

Environmental Impact Due to Clay Mining and Processing: A Case Study from Velichikkala, Nedumpana Panchayat, Kollam District, Kerala

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Abstract

The nature of mining process in Velichikkala, Kollam district created a potential negative impact on the environment both during the mining operation and for years after the mine is closed. The detailed investigation in Velichikkala over an area of 0.26 sq.km has indicated 16.25 hectares to be clay bearing. The average overburden thickness is 12.5cm. Clay mining in the area over the years has imposed notable changes in the environment. Discharge of liquid and solid wastes from the mining area reached the flood plains of Palliman river and increased the contamination of river water. The major impacts of clay mining on land are changes on landscape and land stability. Due to continuous and unscientific mining, pits of different dimension formed in the affected areas. The mining activity also affected the socio economic conditions of the peoples in surrounding areas. This paper attempts to reveal the environmental quality and socio economic settings around the mining sites with special reference to the effects on land, and water.

KEYWORDS; china clay, velichikkala, environmental impact, landuse

INTRODUCTION

Kerala state is endowed with number of occurrence of minerals such as sands, Gold, Iron ore, Bauxite, Graphite, China clay, silica etc. In fact heavy minerals sand and China Clay contribute more than 90% of the total value of the state. Kerala is an important producer of kaolite clay, ball clay and China Clay. Mining of clay is only confined to Trivandrum, Kollam, Ernakulum, Kannur and Kasaragod districts. In kollam districts China Clay deposits are reported in Kundara, Chirakkara, Chathannoor, Mulavana, Kundumon, Velichikkala, Kunnathur, Kaithakkodu and Vadakumthala areas. There is no large scale mining activity. All most all the mines are open cast and limited in areal extent. China clay mining is a complicated process which can be split in to three district section open cast mining, refining and drying. Open cast mining is pit operations. This process firstly requires the removal of ground overlay. This is known as over burden. Which can vary in depth. Refining consist of a series of mineral processing techniques. Predominantly sedimentation designed to remove the smaller sized waste particles, mainly minerals such as very fine quartz, mica and feldspar leaving only the required China clay behind. Drying consist of firstly conversion of liquid clay into solid material by a process known as filtration

A dedicate equilibrium exist on the earth between man and his environment. This equilibrium has been seriously disturbed by man's direct or indirect activity of exploiting nature to meet his personal needs. This impact of mining operations on environment has only recently been recognized. It is now well understood that mining changes the physical Characteristics of land, hydrology and soil. The negative effects are not limited to mining sites alone but may extend to the surrounding areas of the mining points.

STUDY AREA

The area is located in Velichikkala, 10th ward of Nedumpana Grama Panchayat of Kollam district which falls in 8° 53' 45'' N latitude and 76° 43' 25'' E longitude (survey of India toposheet no: 58 D/9). The total mining area is about 8.5 acres. The clay mine is situated near the confluence of two small first order channels originating on either sides of Miyannur hill (the highest point in the area with an elevation of 108 m above mean sea level) with the Pallimon river a major tributary of Ithikkara River. The longer side of the mine is almost parallel to the main power line passing through the western side of the mine. (Fig-1)

Physiographically area is coming under midland topography and divided into isolated hill, hill, slope and valley. Highest portion is in the Valiymala hill and it has height about 108 m above MSL. Based on relief the area is divided into three.(Table-1)

