The Role of Mafic Heterogeneity in the Generation of Lavas on Mauritius

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Mauritius Island (20°20'S, 57°30'E) is the penultimate volcanic island of the Réunion mantle plume. Mauritius has a unique history of episodic volcanism characterized by three temporally distinct eruptive phases: (1) the shield-building Older Series lavas (8.4-5.5 Ma), and the post-erosional (2) Intermediate Series (3.5-1.9 Ma) and (3) Younger Series (1.0-0.00 Ma). Analysis of newly available drill core samples has facilitated an advanced subsurface investigation into the evolution of the island and identified the earliest known samples for the island (8.4 Ma) and demonstrated the existence of deep post-erosional lavas (>200 m). The Intermediate and Younger Series remain chemically indistinguishable, apart from curious differences in $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$. Calculated volumes for the combined post-erosional lavas exceed 35 km^3, closely resembling Hawaiian analogues (20-60 km^3), and form decreasing linear trends with increasing shield volume. The chemically distinct shield and post-erosional lavas cannot be explained solely by variations in the extent of partial melting and require distinct sources for each class. Two scenarios for magma generation from a lithologically heterogeneous plume composed of enriched (eclogitic) and depleted (peridotitic) components are modeled by iterative forward modeling of trace element data: (1) mixing of melts from the enriched and depleted components, and (2) generation and melting of a hybrid pyroxenite component. The post-erosional lavas are plausibly reproduced in each model and a lithologically heterogeneous plume consisting of stretched heterogeneous filaments is suggested to account for the required generation of the Intermediate and Younger Series from a single packet of plume material.