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STRUCTURAL AND TEXTURAL CHARACTERISTIC OF SYENITE INTRUSIONS FROM PAKKANADU AND PIKKILI ALKALINE SYENITE COMPLEX TAMILNADU SOUTH INDIA

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ABSTRACT

The Syenite were formed during the Late Proterozoic in the northern part of South India and show similarity to the Alkaline-Carbonate-Ultramafic Complex of Pakkanadu in South India and displays close relationship with a diverse group of Peninsular Gneissic complex. The isolated bodies of Syenite sporadically distributed in Salem and Dharmapuri districts of Tamil Nadu, correspond to the alkaline magmatism which were intruded into the country rock at Kamaneri, Chindamaniyur, Semmandapatty in Salem and Pikkili and around in Dharmapuri. The field settings and structural characteristics indicate these Syenite bodies must have formed from plutonic origin which was later intruded by dykes. Texturally Syenite is leucocratic, medium to coarse grain, equigranular alkaline rock showing hypidiomorphic texture and consisting of K-feldspar (microcline) pyroxene and amphibole with accessory minerals plagioclase feldspar, magnetite, sphene, zircon, calcite and apatite.

1. Introduction

The Southern Granulite Terrain (SGT) has preserves the archives formation and reworking of continental crust during Neoproterozoic and Paleo Proterozoic to Cambrian related multiple collision subduction with major orogenic cycle. The northern part of Southern Granulite Terrain experienced profound crustal fracture and distinctive lithology, structure by virtue of

magmatic and metamorphic history viewed as Dharmapuri Suture Rift Zone (DSRZ) (Goplakrishnan, 1996; Gopalakrishanan and Subramanian, 2007).The DSRZ is limited by Jawadi hill lineament in the east, Mettur-Palakkadu lineament in the west, in the north Palar lineament, Palghat-Cauvery shear in the south. Evolution history of DSRZ is two phases I) Collisional structural stage and ii) Rifting structural stage. Prior stage two crustal squares on either side stitching and welding from DSRZ after began to proceed with reactivation of shear zone and improvement of tensional crack just as basic pluton emplacement along NNE-SSW, N-S and ENE-WS trend (Goplakrishnan, 1993; Gopalakrishanan and Ganesh, 1992).DSRZ show different proof from the tectonics, for example, banded charnockite and gneisses inter banded with pyroxene granulite's, banded magnetite-quartzite, the rocks show NE-SW trending foliations, N-S trend shear zones, F1-F2-F3 folds. The DSRZ has the Pan African mark of alkaline ultramafic-carbonatite buildings at Pakkanadu, Samalpatty, Sevattur, and Elagiri (Miyazaki et al., 2000). This intrusive display ring complexis emplaced along the main fault (Grady, 1971).This alkaline magmatic intrusion is attention to interest the relationship of their petrogenetic history, tectonic significance (Tchameni et al., 2001).

2. Geological setting

Alkaline intrusive magmatism within the southern granulite terrain occur along fault/shear/suture zones, classified into two major groups i)a mid-Neoproterozoic (Cryogenian) alkaline suite characterized by feldspathoidal syenites, pyroxenites, shonkinites, and carbonatites (Kumar et al., 1998; Miyazaki et al., 2003; Schleicher et al., 1998;Santosh et al., 2014) and ii) late Neoproterozoic- Cambrian group of mostly A-type granites and rare syenites (Miller et al., 1996; Rajesh et al., 1996; Santosh and Drury, 1988; Santosh et al., 2005). Gopalakrishnan and Ganesh, 1992; Gopalakrishnan, 1993, 1996, 2001 reported Dharmapuri rift zone (DRZ) fromthe western part of the Salem Block about 9 major and a few minor syenites being alkaline plutons were emplaced along with an NNE-SSW trendingfault system.Carbonatite–alkaline complexes are associated with Precambrian magmatism within the Eastern Ghat Mobile Belt (EGMB) of eastern and southern India(Schleicher et al., 1998).The Pakkanadu–Mulakkadu Hogenakal, carbonatite complexes are found along within faulting and thrusting, due to intense tectonic zone charnockitic and granulite facies in south India.Hogenakal carbonatites are older than carbonatite along the SGT Early Proterozoic in age while all others were emplaced during the Neoproterozoic NNE to NE-trending fault system.

