

Zirconium enrichment in alkaline ocean island magmas

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This study examines the zirconium enrichment process in alkaline and subalkalic ocean island magmas of the Kerguelen Archipelago, the Afanasij Nikitin, the Ob' and the Lena Seamounts of Indian ocean which have similar petrological and geochemical features. To investigate the zirconium enrichment process in these magmatic suites we have carried out a geochemical study using available trace element data on 130 samples (Gautier *et al.*, 1990; Weis *et al.*, 1993; Barling *et al.*, 1994; Borisova, 1997).

Mineralogical composition and Zr/Sm ratios

The studied alkaline and subalkalic suites contain two kinds of rocks: a) clinopyroxene-bearing basalts or trachybasalts, and b) clinopyroxene-bearing, phlogopite-bearing or amphibole-bearing phonolites and trachytes (Gautier *et al.*, 1990; Weis *et al.*, 1993; Barling *et al.*, 1994; Borisova, 1997).

Mantle-normalized patterns of low magnesian trachybasalts, trachytes and phonolites (MgO < 4 wt.%) show Zr maxima unlike those of basalts with higher magnesium content (MgO > 4 wt.%). In these basalts the order of trace element incompatibility is

typical of OIB and MORB magmas (Sun and McDonough, 1989), while in low magnesian magmas (MgO < 4 wt.%) the degree of Zr incompatibility is high as those for Nb and Ta. Therefore, Zr enrichment of the studied magmas is a result of rather a fractionation process than the mantle source composition. Basalts with higher magnesium content (MgO > 4 wt.%) are characterized by (Zr/Sm)_n ratios ranging from 0.8 to 2.2 (normalized to primitive mantle composition according to Sun and McDonough, 1989), while trachybasalts, trachytes and phonolites (MgO < 4 wt.%) have (Zr/Sm)_n ratios ranging from 1.2 to 18.6 (Fig.1). Besides, the (Zr/Sm)_n ratio of more *LREE* enriched melts increases: magmas with La/Sm ratios higher than 5 show (Zr/Sm)_n > 1.8 (Fig. 1), while magmas with La/Sm ratios lower than 5 exhibit (Zr/Sm)_n < 1.5.

Mineralogical control of Zr incompatibility

The variations of the Zr/Sm ratios observed in the studied suites are likely to be controlled by the difference in Zr and Sm distribution coefficients between certain minerals and the melt (Green, 1994). The increase of the (Zr/Sm)_n ratio with the degree of

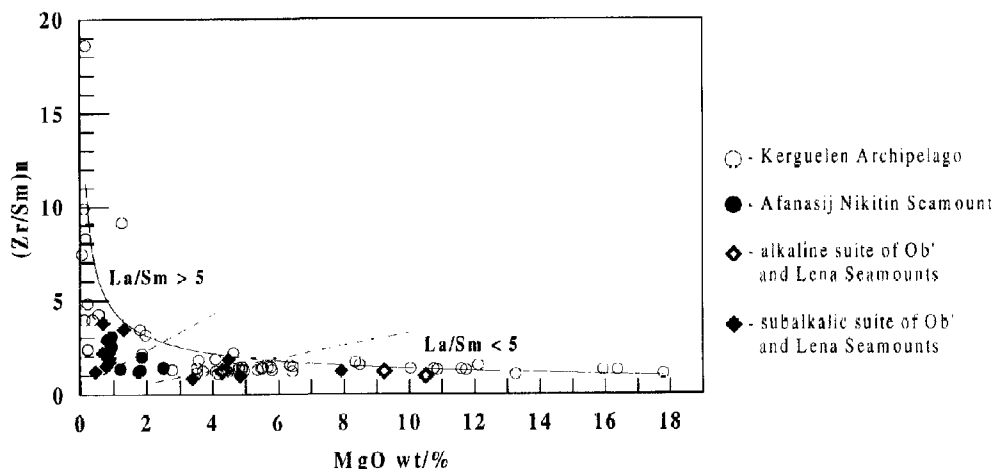


FIG. 1. Normalized (Zr/Sm)_n ratio as a function of MgO content in magmas of alkaline and subalkalic suites.

differentiation in alkaline magmas is likely due to a) the fractionation of clinopyroxene during the early stages of magmas crystallization, and b) the fractionation of clinopyroxene, phlogopite or amphibole during the late stages of magmas crystallization.

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