Geophysical Research Abstracts, Vol. 8, 01308, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01308

Metasomatic events in the lithospheric mantle beneath NW Libya: petrological evidence from the Gharyan peridotite xenoliths

L. Beccaluva (1), G. Bianchini (1), R.M. Ellam (3), M. Marzola (1), K. M. Oun (2), F. Siena (1)

(1) Dipartimento di Scienze della Terra, Università di Ferrara, Italia, (2) Geology Department, Al-Fateh University, Tripoli, Libya, (3) Isotope Geoscience Unit, Scottish Universities Environmental Research Centre, East Kilbride, UK (bcc@unife)

Mantle xenoliths are locally included in the Neogene-Quaternary alkali-basalt/hawaite lavas of the Gharyan volcanic field (NW Libya). They mostly consist of protogranular spinel lherzolites with superimposed pyrometamorphic textures represented by reaction patches where primary orthopyroxene (opx), clinopyroxene (cpx1) and spinel (sp1) are the main reacting phases. The secondary parageneses include Cpx2, Ol2 and feldspar as reaction rims around Opx, spongy-textured clinopyroxene with recrystallized portions (cpx2 $\pm$ feldspar), and brown spinel destabilized in a black vermicular aggregate generally associated with feldspar microlites. Cpx2 are typically depleted in Na_2O and Al_2O_3 relative to Cpx1; feldspar includes both alkali-feldspar (Ab 44 - 70, An 0 – 12, Or 17 - 51) and plagioclase (Ab 37 - 69, An 23 - 61, Or 1 - 8).

REE patterns of bulk rock show flat HREE (1.0 - 2.6*Ch) and variably enriched LREE ($La_N/Yb_N$of 1.0 - 6.2); a single sample (X1a) shows a peculiar downward-convex LREE pattern (La_N/Yb_N = 1.0, Nd_N/Yb_N= 0.4), quite similar to those recorded by some xenoliths from the Manzaz-Atakor district (Hoggar; Beccaluva et al., this session). REE patterns of constituent clinopyroxenes are characterized by flat HREE distribution (7.5 – 15.3 * Ch) and variable LREE enrichement with La_N/Yb_N between 2.2 and 3.9, which generally conform to the bulk rock chemistry.

The sample X1a, relatively unaffected by metasomatic processes, shows extremely radiogenic Nd isotopic composition (up to 0.5139) indicating that the lithospheric mantle beneath the area suffered a long term depletion by extraction of basic melts. The

remaining clinopyroxene samples show the following compositional ranges: $^{87}Sr/^{86}Sr$ 0.7028-0.7030, $^{143}Nd/^{144}Nd$ 0.5130- 0.5134, $^{206}Pb/^{204}Pb$ 19.48-19.66. This suggests that the causative agents of metasomatism had a clear HIMU affinity, in accordance with the isotopic signature of the host lavas ($^{87}Sr/^{86}Sr$ 0.7032, $^{143}Nd/144Nd$ 0.5130, $^{206}Pb/^{204}Pb$ 19.60).

In summary, textural, mineralogical, geochemical and isotopic features are closely comparable with those recorded in mantle xenoliths included in Cenozoic lavas from other occurrences of the Adriatic/African lithosphere (Veneto Volcanic Province, Beccaluva et al., 2001; Iblean District, Sicily; Beccaluva et al., 2005; Canary Islands; Siena et al., 1991). Unlike the European lithosphere, the metasomatizing agent/s affecting the North African lithospheric mantle were represented by Na-alkaline melts with HIMU affinity (Beccaluva et al., 2005 and references therein) without any significant influence of EM components.

References

- Beccaluva L., Bonadiman C., Coltorti M., Salvini L., Siena F., 2001. J. Petrol. 42, 173-187.

- Beccaluva L., Bianchini G., Bonadiman C., Coltorti M., Macciotta G., Siena F., Vaccaro C., 2005. In I.R. Finetti (ed) “CROP Project: Deep seismic exploration of the Central Mediterranean and Italy”. (Elsevier special volume).

- Siena F., Beccaluva L., Coltorti M., Marchesi S., Morra V., 1991. J. Petrol. (Special Lherzolite Issue), 271-290.