

## **Socio-Economic and Environmental Perception of Inhabitants of A Quarry Area - A Case Study of Bidadi, Bangalore Rural District**

<sup>1</sup>, Sreenivasa, <sup>2</sup>, Ravana Reddy R V

<sup>1</sup>, M Sc, M Phil, (PhD), NET, SLET, PGDCA

*Environmental Studies, Govt. College for Boys/Bangalore University, India Teaching Staff*

<sup>2</sup>, MA, B Ed, DCA.

*Minor Irrigation/ Jsys, India District Social Specialist*

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**ABSTRACT:** *In the present study, 'quarry has been studied from the point of view of its stone extraction process and the emitted pollution in term of air, water, noise and its impact on the Social and Economic status of the inhabitants. Besides giving the socio-economic status it gives some attention on environmental perception toward air and sound pollution of the human inhabitation in the mining area including the migrated workers. To that extent this investigation may be considered as a contribution to the dynamic utilization of mineral extraction with reference to the impacts on environment. Karnataka is comparatively blessed with quarry products when considered in non-metallic minerals, which is in the highest position. Complete stoppage of these activities is highly not amenable by giving preference to environmental concern. There is, thus, a great need for the development of environmental/eco-friendly way of mining to minimize the impact.*

**KEY WORDS:** *Air, Granite, Inhabitants, Noise, Quarry.*

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### **I. INTRODUCTION**

**1.1 Mining and quarry:** The physical needs of man are met by the products of two basic resources - those of agriculture and of mining. An adequate supply of minerals and other products is therefore essential for the maintenance and improvement of man's standard of living. Economic activities like mining and manufacturing are often considered to be the main activities in the process of modern economic changes and development. The establishment of mining in any country, irrespective of its economic return will have important ramification on certain criteria like pollution and contamination leading to health hazard of both plants and animals. In spite of these activities it generates greater chances of employment and business opportunities and in turn revenue earnings of the state. A comprehensive study of the extraction of minerals from an area concerned and its neighborhood are with reference to its present utilization are of immense value for its integrated development. However no Environment study is completed without a study of the complex human component and various processes involved - and that is true of minor mineral like stone, pebbles and slabs from the activity of 'quarry'. In this context lies the importance of socioeconomic studies in highlighting the ways and means of utilizing a region's social status surrounding a mining/quarry. Yet there are several instances of resources not being eco-friendly mined in spite of a good demand for them in the country. With the increase of such activities, the environmental awareness also increased and these crisis are the current environmental topic in places like Karnataka where there is high revenue earning from mining of ornamental stone and quarry

**1.2 Quarry and its products:** In considering the importance of quarry product, domestic uses of the state like building stones, sand, pebble, slabs, etc, are also products of immense value conclusively, the whole activity including marketing and distribution provides various job opportunities and economic aids. Besides, quarry products are one of the most important non-metallic minerals and are indispensable commodities of roads, houses, and other engineering constructions as well as other domestic appliances. Quarry products are diverse in ways of extraction. Quarrying, till recently was essentially manual with chisel and hammer and thawing and cooling techniques. From the past few years, the demand for ornamental and decorative stones has increased so much that conventional quarrying techniques are inadequate for production to meet the demand. Numerous techniques and equipment involved in quarry, some of them are - Mud Removal, Drilling, Line Drilling, and Flame cutting, etc, as well as crushing in the final process.

**1.3 Quarry and environment:** Few minerals are in an expendable form when they extracted by low technology due to its abundant distribution and low cost. Consequently, quarry is closely related to such form of minor minerals and release lots of dust pollutants and noise disturbance. And the pollutants in turn mixed with

numerous domestic activities and substances of the inhabitants around the area. To extract usable stone in different desirable size and form involves certain technique like drilling, blasting, flame cutting, jet burners, etc. The main problem is the production of 'dust and sound' in all activities, where "crushing unit" is the worst in the context of Environmental concern. The largest amount of dust is only produced by this activity and all sorts of problem arise from this process, since it has not reached a highly developed stage or a sophisticated operational level. Numerous studies were available regarding the impacts of quarry to the surrounding environment in our regional context. In the present study, 'quarry' has been studied from the point of view of its stone extraction process and the emitted pollution in term of air, water, noise and its impact on the Social and Economic status of the inhabitants. Besides giving the socio-economic status it gives some attention on environmental perception toward air and sound pollution of the human inhabitation in the mining area including the migrated workers. To that extent this investigation may be considered as a contribution to the dynamic utilization of mineral extraction with reference to the impacts on environment. Karnataka is comparatively blessed with quarry products when considered in non-metallic minerals, which is in the highest position. Complete stoppage of these activities is highly not amenable by giving preference to environmental concern. There is, thus, a great need for the development of environmental/eco-friendly way of mining to minimize the impact.

**1.4 Status Quarrying in Karnataka:** The development of ornamental stone industry commenced in the first decade of the 20<sup>th</sup> century as recorded in field reports of Mysore Geological Department for the years 1905 and 1909-10. The demand was only for polished monumental stones exported to UK and on merge demands in the indigenous market for inscriptions and tile plates. The great demand of foreign market in the late seventies gave a strong impetus to the dormant trade of ornamental stones. The total geographical extent of the state is 1,91,773 km<sup>2</sup> out of each 92,000 km<sup>2</sup> covers by granite terrain and approximately the state extend an area of 7,550 km<sup>2</sup> in the form of mounds, hillocks and hills where 185 km<sup>2</sup> has been calculated as ornamental variety of granite (Vasudev, 1996) Karnataka state in particular and India in general are endowed with extensive and wide variety of granite rocks and dykes. During the year 1999-2000, the minor mineral production was valued at Rs 56,88,98,098 (DMG-1999-2000) as against Rs 1,74,67,000 during the year 1980-81 (DMG-1980-81). Thus a concordant value of revenue earning increases drastically during these 20 years. Now, a total of 2826 quarrying sites are present in the state (DMG - 1980-81).

