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U-Pb Dating, whole rock and Sr-Nd-Pb-O isotope geochemistry of collisional magmatism in the CACC: Çiçekdağ igneous complex (ÇIC)

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The closure of Neotethys induced from calcalkaline through alkaline magmatism within the Central Anatolia Crystalline Complex (CACC) during the late Cretaceous-early Paleogene. Timing of these magmatism is very important for understanding the magmato-tectonic evolution and the relation with the collision. Despite the genesis of felsic products are well understood, there is lack of petrogenetic explanation about especially alkaline mafic products. The relation between Neotethyan ophiolites and late alkaline dykes which haven't reported before is the most important undeclared gap. Çiçekdağ igneous complex (ÇIC) is one of the best area for explaining all of these problems within the CACC. In accordance with these purposes, we have carried out detailed petrographic, whole rock geochemical, Sr-Nd-Pb-O isotopic and geochronological (U/Pb and Ar/Ar) study of the rocks in the ÇIC in order to unravel the magmatic history of the CACC and thus constrain the tectonic history.

The intrusive rocks of the ÇIC are differentiated into four main group as an ophiolites, calcalkaline series, alkaline series and late alkaline dykes. The felsic and mafic units intruded to the ophiolitic rocks. The calcalkaline series mostly composed of monzonites and monzodiorite porphyry whereas the alkaline series consist of syenites and feldspathoid-bearing gabbros. Variations in the major oxide compositions of both rock series can be attributed with fractionation of clinopyroxene, plagioclase, amphibole, apatite and iron titan oxide minerals. The high $^{87}Sr/^{86}Sr$ and low $^{143}Nd/^{144}Nd$ of both series are indicative of mantle sources with large continental crustal components. Feldspar and quartz oxygen isotope data from calcalkaline and alkaline series have a range of $\delta^{18}O$ values 5.1-11.4‰ 8.3-9.2‰ and 7.7-14.1‰ 10.2-13.7‰ respectively and are compatible with the values for I-A-type granitoids. Both rock series represent the mixed (mantle-crustal) origin. The combination of all data suggest that these intrusive rocks have experienced fractional crystallisation coupled with crustal assimilation.

The calcalkaline and alkaline series show enrichment in LILE and LREE relative to HFSE and HREE. These rocks have moderate $^{208}Pb/^{204}Pb$ (38.87-39.16) and $^{207}Pb/^{204}Pb$ (15.62-15.71) and high $^{206}Pb/^{204}Pb$ (18.76-18.81). Both trace element and Pb isotope data indicate enriched mantle source (EM-II). Mafic alkaline rocks differed with their low $^{206}Pb/^{204}Pb$ (17.55-17.62). These rocks are derived from subduction modified lithospheric mantle.

The geochemistry and Sr-Nd-O isotope data of ophiolitic rocks and late alkaline dykes are very similar. Both of them have flat REE pattern, high $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$, low $\delta^{18}O$ values (1.9-4.0‰), moderate $^{208}Pb/^{204}Pb$ (38.81-38.97, 38.51-38.91) and $^{207}Pb/^{204}Pb$ (15.62-15.70, 15.54-15.69) and high $^{206}Pb/^{204}Pb$ (18.37-18.77, 18.39-18.73). All data indicate heterogeneous mantle source. Trace element ratio diagrams suggest depleted mantle source and subduction enrichment for late alkaline dykes. Dy versus Dy/Yb diagram and calculated partial melting curves suggest 20-25% degree of partial melting of amphibole-phlogopite bearing spinel lherzolitic mantle sources. Ba/Rb versus Rb/Sr diagram indicate the presence of amphibole in the mantle source of ophiolitic rocks and phlogopite for the late alkaline dykes.

U-Pb dating of zircon yielded crystallization ages of 73.74±0.027-73.78±0.046 and 73.78±0.071 for calcalkaline series and alkaline series, respectively. Both series are coexistence and may have coevally been confined from same sources.