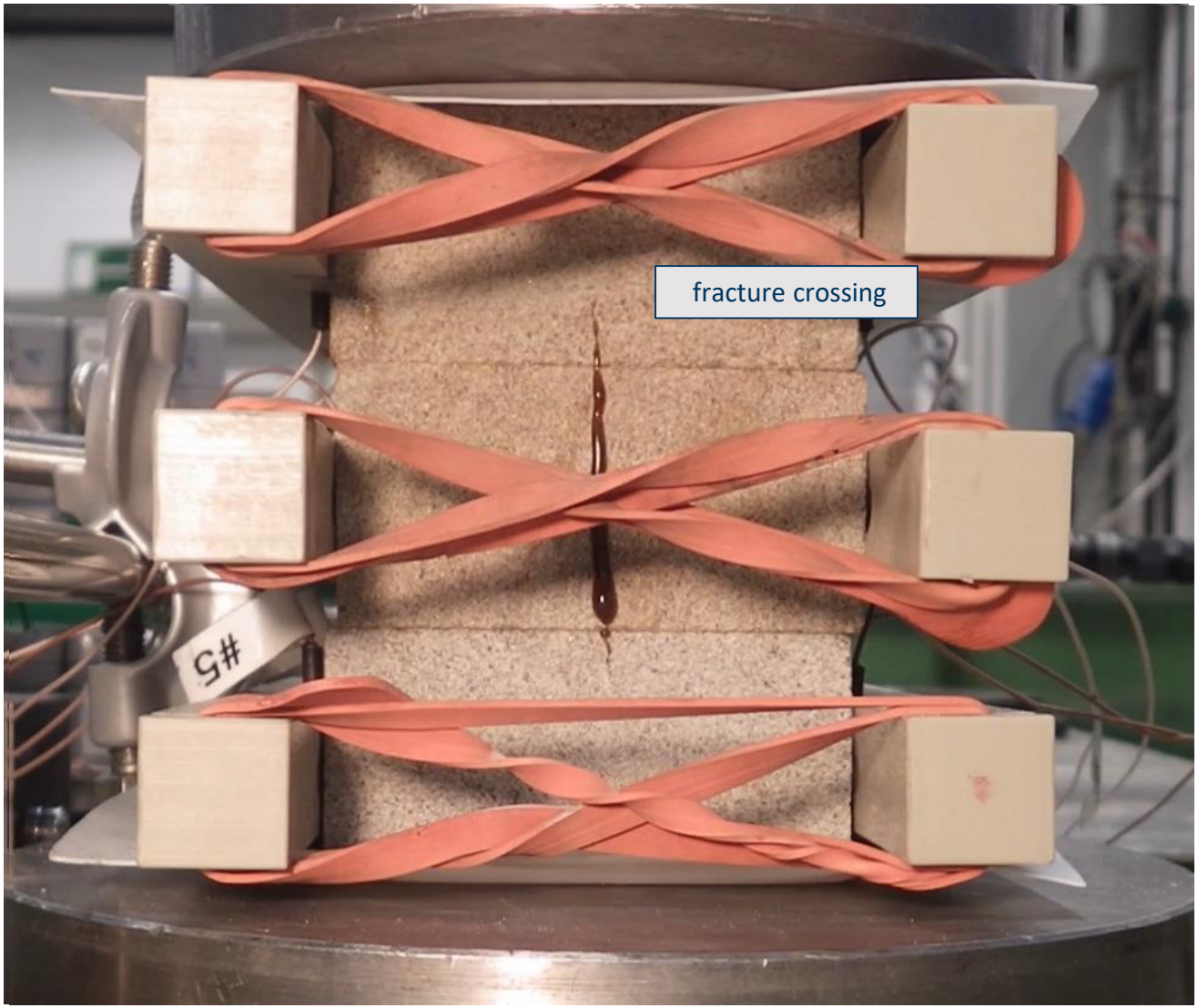
acoustic sensors

injection line

fracture



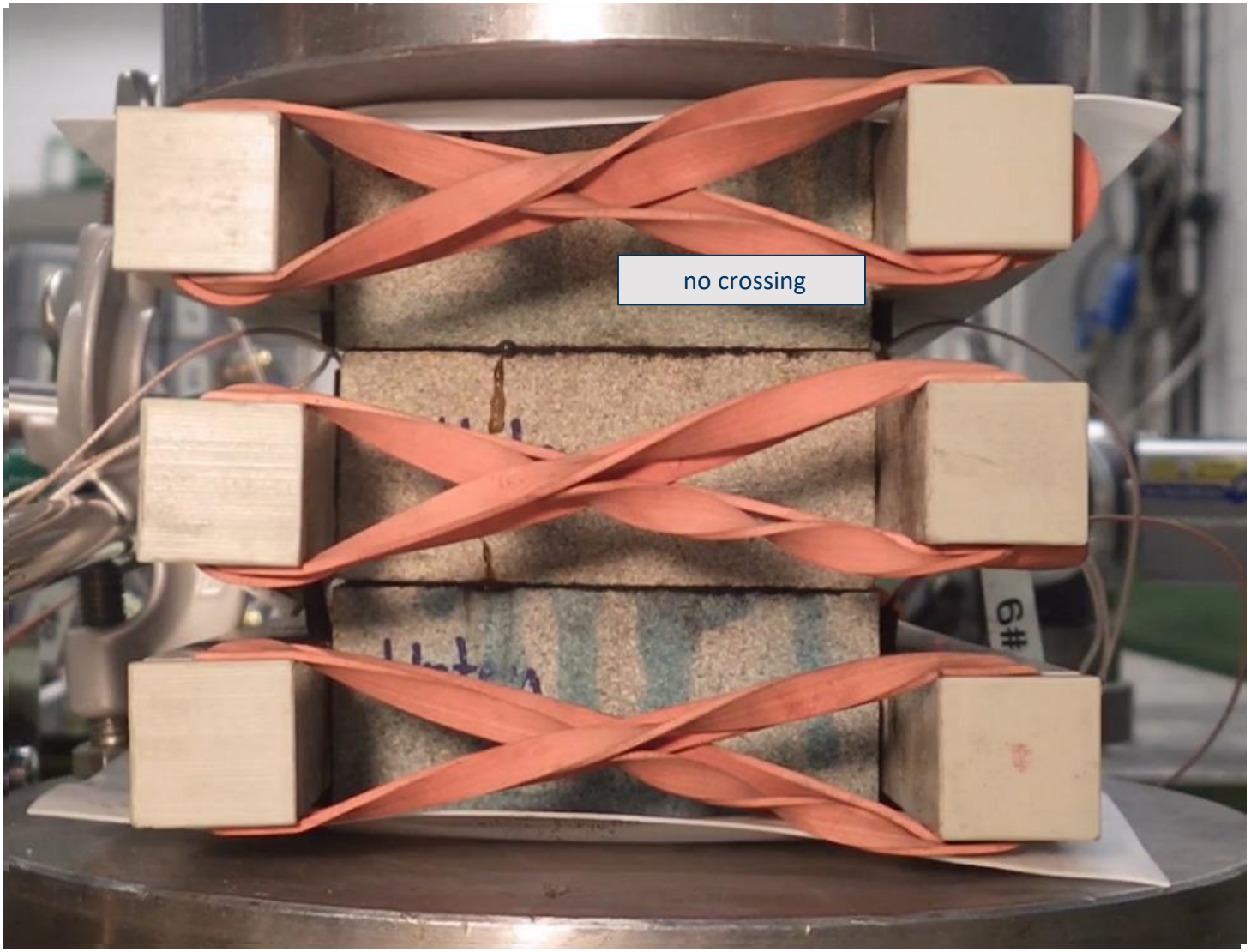

# Trennflächen




ohne Kohle

15 MPa Normal-spannung

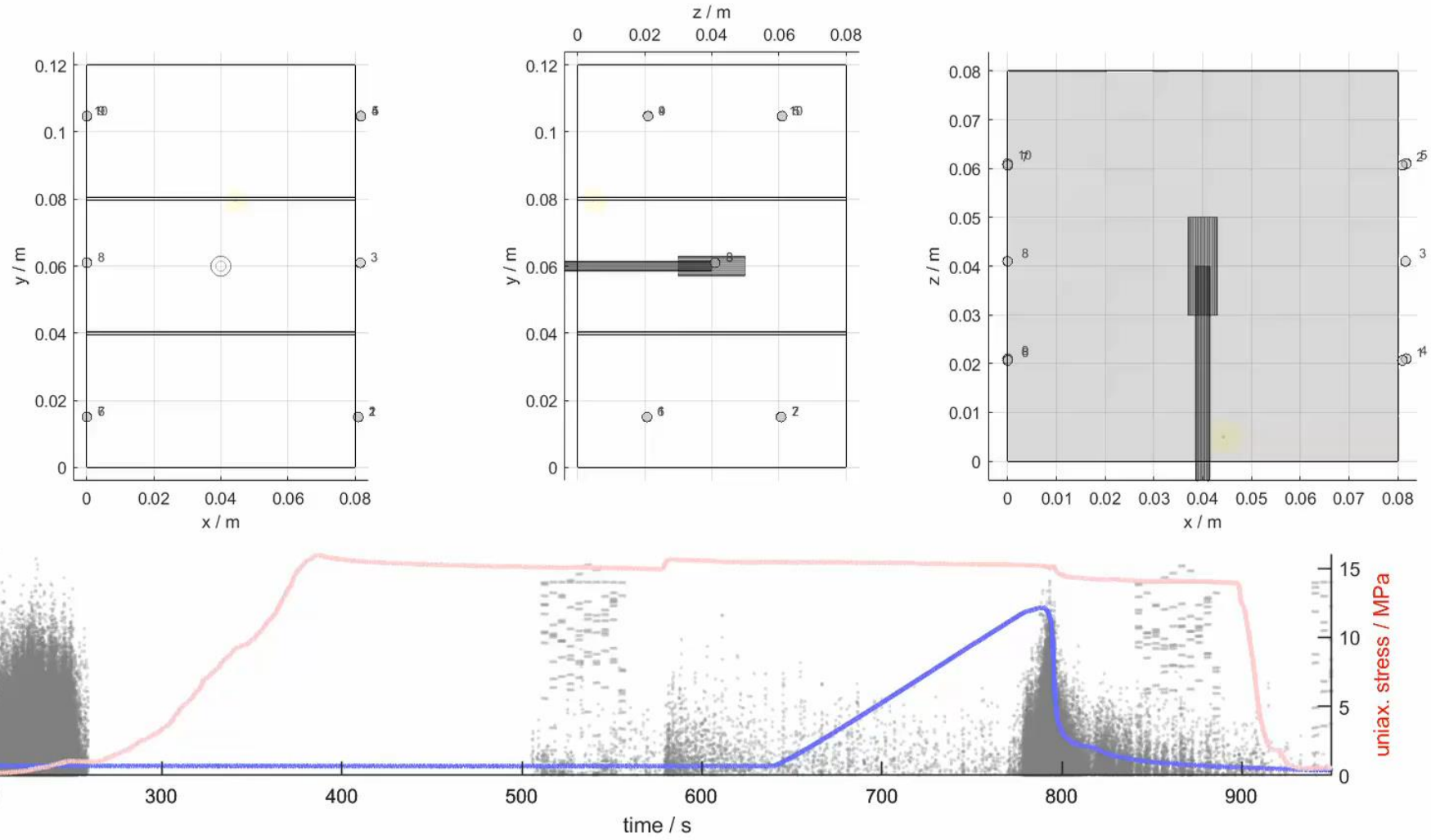
# Trennflächen



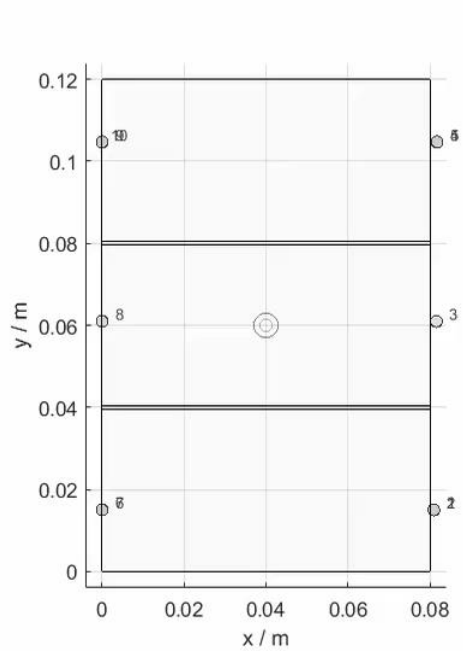

mit Kohle