#### 1.5 Objectives of the study

- [1] To investigate the impacts of quarry on the physical and human environment.
- [2] To assess the pollution and other impacts on the surrounding environment.
- [3] To make comparative study of social and economic status of the workers and non-worker inhabitants.
- [4] To identify different problems faced by inhabitants and their environmental perception.
- [5] To study the attitudes of both beneficiaries and non-beneficiaries of the quarrying activity.
- [6] To highlight certain of impacts on livestock health and productivity of crops.

## II. STUDY AREA.

To understand the social and economic impact of stone quarrying, a study area is selected in Bidadi. Infact among the existing quarry areas in Karnataka, this unit forms the main quarry area situated nearer to the capital city. It came into existence 30 years back and is spread over a large area nearly 50 acres consisting of 23 crushing unit. Villages surrounding the Kallugopannahalli quarrying unit, which have specific influences from the quarry, had been taken for survey. Environmental aspects like air, sound, soil, etc. are considered to understand the impact on socio-economic status. The location (East and West) and position of villages were also considered in this study since there is great variation in the mode of impacts. Together with other demographic characteristics, migration of mine workers to this area also forms an important aspect of the study. The study area comes under Bangalore rural district and lies between 12<sup>o</sup>39' to 13<sup>o</sup>18' N latitude and 77<sup>o</sup>22' to 77<sup>o</sup>52'E longitude covering an area 2,191 sq km. The district (fig 1) lies in the southern maiden region of the state Karnataka and is by large an open country which is lacking in natural barrier. The location of quarry unit with crusher in Kallugopannahalli is shown in fig 2.

**2.1 Geology, rocks and minerals:** Bangalore rural, district forms part of the Deccan plateau and is covered by peninsular gneiss, granite's, basic dykes and late rite. The granite's occur as intrusive in the gneissic complex and vary in colour, structure and texture. A small lenticular patch of Hornblende schist with a few runs of amphibolites in exposed north of Arajimbetahalli, on the Nelamangala - Doddaballapur road. Inclusion of amphibolites is seen in the gneisses (Kamath, 1989).



