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In situ SIMS oxygen isotope analysis of olivine in the Tibetan mantle xenoliths

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Although the mantle-derived xenoliths from Lhasa terrane provide a means of directly investigating the mantle underlying the southern part of the plateau, they were rarely found in the region. The only case of mantle xenoliths came from the Sailipu ultrapotassic volcanic rocks, erupted at ∼17 Ma, which have indicated that the subcontinental mantle of southern Tibetan Plateau is hot and strongly influenced by metasomatism (Zhao et al., 2008a, b; Liu et al., 2011). A further study by Liu et al.(2014) of in-situ oxygen isotope of olivine crystals in Sailipu mantle xenoliths identify a metasomatized mantle reservoir that interpreted as the sub-arc lithospheric mantle, with anomalously enriched oxygen isotopes (δ^{18}O=8.03‰). Here we present oxygen isotopes data on the Sailipu mantle xenolith olivines, using different method of sample preparation. Mantle xenoliths (less than 1 cm in diameter) together originally with their host volcanic rocks were prepared in epoxy adjacent to grains of a San Carlos olivine intralaboratory standard and then polished to a flat and smooth surface. Oxygen isotope compositions of olivines occurs both in mantle xenolith and as phenocryst in the host rock, were analyzed in situ using CAMECA SIMS-1280 ion microprobe at the Institute of Geology and Geophysics, Chinese Academy of Sciences. We also performed traditional oxygen isotope analysis on three olivine phenocrysts separates from the host lava. Our new data show: (1) The mantle xenolith olivines have typical mantle oxygen isotopic composition (δ^{18}O=4.8-8.0‰ with average of 5.5±0.2‰ n=105) with variety Fo$^{\#}$(78-90), (2) Oxygen isotopes of situ olivine phenocrysts in the Sailipu lavas (δ^{18}O=7.1-9.2‰ Fo$^{\#}$=70-84, n=66), are similar to that of the whole rock (δ^{18}O=7.0-9.4‰ Fo$^{\#}$=64-74, n=8, Zhao et al., 2009), and three olivine phenocryst grains (δ^{18}O=7.2-7.8‰); (3) The intralaboratory standard of San Carlos olivine can be a suitable standard using for analyzing olivines with Fo not only around 90, but also as low as Fo of 70; (4) In olivine crystals in mantle xenolith, the oxygen isotopes in rim (δ^{18}O=6.96-7.98‰ Fo$^{\#}$=78-82) significantly shift to high δ^{18}O values that similar to their neighboring lava olivine phenocrysts (δ^{18}O=8.03‰ Fo$^{\#}$ =80). These data suggest that the oxygen isotopes in mantle xenolith olivines are more stable during the processes of metasomatism. The mantle xenolith may have been metasomatized by the host lava, in addition to other enriched reservoir in the sub-arc mantle. [Financially supported by the NSF of China, grants 41273044, 41225006, 41230209, 41130314].

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