

Insight into a not well stirred Indian Ocean Mantle 60-50 My ago

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The central Indian Ocean Basin (CIOB) floor is an outcome of the tectono-magmatic activity of the Central Indian Ridge 60-50 My ago when the Reunion Hotspot was in the vicinity. Basaltic samples recovered in the 11-12.7°S/75.3-76.3°E area allows us to address the enigmatic chemical history of the 60-50 My Indian upper mantle. This regional mantle is characterized by peculiar compositional characters such as a spatio-temporal extension of the DUPAL anomaly. The composition of the Indian upper mantle then is examined within the model in which both the Gondwana breakup and the nearby Reunion hotspot left their imprints in it.

The studied N-MORBs from near-axis seamounts, which were emplaced during India-Eurasia collision, have $0.4 < (La/Sm) < 0.7$. Considering the isotopes (Sr, Nd, Hf and Pb) there are 4 groups of basalts: Group 1 contains depleted samples with the lowest Pb isotope ratios found in Indian MORBs and is considered as representative of the depleted 60-50 Ma Indian MORB mantle. Groups 2 and 3 have comparable low $^{206}Pb/^{238}Pb$ ratios but form two distinct groups in $^{87}Sr/^{86}Sr$; they also have rather or very radiogenic Sr and accordingly unradiogenic Nd isotopes; we regard them as sign of an obvious enriched mantle component EM1. Group 4 has more radiogenic ^{206}Pb than group 1, slightly lower Nd and comparable Sr isotopes and appears to bear like plume derived material mixed within local upper mantle. Mixing models suggest three components and two mixing stages to account for the results. First, local DM was contaminated by African Lower Continental Crust (LCC) material during Gondwana breakup. Second, Reunion hotspot left material within the lithospheric mantle. The geographic distribution of the groups and modeling suggest that the strong EM1 component was first involved in the melting zone followed by a weak EM1 and the Reunion plume one. About 0.5 to 3% of LCC and 3 to 10% of Reunion plume like derived material could account for the isotope heterogeneities.

We conclude that incorporation and mixing of the continental material were not pronounced 50 Ma ago and resulted in more extreme compositions. The present day Indian Ocean upper mantle has signatures of a better stirred reservoir. It also supports the idea that the EM1 mantle endmember resides within the upper mantle.

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