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Quality Assessment of Quartz in Kukatpally, Ranga Reddy District, Telangana, India.

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Research Article

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ABSTRACT

Quartz is used in Glass industry, Ferro-silicon industry, Iron and Steel refractory, Ceramic industry, Electrical abrasive industry and Paint industry. Quality assessment of Quartz helps in determining its utilization in a particular industry. To aid this study mapping of Quartz occurrences were carried out in Pochampally ,Hafeezpet , and Kukatpally area. Systematic sampling and mapping on 1:1000 scale was done to assess the quality of Quartz. Geologically the area forms the crystalline terrain consisting of granites and gneisses occasionally intruded by Quartz- Pegmatite veins. The quantity was assessed as the thickness of intrusions can vary. The general trend of the deposit is NNE-SSW. Detailed investigations proved that the Quartz in the study area is suitable for glass, Ferro-silicon, iron and steel refractory and foundry. The quality of the associated feldspars is found to be of good quality of ceramic grade. Environmentally land degradation has taken place.

INTRODUCTION

The milky white color, the transparent to translucent nature and the hardness of Quartz has made man mine for quartz for generations. Quartz occurs as veins in granite, ore and gangue quartz veins and pockets in limestones, marls, dolomites, authigenic quartz and concretions in sedimentary rocks, pegmatites, miarole pockets and geodes and cavities in volcanic rocks [1]. According to the Indian Minerals Yearbook [2], Andhra Pradesh is still the largest producer of Quartz. As per the UNFC system as on 1-4-2010 India produces 3,4999 million tonnes of quartz.[2] Quartz occurs in both Telangana and Andhra Pradesh states, which is 33 percent of total production in India.[3] According to Mines and Geology Department [4] the two states produce 933089 tonnes of Quartz. Extensive mining is carried out in Khammam ,Ranga Reddy, Mehaboobnagar, Nalgonda and Medak districts of Telangana. Ranga Reddy district alone has seven working mines and ranks first in quartz production. Silica (SiO_2) minerals like Quartz, Quartzite (98793 tonnes), Silica Sand (2238856 tonnes), Stowing sand (3813483 tonnes) and Moulding Sand (650 tonnes) possess different physical characteristics and hence they are used for different purposes [4].

Geology of the area

Geologically the study area forms part Archaean granitic terrain consisting of granites and gneisses occasionally intruded by Quartz- Pegmatite veins. It represents parts of the most ancient crust of the earth [5]. The colors of the granites are pink and grey. Granular and massive quartz occurs extensively associated with Peninsular Gneissic Complex in the Ranga Reddy district.(Fig 1.)[6] This part of the district is mostly a rugged granitic plain with hills of elevation 200m. The area has isolated hills and mounds giving a relict type of topography. Vegetation is scanty, with sparse bushes and scrubs. The temperature varies from 32^o to 45^o in summer with moderate winters, and average rainfall approximately 70-100cm.

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The intrusion of quartz – pegmatite veins are milky white in color and runs for few kilometers across the granitic terrain. Good quality quartz veins occur at Kukatpally, Bahadurpura. Lingampally Hafeezpet, Bolarum, Pochampally and Thummalur. Research was carried out on Hafeezpet, Pochampally and Kukatpally area which is located between 78° 20' to 78° 25' East longitude and 17° 28' to 17° 30' North latitude and falls in the to posheet No 56 K/7 (fig 1).

