Geological investigations and their microscopic properties of the granitoid suite of rocks

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***Abstract*: Our focus here is strictly on the interior and border regions of the Amangal and Mahbubnagar Districts. The goals of the field season programme were to characterize the granitic terrain, as well as to explore shear zones, faults, and pegmatite veins to identify the relative importance of each in the genesis of the Au-Cu-Mo mineralization. Examining the petrography, mineral chemistry, shear zones, faults, and pegmatite veins of these granitoids is central to this study's overarching goal of defining their geological features. Researchers can then see if there is a correlation between these characteristics and the presence of gold, copper, molybdenum, fluorite, and rare earth elements. A region about 70 km2 in size (Toposheet No. 56L/9) was mapped using "Specialized Thematic Mapping" at a 1:25,000 scale.**

***Keywords*: Granitic terrain, genesis petrography mineral chemistry, shear zones, faults, and pegmatite veins.**

I. INTRODUCTION

Research on the granitoid rock family was carried out in the Amangal region of the Mahbubnagar district in Telangana, as well as in the areas immediately surrounding it. Toposheet number 56 L/9 of the Survey of India contains a representation of it [1-4].

Tonalite and granodiorite, two distinct types of granitoids, made up the majority of the terrain in this area. Rocks that are part of the Monzogranite (TGM), Monzosyeniye, and Syenogranite suites. Granitoid, also known as granitic rock, is a type of coarse-grained plutonic rock that has a striking resemblance to granite in terms of both its mineralogy and its chemical make-up. The majority of the rock is composed of feldspar and quartz, which together make up the mineralogy. Granite, quartz monzonite, quartz diorite, syenite, granodiorite, and trondhjemite are all types of rocks that fall under the granitoid category. The development of many is influenced in equal measure by two processes [5]: the subduction of continental arcs and the collision of sialic masses. Granitoids and volcanic rocks are two types of rocks that are quite similar to one another and frequently came from the same location [6].

However, after a significant amount of time spent being eroded, they frequently become worn away and disappear. Granitoid rocks can be found in abundance in locations that have seen crustal thickening as a result of orogenies. However, there are also granitoids that are not related with convergent boundaries or subduction zones. Anorogenic granitoids are the name given to several types of granitoids [7-8]. These anorogenic granitoids could be the deep origins of rift volcanism, which have recently become apparent in regions where erosion has removed volcanic rocks and other indicators of rifting. These A-type granitoids may have been formed as a result of hotspots or mantle plumes [9-10].

1.1.1 LOCATION AND ACCESSIBILITY

This research project includes Telangana's Mahbubnagar district. Amangal's neighbour is Kalwakurthy. Amangal is 60 km south of Hyderabad via road [11-12]. SH-5 passes through the area. Rajiv Gandhi International Airport is 35 km from Amangal. The most convenient station is Hyderabad. Mall, Chintapalle, and Mallepalle are connected via the Hyderabad-Nagarjuna Sagar route (SH-19). Mallepalle is 40km from Nagarjun Sagar. Forest roads, metaled and unmetalled roads, and trails connect the region's settlements. Post, phone, and telegraph offices connect the region's components. Karthal is the northern boundary between Rangareddy and Mahbubnagar [13-17].

1.1.2 PHYSIOGRAPHY AND DRAINAGE

The region has moderate undulations and isolated hills. Lithology determines the region's geomorphology and drainage. Granitoids are hilly. The region's highest peak is in the Mudhivenu reserve forest in the north (TS No. 56L/9). Ghatla Mallepalle is 333 meters above sea level (MSL). In the study area, hills trend northwest-southeast and east-west. Sometimes granitoids appear as sheets. The region has granite tors, knolls, mounds, and inselbergs, as well as dolerite dyke and quartz reef linear ridges. Erosion generated these formations [18-20].

Figure 1: Map showing location of the study area

1.2 GRANITOID SUITES

Each suite's distribution, general characteristics, and enclave types are described separately. This research evaluated granitoids with various components. Granitoids of the TGM suite are characterized by their textures and mineral composition. TGM granitoids contain plagioclase feldspar, k-feldspar, quartz, hornblende, and biotite. Most abundant to least abundant are zircon, sphene, opaque minerals, and apatite. MS suite minerals are quartz, potash feldspar, and plagioclase feldspar. Biotite is an accessory mineral, although hornblende is rare. Accessories include magnetite, sphene, zircon, apatite, and opaque [21-22].

