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Mining and Environmental Degradation, A case study of Jhamar Kotra Rock phosphate mining area , Udaipur (Rajasthan)

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Abstract - Mining is the second biggest industry after farming at all scales and districts and it plays had an essential impact in the improvement of human progress from old times. The greater part of the significant materials for man like metals, synthetics, fuel for energy, shakes and stones for building, all come from mining. Notwithstanding, mining is likewise an ecologically harming movement, causing enormous scope deforestation, escaping away of untamed life and even termination of certain types of it and obliteration of other regular assets. Mining makes tremendous squanders and requires extensive space for their unloading and in this way sets off various ecological issues like land debasement, water and air contamination, land breakdown and even drop in water table. Enormous amount of air and water contaminations is likewise added to the climate during beatification cycles of minerals. Notwithstanding the development of streets, slurry dams and tidal ponds for squander adjustment, common development and so on additionally makes boundless harm the climate.

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INTRODUCTION

Mining is a very long and complex process and involves several steps between the sampling and excavation of mineral ores to concentration and processing of the final products, leading to a variety of environmental problems. The degeneration begins with the extraction of minerals resulting into land degradation followed by the continuing air and water pollution till the final product is available.As a matter of fact, the conflict between mining activity and its external environment has been intensified in recent years. Consequently mining has lead to the destruction of not only its own resources but also of other productive natural resources such as land, water, air and vegetation. These physical changes, let lose and aggravated, in turn, have initiated grave chemical and bio-chemical changes, many of which are yet to be understood by the man. The extent of such an environmental impact can range from scarcely perceptible changes to highly obstructive impediments.

Mining is the second largest industry after agriculture at all scales and regions and it has played a vital role in the development of civilization from ancient times. Most of the valuable materials for man such as metals, chemicals, fuel for energy, rocks and stones for building, all come from mining. However, mining is also an environmentally damaging activity, causing large scale deforestation, fleeing away of wildlife and even extinction of some forms of it and destruction of other natural resources. Mining creates huge wastes and requires considerable space for their dumping and thus triggers a number of environmental problems like land degradation, water and air pollution, land collapse and even drop in water table. Huge quantity of air and water pollutants is also added to the environment during beneficiation processes of minerals. In addition to the construction of roads, slurry dams and lagoons for waste stabilization, civil construction etc. also causes incalculable damage to the environment.

In order to appreciate the interaction between mining and environment as a result of man's interference with nature, it is important to understand the damage done to the environment by the exploitation of natural resources, especially related with the extraction activities of the minerals. The impact of the mining activity has threatened the ecosystem horribly, affecting the very base of living beings and non-living things of the mining areas by their reciprocal reactions. The significance and magnitude of the environmental pollution caused by mining depends on the nature and extent of natural resources found in the area. Its geological and geomorphological setting, nature and type of mineral deposit, land use pattern before the commencement of the mining activity and changed post-mining land use, the methods of mining and beneficiation, smoke and gases coming out from the beneficiation and processing plants, and the scale and concentration of mining activity in the area.

Properties and Geology of Rockphosphate

Rockphosphates are mainly phosphates of lime and while their value as fertilizers depends on their phosphorus content, most soil need phosphorus and lime. Rockphosphate is a collective name given to minerals associated with calcium fluorine crystal structure of apatite. The phosphate is present in every part of the earth but plants cannot get it in water soluble form needing to manufacture the fertilizer out of it. Rockphosphate had gained prominence in the fertilizer industry by the end of the 19" century. Today, a few countries are engaged in mining of this raw material. India unfortunately is not well endowed with large reserves of rockphosphate and shares only 0.51% of the total global reserves but, Udaipur Mineral Basin is fortunate to hold first position in India, producing more than 90 per cent or total production. Phosphorus is present in most rocks in minor to trace quantities, ranging from an average P,O content of 0.05% in sandstone to 0.41% in intermediate igneous rocks. It is only in phosphate rocks that the P,O, content is very high; enough for it to constitute a phosphate ore attaining value as high as 40% P,O, in same rocks. Phosphate rock occurs in deposits, ranging in size from a few tonnes to many billion tonnes. An igneous phosphate deposit are geographically fairly wide spread and range in age from pre-cambrian to tertiary, provides approximately 16% of the total world deposit Sedimentary phosphate deposit phosphorites are by far the most important of the world's sources of phosphate rocks. Phosphorus is a ubiquitous; it is a minor component of the igneous and metamorphic rocks. It contributes 1% in the composition of the earth. The concentrations of phosphorus in igneous and metamorphic rocks is from a small percentage to a few parts permillion.

