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# Petrology and Geochemistry of Granites from the Kakarlapahad area, Near Nawabpet, Mahabubnagar District, Telangana, Southern India.

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**Abstract - In this paper, we present the data on petrology and geochemistry of the granites at Kakarlapahad of Nawabpet Mandal in the Mahabubnager District of Telangana state. Granites of the study area are coarse-grained, leucocratic, and light-grey- greyish pink to pink in colour. The rocks exhibit hypidiomorphic texture and the essential minerals are chiefly constituted by K-feldspar (26.47-31.83%), quartz (30.98-37.21%), plagioclase (29.03-33.24%), biotite (1.20-3.15%), and hornblende (0.5-1.57%) by volume. The common accessory minerals in these rocks are apatite, magnetite and the secondary minerals include kaolin (after K-feldspar) and chlorite (after biotite). Geochemically, the Kakarlapahad granites are characterized by high $SiO_2$ (67.97-71.71%), $Al_2O_3$ (13.10-14.84%), total alkalies (8.87-10.02%), and low $Fe_2O_3$, MgO, CaO, $TiO_2$ and $P_2O_5$. Further, they are enriched in LREE over HREE and also LILE relative to HFSE elements. On the chondrite- normalized REE diagram, the Kakarlapahad exhibit steeply inclined patterns from LREE to HREE with a positive Eu anomaly and one of the sample showing negative Eu anomaly, except a few with less prominent negative anomalies. On the primitive normalized spider diagrams, they display negative anomalies for Nb, Ta, Zr and Hf. Significant enrichment of felsic elements over mafic elements suggests the role of crystal fractionation from the representative mafic parent magma. The LILE and LREE enrichment infer the metasomatic enrichment of their source magma before the crystallization of the granites. Tectonically, these rocks show affinity to the subduction environments.**

**Keywords: Kakarlapahad, Granite, Geochemistry, LREE, LILE, ahaboobnager,Telangana.**

## I. INTRODUCTION

The term granite is a Latinized version of the ancient Welsh expression, gwenith faen meaning a grinding stone for making wheat flour (Pitche, 1997). For a layman it means any hard granular rock, which is used as building stone. During the early years of geological studies, the term was used to include all the quartz-feldspar bearing igneous and 'igneous looking' rocks. Later on, it also acquired a more restricted meaning applied to rocks with subequal amounts of quartz, plagioclase feldspar and potash feldspar. Other names such as adamellite, granodiorite, tonalite, quartz monzonite have been used with different meaning. Despite being the most abundant rock type in the continental crust, granitoids are deprived of a classification that has a widespread use. The reason for the non validation of the classifications of granites, lies in the repetitivity of the more or less similar mineral assemblage quartz and feldspars together with a variety of ferromagnesian minerals, and some workers opine this assemblage can be achieved by a number of processes.

The crustal portion of eastern Dharwar craton of southern India is composed of diverse lithology collectively referred to as granitoids including granites, tonalite-tronghjemite-granodiorite (TTG), syenogranites, and aplites along with their counterpart mafic rocks as microgranular mafic enclaves and dykes (Prabhakar et al., 2009). Corresponding age of these basement rocks range from mid-to late archean and is mainly represented by TTGs (Swami Nath and Ramakrishnan, 1981; Naqui and Rogers 1983) followed by Archean to Proterozoic granitic events represented by Closepet granite (Jayananda et al., 1992 and references therein). The genesis of these granitoids still been a topic of debate owing to the diverse opinions from researchers. Tectonically, the association of these granitoid magmas is mainly attributed to the collisional or subduction (Moyen et al., 2017), rifting (Ondrejka et al., 2021), intraplate and oceanic settings (Bahariya, 2021).The present study aims to provide preliminary information about the petrology, geochemistry of the granites of Kakarlapadu area of Mahaboobnager district of Telangana state.

### IUGS Classification of Granites

Streckeisen (1976) as Chairman of the IUGS sub commission on the systematics of igneous rocks had

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streamlined the terminology and recommended the classification and nomenclature of granites and related rocks which find wide acceptance. The traditional IUGS petrographic classification of granitoids is based Upon their modal abundances of quartz, (Q) plagioclase (P) and alkali feldspar (A) (Streckeisen1967). Adopting the modal mineral proportions the quartz rich plutonic felsic igneous rocks (>20% quartz) have been classified into tonalite, granodiorite, monzogranite, syenogranite and alkali feldspar granite with increasing ratio between alkali feldspar and plagioclase feldspar. Other related rocks on QAP diagram are diorite, monzodiorite, monzonite, syenite and alkali feldspar syenite, corresponding to the above five types of rocks in that order but with <5% quartz. Similarly, there are five other types of rocks transitional between the above two series and containing between 5% and 20% quartz. They are named as quartz diorite, quartz monzodiorite, quartz monzonite, quartz syenite and quartz alkali feldspar syenite with increasing alkali feldspar content. When the mafic minerals are present in considerable amount (>10%). Such names as hornblende tonalite, biotite granodiorite etc. have been recommended. The terminology based on the QAP proportion is simple to follow and forms a fundamental and descriptive terminology without going into the genetic aspects of granites and related rocks (Pitcher, 1997).

The major advantage of the IUGS classification is that it can be readily applied in the field. Furthermore, it is inexpensive, simple to use, and truly non-genetic. Similarly, major drawback of the IUGS classification is that it ignores the compositional variations apart from those that affect the feldspar abundances. Despite having significantly different chemical compositions, the mafic and felsic variants of granites get plotted in the same field and, the classification also fails to address the presence or absence of minor phases, such as muscovite, that carry significant petrologic implications. It is for this reason; several petrologists were forced to innovate new and additional parameters to classify granitoids.

**Geology of the area**

The present Indian subcontinent is mainly consisting of four distinct major cratons, they are the Singhbhum craton in the eastern region, the Bastar craton in the south-central region, Aravalli-Bundelkhand craton in the northwest and central regions and the Dharwar craton in the southern region (Figure-1; Naqvi et al., 1974; Meert et al., 2010). These cratons were stabilized by the end of the Archean time (2.5 Ga). Several Proterozoic sedimentary basins were evolved throughout the peninsular India; typical crescent-shaped Cuddapah basin is a major intracratonic basin among them and situated in the south-eastern part of Dharwar craton. The Dharwar craton (DC) of south India is the largest Archean cratonic block of peninsular India and it covers an area of 238,000 km$^2$. It lies between the latitudes 12" 0' N to 18' 0' N and longitudes 74' 0' E to E 80"0' E. The NW region of the DC is blanketed by the extensive late Cretaceous (~66 Ma) basaltic flows of the Deccan Traps and in the NE region by the Karimnagar Granulite belt (2.6 Ga old); Eastern part is bounded by Proterozoic Eastern Ghats Mobile Belt (EGMB), to the south by Southern Granulite Terrain (SGT) or Pandyan Mobile belt and Arabian sea to the west. The Narmada–Son lineament marks the northern boundary of the Dharwar craton (Rogers, 1985).

