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Carbonated spessartite-vogesite lamprophyre near carbonatite of Sevvattur, Tiruppattur, Tamil Nadu, India

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Abstract: *Chemical and mineralogical composition of a melanocratic spessartite- vogesite lamprophyre from Tiruppattur carbonatite complex (N 12°15'-12°30' E78°25'-78°35')' is studied. The interspersion of natro-carbonate (Na_2CO_3: K_2CO_3 = 3:1) and (cc:(dol+fc)) = 1:3) with significant amounts of aluminum and silicon carbonates indicates its primary origin under CO_2 rich environment. Spessartite has imperceptible gradation to vogesite. Si-C and Si-(F+Cl) variations in minerals show that both feldspars and mafic minerals evolve with increasing of volatile constituents replacing of Si by substituting Al^{iv}, Ti, Zr, Y and Fe^3 from tetrahedral sites. The rock has high content of Zr, Nb, Y, Rb, Sr, Sc, Co and Ni. Linear trends between various ions in this rock show magmatic origin from mantle source.*

Keywords: *Lamprophyre, Vogesite, Spessartite, Carbonatite complex of Tiruppattur, Tamil Nadu*

1. INDRODUCTION

Lamprophyres are group of highly altered igneous rocks. They occur in insignificant volume; commonly as melanocratic dykes and sills in carbonatite complexes. Some of these rocks are composed of diamond and or REE mineral and they form economically potential resources for a country [1]. EDAX analyses (28) are carried out on in a lamprophyre grading spessartite (pl>or) to vogesite (or>pl) [2, 3] to interpret petrogenesis of the rock.

2. FIRLD STUDIES

Field and petrography of three arc-shaped discontinuous exposures of lamprophyre dykes are studied. It is located about 500m NE of Kakangarai Railway Station and 700 m SW of Sevvattur (N12°25'-E78°32') carbonatite which is located about 8 km SW of Tiruppattur Town. The discontinuous arc shaped dyke has steep inward dip towards NE direction. NE portion of the exposure is carbonated. Anatomizing pink pegmatite veins of 1 to 5 mm are permeated throughout the dyke rock producing independent pockets and disseminations of veins of pink feldspars from 0.5 to 5.0 mm. A porphyritic texture is produced by this permeation of feldsic veins. The rock impercepty grades into syenite having green needles of katophorite in SE portion of the dyke. In hand specimen, it is a medium to fine-grained rock. In north western portion of the dyke, biotite-oligoclasite is exposed [4]. In this lamprophyre, mafic minerals masques the feldsic minerals and the colour index of the rock increases. The colour index ranges between 35 and 40%. The rock is emplaced along NW periphery of Sevvattur alkali syenite structural basin where carbonatite cone-sheets and spessartite-vogesite are emplaced at the contact between syenites in the east and granite gneiss in the west. Alkali syenites are highly progressively differentiated series and the youngest occurs towards the center of the basin [4]. A coarse-grained porphyritic syenite having large plates of oligoclase with accessories of hornblende / augite is considered to be the youngest rock in this basin [4]. A shonkinite rock [5. 6] is exposed 1 km SSE of Onnakarai village in this complex near Kanjanur village in the adjacent Jogipatti basin. Shonkinite shows well developed two generations of crystals of olivine, diopside, amphibole, phlogopite and opaque ores in sanidine [4. 5]. These minerals also occur as phenocrysts and in fine-grained ground mass. The rock exhibits panidiomorphic texture [5]. About 1 km NNE of shonkinite exposure ferrocarbonatite, bastnasite bearing carbonatite and barite veins are found 100m south of Onnakarai village.

3. METHODOLOGY

Two samples of the rock were examined and EDAX analyses (28) were made under High Level Scanning-Electron Microscope with varying zooming levels (Fig. 1 , 2) and spot analyses were listed in Table-1 and 2. The analyses were made in Material Science Laboratory, Indian Institute of Technology, Madras-600036. The analyses were re-calculated into oxides and Rittmann's norms [6] were calculated and 32 (O, OH, F) were [7] calculated to study space lattices of mineral grains.

4. PETROGRAPHY

Under polarizing microscope, the rock exhibits panidiomorphic texture (40x). Needles and prisms of katophorite, biotite and spinel are in euhedral form. Similarly, feldsic inclusions are seen in mafic minerals.