1.2.1. Monzogranite-Syenogranite Suite (Ms)

The Monzogranite-Syenogranite Suite (MS) can be recognized by its massive hills or boulder outcrops and can be found across the bulk of the area that was researched. The distinction in composition that exists between monzogranite and syenogranite is so little that it can only be called gradational in nature. The MS suite includes pegmatite and aplite's of differing sizes and locations in a number of diverse settings. The MS suite and the TGM suite interact with one another in a gradual way [23-24].

1.2.2. MONZOGRANITE

Monzogranite is a massive, rosy-pink, holocrystalline mineral with medium-to-coarse grains. Granular and hypidiomorphic best describe its texture. It is mostly composed of the mineral's quartz, plagioclase, and k-feldspar. Microcline is the most common k-feldspar; however, orthoclase is also present in small amounts. Biotite is the only mafic component, whereas hornblende is a rarer one. Accessories include zircon, titanite, ilmenite, sphene, and opaque. Despite its narrow compositional range, monzogranite nonetheless defines a differentiation trend that is mostly governed by the partitioning of biotite and plagioclase. With its subhedral plagioclase, euhedral microcline, and quartz, the texture is quite similar to that of granodiorites. In contrast, microcline is typically perthitic and is made up of plagioclase and quartz crystals with very small sizes. Sub-grain formation, quartz recrystallization, mineral grain periphery granulation, and myrmekite production along feldspar boundaries were all seen as a result of the deformation [25-26].

1.2.3. SYENOGRANITE

MS granites are typically pink, leucocratic syenogranite with medium to exceptionally coarse grains. The rocks are composed of minerals like quartz, k-feldspar, plagioclase feldspar, biotite, and hornblende. Most of the phenocrysts in porphyritic rocks are made of alkali feldspar. In some spots, the rock has a granophyre-like texture. When examined under a microscope, it exhibits a hypidiomorphic granular structure. Feldspars are subhedral-shaped, medium-sized minerals. As an interstitial mineral, K-feldspar is present. You can observe the new perthitic texture under a microscope. Large quantities of perthite can be found in this granite. Sometimes plagioclase will have a slightly sericitized and tarnished appearance. Biotite is the most common mafic mineral, followed by amphibole and chlorite. Zircon is another component of the supplementary phases. Evidence of sub grain quartz formation can be detected in syenogranite under a microscope [27-28].

1.2.4 STRUCTURES

A stretching lineation may be found in the mylonite in the area around Murtuzapalle, with its southern end oriented 250 kilometres north-south on the N-S plane. In the city of Murtuzapalle There are also shear folds visible, with their axial plane gradually orienting along the C plane. Deformation of this litho unit occurred in two stages, as suggested by the presence of sheared granite in the Murtuzapalle region. The ductile deformation came after the brittle deformation. The rock has undergone ductile deformation at a deeper level, yet brittle deformation at a shallower one. A brittle deformation manifests itself in the form of crushing, granulation, and the development of angular grains. Foliation is fully developed on every angular grain, proving that all of the grains have been deformed ductilely [29-31].

1.2.5 ROCKS

Rock denotes the substance that forms the outermost portion of Earth's crust. Several types of mineral aggregates make up this stratum. When comparing granite to marble, the latter is a multi-mineral rock whereas the former is a mono-mineral rock. While a rock's mineral composition is mostly constant, the kind of minerals it contains determine its chemical composition. Since the amount of each mineral changes, it can't be represented by a single formula. Color, density, mechanical strengths, fusibility, and so on are only some of the many physical properties that distinguish one type of rock from another [32-33]. In general, rocks include mineral grains that are numerically or qualitatively consistent but that vary in their textures, physical properties, and the geological processes that gave rise to them. The rock is formed under specific geological conditions, and these conditions have a major impact on the form and nature of the mineral interactions inside it. According to their place of formation, all rocks can be placed into one of three broad types [34-35]: Igneous: Having to do with or formed by magma; Sedimentary: Means having to do with anything external; Metamorphic rocks: From sedimentary and igneous rock changes.