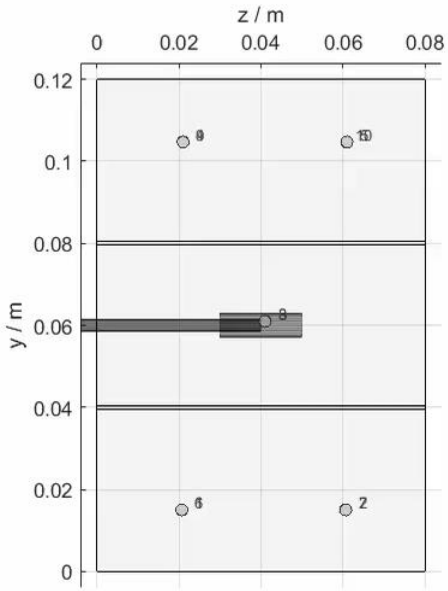
20 MPa Normal-spannung

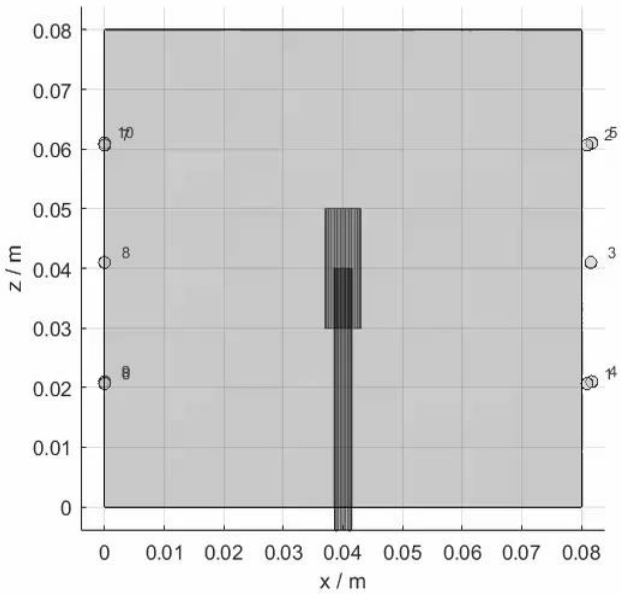
# Trennflächen

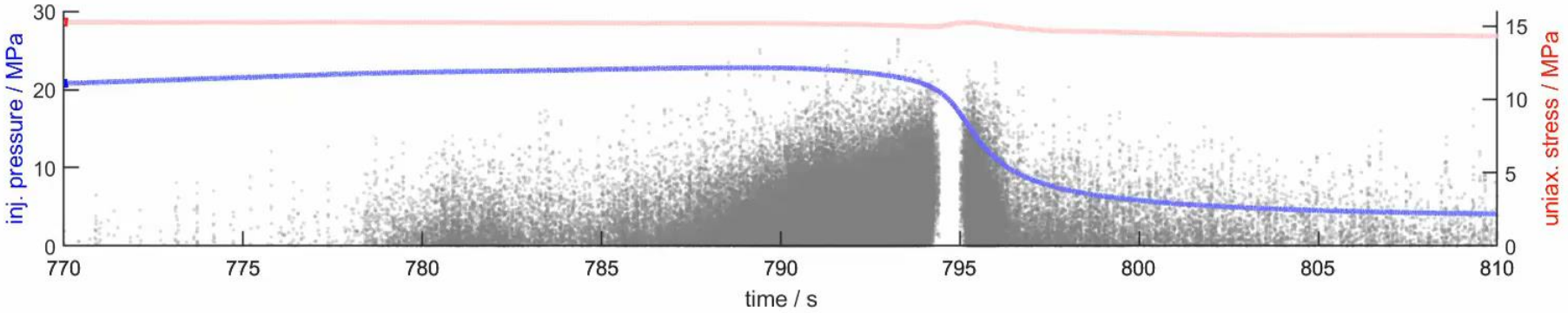


# Trennflächen



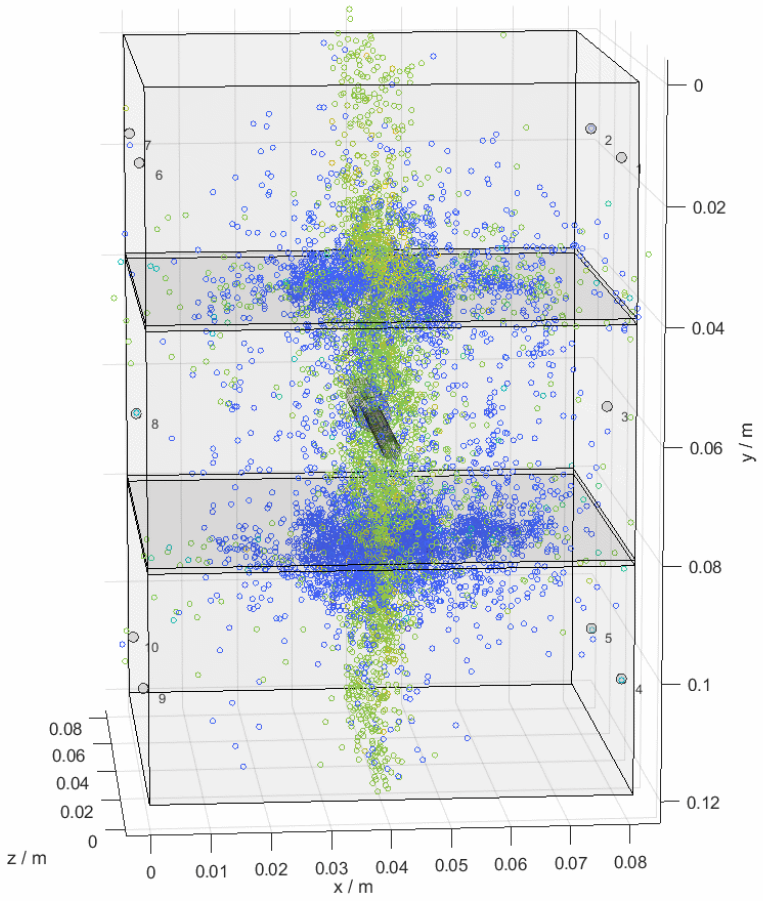



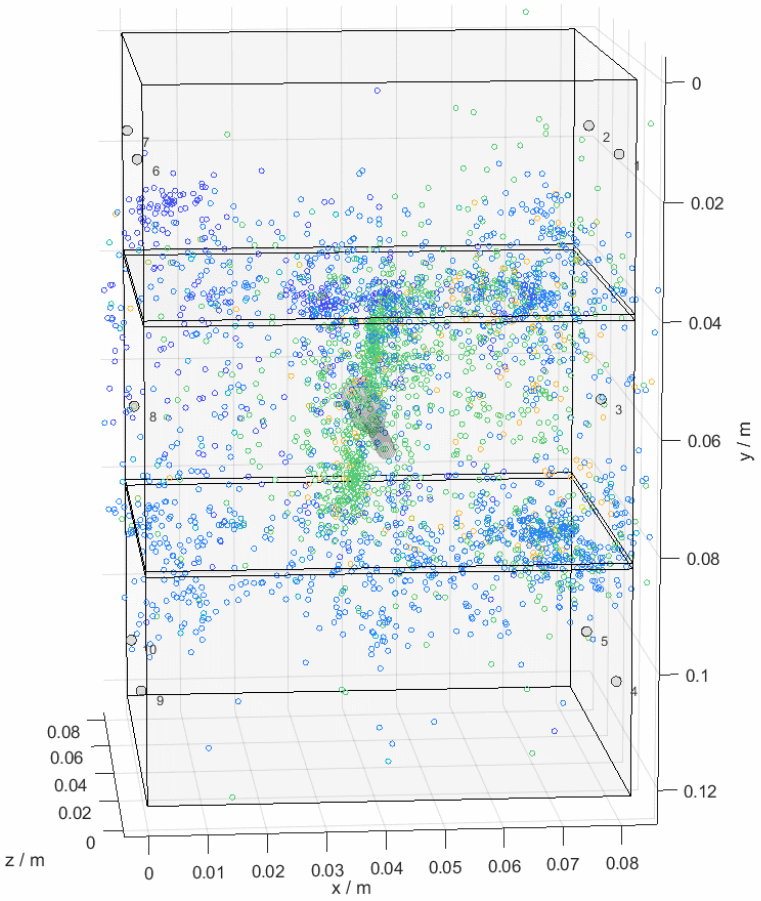



