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New experimental approach to measure seismic wave attenuation of rocks at low frequencies

C. Madonna (1), S. Boutareaud (1), L. Burlini (1), and R. Habiger (2)

(1) ETH Zurich, Geological Institut, Zurich, Switzerland (claudio.madonna@erdw.ethz.ch; sebastien.boutareaud@erdw.ethz.ch;luigi.burlini@erdw.ethz.ch), (2) Spectraseis AG , Zurich, Switzerland (rob.habiger@spectraseis.com)

Here we present a new experimental approach to accurately characterize attenuation on fluid-bearing rock samples. A prototype of apparatus has been built and developed in order to measure attenuation (1/Q) of seismic P-waves passing through a rock sample in the low frequency regime (0.1Hz - 50Hz), by the stress-strain method in an internally heated gas apparatus (Paterson-rig). Stress is measured with a high-sensitivity load cell (resolution 1N). Strain is measured with high sensitive LVDTs of 1mm full range (resolution 1e-7mm). The quality factor Q (i.e. the reciprocal of attenuation) is obtained from the time shift between the mechanically applied sinusoidal stress at the bottom of the sample, and the sinusoidal strain's response measured on the top sample.
We report basic sketch of the apparatus, explain the technical difficulties and lastest improvements. In addition, we present the preliminary results on aluminium (1/Q close to 0) and Fontainbleau-sandstone saturated with oil, and their corresponding digital signal processing.
This new technique can be used to accurately establish a catalog of 1/Q values as a function of in-situ rock properties. In particular, future studies using this apparatus will be used to investigate the effect of different fluid properties on 1/Q.