3. Study Area

The Kamaneri alkaline syenite pluton exposed outcrops on occurred at the road connecting Omalur to Metture NW of Salem(N-11º47'09.5" - E77º59′20.8″Kamaneri,N11^{0}46'58.6'', E078^{0}00'21.9'' Chindamaniyur,N 11^{0}46'59.6''-E 078^{0}01'46.8''Semmandapatty)south-western part of Dharmapuri suture zone(Srinivas et al.2011b; Gopalakrishnan and

Subramanian., 1990; Gopalakrishnan et al. 1991; Gopalakrishnan et al. 2002). Petrology and Geochemical character of Kamaneri syenite first time reported by Srinivas et al. 2011b, it is known as Omalur Igneous Complex (OIC),M. Jayabalan et al. (2015) recently discussed field character and geochemistry of lamprophyre rocks within the syenite alkaline complex.Pikkili Alkaline Complex (N-12º15′24.2″- E78º01′25.6″, N12^{0}13’16.0’’ - E078^{0}01’41.6’’) village is situated near 16km NW of Dharmapuri town forms a set of linear residual hills made up of syenite in and around Pikkili village where NNE-SSW trend. Grady (1971) Selvan and Gopalakrishnan (2007) reported the evolution history of alkaline magmatism of the Pikkili complex.The study area is chosen from Kamaneri, Chindamaniyur, Semmandapatty from Pakkanadu complex, and Pikkili complex from Dharmapuri attempt to discuss alkaline syenite and their field, petrogenetic character (Fig.1).

