A stable isotopic ($\delta^{18}O$) study of the Ortaköy granitoids and their host-rocks in the Central Anatolian Massif (Turkey)

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Palaeocene-?Upper Cretaceous aged Ortaköy granitoids, cropping out western part of the Central Anatolian Massif, have a NW–SW trend and covers approximately 400 km^2. It intrudes the metamorphic rocks undergone upper amphibolite facies, and is surrounded by the cover units. Gabbroic rocks occur as roof pendants.

Analytical methods and results

Major and trace element abundances were analysed at the department of Geology & Applied Geology, Glasgow University (UK), rare earth element and $\delta^{18}O_{SMOW}$ analyses were performed at Scottish Reactor Center, East Kilbride using ICPMS.

The granitoids have variable composition ranging from granite to tonalite and sometimes quartz monzonite. Accordingly SiO2 varies from 64.13% to 73.43 with an average of 69.11.% while Na_2O and K_2O vary between 1.84–4.19% and 2.14–4.56 % respectively. The ratio of K_2O to Na_2O is generally 1 (1.12 mean).

Granitoids are calcalkaline and metaluminous to slightly peraluminous in composition (Koçak and Leake, 1994).

The hornblende bearing mineralogy and the existence of igneous xenoliths (enclaves) in the samples are in confirmity with an I-type granite. Their slight peraluminous character is not untypical since almost one half of the I-type granitoids of the Lachlan Fold Belt are weakly peraluminous with a ratio generally less than 1.1 (Chappel and White, 1992). This slight Al enrichment in I-type granites may result from small analytical errors or hydrothermal alteration which can lead to the destruction or mobilization of feldspars and the mobilization of Na, K and Ca.

The *REE* pattern of the granitoids are characterized by a light *REE* enrichment compared with the heavy *REE*. This is often interpreted as evidence for residual garnet during partial melting event. A moderate negative Eu anomaly (Eu/Eu*: 0.53–0.75) indicates the fractionation of plagioclase out of the magma before the analysed material crystallized, and also indicates the presence of residual plagioclase during the granitoid melting event or be a feature inherited from the source materials. A sample show a much more fractionated pattern, particularly in *HREE*(Gd/Lu: 6.2) than the rest of the samples. The difference in *REE* pattern might have resulted from heterogeneous source compositions, probably variable amounts of garnet provided that all samples have experienced a similar petrological process (Koçak, 1993).

New whole-rock oxygen isotope data (Table 1) for the acidic rocks of Ortaköy plüton reveal that $\delta^{18}O$

TABLE 1. $\delta^{18}O_{SMOW}$ values for the granitoids and their hosts

Sample no	$\delta^{18}O‰_{SMOW}$	SiO_2 (wt.%)	Rb (ppm)	K (ppm)	Rb/Sr
granitoid (233)	10.3	70.97	192	4.56	1.9
granitoid (559)	9.6	68.79	156	3.72	1.2
granitoid (562)	9.7	69.90	184	4.33	1.6
granitoid (669)	10.3	70.98	190	4.02	1.6
granitoid (744)	7.7	76.45	180	2.00	1.8
granitoid (746)	12.2	76.39	253	5.12	10.1
gneiss (272)	12.6	65.50	154	3.28	2.4
gneiss (504)	13.8	65.09	172	3.96	1.35
gneiss (686)	16.1	70.67	117	2.71	1.4

lies in the range +7.7−+12.2‰ with an average of 9.97, which is significantly higher than the maximum on the normal basaltic differentiate range (+7.5‰), while $\delta^{18}O$ lies in country rocks (gneiss) in the range +12.6−+16.1. The $\delta^{18}O$ shows no correlation with chemical composition of the samples.

Summary and conclusions

The whole-rock $\delta^{18}O$ values of Table 1 show that the granites can not represent solely crustal, sediment-derived melts, nor purely mantle signatures. Weak peraluminous character of the granitoids may support this view. It is proposed that they represent a mixture of mantle and crustal materials. The $\delta^{18}O$ values observed and existence of the mafic enclaves do not allow mantle contributions to be ruled out. When magma reaches relatively high crustal levels and encounters preheated metasedimantery rocks, assimilation proceeds readily, shifting the oxygen isotopic signatures towards $\delta^{18}O \cong 10‰$ and leading to generation of the Ortaköy granitoids.

References

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