FIELD CHARACTERISTIC AND MINERAL GENESIS OF SYENITE INTRUSIONS FROM SALEM AND DHARMAPURI DISTRICTS, SOUTH INDIA

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Abstract

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 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 field settings and structural characteristics indicate these Syenite bodies must have formed from plutonic origin which were later intruded by dykes, suggestive of prolonged and pulsative tectono-thermal evolutionary history. 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.

Keywords: Syenite, Field Character, Petrography, SGT, Alkaline Complex.

Introduction

Southern India has been divided into a series of tectonic units with distinct protolith origins and tectono-thermal histories. The Southern Granulite Terrain (SGT) has preserves the archives formation and reworking of continental crust during Neoproterozoic and Paleoproterozoic to Cambrian related multiple collision subduction with major orogenic cycle. The northern part of southern granulite terrain has a chain of undeformed and unmetamorphosed
alkaline magmatic intrusions along paleo-suture zones (Santosh et al., 2014). Where the alkaline magmatic intrusion attention to interest the relationship of their petrogenetic history, tectonic significance (Tchameni et al., 2001). Alkaline intrusive magmatism within the southern granulite terrain occur along fault/shear/suture zones (Fig. 1), based on the geological age Santosh et al., 2014 broadly discussed and classified into two major groups i) a mid-Neoproterozoic (Cryogenian) alkaline suite characterized by feldspathoidal syenites, pyroxenites, shonkinites and carbonatites (e.g., Kumar et al., 1998; Miyazaki et al., 2003; Schleicher et al., 1998) and ii) late Neoproterozoic- Cambrian group of mostly A-type granites and rare syenites (e.g., Miller et al., 1996; Rajesh et al., 1996; Santosh and Drury, 1988; Santosh et al., 2005). Gopalakrishanan and Ganesh, 1992; Gopalakrishnan, 1993, 1996, 2001 reported Dharmapuri rift zone (DRZ) from western part of the Salem Block about 9 major and a few minor syenite being alkaline plutons were emplaced along a NNE-SSW trending fault system. According to Schleicher et al., 1998, carbonatite–alkaline complexes to be associated with Precambrian magmatism within the Eastern Ghat Mobile Belt (EGMB) of eastern and southern India. The Pakkanadu–Mulakkadu Hogenakal, carbonatite complexes are found along within faulting and thrusting, due to intense of tectonic zone charnockitic and granulite facies in the south India. Hogenakal carbonatites are older than carbonatite along the SGT Early Proterozoic in age while all other were emplaced during the Neoproterozoic NNE to NE-trending fault system. The study area chosen from Kamaneri, Chindamaniyur, Semmandapatty from Pakkanadu complex and Pikkili from Hogenakal complex, attempt discuss alkaline syenite and their field, petro genetic character.
Fig. 1 Geological map of Fault Zone in south India showing Syenite-Carbonatite occurrences, (After Krishnamurthy P. 1988).

Study Area

The Kamaneri alkaline syenite pluton exposed outcrops on occurred at the road connecting Omalur to Metture NW of Salem (N-11°47′09.5″ - E77°59′20.8″ Kamaneri, N11°46′58.6″, E078°00′21.9″ Chindamaniyur, N 11°46′59.6″-E 078°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 known as Omalur Igneous Complex (OIC), M. Jayabalan et al. (2015) recently discussed field character and geochemistry of lamprophyre rocks with in the syenite alkaline complex. Pikkili Alkaline Complex (N-12°15′24.2″- E78°01′25.6″, N12°13′16.0″ - E078°01′41.6″) village is situated near 16km of 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 Pikkili complex.
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 were 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 samples were prepared thin sections and examined by the petrological microscope LEICA-Model DM 2700P, Department of Geology, Periyar University.

