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ARCHITECTURE AND DYNAMICS OF MAGMATIC SYSTEMS LINKED TO BASALTIC VOLCANOES : THE CASE OF PITON DE LA FOURNAISE

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ABSTRACT

Constraining the architecture and dynamics of magma systems is fundamental in volcanology. The main objectives of our study are to (1) constrain the architecture of the whole plumbing system of Piton de la Fournaise, and (2) study magma evolution and magmatic fluids transfers between the mantellic and crustal parts of the plumbing system. Coupling magma petrogeochemistry, melt and fluid inclusions analysis with diffusive soil degassing, we develop an integrated approach, focused on the western flank of the volcano. This zone shows evidences of a recent eruptive and seismic activity, poorly documented, but potentially related to deep magma processes.

Our results allow to confirm the hypothesis of an advanced stage of magmatic differentiation and degassing within the lithospheric mantle, and the offset of the deep part of the Piton de la Fournaise plumbing system beneath the western flank of the volcano. We demonstrate that magma stored in the deepest roots of the plumbing system display a geochemical variability, mainly related to minor mantle source heterogeneities and to polybaric crystallization and assimilation processes.

Fluxes and carbon isotopy of CO_2 released through the soil of the western flank of the volcano record early magma degassing in the lithospheric mantle. Temporal variations of soil CO_2 flux, corrected and filtered from the environmental influence, may thus be used to detect magma replenishment of the central magmatic system by deep magma transfers, hardly detectable by the geophysical network. Our results opens exciting prospects to improve the monitoring of deep magma processes below volcanoes, even in tropical conditions