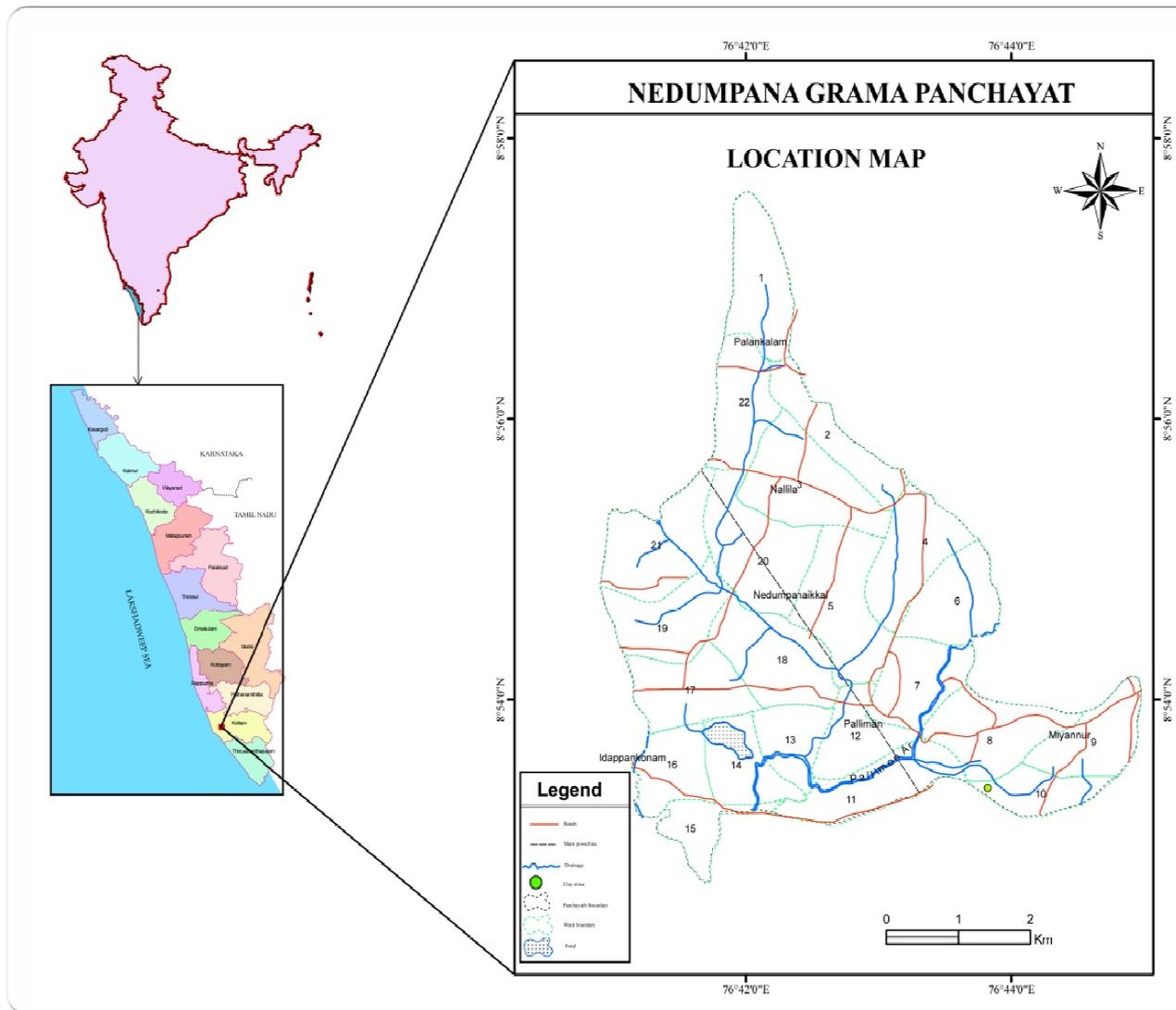
Table-1

Relief in m	Area in sq.km
20-40	12.4
40-60	60.62
>60	50

Vikasanarekha,Nedumpana grama panchayat

Topographically the area is a hillock having E-W trend. It is slopping towards the north and reaches the palliman river in the northern side. The western side of the mine is also a hilly region. A paddy field is seen in the eastern side of the mine the mine area is situated in the northern flank of the hillock.The mined area is in the form of deep trench having an appropriate depth of 50m from the ground level.