The Dharwar craton is divided into Western Dharwar Craton (WDC) and Eastern Dharwar Craton (EDC), separated by an N-NW trending fault zone. The WDC and EDC have amalgamated at ~2.5 Ga. (Chadwick et al., 2000). The WDC comprises of TTG-type peninsular gneisses which accreted in several stagesduring 3.36 Ga and 3.2 Ga (Peucat et al., 1993), two phases of greenstone belts, the older Sargur Group, younger Dharwar Supergroup and calc-alkaline to potassic plutons (Jayananda et al., 2006). The EDC comprises of distinctly younger (2.7–2.55 Ga) rocks, includes TTG gneisses and migmatites with limited 3.38–3.0 Ga crust remnants (Nutman et al., 1996) and multiple exposures of 2.7–2.55 Ga greenstone belts (Balakrishnan et al., 1999; Nutman et al., 1996).

The studied area is situated in the northern part of Mahaboobnager district, Telangana State, which is part of Eastern Dharwar Craton (EDC). The area is placed between 16°49' 38.43" - 16°47' 56.4"N latitude and 78°01' 21.11"- 79°57' 52.4"E longitude in the Survey of India toposheet No. of 56 L/1, South India (Fig. 1). The entire Kakarlapahad region is under Archaean crystalline rocks, comparing granites, gneisses and intrusive rocks. We have collected the granite samples from different parts of Kakarlapahad area, Mahaboobnager district. Sample locations shown in Figure1.

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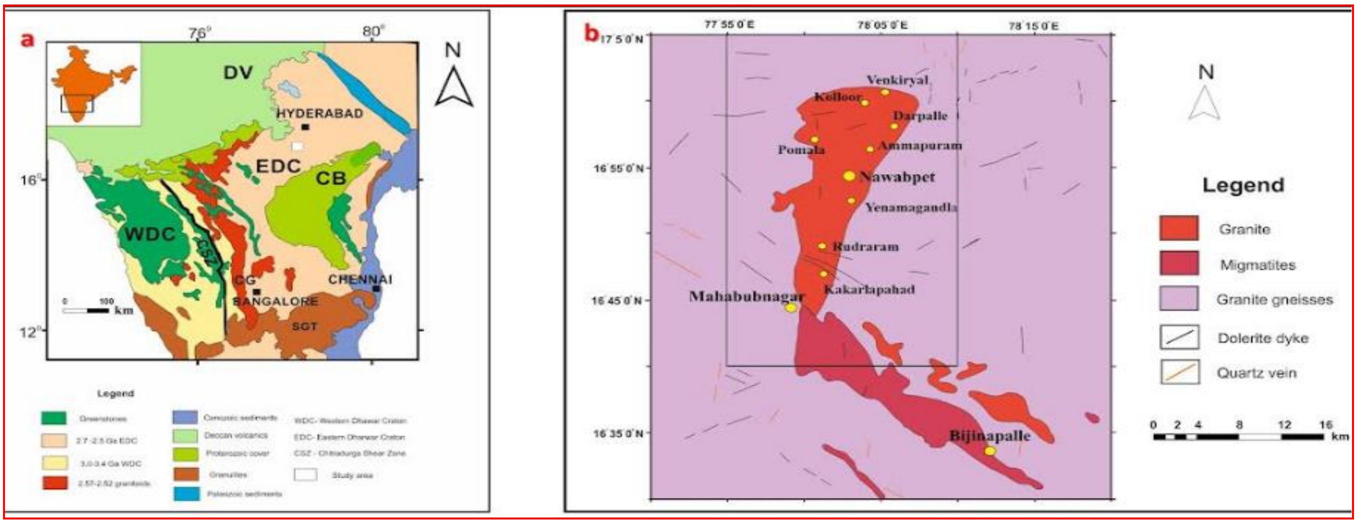


**Fig-1:** **(a)** Generalized geological map of Dharwar Craton, Southern India (GSI 1996). **(b)** Geological map of the Kakarlapadhad area.

**Field Photographs:**


**Fig-2:** Field photographs of the study area: (a) Phanerozoic view of hill outcrop in Nawabpet (b) Brittle fractures of coarse-grained pink granite in the Kakarlapahad.

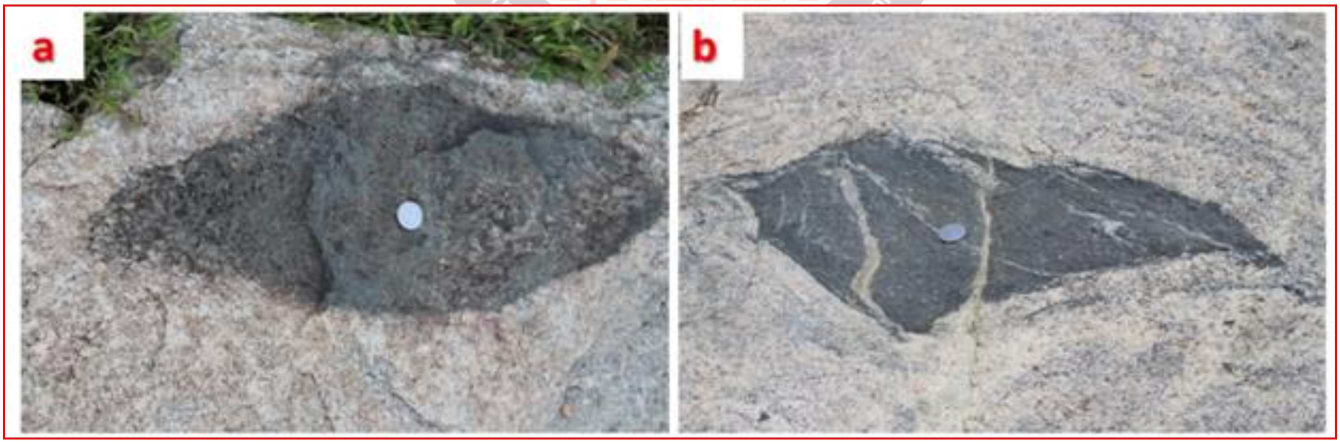


**Fig-3:** Hybridation of mafic magmatic enclaves (MMEs): (a) Medium to fine-grained melanocratic MME with feldspar phenocrysts observed in Kakarlapahad. (b) Melanocratic MMEs exhibit sharp to gradational contact with host granite.

