PETROLOGICAL STUDIES OF GRANITOIDS ROCKS FROM MUSHAMPALLY AREA OF THE NALGONDA DISTRICT, TELANGANA STATE, INDIA

Study Project

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DECLARATION

The present work of the project work entitled "Petrological Studies of granitoids rocks from Mushampally area of the Nalgonda District, Telangana State, India" is entirely carried out by us under the **supervision I.Chandraiah** in the Department of Geology, Nagarjuna Government College (Autonomous), NAAC(B),Nalgonda.

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CERTIFICATE

This is to certify that the subject matter of theproject work entitled "Petrological Studies of granitoids rocks from Mushampally area of the Nalgonda District, Telangana State, India" submitted for the award of project work onGeology, in the Department of Geology, Nagarjuna Government College, Nalgonda is the bonafide project work carried out by following students under my guidance and supervision.

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Acknowledgment

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1. INTRODUCTION

Introduction to Granitoids

The term granitoid is derived from the *Latin* word "granum" which means 'grain' due to its granular nature and *Italian* term "granire" which means to granulate or make grainy.

The term granitoid(sensustricto) applies to the suite of felsic plutonic rocks that are composed of quartz and feldspars on different proportions. The proportions of these minerals define the rock types. Plagioclase feldspar predominates in tonalite and alkali feldspar is abundant in alkali granite and both feldspars are present in granite and granodiorite. Trondhjemite is a variety of tonalite that is unusually quartz rich and contains sodic, not calcic plagioclase. The proportion of mafic minerals varies from 20-40% of hornblende and biotite in granodiorite and hornblende only in tonalite. Pyroxene, micas (biotite and muscovite) and hornblende are found in less proportion in granite, adamellite, quartzmonzonite and other felsic rocks.

Most of the granitoids of significant volume occur in areas where the continental crust has been thickened by orogeny, either continental arc subduction or continental collision. Many of them may be postdated the thickening event by few tens of millions of years. Because the crust is solid in its normal state, some thermal disturbance is required to form granitoids. The general consensus of many petrologists is that the granitoids are derived by either partial melting of crustal or differentiation mantle material.

Several workers have wisely adopted the term **granitoid**for the broader *(sensulato)* usage. Such a broad spectrum of rock types will have a broad range of sources and different genetic processes (more than one). Since Read (1956) has pointed out that there are 'granites and granites', many geologists have triedtodistinguish and classify the various types of granitoids. The first classification of granitoids was bimodal (e.g. intrusive vs autochthonous granitoids by Raguin 1957; orogenic *vs* anorogenic by Martin andPiwinskii1972; leucogranites are of monzogranites to granodiorites by Didier and Lameyre 1969; I-type *vs* S-type by Chappell and White 1974; ilmenite-series vs magnetite-series by Ishihara 1977) and it was not reflect the complexity of granites. While the complexity of granitoids was intruded by the diversity of the origins, sources, subsequent processes (melting, mixing or mingling,

differentiation, contamination, assimilation,.etc), and intrusive or autochthonous nature in various tectonic settings (Barbarin 1990).

IUGS Classification of Granitoids

The traditional IUGS petrographic classification of granitoids is based upon their modal abundances of quartz, plagioclase and alkali feldspar (Streckeisen, 1967). The IUGS classification focuses on differences in abundances and compositions of the feldspars and accounts for a wide variety of granitoids. The advantage of the IUGS classification is that, for most rocks, it can be readily applied in the field. Furthermore, it is inexpensive, simple to use, and truly non-genetic. A major drawback of the IUGS classification scheme is that it ignores compositional variations apart from those that affect the feldspar abundances. Thus mafic and felsic granitoids may plot in the same field but have significantly different chemical compositions. Further-more, the classification cannot address the presence or absence of minor phases, such as muscovite, which may carry significant petrologic implications. For this reason many petrologists have used additional schemes as a way to further classify granitoids.

2. GEOLOGY OF THE AREA

The study area occupies the NE part of Eastern Dharwar Craton (EDC) around Mushampally area of Nalgonda district and is located ~10 km south-east of Nalgonda town The area is bounded by between Latitudes: 16°53'39"N to 16°54'41"N and Longitudes: 79°20'54"E to 79°22'33"E.The area mainly comprises of granitoids of Precambrian age which forms a part of the unclassified crystalline rocks of Peninsular Gneissic Complex (PGC). The outcrops include a variety of pink granites and gneissic grey granites.Quartz veins, quartz reefs, and epidote veins are observed as cross-cutting or bodies in the granitoids and are sometimes folded and deformed. Dolerite dykes have large scale cross-cutting relationship with the granitoids of the study area Fig 1

Granitoids

Granites in the study area are generally classified into two types- (i) Grey and (ii) Pink varieties. It covers the major segment of the area. They are occur as sheeted outcrops of varying sizes. The difference between pink and grey varieties is essentially based on the colour of the feldspar. The pink granite is dominated by potassium feldspar while grey granite is essentially made up of grey plagioclase feldspar. The contact between pink and grey granite is sharp as well as gradational relationships.