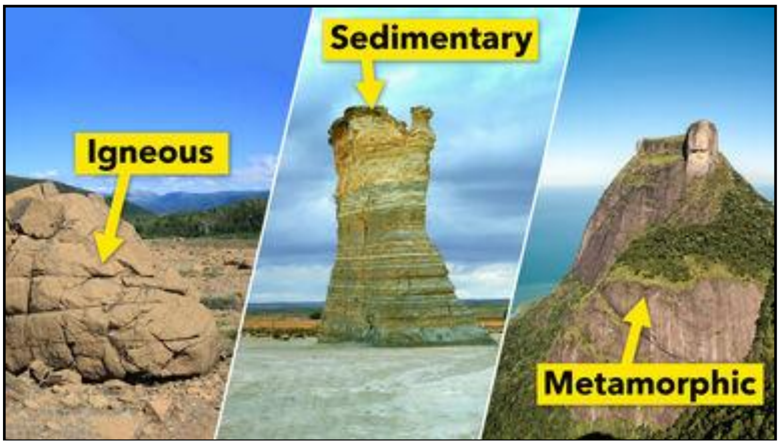

Figure 2: Classification of rocks

II. OBSERVATIONS AND DISCUSSION

2.1. Megascopic Characteristics of Rocks

The Eastern Dharwar Craton was inspired by field petrographic studies of the granitoids in the Amangal region. The investigated granitic rocks span a ten-kilometer-square area in the Dharwar craton's eastern quadrant. A variety of igneous rocks, including alkali feldspar, plagioclase feldspar, granodiorite, monzogranite, quartzmonzonite, and syenogranite, can be found there. K-feldspar, quartz, plagioclase, biotite, and hornblende are the main minerals that contribute to rock formation. Zircon and biotite are two examples of accoutrement stones. According to the International Union of Geological Sciences (IUGS), the majority of the granitoids that make up the TGM suite are magnesian in composition, run the gamut from calc-alkalic to alkali-calcic, and are metaluminous to weakly peraluminous [35-39].

2.2. Microscopic Characteristics of Rocks

When the texture and mineral components of sedimentary rocks cannot be discerned with unaided eyes or with the use of a hand lens, a microscope is used to examine the rocks. Significant information regarding the constituent minerals and framework grains, cement, matrix, grain texture, porosity, sediment maturity, and diagenetic characteristics can be gleaned from the microscopic examination. Even though you might pick up a rudimentary understanding of how some common minerals appear when seen using a petrographic microscope, it is not the major objective of this lesson. I want you to focus your attention, in particular, on the manner in which the mineral grains in a rock are assembled (also known as the rock's Texture) and the manner in which they are arranged (also known as the rock's Fabric), because these characteristics can tell us a great deal about the origin of the rock [40-44].

Table 1: Microscopic properties of various samples

Sample code	Type	Mineralogy and mode		
		Essential	**Accessory**	**Secondary**
1	Granodiorite of TGM suite under crossed polar	Plagioclase + Quartz	Hornblende + biotite	Augite
2	Granodiorite of TGM suite in PPL			
3	Monzogranite of TGM Suite under crossed polar		Zircon	
4	Monzogranite of MS suite under crossed polar	Alkali feldspar + Plagioclase	Amphibole + hornblende	Biotite

5	Monzogranite of MS suite in PPL	+ Quartz		
6	Syenogranite of MS suite under cross polar.	Orthoclase + Plagioclase + quartz.		Magnetite

