MORB-like and radiogenic/nucleogenic noble gas components in southern Patagonian subcontinental lithospheric mantle

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Southern Andean Patagonia is one of the few sites where interactions between oceanic and continental lithosphere due to the subduction of an active spreading ridge beneath continent can be investigated. In order to characterize the noble gas composition of Patagonian subcontinental lithospheric mantle (SCLM) we analyzed noble gas and lithophile (Sr-Nd-Pb) isotopes of mantle xenoliths from Pali-Aike Volcanic Field and Gobernador Gregores in southern Patagonia.
Noble gas composition of the mantle xenoliths reflects three-component mixing between air, SCLM and MORB-like. Pali-Aike mantle xenoliths represent the intrinsic local SCLM reservoir with higher (U+Th+K)/(^{3}He, ^{22}Ne, ^{36}Ar) ratios than MORB source. This mantle reservoir is characterized by radiogenic $^{3}He/^{4}He_{AVERAGE}$ = 6.87 ±0.04 R_A and nucleogenic mantle neon with $^{21}Ne/^{22}Ne$ average of 0.090, with $^{3}He/^{22}Ne$ ratios (up to 13.66 ±0.37) higher than depleted MORBs (8.31-9.75). $^{40}Ar/^{36}Ar$ ratios vary from near-atmospheric ratio (510) up to 16400, with mantle $^{40}Ar/^{36}Ar$ reaching 54000. Mantle $^{129}Xe/^{132}Xe$ reach up to 1.11, whereas $^{136}Xe/^{132}Xe$ up to 0.40. Gobernador Gregores mantle xenoliths represent the SCLM metasomatized by MORB-like component with $^{3}He/^{4}He_{AVERAGE}$ = 7.24 ±0.09 R_A, slightly less nucleogenic mantle neon with $^{21}Ne/^{22}Ne$ = 0.065, $^{3}He/^{22}Ne$ = 8.39 ±0.14, and $^{40}Ar/^{36}Ar$ ratios usually less than 4000.
Based on these new data, we conclude that the highly radiogenic/nucleogenic signature of Pali-Aike mantle xenoliths compared to the MORB source represents an intrinsic feature of the SCLM reservoir beneath southern Patagonia. This signature could have been homogenized during the last 14 Ma, after rapid the passage and northward migration of the Chile Triple Junction and its slab window at this latitude. On the other hand, the less radiogenic/nucleogenic MORB-like component identified in Gobernador Gregores mantle xenoliths can be explained by recent metasomatism of the SCLM due to the asthenospheric mantle upwelling in response to the opening of a slab window beneath Patagonia because of South Chile Ridge subduction.

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