Grey granite

It occurs as massive domes and mounds, sometimes it interspersed with pink granite in the area. Grey granites normally cut by irregular quartz veins, epidote veins, pegmatite, dolerite and basic enclaves. Deformation and alteration of both feldspars are frequently noticed.

The outcrops of grey granite are in the form of patches and small hillocks. At places, the grey granites contain dark inclusions of small to large dimensions with different shapes of mafic enclaves. Such inclusions are not observed in pink granite and it is one of the major differences between grey and pink granites. Pegmatite-epidote veins are also observed near the contact between grey and pink granites.

The Grey granite is characterized by dark grey in color, massive and coarse grained. It shows equigranular to inequigranular texture and contains chiefly quartz, plagioclase feldspar and alkali feldspar in that order of abundance. Hornblende & biotite form subordinate mafic minerals. Magnetite, fluorite, apatite and epidote occur as accessories. The plagioclase feldspar is dominant over K-feldspar, and hornblende is greater than biotite in grey granite. The muscovite is practically unnoticed in these rocks.

Pink granite

The outcrops of pink granite are in the form of massive boulders or sheeted bodies. They show typically both equigranular and inequigranular porphyritic textures. Sometimes they occasionally exhibit aplitic texture. The Pink Granite is characterized by pink in colour, massive form, and medium to very coarse-grained equigranular texture. It consists of chiefly quartz, K-feldspar-(orthoclase/microcline), plagioclase, hornblende and biotite. Magnetite, apatite, fluorite and epidote occur as accessories. The dominant K-feldspar in these rocks is microcline or microcline-perthite and it is dominant over plagioclase feldspar.

Transitional types of granites occur as small outcrops all over the area.

Basic dykes

The study area is traversed by numerous basic intrusives(dolerites) with variable dimentions. The length varies from tens of meters to hundreds ofmeters and the width varies from a meter to 20 meters. Strike directions of the intrusives are NE-SW at erugantipally cross road and N-S at Ithamarigudem. They show a general apparent width of up to 20 meters, which is 100% or more than their true thickness, because of the regularly strewn boulders along their borders. This is a common feature of the basic dikes. They stand out prominently as linear ridges with a relief of up to 30 meters above the enclosing country rock. They are free from any further invasions. The color of the rock is melanocratic in nature. The grain size of dykes is variable from fine to medium to coarse grained. The frequency of joints in these rocks is distinctly higher than the enclosing country rock and the number of joints are inversely proportional to thickness of dykes. Transverse jointing is of utmost prominence in the thin ones and is insignificant or absent in the major dykes.

