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**Petrology and geochemistry of the Late Cenozoic collision volcanism in the Lesser Caucasus**

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Late Cenozoic igneous rocks are widespread within the Caucasus and are one of the major components of the continental crust in the Alpine–Himalayan intracontinental orogenic belt. Their formation was synchronous with the regional continental collision. According to modern concepts, the Caucasus folded structures resulted from the convergence of the Afro-Arabian and Eurasian Plates. N.V.Koronovsky and L.I.Demina (1999) believe that the Late Cenozoic volcanism was manifested at the Caucasus segment of the Alpine–Himalayan orogenic belt during the submeridional compression of the latter. The compression was caused by the rapid northward transition of the Arabian Plate as a result of the opening of the Red Sea in the Middle Miocene (about 15–10 Ma). The Late Cenozoic volcanism was manifested in the central part of the Lesser Caucasus in two stages: Late Miocene–Early Pliocene and Late Pliocene–Quaternary. Differentiated andesite–dacite–rhyolite association formed at the first stage, and bimodal rhyolite and weakly differentiated trachybasalt–trachyandesite associations, at the second stage (Imamverdiev, 2000). *Andesite–dacite–rhyolite association.* The association rocks form a continuous series from andesites to rhyolites by SiO2 contents (SiO2 ≥ 60 wt.%). The rocks of the andesite–dacite–rhyolite association show regular variations in the contents of trace and rare-earth elements. All this indicates that the rocks formed mainly through crystallization differentiation caused by the fractionation of clinopyroxene, magnetite, and olivine. *Rhyolite association.* In contrast to the rocks of the previous association, these rocks are characterized by an ultrafelsic composition, high alkalinity, nearly equal Na2O/K2O ratios, and low contents of CaO, MgO, and FeO. In contrast to the rocks of the andesite–dacite–rhyolite association, the similar rocks of the rhyolite association are depleted in femic components, iron group elements, and HFSE and are enriched in ore and lithophile (Pb, Th, U). *Trachybasalt–trachyandesite association.* These moderately alkaline rocks form a continuous series from basalts to andesites according to SiO2 contents. The rocks of the trachybasalt–trachyandesite association show nearly the same lithophile-element pattern as the rocks of the andesite–dacite–rhyolite association, but it is better pronounced. These rocks have high contents of LILE (Rb, Ba, La, and Sr) and high La/Yb and La/Sm ratios. The geochemical data indicate that the diversity of the rocks is due to their fractional crystallization. In contents of lithophile elements the rocks of the Lesser Caucasus trachybasalt–trachyandesite association are close to oceanic-island and rift zone rocks formed from enriched mantle sources. The primitive-mantle-normalized (Sun and McDonough, 1989) magmatophile-element diagrams show that the mafic and intermediate rocks of the andesite–dacite–rhyolite and trachybasalt–trachyandesite associations are enriched in LILE, LREE, and HFSE, have high LILE/HFSE (e.g., Ba/Nb) ratios, and are depleted in Ti, Y, and HREE as compared with the primitive mantle. The intermediate calc-alkalic rocks of the former association are depleted in Ti relative to the moderately alkaline rocks of the latter association. The REE patterns of the mafic and intermediate rocks are similar and show a weak negative Eu anomaly. The rhyolites of the andesite–dacite–rhyolite association demonstrate similar REE patterns and are slightly depleted in REE. Compared with the intermediate and mafic rocks, they show a higher La/Sm ratio and a small negative Eu anomaly and are depleted in HREE. The mafic and intermediate (??) rocks of the rhyolite association show a stronger negative Eu anomaly (Imamverdiev, 2003). The rocks show steep chondrite-normalized patterns and are enriched in LREE (Imamverdiev, 2003). As shown above, the Late Miocene–Quaternary volcanic rocks in the Azerbaijan area (part) have similar geochemical features (dependence of the contents of major and trace elements on the MgO content). This suggests that their primary magmas were generated from similar sources in similar conditions. These Late Cenozoic volcanics have low contents of Cr and Ni (up to 450 and 110 ppm, respectively, in the least differentiated basaltic lavas) as compared with the primary magmas. The contents of Cr (up to 710 ppm), Ni (up to 350 ppm), and MgO (8–13 wt.