Geophysical Research Abstracts
Vol. 12, EGU2010-7296, 2010
EGU General Assembly 2010

The fate of subducted continental material: Results from coupled thermodynamic-thermomechanical numerical modelling

Juan Carlos Afonso (1) and Sergio Zlotnik (2)

(1) GEMOC ARC National Key Centre, Department of Earth and Planetary Sciences, Macquarie University, Sydney, Australia (jafonso@science.mq.edu.au, +61 (0)2 9850 6904), (2) School of Geosciences/School of Mathematical Sciences, Monash University, Melbourne, Australia (Sergio.Zlotnik@sci.monash.edu.au, +61 (0) 3 9905 4404)

It is now accepted that relatively large sections of continental crust were subducted to depths $>$ 100 km and exhumed at numerous locations worldwide (e.g. Kokchetav massif, Otrøy Island, etc). The possibility of even deeper subduction and the existence of a “depth of no return" for subducted continental material has also been hypothesized based on a number of experimental and geochemical/isotopic observations. However, the effects of such a “depth of no return" on the dynamics of ultra-deep continental subduction ($>$ 200 km depth) and the ultimate fate of different subducted continental rocks (e.g. sedimentary, volcanic, igneous, etc) have not been thoroughly studied with coupled thermodynamic-thermomechanical models, but only estimated based on mass balance calculations from high-pressure experimental studies.

In this contribution we present results of a numerical study of an arc-continent collision setting using an internally consistent combination of mineral physics and thermodynamic calculations into fully dynamic simulations (i.e. no velocity conditions imposed). For this we have developed a new internally-consistent thermodynamic database capable of modelling all important UHP phases in continent-like compositions (e.g. K-hollandite, CAS phase, majorite, etc). Hydration/dehydration reactions, fluid migration, and hydrous melting are also accounted for. Based on the results of these simulations we address: i) the dynamic effects of the compositional/thermal structure of the subducted lithosphere (crust + mantle), ii) the influence of rheological layering on the system’s dynamics, iii) the possibility of continental material stalling indefinitely within the transition zone (440-660 km depth), iv) its effects on the physical properties of the transition zone, and v) the possibility of continental material subducting down to lower mantle depths.