Trace element partitioning between coexisting biotite and muscovite of Portuguese granitic differentiation series

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Twelve Portuguese peraluminous granitic series of differentiation were selected to study trace element partitioning between biotite and coexisting muscovite. Fe^{2+}-biotite, local siderophyllite and primary muscovite from Hercynian granodiorites, granites and rare aplites were analysed for major and trace elements. Data of bulk trace elements were determined on mineral separates. However trace element contents attributed to inclusions are not used. This abstract considers the evolution of partition ratios between micas through differentiation series and compares them with those determined experimentally (Icenhower and London, 1995).

Partition ratios

Most trace elements partition in favour of biotite, but Sc shows preference for muscovite (Table 1). Sn tends to partition preferentially into muscovite compared with coexisting biotite, but average $D(Sn)^{Bt/Ms}$ are >1 in two series (Table 1). Within the same series, it can be either >1 or <1. $D(Sn)^{Bt/Ms}$ increases through the Ervedosa series, but decreases in both series from Alijó-Sanfins, although these micas are from Sn-bearing granites in both areas. $D(Ba)^{Bt/Ms}$ is <1 in eight granitic series and >1 in two other series (Table 1) and decreases through two series (Rebordelo and Torrão). This behaviour is different from that found experimentally by Icenhower and London (1995). Generally, partition ratios for Ba are lower, those for Rb are similar, while those for Cs are higher than those obtained experimentally between coexisting micas from peraluminous melt (Icenhower and London, 1995). $D(Rb)^{Bt/Ms}$ decreases through both series of Penamacor-Monsanto and $D(Cs)^{Bt/Ms}$ also decreases in the Torrão series according to the decrease in temperature (Icenhower and London, 1995). $D(V)^{Bt/Ms}$ increases through Rebordelo series, $D(Sc)^{Bt/Ms}$ decreases in Torrão series, $D(Nb)^{Bt/Ms}$ and $D(Li)^{Bt/Ms}$ decreases through both Penamacor-Monsanto series, but $D(Nb)^{Bt/Ms}$ increases through both Alijó-Sanfins

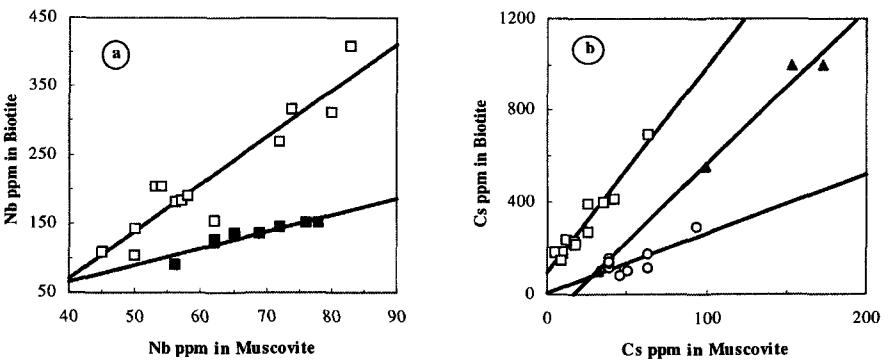

FIG. 1. Correlations between trace elements in biotite and coexisting muscovite. (a) Nb (b) Cs. Symbols: micas from granitic series of ■: Rebordelo, □: Jales, ▲: Alijó-Sanfins, ○: Serra da Estrela.

TABLE 1. Average partitioning of trace elements between biotite and muscovite from Portuguese granite series of differentiation. $D(M)^{Bt/Ms}$

	1	2	3	4a	4b	5	6a	6b	7	8	9a	9b
Cr	1.8	3.4	1.4	4.7	6	4.4	1.2	1.6	1.6	5.5	3.5	11.1
V	1.6	2.6			1.6	1.9	1.7	2		1.9	2.1	3.8
Nb	2	2.8	3.4	4.6	11.5	2.7	2.6	3.5	4.9	3.1	5.4	2.3
Zn	7.4	11.1	11.3	2.1	2.2	11.4	7	7.8	9.6	8.3	9.8	10.3
Sn	0.9	1.4	1	0.8	0.4	1.6	0.3	0.6	0.4	0.9	0.5	0.2
Li	4.8	5.1	5	4.4	3.6	4.6	2	2.3	3.7	4.1	5.6	2.4
Ni	6.9	6.8	3.5	12.6	24	2.8	3.2	2.7	1.2	1	4.4	2.6
Sc	0.7	0.7	0.3	0.5	0.5	0.6	0.3	0.4	0.6	0.5	1.4	0.6
Y	1.6	1.8	1.9	6.2	45.6	1.3	1.5	1.4	1.2	6.7	1.7	2.1
Sr		0.9				0.7	1	0.9	0.9			
Ba	0.3		0.7	0.6	1.2	0.5	0.3	0.1	1	0.2	0.7	3.7
Rb	1.8	1.9	2.2	1.9	2.4	1.6	1.4	1.5	1.6	1.5	1.7	1.5
Cs	8.2	12.7	15.9	5.2	8.8	3.1	8.4	5.6	2.8	3		
n	8	16	13	4	2	6	4	3	10	14	4	2

1- Rebordelo, 2- Ervedosa, 3- Jales, 4a,b- Alijó-Sanfins, 5- Torrão, 6a,b- Paredes da Beira–Penedono, 7- Serra da Estrela, 8- Carregal do Sal-Nelas-Lagares da Beira, 9a,b- Penamacor–Monsanto. M- any trace element, Bt- biotite, Ms- muscovite, partition ratios (Beattie *et al.*, 1993); n- number of biotite/muscovite pairs. 1- biotite granodiorite and biotite-muscovite granite; 2- two muscovite-biotite granites; 3- two-mica granite, muscovite-biotite granite and muscovite granite with tourmaline; 4a- four syntectonic muscovite-biotite granites, 4b- two post-tectonic pink muscovite-biotite granites; 5- two-mica granite and muscovite-biotite granite; 6a- four muscovite-biotite granites, 6b- three facies of a muscovite-biotite granite; 7- biotite-muscovite granite, muscovite-biotite granite and granitic porphyry; 8- biotite granite and biotite-muscovite granite; 9a- biotite-muscovite granite and muscovite-biotite granite, 9b- biotite-muscovite granite and aplite.

series. Most partition ratios do not show any regular variation with the increase in the degree of differentiation.

Equilibrium between coexisting micas

Pearson's coefficients for linear correlation were used to verify correlations between coexisting biotite and muscovite concentrations. They are significant for a probability of >0.95. Equilibrium between coexisting micas was found for Li and Rb in five differentiation series, Cr in four series, Cs in three series, V and Nb in two series and Zn, Sn, Y and Ba only in one series. The same correlation e.g. Nb or Cs (Fig. 1) between coexisting micas shows distinct slopes for different series.

References

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