Petrography and Economic Importance of Koppole Granitic Rocks, Gurrampode (M), Nalgonda District, Telangana, India

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Abstract-Detailed geological mapping of the research area was carried out to update the previous information known about the geology of the study area. The new geologic map was produced to establish the relationship between different lithological units by mapping out distinct geologic boundaries, and delineating the general structural trend of associated geologic structures on a geologic map. Results from petrographic analysis of rock thin-sections obtained from the study area reveal the presence of Syenite, Quartz monzonite, Tonalite, and Gabbro. Associated geological structures observed include dykes, Quartz and Epidote veins, and faults/joints. The research area is enriched with economic importance of Granite has been extensively used as a dimension stone and as flooring tiles in public and commercial buildings and monuments. The rocks are mostly quarried for engineering purposes.

Keywords: Geology, Petrography, Modal mineral abundance, Economic importance

INTRODUCTION

Granites are plutonic, light colored and most common igneous rocks. Granite is made of large mineral grains that fit tightly together. The word granite comes from the Latin granum, a grain, in reference to the coarse-grained structure of such a crystalline rock. Granite is currently known only on Earth where it forms a major part of the continental crust.

In geology, granite is called an intrusive igneous rock. An igneous rock is one that is formed when molten rock (magma) cools and solidifies. The term "intrusive" indicates that the rock solidified below the Earth's surface after it first intruded into other rocks. The average density of granite is 2.75 g/cm^3 with a range of 1.74 g/cm^3 to 2.80 g/cm$^{3.}$

Granite has been intruded into the Earth's crust during all geological periods of the Precambrian age (before 570 million years). The origin of granite is contentious and has led to varied schemes of classification. A classification based on origin of the "parental" magma from which the granite was formed is the most accepted one. As magma in the Earth's crust cools, it undergoes the process of 'fractional crystallization' – a process by which some minerals crystallize before others. This process enriches the melt in silicon, aluminum, and potassium (the major constituents of granite), and lowers the content of iron, magnesium, titanium, calcium and sodium. The fractional crystallization process operates regardless of the chemistry and origin of the magma, but it leaves geochemical and mineralogical evidence of the composition and origin of the parental magma from which granite was formed. The final mineralogy, texture, and chemical composition of granite are often distinctive, based on its origin. It is believed that granite formed from melted sediments will contain a K-feldspar whereas granite derived from melted basalt will be richer in plagioclase feldspar (oligoclase).

GEOLOGICAL SETTING OF THE KOPPOLE AREA

The study area, Koppole in Gurrampode Mondal in Nalgonda District, Telangana state, is at a distance of 125 km SW of Hyderabad. The area covers geological out crops NE of Koppole. The Koppole area lies in the Toposheet Number 56P/1, between the longitudes: $79^0 7' 30''$ E and $79^0 10' 00''$ E and latitudes $16^0 52' 30''$ N and $16^0 54' 53''$N. A total area of around 58 sq. km has been covered for the purpose of studying petrographic variation among the rocks. In general, the investigated area is mostly occupied by the Precambrian granite and its variants including alkali feldspar granite, quartz-alkali feldspar-granite, and granite.

The NE part of the Koppole area is occupied by syenite, the central part is occupied by quartz monzonite, the southern part is occupied by gabbro, and the central part of the quartz monzonite is covered by tonalite.

Based on the field relations of these rock types it is surmised that the following order is the sequence of emplacement or formation of rocks in this area: Syenite, Quartz monzonite, Tonalite and Gabbro.

Syenite: Syenite occupies NE part of the study area. It covers an area of 14 sq. km. Syenite exposed in and around Laxmidevigudem.

Quartz monzonite: Quartz monzonite occupies N, NW, W, SW and SE parts over an area of 25 sq. km. Quartz monzonite is exposed around Koyyaguronibavi and Koppole.

Tonalite: Tonalite occupies central part of the study area over an area of 4 sq. km. Tonalite is exposed around Koyyaguronibavi and Koppole.

Gabbro: Gabbro occupies SE - SW parts over an area of 15 Sq. km. Gabbro is exposed around Kattonigudem and Bollaram.