# Trennflächen

## fracture crossing




## no crossing

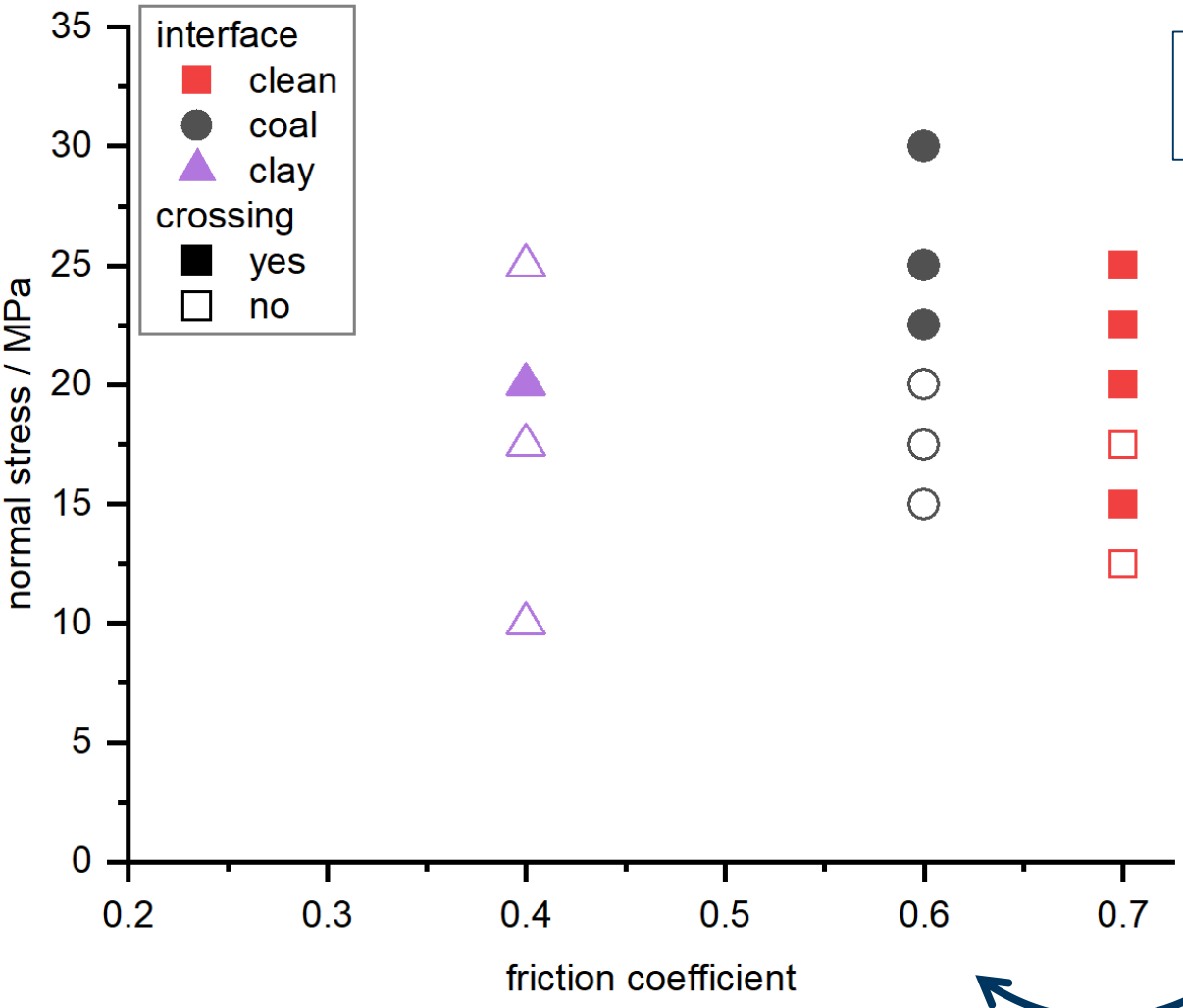


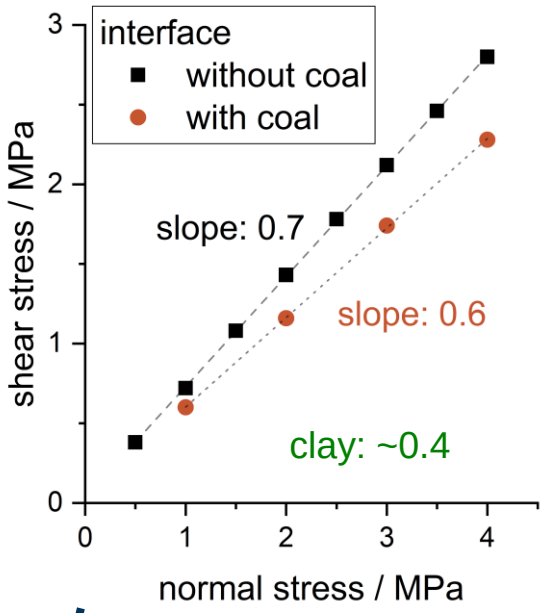

Time: early  late

# Trennflächen

theoretical criterion for fracture crossing (Renshaw & Pollard, 1995):

$$\frac{\text{normal stress}}{\text{tensile strength}} = \frac{0.35 + \frac{0.35}{\mu}}{1.06}$$