Fig-1



METHODOLOGY

Data for the case study were obtained from both primary and secondary sources. Primary data were obtained through socio-economic surveys. Field visit have been conducted in clay mine and surrounding areas to collect data. Interview, were held with the members of the Action council, company officials and local peoples.

Study area is located using GPS. A base map of the study area was generated with the help of survey of India toposheet no 58 D/9 with a scale 1.50,000 with the help of the base map different types of maps was prepared using Arc GIS.

Secondary data were collected from different sources like Vikasanarekha (Nedumpana Panchayat), water quality and land use changes has been collected from CESS (Centre For Earth Study Centre, Trivandrum) report and pollution control board report.

RESULT AND ANALYSIS

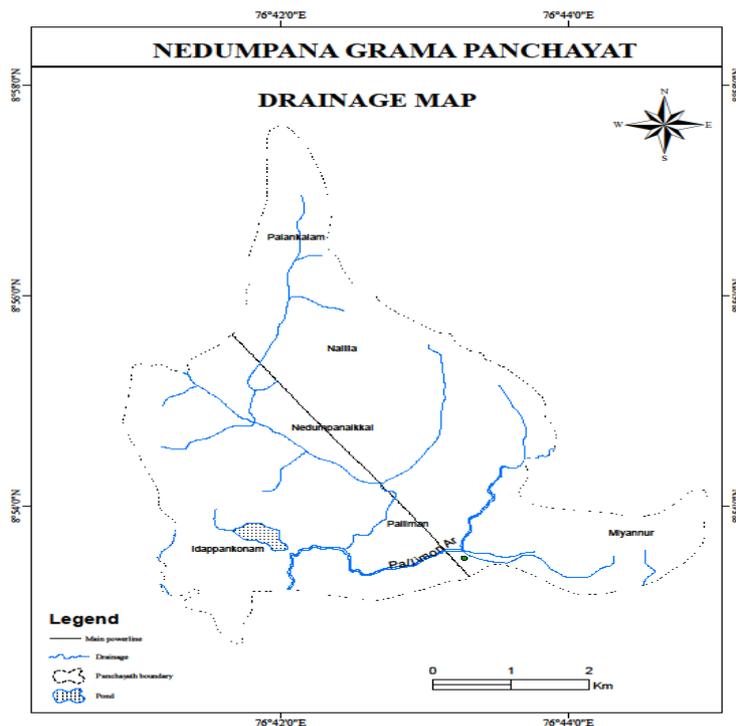
It is evident from the study that the mining is grossly detrimental to the environment. Mining in the Velichikkala was carried out by open cast extraction method. That involves the removal of over burden including the valuable top soil and vegetation cover to meet the deposit. These activities are associated with harmful effect to the environment.

The general environmental problems associated with the mining and processing of China clay are following.

IMPACT ON WATER

Clay mining in Velichikkala caused notable changes in surface water quantity and quality of the area. The mining activity created pits of variable dimensions, which gets covered with the water and became artificial ponds. China clay contain substantial quantity of quartz and importance minerals like mica and Pyrites that are found in necessary amount from other impurities in the China clay. This caused serious problems in the water quality of waste disposal site. The acidic mine water reached the nearby aquatic system and lowered the PH level. Fig 2 showing the surface water bodies of affected area.

Fig-2



Coming to ground water resources of the area mining of China clay to deeper levels could naturally expose the water bearing formation aquifer system. This in turn leads to draining of water from the ground water regime to the mining pit. This will naturally lower the ground water table of the area adjoining the mine. This leads to water scarcity in the surrounding area, especially during the summer season. Draining of water from the unaffected paddy lands into the active mines is another problem that

ultimately ends in the conversion of paddy lands for other types of cultivation in the area.