## II. METHODOLOGY

The whole-rock oxide composition of Kakarlapahad granites was analyzed using a Philips Magi PRO model (PW 2440) wavelength dispersive X-ray fluorescence spectrometer coupled with an automatic sample changer (PW 2540) at National Geophysical Research Institute, Hyderabad. The trace and REE of granite samples are determined using a 0.1% solution prepared using HF-HCl-$HNO_3$ acid decomposing procedures and analyzed with the help of Perkin Elmer Scitex ELAN DRC II ICP-MS available at the National Geophysical Research Institute, Hyderabad.

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## III. RESULTS

**Petrography:**

The granites of Kakarlapadu are essentially composed of alkali feldspar, quartz and plagioclase. The accessory mineral phases are biotite, apatite and magnetite opaque minerals. Large laths of perthitic alkali feldspar contain inclusions of plagioclase and biotite. Plagioclase grains are identified by their typical polysynthetic twinning. Based on crossed-hatched twinning alkali feldspars are identified as microcline. Myrmekitic intergrowth and perthite exsolution textures are present in these rocks. The euhedral alkali feldspar grains exhibit flame perthite pattern indicating the exsolution of albite component from the host. Vermicular quartz intergrowth in plagioclase forms myrmekitic texture. The granite is variably affected by sericitization and saussuritization. The plagioclase in these rocks has partially or completely altered into sericite. The textural relations between different minerals are shown in Figure 5.

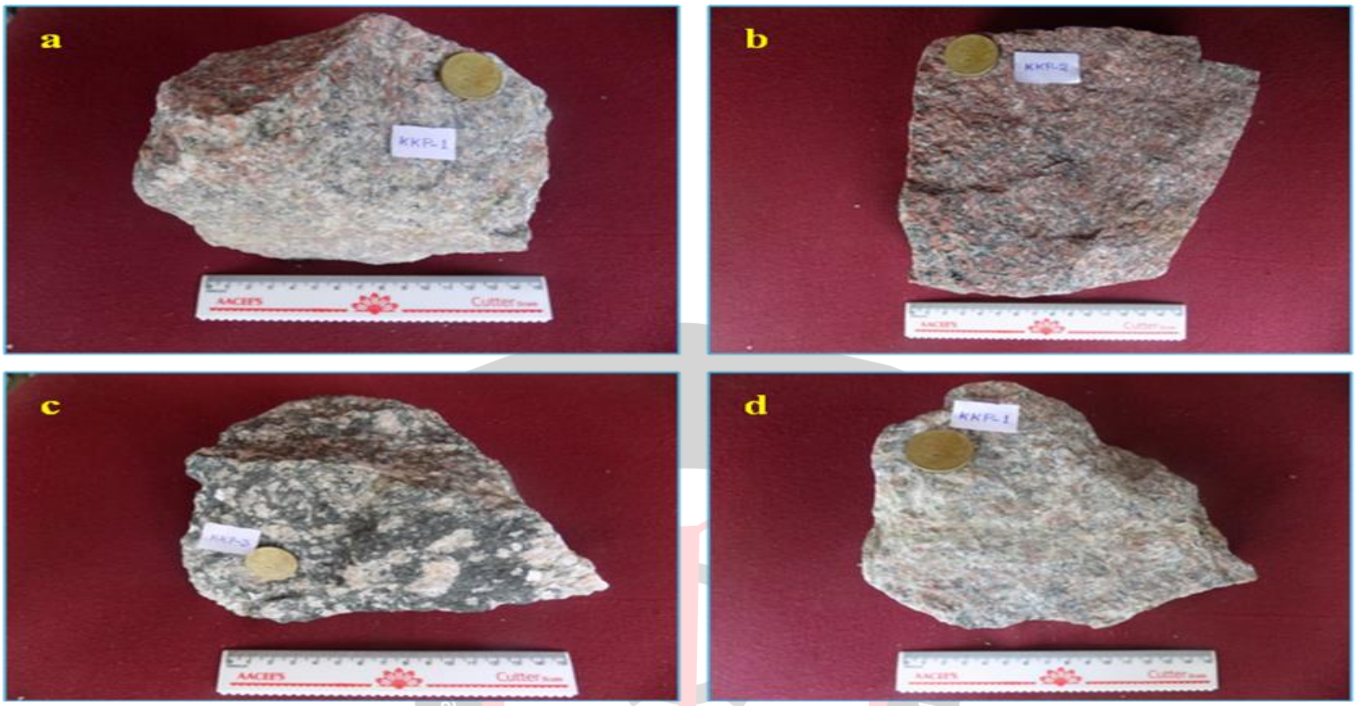


**Fig-4:** Megascopic samples of the Kakarlapahad granites showing (a-b) K-feldspar rich, (c) Melanocratic & porphyritic textute (d) Leucocratic sample showing coarse grains.

