



STRUCTURAL STUDIES OF GRANITOIDS IN ANUMALAKONDA, PAMURU, PRAKASAM DISTRICT, ANDHRA PRADESH IN EASTERN DHARWAR CRATON

Kencha Ramesh¹, G. Nagendra Babu¹, Sreenu Kunsoth¹, M. Vittal¹, B. Naveen¹.

¹ Department of Geology, Osmania University, Hyderabad -500007.

Abstract

Along the south-eastern margin of Eastern Dharwar Craton (EDC), granitoids are intrusive into Nellore-Khammam Schist Belt and are exposed around Anumalakonda, Bukkapuram and Pamuru in Andhra Pradesh, forms part of toposheet number 57M/8. Structural characteristics of these granitoids from the Anumalakonda area were studied. Anumalakonda granitoids consists quartz, feldspar, biotite, muscovite mica and the mica deformation trend in N60⁰W- S60⁰E to N50⁰W- S50⁰E with steeply dipping. Dolerite dykes and quartz veins trend in N50⁰W- S50⁰E and steeply dipping in S40⁰W.

Leucocratic, coarse grained, deformed granitoid near Pamuru town consist majorly quartz, K-feldspar and mica. The mica foliated in N55⁰W- S55⁰E orientation and dipping in S35⁰W with an amount of 50⁰dip angle. Micaceous xenoliths consist of feldspars and quartz as xenocrysts. Later intruded by felsic intrusions like aplites and quartz veins. The granitoids bear the deformation imprints of Nellore-Khammam Schist Belt and Eastern Ghat Mobile Belt.

Keywords: Eastern Dharwar Craton, Granitoids, Anumalakonda and Eastern Ghat Mobile Belt.

1.Introduction

Archean granite-green stone terrain of Dharwar Craton (DC) is a museum of various magmatic rocks from Archean to late Proterozoic, sedimentary rocks and metamorphic terrains etc., the DC divided by Chitradurga Shear Zone (CSZ) into Western Dharwar Craton (WDC) on west and Eastern Dharwar Craton (EDC) on East (Ramakrishnan and Vaidhyanadhan, 2008 and Vijaya Kumar et al.,2011) and the regional stratigraphy is shown in **Table.I-1** and local stratigraphy in **Table.I-2**. The study area is part of EDC in Andhra Pradesh falling in toposheet numbers 57M/8. The Nellore Schist Belt (NSB) which includes Palaeo-Proterozoic volcano-sedimentary successions, and the adjoining Nallamalai fold belt, dominantly with a Meso-Proterozoic sedimentary succession, separates the intra-cratonic Cuddapah basin to the west and the

southern part of the Eastern Ghats Belt. The granitoids exposed in and around Anumalakonda and Pamuru in study area is shown **Fig.1**.

2.Geology

Along the eastern margin of EDC, Proterozoic granitoid plutons were emplaced i.e. terrain boundary tectonic zone in different tectonic settings: rifting, Collisional between EDC and Proterozoic Eastern Ghat Mobile Belt (EGMB) (Reddy, 1991; Sesha Sai 2013). A curvilinear Nellore-Khammam Schist Belt (NKSMB) formed during Archean along the eastern margin of Eastern Dharwar Craton is, equivalent to the Sargur schist belt in WDC, which is the oldest (protolith age of ca. 3.3-2.5 Ga), supracrustal belt in India (Ravikant, 2010) **Fig.1**. The NKSMB is about 600 km curvilinear belt, has variable width from 30 to 130 km and is bounded by the Proterozoic basin sediments (Cuddapah Supergroup and Pakhal Supergroup) on the west and the Proterozoic EGMB on the east (Babu, 2008). This NKSMB geochemically and geologically characterised by two distinct metamorphosed volcano-sedimentary Formations. A series of granites are also observed between Pamuru and Chandrashekar Puram (**Fig-1a**)