# Materialkontrast

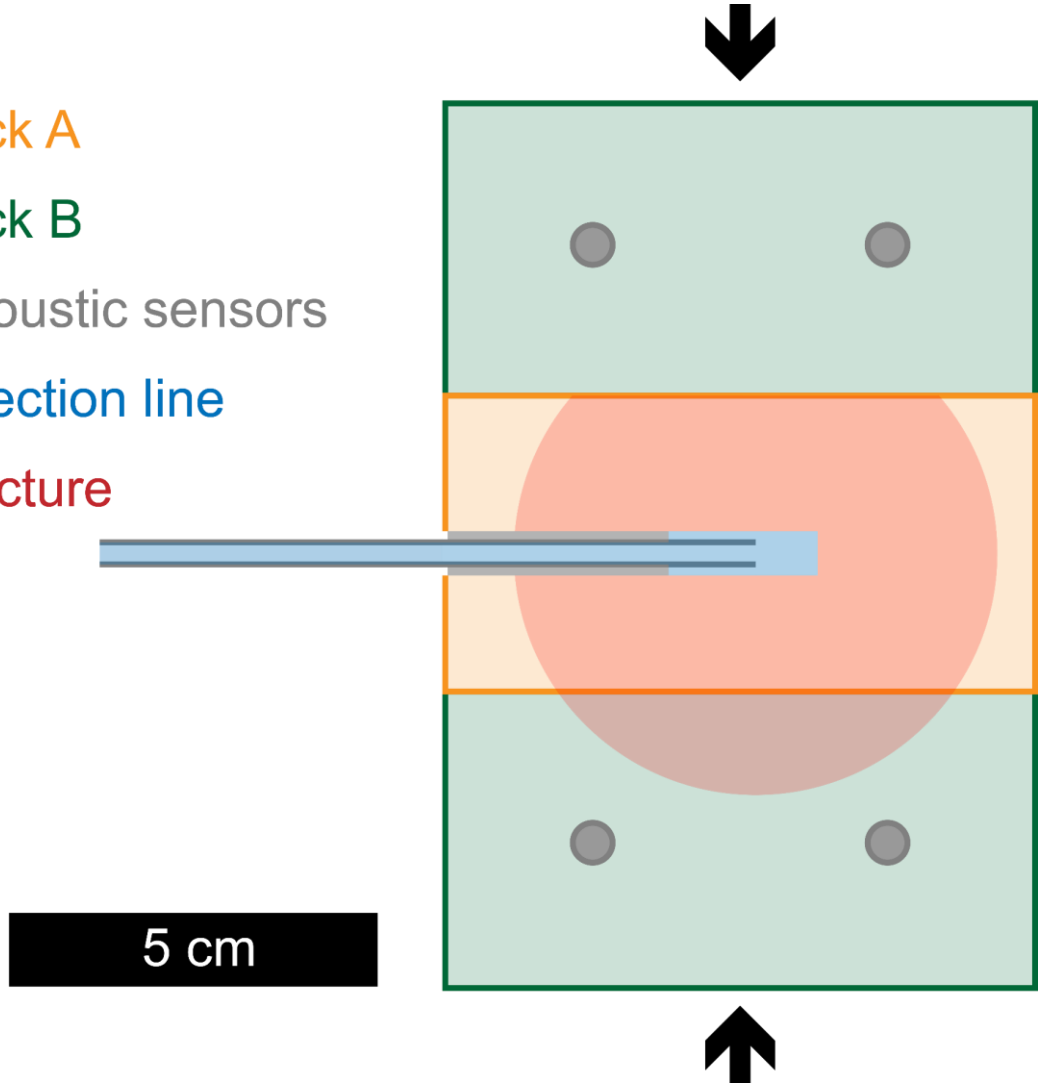
rock A

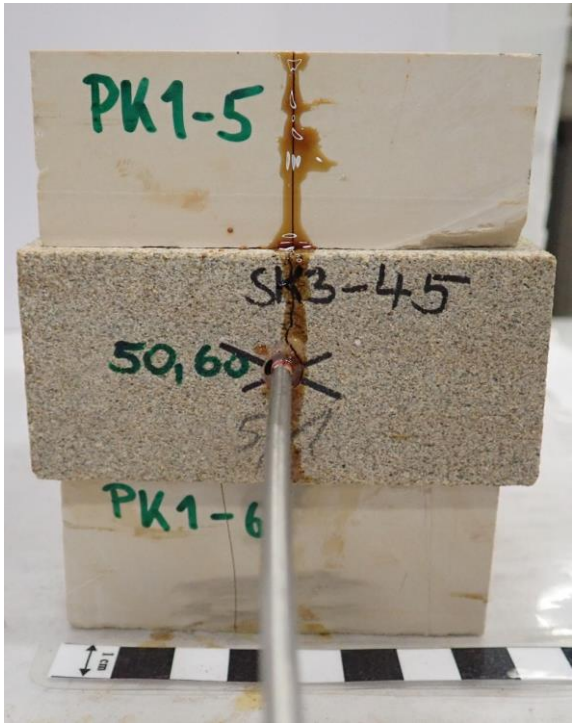
rock B

acoustic sensors

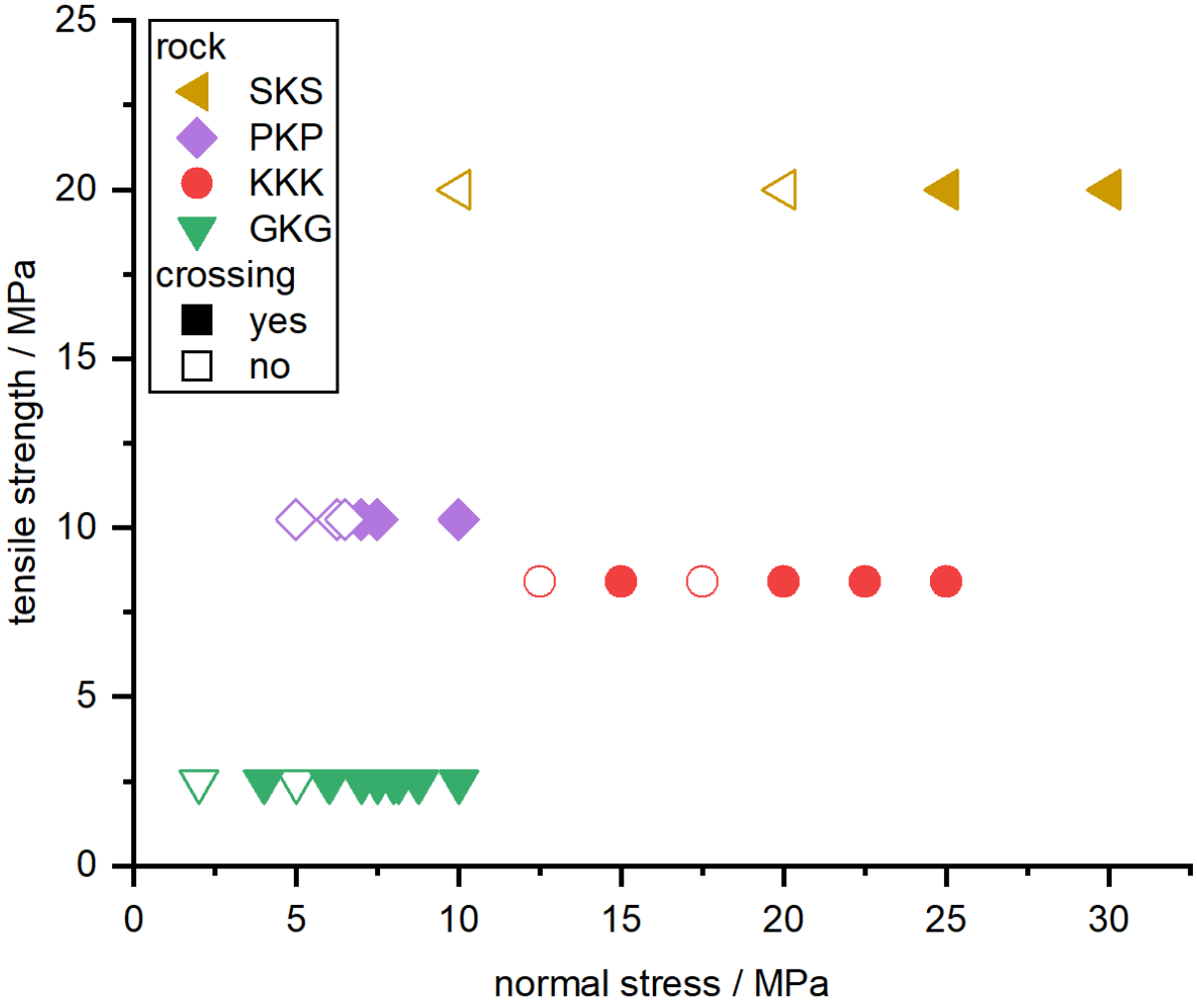
injection line

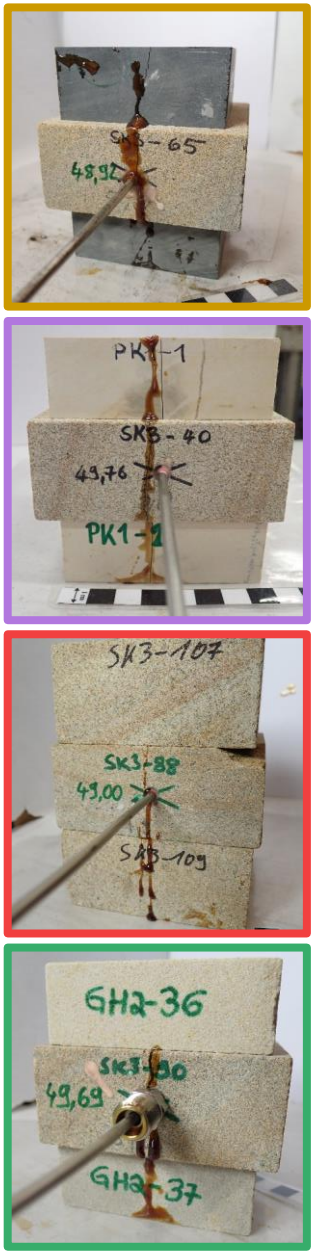
fracture