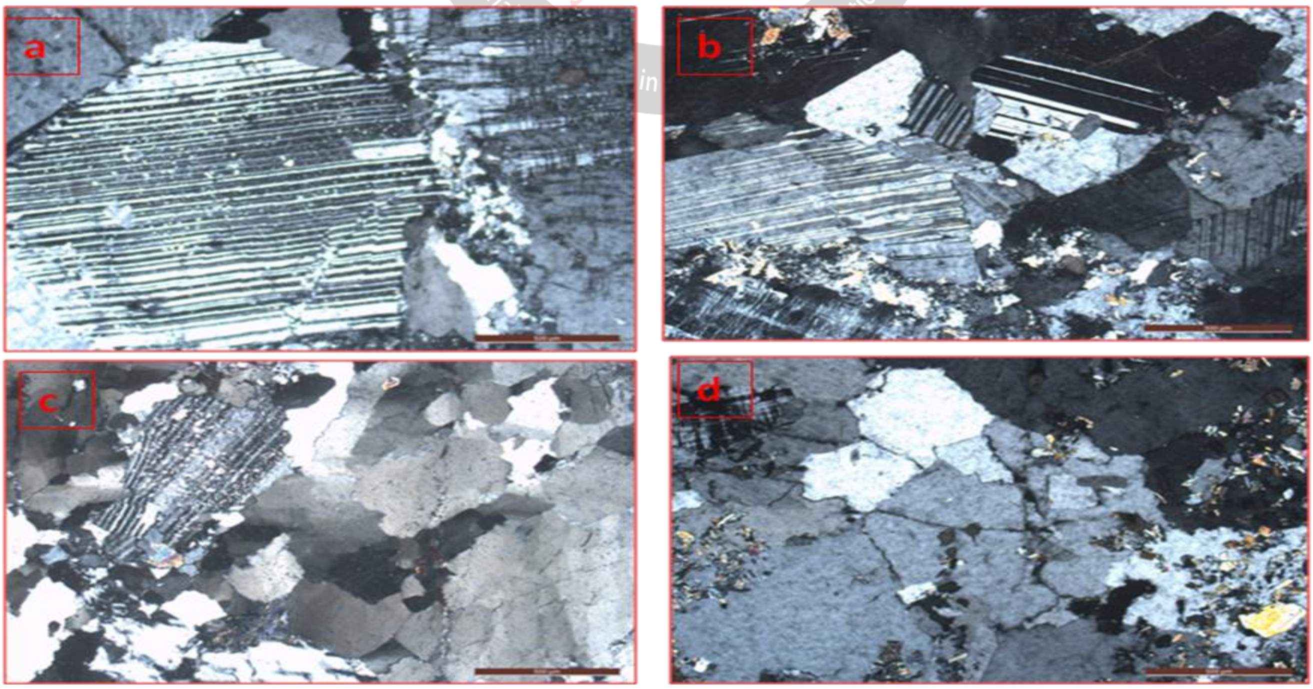


**Fig- 5 (a-d):** Microphotographs of Kakarlapadu granites showing presence textural relations between minerals.

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**Table 1: Modal Compositions of Granites from Kakarlapahad Area.**

| S. No | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Quartz** | 31.39 | 37.21 | 35.53 | 30.98 |
| **Plagioclase** | 33.24 | 29.34 | 32.07 | 29.03 |
| **K – Feldspar** | 30.67 | 28.29 | 26.47 | 31.83 |
| **Biotite** | 1.45 | 2.50 | 1.20 | 3.15 |
| **Pyroxene** | 1.21 | 1.25 | 1.05 | 1.03 |
| **Hornblende** | 0.5 | 1.12 | 1.5 | 1.57 |
| **Magnetite** | 1.29 | 0.43 | 1 | 1.36 |
| **Apatite** | 0.25 | 0.85 | 1.15 | 1.05 |
| **Others** | - | - | - | - |

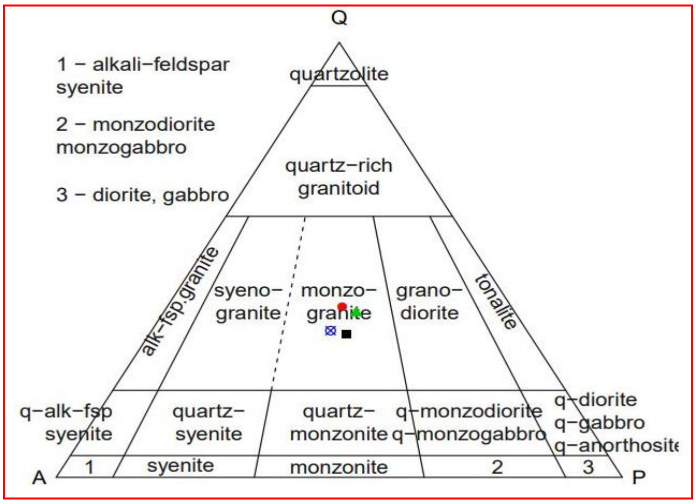


**Fig-6:** QAP diagram of Kakarlapahad granites showing Monzo- granite field.

## Geochemistry

The granites of Kakarlapahad display a silica oversaturation character with similar characteristics to the granites of Mothkur (Devender et al., 2022) (see Table 2). >65% of $SiO_2$ shows a limited compositional variation that ranges from 67.89 to 71.95 wt% and a Harker's variation diagram is plotted to observe the trends (Fig-7) and all samples are showing a alkaline series (Fig-8).

