

Geochemical constraints on the ~120 myr history of the Kerguelen plume; new insights from high-precision Pb isotopes

D. WEIS¹

¹ PCIGR, Department of Earth and Ocean Sciences,
University of British Columbia, Vancouver, BC V6T 1Z4,
Canada; dweis@eos.ubc.ca

The Kerguelen Plateau is by far the most diverse oceanic plateau in terms of age, range of eruption and composition compared to other large plateaus such as Ontong-Java or Caribbean. The large majority of the Cretaceous Kerguelen basalts are tholeiitic and subaerial. The youngest basaltic flows on the Kerguelen Archipelago range from tholeiitic-transitional (29-26 Ma) to mildly alkalic (25-24 Ma) and are also more enriched in LILE compared to earlier basalts from the plateau, and the Broken and Ninetyeast ridges.

Isotopic compositions, especially newly acquired high-precision Pb isotopic ratios by MC-ICP-MS on carefully leached samples, present striking variations and reflect the diverse tectonic settings of the Kerguelen plume magmatism. The <40 Ma basalts, those that were formed in an entirely oceanic setting, trend towards the field defined for the enriched end-member of the Kerguelen plume and show no sign of any significant continental influence. The compositions of the 34 Ma submarine basalts from the Northern Kerguelen Plateau reflect binary mixing between the Kerguelen plume and the depleted asthenospheric source of the Southeast Indian Ridge MORB. Some of the early magmatic products (120-90 Ma), generated when the plateau started forming at the edges of Gondwana, have isotopic compositions indicating contamination by continental crust and their variations resemble those observed in the North Atlantic Magmatic Province. For the basalts with intermediate ages, in the South and Central Kerguelen Plateaus, the overall isotopic characteristics reflect a common enriched mantle plume component with the additional components varying as a function of age and setting. This observation is also true for basalts from the 82-38 Ma Ninetyeast Ridge, where the new Pb isotopic data indicate no contribution from the upper/depleted mantle, nor from continental crust.

The new, high-precision, Pb isotopic compositions allow for a better definition and identification of the various components involved and converge towards a common component that appears to be characteristic of all the Kerguelen-related topographic features of the Indian Ocean.