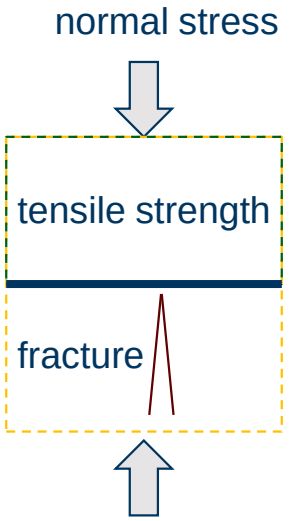


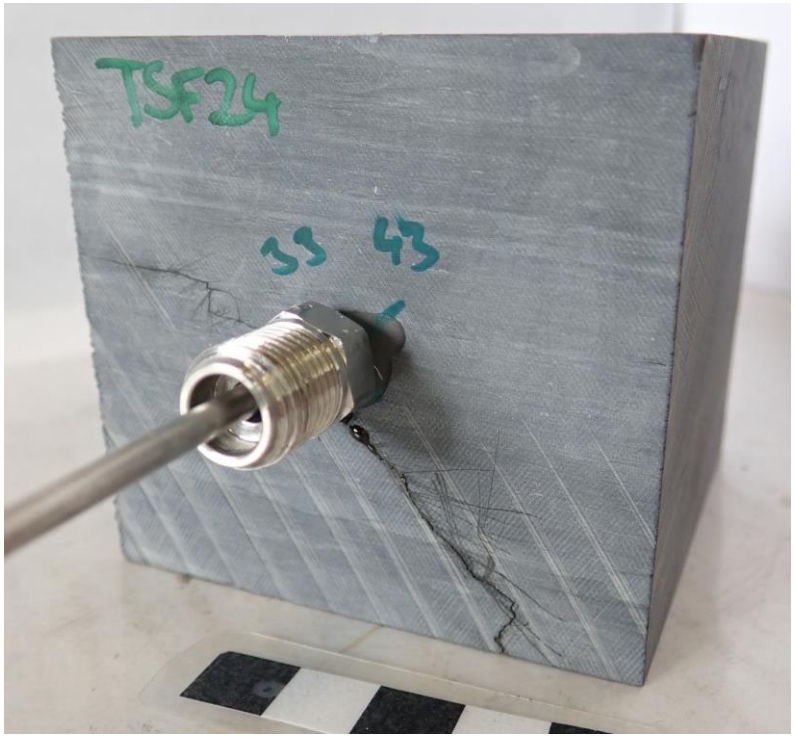
# Materialkontrast



# Anisotropie

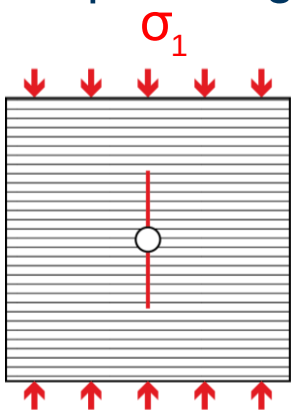



2 cm

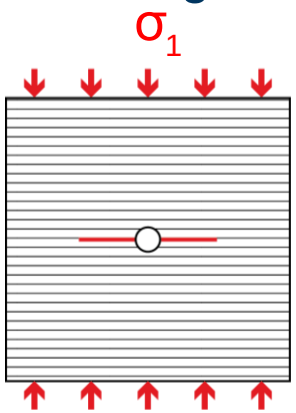
- Schieferwürfel
- senkrecht zur Foliation belastet

