Multiple metasomatism beneath the northern North China Craton: evidence from peridotite xenoliths in Siziwangqi basalts

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Trace element and Sr isotopic compositions of major minerals in peridotite xenoliths carried by the Siziwangqi Cenozoic basalt in the northern margin of North China Craton (NCC) were examined in situ to evaluate the influences of the southward subduction of the Paleo-Asian oceanic plate (PAOP) on the lithospheric mantle transformation under the NCC.

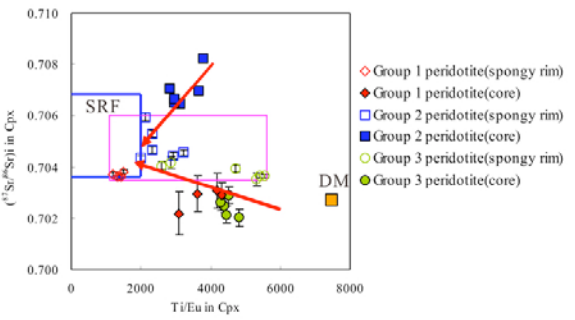

Fig.1 Plots of $^{87}Sr/^{86}Sr$ versus Ti/Eu for clinopyroxenes.

Based on the rare earth element (REE) distribution patterns of clinopyroxenes (Cpx), peridotite xenoliths were classified into three groups. Cpx in Group 1 have LREE-depleted patterns; Cpx in Group 2 exhibit LREE-depleted patterns in the cores to LREE-enriched patterns in the spongy rims; Cpx in Group 3 display convex-upward REE patterns.

As a whole, Cpx in Group 3 have zoned and the highest $^{87}Sr/^{86}Sr$ ratios, decreasing from 0.70648-0.70823 in the cores to 0.70456-0.70594 in the spongy rims (Fig. 1). Although Cpx in Group 1 and Group 2 have different REE patterns, both of them are featured by zoned Sr isotopic compositions contrasting to those of Group 3. Cpx in Group 1 and Group 2 are featured by increasing $^{87}Sr/^{86}Sr$ ratios from the cores (0.70202-0.70307) to the rims (0.70351-0.70393). However, both core-rim variations of $^{87}Sr/^{86}Sr$ ratios demonstrated by Group 1&2 and Group 3 peridotites are accompanied by decreasing Ti/Eu ratios, an index indicating carbonatitic metasomatism.

These observations collectively indicate that the lithospheric mantle beneath the northern margin of NCC sufferred at least twice mantle metasomatism events caused by aqueous fluid/melt at the early stage and CO_2-rich fluid/melt at the late stage. Considering the geological setting, these mantle metasomatism events were thought to be caused by the subduction of PAOP.