Oceanic crust assimilation in Kerguelen Archipelago trachytes

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The Kerguelen Archipelago is a really interesting oceanic island group because of its magmatic evolution going from tholeitic to hyper-alkaline series. Here, we focus on the alkaline silica-saturated magmatic series and its more evolved trachytes. These evolved trachytes display an enrichment in Fe_2O_3, TiO_2, CaO, a depletion in Na_2O and Al_2O_3 and $\delta^{57}Fe$ ranging between 0.05 and 0.1‰ that cannot be explained by cristal fractionation models [1]. These trachytes display neither alteration features nor the clays association typical of hydrothermal processes. Amorphous mineraloids called chlorophaeite are observed in diktytaxic voids and fractures and display clear contacts with well-shaped feldspars and pyroxenes from the mesostasis. The presence of chlorophaeite is due to deuteritic alteration of the interstitial volcanic glass [2] meaning that the trachyic parental magmas were volatiles-rich. However, deuteritic alteration cannot explain major elements nor isotopic enrichments. Assimilation-Fractional-Cristallisation (AFC) is a more likely process for such an evolution. Trachytic melts have high viscosities which means a long residence time into the thick oceanic crust of the Kerguelen. As the Kerguelen Plateau is highly hydrothermalized [3], the relatively high water content of the basaltic crust favors its partial melting. EC-AFC model [4] have been performed in order to test if assimilation of hydrothermalized oceanic crust, with a $\delta^{57}Fe$ of about -1% [5], could lead to the more evolved trachytic compositions. This model shows that less than 10% of partial melting of hydrothermalized basalt is required during the cristallization of the parental melts of the more evolved trachytes in order to get their iron contents and iron isotope compositions.

References
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