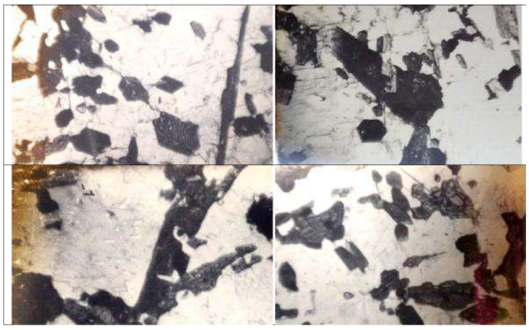

Fig.1 shows panidiomorphic texture with un-altered euhedral amphibole and feldspar [2].

The dyke rock (70x10m) composes of two generations of mafic and feldsic minerals as in phenocrysts and ground mass. The modal composition of the rock is orthoclase 26.74%, microcline 12.27%, oligoclase 20.86%, augite 3.62%, bluish green katophorite 28.31%, biotite 5.60%, chlorite 0.32%, calcite 0.16%, sphene 0.96%, apatite 0.21% and other melanocratic accessory minerals 0.37% [3]. However, volume proportions of mafic and feldsic minerals widely vary place to place in the field. Carbonates are identified by acid droplets. The volume proportion of plagioclase and its anorthite content widely varies. Hand specimen the rock appears to be much altered but contains significant amount carbonates. Thin sections show presence of fresh euhedral inequigranular grains. Presence of small crystals of mafic minerals in large phenocrysts of feldsic minerals rarely produces poikilitic texture.

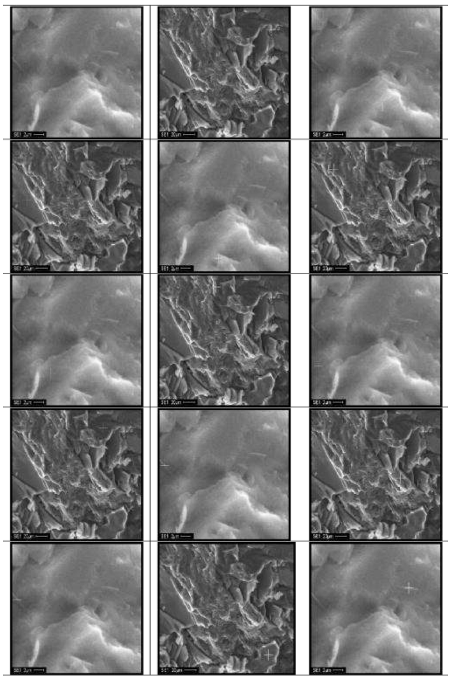

Fig.2- Sample 1 shows needles of katophorite and overlapping feldspar laths under scanning electron images. EDAX analyses are given in sequential order of the images

Detailed optical properties are given both mafic and feldsic minerals [3]. Some plagioclases show anorthite content between $An_{65}Ab_{35}$ and $An_{50}Ab_{50}$ with obliteration of polysynthetic twinning lamellae. The relicts of twinning lamellae indicate original spessartite feature of the lamprophyre. The largest feldspar phenocryst has a size of >100x 60 x 20 μm. Feldspar phenocryst has 25x20x1μm plates. Sample 2 shows presence of skeletal crystals and gas cavities of various dimensions and depths at centre of mineral grains. Some katophorite show tubular skeletal structures.

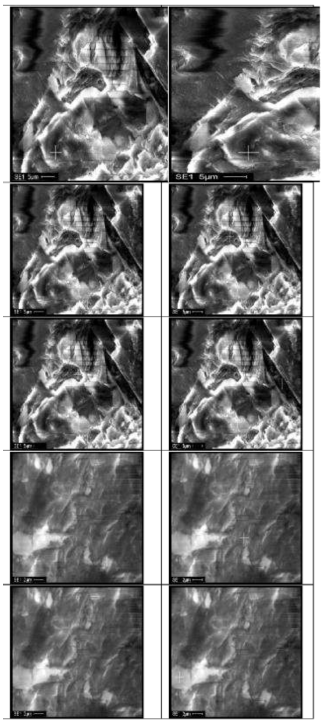

Fig.-3 Electron microscopic images of sample 2 is given, the images show subvolcanic features having gas cavities with irregular shapes and depths. A rhomb 2 μm of natro-carbonate shows 4 growth horns (image 7). The EDAX analysis indicates its chemical composition. EDAX analyses are given in sequential order of the images

