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Lithospheric mantle inheritance and re-fertilization processes beneath the French Massif Central.

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Two distinct lithospheric blocks have been recognized north and south 45° 20'N beneath the French Massif Central. They have experienced different degrees of depletion and various types of metasomatism. The refractory northern domain was enriched by subduction-related fluids during the Variscan orogeny, while various metasomatizing agents refertilized the southern fertile domain [e.g. 1-4]. We present new data on amphibole-free and amphibole-bearing spinel lherzolites from five localities of the Devès volcanic field in order to document and discuss the variability and complex metasomatic history of the FMC southern domain.

The lherzolites show protogranular to porphyroclastic textures. The mineral chemical and isotopic compositions fall into the composition range of the southern domain. Olivine and orthopyroxene have similar mg# (~90) suggesting chemical equilibrium after partial melting, while mg# is lower in clinopyroxene (88-90). Trace element distribution in clinopyroxene varies from LREE-depleted to LREE-enriched (La_N/Yb_N is 0.1 to 14). Clinopyroxene have high amounts of Th and U and display mostly strong Nb-Ta and smaller Ti negative anomalies.

A pargasite amphibole (1. 0 wt.% Cr_2O_3, mg#=85-88) developed at the expense of clinopyroxene and spinel as disseminated grain or veins. A few xenoliths show a selvage composed of a Cr-poor kaersutite (± phlogopite). Amphiboles exhibit either depletion or enrichment in LREE similar to that of the co-existing clinopyroxenes. They have higher Sr than clinopyroxene, show a positive Ti anomaly and variable depletion/enrichment in Th-U and Zr-Hf. The major and trace element composition of amphibole in veins varies progressively as a function of increasing distance from the selvage. The similar REE distribution in amphibole and clinopyroxene suggests an equilibrium crystallization or re-equilibration. Similarly clinopyroxene and amphibole are in isotopic equilibrium (87Sr/86Sr = 0.70313-0.70368, 43Nd/144Nd = 0.512846-0.512-918).

Characteristics, relationships and timing between the different melting and metasomatic events will be discussed: e.g., processes and timing of clinopyroxene and amphibole formation, timing of the refertilization, nature of the metasomatizing agents (asthenospheric melts, silicate and silicate-carbonate melts/fluids, subduction-related fluids), influence of fluid/rock ratios, and so on.

[1] Lenoir, 2000; [2] Downes et al, 2003; [3] Uenver-Thiele et al, 2017 ; [4] Ziobro-Mikhrut et al, 2024]