

The Rheology
and Deformation
Laboratory

TRIAXIAL ROCK
DEFORMATION
APPARATUS

Samples used for experiments include: rocks collected from the field, manufactured and synthetic materials meant to achieve a specific composition, and rocks recovered from drilling projects.

Sandstone
core before
and after a
deformation
experiment

Assistant professor Melodie French and her group study rocks from fault zones to better understand how and why faults slip and what conditions lead to or inhibit earthquakes. The primary aim is to understand what causes earthquakes and other types of slip to nucleate, grow and arrest.

The duration of an experiment can be designed to measure a rocks deformation over time. Experiments can be conducted in as short as a day and up to several weeks.



The French Lab group with the tools of the trade (L to R): Assistant professor Melodie French, Ph.D. student Celine Fliedner, summer intern Lena Nyblade and Ph.D. student Ben Belzer.

Deformation experiments measure the effects of pressure, temperature, pore fluid pressure, the rate at which rocks deform, the total strain on the strength of rocks and the impact on the seismic velocities of rocks. These properties are then used to better understand how faults slip and how to improve interpretation of their seismic tomography.

STUDENT RESEARCH- Rheology and deformation

Ph.D. candidate Celine Flidner studies the behavior of rocks in subduction zones and the resulting mechanical feedback between rock-fluid interactions. Flidner seeks to identify what properties control geophysical signals (seismic waves) in order to infer the types of rocks and conditions deep beneath the surface of the Earth..

Experiments will utilize the triaxial deformation apparatus to vary pressure, temperature and pore pressure to see the effect those environmental conditions have on the propagation of seismic waves through her rock samples. One set of experiments involves rapidly oscillating the axial force at the frequency of seismic waves (0.1 Hz. To 30Hz) and the other uses transducers to send signals that are high frequency (MHz), or ultrasonic waves, through the sample.

From her measurements, she will calculate the elastic response (the seismic velocities) and inelastic responses (a change in the energy as the signal moves through the rock). In addition to studying the environmental controls on seismic waves, she will look at how a rock's microphysical properties (e.g. porosity, but also the mineralogy) also control the seismic signals.

The ultimate goal is to build a tool to use seismic waves measured at the surface to better constrain pore fluid pressure below the surface within subduction zones. Pore fluid pressures are an important control on deformation mechanisms within subduction zones that generate earthquakes. 🌍

"If you can constrain the pore pressure, you could potentially use it to help predict understand how faults slip in subduction zones."



Celine Flidner describes the process of extracting cores from the schist she uses in her experiments.