

Petrologic evaluation of Pliocene basaltic volcanism in Eastern Anatolian region, Turkey: Evidence for mixing of melts derived from both shallow and deep mantle sources

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Collision-related Neogene volcanism in the Eastern Anatolia region (EAR) began after the continent-continent collision between the Arabia and the Eurasia plates, and spreads in a wide zone from the Erzurum-Kars Plateau in the northeast to the Karacadağ in the south. Volcanic activity in the EAR started 15 Ma ago (Middle Miocene) in the south of the region. Voluminous basaltic lavas from local eruption centers formed basaltic lava plateaus and volcanic cones as a result of high production level of volcanism during the Pliocene time interval.

Our dating results (Ar-Ar and K-Ar) indicate that age of this Late Miocene-Pliocene magmatic activity range between 6 and 3.5 Ma. Volcanic products contain alkaline and subalkaline lavas, ranging in composition from basalts to andesites and trachyandesites. Our EC-AFC and AFC modeling, based on trace element and Sr, Nd, Pb isotopic compositions, suggests about 2-7 % crustal contamination in the evolved andesites and trachyandesites. MORB and primitive mantle normalized patterns of the lavas and isotopic compositions imply that alkaline and subalkaline basalts erupted in Pliocene time interval in the EAR could have been derived from a mantle source that had previously been enriched by a clear subduction component.

A partial melting model was conducted to evaluate partial melting processes in the mantle source of the Pliocene basalts. Our melting model calculations suggest that basaltic melts in the EAR could have been produced by melting of mantle sources containing spinel, garnet and amphibole with melting degree in the range of 0.7-7%. The products of mixing of these derivative melts are the Pliocene basaltic lavas of the Eastern Anatolian Region.