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Petrology and Tectonic Importance of the Early Miocene-Pliocene Basalts From Gürün and Kangal Basins (Sivas)

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ABSTRACT

Early Miocene and Pliocene plateau-type basaltic volcanic rocks are located in the Gürün and Kangal basins (Sivas), respectively. The basaltic rocks in the Gürün basin occur in several levels of the Early Miocene sedimentary units. In this study, it is aimed to discuss the Early Miocene – Pliocene tectono-magmatic evolution of the region, by using the detailed petrography, mineral chemistry, whole rock major and trace element geochemistry and Sr-Nd isotopic compositions of these basaltic rocks, which are emplaced between the Central and the Eastern Anatolian Volcanic Provinces.

All volcanic units petrographically include olivine, clinopyroxene, plagioclase and Fe-Ti oxide phases. Olivines are Fo50.5-80.0 in composition range. Clinopyroxene are classified as diopside and augite with compositional range of En34-43Fs12-19Wo42-46. Plagioclases are classified as oligoclase, andesine, labradorite and less anortoclase with Ab36-70An7-54Or1-27 compositions. According to whole rock element chemistry, the Early Miocene basaltic rocks of the Gürün basin are quartz- and/or olivine- normative basalt, trachybasalt and andesite, while the Pliocene basaltic rocks of the Kangal basin are nepheline- and/or olivine-normative basalt, trachybasalt and basaltic trachyandesite in composition. Nb/La values of all samples are in the range of 1.0-1.5, and decrease proportionally to MgO contents. 87Sr/86Sr(i) and 143Nd/144Nd(i) isotopic ratios of all volcanic units are similar and vary in the ranges of 0.70405-0.70565 and 0.51258-0.51280, respectively. 87Sr/86Sr(i) ratios of the samples increase with respect to their decreasing MgO contents.

According to the trace element geochemistry, the basaltic samples in the region have intra-plate affinity, which were derived from mantle sources that were not significantly affected by subduction-related enrichment. Nb-dependent major and trace element variation diagrams further show that these rocks can be grouped under three geochemical clans. Geochemical features of these groups are related to different degrees of partial melting in the source region: the Early Miocene lavas were produced by highest degree of melting, while the Pliocene basaltic rocks were produced intermediate- and low-degree melting of the common mantle. The primitive magmas of these three rock groups then underwent to fractional crystallization coupled with high-degree crustal assimilation processes to produce the more evolved rocks of each groups. As a result, the Early Miocene-Pliocene basalts in the region tectonically represent intra-plate volcanic activity, revealing that such magmatic activity in the region commenced in the Early Miocene times.

Keywords: Geochemistry, intra-plate basalt, Central-East Anatolian volcanism