Geophysical Research Abstracts
Vol. 17, EGU2015-6610, 2015
EGU General Assembly 2015

Efficient exhumation of (ultra) high-pressure rocks by slab extraction

Zhongbao Zhao (1), Paul Bons (1), Enrique Gomez-Rivas (2), Alvar Soesoo (3), and Burov Evgueni (4)

(1) Department of Geosciences, Eberhard Karls University Tübingen, Germany, (2) Department of Geology and Petroleum Geology, University of Aberdeen, Scotland, UK, (3) Institute of Geology, Tallinn University of Technology, Tallinn, Estonia, (4) iSTeP - Institut des Sciences de la Terre de Paris - UMR 7193 UPMC-CNRS, Université P. & M. Curie (Paris VI), Paris, France.

A range of mechanisms has been proposed for the enigmatic exhumation of (ultra) high-pressure (UHP) rocks from great depths. These include channel flow, wedge extrusion, diapiric rise, metamorphic core complexes and eduction. Most current models envisage exhumation to occur in a subduction setting, where exhumation of UHP rocks takes place in the context of the downward movement of the subducting slab. In addition, removal of the downward pull on the subducting slab (by slab break-off and slab retreat) may lead to buoyant rise of the UHP material, especially in case of subduction of continental crust.

Here we consider the alternative scenario of slab extraction, where subduction is reversed and the slab is pulled up and away from the overriding plate, instead of sliding down into the mantle. UHP rocks are then exhumed together with the ascending plate. Slab extraction occurs when the downward pull of the subducted slab is exceeded by an opposite force, for example in case of plate divergence. Another case is a divergent double subduction zone (DDSZ), where the two hinges inevitably converge by rollback. At some point the pull of one slab can exceed that of the other one if it is short enough, leading to the extraction of the shorter slab and concomitant exhumation of UHP rocks.

The evolution of a DDSZ with one short slab was modelled with the thermo-mechanical code FLAMAR, varying the relative movement of the two overriding plates. If the two overriding plates do not converge too fast, the short slab is pulled up and away from its suture and is eventually pulled down at the opposite suture. UHP rocks are exhumed at rates exceeding cms/yr in what is effectively a lithospheric-scale core complex. This mechanism may explain the exhumation of UHP rocks in the Tibetan Qiangtang Metamorphic Belt and the d'Entercasteaux Islands. If the sutures converge slower than the long slab slides down, an oceanic basin forms, which we suggest is the cause for the rapid opening of the Woodlark Basin off the coast of Papua New Guinea.