The 9th Global-COE International Frontier Seminar

May 28th, 2009, from 17:00, at seminar room II (# 385), 3F

Rheology of serpentines, seismicity and mass transfer in subduction zone

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Serpentinites have a lower density and lower viscosity than "dry" ultramafic rocks and it was proposed, based on numerical simulations, that they play a major role in mantle-slab decoupling, and in downward (sink) or upward (exhumation) motion of eclogites and ultra-high pressure (UHP) rocks in subduction zones. Rheological data on antigorite, the stable variety of serpentine in subduction zones, were obtained over a P-T range of 1-4 GPa and 200-500 /deg C that cover most of its stability field. The experiments were carried out in a D-DIA apparatus installed at GSECARS on the 13-BM-D line of APS. The determined stress-strain curves were fitted to a power-law equation including both temperature and pressure dependence. The results confirm that serpentinites acts as a weak layer that allows significant mass transfer along the "serpentinized channel" and dynamic processes such as mantle slab decoupling, and mantle wedge convection. Regardless of the temperature, serpentinized mantle at the slab surface has a low viscosity that allows localizing the deformation and impeding stress build-up. It will limit the downdip propagation of large earthquakes, and allow viscous relaxation as an origin of post-seismic deformations and slow earthquakes. Models of growth and transport of a serpentinized channel using available kinetic and present rheological data explain high exhumation rates of eclogites and limited thickness of the channel at great depths (≥ 50 km), and slower exhumation in a thick hydrated mantle corner at shallower depths. Such channels may be difficult to detect from sismic tomography or using guided waves because of their small thickness (<2-3 km).

28 May 2009 17:00-18:00
Room 385, seminar room 3F
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