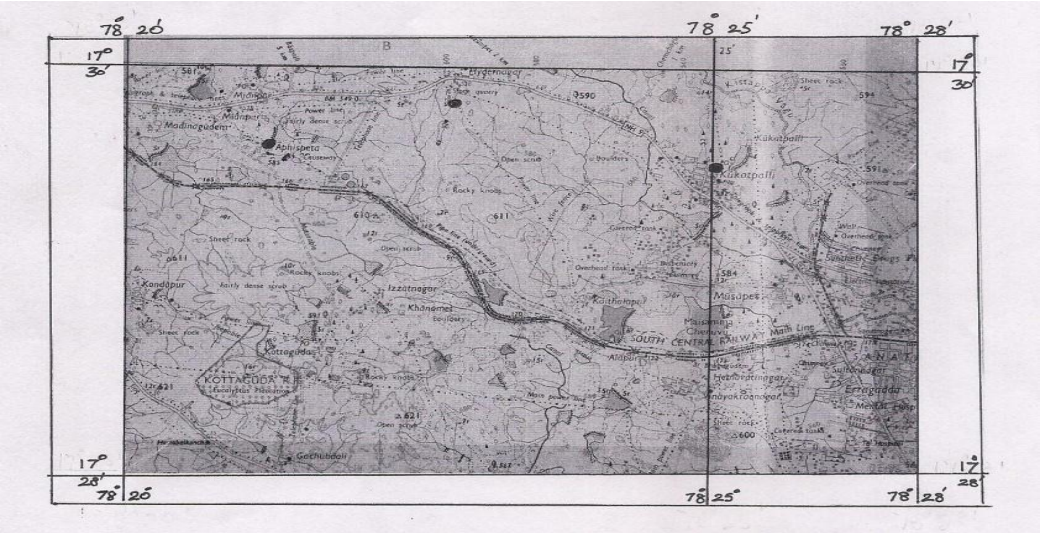

Figure 1. Location Map of study area, part of toposheet 56K/7

METHODS OF STUDY

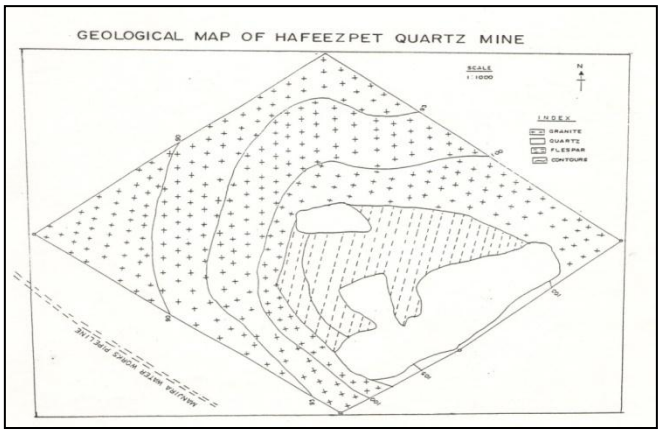

Figure2

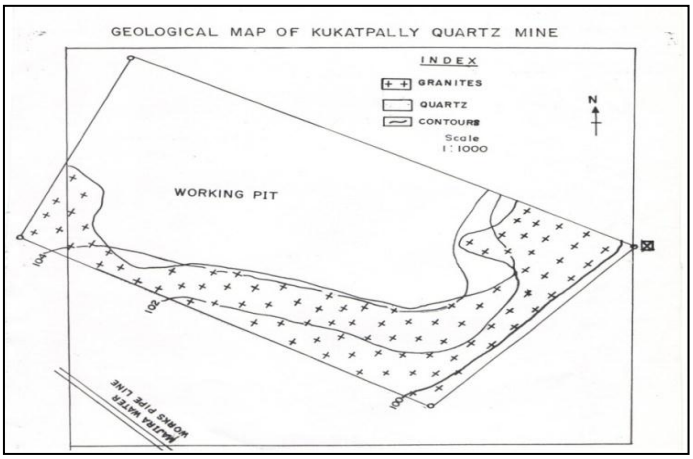

Figure 3

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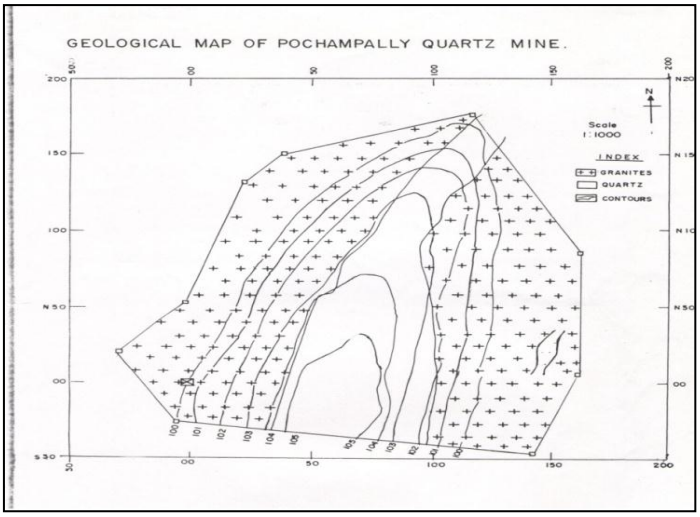

