THE PRE-ALTERATION COMPOSITIONS ...

Wark, D.A.

TABLE 1. Weights of reactants involved in alteration. (Present CAI = 100)

CAI	SOLIDS		GASES IN					GASES OUT	
	MEL	SPINEL	SiO_2	FeO	Na_2O	K_2O	Cl	CaO	MgO
20A,B	13.91	0	3.97	.35	.51	.03	.04	2.17	.23
20A,J	20.98	7.39	4.79	.91	.84	.07	.09	3.59	.35
20B,L	20.89	0	6.43	1.06	.88	.09	.05	.81	.30
3529,33	43.99	8.15	11.86	1.73	2.04	.12	.19	10.41	1.18
3643A	20.51	0	7.96	1.04	1.10	.10	.11	3.01	-2.9
4691	7.15	0	2.05	.30	.21	.01	.03	.48	.11
A70	30.02	29.16	9.08	3.20	1.52	.10	.17	7.18	- .27
3643B	31.66	0	13.87	2.58	1.04	.04	.19	-1.92	.23
3593	33.39	35.27	11.31	3.91	2.53	.15	.30	5.46	1.01

4. Replace alteration products (and any Fe-spinel) in step 1. with pre-alteration amount of melilite (and spinel) and combine to obtain primary CAI composition, then renormalise.

Primary CAI = spinel + pvsk + mel + mel
92.6 = 5.1 + 1.0 +65.6 + 20.9
100 = 5.5 + 1.1 + 93.4.

Table 1 above shows the weights of solid and gaseous reactants (as oxides) calculated by the above method for 9 different CAI's. The first 5 CAI's (20A,B; 20A,J; 20B,L; 3529,33 and 3643A) are coarse-grained type A Group I, the next three (A70; 4691 ; 3643B) are coarse-grained type A Group II, and the last one (3593) is fine-grained Group III (4).

It is immediately obvious that substantial amounts of material, sometimes almost half of the CAI, are involved in alteration reactions, with material both entering and leaving the CAI's. More material appears to enter than leave. There is also a systematic pattern of Si,Fe and alkalis entering, and Ca and Mg leaving (except for the extremely refractory CAI 3643A into which Mg entered).

Table 2 below compares the measured altered compositions with the calculated primary compositions. It is again obvious how substantial a change in composition has been effected during alteration. Although no primary compositions of fine-grained Group II aggregates have as yet been calculated, it is likely that changes of a similar magnitude to those found in fine-grained CAI 3593 would occur. These calculations also resolve the paradox of why 3593 should simultaneously show the greatest enrichments of any CAI in both the most refractory (Os,Ir) and the most volatile (K,Cl) elements. The primary 3593 condensate must have been extremely refractory and volatile-free but, perhaps because of its fine-grained texture, has been intensely metasomatised,without losing its refractory trace elements.

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TABLE 2. Altered and primary compositions of CAI's (wt.%, SUM = 100)

ALTERED	20A,B	20A,J	20B,L	352933	3643A	A70	4691	3643B	3593
SiO_2	25.8	26.0	27.2	31.2	14.7	23.2	20.7	24.8	28.1
TiO_2	1.0	1.2	0.6	3.3	1.0	1.5	2.2	1.2	1.7
Al_2O_3	34.0	34.7	32.7	33.9	64.1	42.4	37.9	42.4	37.5
MgO	3.3	3.1	2.4	2.8	3.8	9.0	5.8	4.3	12.1
CaO	35.0	33.2	35.0	24.7	14.1	18.9	32.7	23.2	13.6
FeO	0.4	0.9	1.1	1.7	1.0	3.2	0.3	2.6	4.0
Na_2O	0.5	0.9	0.9	2.0	1.0	1.5	0.2	1.1	2.5
K_2O	.04	.07	.07	.12	.08	.04	.01	.05	0.1
Cl	.05	.10	.05	.20	.10	.15	.03	.20	.27
PRIMARY									
SiO_2	22.4	21.8	22.5	20.2	7.4	15.2	19.1	13.7	19.0
TiO_2	1.0	1.3	0.6	3.5	2.8	1.7	2.3	1.5	1.9
Al_2O_3	34.9	35.6	35.3	35.4	69.1	45.6	38.7	52.7	42.6
MgO	3.6	3.5	2.9	4.2	2.0	9.4	6.1	5.6	14.9
CaO	38.1	37.8	38.7	36.7	18.7	28.1	33.9	26.5	21.6

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