Rissgeometrie kontrolliert durch

Spannungsfeld




Gefüge



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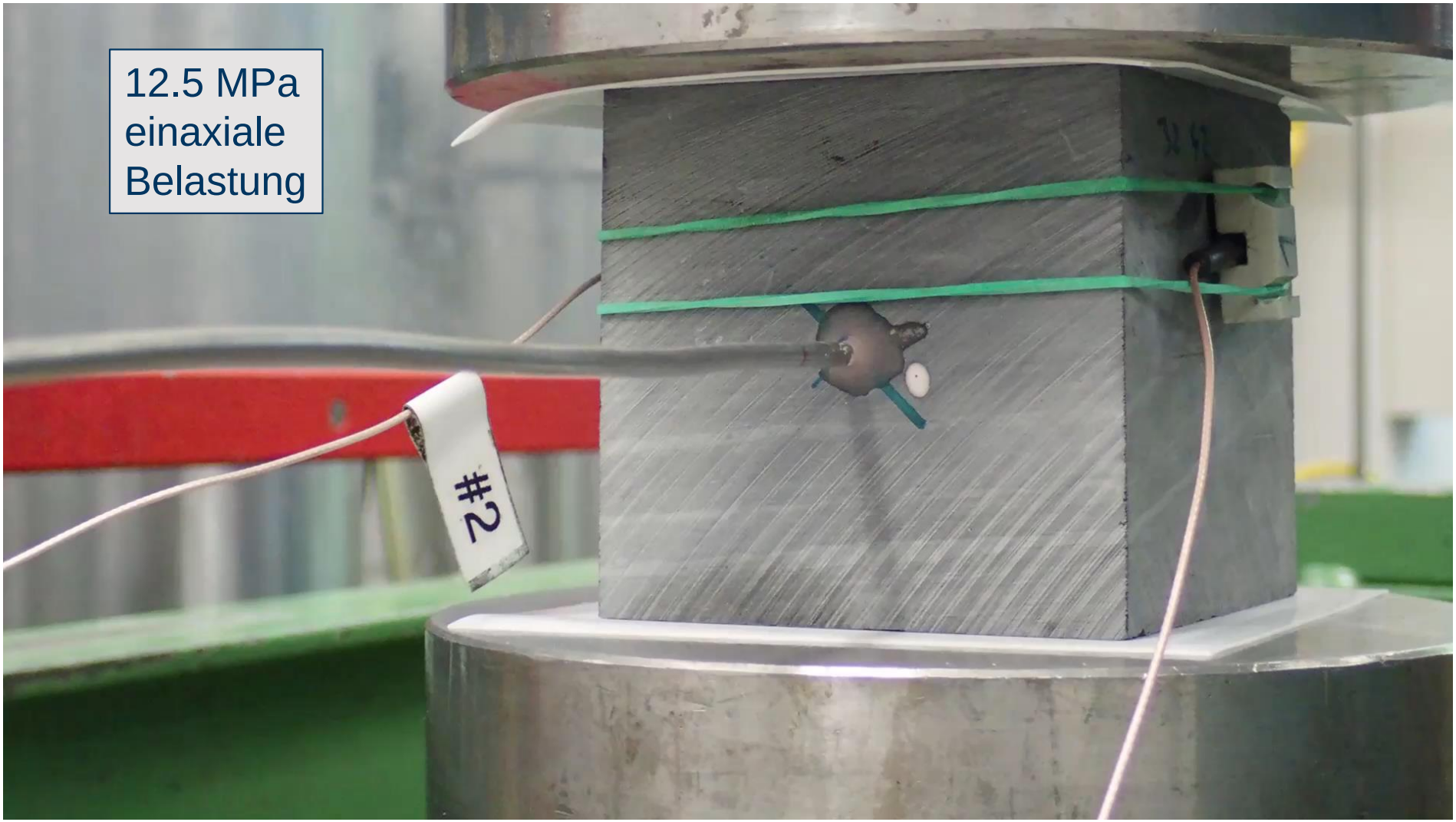
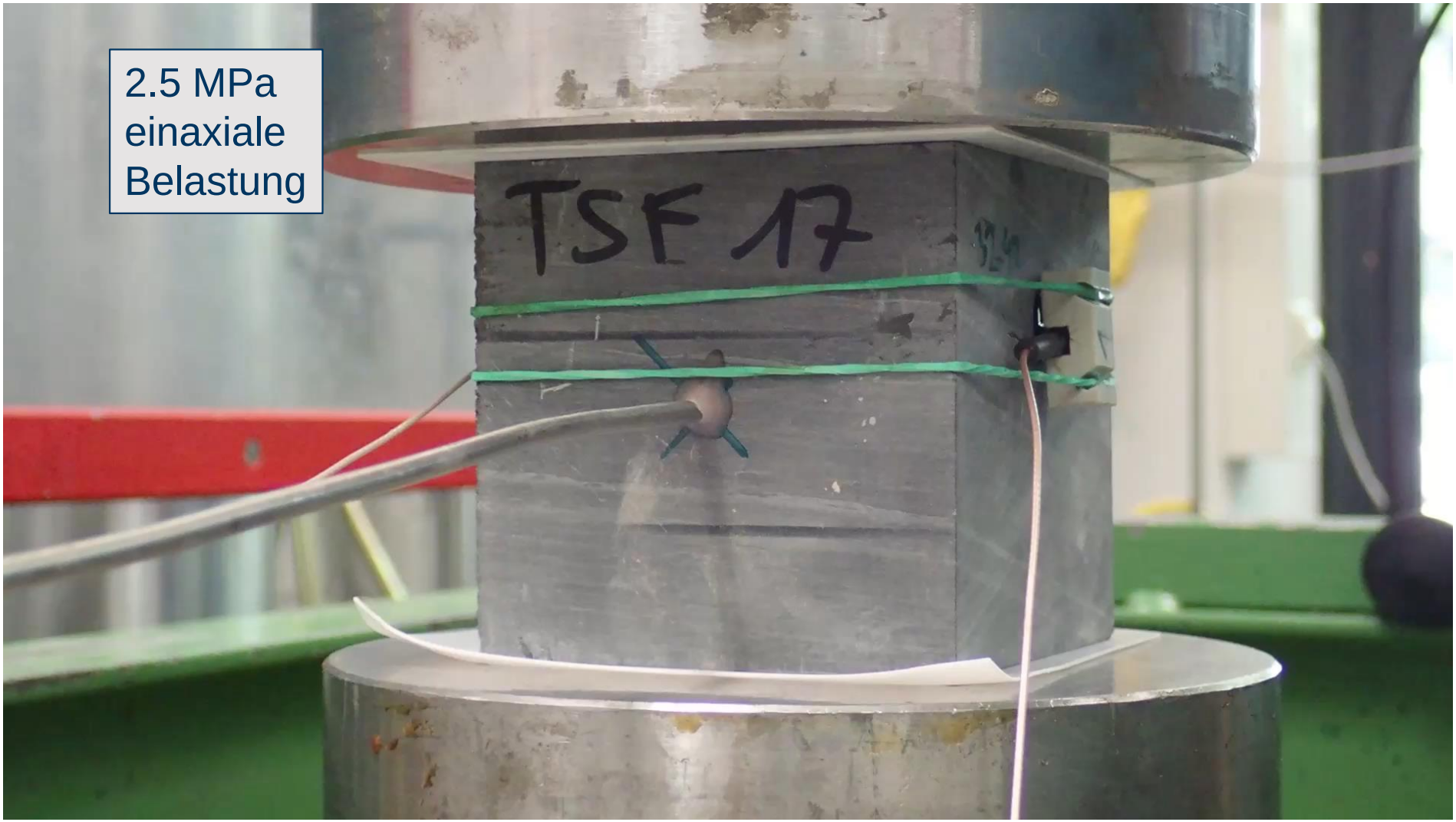