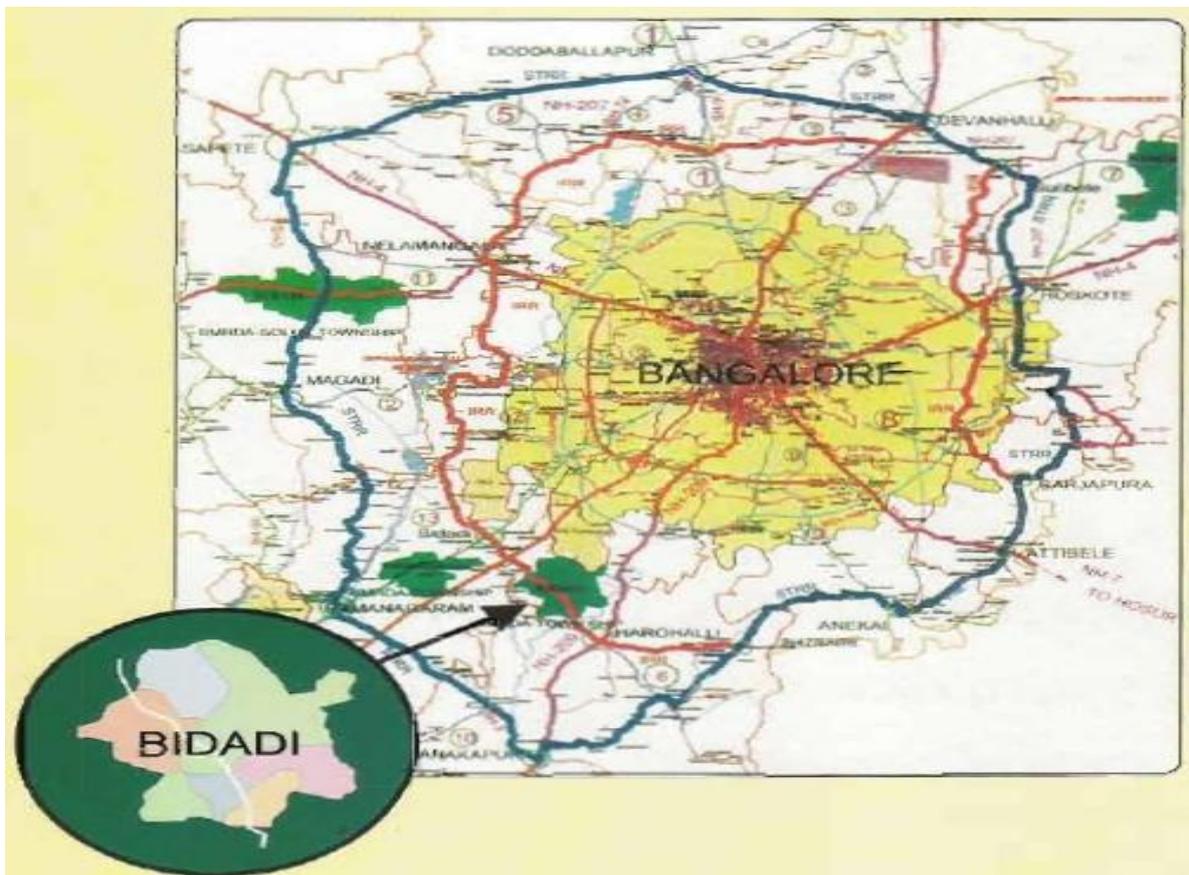
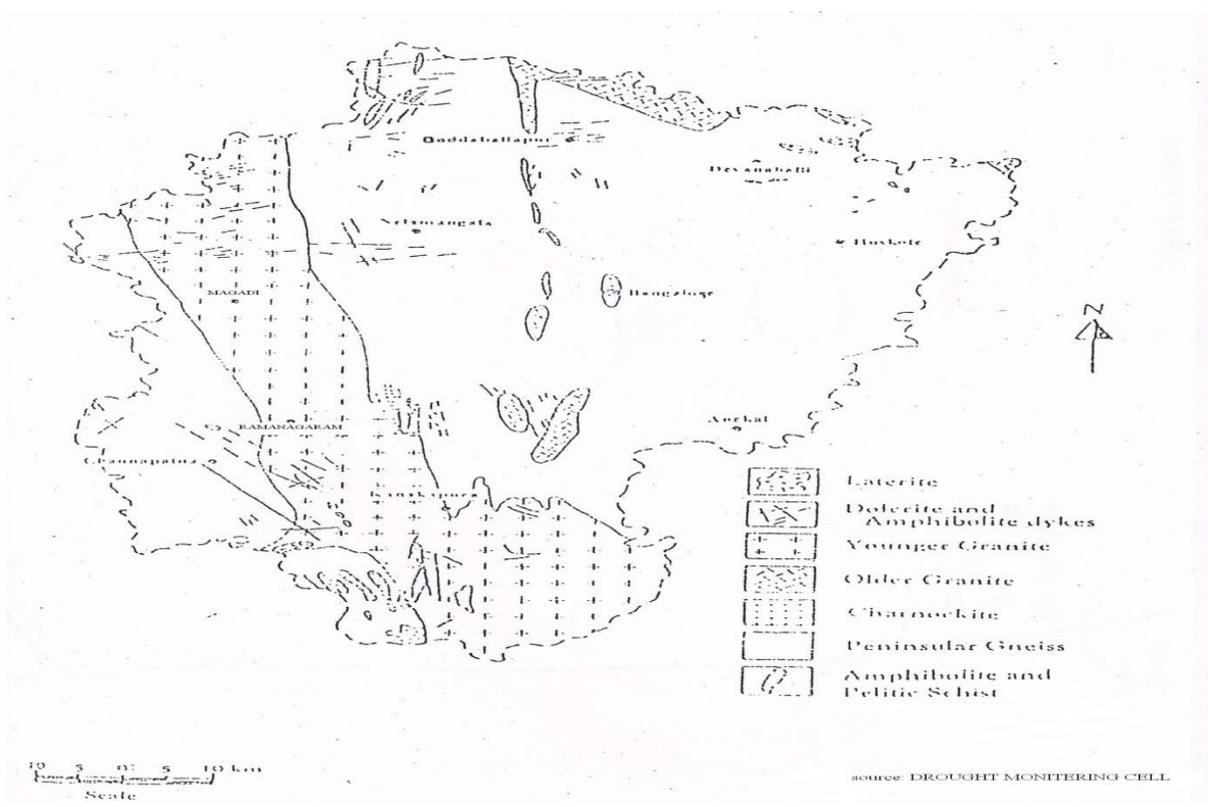


