Oral | Symbol S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Techtonophysics

# [S-IT40_1PM1]Geofluids: their distribution and role in the Earth's dynamics

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Recent advances of magnetotelluric and seismic imaging of the Earth's interior have suggested "geofluids" distribute more ubiquitously than ever thought; this has accelerated the development of a new integrated discipline on the geofluids ranging from material sciences in molecular scale to geophysics and geochemistry in the island arcs and mid oceanic ridges. The scope of this session is to bring together multi-scale and interdisciplinary researches on distributions of aqueous fluids and silicate and other melts in the crust and mantle of a wide range of tectonic settings, and on the physical and chemical properties of these fluids. Topics on geodynamics related to the presence of fluids are also welcomed.

2:15 PM - 2:30 PM

# [SIT40-P04_PG]Influence of confining and pore-fluid pressures on velocity and conductivity of a fluid-saturated rock

3-min talk in an oral session

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Pore-fluid pressure in seismogenic zones can play a key role in the occurrence of an earthquake (e.g., Sibson, 2009). Its evaluation via geophysical observation can lead to a good understanding of seismic activities. It is critical to understand how pore-fluid pressure affects seismic velocity and electrical conductivity. We have studied the influence of pore-fluid pressure on elastic wave velocity and electrical conductivity of water-saturated rocks. Measurements have been made using a 200 MPa hydrostatic pressure vessel, in which confining and pore-fluid pressures can be separately controlled. An aqueous pore-fluid is electrically insulated from the metal work by using a specially designed device (Watanabe and Higuchi, 2013). Elastic wave velocity was measured with the pulse transmission technique (PZT transducers, f=2 MHz), and electrical conductivity the four-electrode method (Ag-AgCl electrodes, f=100 mHz-100 kHz) to minimize the influence of polarization on electrodes. Berea sandstone (OH, USA) was used for its high porosity (19.1%) and permeability (~$10^{-13}$ $m^2$). It is mainly composed of subangular quartz grains. Microstructural examinations show clay minerals (e.g., kaolinite) and carbonates (e.g., calcite) fill many gaps between quartz grains. A small amount of feldspar grains are also present. The grain size is 100-200 micrometers. Cylindrical samples have dimensions of 25 mm in diameter and 30 mm in length. Their axes are perpendicular to sedimentation bed. Elastic wave velocity is slightly higher in

the direction perpendicular to the axis than in that parallel to the axis. Confining and pore-fluid pressures work in opposite ways. Increasing confining pressure closes pores, while increasing pore-fluid pressure opens them. For a given pore-fluid pressure, both compressional and shear velocities increase with increasing confining pressure, while electrical conductivity decreases. When confining pressure is fixed, velocity decreases with increasing pore-fluid pressure while conductivity increases. The closure and opening of pores can explain observed changes of velocity and conductivity. Effective confining pressure is defined by the difference between confining and pore-fluid pressures. Velocity increases with increasing effective confining pressure, while conductivity decreases. However, neither velocity nor conductivity is unique function of the effective confining pressure. For a given effective confining pressure, conductivity significantly increases with increasing confining pressure. Velocity also increases with increasing confining pressure, though it is not so significant. Increasing pore-fluid pressure can compress clay minerals to increase pore space. This might explain observed conductivity change.