Petrogenesis of the Andong ultramafic complex, South Korea

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We have determined the geochemical and Sr-Nd-Hf-Pb isotopic compositions of the Late Triassic (ca. 222 Ma) Andong ultramafic complex from South Korea, to better understand the petrogenesis. The complex is composed of dunites, wehrlites and pyroxene/hornblende peridotites, which formed by crystal fractionation of basaltic melts. Constituent minerals are olivine (Fo = 81.1-87.8), clinopyroxene ($Wo_{43.4-48.1}En_{46.2-50.0}Fs_{5.0-7.1}$), orthopyroxene ($Wo_{1.3-2.6}En_{81.6-86.2}Fs_{11.9-16.8}$), calcic amphibole ($Ca_B \geq 1.5$), and Cr-spinel (Cr# = 26.7-62.7). The calculated melts in equilibrium with constituent clinopyroxenes of the complex exhibit arc-like LILE enrichment and HFSE depletion. Meanwhile, spinels from the complex have relatively lower Cr# at a given Mg# compared with those of arc-related rocks. Furthermore, clinopyroxenes separated from the Andong ultramafic complex are characterized by highly enriched Sr and Nd isotopic compositions [$(^{87}Sr/^{86}Sr)_i$ = 0.705546-0.705957, $(^{143}Nd/^{144}Nd)_i$ = 0.512269-0.512309, $(\varepsilon_{Nd})_i$ = -7.2 to -6.4] compared with mid-ocean ridge basalt (MORB) or fore-arc basalt (FAB). They also have elevated initial $^{207}Pb/^{204}Pb$ (15.54-15.55) and $^{208}Pb/^{204}Pb$ (38.06-38.17) ratios at a given $^{206}Pb/^{204}Pb$ (18.02-18.13) compared with MORB or FAB. The initial $^{176}Hf/^{177}Hf$ ratios of the clinopyroxenes range from 0.282771 to 0.282833 [$(\varepsilon_{Hf})_i$ = 0.0 to +2.2]. In an Nd-Hf isotope plot, they are characterized by highly radiogenic Hf in association with less radiogenic Nd, resulting in Nd-Hf decoupling referenced to the mantle array. These observations suggest that the metasomatized sub-continental lithospheric mantle (SCLM) might be the dominant source for the Andong magmatism. The paleo-Pacific subduction before continental collision between the North and South China blocks might have induced metasomatic overprinting in LILE in the overlying lithospheric mantle. Asthenospheric upwelling through the slab breakoff might be the heat source for melting of the SCLM.