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Geochemical and Sr-Nd Isotopic Constraints on the Petrogenesis of Pre- to Post-collisional Volcanic Rocks in Armenia

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Cenozoic magmatism in Armenia took place in two main stages, i.e. an early one from Eocene to Oligocene and a late one from late Miocene to Quaternary, which, respectively, pre- and post-date the onset of the Arabia-Eurasia collision. In contrast to the general consensus that attributes the early stage magmatism to the Neotethyan subduction, how did the late stage occur as voluminous post-collisional volcanic eruptions ($\sim$11 Ma to Recent) in the vast region covering much of the Caucasus, Northwestern Iran and Eastern Anatolia (hereafter named as the CIA magmatic province) has long been an issue of debates. This study reports geochemical data of 10 samples from the early stage and 34 others from the late stage from NW and central parts of Armenia. The former that range from basaltic to dacitic compositions show medium-K calc-alkaline nature, while the latter composed of basalts to rhyolites that constitute a high-K calc-alkaline suite. Although all these rocks show LREE-enriched rare earth patterns, basalts from the early stage, which contain La of 15-28 ppm and (La/Yb)N of 3.5-7.9, are markedly less enriched than those of the late stage [La=24-63 ppm and (La/Yb)N=5.8-20]. In the multi-element diagram, such secular variations are observed also for other highly incompatible trace elements (e.g., R_b, B_a, T_h, U), despite all the basalts display apparent depletions in the high field strength elements (e.g., N_b, T_a, T_i). These geochemical features, similar to those of many coeval volcanic rocks from the CIA magmatic province, support the existence of a subduction-modified lithospheric mantle that prevails in the Lesser Caucasus and nearby regions throughout the Cenozoic. The Armenian rocks show rather uniform Sr-Nd isotopic compositions, with the early stage having 87Sr/86Sr=0.7040-0.7047 and 143Nd/144Nd=0.5137-0.5129 and the late stage having 87Sr/86Sr=0.7042-0.7046 and 143Nd/144Nd=0.5128-0.5129, similar with the isotopic compositions reported in other CIA magmatic province. Moreover, the Sr-Nd isotopic compositions do not change with SiO_2 contents, suggesting FC, rather than AFC, processes in the petrogenesis or magma differentiation. We performed REE modeling for the Armenian basaltic magma generation and the results suggest that the pre- to post-collisional magmatism resulted from changing degrees of partial melting of a shared mantle source, with the melting degrees being larger in the early stage (5-15%) and smaller in the late stage (1-6%).