Geophysical Research Abstracts
Vol. 13, EGU2011-4894-1, 2011
EGU General Assembly 2011

Deformation Record of Upper Mantle Peridotite Xenoliths from SE Iberian Volcanic Province (Spain)

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The volcanic activity in the SE Iberian Volcanic Province (SEI-VP) is the surface expression of magmatism in a complex geodynamic setting during the Cenozoic, which was characterized by a sequence of transpressional and transtensive stages in a "Mediterranean-type" back-arc system. The late stage of this geodynamical evolution was characterized by Neogene alkaline basalt volcanism erupted at 2-3 Ma. This volcanism entrained numerous mantle xenoliths providing a unique possibility to study the nature of the lithospheric mantle beneath this region. Here, we present a detailed petrographic, geochemical and olivine LPO (lattice preferred orientation) study of alkaline basalt-hosted upper mantle xenoliths from the SEI-VP. The studied samples came from the "Cabezo Negro" de Tallante and Los Perez (Murcia) volcanic centers. Xenoliths are spinel peridotites (lherzolite and wehrlite) with textures ranging from fine-grained equigranular to coarse-grained granular. In many samples (∼30%) tiny plagioclase and/or amphibole appear interstitially. The LPO of olivine is similar in all samples. It displays a strong [100] maximum, implying dominant activation of the high temperature [100] {0kl} slip systems of olivine. However, the strength of the LPO varies as a function of the xenolith texture and modal content of clinopyroxene. In coarse-grained peridotites, from lherzolite to wehrlite, the olivine LPO ranges from strong to a weak LPO. The stronger olivine LPO is characterized by alignment of [100] axes near the lineation and a girdle distribution of [010] with a maximum normal to the peridotite foliation. In the weaker olivine LPO, the [100] maximum is also close to the lineation but the [010] maximum is normal to the foliation. Altogether, stronger olivine LPO are observed in the coarse-grained peridotites. Modal enrichment in clinopyroxene and development of fine-grained equigranular texture are both accompanied by a dispersion of the olivine LPO. These results are consistent with a scenario where coarse-grained samples are representative of a primary, coarse-granular subcontinental lithospheric mantle that was later affected by cpx-forming, melt-peridotite reactions. These refertilization reactions caused weakening and dispersion of the olivine LPO, as well as the formation of secondary lherzolite. The textural record of upper mantle peridotite xenoliths in SEI-VP hence records strong thermal and chemical erosion of the subcontinental mantle during Cenozoic extension in the western Mediterranean region.