Mantle water contents beneath the Rio Grande Rift (NM, USA): FTIR analysis of Rio Puerco and Kilbourne Hole peridotite xenoliths

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Peridotite xenoliths from the Rio Grande Rift (RGR) are being analyzed for H_2O contents by FTIR as well as for major and trace element compositions. Nine samples are from the Rio Puerco Volcanic Field (RP) which overlaps the central RGR and southeastern Colorado Plateau; seventeen samples are from Kilbourne Hole (KH) in the southern RGR. Spinel Cr# (Cr/(Cr+Al)) (0.08-0.46) and olivine Mg# (Mg/(Mg+Fe)) (0.883-0.911) of all RGR samples fall within the olivine-spinel mantle array from [1], an indicator that peridotites are residues of partial melting. Pyroxene H_2O in KH correlate with bulk rock and pyroxene Al_2O_3.The KH clinopyroxene rare earth element (REE) variations fit models of 0-13% fractional melting of a primitive upper mantle. Most KH peridotites have bulk-rock light REE depleted patterns, but five are enriched in light REEs consistent with metasomatism. Variation in H_2O content is unrelated to REE enrichment. Metasomatism is seen in RP pyroxenite xenoliths [2] and will be examined in the peridotites studied here. Olivine H_2O contents are low (≤15 ppm), and decrease from core to rim within grains. This is likely due to H loss during xenolith transport by the host magma [3]. Diffusion models of H suggest that mantle H_2O contents are still preserved in cores of KH olivine, but not RP olivine. The average H_2O content of Colorado Plateau clinopyroxene (670 ppm) [4] is ~300 ppm higher than RGR clinopyroxene (350 ppm). This upholds the hypothesis that hydration-induced lithospheric melting occurred during flat-slab subduction of the Farallon plate [5]. Numerical models indicate hydration via slab fluids is possible beneath the plateau, ~600 km from the paleo-trench, but less likely ~850 km away beneath the rift [6].

[1]Arai, 1994 CG 113, 191-204. [2]Porreca et al., 2006 Geosp 2, 333-351. [3]Peslier and Luhr, 2006 EPSL 242, 302-319. [4]Li et al., 2008 JGR 113, 1978-2012. [5]Humphreys et al., 2003 Int Geol Rev 45, 575-595. [6]English et al., 2003 EPSL 214, 619-632.