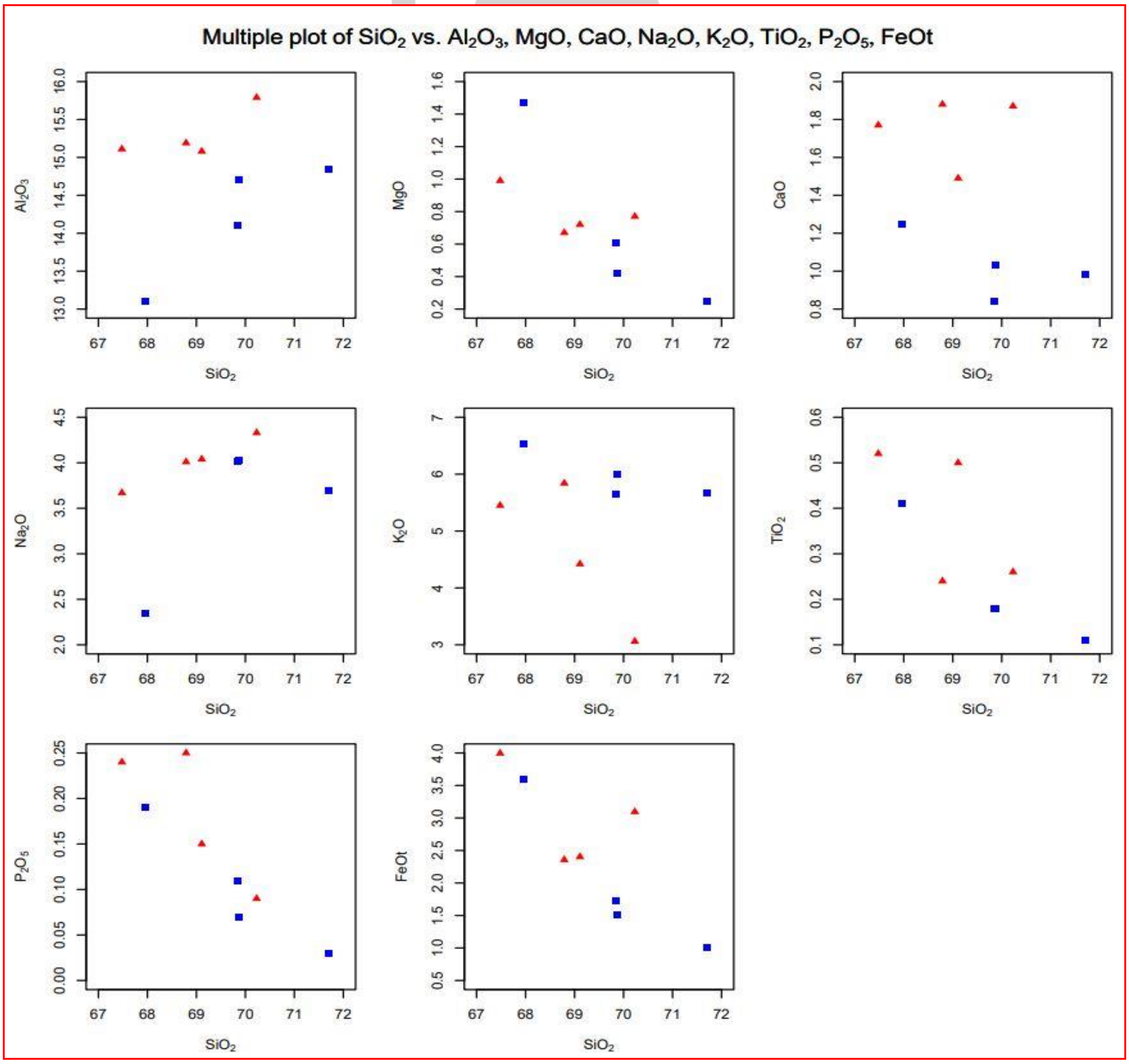


**Fig-7:** Harkar variation diagram of Kakarlapahad granites


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The $Al_2O_3$ also represents a limited variation ranging from 13.44 to 14.15%, which is metaluminous and peraluminous in character. The Mothkur granites are similarly related to the present area. A correlation of major oxide compositions is plotted (Fig-7). The granites exhibit $K_2O$ > $Na_2O$, where the high contents of $Al_2O_3$ and $K_2O$ are due to the presence of K-feldspar. The MnO and MgO contents are low (see Table.2). The CaO content ranges from 0.42 to 1.47%, attributed to the presence of amphibole and plagioclase feldspar grains at medium levels.

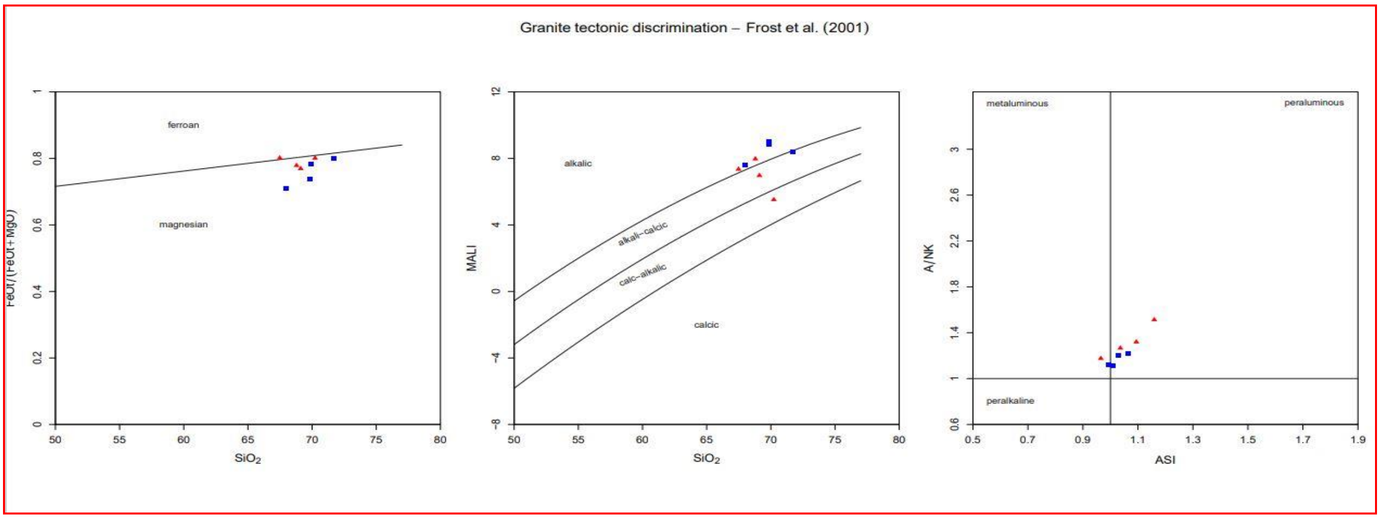


**Fig-8:** Techtonic discrimination diagram of Kakarlapahad granites by Frost et al,. 2001

**Table-2: Major elements of Granites from present study and compare with the other area**

| | KKP-1 | KKP-2 | KKP-3 | KKP-4 | MG-4 | MG-9 | MG-16 | MG-20 |
|---|---|---|---|---|---|---|---|---|
| SiO2 | 69.88 | 69.85 | 67.97 | 71.71 | 67.48 | 70.23 | 69.11 | 68.79 |
| TiO2 | 0.18 | 0.18 | 0.41 | 0.11 | 0.52 | 0.26 | 0.5 | 0.24 |
| Al2O3 | 14.70 | 14.10 | 13.10 | 14.84 | 15.11 | 15.79 | 15.08 | 15.19 |
| Fe2O3 | 1.68 | 1.92 | 3.99 | 1.11 | 4.44 | 3.44 | 2.67 | 2.62 |
| MnO | 0.02 | 0.03 | 0.05 | 0.02 | 0.03 | 0.04 | 0.03 | 0.03 |
| MgO | 0.42 | 0.61 | 1.47 | 0.25 | 0.99 | 0.77 | 0.72 | 0.67 |
| CaO | 1.03 | 0.84 | 1.25 | 0.98 | 1.77 | 1.87 | 1.49 | 1.88 |
| Na2O | 4.03 | 4.02 | 2.34 | 3.70 | 3.67 | 4.33 | 4.04 | 4.01 |
| K2O | 5.99 | 5.64 | 6.53 | 5.66 | 5.45 | 3.06 | 4.42 | 5.84 |
| P2O5 | 0.07 | 0.11 | 0.19 | 0.03 | 0.24 | 0.09 | 0.15 | 0.25 |
| LOI | 0.57 | 0.79 | 0.98 | 0.53 | 0.76 | 0.5 | | 0.83 |
| Sum | 98.57 | 98.08 | 98.29 | 98.92 | 100.45 | 100.37 | 98.21 | 100.34 |