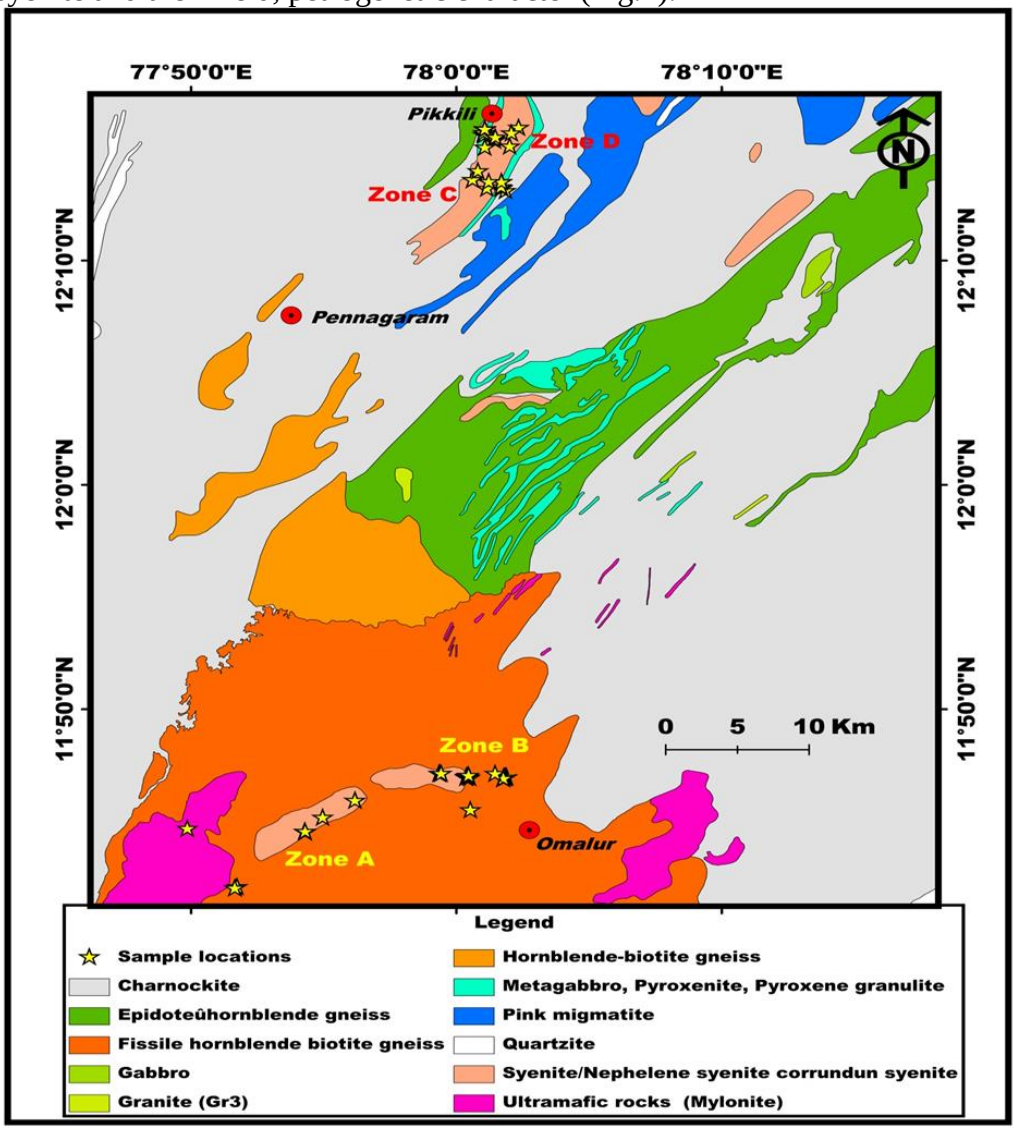

Figure.1*Location map of Pakkanadu and Pikkili alkaline complex*

4. Analytical techniques

Detailed field study carried out by study area using topo sheet published by Geological Survey of India. During the field work fresh samples from syenite and host rock where collected for lab study, sample location was marked by geographical coordinates using GPS(GARMIN 76 CSx). The structure and field relationship of alkaline outcrop was studied detailed and mapped. The samples were analyzed for petrography. For petrographic textural study selected sampleswere preparedthin sections and examined by the petrological microscope LEICA-Model DM 2700P, Department of Geology, Periyar University.

5. Result and Discussion

Field Relationship

The emplacement of Pakkanadu and Pikkili alkaline complex by deep crustal fracture at the northern part of southern granulite terrain which was known as the Dharmapuri suture rift zone (DSRZ) has characterized by various litho units, structures, and defends into the imprints of magmatic, metamorphic history. These magmatic structures are offered on structural events of the emplacement history of the Pakkanadu and Pikkili alkaline complex. The bands of gneissic granulite were used as structural markers and the intrusive dykes as time markers is established the stratigraphic, igneous and metamorphic events in the Pakkanadu and Hogenakkal complex, part of the southern granulite terrain. Low to moderate angle the most common fold is noticed in the research area (Fig.2.a). The primary igneous structures of magmatic foliation structure were observed in the PikkiliMalayur village (Fig.2.b). Parallel arrangement of mafic bands with magmatic fold along the axis plan was seen in the hornblende biotite gneissic rocks (Fig.2.c). At Pikkili hill later invade felsic magmatic intrusions of veins with mafic enclaves are commonly observed (Fig.2.d).Well developed joints are observed mostly in the charnockite and pyroxene granulite rocks in the study area (Fig.2.e). The study area show various folded structural markers along with limbs, the Pakkanadu carbonatite intrusion show low to high amplitude folded structure (Fig.2.f). Lenses and veins occurrence of carbonatite mixed with pyroxene and syenites is located at Pakkanadu area. The width of the carbonatite lenses from 3 to 5 m is observed in carbonatite complex (Fig.2.g). The calcite soviet occurs as within the shear flow, later invaded carbonatite veins are noted (Fig.2h). Macroscopic scale observation the research area shows deformation nature of parallel arrangement of mineral.