%) in the gabbroid inclusions are higher than those in the host basaltoids. The inclusions are probably close in major- and trace-element composition to the primary magmas. Nevertheless, the contents of MgO, Cr, and Ni in these inclusions are lower than those in the parental melts. We assume that these are cumulates and schlieric rocks. The upper-mantle primary magmas are characterized by high Mg# values (>0.7%), high contents of Ni (>400–500 ppm) and Cr (>1000 ppm), and SiO2 < 50 wt.% (Condie, 2001; Taylor and McLennan, 1985; Thirwall et al., 1994; Wilson, 1989). Thus, the primary magmas that generated the rocks of both associations were probably weakly differentiated. As shown above, the rocks of the early association formed from high-alumina basaltic magma, whereas the parental melt that produced the rocks of the late association was close in composition to weakly differentiated moderately alkaline olivine basalts containing equilibrium olivine Fo84 at KD = 0.33 (Imamverdiev, 2000). Note that the Neogene–Quaternary volcanic associations are characterized by nearly the same REE and trace-element patterns. The normalized spidergrams of the mafic and intermediate rocks show negative Nb, Ta, Hf, and Zr anomalies. The salic rocks are strongly enriched in Rb, Ba, Th, and La and are depleted in Ti, Yb, and Y relative to the primitive mantle. The enrichment of rocks in incompatible elements suggests that the parental melt was generated from the metasomatized lithospheric mantle enriched in K and incompatible elements. Negative Nb–Ta anomalies are considered to be intrinsic to suprasubductional magmatism. In subduction zones, K, Rb, Th, and La localized above the mantle wedge pass into a melt, whereas Nb and Ta stay in solid peridotite restites and thus cause depletion of suprasubductional magmas in these elements (Condie, 2001). In contrast to IAB, the studied samples are enriched in LILE. Similar geochemical features were earlier revealed in other postcollisional areas (Pearce et al., 1990). The geochemical data, in particular, the high Th/Nb, Ba/Nb, and K/Ti ratios and low Nb/Y and Ti/Y ratios, and the regional geological data show that the mantle sources beneath the Lesser Caucasus were metasomatized by more ancient subduction processes and contain HFSE-depleted high-K water fluids. Gabbroid nodules and the least differentiated Miocene–Quaternary basaltoids have similar compositions indicating their formation from the enriched lithospheric mantle. Thus, volcanism in the central part of the Lesser Caucasus was developed in two stages: Late Miocene–Early Pliocene (high-K calc-alkalic volcanism) and Late Pliocene–Quaternary (moderately alkaline volcanism). All volcanic rocks are characterized by similar primitive-mantle-normalized trace-element and REE patterns, negative Nb and Ta anomalies, enrichment in Rb, Ba, Th, and La and depletion in Ti, Yb, and Y. This indicates the presence of the subduction-metasomatized lithospheric mantle in the magma source. Magma evolution was controlled by the partial melting of the subcontinental mantle lithosphere and assimilation-fractional crystallization developed in the postcollisional magmatic belts of the Lesser Caucasus (Imamverdiyev et al., 2015). The increase in the rock alkalinity in the period from Late Miocene to Quaternary, the high La/Yb ratios, and the LILE enrichment of the rocks are due to the influence of a suprasubductional source. These features indicate the presence of the suprasubductional metasomatized mantle material beneath the recent Turkish–Iranian plateau, including the Lesser Caucasus (Dilek et al., 2010). The partial melting of the rising asthenosphere in the Arabian–Eurasian collision zone favored the enrichment of magmas with alkaline components of younger volcanic rocks and probably resulted in the regional lithospheric delamination.

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