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Paricutin volcano (Michoacán, Mexico): petrogenesis and magma dynamics of a nine-year historical monogenetic eruption

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Petrological signatures at Paricutin volcano (Michoacán-Guanajuato volcanic field, Mexico) were traditionally considered a classic example of combined crustal assimilation and fractional crystallization of mantle-derived magmas [1]. However, detailed petrogenesis and magma ascent and storage dynamics remained underexplored. Here we explore the excellent record of nine years of eruptive activity (February 1943 - March 1952) applying high-resolution and -precision elemental and Sr-Nd-Pb-Os isotope geochemistry. The reconstruction of the eruption [2] allowed the sampling of the emitted volcanic products in a well-constrained temporal framework, including the early explosive tephra from the first weeks/months and the whole effusive sequence of lava flows.

Our new isotope data argue against significant crustal assimilation in Paricutin magmas, and point to mantle source heterogeneity and fractional crystallization as the key processes involved in the compositional variability of the magmas [3]. In addition, the petrological characterization of olivine, plagioclase, pyroxene, Cr-spinel and Ti-magnetite chemistries and zonations, together with timescale results from diffusion chronometry in olivine, show a systematic evolution between the products of the explosive vent opening and tephra production to the effusive lava outpouring stage. Eruption dynamics are characterized by a change from a convective magma regime with large temperature and oxygen fugacity gradients characterized by short timescales (few days) during the opening stage, to a steadier magma regime with longer timescales (few months) that includes periodic events of magma recharge, mixing, and fractional crystallization [4,5].

This detailed investigation of the Paricutin volcano showcases the benefit of integrating volcanological data with high-resolution petrology and geochemistry and timescale calculations, to infer temporal changes in magmatic processes and the configuration of the plumbing systems beneath monogenetic volcanoes in the scale of days to years, and from mantle depths to eruption.

[1] Cebriá, Martiny, López-Ruiz & Morán-Zenteno (2011) *Journal of Volcanology and Geothermal Research* 201, 113-125.

[2] Larrea, Salinas, Widom, Siebe & Abbitt (2017) *Journal of Volcanology and Geothermal Research* 348, 36-48.

[3] Larrea, Widom, Siebe, Salinas & Kuentz (2019) *Chemical Geology* 504, 66-82.

[4] Albert, Larrea, Costa, Widom & Siebe (2020) *Scientific Reports* 10, *11632.*

[5] Larrea, Albert, Ubide, Costa, Colás, Widom & Siebe (2021) *Journal of Petrology. DOI:10.1093/petrology/egaa112*