MORB-like noble gas isotopic composition in spinel peridotite xenoliths from Mt. Quincan, North Queensland, Northeast Australia

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Helium and argon elemental and isotopic composition have been determined by stepwise crushing in spinel-peridote xenoliths from Mt. Quincan, North Queensland (Northeast Australia). The $^{3}He/^{4}He$ ratios trapped in fluid inclusions cover a narrow range (7.7-8.7Ra) which agree well with values reported in MORB (8+/-1Ra; Hilton et al., 1993). The observed $^{40}Ar/^{36}$ (315-2890) ratios and $^{3}He/^{36}Ar$ (0.0012-0.013) show large variation with lower values than that assumed for MORB source ($^{40}Ar/^{36}Ar$=44000, $^{3}He/^{36}Ar$=0.07; Staudacher et al., 1989). This variation and the positive correlation between $^{40}Ar/^{36}$ and $^{3}He/^{36}Ar$ ratios can be explained by a mixing between air-like and MORB-like components. Thus, both helium and argon isotopic compositions suggest a MORB-like source, as a primary source of fluid in samples.

Xenoliths from subcontinental lithospheric mantle (SCLM) are generally characterized by consistently lower $^{3}He/^{4}He$ ratio (e.g. 6-7Ra xenoliths from Europe, Dunai and Baur, 1995; Gautheron et al., 2005; 4-7Ra New Zealand, Patterson et al., 1994; 0.3-8Ra in Far Eastern Russia, Yamamoto et al., 2004) than the MORB value. To explain the lower (more radiogenic) $^{3}He/^{4}He$ values found in xenoliths derived from subcontinental mantle, several theories have been proposed: (1) contamination of a MORB-like source with crustal material at subduction zone (Dunai and Baur, 1995); (2) closed system evolution with initial MORB helium composition (e.g. Reid and Graham, 1996); (3) in-situ radiogenic ^{4}He eccentrically-located within U+Th enriched metasomatic minerals (Matsumoto et al., 1997;, 2000); (4) continuous metasomatism by percolating fluids from asthenosphere: steady-state model (Gautheron et al., 2005).

However, the xenoliths in Mt. Quincan do not show any enrichment in radiogenic ^{4}He comparing to the MORB value. Thus, these noble gas signatures may suggest a MORB-like source underlying Northeastern Australia. In addition, the MORB-like helium signatures found in xenoliths from Mt. Quincan suggest the absence of ^{4}He ingrowths by U+Th enriching metasomatism; and this agrees with trace element and Sr, Nd isotopic characteristics of the xenoliths that suggest only minimal metasomatic modification has affected the SCLM beneath Mt. Quincan (Handler et al., 2005). Further implication of this result can be that the subcontinental lithosphere mantle is not homogeneous on global scale that was suggested by some models (e.g: Gautheron et al., 2005).