EXPERIMENTAL STUDY OF LAMPROPHYLLITE-NEPHELINE PHASE DIAGRAM

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The lamprophyllite group minerals are widely-spread in agpaitic rocks, experimental data about they stability is absent. We study the phase relationship in system lamprophyllite $(Sr,Ba,K,Na)_2Na(Na,Fe)$. Starting materials were natural lamprophyllite and synthetic nepheline $NaAlSiO_4$ glass. The charges composition is in table 1.

All experiments were carried out in platinum capsules by cooling method. The duration was 5 - 360 hours. We executed a number of experiences "up" and "down", and others only "up".

Table 1

Composition of charges, used in experiments

Charge	Lam	Ne	7Lam:1Ne	15Lam:8Ne	18Lam:19Ne	5 Lam:7Ne	7Lam:15Ne
SiO_2	31.78	42,30	32.79	34.76	36.40	37.14	38.24
TiO_2	29.49		26.66	21.12	16.53	14.45	11.38
Al_2O_3	0.17	35,88	3.59	10.30	15.87	18.38	22.11
FeO	2.15		1.94	1.54	1.21	1.05	0.83
MnO	4.02		3.64	2.88	2.26	1.97	1.55
MgO	0.63		0.57	0.45	0.35	0.31	0.24
CaO	0.87		0.79	0.63	0.49	0.43	0.34
SrO	15.05		13.61	10.78	8.44	7.38	5.81
BaO	1.05		0.94	0.75	0.59	0.51	0.40
Na_2O	12.07	21,81	13.00	14.83	16.35	17.04	18.05
K_2O	0.49		0.44	0.35	0.27	0.24	0.19
Nb_2O_5	0.21		0.19	0.15	0.12	0.10	0.08
F	2.05		1.86	1.47	1.15	1.01	0.79
Summ	100.03						

After experiments we studied material in immersion preparations and by electron microprobe analyse. We found presence of glass, lamprophyllite, tausonite (Sr-analogue of perovskite), rutile (TiO_2) and freudenbergite ($Na_2Fe_{2-x}Ti_{6+x}O_{16}$), nepheline and undiagnosted phase. Glass generated in experiments is yellow-brown. Refraction index is >1.640.

The crystals of tausonite are cubic. They are twinned by fluorite law often. It contains 0.77-0.87 atoms of Sr, 0.10-0.15 atoms of Na and up to 0.05 atoms of Nb per formula unit. It is clear that niobium content is too low to compensate the content of sodium. It means that tausonite is nonstechiometric and its formula must be written as $Sr_{1-x}Na_xTiO_{3-x/2}$..

Rutile crystallizes in thin crystals, which are square in section. They have strong berefraction. It contains up to 4% of Nb_2O_5 .

Freudenbergite forms reddish-brawn prismatic crystals with strong berefraction. It contains 6.5-7.5 of Ti atoms, 1.7-2 atoms of Na, 0.4-0.9 atoms of Fe, 0.25-0.4 atoms of Mn and up to 0.2 atoms of Mg per formula unit.

New lamprophyllite was found in some experiments "up". It forms big (up to 1 mm) prismatic crystals with strong berefraction. Their color is slightly greenish or yellowish. Tausonite crystals and glass are included in lamprophyllite often.

Nepheline crystallizes as isomertic colorless crystals with low refraction and low berefraction.

In the richest of nepheline compositions the presence of one undiagnosed phase was fixed. It is isotropic, colorless Its refraction is low.

Phase diagram shown in fig. 1.

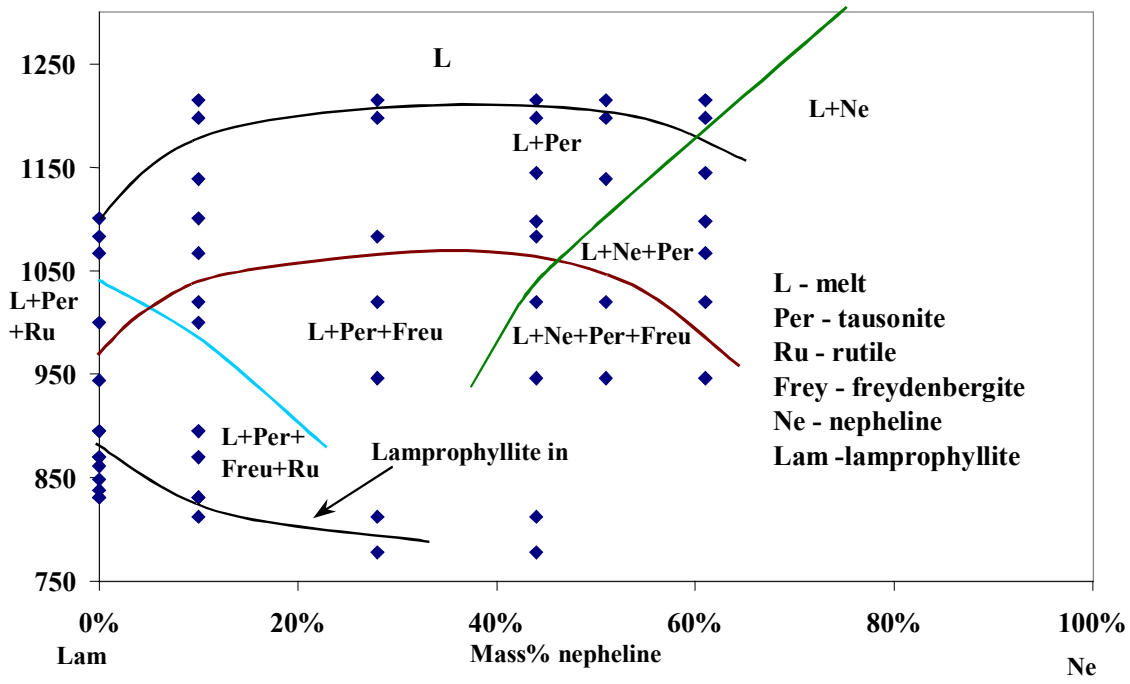

Fig.1. Phase diagram lamprophyllite-nepheline

We found that melting of pure lamprophyllite is incongruent with formation of melt, tausonite, rutile and freydenbergite. Temperature of reaction is 860-870°C. The melt is only phase at the temperatures more that 1100°C. The first crystal was tausonite in all compositions (up to 61 mass % nepheline). The second phase, crystallised in lamprophyllite composition system was rutile and the third was freudenbergite. Liquiduses of tausonite and freudenbergite have maximum in middle part of diagram at 1200 и 1050°C accordanly. This is the result of the diagram's pseodobynary character.

We estimate the nepheline-lamprophyllite eutectic temperature as 790°C by extrapolation of nepheline and lamprophyllite liquiduses curves.

The diagram shows the succession of oxides and titanates by titanosilicits with temperature decrease. The same situation takes place in nature: for example in Lovozero massif where lopariate is followed by lamprophyllite and barytolamprophyllite.

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