Nature and Mechanisms of mantle metasomatism of the Tariat mantle xenoliths, central Mongolia

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The interaction between hydrous fluids and melts with dry pre-existing mantle rocks alters the physocochemical porperties of the deep lithosphere. Here we present new insight into mantle metasomatism based on petrology, geochemistry, and Rare Earth Element (REE) distribution modelling using mantle xenoliths from various eruption centres in the Cenozoic Tariat volcanic field, Mongolia. These centres include the Horgo, Tsagan, Zala, Haer and Shavaryn-Tsaram lava flows that vary in composition and age between alkali basalts to trachybasalts to tephrite basanites and 4 ka to 1.5 Ma, respectively. Our sample suite contains xenolith from the lower crust and underlying mantle with a size range of individual xenoliths between 3 cm and 8 cm. Based on the clinopyroxene REE concentration pattern, the investigated xenoliths can be divided in two groups, characterized by LREE depletion (Group 1) and enrichment (Group 2) relative to primitive mantle. Group 1 xenoliths display well–preserved deformation textures and are considered to represent the sub-continental lithosphere prior to Cenozoic rejuvenation. In contrast, Group 2 samples are marked by partial annealing of pre-existing textures. REE distribution modelling between clinopyroxene and inferred chemically enriched basaltic melt suggests that the observed REE pattern do not reconcile with a simple mixing model but reflect chromatographic fractionation during reactive melt flow. In addition, the clinopyroxene core–rim REE variation in some of the xenoliths suggests interaction with at least one other melt of distinct chemical composition.