Water scarcity is a main problem in the Velichikkala area. Most of the wells near the mining area drying up during summer season. According to the CESS report PH of the well water in this area is from 2.99 to 5.0. This water cannot be used drinking and domestic purposes due to mining activity (table-2)

Table-2 Water quality parameters well water samples(W1,W2,W3) collected in and around the clay mine at velichikkala, kollam district. DW and BW-drinking water and bathing water standard values of WHO.

Sl No	Parameters	W1	W2	W3	DW	BW
1	PH	5.66	2.98	4.39	6.5-8.5	6.5-8.5
2	Conductivity, $\mu\text{S}/\text{cm}$	102	460	100	800	800
3	DO, mg/l	6.4	3.0	4.85	5	5
4	Alkalinity, mg/l	40	12	8.0	20	20
5	Chloride, mg/l	16.3	61.5	30.8	200	250
6	Hardness mg/l	70	140	14.0	250	300
7	NO ₂ -N $\mu\text{g}/\text{l}$	18.1	26	21.1	-	-
8	NO ₃ - mg/l	0.662	0.024	2.08	10	10
9	SO ₄ - mg/l	5.54	1.61	3.45	200	200
10	P, $\mu\text{g}/\text{l}$	17.4	19.0	18.7	-	-
11	Si, mg/l	13.39	12.29	4.39	-	-
12	Ca mg/l	15.23	28.06	5.21	75	75
13	Mg, mg/l	7.78	17.2	0.24	30	30
14	Na, mg/l	3.7	7.5	13.3	-	-
15	Fe, mg/l	0.011	0.034	0.011	.3	1.0

Source CESS Report

IMPACT ON LAND

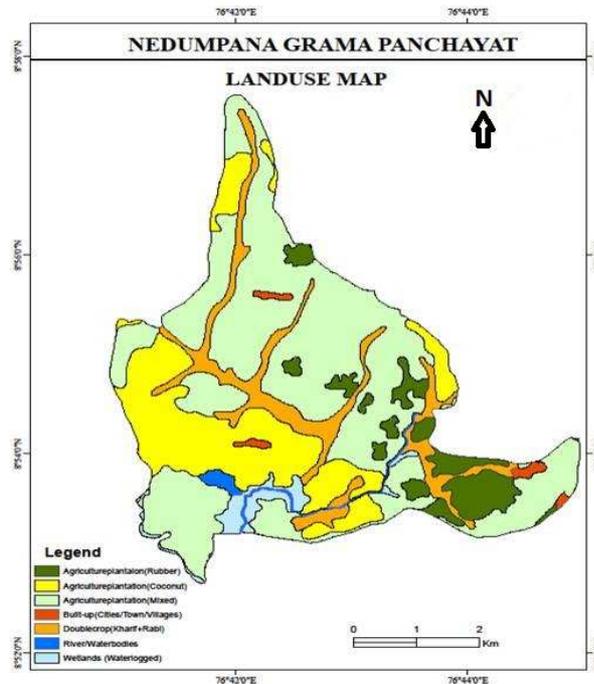
Open pit mining is adopted in the mine of English Indian clay Ltd at Velichikkala for the extraction of residual China clay developed over the weathered Archaean gneisses. The lateritic overburden is removed with the help of excavators to extract the clay. The depth of the mine, reached about 100 feet from ground surface.

Opencast mining has thoroughly changed the natural topography of the area. Large pits are left after mining and large amount of overburden material excavated during mining is dumped in the vicinity of mine sites. Flow of silt from overburden dumps causes degradation of land and disruption of water flow.

The major impact on China clay mining noticed on land is the change in landscape in to deep scar. In addition to landscape attractions, the land stability is also adversely affected by open pit mining of the four quarry faces of the clay mines, the western side is the most affected in regard to land stabilities. This is reflected in the frequency of land sliding incidents of the quarry faces. Compared to the western quarry face, those of southern and eastern sides are almost stable as these sides are cut with a few terraces. Fig-3 showing the land use of the mining site.

