Geophysical Research Abstracts
Vol. 15, EGU2013-14056, 2013
EGU General Assembly 2013

Subduction-related cryptic metasomatism in fore-arc to nascent fore-arc Neoproterozoic mantle peridotites beneath the Eastern Desert of Egypt: mineral chemical and geochemical evidences

Mohamed Hamdy (1), Abdel Salam Abu El-Ela (1), Adel Hassan (1), Youngwoo Kill (2), and Hamed Gamal El Dien (1)

(1) Geology Department, Faculty of Science, Tanta University, 31527 Tanta, Egypt, (2) Department of Energy and Resources Engineering College of Engineering Chonnam National University, Yongbong-ro, Buk-gu, Gwangju, Korea

Mantle spinel peridotites beneath the Arabian Nubian Shield (ANS) in the Eastern Desert (ED) of Egypt were formed in arc stage in different tectonic setting. Thus they might subject to exchange with the crustal material derived from recycling subducting oceanic lithosphere. This caused metasomatism enriching the rocks in incompatible elements and forming non-residual minerals. Herein, we present mineral chemical and geochemical data of four ophiolitic mantle slice serpentinized peridotites (W. Mubarak, G. El-Maiyit, W. Um El Saneyat and W. Atalla) widely distributed in the ED.

These rocks are highly serpentinized, except some samples from W. Mubarak and Um El-Saneyat, which contain primary olivine (Fo# = 90–92 mol %) and orthopyroxene (En# = 86–92 mol %) relics. They have harzburgite composition. Based on the Cr# and Mg# of the unaltered spinel cores, all rocks formed in oceanic mantle wedge in the fore-arc setting, except those from W. Atalla formed in nascent fore-arc. This implies that the polarity of the subduction during the arc stage was from the west to the east. These rocks are restites formed after partial melting between 16.58 in W. Atalla to 24 % in G-El Maiyit. Melt extraction occurred under oxidizing conditions in peridotites from W. Mubarak and W. Atalla and under reducing conditions in peridotites from G. El-Maiyit and Um El-Saneyat.

Cryptic metasomatism in the studied mantle slice peridotites is evident. This includes enrichment in incompatible elements in minerals and whole rocks if compared with the primitive mantle (PM) composition and the trend of the depletion in melt. In opx the Mg# doesn't correlate with TiO_2, CaO, MnO, NiO and Cr_2O_3concentrations. In addition, in serpentinites from W. Mubarak and W. Atalla, the $TiO_{2spinel}$ is positively correlated with the TiO_2 $_{whole-rock}$, proposing enrichment by the infiltration of Ti-rich melts, while in G. El- Maiyit and Um El-Saneyat serpentinites they are negatively correlated pointing to the reaction with the Ti-rich melts.

All rocks are enriched LREE, FMEs and HFSEs. This took place mostly by different agents. As the H_2O-rich liquid, which seems to have been produced from the subducting oceanic slab percolating peridotites, gradually loses trace elements, the HFSEs are fractionated from LILEs and REEs. This could explain the high ratios of $(Nb/La)_N$ and $(Nb/Ba)_N$ of some of the studied rocks. All the studied serpentinized mantle slices have subchonddritic to near chondritic ratios of Nb/Ta (< 13.8) and Zr/ Hf (< 36.09). It is suggested that Nb did not fractionate from Ta and Zr from Hf. There are might be silicate melts enriched the peridotites in Ta rather than Nb causing a much great decrease in the Nb/Ta especially serpentinites from W. Mubarak. This melt/fluid might have been derived from recycled subducted oceanic crust or from hot asthenosphere. Concentrations of U in all the studied samples (except for W. Mubarak serpentinites) are positively correlated with LILEs, Pb and Mo, indicating that the studied serpentinites were enriched in these elements from the same fluids, most probably derived from subducted oceanic lithosphere. Positive anomalies of Li (in W. Mubarak and G. El-Maiyit serpentinites), U (except for W. Mubarak serpentinites), Mo and Pb are characteristics of hydrothermally altered ocean-floor peridotites. High Sr/Nd ratios may be typical of the hydrous metasomatism caused by hydrous melt/fluid.