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Amphibole origin in the mantle lithosphere peridotites beneath continents: An example from Marais de Limagne (Massif Central, France) xenoliths

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The Marais de Limagne (MdL) site is located at the Devès volcanic field in the French Massif Central. MdL is known for abundant peridotite xenoliths, which come from the “southern domain” of lithospheric mantle underlying Variscan crust of the Massif Central. The MdL xenolith suite consists of spinel lherzolites and harzburgites which contain from 0 to 21 vol. % of amphibole (Touron et al. 2008). We studied in detail 13 xenoliths in order to understand better the mechanisms of amphibole formation by modal metasomatism.

The suite studied by us contains from 0 to ca. 20 vol. % of amphibole, the textural context and volume of which varies from thin rims of the mineral on spinel to rocks containing thick mantles of amphibole on subordinate or relict spinel. Exceptionally (one xenolith), amphibole occurs as interstitial grains independent of spinel. Amphibole is pargasite *sensu* IMA 2012 classification. Peridotites consist of olivine Fo 89.4-90.5, orthopyroxene Al 0.11-0.19 atoms per formula unit (apfu), clinopyroxene Al 0.13-0.28 apfu and spinel Cr# 0.09-0.39. The exception is harzburgite with olivine Fo 87.0 (orthopyroxene Al 0.11, clinopyroxene Al 0.15 apfu, spinel Cr# 0.15). Clinopyroxene REE patterns vary from LREE-depleted to LREE-enriched. The abundance of amphibole in many xenoliths and equal participation of peridotites with LREE-depleted and LREE-enriched clinopyroxene distinguishes the MdL suite from other xenolith suites from the Devès volcanic field, dominated by lherzolites which contain no or only traces of amphibole and mostly contain aluminous clinopyroxene with LREE-depleted REE patterns.

Clinopyroxene occurring in rocks containing no or little amphibole has < 100 ppm of Sr, whereas that coexisting with abundant amphibole has 230-370 ppm of Sr. The content of Ba in amphibole varies from 2.6 ppm in rocks with only thin rims of mineral on spinel to 467.0 ppm in those which contain high volumes of amphibole. The REE patterns of amphibole are similar to those of coexisting clinopyroxene. Because both Sr and Ba are fluid-mobile elements, we assume that amphibole has originated by reaction of hydrous fluid with spinel, in which clinopyroxene has also participated as a source of elements not present in a fluid or spinel. By analogy with a similar mechanism described by Puziewicz et al. (2023), we speculate that hydrous fluid migration

through the peridotite host might have induced its recrystallization.

Puziewicz et al. 2023, Journal of Petrology 64: https://doi.org./10.1093/petrology/egad049

Touron et al. (2008), In: Metasomatism in Oceanic and Continental Lithospheric Mantle, Geological Society Special Publ. 293, 177-196.