Fig 3: Geological map of Bangalore district

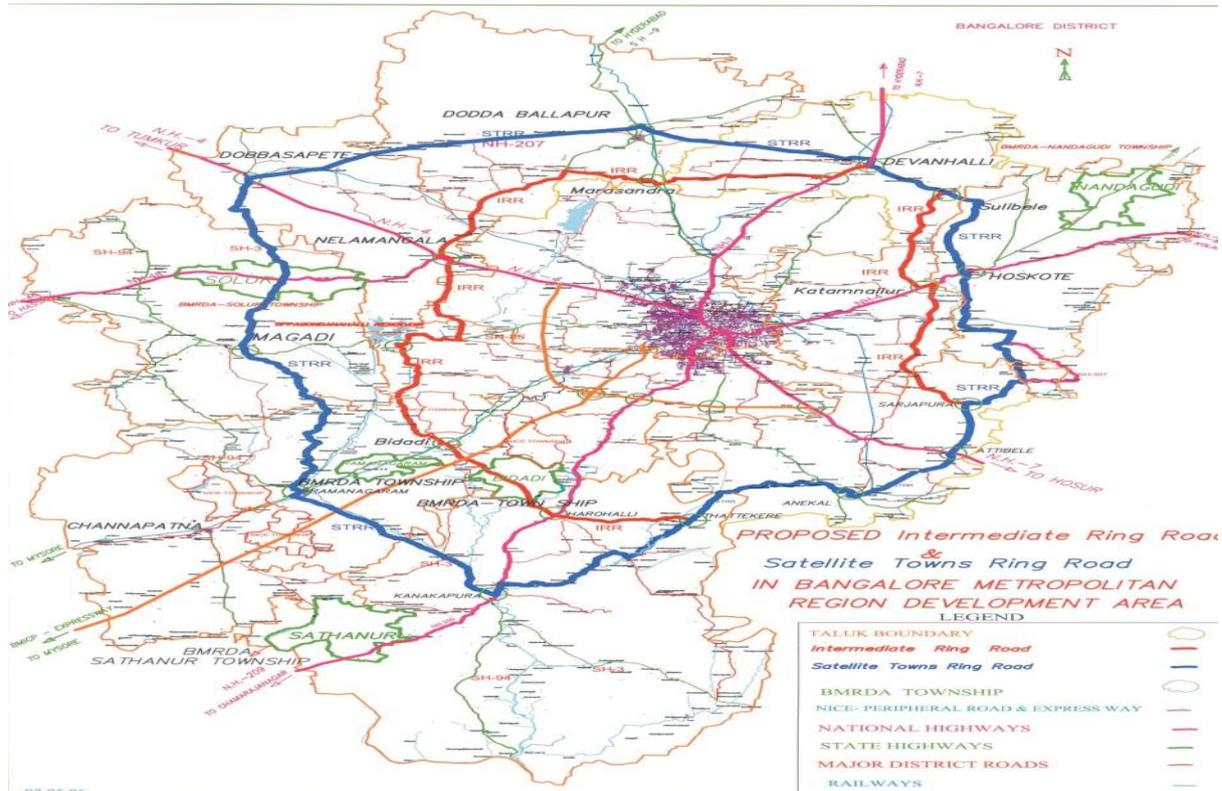


Fig 4: Distribution of settlements in Bidadi Quarry Area

Table 1 Demographic characteristics of the surveyed settlement (1991 to 2001 census)

Sl. No.	Settlements	Area (km <sup>2</sup> )	Population			Total households	Quarry Worker	Irrigated land (acre)	SC
			Total	M	F				
1	Kallugopanahalli (West)	257.78	677 (21.9%)	350	327	159	168 (24.8%)	39 (15.1%)	357 (52.7%)
2	Kenchanakuppe (east) a) K.K.main b) K.K.Janatha site c) Thammananadoddi	413.28	2407 (1640) (512) (255)	1291 (904) (250) (137)	1116 (736) (262) (118)	450 (332) (70) (48)	41 (1.7%)	257 (62.1%)	771 (32.0)
<b>Total</b>		<b>671.06</b>	<b>3084</b>	<b>1641</b>	<b>1443</b>	<b>608</b>	<b>209</b>		

Table 2 Family size in the Environment of Bidadi quarry (for survey household)

Sl. No.	Settlement	Total households	Surveyed household	Family size			
				Single	2-5	6-9	9 above
1	Kallugopanahalli	159	57 (35.8)	2	41	11	3
2	K.K. main	332	41 (12.3)	1	22	15	3
3	K.K.Janatha Site	70	23 (32.8)	0	15	7	1
4	Thammanadoddi	48	34 (70.1)	0	22	11	1
<b>Total</b>		<b>609</b>	<b>155 (25.4)</b>	<b>3 (1.9)</b>	<b>100 (64.5)</b>	<b>44 (28.3)</b>	<b>8 (5.16)</b>

Table 3 Literacy rate in two villages (according to the data available in revenue Dept. 1991 census)

Sl. No.	Settlements	Population	Literates			% of illiterate	Quarry worker
			Male	Female	Total		
1	Kallugopanahalli	677	103	43	146 (21.5)	531 (78.4)	168 (24.8)
2	Kenchanakuppe	2407	522	212	734 (30.5)	1673 (69.5)	41 (1.7)
<b>Total</b>		<b>3084</b>	<b>625</b>	<b>255</b>	<b>880 (28.5)</b>	<b>2204 (71.4)</b>	

Table 4 Distribution of literacy by level of education (data compiled from surveyed households and personal members)

Sl. No.	Settlement	Surveyed person	Literacy					Total	% of school going	% of non-school going
			>7	7-10	PUC	Deg	PG			
Non-quarry workers										
1	Kallugopanahalli	167	32	23	5	2	1	63	37.7	63.3
2	K.K.main	220	26	23	2	1	-	52	23.6	76.4
3	Kenchanakuppe-Janatha site	116	14	8	3	-	-	25	21.5	78.5
4	Thammanadoddi	173	30	24	7	-	-	61	35.2	64.8
Total		676	102	78	17	3	1	201	29.7	70.3
5	Temporary settlements	116	7	1	-	-	-	8	6.9	93

Table 5 Size of land holdings in the environment of Bidadi quarry (data compiled from randomly surveyed household)

Sl. No.	Settlements	Households surveyed	Upto 1 acre	2 acre	3 acre	4 acre	Above	Landless
Non-quarry workers								
1	Kallugopanahalli	32	10 (31.2)	11 (34.3)	2 (6.2)	1 (3.1)	1 (3.1)	7 (21.8)
2	K.K.main	41	9 (21.9)	7 (17.0)	3 (7.3)	--	6 (14.6)	16 (39.0)
3	K.K.Janatha Site	23	1 (4.3)	--	--	--	--	22 (95.6)
4	Thammanadoddi	34	15 (44.1)	3 (8.8)	3 (8.8)	3 (8.8)	1 (3.0)	9 (26.4)
Total		130	35 (26.9)	21 (16.1)	8 (6.1)	4 (3.0)	8 (6.1)	54 (41.5)
Quarry workers								
5	Temporary settlements	25	--	--	--	--	--	25 (100)

(Values in the parenthesis indicate percentage.)

Table 6. Livestock population in the surveyed households.