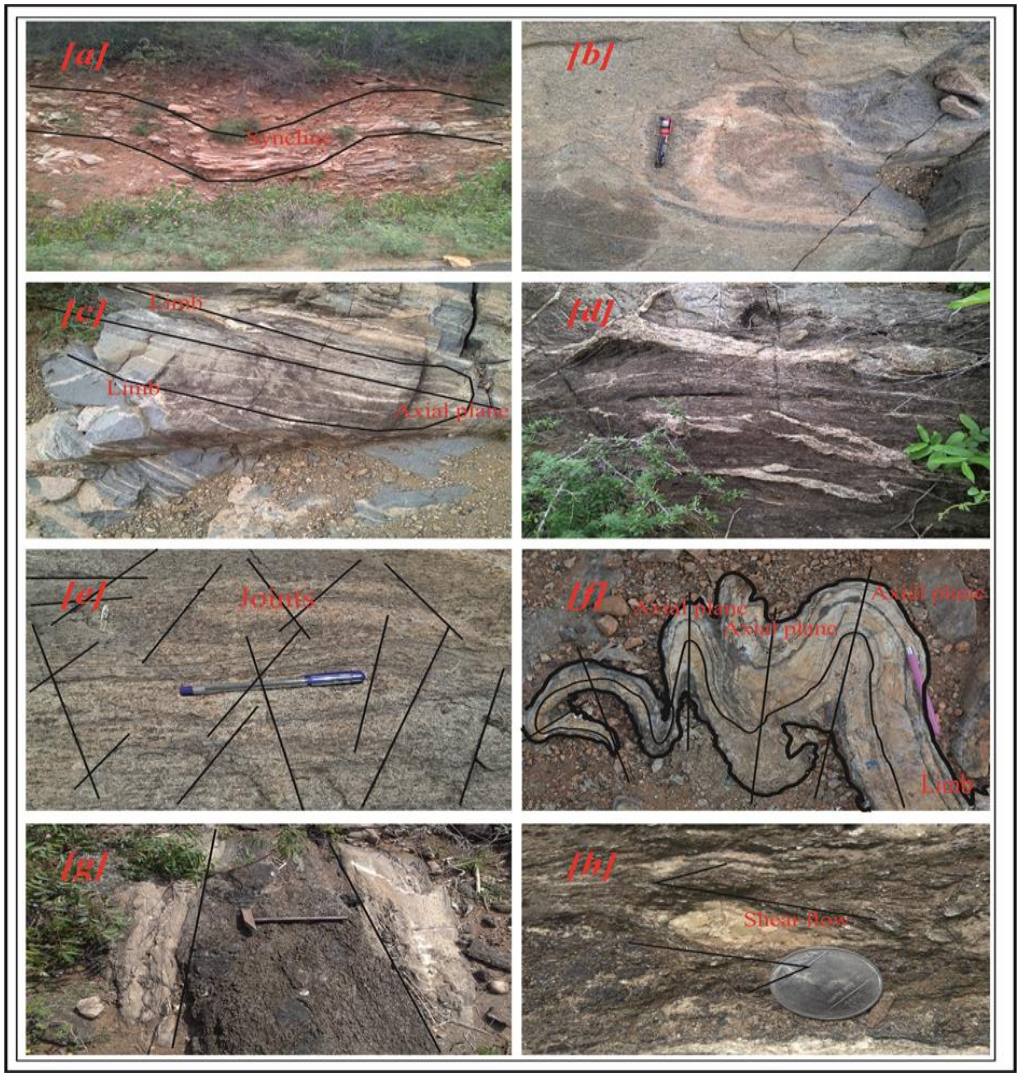

Figure 2.*Field photographs showing* ***a.*** *the thick pill of contact between host rock and syenite.* ***b.*** *Magmatic foliation along with secondary developed joits.* ***c.*** *Magmatic foliation with axial plane in well-developed banded gneiss.* ***d.*** *Later invade felsic magmatic intrusions veins.* ***e.*** *well-developed joints in pyroxene granulite.* ***f.*** *Folded structural markers along with limbs.* ***g.****Calcio carbonatite veins along with altered carbonatite veins.* ***h.*** *Carbonatite intrusion within the shear flow gneiss.*

