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Water contents of mantle xenoliths from V.Grib kimberlite pipe (Arkhangelsk diamondiferous province, Russia)

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Water can change physical and chemical properties of mantle minerals, or the part of the mantle, for instance, the effect of OH on mineral deformation and its impact on mantle rheology (Miller et al., 1987). Moreover, presence of water in the eclogites make them important reservoirs of hydrogen in the lithospheric mantle. A representative collection of relatively fresh xenoliths of peridotites and eclogites (10 and 6 samples respectively) from the V. Grib kimberlite pipe have been studied in order to identify water enrichment. Peridotites are presented by two groups: garnet lherzolites and phlogopite-garnet lherzolites. The peridotites of both groups have two structural varieties: protogranular and transitional from protogranular to porphyroclastic. The peridotites contain typical minerals (vol.%): 47-85 olivine, 5-25 orthopyroxene, 5-12 clinopyroxene, 5-15 garnet, and 1-4 phlogopite. The eclogites are bimineralic with clinopyroxene/garnet modes varied from 40/60 to 60/40. Eclogite suite is divided into high-MgO (Group A) and low-MgO (Groups B and C) varieties (Taylor and Neal, 1989). Water contents in minerals have been calculated using calibration coefficients (Bell et al., 1995, 2003). Water contents in peridotites range from 8 to 168 ppm in olivine, 1-41 ppm in orthopyroxene, 41-185 ppm in clinopyroxene. The water in eclogites is mainly stored in clinopyroxene (85-186 ppm). Garnets do not contain measurable OH in both rock types. Taking into account the volume ratios of mineral phases in the xenoliths, the water contents vary over ranges, from <1 to 137 ppm in peridotites and from 42 to 112 ppm in eclogites. No correlations between water concentration in peridotites with temperature, pressure or magnesium number of the rock have been obtained. Higher amounts of water in phlogopite-garnet lherzolite may indicate an enrichment caused by phlogopite metasomatism.

It should be noted that there are negative correlations of OH content in eclogitic clinopyroxene (Cpx) with equilibrium temperature, MgO content in a whole-rock and LREE concentrations in Cpx. The average OH content in low-MgO eclogites is in a two times higher compared to high-MgO variety. Low-MgO eclogites with oceanic gabbro protolith have higher OH content compared to low-MgO eclogites with basaltic precursor.

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