Dharmapuri Suture Rift Zone

The northern part of Southern Granulite Terrain experienced deep crustal fractures and different lithology, structure on account of magmatic and metamorphic history regarded as Dharmapuri Suture Rift Zone (DSRZ) (Goplakrishnan, 1996; Gopalakrishnan and Subramanian, 2007). The DSRZ is bounded 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 stages i) Collisional tectonic stage and ii) Rifting tectonic stage. Earlier stage two crustal blocks on either side suturing and welding from DSRZ after started to continue reactivation of shear zone and development of tensional fracture as well as alkaline pluton emplacement along NNE-SSW, N-S and ENE-WS trending. (Goplakrishnan, 1993; Gopalakrishanan and Ganesh, 1992). DSRZ show various evidence from the tectonics such as banded charnockite and gneisses inter-banded with pyroxene granulites, banded magnetite-quartzite, the rocks show NE-SW trending foliations, N-S trending shear zones, F1-F2-F3 folds. The DSRZ has Pan African signature of alkaline-ultramafic-carbonatite complexes at Pakkanadu, Samalpatty, Sevattur and Elagiri (Miyazaki et al., 2000). This intrusive exhibit ring complexes emplaced along main fault (Grady, 1971).

**Interpretation and inference**

**Field Relationship**

The NE trend of syenite from Kamaneri intrusive intrude within the hornblende biotite gneiss, relation between them sharp contact. Structurally NE-SW in trend vertical dip, the secondary late joints are noticed (Fig. 3.A) it may be result of post intrusive regional tectonic stress. Quartz vein along the syenite body (Fig. 3.C) suggest due to the late stage of magmatic activity. Medium to coarse grained feldspar, phenocrystic hornblende with syenitic composition of porphyritic syenite body also noticed at the dyke intrusion. (Fig. 3.B) (Fig. 3.D).
Fig. 3 Field photograph of Syenite Dyke from Kamaneri

The Pikkili alkaline complex show different composition of xenolith structure of older granulite, migmatitic gneiss along with brecciated syenite and mafic enclave suggest the magma undergoes mingling. The enclaves to address the mafic magma were intruding into unsolidified syenitic magma. Parallel joints within the xenolith are noticed, suggest the xenolith undergoes tectonically deformed due to strain during magma emplacement (Fig. 4).
Fig. 4 Field photograph of Layered Syenite intrusion at Pikkili

**Petrography**

Most of the syenite shows leucocratic to mesocratic nature with medium grains arranged in equigranular manner. Hypidiomorphic texture seen in most of the samples and some samples shows poikilitic texture which has subhedral to euhedral mineral inclusions. The syenite rock shows dominant feldspar with pyroxene minerals. Other than these minerals plagioclase and nepheline hosted and microcline shows distinguish crosshatched twinning and euhedral titanite identified in some samples of syenite rock from Chindamaniyur. 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.5.
Plate 1: Photomicrograph of Chindamaniyur syenite rock shows inequigranular of fine to medium minerals grains. Feldspar, plagioclase, aegirine, microcline, pyroxene, are the major minerals and titanite and augite are formed as accessory minerals.
Plate 2: Photomicrograph of Kamaneri syenite rock A & C (PPL), B and D (XPL) and Pikkili syenite E (PPL) & F (XPL). Section C & D shows small subhedral to euhedral mineral inclusions in large crystal which is termed as poikilitic texture. Section E (PPL) shows low relief minerals of dominant plagioclase and feldspar.
Plate 3. Photomicrograph of Pikkili Syenite. Section A (PPL) shows low and high relief minerals which is feldspar and quartz respectively. Feldspar, nepheline, clinopyroxene (aegirine) are the major minerals and quartz formed as accessory. Section C (PPL) & D (XPL) shows dominant feldspar and pyroxene with opaque minerals. Section E (PPL) & F (XPL) shows euhedral garnet with internal fractures of nepheline and opaque minerals. Section F (XPL) shows isometric behaviour of garnet.
Fig. 5 Q-A-P triangular diagram of syenite rock from Kamaneri and Pikkili alkaline complex.

Conclusion

The field character of Kamaneri, Pikkili alkaline plutons and some outcrops were observed from part of the terrain. We inferred the 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 diagram of Streckeisen 1967, confirmed that the syenite are chiefly composed of early formed alkali rich feldspar along with subordinate mineral genesis.

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References