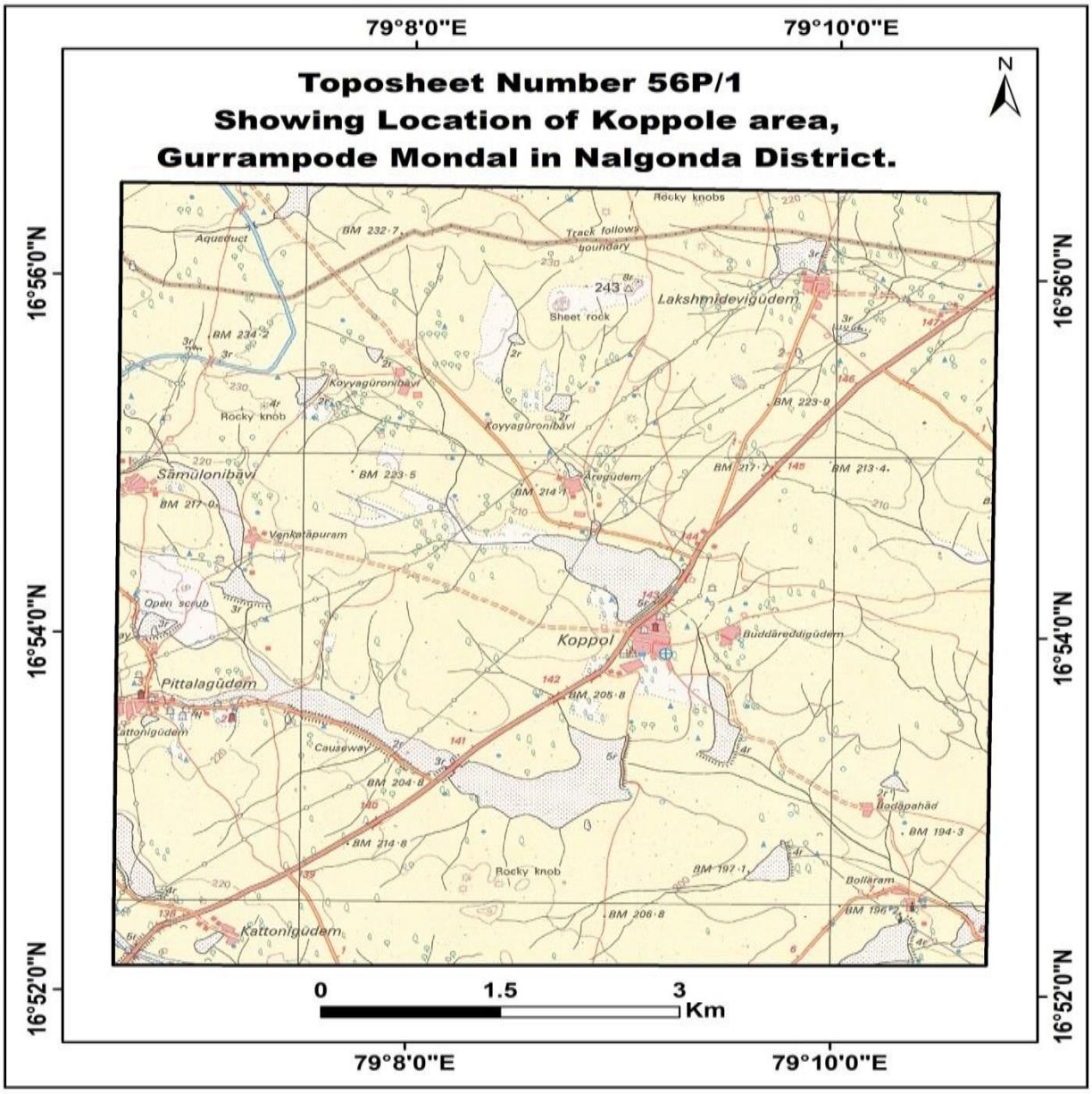

Fig. 1.Toposheet of the study area

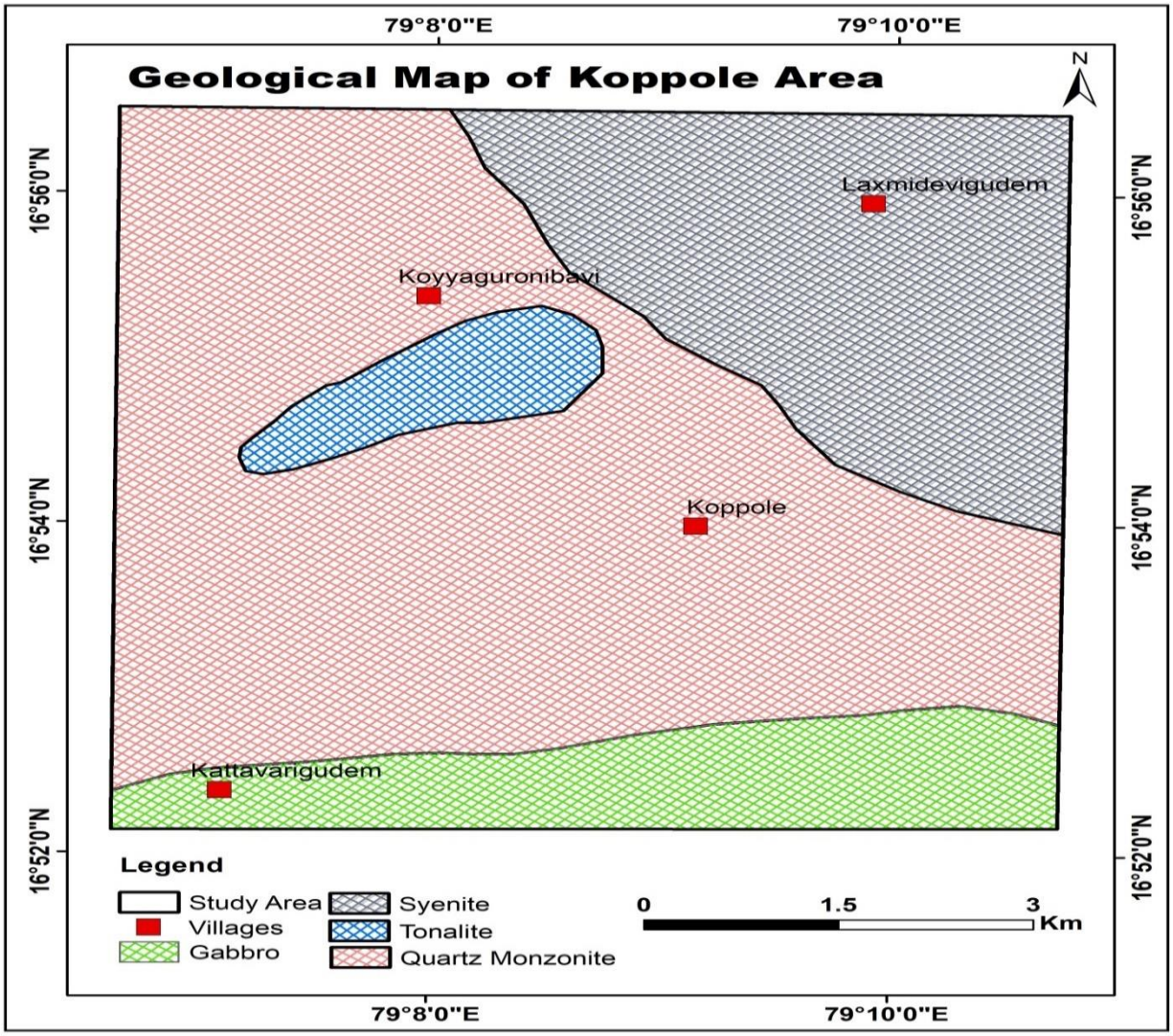

Fig. 2.Geological map of the study area

METHODOLOGY

A total of 4 days were spent in the field around Koppole, mostly covering the areas south of Koppole, SE of Bollaram and NNE of Laxmidevigudem and NNW of Koyyaguronibvi. Field observations have revealed the field setting of different rock types as enumerated above. A total of 14 most representative, insitu, fresh, and unweathered samples were collected from all the outcrops available in the area. Samples B-1, K-5, L-2 and K-1 are taken from Bollaram, Laxmidevigudem, Koyyaguronibavi, surroundings of Koppole.