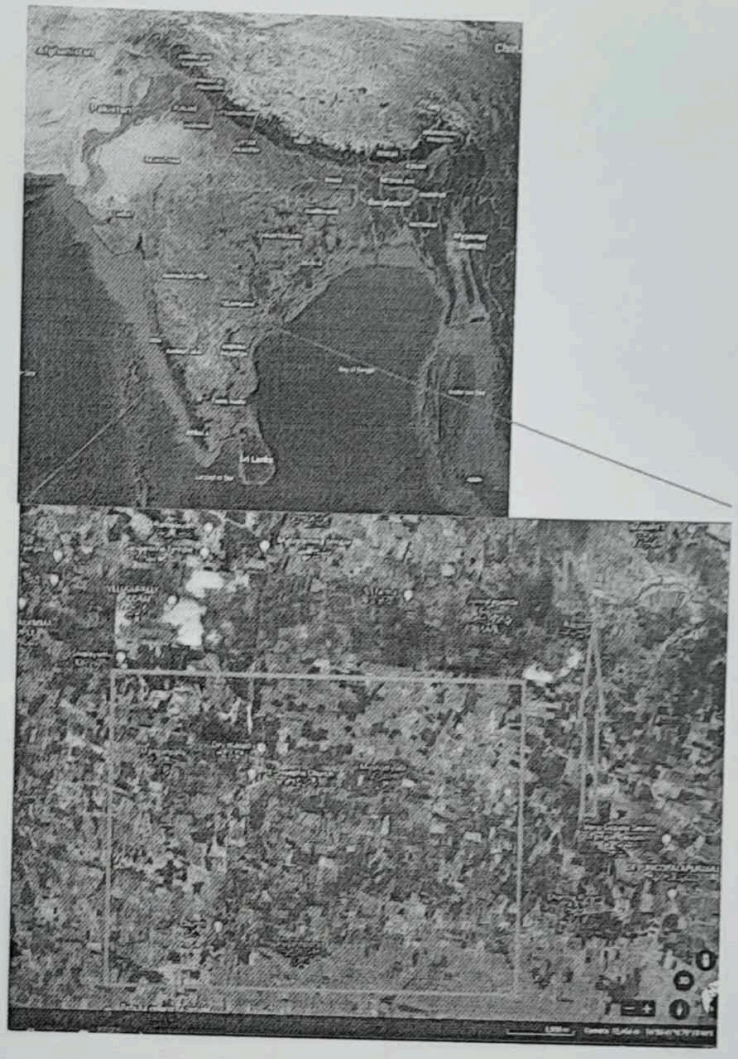

Fig.1 Location (source Google) map of the area

Field photographs

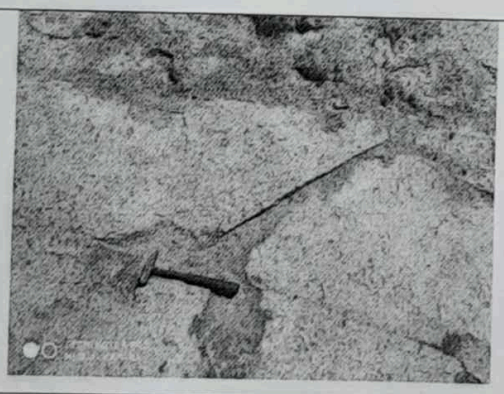	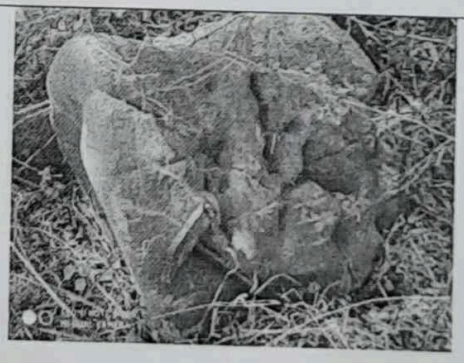
Figure 2. geanitoid shown by two set of joints at Mushampally area	Figure 3. Dolerite boulder crosscut the contry rock at Mushampally area

3. PETROGRAPHY OF THE AREA

Classification of granitoids and basic dykes (dolerites) of the Mushampally area

In this , the modal compositions of the granitoids and basic dykes (dolerites) Mushampally area of Nalgonda district are listed in the Table 1, and are shown in the Figure 4. Point counting method of Chayes (1956) was employed to estimate the modal compositions of the felsic granitoids and dolerites. The number of the points counted for modal analysis depends upon the texture of the rocks. Therocks of the study area are classified as a monzogranitebased on the modal % of quartz (Q), alkali feldspar (A) and plagioclase (P) by using classification scheme of Streckeisen, 1974. The rocks are plotted in QAP triangular diagram after recalculating into 100%. On the basis of this mineralogical classification scheme of Streckeisen, 1974, 1976, the rocks are plotted in monzogranite fields in the QAP diagram of Le Maitre et al ., 1989 (Figure 4).

Table 1 Modal analyses of granitoids and associated mafic rocks of the Mushampally area

	Granites	
Sample No	M1	M2
Quartz	33	32
K-Feldspar	26	29
Plagioclase	32	31
Biotite	3	3
Hornblende	4	3
Magnetite	1	1
Others	1	1
	100	100

Others: apatite, iron oxide and chlorite

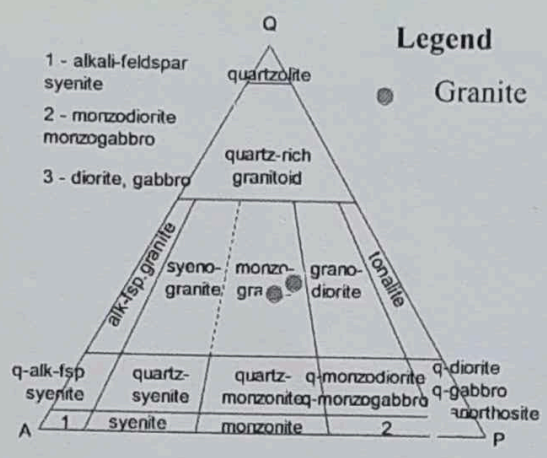

Fig 4. The QAP modal classification scheme for the rocks of the Mushampally area (after Streckeisen, 1974, Le Maitre et al., 1989).

