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# Evolution of lithospheric mantle beneath mobile belt between two cratons: An example from the Oku Massif, Cameroon Volcanic Line (W Africa)

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Cameroon Volcanic Line (CVL) is located in the western part of equatorial Africa and consists of volcanoes which were active from Eocene to recent, stretching ca. 1700 km from the Atlantic in the SW into the African continent in the NE. The continental part of the CVL is located on the Neoproterozoic Central African Orogenic Belt and is situated between the Congo craton and Sahara/Western Africa craton. Mantle peridotite xenoliths which occur locally in lavas of the CVL come from the spinel facies only, suggesting a relatively shallow lithosphere-asthenosphere boundary (LAB). This is supported by seismic studies, showing the LAB at 90-100 km.

In order to understand better the evolution of the lithospheric mantle beneath the CVL, we studied xenolith suite (16 xenoliths) from Befang in the Oku Massif (Tedonkenfack et al., submitted). The Befang xenoliths are almost entirely lherzolites which have cataclastic to weakly porphyroclastic texture. Harzburgites and websterites occur subordinately. Spinel is interstitial and has amoeboidal shape. The studied peridotites (14 lherzolites, 1 harzburgite) consist of minerals with almost constant composition (olivine $Fo_{88.7\text{-}90.3}$, orthopyroxene Al 0.17-0.19 atoms per formula unit (a pfu), clinopyroxene Al 0.28-0.30 a pfu, spinel Cr# dominantly 0.09-0.11). Spinel of Cr# 0.15 occurs in one of the lherzolites, whereas that occurring in harzburgite has Cr# 0.19. Clinopyroxene REE patterns are similar to those of Depleted MORB Mantle (DMM) except LREEs, which vary from depleted to enriched. The A-type olivine fabric occurs in the EBSD-studied subset of 8 samples (one harzburgite and 7 lherzolites). Orthopyroxene shows deformation consistent with olivine. The fabric of LREE-enriched clinopyroxene is equivalent to those of orthopyroxene and olivine, whereas spinel and LREE-depleted clinopyroxene are oriented independently of the fabric of host rock.

These data, thermometry, phase relationships and phase equilibria diagrams suggest that the Befang mantle section was refertilised by MORB-like melt at pressures 1.0-1.4 GPa and temperatures slightly above 1200 – 1275 ºC. The olivine-orthopyroxene framework and LREE-enriched clinopyroxene preserve the fabric of protolith. On the other hand, the LREE-depleted clinopyroxene shows discordant orientation relative to olivine-orthopyroxene protolith framework, and amoeboidal spinel crystallized from the melt. The major element and REEs composition of pyroxenes occurring in the Befang peridotites indicate chemical reequilibration at temperatures 930 – 1000 ºC. Trace element modeling shows that websterites can be linked to Cenozoic volcanism. We speculate that they form veins in the lithospheric mantle. Our study therefore supports the origin of fertile SCLM via refertilization rather than by extraction of small melt fractions, and further emphasizes the involvement of depleted melts in this process, which contrasts with the incompatible element-enriched melts typically invoked in within-plate settings.

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References:

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