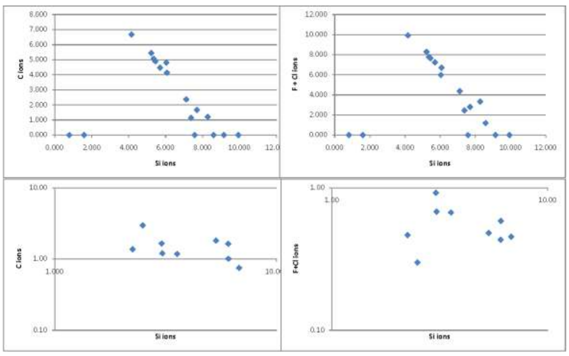

Fig. 4 Top 2 diagrams represents linear negative trends of magmatic differentiation for sample 1 while bottom for sample 2 shows slightly deviating trends.

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5. GEOCHEMISTRY

The irregularity of differentiation trends is to sub-volcanic nature (Fig. 4) of sample 2 by degassing.

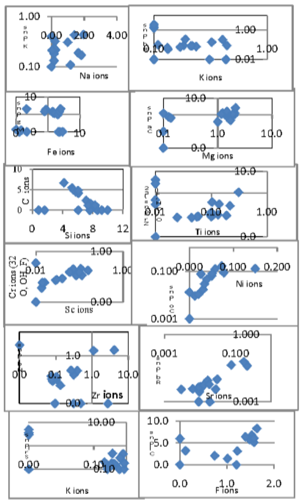

Fig.-5 shows most of bi-variants show positive or negative variations for the sample 1 indicating magmatic differentiation for the rock.

Feldspar laths are deposited one over other. Small crystal of a size of 5x2x0.5µm is also seen. Needles of amphibole 10x0.1x0.05µm are penetrated into feldspar laths. Grain boundaries of minerals have significant spaces (30x10x5 µm) to incorporate volatiles. Upper surface of feldspars is highly corroded with rugged surfaces but some has (80x25x0.2µm) smooth surfaces. Feldspar (5x1.5x 0.2 µm shows bifurcation in mid of crystal may be due to presence of twinning lamellae and thick outer rims at peripheral portions. Some amphiboles have rounded smooth surfaces. The length and breadth ratio of amphibole exceeds over 10 times showing their magmatic crystallizations. Needle, square and rhomb shaped euhedral katophorite are seen (Fig 1). Crude magmatic flow banding is seen.

A carbonate of 2x1.8x0.1µm size shows with growth structure of horns at 4 ends of a rhomb (image7) in sample 2. It has Na_2CO_3:K_2CO_3 1:3 and it has lower calcite content. It has Calcite: (dolomite+ferrocarbonate) in the ratio of 1:3.

Table1. contains re-calculated EDAX analyses,, structural formula and Rittman' norm for sample 1

