Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06065, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06065
EGU General Assembly 2008

Decoupled modal and mineral chemical variations of uppermost mantle peridotites beneath a spreading center: an example from Wadi Rajmi of the northern Oman ophiolite

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We examined peridotites exposed within the uppermost mantle, about 5 km in depth downsection from the base of the Moho transition zone (MTZ) dunite, along Wadi Rajmi of the northern Oman ophiolite to constrain petrological structures of the uppermost mantle beneath a mid-ocean ridge. The peridotites from Wadi Rajmi are opx-bearing dunites to harzburgites with weakly porphyroclastic to protogranular textures. Modal amounts of pyroxenes (especially opx) decrease upward to the MTZ from 20 to 30 vol.% to 10 to 20 vol.% (= from harzburgite to opx-bearing harzburgite). In contrast, mineral chemical characteristics almost remain the same throughout the section we examined. Fo contents of olivine are around 91, Cr#s (= Cr/(Cr+Al) atomic ratios) of spinel are around 0.4 to 0.6, and Al_2O_3 contents of opx are 1 to 2 wt%, *irrespective of modal ratios of olivine and pyroxenes*. Yb_N and Lu_N contents of cpx are around 1 to 2, also irrespective of modal amounts of minerals. These characteristics may mean they are in equilibrium with melts that have common chemical properties, i.e. possibly MORB. The modal variation of the peridotites may mean that the uppermost part (>5 km in thickness) of the abyssal mantle is a reaction zone between a mantle harzburgite and a melt. The reaction was more pervasive upward towards the MTZ dunite, which is its final product. Alternatively the modal variation may be a relic of a mantle diapir, where melting degree increased upward but minerals were chemically homogenized by a melt afterward.