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Fractionation of melelite in the differentiation of high calcium larnite-normative melts, close in composition to kimberlites

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High calcium undersaturated larnite-normative magmas represent primary melts for ultramafic alkaline associations of the Globe including melelite-bearing rocks, ijolites, melteigites, carbonatites, nepheline syenites and kimberlites.In this work we for the first time investigated in details the melelite composition in the differentiation of Larnite-normative nepheliniteRuns were performed on piston-cylinder apparatus at 5-60kb pressure and 1050-1500^{o}C

Table

	438	436	462	451	500	559
P, kbar	5	5	5	5	15	18
T, C^{o}	1225°	1200	1130	1160	1260	1280
SiO2	43,14	43,56	42,72	42,46	42,46	42,59
Al2O3	3,97	4,22	6,73	4,93	6,82	7,16
FeO	3	3,61	3,64	3,7	2,82	2,83
MgO	10,97	10,66	8,66	10,39	9,03	8,85
CaO	37,73	36,39	34,84	36,67	36,34	35,96
Na2O	1,21	1,56	2,87	1,78	2,18	2,24
K2O			0,35		0,35	0,37
Mg#	86,77	84,2	80,97	83,3	85.2	85
Kagp	0.6	0.69	0.75	0.88	0.97	0.55

Experiments showed [*Kogarko, Green*, 1998] that larnite-normative nephelinite is characterized by very large field of melelite which is liquidus phase up to 20 kb.It means that melelite-bearing rocks were formed no deeper than60kmdeph.With the increasing pressure melelite became unstable and merwinite is liquidus phase according to the reaction Ca2 Mg Si2O7+L1=Ca3Mg(SiO4)2+L2.

Melelite composition depends on temperature in the investigated system. With the increasing temperature the sodium and alumina concentrations drop. For instance at 5 kb and 1130^{O}C sodium oxide concentration in melelite is 2.87% and aluminium oxide is 6.73%.At 1225^{o}C sodium oxide content is1.25% and alumina oxide 3.97%.Increasing pressure result in growing alumina oxide concentration in melelite (table).

Agpaitic index of crystallyzing melelite is less then unit (0.97-0.6) therefore fractionation of melelite will resul in increasing alkalinity and agpaitic index of resudial melt.Wide development of peralkaline veraities in ultramafic-alkaline assisiations containing larnite normative rocks result from large melelite field during crystal ization differentiation.This process is also facilitated by the fractionation of high alumina pyroxenes.

References

Kogarko, L. N., D Green (1998) Phase equilibria during melting of melelite nephelenite at pressuire up to 60 kb. *DAN,v359*, N4, pp.522-525

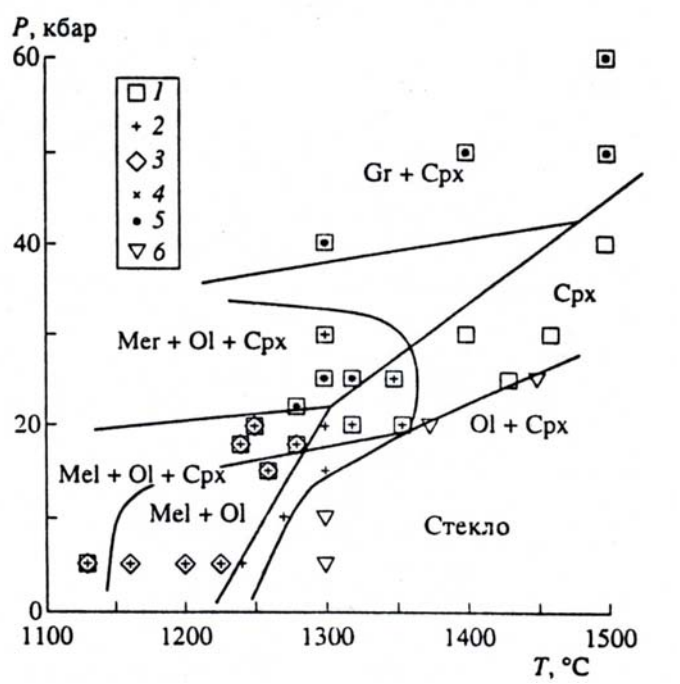

Fig.1. Phase diagram of larnite-normative nephelinite.
1-Clinipyroxene; 2-Olivine; 3-Melelite; 4merwinite; 5-garnet; 6-glass

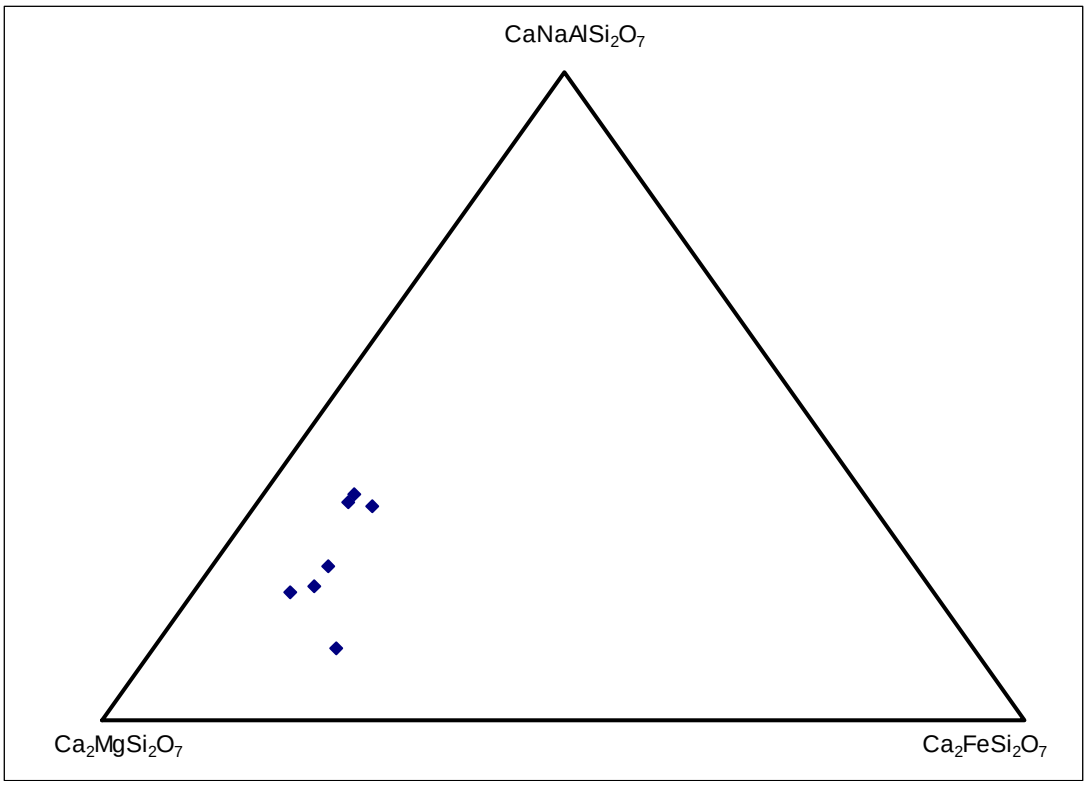

Fig.2. Melelite evolution during melting of larnite-normative nephelinite