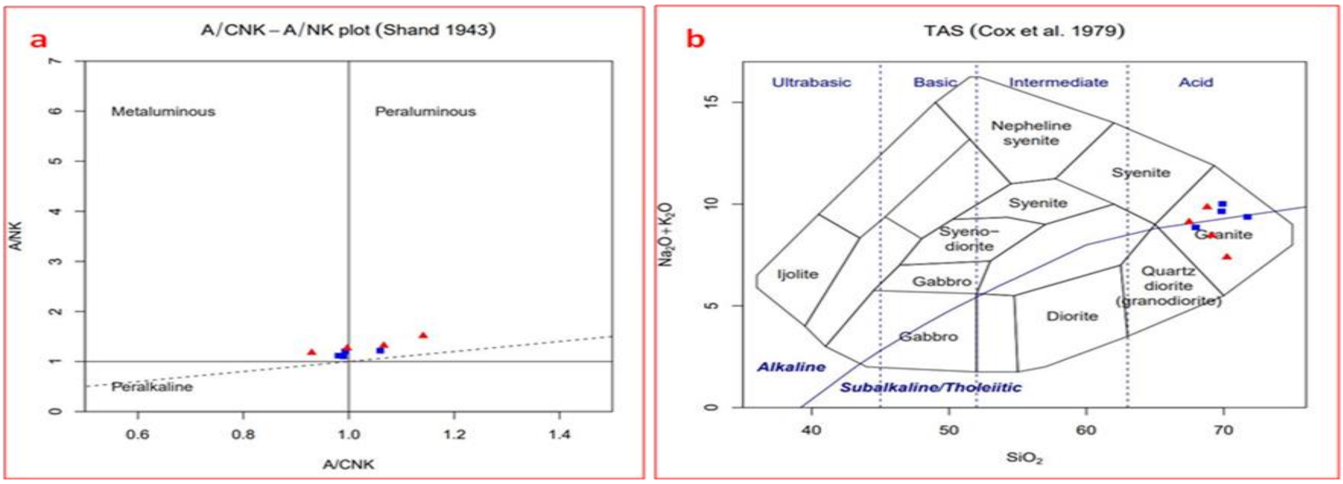


**Fig-9:** (a) Al- saturation index (Shand 1943) and (b) TAS (Cox et al, 1979) diagrams of Kakarlapahad granites.

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The granites of the Kakarlapahad located in the field of metaluminous and Peraluminous (Fig- 9a) given by Shand (1943). All the samples of the study area are seen plotted in the granite field of defining the composition ranging from granite to granodiorite. The generalized TAS diagrams (Fig- 9b) of granites from all areas are plotted as given by Cox et al. (1979).

**Table 3: Trace. RE elements of Granites from present study and compare with the other area granites**

| Analyte | KKP 1 | KKP 2 | KKP 3 | KKP 4 | MG-4 | MG-9 | MG-16 | MG-20 |
|---|---|---|---|---|---|---|---|---|
| **Sc** | 1.810 | 1.197 | 13.639 | 1.866 | 4.40 | 5.18 | 2.43 | 2.31 |
| **V** | 21.030 | 11.905 | 28.102 | 13.148 | 52.04 | 30.94 | 28.46 | 33.64 |
| **Cr** | 109.596 | 68.832 | 115.375 | 149.201 | 13.74 | 14.56 | 14.12 | 17.13 |
| **Co** | 3.570 | 2.854 | 11.116 | 2.359 | 6.02 | 4.57 | 4.29 | 5.15 |
| **Ni** | 4.029 | 3.782 | 5.568 | 4.076 | 1.55 | 0.86 | 1.61 | 1.46 |
| **Cu** | 2.154 | 1.405 | 1.178 | 1.156 | 7.73 | 16.99 | 5.54 | 60.21 |
| **Zn** | 14.219 | 20.729 | 41.859 | 16.058 | 66.66 | 98.82 | 64.72 | 295.40 |
| **Ga** | 17.024 | 10.560 | 14.968 | 16.204 | 18.92 | 17.81 | 16.87 | 16.93 |
| **Rb** | 202.436 | 120.379 | 197.535 | 275.964 | 195.67 | 122.57 | 134.33 | 143.92 |
| **Sr** | 169.277 | 92.526 | 173.724 | 138.953 | 231.58 | 258.10 | 227.56 | 906.34 |
| **Y** | 11.146 | 5.763 | 30.304 | 3.305 | 8.12 | 4.82 | 2.35 | 4.88 |
| **Zr** | 366.087 | 208.251 | 520.442 | 350.766 | 763.28 | 287.70 | 319.76 | 232.69 |
| **Nb** | 9.682 | 4.651 | 18.410 | 4.527 | 13.41 | 18.56 | 5.76 | 6.01 |
| **Cs** | 0.442 | 0.248 | 1.086 | 2.362 | 0.85 | 0.77 | 1.02 | 0.89 |
| **Ba** | 701.155 | 390.087 | 795.689 | 464.531 | 1082.78 | 606.45 | 959.50 | 1133.03 |
| **Hf** | 8.656 | 4.742 | 12.664 | 9.240 | 19.36 | 7.73 | 8.67 | 6.86 |
| **Ta** | 0.636 | 0.283 | 1.358 | 0.493 | 0.90 | 0.85 | 0.63 | 0.60 |
| **Pb** | 69.664 | 22.170 | 37.209 | 41.091 | 28.78 | 27.62 | 26.22 | 55.10 |
| **Th** | 50.091 | 9.976 | 41.003 | 32.576 | 39.53 | 15.37 | 13.31 | 51.32 |
| **U** | 2.911 | 0.777 | 4.749 | 7.609 | 2.04 | 0.96 | 1.86 | 9.01 |
| REE | | | | | | | | |
| **La** | 110.350 | 31.905 | 64.780 | 41.769 | 64.76 | 31.91 | 43.29 | 120.53 |
| **Ce** | 211.413 | 61.684 | 135.467 | 76.142 | 112.84 | 53.39 | 69.26 | 191.44 |
| **Pr** | 20.615 | 6.125 | 15.455 | 6.657 | 12.47 | 5.78 | 7.30 | 19.10 |
| **Nd** | 52.916 | 17.005 | 48.045 | 16.185 | 40.49 | 18.44 | 23.37 | 57.22 |
| **Sm** | 5.905 | 2.248 | 8.859 | 1.603 | 5.46 | 2.98 | 2.81 | 6.04 |
| **Eu** | 1.007 | 0.520 | 1.436 | 0.752 | 1.05 | 0.94 | 1.13 | 1.10 |
| **Gd** | 2.832 | 1.234 | 5.562 | 0.792 | 3.60 | 2.38 | 1.68 | 3.31 |
| **Tb** | 0.369 | 0.183 | 0.961 | 0.092 | 0.43 | 0.31 | 0.15 | 0.31 |
| **Dy** | 1.902 | 0.981 | 5.194 | 0.518 | 1.98 | 1.30 | 0.60 | 1.19 |
| **Ho** | 0.380 | 0.197 | 1.029 | 0.123 | 0.33 | 0.21 | 0.11 | 0.19 |
| **Er** | 0.978 | 0.505 | 2.580 | 0.385 | 0.68 | 0.42 | 0.28 | 0.45 |
| **Tm** | 0.132 | 0.068 | 0.338 | 0.063 | 0.12 | 0.08 | 0.07 | 0.10 |
| **Yb** | 0.873 | 0.445 | 2.178 | 0.458 | 0.67 | 0.44 | 0.40 | 0.65 |
| **Lu** | 0.125 | 0.063 | 0.304 | 0.071 | 0.12 | 0.08 | 0.08 | 0.09 |