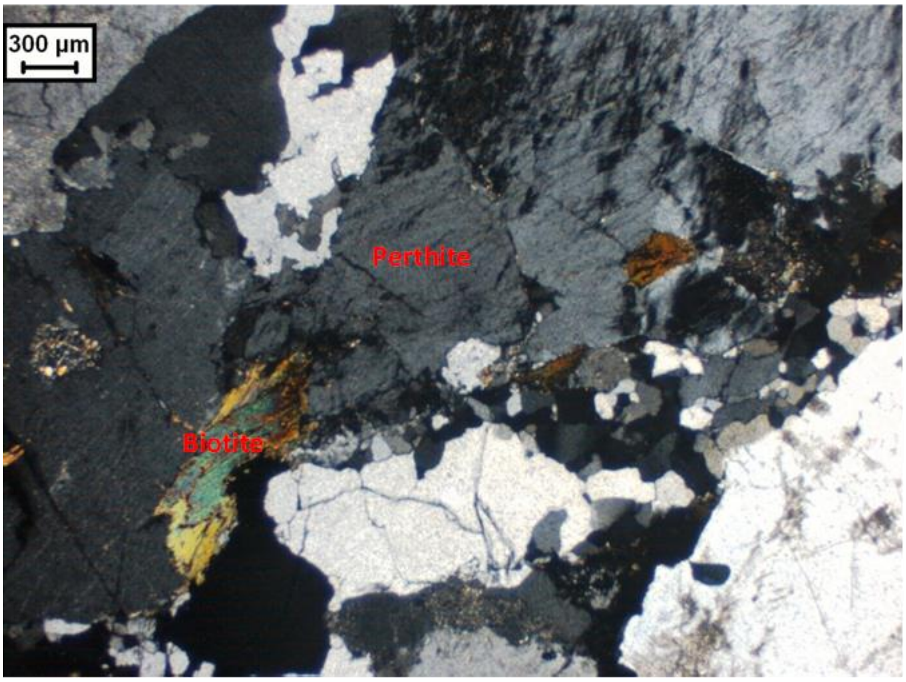

Figure 3: Photomicrograph of granodiorite of TGM suite under crossed polar

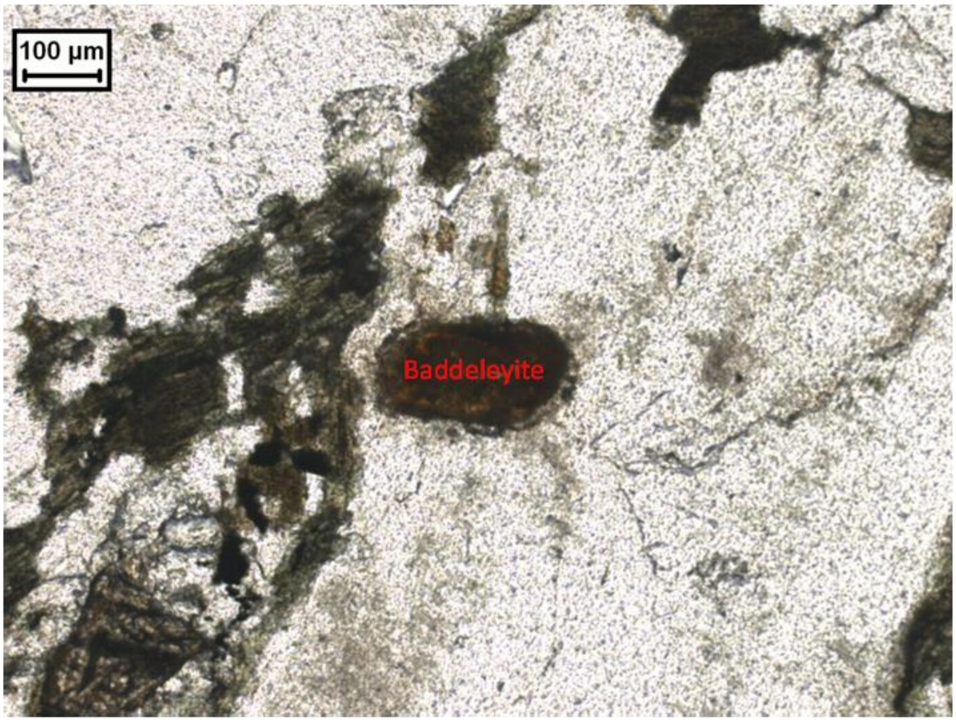

Figure 4: Baddeleyite is embedded in feldspar of granodiorite of TGM suite in PPL

Figure 5: Zircon grain embedded in plagioclase feldspar, granodiorite of TGM Suite under crossed polar.

