Long-lived volcanism of the Kerguelen hotspot

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The Kerguelen hotspot in the south Indian Ocean has been active since at least 119 Ma, but possibly since about 132 Ma. This long-lived volcanism provides strong evidence that the Kerguelen hotspot results from a deep-sourced mantle plume and this is consistent with tomographic images. During its greater than 120 Myr history, the tectonic setting of the Kerguelen hotspot has changed remarkably, resulting in a geological feature that is complex in both a structural and geochemical sense. The stages of development of the Kerguelen hotspot may be subdivided into time periods in order to facilitate study of this complex, long-lived volcanic feature: Early Cretaceous, Late Cretaceous and Cenozoic times. During Early Cretaceous times, the Kerguelen hotspot created the Kerguelen Plateau and Broken Ridge (at that time adjacent to the central plateau) and possibly continental flood basalts on the margins of India and Australia. The majority of rocks erupted during this time are tholeiitic basalts and basaltic andesites. These rocks also show large ranges in their values for isotopic and trace element ratios sensitive to contamination by continental lithosphere. This can be ascribed to assimilation of continental crust by plume-derived basaltic magmas. Throughout Late Cretaceous times, the Kerguelen hotspot created a hotspot track (Ninetyeast Ridge) composed of tholeiitic basalts as well as alkalic bimodal volcanics on the northwest of the plateau. Since the beginning of the Cenozoic, the distance between the Kerguelen hotspot and Australia has increased, due to spreading on the Southeast Indian Ridge. From the Cenozoic to the present, volcanic products have changed systematically from tholeiitic to transitional to alkalic with increasing relative distance to the ridge. This implies ridge to plume transfer of material, a phenomenon documented only rarely. In summary, certain geochemical trends can be observed in this complex structure, but these are only evident when the tectonic setting and age are taken into account. This overview will examine the volcanic products of the Kerguelen hotspot in relationship to its tectonic environment over the past approximately 130 Ma.