Figure 4

Table - 1
Analysis of Quartz & Felspar samples

Sample Number	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	K_2O	Na_2O	(L.O.I.).
HPT- Q1	98.60	0.03	0.59	0.59	TRACES	-	-	0.19
HPT- F2	66.65	0.05	18.43	0.84	0.19	11.65	1.70	0.41
HPT-Q3	98.54	0.033	0.52	0.52	TRACES	-	-	0.17
HPT-Q4	98.70	0.03	0.69	0.59	TRACES	-	-	0.18
HPT-Q5	98.32	0.034	0.57	0.49	TRACES	-	-	0.19
PBM-Q6	96.90	1.29	0.08	1.12	0.20	TRACES	0.22	0.18
PBM-Q7	96.85	1.19	0.12	1.12	0.20	TRACES	0.19	0.24
PBM-Q8	96.97	1.29	0.10	1.04	0.20	TRACES	0.20	0.23
MPT-Q9	97.99	0.03	0.42	0.4 2	TRACES	-	-	0.16
M T-Q10	98.01	0.023	0.49	0.52	TRACES	-	-	0.16
MPT-F11	66.35	0.05	18.63	0.84	0.19	12.65	1.80	0.43
MPT-F12	65.65	0.05	17.43	0.64	0.21	13.65	1.40	0.40

After reconnaissance survey of the whole area, three mines were selected. They are Hafeezpet quartz and feldspar mine, Kukatpally mine, and Pochampally mine. Detailed field mapping was carried out as shown in figures 2, 3 and 4. These three are opencast mines. Samples were collected and major element analysis was carried out. For this study 12 samples have been selected and the major element analysis is given in Table 1. The major elements are SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, K_2O, Na_2O and loss on ignition.

DISCUSSION

The quartz body inPochampally Quartz mine is lenticular within the grainitic terrain and trending NNE-SSW and dipping vertically. The width of the quartz vein in the northern part is 10m while attaining a maximum of 70 m towards the southern part of the mining lease. Quartz occurs as massive semi-transparent and showing three sets of joints. (photo1.) In a small part of the lease area quartz has brownish tinge due to iron which makes it unstable. Reserve estimation is around 1,50000tonnes with a recovery of 90 percent on the bulk density.

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Photo 1: Quartz exposures occur as massive, semi-transparent and with three sets of joints.

The quartz and feldspar veins in Kukatpally Quartz mine trend in N 60° E. The feldspars occur in veins and are flesh red color. The thickness of soil cover in the existing mines is negligible and weathered feldspars with quartz pebbles are exposed on the elevated portion of the mound towards western side. Quartz occurs as blocks with joint planes.(Photo 2). The joints trend in NW-SE direction. Along the joint planes clay fillings are observed whichmakes the quartz non-usable due to high iron content.(Photo 3). The length and width of the quartz is 80m x 30m. The reserve of quartz is 90,000 tonnes and feldspar is 90,000 tonnes.

Photo 2: Quartz occurring as blocks due to joints

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Photo 3: Clay fillings are in the joints which are left behind as mounds

The quartz and feldspar in Hafeezpet mine trend N 60° E – S 60° W. Feldspar is in a vein from and off white in colour. The soil thickness observed in the existing a mine is negligible and weathered feldspar with quartz pebbles are exposed on the elevated portion of the mound (photo – 4), Mining operations touched the groundwater table, hence water pumping is practiced. In this mine quartz is secondary mineral. The feldspar is of good quality and it is ceramic grade. Reserves of Quartz mineral are lesser in quantity, about 20000 tonnes in the entire lease area.

