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The solid medium deformation apparatus – reloaded

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Rock deformation experiments are used to compile mechanical data sets for minerals and rocks and to study microstructure and texture development.

The Griggs apparatus, a solid medium piston cylinder machine was designed about 60 years ago to investigate rock deformation mechanisms and rheology at elevated confining pressures. In a typical experiment today, the confining medium is NaCl, with confining pressures up to 3 GPa, temperatures up to 1100°C, and displacement rates between 10^{-8} and 10^{-2} ms^{-1} (equivalent to strain rates of 10^{-7} to 10^{-3} s^{-1}). In axial tests, the cylindrical samples are 12 to 15 mm long with a diameter of 0.625 mm. In shearing test, split cylinder assemblies are used with 0.5 to 1 mm thick samples introduced along the 45° pre-cut. Reasonable total strains are limited to 30% axial shortening or shear strains of gamma 4. (Higher strains can be attained but are difficult to analyse mechanically. Unlike for gas rigs, torsion is not available for solid medium machines).

As of now, the operational fleet of solid medium deformation apparatus comprises worldwide over 20 machines in different labs (mainly in Europe, U.S.A. and Japan), providing the scientific community with an ever-growing rheological and microstructural data base.

In view of numerous developments in experimental design, as well as improvements of hardware and software for data acquisition and processing, the experimental community was recently invited to a two-day workshop, hosted by the experimental group of Orléans University. The main goal was to discuss the following points:

- how to further improve the apparatus, increase its scope and improve calibrations;
- how to further improve data processing, and the precision and reliability of the results;
- how to maintain consistency among the labs and through time (backwards compatibility);
- how ensure compatibility of results from axial and shearing experiments;
- how to make the data available to the community.

The poster represents a condensed report of the meeting highlighting a few issues of special interest to the structural community. Visitors to the poster are invited to share their thoughts and to give us feed-back.