Vogesite co-existing minerals EDAX Analyses Sample 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SiO2	36.70	34.68	29.59	35.50	33.90	33.92	39.65	40.15	41.53	43.56	27.27	50.78	40.11	35.08	50.12	2.25	4.22	18.20
Al2O3	7.42	6.02	5.59	7.72	6.52	6.57	11.92	14.32	15.52	13.39	0.00	19.94	15.85	7.45	17.46	0.00	0.00	0.00
FeO	9.19	6.64	6.55	8.34	10.60	10.59	10.80	12.65	12.83	12.78	17.13	0.77	1.15	16.96	1.88	67.58	14.67	14.89
MgO	8.40	8.78	7.11	7.81	6.22	5.18	4.34	3.49	5.58	4.70		0.00	0.55	6.77	0.56	0.00		
CaO	7.26	6.09	5.19	6.69	7.33	7.53	5.88	1.89	2.10	7.18		6.11	4.81	11.92	3.71	0.26		
Na2O	0.80	0.51	0.60	0.50	0.51	0.13	2.84	3.77	4.88	0.00		4.32	3.97	0.56	5.71			
K2O	1.03	0.69	0.73	1.15	0.90	1.03	1.35	1.77	1.67	1.51		0.76	0.57	1.20	0.81			
TiO2	0.77	0.51	0.52	0.83	0.83	1.09	1.39	1.62	1.90	1.31		0.70	0.39	1.36	0.20	1.15		
P2O5	0.19	0.14			0.11	0.48	1.24	0.00	0.82				0.59		0.60			
SO3	0.21	0.19	0.19	0.18	0.00	0.32	0.80	0.54	0.69	0.57			0.28	0.72	0.68			
CO2	18.38	26.54	34.82	21.20	23.87	22.35	10.37	6.35					23.44	4.01	11.50			
F	3.00	3.20	3.68	2.92	2.79	3.10	2.15	1.22	1.84					1.52	0.23			
Cl	0.52	0.35	0.32	0.60	0.37	0.57	0.53	0.72	0.54	0.37		0.10	0.33	0.81	0.39			
Sc2O3	0.20	0.10	0.13	0.29	0.10	0.21	0.53	0.36	0.39	0.85		0.63	0.45	0.62	0.68			
Cr2O3	0.16	0.06	0.14	0.21	0.12	0.18	0.28	0.42	0.58	0.48		0.66	0.53	0.24	0.48	0.78		
CoO	0.07	0.00	0.12	0.14	0.08	0.23	0.61	0.42	0.78	0.78		1.08	0.65	0.49	0.36	2.27		
NiO	0.09	0.00	0.00	0.24	0.16	0.26	0.54	0.33	0.35	0.89		0.47	0.22	0.31	0.30	1.35		
Rb2O	0.80	0.52	0.70	0.73	0.88	0.83	0.00	0.00	0.67	1.67	8.14	1.88	1.03	1.12	0.67	0.00	7.54	11.34
SrO	1.12	0.97	0.63	1.00	1.06	0.93	1.89	0.93	2.80	1.66	7.63	3.07	1.30	1.83	0.30	1.94	21.42	17.25
Y2O3	1.03	1.20	0.85	1.30	1.09	1.41	1.80	3.86	1.43	3.54	17.42	1.90	0.69	1.87	1.03	5.83	19.71	21.36
ZrO2	1.28	1.18	1.19	1.08	1.73	1.31	1.08	3.36	3.09	4.78	0.00	4.14	1.03	2.60	0.96	6.38	22.32	16.96
Nb2O5	1.38	1.64	1.36	1.57	0.81	1.79	0.00	1.83	0.00	0.00	22.41	2.70	2.04	2.57	1.39	10.19	10.12	0.00
	On the basis of 32 (O,OH,F)																	
Si	6.067	5.223	4.158	5.698	5.356	5.449	7.115	7.692	8.588	9.147	7.573	9.935	6.038	7.376	8.275	0.797	1.592	6.049
C	4.149	5.456	6.681	4.645	5.149	4.901	2.540	1.661	0.000	0.000	0.000	0.000	4.817	1.152	2.592	0.000	0.000	0
Ti	0.095	0.058	0.055	0.101	0.099	0.131	0.187	0.000	0.138	0.000	0.000	0.103	0.044	0.216	0.024	0.307	0.000	0
Zr	0.103	0.086	0.082	0.085	0.134	0.103	0.095	0.314	0.312	0.490	0.000	0.396	0.076	0.266	0.077	1.102	4.113	2.75
Al	1.447	1.069	0.926	1.462	1.215	1.244	2.522	3.234	3.784	3.316	0.000	4.601	2.814	1.846	0.000	0.000	0.000	0
Sc	0.028	0.014	0.016	0.040	0.014	0.030	0.083	0.061	0.071	0.156	0.000	0.107	0.059	0.114	0.098	0.000	0.000	0
Cr	0.020	0.007	0.014	0.025	0.014	0.021	0.038	0.061	0.091	0.075	0.000	0.097	0.060	0.038	0.059	0.209	0.000	0
Y	0.090	0.096	0.063	0.111	0.092	0.121	0.172	0.233	0.158	0.207	2.576	0.000	0.000	0.209	0.090	1.099	3.963	3.201
Fe3											1.851			0.766	0.930	8.486	2.332	0
Tetra	12.00	12.009	11.995	12.166	12.073	12.00	12.753	13.26	13.141	13.392	12.00	15.238	13.909	11.982	12.147	12.000	12.000	12
Fe	0.212	0.853	0.783		1.404	1.445	1.621	2.026	2.218	2.244	2.312	0.126	0.145	2.469	0.000	0.216	2.096	2.856
Mg	2.07	1.972	1.490	1.870	1.465	1.24	1.162	1.00	1.720	1.470	0.00	0.000	0.124	2.124	0.137	0.000	0.000	0.000
Ca	1.285	0.962	0.781	1.151	1.240	1.297	1.131	0.388	0.464	1.615	0.000	1.281	0.776	2.684	0.656	0.099	0.000	0.000
Ni	0.012	0.000	0.000	0.031	0.020	0.034	0.078	0.051	0.059	0.150	0.000	0.073	0.026	0.052	0.040	0.385	0.000	0.000
Co	0.009	0.000	0.013	0.017	0.011	0.030	0.088	0.065	0.130	0.131	0.000	0.169	0.078	0.082	0.047	0.645	0.000	0.000
Sr	0.109	0.086	0.052	0.095	0.099	0.089	0.200	0.105	0.343	0.206	1.253	0.355	0.115	0.228	0.029	0.407	4.781	3.388
Nb	0.103	0.112	0.087	0.114	0.058	0.130	0.000	0.159	0.000	0.000	2.813	0.238	0.139	0.244	0.104	1.631	1.728	0.000
P	0.026	0.017	0.000	0.000	0.015	0.065	0.188	0.000	0.144	0.000	0.000	0.000	0.076	0.000	0.084	0.000	0.000	0.000
S	0.025	0.021	0.020	0.021	0.000	0.039	0.106	0.077	0.106	0.089	0.000	0.000	0.092	0.112	0.083	0.000	0.000	0.000
Octa	3.699	3.894	3.119	3.164	4.239	4.134	4.280	3.632	4.933	5.815	3.565	2.004	1.265	7.639	0.910	1.752	6.878	6.244
Rb	0.085	0.050	0.063	0.075	0.090	0.085	0.000	0.000	0.089	0.225	1.454	0.236	0.100	0.152	0.071	0.000	1.832	2.422
Na	0.258	0.150	0.164	0.157	0.155	0.040	0.988	1.401	1.957	0.000	0.000	1.638	1.159	0.227	1.829	0.000	0.000	0.000
K	0.217	0.133	0.131	0.235	0.182	0.212	0.309	0.432	0.440	0.404	0.000	0.189	0.109	0.323	0.170	0.000	0.000	0.000
Rb+Na+K	0.560	0.333	0.358	0.467	0.427	0.337	1.297	1.833	2.486	0.629	1.454	2.064	1.367	0.702	2.070	0.000	1.832	2.422
F	1.569	1.525	1.636	1.483	1.396	1.573	1.218	0.738	1.201	0.000	0.000	0.000	0.000	1.010	0.119	0.000	0.000	0.000
Cl	5.145	6.766	8.284	5.760	6.385	6.078	3.149	2.060	0.000	0.000	0.000	0.000	5.974	1.428	3.215	0.000	0.000	0.000
F+Cl	6.714	8.291	9.921	7.243	7.780	7.650	4.367	2.798	1.201	0.000	0.000	0.000	5.974	2.438	3.333	0.000	0.000	0.000