The collected samples were washed with water, and dried for some time before they are studied in the petrography lab. All rocks have been made thin sections to observe the textural and mineralogical aspects under the petrological microscope.

Rock thin sections were prepared in the Petrographic Laboratories of Department of Geology, Osmania University. For making thin sections of rocks, the samples were cut into slices manually. Pieces with flat surface are grinded on the disk of a grinding machine by using a flow of water and carborundum powders of 120 mesh. After one side is grinded, the rock slice is once again grinded on the reverse side after mounting on the glass slide with Canada balsam whose refractive index is 1.54. Once the required thickness is achieved, the rock slice is covered with cover-slip using Canada balsam. Care was taken to prevent air bubbles cropping up in the thin sections.

RESULT AND DISCUSSION

Petrography: Megascopy

Sample B-1: The sample B-1 is collected from Bollaram village which is situated 3.5 km SE of Koppole town. The rock is coarse-grained, melanocratic, holocrystalline, equigranular, hypidiomorphic in texture. It appears to be a gabbro. It occurs as enclaves within pink granite. The contacts between these two rocks are gradational from the field observation it is surmised that the gabbro is older than the granite.

Sample L-1: It is collected from Laxmidevigudem which is situated 4 km NE of Koppole. The rock is melanocratic, holocrystalline, medium grained, equigranular, hypidiomorphic in texture. It shows sharp contacts with host granite and occurs as dyke cutting accross granite in the direction of ENE that is strike direction of the dyke.

Sample K-5: It is collected from Koyyaguronibavi situated 3.5 km NW of Koppole. The rock is a diorite which is mesocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It occurs as enclaves within diorite. The contact between these two rocks are graditional. The field observations suggest that the diorite is older than the granite.

Sample L-2: It is collected from Laxmidevigudem situated 4 km NE of Koppole. The rock is leucocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It shows transitional contacts with host granite. It occurs as dyke cutting across granite in the direction of NE that is strike direction of the dyke.

Sample K-4: It is collected from Koyyaguronibavi situated 3.5 km NW of Koppole. The rock is leucocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It is a felspathic vein cutting accross gabbro. The contacts between these two rocks are graditional. From the field observation it is surmised that the felspathic vein cutting a cross gabbro is older than the granite.

Sample K-1: It is collected from Koyyaguronibavi situated 3.5 km NW of Koppole. The rock is leucocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It as enclaves within coarse pink granite. The contact between these two rocks graditional from the field observation it is surmised that the coarse pink granite is older than the granite.

Sample K-3: It is collected from Koyyaguronibavi situated 3.5 km NW of Koppole. The rock is leucocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It occurs as enclaves within pink granite. The contacts between these two rocks are graditional from the field observation it is surmised that the pink granite is older than the granite.

Sample V-1: It is collected from Venkatapuram situated 3.5 km WNW of Koppole. The rock is leucocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It occurs as enclaves within pegmatite (rich K-felspar). The contacts between these two rocks are graditional from the field observation it is surmised that the pegmatite is older than the granite.

Sample K-2: It is collected from Koyyaguronibavi situated 3.5 km NWN of Koppole. The rock is leucocratic, holocrystalline, medium grained, equigranular, hypidiomorphic, in texture. It occurs as enclaves within garnet ferrous pegmatite .The contact between these two rocks are graditional. From the field observation it is surmised that the garnet ferrous pegmatite is older than the granite.

Sample V-2: It is collected from Venkatapuram situated 3.5 km WNW of Koppole. The rock is leucocratic, holocrystalline, medium grain, equigranular, hypidiomorphic, in texture. It occurs as enclaves within graphic granite. The contacts between these two rocks are graditional from the field observation it is surmised that the graphic granite is older than the granite.