Sl. No.	Settlement	Household surveyed	Livestock				% of people related agricult.	% of people working in quarry	
			Cow	Buffalo	Goat/Sheep	Total			Average
1	Kallugopanahalli	32	16	5	8	29	0.9	59.3	18.7
2	K.K.main	41	30	17	13	60	1.4	60.8	39.9
3	K.K.Janatha Site	23	1	1	-	2	0.02	4.3	60.0
4	Thammanadoddi	34	51	8	11	7	2.0	70.5	26.4

Table 7. Occupational structure of the households surveyed in the environment of quarry. (Values in parenthesis represent %)

Settlement	Total population	Captivators	Salarized job	Trade and commerce	Quarry	Others	Unemployed
Kallugopanahalli	677	77 (11.3)	54 (7.9)	8 (1.1)	168 (24.8)	49 (7.2)	320 (47.2)
Kenchanakuppe	2407	486 (20)	22 (4.5)	18 (0.7)	41 (1.7)	537 (22.3)	1305 (54.2)
Total	3084	563	76	26	209	586	1625

Table 8. Dependency of household on agriculture, quarry and others, compiled from randomly surveyed household (Values in the parenthesis indicate percentage)

Settlement	% of land less	Household surveyed	Dependency on agriculture	Dependency on quarry	Dependency on trade and commerce	Salaried job	Dependency on agriculture and quarry	Dependency on agriculture and others
Kallugopanahalli	21.8	32	7 (21.8)	6 (18.7)	1 (3.1)	--	12 (37.5)	6 (18.7)
K.K.main	39.0	41	23 (56.0)	16 (39.0)	--	--	2 (4.8)	--

K.K.Janatha Site	95.6	23	1 (4.3)	14 (60.8)	5 (21.7)	3 (30.0)	--	--
Thammanadoddi	26.4	34	15 (44.1)	9 (26.4)	--	--	9 (26.4)	1 (3.0)
Total		130	46 (35.3)	45 (34.6)	6 (4.6)	3 (2.3)	23 (17.7)	7 (5.3)

Table 9. Distribution of population by earners and dependency.

Sl. No.	Inhabitants	House hold surveyed	Population			Earners	Dependency
			Total	Elders	Children		
1	Native quarry worker	44	193	105	88 (45.6)	51 (26.4)	142 (73.6)
2	Migrated quarry worker	25	116	58	58 (36.2)	69 (59.4)	47 (40.6)
3	Cultivars	46	246	124	122 (49.6)	60 (24.3)	186 (75.7)
4	Cultivars and quarry	24	140	79	61 (43.5)	52 (37.1)	88 (62.9)
5	Others	16	97	52	45 (46.3)	27 (27.8)	70 (32.2)
		155	792	418	374		

Table 10. Public amenities in the environment of Bidadi area

Sl. No.	Settlement	Schools and colleges			Hospital/Health clinic	
		Primary	Secondary	Others	Govt.	Private
1	Kallugopanahalli	1	Nil	Nil	Nil	Nil
2	K.K. main	1	Nil	Anganwadi	Nil	Nil
3	K.K. Janatha Site	1	Nil	Anganwadi	Nil	Nil
4	Thammanadoddi	1	Nil	Nil	Nil	Nil

Table 11. Indicators of the status of physical environment in the surroundings of Bidadi quarry unit.

Parameters	SCORES			
	Kall	KK	KJS	Tha
<b>A) Disturbance by dust pollution</b>				
Nuisance to dust accumulated on every domestic materials including edible food/fruits/vegetable utensil, water, or anything exposed to air.	3	Nil	Nil	6
Increase in frequency of human diseases like fever, diarrhoea, irritation, T.B. etc.	3	2	1	4
Due to dust certain cultivable land has become wasteland	1	Nil	Nil	2
Frequency of livestock diseases increases	2	Nil	Nil	1
Decrease of livestock population	2	Nil	Nil	1
Fear for livestock being fed on contaminated fodder and grasses	2	1	Nil	3
Due to quarry reduction in grazing land and consequently more percentage of stall feeding instead of sending out.	4	1	Nil	4
<b>B) Disturbance by sound pollution</b>				
Walls and roof sheets cracking	5	6	2	7
Livestock startled and have a pause for few seconds in every blasting sound and leading to change in animal behavior.	3	4	Nil	5
Children disturbed while reading when the frequency of blasting is high	7	5	3	7
Shaking while blasting leads to breaking of household material when fell from high elevation	7	7	3	8
Frequency of TV, radio repair	5	3	Nil	1
<b>C) Water</b>				
Failure of bore well and open well.	3	1	Nil	Nil
Loss of crop productivity and increase in crop disease.	2	Nil	Nil	5

Kall - Kallugopanahalli; KK - Kenchanakuppe; Tha- Thammanadoddi; KJS-Kenchanakuppe-Janatha Site

**2.3 Climate:** The climate of the district is classed as the seasonally dry tropical savanna climate with four seasons. The dry season with clear bright weather is from December to February. The summer season from March to May is followed by the southwest monsoon from June to September. October and November constitute the post - monsoon or retreating monsoon season. The mean day temperature is about 33<sup>o</sup>C in summer and 14<sup>o</sup>c in the winter. The maximum percentage of rain falls between June to September and the mean annual rainfall is around 860 mm.