The granites of the Mushampally area are grey and pink varieties and they are massive in form and they are mediumto coarse-grained in nature. They show variety of textural features such as equigranularhypidiomorphic to inequigranularporphyritic. Myrmekitic texture occasionally exhibited by these rocks. The primary minerals of granites include quartz, plagioclase, K-feldspars, hornblende and biotite occurring as essential minerals. Apatite, zircon, epidote and opaque constitute as minor phases. The secondary alteration products are represented by kaolinisation, sericitisation and chloritisation, in these rocks by the deuteric alteration of primary K-feldspar, plagioclase feldspar, hornblende and biotite.

Quartzis an important constituent of the granites. The modalcomposition of quartz ranges from33 to 32%. It commonly occurs as colorless anhedralgrains, and shows first order grey to yellow polarization colours and wavy extinction in crossed polarised light. Sometimes, quartz shows fine grained, recrystallized and xenomorphic texture. Quartz occurs in association with alkali feldspar (microcline)and plagioclase in these rocks and its grain size varies from 1 mm to 3.5 mm.

K-feldspars of the granites are mostly microcline perthite and microclinevarieties.These together make up 26-29% of the modal composition. These minerals show subhedraldiscrete grain habits. Perthites are of both flame and string types. Microcline is occasionally altered to kaolin, String Perthiteis developed between plagioclase and K-feldspar by intergrowth phenomenon in grey granite. Deformed cross-hatched twinning is present in microcline and contains inclusions of rounded quartz and tabular hornblende grains, Carlsbad twinning is prominent in perthite containing opaque inclusions .

Plagioclasein granites occurs as medium to coarse grained and subhedralin form. It makes up 32-31% of the total mode of the rocks. Altered plagioclase exhibits variable degrees of alteration to sericite, selectively along the cleavage planes.Myrmekitic texture is uncommon in granitoids of study area and it is formed by the intergrowth between quartz and plagioclase at the margins of K-feldspar.

Hornblende is medium to coarse grained and subhedral to anhedral in form. The modal composition of hornblende ranges from less than 4 %. It shows light green to dark green pleochroism. Hornblende alters to chlorite along the cleavage planes and grain boundaries.

Biotite is a common mafic mineral in granites. The modal composition of biotite range up 3%, and it shows light brown to dark brown pleochroism. It shows frequent alteration to chlorite. Inclusions of apatite and magnetite are commonly seen in biotite.

Accessory minerals

Apatite, sphene and magnetite are the main accessory minerals in granites of the Yerrabelly area. Besides, there accessories chlorite and epidote occur as common secondary minerals.

Micro photo graphs

Figure 5. Myrmekitic texture in pink granite note on scale XPL]

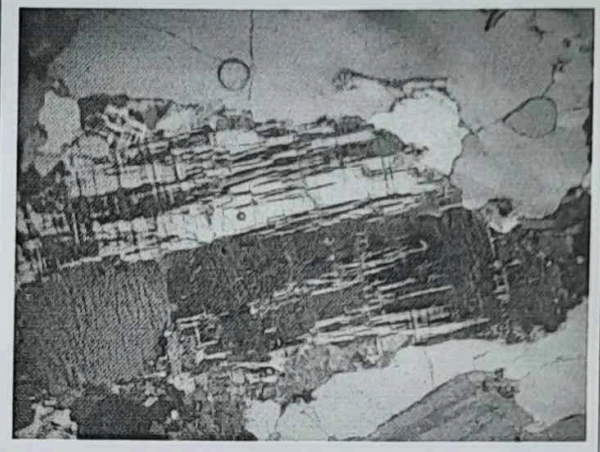

Figure 6. granitoid shown crosshatched twinning XPL

Figure 7 granitoid shown chloritization of mafic mineral XPL

Figure 8 granitoid shown excelent biotite miners under the plain polaries light PPL

CONCLUSIONS

The field relationships of the granitoids suggest that the felsic granites are formed at the most by magmatic crystallization of felsic magma, which is generated by partial melting of lower crust rocks (amphibolitiefacies metamorphic rocks) or diorite crust.