

# New Insights on the Origin of the Ninetyeast Ridge and its Connection to the Kerguelen Hot Spot

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Since the Ninetyeast Ridge (NER) basement was successfully drilled at three Sites (756, 757, 758) during ODP Leg 121 in 1988, analytical techniques have greatly improved. New Pb isotopic analyses of NER samples were determined on a Nu Plasma MC-ICP-MS after being subjected to acid leaching (up to 19 steps) to minimize the effects of alteration. Sequential leaching lowers the Pb isotopic ratios of the samples and leads to weight losses of 50 to 80%. Previous studies [1, 2] had reported  $^{206}\text{Pb}/^{204}\text{Pb}$  ratios that evolved from less radiogenic values in the older lavas at Site 758 (~82 Ma) to more radiogenic values in the younger lavas at Site 756 (~43 Ma). Our new results do not support this evolution with decreasing age as basalts from Site 757 (~58 Ma) have the highest  $^{206}\text{Pb}/^{204}\text{Pb}$  and  $^{207}\text{Pb}/^{204}\text{Pb}$ . In Pb-Pb isotopic space, the results from all three sites plot between the more radiogenic values of basalts from Amsterdam Island and the proposed composition of the Kerguelen plume head source [3]. Site 756 basalts have lower  $^{207}\text{Pb}/^{204}\text{Pb}$ , close to compositions from St. Paul Island basalts [4]. Linear trends in  $^{208}\text{Pb}/^{204}\text{Pb}$  vs.  $^{206}\text{Pb}/^{204}\text{Pb}$  defined by the individual sites do not intersect the depleted MORB field. For a given  $^{206}\text{Pb}/^{204}\text{Pb}$  value, all NER lavas have lower  $^{208}\text{Pb}/^{204}\text{Pb}$  than the estimate of the enriched end-member of the Kerguelen plume. Our new results lie within a triangular field defined by the plume head, the plume tail and another enriched component with higher  $^{206}\text{Pb}/^{204}\text{Pb}$ , but similar  $^{207}\text{Pb}/^{204}\text{Pb}$ , best represented by Amsterdam Island compositions. The involvement of different proportions of each component can explain the observed isotopic variability in NER basalts. In a Sr vs. Pb diagram, the three different sites define separate fields that overlap at  $^{206}\text{Pb}/^{204}\text{Pb} \sim 18.7$  and  $^{87}\text{Sr}/^{86}\text{Sr} \sim 0.7043$ , with Site 758 reflecting a larger contribution from the plume head, Site 757 showing contributions from the plume tail and a component comparable to the one in Amsterdam Island basalts, and Site 756 reflecting a greater contribution from a St. Paul Island component. Contrary to the early stages of the Kerguelen Plateau (>90 Ma), there is no evidence for any continental crust contribution to the origin and evolution of Ninetyeast Ridge basalts.

## References

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- [2] Weis D. & Frey F. (1991) *Proc. ODP*, **121**, 591-610
- [3] Ingle et al (2003) *G3*, **4**, 1-28
- [4] Doucet et al (2004) *EPSL*, **218**, 179-195.