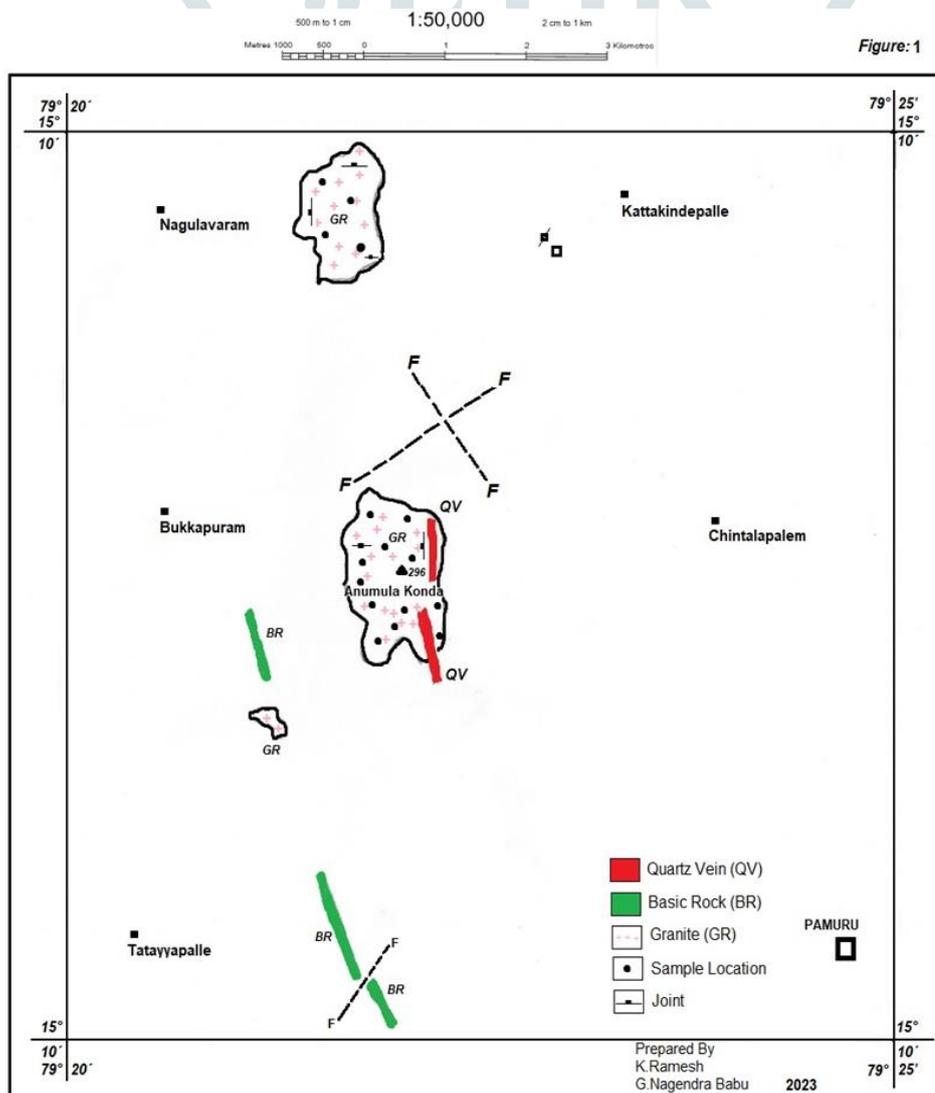


Fig1: Generalized Geological map of Anumalakonda- Bukkapuram, Prakasam district, Andhra Pradesh.

MESOPROTEROZOIC		Kandukur Formation	Shale, sandstone and pebbly sandstone with ptilophylum flora (upper Gondwana) -----Unconformity-----	
		Prakasam alkaline non-alkaline intrusive complex (PANIC)	Alkali granite, alkali feldspar granite and quartz syenite, Hornblende syenite, (Kanigiri/Darsi/Podili), Gabbro-norite dykes, Fayalite bearing quartz monzonite, quartz diorite, Olivine gabbro, gabbro-norite-anorthosite-olivine clinopyroxenite and Olivine-pyroxene+plagioclase cumulates (Inkurti/Chimakurti)	
			Alkali lamprophyre dykes, Nepheline syenite (Elchuru/Purimetla/Uppalapadu/Settupalli/Kommalapadu/Pasupugallu)	
		Kandra Igneous Complex	Metabasalts and dolerite dykes (sheeted); Plagiogranites, Lueco gabbro, coarsegrained cumulus gabbro with interbands of ultramafics	
		Tirumala (Nagari) Quartzite	Quartzite with minor shale	
			-----Angular Unconformity-----	
	PALAEOPROTEROZOIC		Mafic dykes	Dolerite dykes (Phase -II>1600 Ma)
			Rapur (Pamur) granite	Biotite granite, mica pegmatite and quartz veins (? Vinukonda Granite)
			Chimalpahad layered mafic-ultramafic complex	Orbicular diorite associated with younger tonalite, Luecogabbro (gabbroic anorthosite-anorthositic gabbro) with minor anorthosite and gabbro, Pyroxinite and actinolite-trimolite schist, talc-tremolite-actinolite schist with chromite
			Udayagiri Group	Sitarampuram Formation Quartz-chlorite schist±sericite, muscovite with intercalated quartzite (upper) (interbanded with basic to acid volcanics and mafic-ultramafic rocks)
			Duttaluru Formation Quartzite and quartz mica schist±garnet with autoclastic intraformational conglomerate (lower) -----Disconformity-----	
		Atmakuru Group	Sirisanambedu Formation Banded hematite-magnetite quartzite (BIF) with quartzite (metachert)-clac silicates-barytes	
			Dirsuvanacha Formation Quartz sericite schist±chlorite (acid volcanic) bedded tuffs and agglomerates	
			Chagnam Formation Metabasalt (amygdular)/amphibolite±garnet and amphibolite intrusive	
			-----Tectonic----- (Vinjamuru fault (thrust)/ Shear zone)	
		Mala-konda Group	Banded magnetite quartzite±garnet; Clac silicates/Marble Banded / Schistose amphibolites±garnet and ultramafic; Garnetiferous mica schist ± staurolite-kyanite-sillimanite; Quartzite and quartz-mica schist±garnet with intercalated quartzite±garnet -----Nonconformity----- ----- (Eparchean Unconformity) -----	
	Basement Gneiss and Granites (3000-2200 Ma)		Banded tonalite-trondhjemite gneiss, Tonalite-granodiorite-granite gneiss/ monzogranite-syenogranite and grey /pink granite (Hyderabad batholiths) with supracrustal enclaves	

