

Kerguelen oceanic carbonatite sourced from deep recycled continental crust material

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Carbonatites are mantle-derived rocks associated with Rare Earth element deposits, although their origin is debated. The majority of carbonatites are found in proximation to old continental crust and exhibit strong Sr and Nd isotopes enrichments, with only a few known carbonatite occurrences found in intra-oceanic settings on Cape Verde and Canary Island in the Atlantic Ocean. These oceanic carbonatites are moderately depleted with isotopic signatures similar to the prevalent mantle, indicating that Sr and Nd isotopic enrichment observed in continental carbonatites is controlled by the continental lithospheric mantle, metasomatized by melts and fluid over billions of years. Here we report a newly discovered intra-oceanic carbonatite unit from the Kerguelen Archipelago, the emerged part of the long-lived Cretaceous Kerguelen Plateau. The Kerguelen carbonatite erupted at 24.1 ± 0.1 Ma after the main building phase of the northern Kerguelen Plateau, and was fed by the Kerguelen mantle plume. The carbonatite shows strong Sr and Nd isotopic enrichments consistent with the presence of recycled continental material in the deep mantle source of the Kerguelen plume, enriched during the assembly and breakup of the supercontinent Pangaea. These new data show a significant role of geodynamic processes in controlling deep recycling of continental material, location of mantle plumes, and composition of carbonatites.