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Is a Primitive Réunion plume component composition recorded within the Mascarene Basin?

SIDONIE REVILLON[1], VINCENT FAMIN[2], MARTIN DANIŠÍK[3], DANIEL SAUTER[4], SEBASTIEN ZARAGOSI[5], LUC BEAUFORT[6], JULIA RICCI[7], XAVIER QUIDELLEUR[8], BORIS ROBERT[9], AURÉLIE DE BERNARDY DE SIGOYER[10], AXEL K. SCHMITT[3], HUGO OLIEROOK[3], JULIEN SEGHI[10], ADRIEN EUDE[5], NICOLAS VINET[10], SYLVIE LEROY[11], FRANÇOIS NAURET[12], LAURENT MICHON[13], PATRICK BACHÈLERY[14], EMMANUELLE LEROY[15], HUGO ALBAREDES[5], ATHINA TZEVAHIRTZIAN[5], GENEVIÈVE LEBEAU[16], GUILLAUME LEDUC[17], FRANCK BASSINOT[18], ELISE THOUVENET[10] AND LEA VIDIL[11]

[1]SEDISOR
[2]Université de La Réunion - IPGP
[3]Curtin University
[4]Institut Terre et Environnement de Strasbourg (ITES-UMR7063), Université de Strasbourg/EOST, CNRS
[5]Université de Bordeaux
[6]CNRS-CEREGE-Aix Marseille Université
[7]New Mexico Bureau of Geology and Mineral Resources
[8]Universite Paris-Saclay - CNRS
[9]Institut de Physique du Globe de Paris (IPGP)
[10]Université de la Réunion
[11]Sorbonne Université
[12]Université Clermont Auvergne
[13]Université de Paris, Institut de Physique du Globe de Paris, CNRS, UMR 7154
[14]Laboratoire Magmas et Volcans, Université Clermont Auvergne - CNRS - IRD, OPGC
[15]Globice
[16]Université de la Réunion, Laboratoire GéoSciences Réunion
[17]CEREGE
[18]Laboratoire des Sciences du Climat et de l'Environnement (LSCE/IPSL)

To better constrain the composition of Earth's mantle—particularly its deep and potentially primitive components—we investigate volcanic chains commonly interpreted as the surface expression of mantle plumes. During the MASC cruise [1], we identified and sampled the Mascarene Secondary Chain (MASC), which extends from the Seychelles across the seafloor toward Réunion Island. We applied a multi-technique geochronological approach—40Ar/39Ar dating of biotite, U–Pb dating of zircon, and (U–Th)/He dating of zircon and apatite—to constrain the timing of volcanism between ~64 Ma and 10 Ma. Petrological analyses, whole-rock major and trace element geochemistry, and Sr–Nd–Pb isotopic compositions provide detailed insights into magma petrogenesis and mantle source characteristics.

Our results indicate that MASC magmas were generated by very low degrees of partial melting of a heterogeneous mantle source, isotopically distinct from, yet genetically linked to, the Deccan Traps and Réunion hotspot signatures. The isotopic compositions of the MASC magmas are consistent with mixing among at least three components, including a predominant FOZO component and two enriched end-members, such as EM1 and continental crust.

From the Deccan Traps through the Cenozoic volcanism of the Seychelles and along the MASC, magma compositions become progressively more homogeneous over time, converging toward those of Rodrigues, Mauritius, and Réunion islands.

We therefore propose that the MASC seamounts preserve one of the most pristine records of the early, FOZO-like composition of the Réunion plume, largely unaffected by the crustal contamination observed in the Deccan and Seychelles Cenozoic magmas. The convergence of both the MASC volcanic track and isotopic compositions toward Réunion Island reflects the progressive homogenization during the waning activity of the Réunion plume.

[1] Famin et al, A second track of the Réunion hotspot in the Mascarene Basin, EGU26-4542, Vienna