Table.I-1: Generalized stratigraphic succession of the study area (after Ramakrishnan et al., 1998 & Dobmeier and Raith 2003)

Gabbro - Anorthosite - Syenite Plutons	- Mesoproterozoic
Younger Granites (East of Cuddapah Basin)	- Paleo-Mesoproterozoic
Acid to Intermediate schistose meta-volcanics/Pyroclastics.	
Qtz –Chl-Bt Schist + Gt-Ky (with quartzite and chert bands).	
Migmatites/Gneisses (with patches of quartzites and pelitic schists and mica pegmatites)	
Granite/Granite gneiss (equivalent to Closepet granite).	- 2.5Ga.
Eastern Ghat Mobile Belt	
Banded Iron Formation	
Amphibolites Archean Nellore Khammam Schist Belt	- 2.7Ga.
Metapelites	
Table.I-2: Stratigraphy of the Local Geology (Srinivasan and Roop Kumar, 1995)	

3. Anumalakonda granitoids

Biotite dominated leucocratic granitoid outcrops are exposed between Bukkapuram - Anumalakonda villages (N 15° 07' 08.1" to N 15° 08' 02.8" and E 79° 21' 43.7 to E 79° 22' 15.9"- 57 M/8), west of Pamuru town. The granite consists of quartz, feldspar, muscovite, biotite (as phenocrysts), pyrite, epidote and fluorite. The granite is two mica (biotite and muscovite) bearing. Noticed the mica of N55°W-S55°E deformation trend with dipping of 50° in S35°W and mafic veins showing N40°W-S40°E orientation. These outcrops showing micaceous (mafic, dark in colour) xenoliths which having quartz & feldspars as xenocrysts within them. Few xenoliths showing gradational contacts & diffusional contacts indicate the mixing of basic and acidic magmas. This granite is intrusive into NKSB, and shows a variation in grain size from the periphery (fine grained) to the centre (coarse grained) of the pluton. The Basic dykes (dolerite), thick quartz veins, aplite veins, quartzofelspathic veins and pegmatites are striking NW-SE and are nearly steeply dipping (**Fig.1**).

4. Structure

The Precambrian Nellore Khammam Schist Belt of Prakasam district, Andhra Pradesh reveal a complex structural history involving five phases of folding (D1 to D5), of which the imprints of the first, second and fifth are seen only on the mesoscopic scale while the third and fourth resulted in the development of regional folds in the area. The earliest recognizable deformation (D1) is characterized by initial layer parallel compression followed by extension tectonism resulting in the transposition of the lithological layering. The second deformation (D2) is seen in the form of minor crenulations while the major folds belong to third deformation (D3) which controls the present lithological setting. Crustal shortening took place along NWSE direction resulting in a series of anticlines and synclines in the area. Superposition of fourth phase of deformation (D4) over the D3 regional structures is more conspicuous throughout the region forming dome and basin. The fifth deformation (D5) is semi brittle to brittle type indicated by the presence of large-scale fracturing and faults with occasional development of minor asymmetric folds, as well as emplacement of

quartzo-felspathic veins along the axial planar direction of F5 folds. The arcute pattern with the convexity towards west to North West of all the litho-tectonic units of the area, acts as a mirror image of the convexity of the Nellore Schist Belt which is probably caused due to the effect of D4 deformational event (Sarma, 2013).