The availability of phosphorus varies with rocks. Today, any rock that possesses at least 4% PO can be called as phosphate rock but its commercial importance is with 10-12% PO The importance of this mineral can be adjudged by the fact that deposition of it on the earth surface remains unaffected with the varying weather conditions. The effect of climate has been on it in the course of millions of years and if at all there is any change, it rather upgrades the deposited binding material, leaving the residual phosphate in a better form. The deposition of phosphorus experiences a varied geological cycle. The ultimate source of all phosphate materials, among which apatite is the most common, is igneous rock source; second is dissolved in soil from which it is absorbed by the plants. It is ultimately consumed by the animals and is again deposited into the beds or taken to the sea life to start the cycle anew. There are many secondary phosphate deposits viz., phosphate rock, phosphate limestone, phosphate marks, marine phosphate beds, apatite guanno blast, furnace slage, bone bed etc. Its commercial exploitation is possible from Igneous and sedimentary sources and all these phosphate deposits have been found suitable. The sedimentary deposits of JhamarKotra phosphate are the result of the igneous phosphates rock derived through the process of denudation.

According to Dr. R.P. Sheldon, in India phosphate deposits can be available at the Himalayan foot-hills and in the Rajasthan desert. As such the G.S.L. (Geological Survey of India) started investigations into the deposits of Rajasthan. In 1964-65, a deposit of low grade phosphorite in sedimentary formation of Jaisalmer was found near Birmania and Fatehgarh villages. In 1966, an indication of phosphate rock was noted in Navalgarh and in Rama-Ushan and Bhindar areas in Udaipur district by the State DMG (Directorate of Mines and Geology). Realising that the rocks around Udaipur have the potential sources of phosphatic deposits, the search continued. The G.S.I explored the phosphate deposits of Kanpur-E of Udaipur city. In this bed, further discoveries around Matoon, Kanpur, Kharwaria and DakanKotra proved that the deposits were close together. These deposits, however, contain low grade ore and that too in small quantity. The state DMG on the other hand discovered the deposits of Neemuch Mata, Sisarma and Badgaon areas in the vicinity of Udaipur city. All these vigorous efforts made by the state DMG and GSI, culminated with the 1968 exploration of high grade extensive ore deposits at JhamarKotra of Girwa tehsil (Udaipur district).

Uses of Rockphosphate

Fertilizer Industry: The bulk amount of rockphosphate is used (80 %) in the manufacturing of water soluble phosphatic fertilizers. Small quantities of suitable grade of rockphosphate are also used directly in the acid and soils. Different types of straight and complex fertilizers are manufactured out of the rockphosphate. In the category of straight fertilizers it comes as single super phosphate (SSP), triple super phosphate (TSP), diamonium phosphates (DAP) and NKP fertilizers.The P2O5 content occurs (indicating total and available forms) in various types of fertilizers and the amount of rockphosphate (analysing about 30% PO) that is used for each fertilizer.

Chemical Industry: In the chemical industry, rockphosphate is used to the extent of 18% to produce elemental phosphorus by electro thermal reduction and in phosphoric acid by wet process and in various phosphorus compounds, such as phosphorus pentaoxide, phosphorus pentasulphide and phosphorus trichloride. The phosphoric acid is used for hexametaphosphate. The elemental white phosphorus is used for making phosphoric acid and phosphatic compounds, phosphorus alloys and for some defence requirement. For making it more usable, it is converted into red phosphorus that is used in the manufacturing of safety matches. Phosphatic compounds have wide uses in baking powder, water softening, dental cement, glass fibre, proofing and phosphatic chemicals.

Other Uses: Small quantity (2%) of rockphosphate is also used for the production of phosphorus rich pig iron, phosphorus based fire alloys and in the refining of sugar.

Overview of study area

JhamarKotrarockphosphate mining area is situation between 73°49′15" E to 73°52' E Longitudes and 24°27'30" N to 24°29'45 N Longitudes. It is 25km in south east of udaipurcity.The area shows a fairly high degree of ruggedness through regular existence of high hills and hill ranges, accompanied by deep valleys and high gradient seasonal rivulets. The terrain shows a general Snly to S easterly slope with gradient of about 250 to 300 m in 1 km. The topography of the area is not yet matured and as such it experiences erosion.

