Modification of subcontinental lithospheric mantle in SE China

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Studies of mantle-derived xenoliths are important for understanding the composition of the subcontinental lithospheric mantle (SCLM), its evolution through time, and continental dynamics. The removal or modification of the older lithospheric mantle beneath eastern China is interpreted to be mainly a Mesozoic process. However, the mechanism and timing of lithospheric thinning in eastern China have not been clearly documented.

Trace-element patterns of peridotite xenoliths from SE China reflect the interplay between partial melting and subsequent enrichment by metasomatism. On the basis of the geochemical characteristics of the SE China clinopyroxenes, and by comparison with the experimental results, it is suggested that the mantle beneath SE China has undergone metasomatism either by sequential events with different compositions (one silicate and one carbonatitic) or by a single event with a complex silicate fluid rich in both H_2O and CO_2 components that fractionated and/or disproportionated during percolation in the lithospheric mantle to imprint the observed range of trace-element signatures.

Our recent work, focussing on peridotites with no volatile-bearing phases, reveals other evidence of metasomatism and provides more constraints for identifying the metasomatic agent(s).

In situ Re-Os isotopic data for sulfides in mantle xenoliths from eastern China show a wide range in Os isotopic composition, reflecting the complexity of mantle events. The data suggest the widespread presence of Proterozoic mantle, which has been repeatedly flushed with sulfur-bearing metasomatic fluids since Proterozoic time.

Detailed compositional profile analysed by electron microprobe show that primary olivine and clinopyroxene have higher mg numbers (0.89-0.91), while neoblast olivine and clinopyroxene have lower mg numbers (0.65-0.88). No significant zoning has been found for spinel and orthopyroxene, but olivine has very distinctive composition zoning with mg number decreasing from 0.90 to 0.73 from core to rim. Feldspar- and carbonate-bearing peridotites, rare in other perodotite xenoliths worldwide, have been identified. The feldspar occurs as interstitial material, but typically forms fine-grained aggregates made up of secondary olivine, plagioclase, clinopyroxene and very small grains of Cr-rich spinel, ilmenite. Feldspar is relative rich in titanium (0.15-0.46% TiO_2). The formation of feldspar is inferred to be due to the reaction: sp+opx+cpx+fluid=fs+ol and indicates that the most recent metasomatic process was related to infiltration of an alkali-rich fluid into the peridotites.