Geophysical Research Abstracts
Vol. 13, EGU2011-8864, 2011
EGU General Assembly 2011

Metasomatism and degassing processes in the Hyblean heterogeneous mantle, as inferred from noble gas investigation of ultramafic xenoliths

Alessandra Correale (1), Mauro Martelli (2), Antonio Paonita (2), Andrea Rizzo (2), Lorenzo Brusca (2), and Vittorio Scribano (3)

(1) Dep. CFTA, Università di Palermo, Italy, (2) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo, Italy, (3) Dep. Scienze Geologiche, Università di Catania, Italy

We analysed He, Ar and Ne isotopic composition of fluid inclusions hosted in olivine, orthopyroxene and clinopyroxene phenocrysts separated from some ultramafic xenoliths retained in Hyblean products. In particular, the studied samples consist of peridotites (spinel lherzolites and harzburgites) and pyroxenites (websterites and clinopyroxenites), which are commonly considered as coming from the local upper mantle.
The REE pattern of these peridotite xenoliths is characterized by an enrichment of LREE and by a slight HREE depletion, and is thus interpreted as due to a pervasive or cryptic metasomatism of a moderately depleted mantle (Sapienza and Scribano, 2000). In this context, the pyroxenites would represent the crystallization products of deep-seated magmatic liquid that intruded the peridotites at different levels of the lithospheric mantle.
Noble gases analysis (mainly 4He/20Ne and 40Ar/36Ar ratios) showed the presence of an atmospheric contamination of fluid inclusions. As already observed in similar investigations, this air contribution seems to be post-eruptive, probably entrapped in microfractures of the crystals (Nuccio et al., 2008).
The measured 3He/4He ratios vary between 7 and 7.6 Ra and correspond to variations of 4He/40Ar* ranging between 0.4 and 15 respectively. The 3He/4He variations can be interpreted as a result of mixing of two end-members: 1) the first one, corresponding to a deep pyroxenitic mantle having a high 3He/4He signature; 2) the second one, corresponding to a shallow peridotitic mantle having a lower isotopic marker. The observed increasing trend of 4He/40Ar* ratio can be interpreted as a result of degassing process involving the deep-seated pyroxenitic melts during the intrusion of the mantle at shallower depths.
The existence of a mantle heterogeneity is strongly supported by the relations found between the concentration of some trace elements (as Sm and Nd) and the3He/4He ratio. The mixing between a peridotitic mantle (R/Ra=7, Sm=0.3 ppm Nd=2 ppm) and a pyroxenitic mantle (R/Ra=7.4, Sm= 3.5 ppm, Nd=13 ppm) would explain the observed noble gas and trace elements variations.