Microscopy:

The modal compositions (vol. %) of rocks of Koppole are presented in Table 1. The microscopic descriptions of individual rocks of Koppole area are given below

Sample No	B1	K2	K5	L2
Orthoclase	-	61	-	55
Microcline	-	19	-	15
Plagioclase	48	18	38	15
Quartz	-	2	12	10
Clinopyroxene	49	-	-	-
Amphibole	-	-	48	5
Biotite	-	-	2	-
Sphene	1	-	-	-
Opaques	2	-	-	-
Total	100	100	100	100

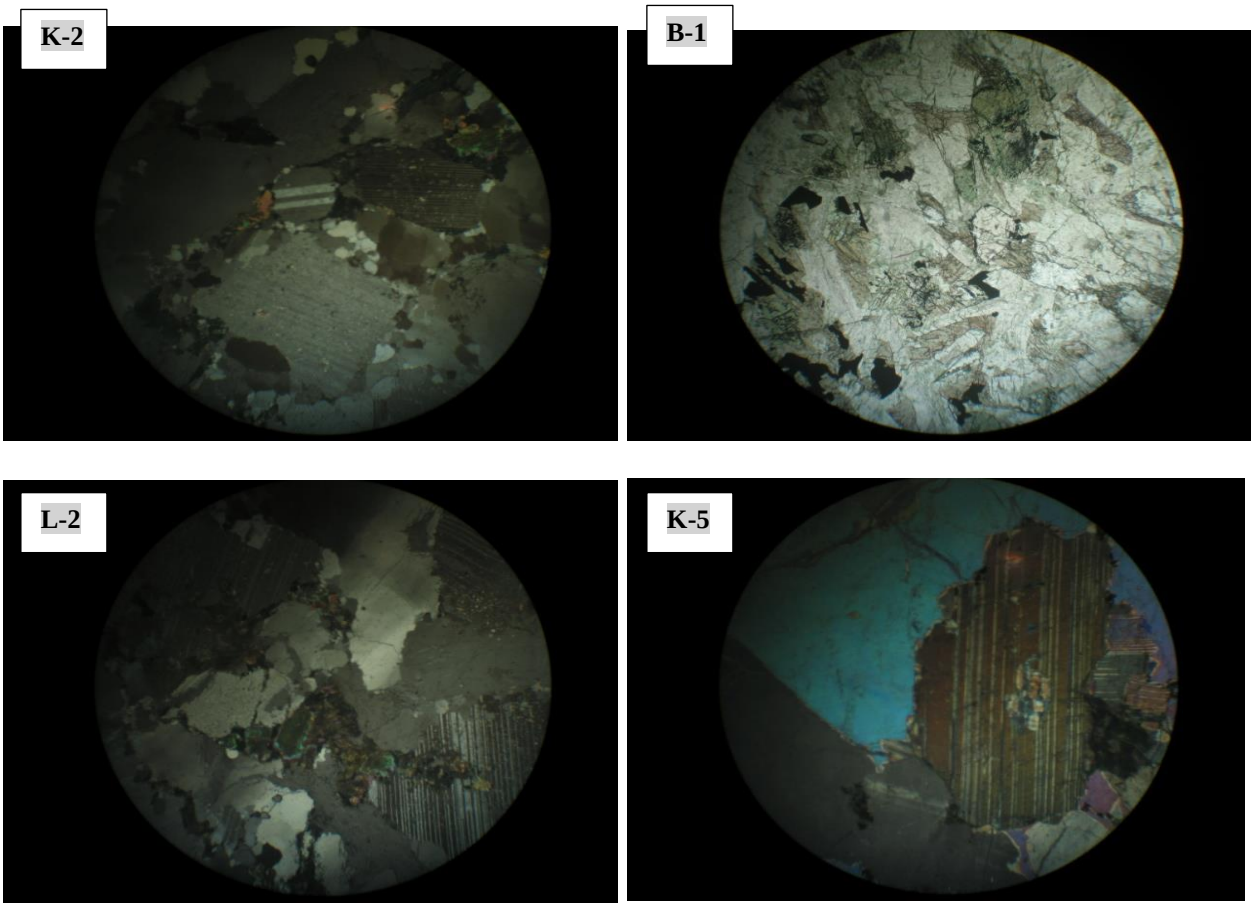

Fig. 3.Showing K-2, B-1, L-2, K-5 Samples Microscopic Images

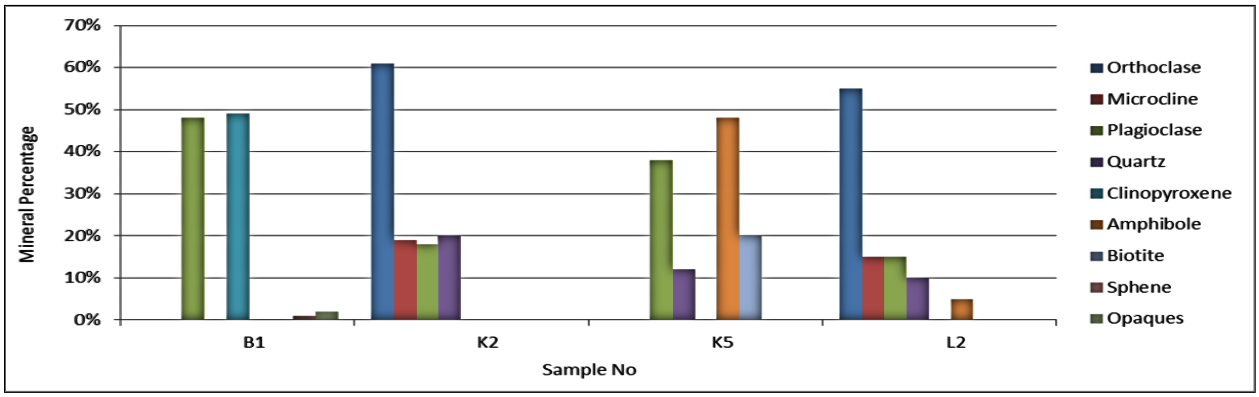

Table 2.Showing Mineral Percentages of rocks from Koppole area

ECONOMIC IMPORTANCE

Granite has been extensively used as a dimension stone and as flooring tiles in public and commercial buildings and monuments. Aberdeen in Scotland, which is constructed principally from local granite, is known as "The Granite City". Because of its abundance, granite was commonly used to build foundations for homes in New England. The Granite Railway, America's first railroad, was built to haul granite from the quarries in Quincy, Massachusetts, to the Neponset River in the 1820s. With increasing amounts of acid rain in parts of the world, granite has begun to supplement marble as a monument material, since it is much more durable. Polished granite is also a popular choice for kitchen countertops due to its high durability and aesthetic qualities. In building and for countertops, the term "granite" is often applied to all igneous rocks with large crystals, and not specifically to those with a granite composition.

Curling stones are traditionally fashioned of Ailsa Craig granite. The first stones were made in the 1750s, the original source being Ailsa Craig in Scotland. Because of the particular rarity of the granite, the best stones can cost as much US$1,500. Between 60-70 percent of the stones used today are made from Ailsa Craig granite, although the island is now a wildlife reserve and is no longer used for quarrying.

