2D numerical model of an ocean/continent subduction system: examples from the Variscan crust

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Mechanisms that favor the exhumation of subducted crustal material, both continental and oceanic, have been explored by mean of several models and 2D numerical studies. Petrological and numerical models (e.g. Ernst and Liou, 2008; Roda et al., 2010 and refs. therein) reveal that the dehydration process of the oceanic slab, with a consequent hydration of the mantle wedge, have a primary role for developing a convective dynamics in the area between the slab and the upper plate, since the beginning of the subduction.
The geodynamics of a convergent ocean/continent margin, evolving from subduction to continental collision, was analyzed by means of a 2D finite element thermo-mechanical model, in which the physics of the crust-mantle system is described by the equations for continuity, conservation of momentum and conservation of energy. A viscous behavior for the whole system is assumed, with both density and viscosity depending on temperature and composition. Different values of convergence velocities, 3, 5 and 8 cm/yr, have been used, as representative of slow, medium and fast subduction systems, respectively.
Our analysis is particularly focused on the effects of viscous heating and mantle hydration on the dynamics in the wedge area. The results support that these mechanisms, differently from our reference model without hydration and viscous heating (Marotta and Spalla, 2007), induce the development of short wavelength convective cells in the wedge area, that favor the exhumation of buried crustal material since the early stages of the subduction.
Model predictions, in terms of pressure, temperature, lithology and time, will be compared with structural, petrological and age natural data from the European Variscan crust to check and interactively improve 2D numerical models of the explored ocean/continent subduction system.

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