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Petrological Investigation of Eğrikuyu Monogenetic Field (central Anatolia, Turkey)

Göksu Uslular and Gonca Gençalioğlu-Kuşcu
Muğla Sıtkı Koçman University Geological Engineering, Kötekli Campus, Muğla, Turkey (goksuuslular@mu.edu.tr)

Source heterogeneity detected either in the individual monogenetic (*sl*) volcano or the entire monogenetic basaltic field has been recently reported from different parts of the world. Possible mechanisms proposed to explain this variation are various degrees of crystallization or melting, crystal-melt interaction, multiple components of mantle source, and ascent dynamics. Therefore, investigation of primitive basalts in monogenetic fields provide new insight into the evolution of a basaltic melt from the mantle.
Eğrikuyu Monogenetic Field (EMF) is located at the southwestern part of the Central Anatolian Volcanic Province (CAVP), and consists of numerous scoria cones and related lava flows, and a few maars. EMF basalts are olivine-rich with the mineral assemblages of clinopyroxene, plagioclase, and Fe-Ti oxides. Most of them have high MgO (7.9-11.5 wt.%) and Ni (up to 226 ppm) contents, and both silica-saturated (Ol-Hyp normative) and silica-undersaturated (Ol-Nph normative) compositions. They are all enriched in LILE compared to HFSE (K/Nb > 500), and display depletion in Nb, Ta, P, and Ti in the multi-element diagrams, typical for subduction-related magmas. Subduction signature of EMF (and CAVP in general) basalts is believed to be inherited from a previous subduction. The mildly alkaline nature of EMF basalts with the depletion in Yb and also Zr-Hf trough indicate a comparably deep garnet-bearing source. This is also evident in mineral chemistry analysis of EMF basalts that show some implications of heterogeneity in the mantle source (i.e. green-cores of clinopyroxenes). Less radiogenic Sr ($^{87}Sr/^{86}Sr$: 0.7044-0.7054) and more radiogenic Nd ($^{143}Nd/^{144}Nd$: 0.5127-0.5128) contents support the idea of a mixed mantle source not only for EMF, but also for other CAVP basalts. Pb isotope compositions of the EMF basalts ($^{206}Pb/^{204}Pb$: 18.7191-18.8821; $^{207}Pb/^{204}Pb$: 15.59-15.68; $^{208}Pb/^{204}Pb$: 38.68-39.10) are mainly controlled by subducted-sediments (Eastern Mediterranean Sediments, EMS) in the mantle source.
Two distinct possible mantle sources were used in the non-modal melting model of EMF and CAVP basalts. Spinel lherzolite metasomatized by subducted-fluids (mixing of oceanic crust and EMS) was used to denote the shallow lithospheric mantle, whereas deeper asthenospheric mantle was represented by fertile garnet-amphibole lherzolite. The melting models show that mixing of higher degrees of melting (5-10%) of asthenospheric source (OIB-like and isotopically similar to common “C” mantle) with small-degree melting (0.1-1%) of lithospheric mantle (addition of c. 15% subducted-fluid) may explain the trace-element composition of EMF and CAVP basalts. This higher degrees of melting of asthenospheric source probably caused melting of overlying (or dripping) lithospheric mantle. Various melting proportions of two distinct components (e.g. higher abundance of asthenospheric source in mildly-alkaline basalts) and metasomatism-agent of lithospheric mantle are considered as the main controlling factors in the evolution of EMF and CAVP basalts.

Keywords: mildly-alkaline basalts, monogenetic volcanism, source heterogeneity, central Anatolia