Norm 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
zr	2.21	1.42	1.47	1.45	2.07	1.69	1.4	4.69	4.93	7.28		6.12 F		10.46	7.8	10.1	8.05	13.07
ilru	3.79	0.71	1.17	1.79	1.28	2.22	1.83	3.09	3.11	1.98		2.28		4.48	4.47	4.53	4.5	5.62
anh	0.32	0.2	0.2	0.22		0.42	1.07	0.80	1.17	0.86					2.24		1.23	
ap	0.42	0.25			0.25	0.53	2.42		2.07						0.29			
caf2	3.41	12.87	14.23	12.72	10.90	12.89	9.07	5.49	9.4									
nacl	0.95	1.02	0.88	1.9	0.99	1.69	1.61	2.29	1.94	1.23		0.36			0.11	0.7	1.23	1.68
cc	10.32	32.66	24.84	37.28	37.40	30.01	25.34	16.46							8.94			
al2c3	16.32	11.8	9.78	20.65	15.89	16.59												
sic2	9.48	11.04	30.61				2.8											
fesccry	2.42	0.61	0.59	1.00	1.18	0.95	1.5	2.63	1.69	3.09		1.02		2.87	1.49	1.92	3.96	
feconi	0.63		0.2	0.56	0.30	0.74	1.61	1.24	1.94	2.72		2.40		0.46	0.46	0.17	2.32	
ol																		14.9
hy	16.85						1.18	7.20		47.41				2.99			5.87	
or	7.9	4.58	4.89	6.42	5.92	3.70	7.78	10.57	12.64	12.65		7.80		5.75	4.87	7.37	6.48	6.68
ab	1.05	1.78	2.44		1.48		20.67	29.14	46.01			40.79		41.67	28.38	2.09		4.92
an	16.35									21.60		34.49		21.84		29.89	22.51	23.05
ne														9.48	17.03	36.56	38.47	26.14
lc																1.04	5.18	3.94
sil							10.31	12.10	11.99						23.91	5.63	0.20	
qz	7.58	21.06	8.7	16.01	22.34	25.78	14.22	4.30	3.11	1.17		4.74						