The low abundance of compatible elements like Ni (3.782 to 5.568 ppm), Cu (1.156 to 2.154 ppm), and Co (2.359 to 11.116 ppm) suggest that all granites of the study area represent a compositional variation that is highly dominated by the fractional crystallization process (O' Hara and Fry, 1996). The granites have a relatively high Ba, Sr, Rb, Zr and Cr and low Cu, Co, Ni, similar to granites differentiated from a mafic-rich magma originating from a mantle source. From the geochemical aspect pertaining to Sr-CaO relation, suggests that the Sr substituted Ca mostly in hornblende and not in plagioclase. The high content of Ba and Sr is attributed to the presence of partially altered K- feldspars. A similar conclusion can be noted based on K and Rb relation.

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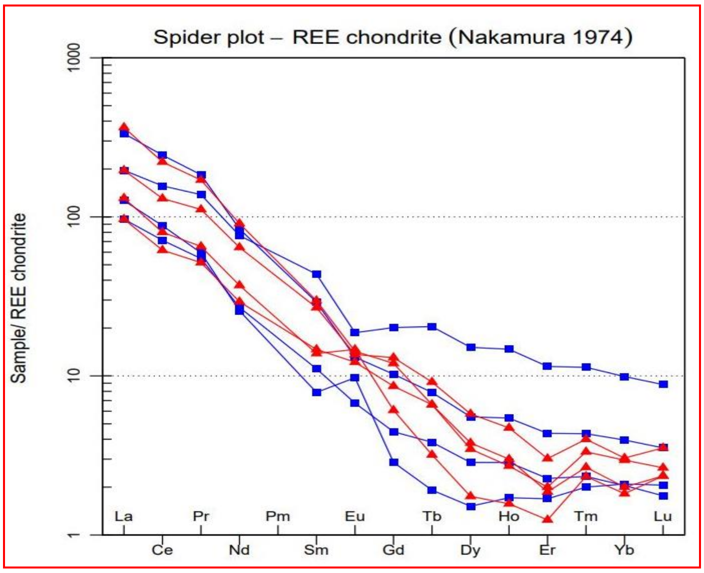


**Fig-10:** Chondrite normalized REE (Nakamura 1974) diagram of Kakarlapahad granites.

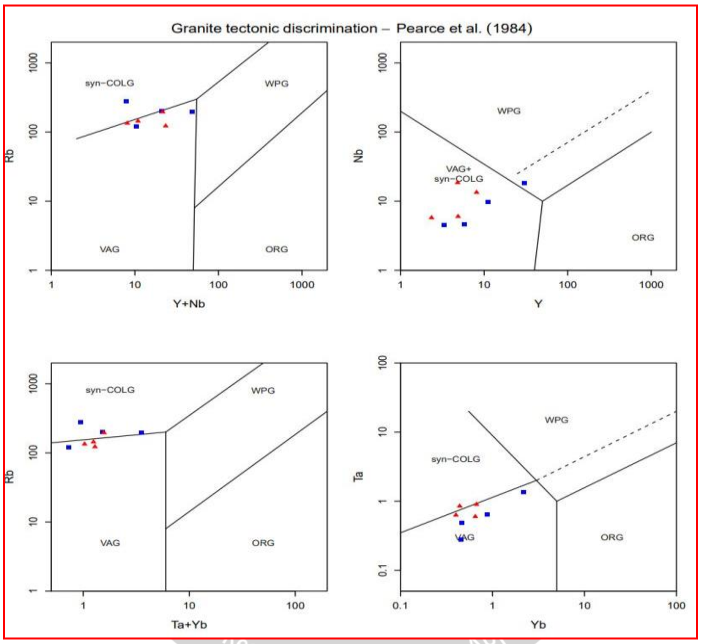


**Fig-11:** Techtonic discrimination diagram of Kakarlapahad granites by Pearce et al., 1984.

The granites of Kakarlapahad, and Mothkur have high LILE and HFSE that display enrichment in LREE. HREE depleted pattern in the chondrite normalized plots with perceptible Eu anomalies (Fig-10), thereby hinting the role of plagioclase fractionation in the genesis of granites from the areas of Kakarlapahad and Mothkur. The granite is probably formed by fractional crystallization of mantle-derived magmas with biased assimilation of older crust and contents in CaO, MgO, FeO, $TiO_2$, and $SiO_2$, indicating that the granites were produced by fractional crystallization of plagioclase, pyroxene and hornblende.

## IV. DISCUSSION

Petrographic studies reveal the presence of both K-feldspar and plagioclase as individual phases indicating subsolvus conditions of crystallization to the magma and based on the modal composition of QAP diagram (Streckeisen, 1974) study area get located clearly in granitic field Fig-6 (monzogranite). The granites of Kakarlapahad are derived from the melts that have a shoshonitic character, have been amply endorsed in the geochemical signatures and an overall positive correlation of $SiO_2$ with $K_2O$ and attributes like low $TiO_2$ content (0.11-0.41% wt) and $Al_2O_3$ contents (13.10 to 14.84 wt%) endorse and support of the shoshonitic character of the granites of Kakarlapahad and other related area of Mothkur exhibit their calc-alkaline signatures that are displayed in the AFM (Irvine+Baragar 1971) plots of granites of the study area shows alkaline field & suggests that the granitic rock represents the intrusive nature of the magmatic arc (Fig-8). From the geochemical data, the following features are evident. The oversaturated silica character, as evident expressed through powerful modal and normative

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quartz. The A/CNK plot (Shand 1943) Fig-9a befitting in metaluminous and peraluminous nature reflected in the low ASI values; with high total alkali and sub alkaline affinity evident in the TAS diagram (Cox et al, 1979) Fig-9b indicate Kakarlapahad and Mothkur areas are fall within the granitic segments. Here major oxide wt% has been plotted against $SiO_2$ in order to understand the evolution of magma through element partitioning. The granite samples of the study area are plotted in the Fig-7.

