# THEME 5: THE DEEPER EARTH

## Session 5.7: Intraplate magmatism and lithosphere

CONVENED BY:

ELSE-RAGNHILD NEUMANN (E.R.NEUMANN@GEO.UIO.NO)

GRAHAM PEARSON (D.G.PEARSON@DURHAM.AC.UK)

*INVITED SPEAKER:*

*DMITRI IONOV (IONOV@MPCH-MAINZ.MPG.DE)*

This session aims to document the petrological and chemical characteristics and evolution of the lithospheric mantle in a range of tectonic settings and to integrate these observations with studies of intra-plate magmatism and magmatic episodes that may have affected the evolution of the lithospheric mantle. Specifically we welcome contributions that explore:

- New geochemical ways of dating and constraining the petrogenesis of lithospheric mantle, including micro-sampling approaches.
- Studies that provide new constraints on the interaction of continental and oceanic lithosphere with intra-plate magmas passing through or being generated within these reservoirs.
- Regional studies that explore the evolution of the continental lithospheric mantle.

### 5.7.11

## Transformation of lithospheric mantle from old refractory to young fertile through peridotite-melt interaction

ZHANG HONG-FU, YING JI-FENG, TANG YAN-JIE AND ZHANG JIN

Institute of Geology and Geophysics, Chinese Academy of Sciences, P.O. Box 9825, Beijing 100029, China (hfzhang@mail.igcas.ac.cn)

The lithospheric mantle of the North China Craton has attracted considerable attention over the last two decades because of a dramatic difference between the Paleozoic cratonic and the Cenozoic oceanic mantle. This change requires considerable thinning of the lithospheric mantle during the Phanerozoic. The mechanism for such a change is hotly debated. Mantle xenoliths and xenocrysts entrained in Mesozoic basalts provide important constraints on the mechanism. Mantle xenoliths are dominantly olivine clinopyroxenites, in which clinopyroxenes are mainly diopsides and olivines are small intergranular grains with very low Mg (81-87). Olivine xenocrysts are chemically zoned. The core has Mg (87.2-90.7), close to that of olivine from mantle peridotites entrained in the Cenozoic basalts and the rim has Mg close to that of olivine phenocrysts (75.7-79.0) in the host basalts. This chemical affinity suggests that the xenocrysts were disaggregates from mantle peridotites. Thus the core generally represents the olivine composition of the mantle peridotites of the source region. The highly fertile lithospheric mantle considerably differs from the Paleozoic refractory mantle, as we see from the kimberlite-borne xenoliths and xenocrysts (Mg=92-95), but is similar to the Mesozoic counterpart as revealed by rare peridotitic xenoliths (Mg dominantly in the range of 88-91) entrained by late Cretaceous basalts and gabbros. Olivine zonation probably formed by the olivine-melt reaction, which terminated when the host basalt erupted, preserving the chemical disequilibrated texture. This reaction mechanism could have been widespread in the lithospheric mantle when small volume melts penetrated. The result of the peridotite-melt interaction finally transformed the lithospheric mantle from old refractory (high Mg) to young fertile (low Mg). The coexistence of both high- and low-Mg olivines in spinel-facies peridotites entrained in the latest Cretaceous basaltic volcanic breccia from the Junan region and in the Cenozoic basalts from the Hebi region (North China craton) support such a reaction or replacement mechanism. The nature of transformed lithospheric mantle depends on the penetrated melt composition. Massive addition of the crustal melt originated from subducted Yangtze lithosphere resulting in the formation of the late Mesozoic highly enriched lithospheric mantle beneath the southern portion of the North China craton, whereas the addition of the asthenospheric melt led to the generation of the Cenozoic fertile, but isotopically depleted, lithospheric mantle.