Dolomite and ferro-carbonate enriched magma generally derives from mantle source [2]. In addition it is composed of high contents of aluminum and silicon carbonates under high CO_2 content. The sub-volcanic rock with primary growth of horn-structure contains sodium, potassium, aluminum and silicon carbonates resembles its similarity to natrocarbonatite [9]. Square-shaped euhedral prisms of pyroxene / amphibole are found in sample 1 and 2. Sample 2 shows sub-volcanic hypidiomorphic granular texture. Mineralogy of sample 2 is very similar to sample 1. They are collected from the same exposure.

Silica saturated and undersaturated minerals co-exist together. Sample 1 all analyses are ultra pottassic $K_2O/(K_2O+Na_2O)$=>3. Sample 1 shows agpaitic index (a . i) i.e.$(Na_2O+K_2O)/Al_2O_3$) 5 to 61. On the other hand sample 2, (a.i) varies between 0.19 and 0.60. Both samples are enriched with Zr, Nb, and Y ions. CO_2 content is very high in these rocks. (F and Cl) are present in significant amount in these rocks. Similarly SO_3 is present. Sudden escape of volatiles during consolidation of minerals might have been affected compositions and trend of magmatic crystallization.

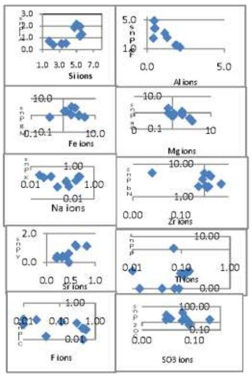

Fig.6- Bi variants show regular and irregular magmatic trends of sample 2.

Volatiles carry considerable amounts of alkali constituents. EDAX analyses are re-calculated on the basis of 32 (O, OH, F) for correlative studies of unknown minerals [8]. Feldspar and spinel are usually calculated on the basis of 32 (O,OH, F), while amphibole on the basis of 24 (O,OH, F) i.e. 75% of feldspar structural formula. Tetrahedral site highly deficient and C, Al^{iv}, Ti^{Iv}, Zr^{iv} , Y and Fe^{iii} enter into this lattice and Fe^{ii}, Mg, Ca Sr Sc Co, and Ni enter in Octahedral site, Logarithmic proportion on Co against Ni shows a positive linear trend a characteristic for their deep mantle source.

Rb enters in alkali site. The entry of C, F, and Cl replace notable amount of silica causing formation of carbonates and halides producing a negative trend of differentiation with progressive enrichment of C or (F + Cl) ions with impoverishment of Si ions. Sample 2 such

Table2 contains re-calculated EDAX analyses,, structural formula and Rittmann's norm for sample 2