### III. METHODOLOGIES

**3.1 Plot selection:** At the outset, a preliminary survey of most of the quarry site in Bangalore and Kolar district have made covering 25 sites including minor (only manual), medium (manual works and crushing), and major (consisting of numerous crushing units) areas. The number of workers, their settlements as well as the number

of villages dispersed in different sides along with their landholding like paddy field, plantation, including livestock freeing out near the quarry, is wholesomely considered. Also annoyance arises due to traveling difficulties should be minimized. It has been decided that Bidadi quarry area is sufficient area for a small - period study. Bidadi is 25 km away from the capital and this area is located in Bangalore district, which comes under Ramangaram taluk. The quarry unit is a private sector where lease are taken from the Government for 5 years and continue the process of extension. It is working since 1970s with main production including slabs, jelly, chips, building stones, etc. For the study of the socio-economic impact, two villages namely Kallugopanahalli (west), Kenchanakuppe (east), were sampled. The village Kenchanakuppe is divided into three sub-villages namely Kenchanakuppe main (K.K. main), Kenchanakuppe-Janatha Site (K.K. Janatha Site), Thammanadoddi. These sub-villages are categorized according to the distance from quarry unit and occupational structure, as well as land holding. The number of settlements coming under the four sampled villages is 727. The villages are sampled to provide different patterns of settlement representing back and front environment of 'quarry site so as to provide variation in disturbance in different settlements within a distance of 1 - 2 km radius.

### **3.2 Household survey**

1. Secondary data regarding minor mineral production has been collected from the publication of the Dept. of Mines and Geology, Land Revenue Records from its taluk, Village Records, etc.
2. Questionnaires consisting of both open ended and closed types are used to collect primary data. A common questionnaire for public survey regarding the Environmental awareness has been surveyed by using the methods like Rapid Rural Appraisal. This has help to assess the important question in preparing the second set of specific questions for survey.
3. The second type is used to collect data from each village household. This has helped to assess the socio-economic impacts and the state of the physical environment around the quarry area. More than 20% of the total households of the settlement had been randomly surveyed. The question schedule had three major parts namely; 1) demographic; 2) economic and 3) environmental aspects. The schedule used for survey has been given in Appendix.

## **IV. RESULTS AND DISCUSSION**

In this chapter an attempt has been made to study the impact of quarry unit at Bidadi on its surrounding. The study showed the prevailing socio-economic and to some extent the Environmental quality around this 'stone quarry'. For this purpose four settlements had been selected coming under two villages. These lie within 1-3 km radius from the quarry. In the beginning, demographic aspects like distribution and size of population, movement and migration aspects had been studied. Later, aspects like landholding, occupation, livestock and level of income are considered. Lastly, an effort has been made to bring out the impact on domestic activities and properties of the inhabitants concerning economic loss regarding the resultant dust blown by wind form crushers in specific directions (leeward direction). The perception regarding loss of crop productivity and livestock health is highlighted at the end. To study this socio-economic and physical variability's, households were sampled randomly in each village representing different settlement on different sides of the quarry to indicate the physical environment and environmental perception on different directions.

**4.1 Village characteristics:** The population characteristic includes the distribution, size, growth age-structure, gender, etc. It is quite clear that the study area has a population of 3851 with 727 households occupying a geographical area of 671.06 km<sup>2</sup> (1991 to 2001) census.

1. Kallugopanahalli - This village has 21.9% of the total population of the surveyed area. It ranks first from the point view of number of quarry workers (Table 1 ) It accommodated a higher population of unemployed inhabitants (table 3) may find quarry as subsidiary occupation Certain reason, like low landholding and landless condition may induce the people to take up services like 'quarry'. Also most of the area of quarry activities comes under this village. The settlements of this village have two categories, a permanent native inhabitants and migrant workers with temporary thatch-households.
2. Kenchanakuppe main - It occupies highest area of the total village area considered. It ha highest population (1640) above all the three villages consequently highest number of households. This village is situated 2km away from quarry unit and is considered as the farthest village from the 'quarry' when compared to the remaining sampled villages.
3. Thammanadoddi - It has 48 households and represents a small village. The agricultural field of these villagers is situated in front of the quarry unit where there is highest dust fall and has subjected to more impact terms of dust pollution. This village has least number of people involved in quarry (Table 7). The main occupation of the villagers is agriculture and subsidiary occupation includes Sericulture, etc.

Thus intermixing crop with mulberry plantation was common in this village. This may be the reason why less number of inhabitants are engaged in quarry (table 8).

4. Kenchanakuppe-Janatha site - This village is newly established and situated in front of the quarry near Bidadi proper. Recently there was high rate of migration our running the Village record. The reason may be high job opportunities like trade and commerce in Bidadi main market area. Rather than this, quarry activities provide easy employment for the daily-waged services. In this village, people have also taken up occupation like daily-waged laborer in agricultural fields and plantations in the neighborhood villages like Thammanadoddi, Kenchanakuppe, etc. Most of the villagers do not have their agriculture land (Table 7)

**4.2 Family size:** The highest percentage families in all the villages have 2-5 members (64.5%). This is of because the feeling that such family size assures moderate income.

Quarrying, Values in the parenthesis indicate percentage is not the source of side-income and it is rather from agricultural activities for the inhabitants in the study area. Thus income is moderately assured since agriculture is the lone source. Families with 6-9 person accounts for 28.3% of the total families surveyed.