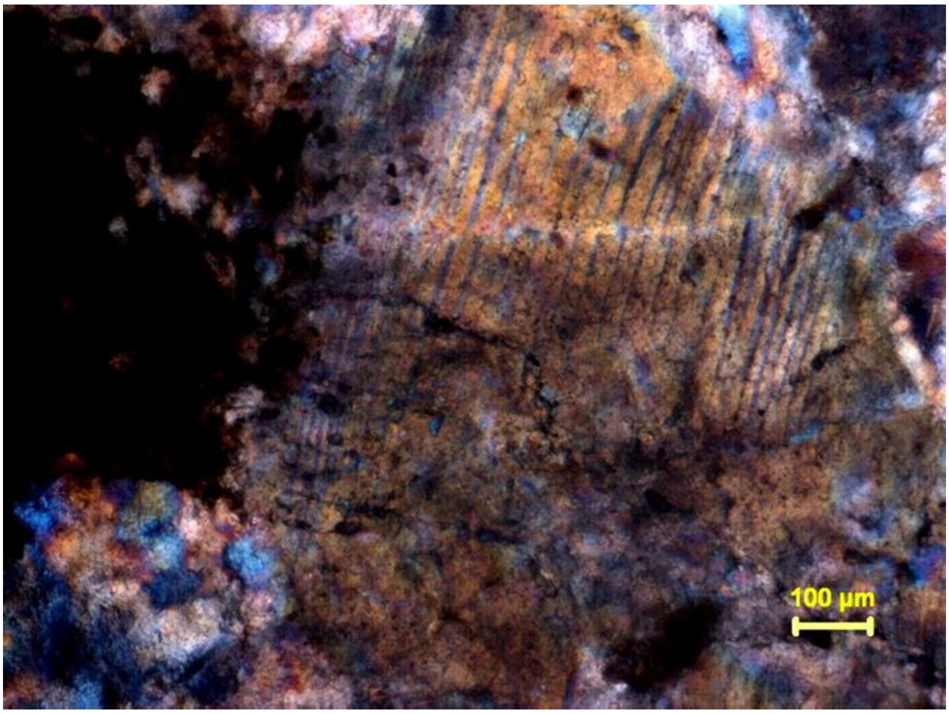

Figure 6: Photomicrograph kinking of twin lamellae in plagioclase, monzogranite of TGM suite under crossed polar.

