Numerical modelling of the influence of subduction parameters on partial melting

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Nowadays, a lot of models study subduction zones without any geometrical constraint. We use here a different approach, and model subduction zones with known geometry, for which both geophysical and geochemical constraints are available. The latter data provide information about partial melting conditions and rock chemical compositions.

A new 2D numerical model is developed to study the influence of subduction parameters on partial melting. We use a thermo-mechanical model which solves classical fluid mechanics equations using the finite element solver FreeFEM++ (http ://www.freefem.org/ff++/). Conservation of energy is solved using a Galerkin procedure, whereas Stokes equations use the penalty method. A non-linear rheology is computed with both nonnewtonian viscosity for the mantle and a brittle regime for the crust. We also introduce, in viscosity computations, a water-dependent term corresponding to the decreasing of rocks strength (Arcay et al., 2005) with water content. Water is introduced in the model according to phase diagrams relevant to the mantle and the crust, respectively. Melting curves are controlled by water contents (Katz et al., 2003).

In order to investigate the relations between subduction zone parameters and partial melting, we resume subduction zones parameters to the convergence rate, to the dip angle and to the age of the subducting lithosphere (Heuret and Lallemand, 2005). We add an other parameter, the crustal thickness of the overriding plate, which could have some influence on the partial melting and thermal regime in the mantle wedge (Plank and Langmuir, 1988). Several actual subduction zones are investigated in order to inquire the largest range of values for each parameter.

References

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