

Wet mantle plume account for the genesis of the alkaline basalts in French Massif Central

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The genesis of the alkaline basalts in French Massif Central (FMC) has drawn extensive attention as a representative of the Circum-Mediterranean anorogenic Cenozoic igneous province. However, the origin of these basalts is still under debated. To shed new light on this issue, we studied the origin of the Ray-Pic alkaline basalts in southeast FMC, which carried abundant fresh peridotite xenoliths. In addition to the major- and trace-element, Sr-Nd-Pb isotope composition of bulk rock, we focused on the oxygen isotope composition, H₂O content and crystallization temperature of the Ray-Pic basalts. Compared with normal MORB, the Ray-Pic basalts have the relatively high $\delta^{18}\text{O}$ values of the clinopyroxene (cpx) phenocrysts (6.41 - 8.44 ‰), high water contents (0.96 - 2.49 wt.%), but similar crystallization temperature of olivine phenocrysts (~ 1200 °C). The differences of the Sr-Nd-Pb-O isotope composition and the H₂O content between the Ray-Pic basalts and peridotite xenoliths conflicted with an amp-rich metasomatized lithospheric mantle source. Instead, the relatively high $\delta^{18}\text{O}$ values of cpx phenocrysts, high Ni content and Fe/Mn ratios of early crystalized olivine phenocrysts indicated that the recycled oceanic crust was involved in the mantle source of Ray-Pic basalts. Seismic tomography identified the presence of a plume-like low-velocity domain in the upper mantle beneath the FMC and a remnant oceanic slab in the mantle transition zone (MTZ) beneath the western-central Europe [1, 2]. Therefore, the high-water content in the mantle source (> 1000 ppm, wt) and the normal crystallization temperature of Ray-Pic basalts suggest that a wet mantle plume with the component of a recycled oceanic crust originating from the MTZ is involved. Therefore, we proposed that the wet mantle plume in upper mantle probably account for genesis of the alkaline basalts with HIMU feature in the FMC and even the western-central Europe.

References:

[1] Chevrot, S. et al. (2014). *Journal of Geophysical Research: Solid Earth*, **119**(8), 6399–6420.

[2] Fichtner, A. & Villaseñor, A. (2015). *Earth and Planetary Science Letters*, **428**, 52–62.