The dominant feature in the region is the NE hill with 658 m height, in the NW 619 m height and others are of 616 m, 612 m, 600 m, 579 m and 586 m elevations. The master contour of the area is 500 m above msl along the seasonal rivulet. The original landscape of the area has been completely changed . The mining pits have been dug for more than 100 m in depth and spread over an extensive area. The original geomorphological features have disappeared and the hillocks found there in past times, have turned into ditches and the parts of the area stand filled with overburden, particularly in the Sn parts. The overburden dumps have spread over a large area. The dumps lying in the SEn and Nn parts look like hillocks.

The drainage of the areas within the JhamarKotra mining complex is seasonal and there is no perennial flowing stream except trickling of water down the stream of 3 springs. There are some localised valley areas which have appreciable water storage capacity and are serving effectively. The area is devoid of any major river system. It is drained by seasonal river Jhamari and a number of small rivulets which originate from the neighbouring hills in direct response to precipitation. There are two prominent rivulets: one is 'Jhameshwar rivulet which flows from NW to SE and discharges into Jaisamand lake and the second one originates from the Sn slope of activity hillock and flows from N to S and drains into jhamari river.

Environmental degradation in the study area

Mining along the ore rifining and purification processes degrades the environment in my ways. Land degradation Jhamarkotra mining activity has grabbed 217.5 hect of land. Out of this total, 131.5 hect went for mining and 86 hect for overburden dumping.TheJhamarkotra mines alone has grabbed 112.00 hect(97.39%) of the total forest land, and 37.96% of the total Basin forest land. Out of the above grabbed land, 32 hect has been grabbed for mining and 80 hect for overburden dumping.

Similarly, out of the 105.5 hect of open land, the mining activity grabbed 99.50 hect and dumping the overburden had a share of 6 hect. No agricultural land has been grabbed by the mining activity in Jhamarkotra.

Ground water and Drainage system presently, de-watering operation in mining area is taking place and 10 tubewells are active in de-watering the mining pits. It may cause many problems, such as lowering of groundwater table, change in water quality, aquifer puncturing, etc. The rivulets, most affected by the mining activity were from the NEn slopes of hillock, merge in the Jhameshwar rivulet. At NE 6 first order rivulets at an average depth of 50 m have now disappeared. The Sn overburden dumps have affected the drainage of this part of the activity area. A total of 11 first order tributaries of the river have been disturbed by the overburden dumps. Most of these rivulets are filled with waste, changing their original courses. The loose .material from these dumps flow with rain water and get deposited both in the stream bed and on the nearby surface. The Wn newly opened mining pit has also affected two rivulets flowing from NW to SE. The mining pit has disturbed the original course and waste dumps have filled the valley portion of the area. The tailing disposal causes extensive contamination in the surrounding catchment area. Groundwater is also contaminated by seepage through the bottom of the disposal area. A surface waterbodies,Jhaman dam constructed 10 km down S, by the mining authority near Mamadeo village commands about 122.58 sq. km of total catchment area. The full tank level and foundation level of the dam are 402 m and 374 m respectively.

Groundwater Condition in JhamarKotra - There are six aquifers present in JhamarKotra and its surrounding areas, varying according to their respective rock lithology. However, these aquifers are not inter-connected. In the mining area of JhamarKotra, due to dewatering only one aquifer so affected belongs to dolomitic and ferrogineous limestone (including siliceous limestone). This aquifer is mainly found in dolomitic limestone. The mining pit has the catchment area of around 40 km^2. Earlier the level of groundwater table at the mining pit was 495 m above msl in 1990 but in recent times, due to dewatering, it has come down to 468 m. The mining level is at 480 m above msl. Out of the total 19 tube wells in this area, only 13 are in working condition. Aquifer recharge here is only from rainfall as it is not connected to other aquifers and surface water bodies. The mining pit acts as a major recharger. Annual recharge is 3 mcum (rainfall 600 m.m./ year). Here numerous cracks have developed during the blasting, act as rechargers during the rainy season. The water flows in this aquifer is from SW to NE.

Water discharge is about 700-900 cum/hr but the total effective pumping is 75%. The withdrawal is 4.5 m cum. The recharge of water in this aquifer is mainly due to porosity of rock and in JhamarKotra (mining area) both types of porosities are observable. The presence of primary porosity means that the rock has voids between the grains in which water is available.

