Geophysical Research Abstracts
Vol. 13, EGU2011-3555, 2011
EGU General Assembly 2011

Partially molten blocks from eastern Cuba serpentinite mélanges: first report of aborted thermal-chemical plumes

Idael Francisco Blanco-Quintero (1), Taras V. Gerya (2,3), Antonio Garcia-Casco (1,4), and Antonio Castro (5)

(1) Departamento de Mineralogía y Petrología, Universidad de Granada, Fuentenueva s/n, 18002-Granada, Spain (blanco@ugr.es), (2) Department of Geosciences, Swiss Federal Institute of Technology, 8093 Zurich, Switzerland (taras.gerya@erdw.ethz.ch), (3) Department of Geology, Moscow State University, 119899 Moscow, Russia, (4) Instituto Andaluz de Ciencias de la Tierra, CSIC-Universidad de Granada, Fuentenueva s/n, 18002-Granada, Spain (agcasco@ugr.es), (5) Departamento de Geología, Universidad de Huelva, Campus del Carmen, 21071-Huelva, Spain (dorado@uhu.es)

A series of numerical experiments were carried out for incipient subduction of very young oceanic lithosphere (10 to 30 Myr) by varying the rate of induced convergence (2 to 5 cm/yr) across a pre-existing rheologically weak fracture zone. In the experiments partial melting of the subducted young crust creates thermal-chemical instabilities (cold plumes) that ascend along the slab-mantle interface until they penetrate the upper plate lithosphere and produce volcanic arc magmatism. However, under special circumstances (e.g., 10 Myr age of lithosphere and 4 cm/yr of convergence rate) cold plumes crystallize at depth in the slab-wedge interface region shortly after onset of subduction. These plumes have no significant influence on the evolution of the upper plate mantle and arc crust. In eastern Cuba, the exhumed fragments of the Caribbean subduction channel (La Corea and Sierra del Convento serpentinite mélanges) bear evidence for hot subduction interpreted as the result of onset of subduction of young oceanic lithosphere. These mélanges are characterized by the presence of subducted MORB-derived epidote$\pm$garnet amphibolite blocks associated with tonalitic-trondhjemitic-granitic (with adakitic affinity) bodies and veins generated after partial melting of the amphibolites and crystallized at depth (ca. 50 km; 15 kbar; 700-750 ºC). The observed processes of melt formation and migration during subduction, including little melt-upper plate peridotite interaction, compare well with the predictions of numerical experiments. Consequently, we suggest that the partially molten blocks from these serpentinite mélanges represent fragments of an aborted thermal-chemical plume frozen at depth. Exhumation of this type of plumes is expected to take place within subduction channels, as in the Cuban example, for they freeze at relatively shallow depth (ca. 50 km) in a region close to the slab-wedge interface where buoyant serpentinitic subduction channel is generated with time during ongoing subduction.