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Fractional crystallization and magma mixing in the calc-alkaline Karadağ Granitoid (Balya-Balıkesir-Turkey)

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Granitoidic rocks reflect complex processes that might occur in magma chambers and these magmas may be controlled by melting reactions and hybridization processes of original crustal melt with mantle - derived magmas. Two magma sources coexisted and melted almost contemporaneously. The Late Oligocene-Lower Miocene Karadağ granitoid has been interpreted as formed by fractional crystallization and magma mixing/mingling between anatectic crustal melts and mantle derived magmas according to field, major and minor element behaviours.

Post-collisional magmatic activities of NW Anatolia are represented by a series of granitic intrusions and volcanic succesions. One of the granitic intrusions, Karadağ granitoid is located in the Central part of the Biga Peninsula. It has fine-grained outer zone and medium-coarse-grained inner zone. This granitoid has distinct textures, chemical composition and isotope characteristics. It also shows equigranular and hypidiomorphic textured monzogranite, quartz monzonite, granodiorite, leucocratic alkali feldspar granites and mafic microgranular encleves (MMEs). It is composed of quartz, K-feldspar, plagioclase, hornblende and biotite. Leucocratic facies rarely contains mafic minerals. Accessory phase composed of zircon, apatite, magnetite and sphene. MMEs have microdioritic or quartz microdioritic composition and they include more mafic mineral than felsic granitic host rocks. Both of them have some mixing texture such as antirapakivi, spongy cellular plagioclase, poicilitic K-feldspar textures, blade-shaped biotite, acicular apatite, feldspar-biotite ocellar textures etc.

The geochemical evolution of fractional crystallization and mixing in Karadağ granitoid had been processes controlling the major and trace element variability, good linear positive correlations between K_2O, Rb and SiO_2. In addition, some hyperbolic trends shown between Ba, Sr, Co, Ta, Zr, Th, Nb elements and SiO_2. ASI contents of the pluton is between 0.79–1.08. It is therefore classified as a metaluminous I-type affinity. K_2O contents show that the granitoid samples except for one sample are high K-calc-alkaline and one sample shows that shoshonite in character. Initial $^{87}Sr/^{86}Sr_{(t)}$ (0.70700–0.070713), $^{143}Nd/^{144}Nd_{(t)}$ (0.51246–0.51247) isotope compositions and negative $Nd_{(t)}$ (-2.7– -2.9) values show that this stock derived from enrichment mantle sources. N-MORB normalized spider diagrams of Karadağ granitoid is characterized by the large ion lithophile elements (LILE) and light rare earth elements (LREE) enrichments and negative high field strength elements (HFSE) anomalies, indicates that hydrous melting of mantle wedge in a subduction zone or enrichment of the magma sources with inherited from an ancient subduction component. All of the Karadağ granitoid samples fall into the volcanic arc granite and syn- and post-collisional granite field in tectonic setting discrimination diagrams. The pluton was dated by the using K/Ar method on hornblende, biotite and whole rock, yielded ages between 20.2±0,9 Ma and 23.9±0,5 Ma (Upper Oligocene - Lower Miocene).

Field relationships, mineralogy and major- and trace-element geochemistry show that: the equigranular and porphyritic granitic rocks are differentiated and evolved by small degrees of fractional

crystallization with magmatic diferantiation. Also, they are mixing/mingling by mafic magma. Leucocratic part of the Karadağ granitoid is not interaction with mafic magma.