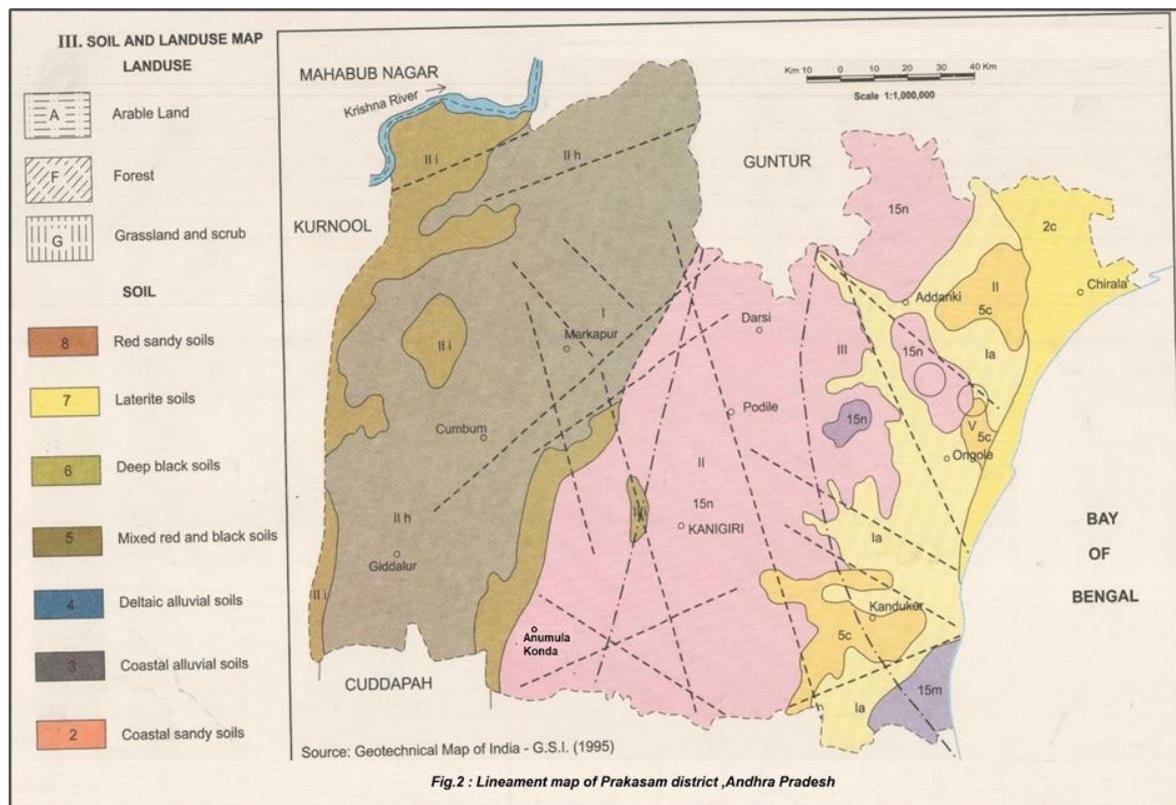


Fig 2: Lineament map of Prakasam district, Andhra Pradesh.

Tectonically, the study area is dissected by NW-SE, NNE-SSW and NE-SW lineaments. Granitic plutons are aligned in NNE-SSE direction between the eastern margin of Cuddapah basin and western margin of NNE-SSW trending Eastern Ghat Mobile Belt. Granites at places show crude foliation of WNW-SSE. General attitude of joints is $N30^{\circ}E-S30^{\circ}W$, N-S, E-W and $N20^{\circ}W-S20^{\circ}E$. Shearing of minor nature at places is noticed and along which ferruginisation and silicification is observed. A thick milky quartz vein trending $N30^{\circ}E-S30^{\circ}W$ measuring 500m in length and with varying width 5m to 20m is exposed near the temple. A dolerite dyke trending $N45^{\circ}E-S45^{\circ}W$ is exposed to the SW of Anumalakonda hill, is traced from Bukkapuram to Peddamattipalle intermittently over a length of 4 km and width varying from 10m to 100m. Basic dykes, quartzo-felspathic veins, epidote veins, fluorite veins and quartz reef/veins preferably occupy these dominant fracture trends, which indicate that NW-SW and NE-SW are dominant trends followed by N-S and E-W. The main drainage in the study area is Manneru River which flows from west to east, however the flow at places is controlled by NW-SE and NE-SW faults. The lineament map of Prakasam district compiled by GSI (Geotechnical map, 1995), show three sets of major lineaments trending NNE-SSW, $N45^{\circ}E-S45^{\circ}W$ and $N45^{\circ}W-S45^{\circ}E$ (Fig.2). Some field photos are shown in Fig.3 (a to d).