**4.3 Literacy rate:** Kallugopanahalli has 21.5% of literate population. Most of the migrant workers Data regarding the separate information of Kenchanakuppe-Janatha site and Thammanadoddi is not available in Revenue Dept. From Tamil Nadu are almost illiterates and if literates, up to elementary schooling only. The low percentage of literacy in general may be attributed to the poor economic background that prevails in the area around Bidadi and lack of educational institutions nearby. But in the case of Kenchanakuppe, the literacy rate is 30.5%. The higher rate accounts for the reasons that higher income of the inhabitants can afford higher studies. The social awareness of the parents has helped in a big way to take up higher studies. An assessment had been made from the surveyed household personals including temporary worker settlement, to highlight distribution of literacy by level of education (Table no. 4). From the table it is clear that percentage of non-school going population in worker settlement cross 90%. These shows that all the children have left school and are employed in the quarry unit. Their status of education is completely nil. This is due to the lack of awareness among parents since quarry provides them high job opportunities even though they are illiterate. On the whole four villages, with their agricultural base, have created threshold population for the sustenance of all levels of schools up to high schools. Infact Bidadi area doesn't have a Junior college; some of the economically better placed families in these villages are sending their children for higher studies to area like Bidadi proper and Ramanagaram. In Kenchanakuppe-Janatha site where one or two people have taken up higher education up to PUC level only. In general that, poor living conditions and ignorance and socio-economic conditions are a few reasons to cite for not opting for higher education. If there is more improvement in infrastructure and transportation, as well a increased in job opportunities, with assured higher income, literacy rate may definitely go up. A whole consideration, highest percentage (Table 4) of inhabitants were educated up to 7<sup>th</sup> standard, as the Government primary school provides free education facility in these villages. So, there is need necessary to provide facilities of higher education.

**4.4 Hand holdings:** Table 5 gives the details of the size of land holdings of the surveyed households in the four villages. Thammanadoddi has about 44.4% of the total households, having up to 1 acre of landholding. Nearly 43% of the households have land area up to 2 acres and 41.5% of the village households are landless. The adjoining village Kenchanakuppe-Janatha site is another village with leas geographical are available for cultivation. This is mainly because the inhabitants are mostly engaged in other occupation like trade and commerce in Bidadi main market, and as daily wage laborers in agriculture and plantation acres. In addition they are involved in quarry activity occasionally. Kallugopanahalli has the extent of landholdings. In the study area as a whole about 6.1% of the households have landholding higher than 4 acres. It is concluded that the area is not agriculturally rich and if there is further increase in population, there is chance of people taking up quarry occupation. So in the near future, quarry unit may become the main source of occupation for those income group households and landless people.

**4.5 Live stocks:** A survey of livestock population was done and represented in table 6. It was found that Thammanadoddi village had highest average livestock. One can see clearly that people engaged in agriculture acquire more livestock. In the meantime, settlement like K.K. Janatha site, having highest percentage of inhabitants that were related to quarry, acquired least livestock. Thus, It was concluded that household engaged in works of quarry may not be interested in domesticating animals due to lack of time of management and feeding.

**4.6 Occupational structure:** Table 7 indicates details of the occupational structures of the household in two main villages available with the Revenue Dept for the year 1991. From the table it is seen that Kallugopanahalli village, having higher percentage of quarry workers showed lesser unemployment population while, Kenchanakuppe having lower percentage of quarry workers showed higher extent of unemployment. In some sense there is certain correlation as under this aspect one can see some tangible positive impact of quarry on these villages in terms of scope for job opportunities. During the field study quarry was considered as 'wrath of evil to agriculture settlements like Kenchannakuppe, which had 20% cultivable population and owing for the reason that most of the paddy field were situated in front of quarry unit, with highest dust fall due to its location towards wind direction. The activity of quarry had made more people to settle down at a particular site along with the native villagers. Consequently there is a higher demand for domestic materials and daily subsidiaries. Thus higher percentages of population are engaged in trade and commerce (1.1%) in Kallugopanahalli against 0.7% in Kenchannakuppe (Table 8) Trade and commercial activities included business, which are necessary for settlement, like petty shops, provisions, trades, hair cutting parlors, tea shall, etc. An attempt was made to highlight the impact of quarry on the occupational structure of the surveyed household in the quarry area for the year 2001 (Table 8). By considering column 2 and 5 it is clear that a village having higher value of landless household, results in more dependency on quarry. Kallugopanahalli, which is accessible, and agriculture has the highest percentage of households engaged in both the activities. This accounts for 37.5% of total household surveyed. This village had least landless household as compared to other villages. This showed that majority of people have their own land, engaged themselves in agriculture and related activities. Also, the quarry unit lies within this village land area; thus, these two criteria gave the village higher chances of dependency on more than one source of income. Conclusively, this is where we see the tangible impact of the quarry, that is, it has provided jobs to villagers who were economically poor. It has gone a long way in providing a living habitat to the poor people rather than bringing drastic changes in their living conditions and life styles. This is quite true for villages like Kenchannakuppe-Janatha site (dependency on quarry - 60.8%) which is highly favoured by quarry as source of household income. Undoubtedly the study revealed that, the quarrying has come as a blessing especially to the poor landless villagers with consistent low income.

**4.7 Earner and dependency:** An attempt had been made to compare the percentage of earners and dependency indifferent groups of inhabitants around the Bidadi quarry environment. Thus five groups of settlements were categorized according to occupational structure and dependency on specific source of income. Here quarry workers are divided into two groups - native quarry workers with permanent household and land records, while the other working groups is migrated workers group staying in temporary thatch-house beside the quarry site. Table 9 shows that the percentage of earners in all types of inhabitant ranged from 24.3% to 37.1% except migrated workers group. This group showed highest percentage of earners and consequently has lower number of dependants. Again it was found that earners population is 59.4% against elder population of 36.2%. Thus, it is clear that large percentage of children contribute to this earner population. Conclusively, children of migrated workers are not going to school and worked as quarry laborers along with their parent.

