K-Ar age, whole-rock and stable isotope geochemistry of A-type granitoids in the Divrigi-Sivas region, eastern-central Anatolia, Turkey

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The bimodal, A-type Dumluca and Murmana granitoids, consist of felsic monzonitic/syenitic and mafic monzogabbroic/monzodioritic rocks and intruded the Cretaceous ophilitic suture zone. These intrusions resulted from the slab break-off stage of the Neo-tethyan convergence system along the Izmir-Ankara-Erzincan suture zone in the Divrigi-Sivas region, eastern-central Anatolia, Turkey. These intrusions are also associated with giant contact metasomatic skarn and hydrothermal iron oxide deposits that occur where three rock types are in close proximity: ultramafics, limestones, and granitoids. New hornblende and biotite K-Ar dates yield cooling ages ranging from 76.6 $\pm$ 0.6 to 77.4 $\pm$ 1.5 Ma, and from 62.1 $\pm$ 0.3 to 73.0 $\pm$ 1.2 Ma for the felsic and mafic rocks, respectively, in the Murmana pluton. Similarly, the felsic and mafic rocks of the Dumluca batholith also give some hornblende and biotite K-Ar ages from 71.5 $\pm$ 0.1 to 75.6 $\pm$ 0.1 Ma, and from 67.8 $\pm$ 0.4 to 76.6 $\pm$ 1.6 Ma, respectively. Felsic and mafic rocks of these intrusions have a metaluminous high-K alkaline composition, however, highly differentiated members of the felsic rocks are peraluminous in character. The Zn, Ni, Sc, V, Cu and Sr contents of the mafic rocks are relatively higher than those of the felsic rocks; however, the W, Co, Rb and Th contents are higher in the felsic rocks. The REE contents of the mafic rocks are clearly higher than those of felsic rocks. $\delta^{18}O$ values of the felsic rocks of the Dumluca and Murmana plutons average 10.5‰ and 11.7‰, respectively. Mafic rocks from these plutons have average values of 8.2‰ and 9.6‰, respectively. The felsic rocks from the Dumluca and Murmana plutons are clearly distinct in terms of their $\delta^{34}S$ values, averaging 4.7‰ and 15.7‰, respectively. The mafic rocks of the two intrusions also are very different in terms of $\delta^{34}S$ values, averaging 2.4‰ and 7.4‰, respectively for the Dumluca and Murmana plutons. The felsic parts of these A-type plutonic suites exhibit the high ^{18}O-granitic characteristics with the $\delta\ ^{18}O$ values greater than 10‰ that can be derived mainly from a significant crustal contribution during magma genesis and ascent. The mafic parts show an apparent "mantle-derived" ^{18}O-granitic pattern with lower $\delta^{18}O$ values, between 6‰ and 10‰. However, most of the values fall at the higher end of this range and may have resulted from a minor crustal contribution into a mantle-derived mafic magma source. $\delta^{34}S$ values from the mafic rocks are low relative to $\delta^{34}S$ values of cogenetic felsic rocks. However, there is a significant difference between the two suites, with Dumluca having $\delta^{34}S$ values nearer to mantle values than those of Murmana. In addition, Dumluca $\delta^{18}O$ values are generally lower than those from Murmana. From these data it is clear that the Murmana suite incorporated significantly more crustal material during ascent than the Dumluca suite. In addition, we suggest that a significant source of sulfur for almost all of these magmas is the crustal rocks, probably those containing evaporitic components (i.e., sulfates).

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