There will be marked decline in aesthetic environment of the area subjected to clay mining. The valley covered by paddy fields are naturally set with in vegetated hillock. Ugly scars within paddy fields due to mining are aesthetically unacceptable and produce a negative impact.

Fig-3



IMPACT ON SOIL

Clay mining is the process of scooping of soil that actively supports the agricultural activities of an area. The removal of naturally formed soil for clay particles is loss forever of the fertile natural medium. The entire process is a kind of man made erosion of material otherwise segregated the mother earth through its geological process. The top soil is usually fertile in nature. The present study also reiterate the fact that the top layer is several folds richer in N,P,K and other micro nutrient elements. But according to some farmers in the Velichikkala, the top soil of certain areas of paddy lands are unsuitable now for agricultural activity. Nearly 15 families near the mine mainly depend up on agriculture. Due to acid water and wastes material from mine, the soil fertility of the land reduced. These adversely affected the agricultural production

IMPACT ON VEGETATION

The area where clay mining is practiced is usually paddy lands which are generally devoid of natural vegetation. But in some cases, wetlands other than paddy lands are also scooped out for clay processing. As regards agriculture any type of quarrying or reclamation would produce only negative impacts and the magnitude of which is proportional to the area under mining. These problems were noticed in velichikkala

Large scale mining activities have contributed directly or indirectly to the depletion of the biological diversity in the region. Removal of vegetative cover is often followed by massive soil erosion, and sedimentation of river. Indirect impact may include changes in nutrient cycling, disruption of ecosystem etc

IMPACT ON SOCIO ECONOMIC CONDITION

Clay mining at velichikkala also affected the socio economic setting of the surroundings. So many people were forced to leave from their land due to the commencement of the company. Initially the company provided job to a section of people in the area . The employment potential of the mining was much less than claimed and very few locals are actually benefited .The workers from other area caused increased pressure on the locally available resources such as water land fuel wood etc. But however it is observed that more than 25 labours lost their job after the company was closed. It is also affected the health and livelihoods. It caused a division in communities over who benefits from the mine and who doesn't.

CONCLUSION

According to export committee report (Govt of India, 1982) mining activities create various ecological and socio economic problems. Asper the report important problems generated due to mining activity includes water pollution, air and noise pollution, land degradation, disruption of aquatic ecosystem, deforestation, landslides, human environmental problem like settlement displacement, employment and allied problems and damage to topographical, cultural, historical and scenic importance

In the case of China clay mining in Velichikkala also we can see some of these problems like water pollution, land degradation and socio economic problems even after the company was closed. Due to mining operation undertaken in the fertile or productive land, the areas available for cultivation, forestry and grass land are reduced. Major findings from the study are following below.

- Land Pollution in the Velichikkala area reduced the land capability and productivity
- According to CESS report PH of the well water in this area is from 2.99 to 5.00. due to acidity this water cannot be used for drinking and domestic purposes,
- The storm water from the plant area missed with the raw materials is reached Palliman river increased the contamination of river. This caused health problem to nearby people
- Greater depth mining caused the lowering of water table of the area adjoining the mine. This leads to water scarcity in the surrounding area.
- People living in the surrounding area suffering from cancer, lung diseases allergy and skin diseases from suspended particles from the mining sites
- The China clay mining has created an ugly scar at the expense of the aesthetic environment of the area

Recommendations / Suggestions

1. Mining should be strictly in accordance with stipulation in the approved mining plan and also recommendations of the report on joint inspection of director of mines and safety and department of mining and Geology.

2. Prohibit mining activities within 50m zone of residential area
3. Immediate steps are to be made to strengthen the western side of the clay mine by constructing suitable supporting structure that can prevent land failure incidents.
4. The scar developed due to mining has to be healed by taking appropriate remedial measures.
5. Effort should be made to revive the original landscape to the best possible level. Use native plant species to reinstate the greenery of the reclaimed area.

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