6. Petrography

Syenite rocks are predominantly consisting of pyroxene with a subordinate amount of alkali feldspar, amphibole, Quartz, and major accessories. The Kamaneri alkaline syenite majorly composed Microcline, Amphibole, Pyroxene, are subhedral crystal, coarse-grained. Microcline shows Tartan twinning, Poor to moderate relief, colorless,two cleavages intersecting nearly at right angles on a (100) section. Anisotropic extinction angle 5^0. Coarse-grained pyroxene is brownish to green colored euhedral, low pleochroic in pink to

greenish. Clinopyroxene show parallel extinction, and orthopyroxene show exsolution lamellae. Pyroxene is identified as 90^0 cleavage angle of orthopyroxene. Orthopyroxene show high relief, pleochroic, and pink in color. Amphibole present in green colored subhedral grains, olive-green to dark green pleochroism, two sets of prismatic cleavage intersect cleavage angle at 56°, moderate to high relief, anisotropic. Alkali feldspar identified with contact twining, Plagioclase present with polysynthetic twinning. Biotite grains are green in color, brown to black, pleochroic with parallel cleavage. Apatite minerals present as small amounts of the accessory mineral, Fe-Oxides present as opaque mineral. Sphene and zircon occur as minor accessory. Sphene mineral identified by diamond shaped well develop euhedral crystal. Microscopically sphene is brown in color, pleochroic, high relief, twinning present in simple twinning. Euhedral sphene is intergrowth within alkali feldspar. In soragai samples are majorly composed alkali feldspar, clinopyroxene and amphibole. Titanite, zircon, calcite present as accessory amount with distinguish properties (Fig.3).

