Geophysical Research Abstracts
Vol. 15, EGU2013-6771, 2013
EGU General Assembly 2013

Fluid and deformation induced metamorphic processes around continental Moho

Håkon Austrheim
University of Oslo, Norway (h.o.austrheim@geo.uio.no)

Exposed High Pressure (HP) and Ultra High Pressure (UHP) metamorphic terrains have been studied in order to assess the metamorphic processes and their role in changing petrophysical properties near Moho depth in continental root zones. The investigation points to the critical role of fluid and deformation in metamorphic transformation in the deep crust and upper mantle. This applies to a) formation of granulite facies areas, b) transformation of granulites to eclogites, c) retrogression of eclogite facies rocks to amphibolite and greenschist facies rocks and d) the spinel lherzolite to garnet lherzolite transition. Dry rocks, both feldspar bearing and ultramafic, remain with their pre-HP and UHP structures and anhydrous mineralogy preserved while reactions occur where fluid has been introduced along deformation zones. Metamorphic rocks of different ages and stable at different P-T conditions are mixed on a metre to km scale and such mixtures will be present throughout the crust and upper mantle. This lack of equilibration may lead to error in geothermal gradients calculated on minerals from xenoliths; b) misinterpretation of rock composition inferred from geophysical signature and c) induce extra uncertainty in geodynamic models that assume continuous metamorphic equilibration.
Pseudotachylytes (frictional melts or ultracomminuted material) are observed in both ultramafic and feldspar bearing lithologies spatially associated with HP and UHP rocks, suggesting that rock properties at Moho depth allow earthquakes. Seismicity enhances the metamorphic and metasomatic transitions through fragmentation and by opening the rock for fluid influx. Ductile eclogite facies shear zones nucleate along the brittle structures. These observations point to Moho as a rock processing zone with the following facets: 1. A metastable dry and strong lower crust and upper mantle 2. Earthquakes and tremors result in fluid flow and HP metamorphism. 3. A pronounced weakening of the hydrated and transformed rocks allows the development of new fabrics (crystallographic preferred orientation, CPO) in the transformed rocks. Deep tremors and earthquakes at Moho depth may record ongoing metamorphic transitions.