Porosity of metamorphic rocks and fluid migration within subduction interfaces

Bruno Reynard, Anne-Céline Ganzhorn, and Hélène Pilorgé
CNRS, UMR 5276 Laboratoire de Géologie de Lyon, Lyon, France (bruno.reynard@ens-lyon.fr)

Large earthquakes break the subduction interface to depths of 60 to 80 km. Current models hold that seismic rupture occurs when fluid overpressure builds in link with porosity cycles, an assumption still to be experimentally validated at high pressures. Porosities of subduction zone rocks are experimentally determined under pressures equivalent to depths of up to 90 km with a novel experimental approach that uses Raman deuterium-hydrogen mapping. Natural rocks (blueschists, antigorite serpentinites, and chlorite-schists) representing a typical cross-section of the subduction interface corresponding to the deep seismogenic zone are investigated. In serpentinite, and to a smaller extent blueschist, porosity increases with deformation, whereas chlorite-rich schists remain impermeable regardless of their deformation history[1]. Such a contrasting behavior explains the observation of over-pressurized oceanic crust and the limited hydration of the forearc mantle wedge. These results provide quantitative evidence that serpentinite, and likely blueschist, may undergo porosity cycles making possible the downdip propagation of large seismic rupture to great depths.