# Anisotropie



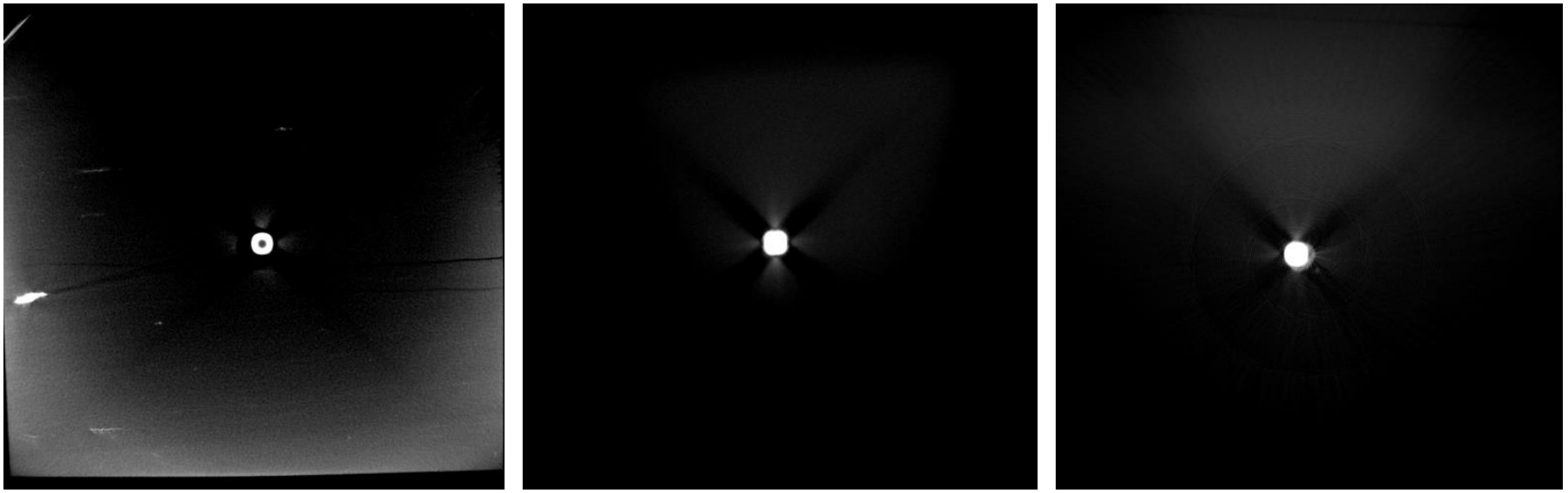
# Anisotropie

Röntgen-µCT:

