Parícutin volcano: A multi-isotopic study of the eruptive sequence

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Parícutin volcano is one of the best studied monogenetic cones from the Michoacan-Guanajato volcanic field (Mexican Volcanic Belt), with an excellent historical record of the eruption (February 1943 - February 1952) [1]. Prior studies of the geochemical characteristics of its products and the changes in the eruptive style have suggested three distinct eruptive phases [2 and references therein]. Phase 1 (February-July 1943) comprises the most mafic material, and is a compositionally distinct magma batch (K_2O<1%, SiO_2<56% and Zr/Nb~22). Phase 2 (July 1943-1946) is characterized by K_2O>1%, limited major element variability (e.g., SiO_2: 54.27-57.19%) and Zr/Nb<21, possibly representing a different magma batch from Phase 1. Phase 3 (1947-1952) shows the most distinctive compositional change, characterized by a wide range in SiO_2 (56.7-61.58) and $^{87}Sr/^{86}Sr$ (0.70398-0.70430), and higher Zr/Nb (>19) than Phase 2, interpreted previously [2] as a third magma batch affected by progressive crustal assimilation.

We present the first complete Sr-Nd-Pb isotopic study of all representative products including tephra and lavas from throughout the Parícutin eruptive history (1943-1951). Phase 1 and most Phase 2 samples exhibit relatively less radiogenic Sr and Pb isotope signatures and more radiogenic $^{143}Nd/^{144}Nd$ than Phase 3, consistent with the onset of crustal assimilation in Phase 3 or late Phase 2, as previously proposed [2]. However, on Sr-Nd-Pb isotope diagrams, the late Phase 2 and Phase 3 samples produce similar trends to that of the primitive lavas from nearby Jorullo volcano, which are interpreted as mantle signatures. In addition, Sr-Nd-Pb isotopic signatures of the Phase 3 samples are similar to those found in high-Nb basalts from other areas of the TMVB (e.g., the Sierra Chichinautzin Volcanic Field), also interpreted as mantle-derived signatures [3]. We are pursuing Os and high precision Pb isotope analyses to further evaluate the relative roles of crustal assimilation versus mantle source heterogeneity in the evolution of Parícutin volcano.

[1] Luhr (2001) *Contrib. Mineral. Petrol.* **142**, 261-283.[2] Rowe et al. (2011) J. *Petrol.* **52**, 2187-2220. [3] Cai Y. (2009) Columbia University.