Photo 4: Feldspar and quartz exposed

Mining of quartz in these mines is by open cast method using simple tools like crowbars and pickaxe, which are manual and labor intensive. The mining practices are unscientific and unsystematic resulting in wastage of the quartz deposit.(Photo-7) Drilling is by jackhammers, blasting is by using gunpowder creating soil contamination (Photo-5). Enormous dust is generated during mining operations resulting in air pollution. Prolonged exposure to quartz mine results in silicosis.

Dumping of subgrade mineral and waste is done haphazardly resulting in degradation of the environment (photo-6) which is detrimental to the perspective development and conservation of the mineral.

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Photo 5: Soil contamination

Photo 6: Mining practices not systematic leading to land degradation

Photo 7: Haphazard mining leading to wastage of quartz.

Table 1 shows the details of the major element analysis of the selected samples from the detailed samples. Sample Nos. HTP- Q1, HTP- F2, HTP- Q3, HTP- Q4, HTP- Q5, represent Hafeezpet mine. PBM- Q6, PBM -Q7, PBM- Q8 represent Pochampally mine, and sample Nos. MPT- Q9, MPT- Q10, MPT- F11, MPT- F12 represent Kukatpally mine. The SiO_2 values of the Q series show 98 percent silica while in the F series the SiO_2 shows 65 to 66 percent. The samples of the Q series show negligible amounts of Fe_2O_3, Al_2O_3, CaO, MgO, K_2O, Na_2O. The samples of the F series show higher value of Fe_2O_3, Al_2O_3, CaO, MgO, K_2O, Na_2O. The geological mapping of Kukatpally and Pochampally (Fig 3 and fig 4) show no feldspars

and geochemically also these samples are high in SiO_2. Whereas the Hafeezpet mine has the quartz vein high in SiO_2, and pink feldspars low in SiO_2 as shown in the geological map (fig 1).

Many industries like glass, ferrosilicon, iron and steel, refractory, foundry, ceramic, electric abrasive and paints use quartz with different specifications as shown in Table 2.[3] Optical glass making industry uses very high grade quartz with 99 percent SiO_2. Quartz usually contains small amounts of Fe_2O_3, TiO_2, Cr_2O_3, MnO, K_2O and Na_2O. Out of these Fe_2O_3 is the most objectionable impurity as it imparts coloration to the glass. The permissible limit of Fe_2O_3 in Optical glass is 0.005-0.008 whereas for Flint glass it is 0.02-0.05. According to the specifications the samples with the Q series can be used for glass industry.

SPECIFICATIONS			
Glass Industry			
Chemical	*SiO_2*	*Fe_2O_3*	*L.O.I.*
	97 - 99	*0. 02 – 0. 10*	*0.5% Max*
Physical	*- 30 to + 100 mesh powder*		
Refractory Industry	*SiO_2*	*Fe_2O_3*	*L.O.I.*
Chemcial	*above 96%*	*less than 1.5%*	*Less than 1%*
Physical	*Medium to fine graned compact homogenous. free from Iron bands, patches, pyrite spots and devoid of mica*		

Table 2: Specifications (after Raman P.K. 1999)

CONCLUSIONS

The areas under investigation constitute mainly granites and thin fracture fillings of quartz as veins and lenses traversing granites and gneisses of varying colours. Sometimes quartz veins traverse over few meters to few kilometers in length and have a tabular to lensoid shape. Quartz body is an hydrothermal emplacement to the host rock granite along the major regional fracture pattern The low grade quartz with different colours of quartz are due to the fact that the trend of the emplacement , occurrence of similar fracture pattern and the assimilation features are clearly observed along the contact zones. The nature of quartz is massive, and semitransparent in nature. Physically quartz mineral appears to be pure with occurrences of impurities near the contact with host rock, example granite. In few places the quartz shows pinkish to brown colour due to iron content. Geochemically the quartz show high SiO_2 content with Fe_2O_3, TiO_2, Cr_2O_3, MnO, K_2O and Na_2O within permissible limits. Environmentally the generated dust creates exposure to silicosis and dumping of waste causes degradation of land.

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