Water pollution The commonest water pollution problem caused by the mining and ore preparation processes is the deposition of suspended solids in the adjacent water courses, resulting from the wash - off from waste dumps and flotation and leach plant wastes in tailing disposal areas. The most common and direct form of such physical pollution of water is turbidity and silting up of rivers, lakes, tanks and irrigation canals. Water turbidity results in decreased light penetration, which seriously affects the food chain in a marine ecosystem. Directly, it has a serious effect on fish and particularly crustaceans. However, the most serious water pollution problem associated with the mining industry is caused by toxic metals and by acid water drainage from both underground and open cast mines. This form of pollution results from the oxidation of the primary mineral being mined and from other minerals of the ore. To analyse the water quality in rockphosphate mining areas, 9 water samples have been collected from different locations , 4 samples have been collected from wells ,2 from tubewells , 2 from hand pumps and 2 from handpumps and 1 from rivulet.

These samples represent the following chemical properties-

pH The pH value ranges from 7.35 to 8.45 the highest value was recorded in the samples of tube well situated in the core area of JhamarKotra mining area. All the samples represent alkaline nature which is due to chemical composition of the host rock. Rockphosphate has 4550% of CaO which develops base with the action of water.

EC (Electrical conductance): In the rockphosphate mining areas, the average EC value was recorded 0.716 m/mhos, the range being 0.406 to 1.118 m/mhos. The highest value 1.118 mimhos was recorded in the sample of a rivulet which flows in the SEnpart of activity area and the lowest was recorded in the sample of the tubewell located in the core area; both in JharmarKotra mine. In the rivulet, the salt of host rock is dissolved by the mechanical process running water and thus it increases the EC value.

Total dissolved solids (TDS): The TDS value in the collected samples varies from 0.266 to 0.728 ppt or g/l The average value is 0.529 g/l The highest value was recorded in the rivulet the tube well located in the core of which flows in the SEn part of activity area and the lowest activity area for dewatering. The TDS value of open wells was recorded near to 0.500 ppt. Total hardness: The total hardness value of Rock phosphate mining areas varies from 216 to 636 mg/l. The average of the region is 390 mg/l which is the highest in comparison to the other mineral mining areas. The total hardness of the water is the result of calcium and magnesium ions in the water. The host rock of the region rockphosphate has 46-50% of CaO and 1-2% of MgO in its chemical composition which dissolves in water and increases the total hardness value of water.. Calcium: The Calcium content was found to be the highest in the rockphosphate mining area which ranges from 60.90 to 277.2 mg/l. The average Calcium value is 216.95 mg/l. It is higher than the standard limit. It is due to the higher content of CaO in the host rock. Magnesium: The magnesium content was also found to be highest in the rockphosphate mining areas. It varies from 31.32 to 87.54 mg/l. The average value is 42.72 mg/l. The highest value was recorded in the sample of rivulet. The magnesium content in the samples of wells was recorded about 35 mg/l.

Total alkalinity: The values of total alkalinity vary from 210 to 454 mg/l The average value. is 352.68 mg/l. According to standard limit it should be more than 100 mg/l for the growth of phytoplanktons.

Chloride: The concentration of chloride ions in rockphosphate mining areas was recorded 149.50 mg/l on an average. It varies from 113 mg// to 255.6 mg/l. It is so under the standard limit except in its highest value. The highest concentration of chloride value was recorded in the sample of a tube well located in the core area of JhamarKotra mines.

REFERENCES

1. Agarwal, M.C. (1980). Environmental Pollution due to Surface Mining. Indian Mining and Engeneering Jl., 19, (102): pp. 13-18.
2. Boulton, R.J. (1971). Open cast coal Mining and conservation Agriculture 78, pp. 132-51.
3. Dhar, B.B. (1986). Assessment and Analysis impact of mining on ecology int. symp. on environmental problems in regions of mining and associated activities, Jan. 1016, New Delhi.
4. DharB..B. and Ratan, S.., 1985. Impact if surface surrounding blasting mine on Mining environmental, Indegenious Explosive and accessories, policies and programmes, Feb. VigyanBhawan, New Delhi.
5. Ghosh, A.K. (1982). Environmental control and the Mining Industry.
6. Ghosh, Rekha (1990). Land Restoration Measures in area damaged by unplanned mining, A.P.H., New Delhi-26.
7. Lodha R.M. Aggarwal V., Lodha P. (1996). MiningHimanshuand Environmental stress, Publishers, New Delhi.
8. Lodha R.M. (1997). Environmental and IndustryAn Alarm, Shiva Publishers Distributers, Udaipur.

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