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Oxidation stats of Fe within constituent minerals in spinel-lherzolite xenolith from Tariat Depression, Mongolia: Signif

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The Tariat depression is one of the most famous areas of deep-seated megacrystic xenoliths and mantle-derived xenoliths in the Baikal-Mongolia rift. Spinel-garnet-bearing websterite, garnet lherzolite and spinel lherzolite have been found in this area (Osanai et al. 2010). In this study, oxidation state of Fe in olivine (Ol), orthopyroxene, clinopyroxene and spinel in fresh spinel-lherzolite xenolith, and olivine in host basalt in Tariat depression were investigated using Mossbauer spectroscopy, X-ray FeL?/FeL?-intensity ratio analysis (EPMA method) and transmission electron microscopy (TEM).

Olivine, clinopyroxene, orthopyroxene and spinel have homogeneous chemical compositions. Olivine is forsterite with average composition of Fo90Fa10, Clinopyroxene is Na-bearing diopside [(Na0.17Ca0.71Mg0.81Fe0.09Al0.20)?2.00(Si1.89Al0.11)?2.00O6], and have symplektite consisting of diopside and glass on the rim with the width of ˜50 micro m. The chemical composition of the glass is similar to that of feldspar with compositions of An. Orthopyroxene is [(Mg0.85Fe0.09Al0.04Ca0.02)(Si0.94Al0.06)O3]. Spinel is [(Mg0.81Fe2+0.22)?1.03(Al1.80Cr0.17)?1.97O4].

The Fe2+: Fe3+ ratios of forsterite, orthopyroxene, clinopyroxene and spinel determined by Mossbauer analysis are 97(1):3(1); 85(8):15(1); 74(4):26(3); 66(8):34(5), respectively. Fe3+ in olivine is not attributed to any precipitates nor minute inclusions, which was confirmed by TEM observation, and, thus, exists in olivine structure. Fe of olivine phenocrysts from host basalt lava is only Fe2+ which was proved by EPMA method.

Fe3+-bearing forsterite in spinel-lherzolite xenolith is considered to have been stable under mantle condition.

Keywords: olivine, oxidation state of Fe, spinel-lherzolite xenolith, Mossbauer methods, Mongolia