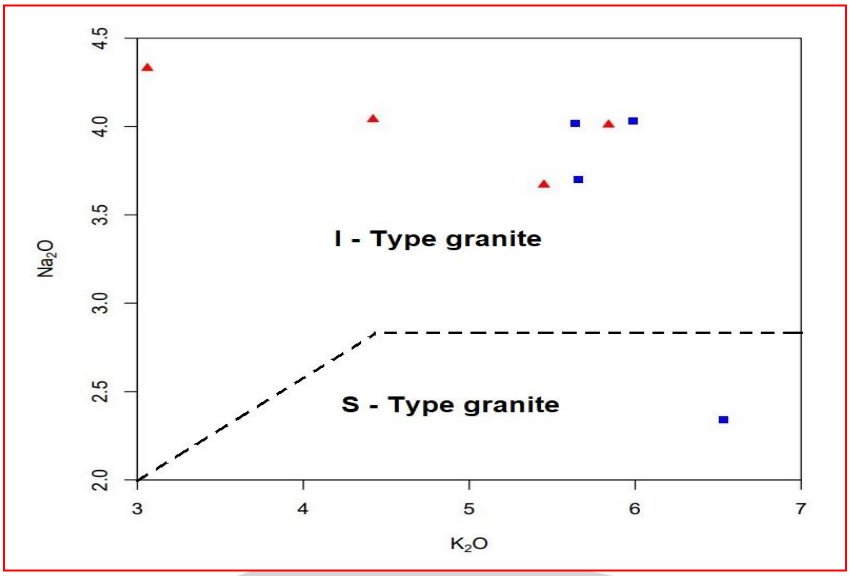


**Fig-12:** The $K_2O$ vs $Na_2O$ diagram suggested by Chappell, B.W and White, A.J.R. (1974),

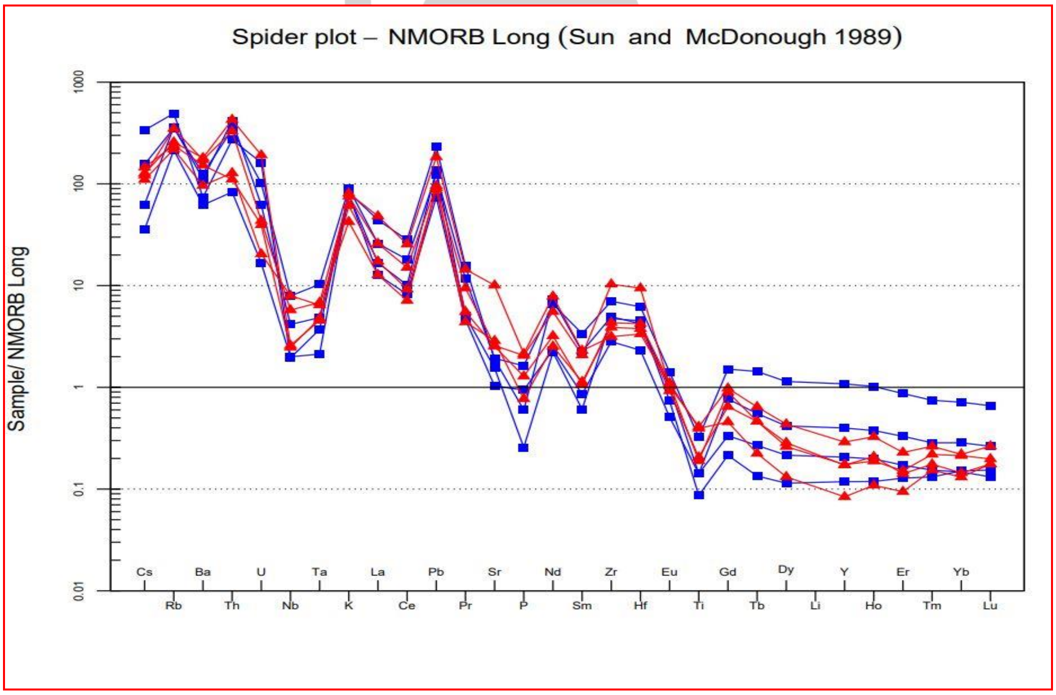


**Fig-13:** Primordial mantle normalized multi-element spidergram (Sun & McDonough 1989).

When the molar values for study area granites of the $K_2O$ vs. $Na_2O$ are plotted in the diagram suggested by Chappell, B.W and White, A.J.R. (1974), most of the samples fall in the I-Type & one of the sample fall in S- Type Granite field (Fig-12). A general enrichment in Cr, Rb, Sr, Zr, and Ba and low abundances of compatible elements like Sc, Co, Ni, etc. On a primordial mantle normalized multi-element spidergram (Fig-13) (Sun & McDonough 1989). Distinctive peaks at Rb, K, Nd and Pb and troughs at P and Ti. REE and LILE-enrichment that probably formed by partial melting of an enriched mantle source (Moyen et.al. 2003). The chondrite normalized REE diagram for the Kakarlapahad and Mothkur granites patterns, see Fig-10 Nakamura (1974) reveal a general enrichment of LREE, negative Eu anomaly, two of the samples are showing positive Eu anomaly and depleted HREE patterns, a characteristic feature of granites emplaced during Archaean-Proterozoic transition. Tectonic discrimination diagram representing all samples are of volcanic arc granites (VAG) and synchronized with collision activities (Syn-COLG) (Fig-11). Y+Nb vs Rb, Y vs Nb plots of Pearce et al. (1984) to decipher the tectonic setting. The samples plot in the fields of VAG + Syn-COLG (volcanic arc granite + syn-collisional granite).

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## V. CONCLUSION

Detailed field, petrographic and geochemical studies of the Kakarlapahad granites from Mahaboobnager of Southern Granulite Terrain indicate that mineralogically they fall in the Granitic suite. Granitic suite of rocks are widely, emplaced during the Archaean-Proterozoic transition in the granulite terrain in Southern India observed.

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