In some areas granite is used for gravestones and memorials. Granite is a hard stone and requires skill to carve by hand. Modern methods of carving include using computer-controlled rotary bits and sandblasting over a rubber stencil. Leaving the letters, numbers and emblems exposed on the stone, the blaster can create virtually any kind of artwork or epitaph.

Engineers have traditionally used polished granite surfaces to establish a plane of reference, since they are relatively impervious and inflexible. Sandblasted concrete with a heavy aggregate content has an appearance similar to rough granite, and is often used as a substitute when use of real granite is impractical. A most unusual use of granite was in the construction of the rails for the Haytor Granite Tramway, Devon, England, in 1820.

CONCLUSION

The investigated area is mostly occupied by the Precambrian granite and its variants including alkali feldspar granite, quartz-alkali feldspar-granite, and granite. The NE part of the Koppole area is occupied by syenite, the central part is occupied by quartz monzonite, the southern part is occupied by gabbro, and the central part of the quartz monzonite is covered by tonalite. Based on the field relations of these rock types it is surmised that the following order is the sequence of emplacement or formation of rocks in this area: Syenite, Quartz monzonite, Tonalite and Gabbro. Essential minerals consist of K-feldspar, quartz, orthoclase, plagioclase and microcline. The common accessory minerals are hornblende, biotite, sphene and opaque. The structures observed on these rocks in the field include, dykes, quartz veins, joints.

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