Sample 2	1	2	3	4	5	6	7	8	9	10
SiO2	8.70	26.26	23.53	11.86	13.84	11.78	9.67	23.50	20.67	25.59
Al2O3	1.34	5.10	4.18	1.52	1.62	1.40	3.30	8.50	6.84	7.79
FeO	8.33	10.26	12.19	13.68	13.80	20.43	2.46	6.07	6.32	6.76
MgO	2.82	10.21	8.17	2.31	2.61	1.88	2.80	5.47	5.22	5.73
CaO	3.31	1.30	1.81	2.24	2.24	3.20	9.69	4.55	4.95	3.29
Na2O	0.14	0.32	0.29	0.08	0.04	0.05	0.45	0.79	0.80	0.66
K2O	0.17	0.39	0.43	0.70	0.85	0.59	0.25	0.87	0.81	0.50
TiO2	0.07	0.36	0.00	0.44	0.55	0.46	0.29	0.81	0.85	0.46
P2O5	0.00	0.10	0.12	0.00	0.04	0.06	0.00	0.10	0.11	0.00
SO3	0.04	0.28	0.21	0.31	0.31	0.31	0.06	0.08	0.20	0.10
CO2	6.39	7.61	5.60	2.59	1.20	2.12	33.60	9.85	4.88	9.44
F	0.05	0.00	0.42	0.13	0.03	0.00	0.80	0.64	0.76	0.71
Cl	0.03	0.18	0.21	0.21	0.27	0.28	0.00	0.12	0.09	0.11
Sc2O3	0.05	0.28	0.35	0.43	0.50	0.70	0.08	0.24	0.15	0.00
CoO	0.16	0.47	0.40	0.46	0.54	0.49	0.05	0.29	0.08	0.14
NiO	0.00	0.23	0.25	0.43	0.35	0.52	0.03	0.27	0.10	0.19
SrO	3.04	2.62	3.39	3.91	3.74	5.13	1.88	2.52	3.00	1.75
Y2O3	6.77	3.77	5.07	7.88	8.35	7.67	3.04	3.10	3.34	3.91
ZrO2	12.17	4.78	13.47	11.77	14.22	9.16	6.34	12.31	7.50	10.82
Nb2O5	46.40	25.47	19.92	39.04	34.91	33.76	25.21	19.90	33.32	22.04
Sample2	On the basis of 32 (O,OH, F)									
	1	2	3	4	5	6	7	8	9	10
Si	2.243	6.769	6.064	3.057	3.567	3.036	2.492	6.057	5.328	6.595
C	2.248	2.677	1.969	0.910	0.422	0.747	11.820	3.467	1.718	3.323
Al	0.407	1.550	1.271	0.461	0.493	0.425	1.002	2.583	2.078	2.367
Ti	0.014	0.069	0.000	0.086	0.106	0.089	0.057	0.156	0.165	0.089
Zr	1.530	0.600	1.692	1.479	1.786	1.151	0.797	1.547	0.943	1.360
Nb	5.406			4.549	4.067	3.933	2.937	2.318	3.882	2.568
Fe3	0.152	0.334	1.003	1.458	1.559	2.618				
Tetra	12.00	12.000	12.000	12.000	12.000	12.00				
Fe2	1.642	1.877	1.623	1.489	1.415	1.785	0.530	1.309	1.362	1.456
Mg	1.085	3.922	3.140	0.889	1.004	0.722	1.074	2.103	2.006	2.200
Ca	0.915	0.359	0.501	0.618	0.619	0.884	2.675	1.256	1.367	0.909
Sr	0.454	0.391	0.507	0.584	0.558	0.767	0.282	0.377	0.448	0.262
Sc	0.012	0.062	0.079	0.097	0.113	0.157	0.017	0.054	0.035	0.000
Co	0.032	0.092	0.077	0.090	0.105	0.095	0.010	0.057	0.015	0.028
Ni	0.000	0.048	0.052	0.089	0.072	0.108	0.007	0.055	0.021	0.040
Y	0.929	0.518	0.696	1.082	1.146	1.053	0.417	0.425	0.458	0.536
Nb		2.967	2.320							
Octa	5.068	10.237	8.995	4.937	5.033	5.571				
Na	0.070	0.160	0.147	0.042	0.018	0.024	0.226	0.397	0.398	0.328
K	0.055	0.130	0.140	0.231	0.280	0.194	0.083	0.287	0.266	0.165
Na+K	0.125	0.290	0.287	0.272	0.298	0.218				
F	0.042	0.000	0.339	0.108	0.022	0.000	0.649	0.523	0.621	0.579
Cl	0.015	0.079	0.091	0.093	0.116	0.121	0.000	0.051	0.039	0.049

