The generation of composite dykes of leucite-diopside and phlogopite-diopsite lamprophyres in a long lived volcanic arc setting: An example for the heteromorphic reactions during differentiation

FATMA GÜLMEZ[1]*, Ş. CAN GENÇ[1] AND DEJAN PRELEVIC[2]

[1]Jeoloji Mühendisliği Bölümü, İstanbul Teknik Üniversitesi, Istanbul, Turkey; [2]Institut für Geowissenschaften, Johannes Gutenberg Universitat Mainz, Germany

The term "heteromorphism" is applied to the crystallization of magmas of nearly identical chemical composition into different mineral assemblages. It is commonly used for variation in development of distinct mineralogies produced by diverse kinetic paths during the solidification of chemically similar or identical magmas. We study ultrapotassic rocks that intruded fore arc basins of Pontide magmatic arc as dykes and stocks during Upper Cretaceous subduction of NeoTethys ocean. We focus on Kalecik region where numerous composite dykes of leucite-diopside (LDL) and phlogopite-diopside lamprophyres (PDL) cut the fore arc and Ankara mélange units.

The composite dykes have no sharp border and LDL changes through a transitional zone to PDL lithology. The two lithologies have identical chemical composition, including Sr, Nd and Pb isotopes. The only exception is demonstrated by the antipathetic behaviour of K_2O and Na_2O due to severe analcimization of primary leucite. The lavas display a clear subduction signature in their trace element patterns similar to abundant coeval calc-alkaline andesites of Pontide arc.

The clinopyroxenes from each lithology were measured to detect if any compositional diversification exist on the mineral scale. They are all diopsidic, represented by the identical trace element characteristics and are similar to Roman type clinopyroxene in terms of their Al tot (a.f.u) and Ti tot (a.f.u) variations. Similar, but extremely low $\delta^{18}O$ values (LDL: 2.6 ‰, PDL: 2.4‰) obtained from separated diopside crystals are another strong evidence that the LDL and PDL were crystallized from the same parental ultrapotassic melt.

The absence of leucite in PDL and the abundance of phlogopite should be controlled by volatile content variations during the solidification of chemically similar or identical magmas. The differentiation of PDL and LDL may be caused by heteromorphic reactions.