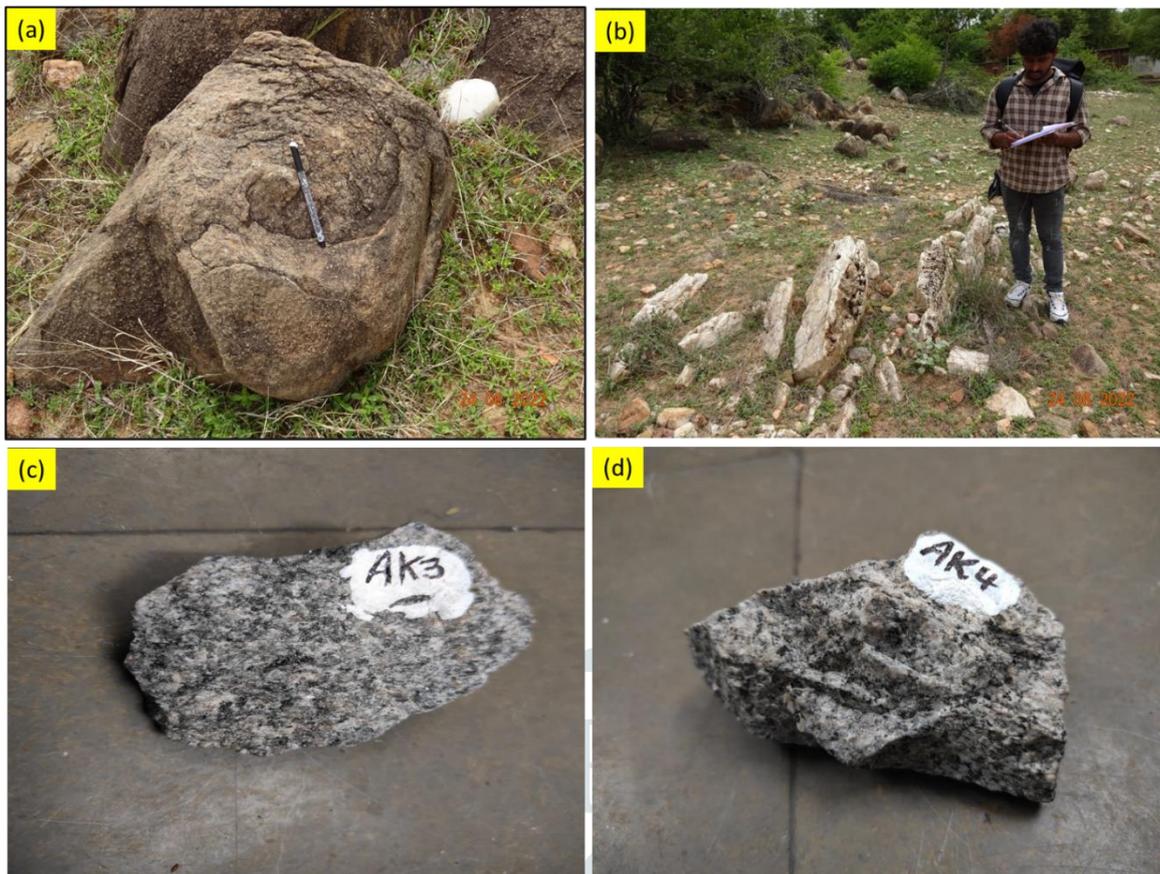


Fig.3: Field Photographs. a) exfoliation of granite b) outcrop of quartz vein c) Grey granite hand specimen and d) Grey granite hand specimen.

Conclusion

The granites around Anumalakonda – Bukkapuram area bears the imprints of structural trends of Nellore-Khammam Schist Belt (N-S to NNE-SSW) and Eastern Ghat Mobile Belt (NE-SW). Area is structurally disturbed, and the structural trends observed are NW-SW and NE-SW are dominant followed by N-S and E-W trends. Basic dykes, quartzo-felspathic veins, epidote veins, fluorite veins and quartz reef/veins preferably occupy these dominant fracture trends.

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