Geophysical Research Abstracts
Vol. 12, EGU2010-10953, 2010
EGU General Assembly 2010

The formation and chemistry of low degree hydrous partial melt on top of the transition zone

Daniel J. Frost and Mainak Mookherjee
University Bayreuth, Bayerisches Geoinstitut, Bayreuth, Germany (dan.frost@uni-bayreuth.de)

There is some geophysical evidence for the presence of silicate melt on top of the 410 km seismic discontinuity. It has also been argued that the difference in the water storage capacity of upper mantle versus transition zone minerals may cause dehydration melting as material up-wells across the 410. Studies have proposed that hydrous partial melts may be neutrally buoyant in the mantle at these conditions. In order to assess these possibilities it is important to determine the likely composition of small degree hydrous melts at these conditions and to measure the H_2O contents of mantle minerals coexisting with this melt phase.

The composition of a hydrous melt in equilibrium with a mantle peridotite composition has been determined at conditions of the 410 and 1450°C. Sandwich experiments were performed where an "initial-guess" hydrous melt composition was equilibrated with 50% anhydrous peridotite. The resulting melt composition was used to assemble a further melt, which was then equilibrated in the same way. After several iterations it was possible to derive a melt composition, which was in equilibrium with a mineral assemblage identical to that observed for an anhydrous peridotite composition at the same conditions. We assess whether this melt composition could be neutrally buoyant at 410km.

The 410 km discontinuity may also correspond to a transition in redox state in the mantle from a reducing transition zone to a less reduced upper mantle. Volatiles may also collect and induce melting at this horizon due to the oxidation of a rising mobile reduced fluid phase containing CH_4. Minerals in mantle upwelling out of a hydrous melt layer would be expected to have H_2O contents close to saturation; however, this may not be the case if the melt layer also contains other volatile components such as CO_2 or CH_4, which further lower the H_2O activity in the melt. We assess ranges of melt compositions that may be in equilibrium with minerals containing relatively low H_2O contents, and whether these melts could be neutrally buoyant at 410 km.