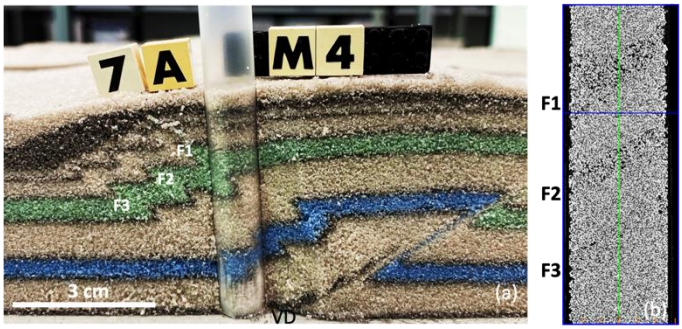
Fault structure and porosity in analogue scale models

Department: Earth Sciences
Research group: Tectonics
Supervisor: dr. E. Willingshofer
Email address: e.willingshofer@uu.nl

Project description

In this study, porosity development of contractional faults is quantified in relation to fault displacement. For that a series of physical models have been performed at Utrecht University where the amount of shortening has been varied to produce thrust faults with variable off-set, ranging from 0.2-2 cm. Our setup a 3 cm thick layer of quartz sand that is placed on two plastic sheets, with the mobile sheet being pulled below the overlaying stationary sheet. This creates a stationary singularity point at the contact of the two sheets and triggers localization of deformation at the velocity discontinuity leading to the formation of conjugate thrusts (Fig. 1a). Drill cores have been extracted and scanned with a micro-CT scanner, ZEISS Xradia 610 Versa 3D X-ray Microscope, located in the EPOS-NL Multi-scale Imaging and Tomography Facility (MINT) at Utrecht University (https://epos- nl.nl/facilities/). The results show that porosity is higher at locations of the faults (Fig. 1b)



This project pursues 2 goals:

1. quantifying for the first time the porosity of fault structures in physical analogue experiments and showing its 3 dimensional variability.
2. evaluating if grains and pores develop a shape preferred orientation during faulting.

Both aspects are relevant for the evolution of fault properties including, porosity, permeability and fault strength, which is important for subsurface application within the frame of sustainable energy storage and extraction. For that the micro-CT images will be analysed using Dragonfly software, which allows for characterizing and quantifying fault zone characteristics mentioned above.

Job requirements

The successful candidate will develop skills in sophisticated image analysis, which is relevant to many Earth science applications and should be enthusiastic about learning new software applications.