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Tectonic slicing of subducted oceanic crust along plate interfaces: numerical modeling

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Remains of high-pressure low-temperature metamorphic oceanic crust are observed within orogenic belts and along recent subduction zones all around the globe. Such blueshist and eclogite "slivers" can strongly vary in extend and experienced P-T-t evolution. To reveal the surficial occurrence of oceanic rocks that occasionally have been at depths down to $\sim$ 80 km within subduction zones, two main processes have to be investigated individually: (i) Detachment of oceanic slivers from the down going plate preventing rocks to be consumed by the mantle, and (ii) exhumation of detached oceanic material to the surface. It has often been stated that the process of slicing and exhumation of oceanic blueshists and eclogites is closely related to continental subduction. Nevertheless, several examples worldwide show exhumation (and therefore latest possible detachment from slab) occurring early or intermediate of the subduction process.
We present new insight into the mechanical processes of detachment of oceanic slivers and their exhumation independent of continental collision by using numerical modelling tools. Large-scale thermo-mechanical models (600 * 200 km) based on finite difference, marker-in-cell technique, are applied to test how serpentinised upper slab mantle (mantle serpentinisation at oceanic ridges or/and along to outer-rise normal faults) influences shallow and deep crustal detachment.
Preliminary results show that a through-going serpentinite layer below the oceanic crust, if serpentinisation exceeds 50%, triggers slicing at wedge depths. Even if mechanical coupling mainly occurs at intermediate depths along the subduction interface, stresses within the oceanic crust are dispersed upward due to the weak, decoupling serpentinite layer. Unconnected patches of serpentinised upper slab mantle eventually lead to deep slicing, depending on upper plate serpentinisation due to slab dewatering. Furthermore, we investigated the effect of pressure-dependent fluid migration and according weakening (increasing fluid pressure) of subducted crust and its implications on slicing.