zr	21.91	5.80	16.10	22.30	26.50	14.68	7.77	14.17	9.85	13.14
ilru	37.00	14.29	11.05	41.93	44.01	49.80	7.40	13.04	20.18	12.40
mt	1.54	2.46	1.48	0.70	0.92	0.40			0.32	0.45
ap		0.22	0.37		0.35	0.30			0.40	
anh	0.22	0.60	0.44	0.70	0.92		0.15	0.14	0.48	0.15
caf2			2.44	1.28	0.23		4.71	3.61	4.84	
kf	6.00									
kcl	2.00	0.74	0.89	1.39	1.61	1.59		0.43	0.48	0.45
cc	12.78	2.38	2.22	7.90	6.22	9.52	25.71	8.65	10.01	5.83
mgco3							10.31	19.28	7.91	21.21
feco3							5.08			2.54
conisrco3	7.49	5.21	6.50	5.81			3.44	3.83		2.54
y2co3	9.80	5.95	7.83							
al2c3		9.15	0.52				16.82			
sico3							16.29			
na2co3							1.72			
k2co3							0.60			
ol			8.64							
hy		37.65	29.54			15.08		2.83	17.27	4.93
sil	3.52	4.24	7.53	5.23	0.69	0.89		13.32	11.38	13.89
or		1.12	1.11	5.23	6.34	2.48		5.67	5.65	2.99
ab	2.75	3.72	3.32	1.74	0.58	0.99		9.21	10.49	7.84
an					4.61	3.47				
qz	2.20	6.47		5.81	7.03	0.79		5.81	7.03	11.65

variations have slight deviation from a normal trend. Rittmann's [6] norm calculated for oxides of EDAX spot analyses (Table 1 and 2) show that sample 1 contains both extremely silica undersaturated and silica saturated minerals co-exist together. But absence of the above foidal minerals in thin section might have been [2, 10] due enrichment of volatile constituents (H_2O, CO_2). The presence of bluish-green katophorite and biotite bears evidence for absence of foidal minerals in thin sections.

6. CONCLUSIONS

Volume proportions plagioclase and orthoclase insignificantly vary in this lamprophyre place to place within the rock due to original abundance of plagioclase and subsequent effect of its post potash metasomatism in this rock by sequential emplacements of Na-K enriched alkali syenite series within two adjacent structural basins [4]. The SW basin is composed of ultrapottassic (1) rocks. The source of extreme pottassic constituents might have derived from mantle source. At extreme magmatic differentiation ultrapotassic syenites are emplaced in the basin as melanite-ultrapotassic syenites [4]. During the course of sequential emplacements of syenites, release of alkali constituents and volatiles [10] are metasomatised spessartite into vogesite with depletion of plagioclase.

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REFERENCES

[1] Stephen Foley and Angelo Peccerilio Pottassic and ulrapotassic magmas and their origin, Lithos, v 28, 181-185, 1992.

[2] R, Ramasamy, Geology of the area South west of Tiruppattur, Madras State (Tamil Nadu), India. Ph.D, Thesis, University of Madras, pp226, 1973.

[3] R. Ramasamy, Vogesite from carbonatite Complex of Tiruppattur,, Tamil Nadu India, Jr. Geol. Soc. India, V. 25 (5) pp., pp307-310, 1984.

[4] R. Ramasamy, Crystallization, fractionation and solidification of co-magmatic alkaline rocks sequentially emplaced in co-magmatic carbonatite complex of Tiruppattur, Tamil Nadu, India in Crystallization- Science and Technology Edr: Marceilo Ruben Barsi Andreeta In TechOpen 105772 l4799l 2012.

[5] S. Saravanan and R. Ramasamy Geochemistry and petrogenesis of shonkinite and associated alkaline rocks of Tiruppattur carbonatite complex, Tamil Nadu, Jr. of Geol Soc. India, v.46, pp. 235-43, 1995.

[6] R. Ramasamy, S.P. Subramanian and R, Sundaravadivelu, Compositional variations of olivine in shonkinite and its associated ultrabasic rock from carbonatite complex of Tiruppattur, Tamil Nadun Current Sci, v. 99 (10) pp. 1428-1433, 25th Nov 2010

[7] A, Rittmann, Stable Mineral Assemblages of Igneous Rocks, Springer-Verlag, pp.262, 1973

[8] W. A. Deer, R. A. Howie and J. Zussman An Introduction to Rock Forming Minerals, Prentice Hall, London, 695p. 1992.,

[9] J. B. Dawson, Sodium carbonate lavas from Oldoiniyo Lengai,Tanyika Nature, v. 195, pp1075-1076, 1962.

[10] K. Yagi, Petrochemical studies on the alkaline rocks of the Morotu District, Sakhalin, GSA Bull, v. 64, 769-810, 1953.

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