5 MPa

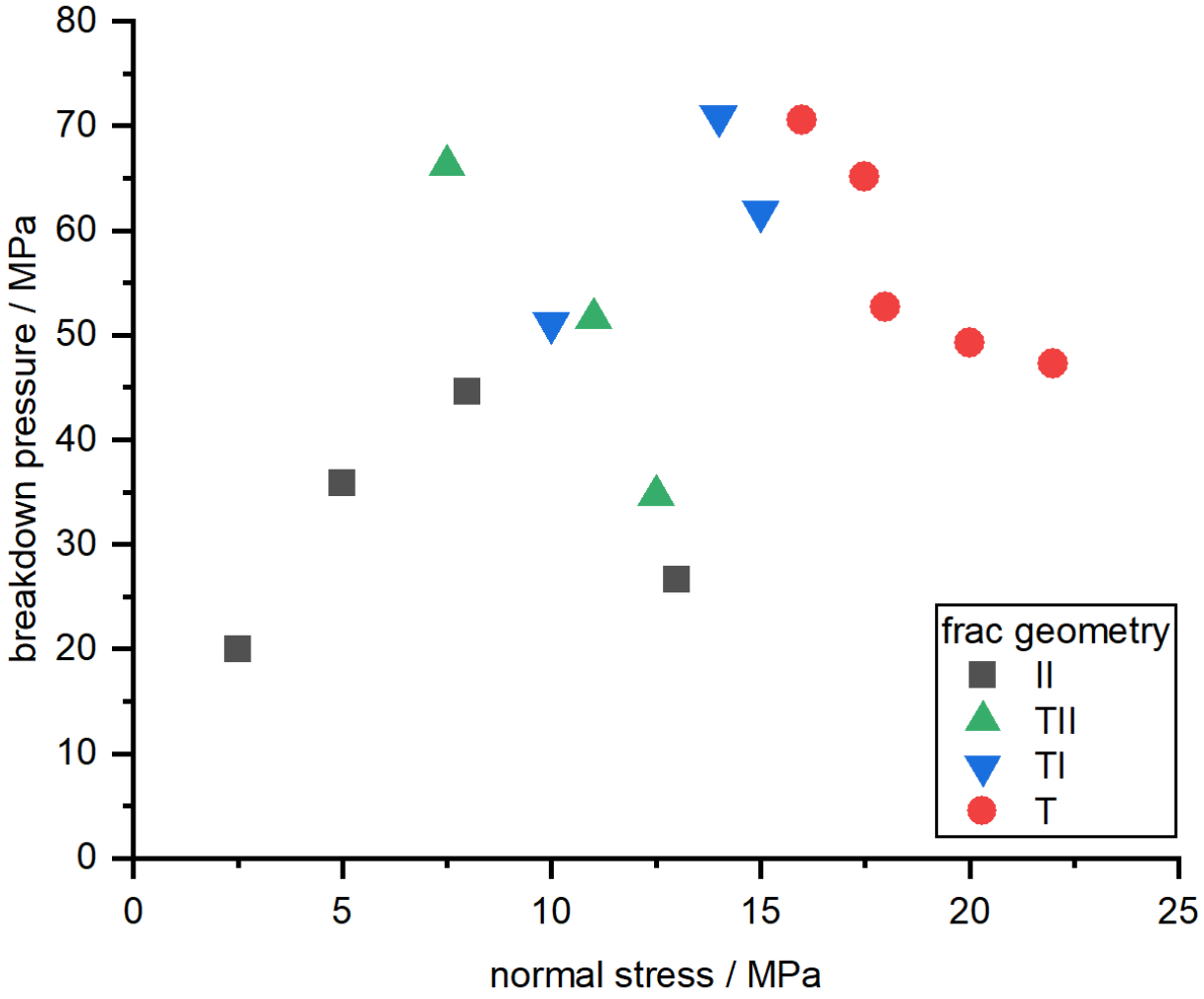
7.5 MPa

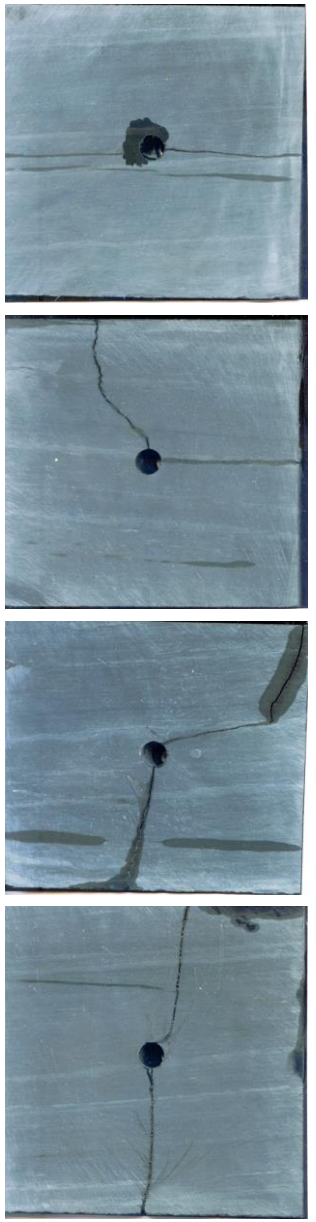
10 MPa



2 cm

# Anisotropie



II

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# Danksagung

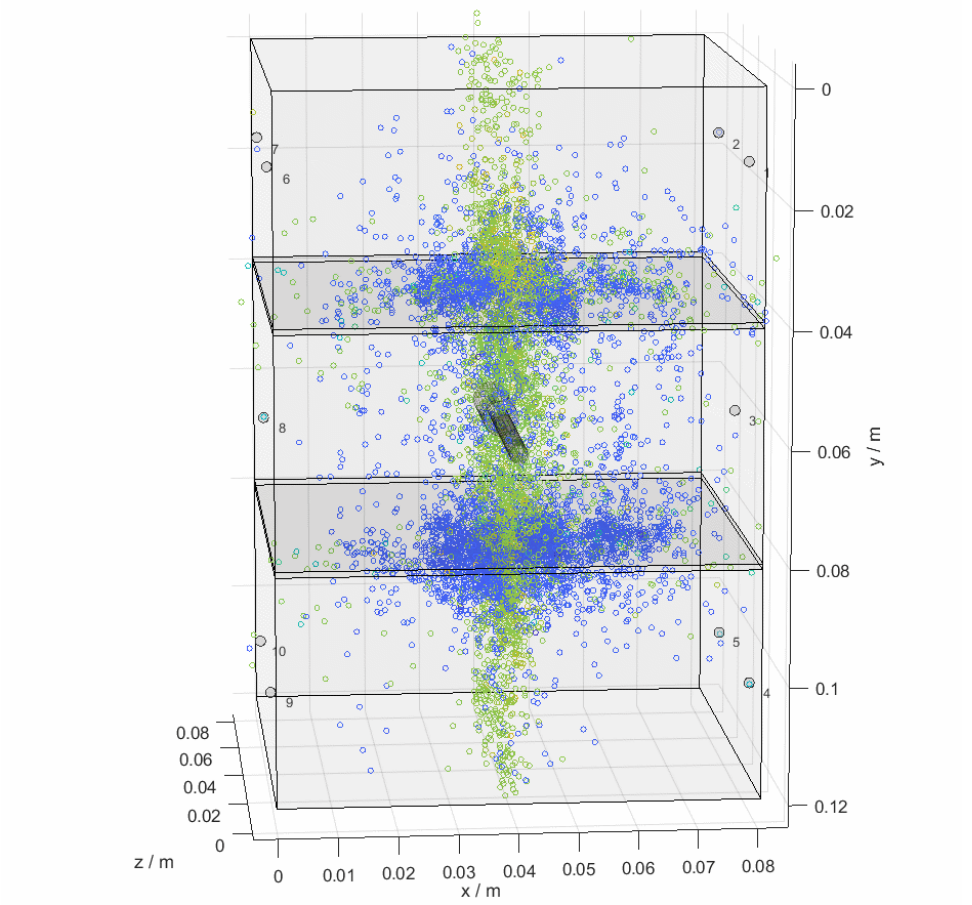

**PROJEKT MULTIFRAC**

FKZ 0324138A

Gefördert durch:

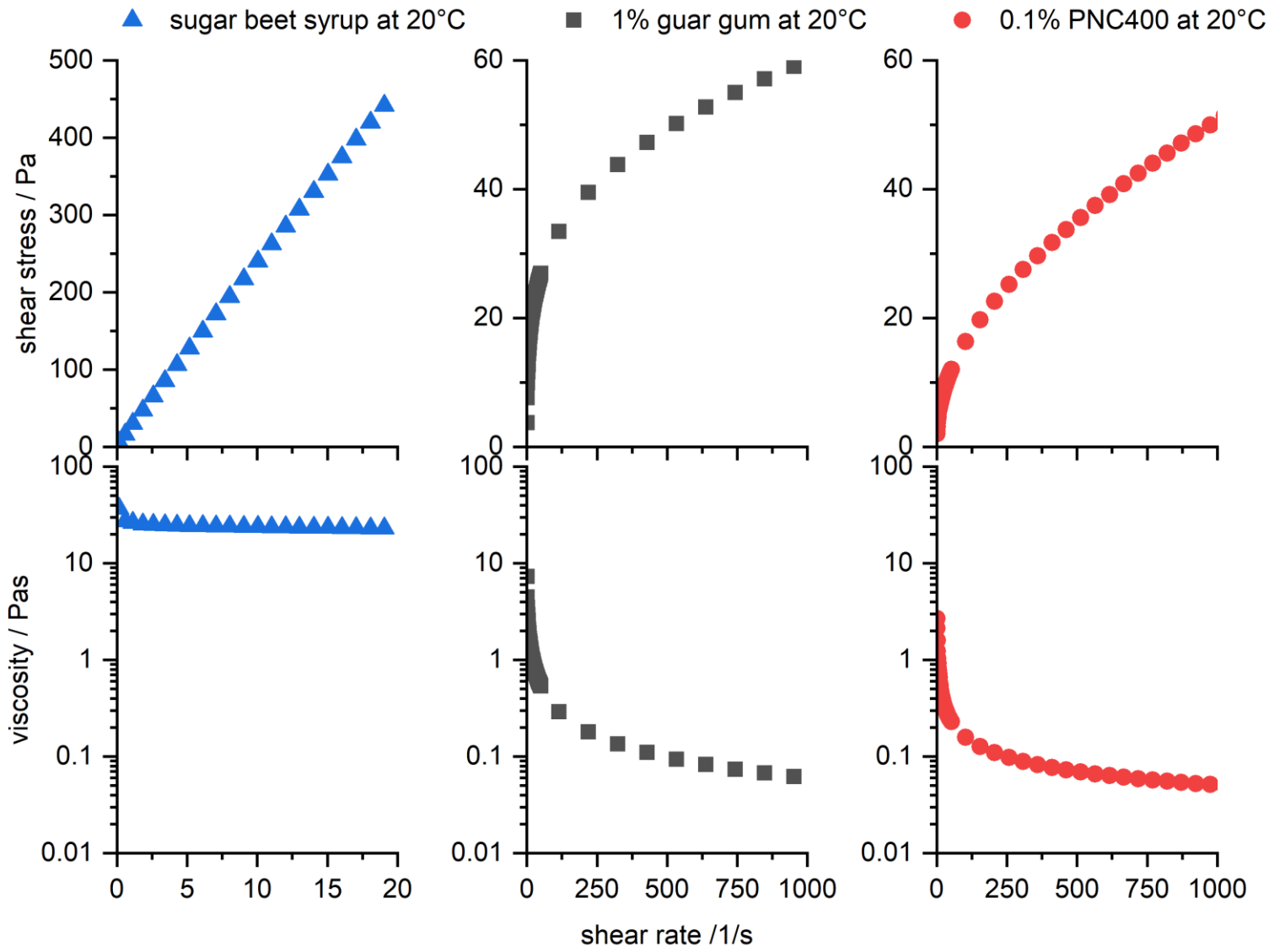
Bundesministerium
für Wirtschaft
und Energie

aufgrund eines Beschlusses
des Deutschen Bundestages

# Fracfluide


Grafschafter
Goldsaft
Zuckerrübensirup
e 500 g


sugar beet syrup at 20°C
1% guar gum at 20°C
0.1% PNC400 at 20°C
shear stress / Pa
viscosity / Pas
shear rate /1/s

# Laborversuche: elastische Parameter