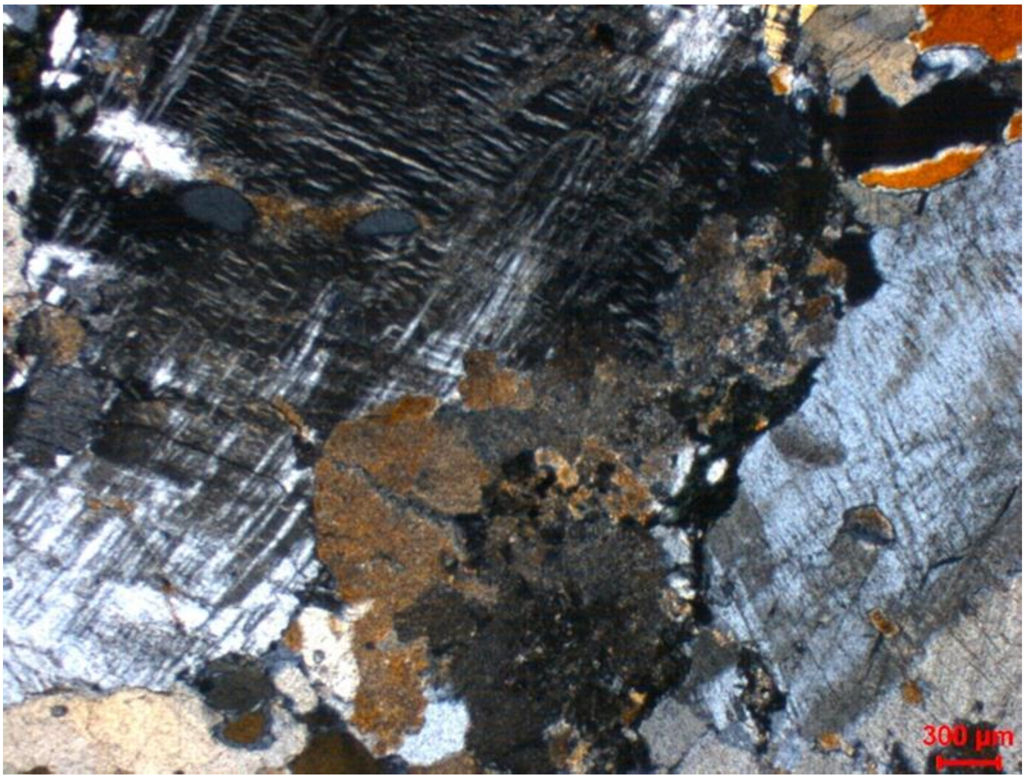

Figure 7: Photomicrograph of perthitic (microcline and fine grained of plagioclase) of monzogranite of MS suite under crossed polar

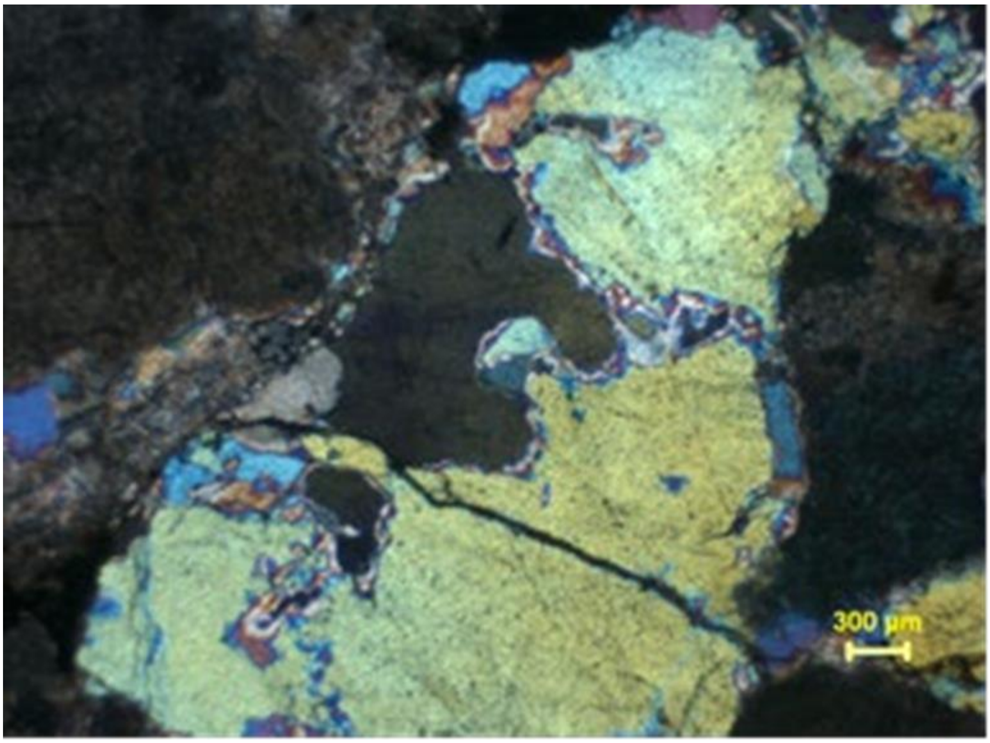

Figure 8: Photomicrograph show sub grain formation of quartz of syenogranite of MS suite under cross polar.

III. CONCLUSION

In addition, the chemistry of the principal elements in the granitoids that were generated in the region is very similar to the chemistry of the principal elements in the granitoids that were generated in a convergent environment in the Cordillera. This is because both environments produced granitoids. It has been established, on the basis of mineralogy and texture, in addition to the field relationships, that the following order indicates the sequence of parental magma differentiation for granitoids that can be found in Amangal rocks. This order can be found in the following paragraph. Both the field relationships and the mineralogy were taken into consideration in order to arrive at this sequence.

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