**4.8 Subsidiary functions and Amenities:** An attempt has been made to describe the existing subsidiary functions and public amenities in the study area. The emphasis is on examining the impact of quarrying in providing them with more public amenities or enhancing the existing facilities. Table 10 gives the details of schools and other hospitals/clinics in the quarry area. Quarry also initiated establishment of other services like grocery shops and hotels. This also provided more job opportunities in tea-stalls, shops, etc. In general the amenities available are inadequate. To meet major ailments the workers have to avail vehicle facilities to reach Bidadi main market for first-aid and other medication, which is 3 km away from the quarry site. There is absolutely no facility for higher education in this area and nearest school/colleges are situated 3 kms away in Bidadi proper, and 13 km away in Ramanagara. Although schools and colleges are far from this village, this sustenance is met by good public transportation services.

**4.9 Migration of workers:** Since details regarding the migrants settled are necessary in the study area, information regarding their state of origin or place of birth, mother tongues was surveyed through personal conversation involving 28 households representing a population of 116 individuals including elders and children. Almost 100% of the quarry manual workers (employed for breaking stones with hammer and chisel) were found to have migrated from Tamil Nadu with some knowledge of occupation relating stones and also like road-making, building, etc. The migrants have come to this area through their relatives, who are working in this area, or through someone known to them before. According to them, preference of taking up quarry work in this region of Karnataka is credited by reason like high job opportunity and attractive salary being provided in this region, better than the type of occupation.

**4.10 People's perception towards quarry:** In the last section of this study an effort has been made to explain the impact of Bidadi quarry on the surrounding physical environment. Though the study has limitation in obtaining empirical data, the opinion of the respondents had been sought on this aspect. The field study with designed questions relating to impact of dust and sound to the environmental scenario of the area was carried out. The data collected on people's perception from respective villages from different sides (front/back) contributed to an assessment of the percentage of household disturbed by quarry in terms of air, noise, and water and soil deterioration. Table 11 illustrates the score of the respondents indicating the prevailing environmental problems in the surroundings of the quarry area. The score is calculated from the percentage of respondents of the corresponding parameter. These parameters are reported by inhabitants as most common disturbance from quarry.

**4.10.1 Air pollution/dust problem:** A careful observation of the table 11 indicates that, villages in front of the quarry (eastern side) such as Thammanadoddi village have dust problems. During the dry month, when there is constant breeze, these villages suffer most. The pre-monsoon southwesterly winds are strong in picking up the fine dry dust and deposit them towards the east and northeastern sides of quarry. It falls on all area including paddy field, households and domestic appliances, livestock and every corner. Kallagopallahalli lies to the west (back) of the quarry. It does not have high dust problem but paddy fields and plantation (like Mango) within around 200 meters of the quarry site, are affected in terms of crop production and plant health degradation. However, an assessment of actual loss of property and health due to 'quarry' has not been attempted.

**4.10.2 Sound problem:** The main problem of sound arises during the time of blasting of rocks. Unlike dust, sound is distributed on all the sides irrespective of wind direction. The inhabitants living nearer to quarry, suffer from more sound pollution. Thus the score in table 11, for nuisance due to sound problem is similar in all settlements but differs according to the distance from the source.

**4.10.3 Water problem:** There is inadequacy of water in this area due to quarrying activities. The available open wells and bore well are meant for irrigation and drinking water. In course of time the discharge becomes very limited and lastly abandoned. The reason cited is that the vibration of ground/soil mass due to blasting might have resulted in blockage recharge rate. And it is also due to low tapping of underground water in this hard rock area. Infact low average rain per annum also accounts for the limited recharge. Due to water shortage, crops rotation is very low and the whole paddy lands are left un planted throughout the year except during monsoon season.

**4.10.4 Soil Problem:** The soil infertility results in two ways. It is true that tons of dust is deposited on the paddy field and reduces the fertile soil. The other way is the improper drainage system. The contaminated water, during the monsoon season flows in all the directions and especially so in the direction of paddy field and plantation because of gradient. Thus planned drainage system should be constructed in and around minor mining area like 'stone quarry'. Risk of contamination of dust in the fertile soil of the Bidadi environment should be reduced since many settlements are depending on agriculture as the main source of income.

## V. CONCLUSION AND RECOMMENDATION

The process of extraction of minerals and environmental problem go side by side as for development of a country is concerned. Mining cannot be altogether stopped in the context of environmental awareness, thus, agreeable remedies have to be found and that favor both sides. Thus more extensive study should be undertaken aiming at environmental reclamation of the mining area. From the study it has been shown that quarry and minor mining units can alter the social and economic status of the inhabitants, particularly those settled within 1/3 km radius.

Many positive impacts can be resulted from a long-term quarry unit. In this context, provision of job opportunities, business, transport and communication, laborer etc are the major ones. Thus, this unit is a highly favored poor and landless people. But negative impact also prevails in this environment like health hazards, crop loss (both in productivity and health) reduction in livestock population etc, resulting in higher reduction in economic status of certain household. From the survey it was found that higher percentage of inhabitants favours quarry and some households are highly affected by it.

The other aspects that need immediate attention include

- [1] Provision for free Government Health Clinic/Hospital in the environment of quarry.
- [2] Modern technique should be adopted while quarrying to reduce pollution like dust and sound which are the main problems faced to the inhabitants.
- [3] Density of crushing unit should be limited under specific areas in a way so as to reduce impact of noise.
- [4] Provision must be made for green belt of plantation that will check further dispersal of dust and absorb sound.
- [5] Free compulsory education for children of worker group.
- [6] Compensation should be given to farmer undergoing actual loss of crop and livestock production.
- [7] Environmental awareness should be developed with people undertaking quarry works.

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