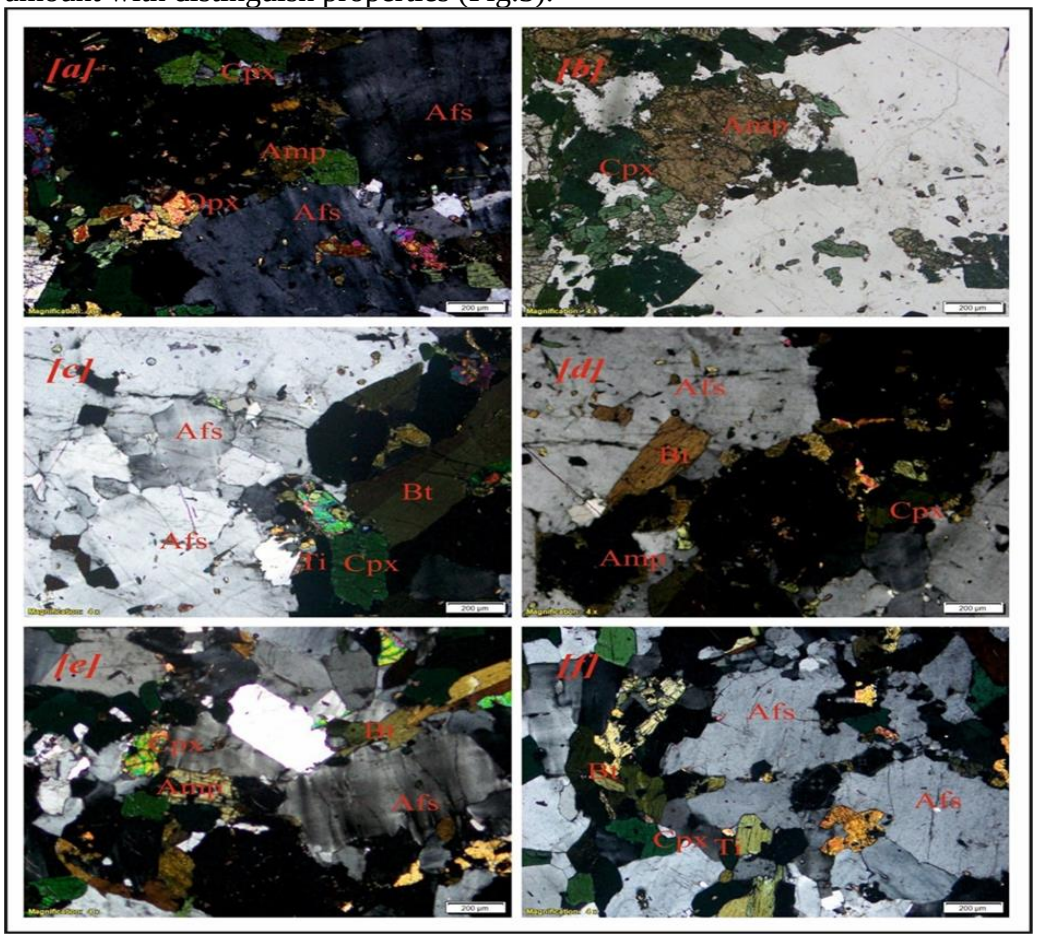

Figure.3*Micro photographs show* ***(a-f),*** *medium to coarse-grained alkali feldspar, which exhibits hypidiomorphic texture. Subhedral to euhedral amphibole shows moderate pleochroism with elongated fibrous biotite. Magnetite with Allanite is present in opaque.*

Whereas feldspar and pyroxene is essential minerals with euhedral garnet and opaque minerals are identified in Pikkli syenite. Syenite from Kamaneri and Pikkili alkaline complex falls in alkali syenite filed in the Q-A-P triangular diagram Fig.4.

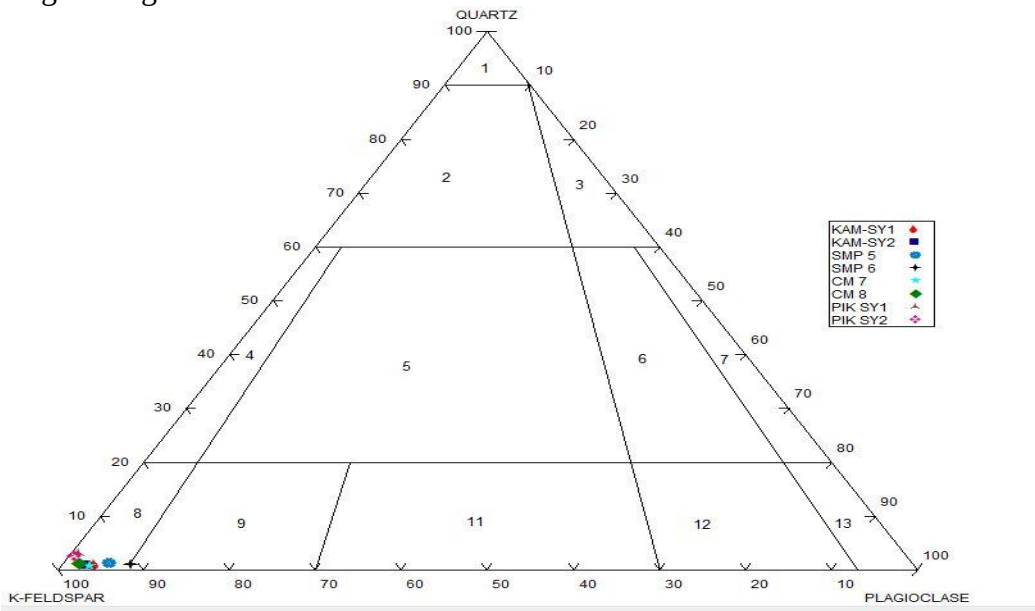

Figure. 4. *Q-A-P triangular diagram of syenite rock from Pakkanadu and Pikkili alkaline complex.*

7. Conclusion

The field character of Pakkanadu and Pikkili alkaline plutons and some outcrops were observed from part of the terrain.We inferredthe emplacement, primary, secondary structure development, deformation and metamorphic history of the alkaline complex during the alkaline magmatism. From petrography and Modal composition (Vol %) in QAP triangular diagramof Streckeisen 1967, confirmed that the syenite are chiefly composed of early formed alkali rich feldspar along with subordinate mineral genesis.

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