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# Late Cretaceous A- and I-type granite association in the Sakarya Zone, NE Turkey: implications for the origin and slab roll-back of Neotethyan oceanic lithosphere

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We present new geochronological, isotopical and geochemical data for the granitoid plutons that crop out within the eastern Sakarya Zone, in order to understand their origin and genetic links between A- and I-type granites. The plutons were divided into two subgroups as A- and I-type granites. LA-ICP-MS zircon U-Pb crystallization ages of 72 and 80 Ma indicate emplacement in latest Cretaceous time in the area. The plutons have almost similar mineral assemblages consisting mainly of quartz, alkali feldspar, plagioclase, amphibole, biotite and pyroxene with accessory minerals such as ilmenite, magnetite, apatite and zircon. They are mostly metaluminous to weakly peraluminous, with ASI (molar $Al2O_3$/[CaO+K2O+Na2O]) values of 0.80 to 1.20 and belongs to shoshonitic and ultra-potassic series for A-types and high-K calc-alkaline for I-types. The samples of all the plutons have almost similar 87Sr/86Sr(i) ratios ranging from 0.704 to 0.707, relatively low $\varepsilon$Nd (t) values varying from -5 to 2 and their young TDM ages (0.70-1.20 Ga). The in situ zircon analyses of the samples show that the rocks have variable negative and positive $\varepsilon$Hf (t) values (-5 to 6) and Hf two-stage model ages (0.7 to 1.5 Ga), which are indicative of minor addition juvenile material. Simple isotope modeling of Sr-Nd data points to mixing of 70-90% of the lower crustal-derived melt with [U+F07E] 10-30% of the mantle-derived melt at depths of lower crust. The required heat for partial melting is upwelling of hot asthenosphere triggered by slab roll-back events. All the data suggest that the metaluminous A- and I-type granites were derived from partial melting of the Paleoproterozoic lower continental crust dominated by mafic rocks in amphibolitic composition, with minor input of subcontinental lithospheric mantle-derived magma and followed by subsequent a limited fractional crystallization to generate a variety of rock types. Here, we believe that underplated basaltic magma, which carry alkaline fluids, induces alkali metasomatism of the mafic lower crust, while A-type granite generate and halogens (i.e. F and Cl) play an important role at the site of partial melting, allowing small-degree partial melts. Integrated all available data with the regional tectonic evolution in Sakarya Zone, we attribute generation of the aluminous A- and I-type granites to a back-arc extension in the subduction zone, which is induced by the roll-back of the Neo-Tethyan oceanic slab between 70 and 80 Ma. Consequently, we conclude that these A- and I-type granites were related to intensive extension tectonic, which peaked during the Latest Cretaceous in response to the roll-back of Neo-Tethyan oceanic slab, indicative of final stage of subduction event in the Sakarya Zone.