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Empirical Estimation of Magnetite/Liquid Distribution Coefficients for Some Transition Elements

A Correction

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We recently discovered computation errors in our original paper (Leeman et al., 1978) and the purpose of this note is to present revised magnetite/liquid distribution coefficients. The basic equations in the original paper are correct, but their applications are incorrect due to programming errors. Fortunately, the new estimates (Table 1) do not alter our original conclusions.

In comparing the results in Table 1 with other published values for magnetite/liquid distribution coefficients (D_{Mt}), it is seen that our values for Sc and Cr based on the Rayleigh fractionation model are in reasonable agreement with those of Ewart et al. (1973) and Dudas et al. (1971) as well as with Hildreth's (1977) values for Cr. Our new values for V (Rayleigh model average is 11 ± 5) are lower than the original values by a factor of about two. Thus these values, if appropriate for andesitic magmas, will allow even more extreme degrees of magnetite fractionation (along with other relevant phases) in calcalkaline magmas before the V content in residual liquids reaches depletion. The value for D^V_{Mt} experimentally determined by Lindstrom (1976) to be 23 (at 1130° C and f_{O_2} near the fayalite-magnetite-quartz redox buffer) lies between our average values corresponding to Rayleigh and Nernst fractionation models. As the conditions of Lindstrom's experiment are similar to those estimated for crystallization of the rocks used in our study, his result indicates that our values of D^V_{Mt} are reasonable. Finally, we again emphasize the need for further experimental determinations of magnetite distribution coefficients.

Table 1. Corrected magnetite/liquid distribution coefficients

Sample #	D_{Sc}	D_{Cr}	D_V	D_{Ti}
Rayleigh fractionation model				
2	5.5	9.9[a]	–	7.5
3	3.6	25.5	–	7.7
4	4.1	21.1	9.5	7.4
5	2.9	24.9	4.9	7.8
6	3.5	–	11.6	8.2
7	4.3	–	13.5	9.6
8	4.0	–	17.0	9.7
9	6.0	–	<14.1[a]	11.4
Average ± s.d.	4 ± 1	24 ± 2	11 ± 5	9 ± 1
Nernst fractionation model				
2	5.6	14.0[a]	–	8.2
3	3.6	56.5	–	8.8
4	4.1	40.9	11.5	8.0
5	2.7	67.6	5.0	8.3
6	3.4	–	21.7	11.5
7	4.5	–	45.0	19.1
8	3.9	–	98.7	19.4
9	7.4	–	70.2	35.0[a]
Average ± s.d.	4 ± 1	55 ± 13	42 ± 36	12 ± 5
A	1.4–5.8	37	23–190	–
B	4.1	23–37	39.4	16.2
C	9–12	16–30	–	–

A = range reported by Ewart et al. (1973), B = range reported by Dudas et al. (1973), C = range reported by Hildreth (1977)

[a] Values excluded from average

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