Environmental Geochemistry, Vol.1, No.2, pp.97-100, 1998

IMPACT OF MINING ON ENVIRONMENT IN GOA: A REVIEW

G.N. Nayak
Dept. of Marine Sciences &Marine Biotechnology, Goa University, Goa - 403 205

Abstract: Among all the activities, mining appears to be one of the most degrading actions of man on earth. Modern industrial, economic and commercial activity depends a lot on the exploitation and consumption of minerals. The process of extraction of mineral resources and its use in various ways generate a wide range of environmental changes sometimes having far reaching consequences. Similarly, the rapid strides in exploration of mineral resources, to cope with the ever increasing demand intensified the mining activity in Goa which still forms the backbone of state's economy. Mining must inevitably causes disturbance to land, and to the soil and plants which clothe it. Mining implies selection, which in turn implies the rejection of waste, and the very process of selection will cause an impact on environment. It is noticed that the mining industry in Goa caused immense ecological damage only due to improper planning. As demands for minerals grow, the area of mining would expand at a faster rate, threatening increasingly larger areas of landscape with scarification, debris dumps, soil degradation, with widening circle of deforestation and distress to the population affected.

Keywords: Mining, Environmental impact, Goa.

INTRODUCTION

Among all the activities, mining appears to be one of the most degrading actions of man on earth, whose impact on the environment has created a number of mind boggling environmental problems (Ganihar, 1990). Modern industrial, economic and commercial activity depends a lot on the exploitation and consumption of minerals. The process of extraction of mineral resources and its use in various ways generate a wide range of environmental changes sometimes having far reaching consequences (Veeresh, 1989). Similarly, the rapid strides in exploration of mineral resources, to cope with the ever increasing demand intensified the mining activity in Goa which still forms the backbone of state's economy (Ganihar, 1990).

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DAMAGE TO FOREST LAND

Valuable ore bodies located in thick forest areas or adjacent to them, if mined by open pit method, would unquestionably require the removal of trees and vegetation. In Goa, deforestation was inevitable as 70% of the mining activity is carried out in forest areas (D souza and Nayak, 1994). This in many cases drastically changes the micro-climatic conditions which leads to degradation of flora and fauna (Paliwal, 1989). The indiscriminate cutting of forests results in uncontrolled erosion and silting of water courses. Damage of forest land is caused particularly in the Bicholim Sirigao area, Pissurlem - Sonshi area, Surla-Pale area and Odamol-Tathodi area. The forest growth in these areas is generally of scrubby type with no commercial timber. Nevertheless, the damage does cause environmental degradation.

LAND DEGRADATION

Sliding and slumping of land due to large scale excavations in the surface mining is the basic cause of land degradation. Clearance of vegetation for exploration, advancement of mining activities and disposal of waste rock affect the landscape and environment (Subramanyam, 1986). Land is not a resource which automatically renews itself. It is a finite resource, being diminished by the spread of industry and urbanisation (Coleman, 1979).

Top soil, overburdens and rejects are stacked in places most convenient to the company giving least consideration to and the environment and cause extensive and widespread land degradation. Each year some 30 million tonnes of rejects are generated and stacked in large dumps (Alvares, 1993).

GROUND WATER DEPLETION

In mines, where workings have gone below the water table, pumping out of water from the mining pits, besides polluting of water streams, has resulted in the depression of the water table. This enventually affects the biodiversity in the forests and rivers due to shortage of water. In some cases, due to accumulation of water in the pits, the water in the wells located in the lower contours become turbid. As the mining activity extends deeper in search of more ore, well water supply to the inhabitants is likely to be affected adversely (Swaminathan, 1982). Initial deforestation/ devegetaton and stripping of top soil at the mining site reduces the filtration capacity of the soil which results in a reduction in the quantum of water which normally percolates to the substrata, thus affecting the ground water supply (Alvares, 1993).

NOISE POLLUTION

Mostly the ores which are mined are covered by a thick mantle of overburden material consisting of laterite, lateritic clays and manganiferrous clays has to be removed by blasting. About 1000-5000 kg/of expslosives are used for blasting per mine per month (D Souza, 1993). Heavy blasting leads to ground vibrations which may damage the structures in the vicinity of mining centres and may also cause irritation to the people inhabiting nearby (Paliwal, 1989). Blasting is known to be causing cracks in the near by houses besides having a deafening effect on the people (Dessai, 1990).

Besides blasting operations, movement of vehicles, operation of heavy mining machinery leads to noise pollution. In manually operated mines noise levels are low. Noise levels below 85 dBA does not cause permanent hearing loss (Natarajan, 1989).

AIR POLLUTION

Mining and associated activities like drilling, blasting, road haulage, crushing and screening generate dust and adds particulate matter to the air. When mining operations are in full swing, the air pollution is prominently visible. The entire atmosphere appears masky due to the raising of dust in the area of the mine. The particulate matter remains suspended in the air due to the continuous day and night operations (16 hour/day) inside the mine. The continuous movement of trucks raises tremendous amount of dust into the atmosphere (Dessai, 1990). Also dumping of ore and waste, transport of the ore or the overburden in the open trucks, the fine particles of soil or ore becomes easily airborne. The dust settles heavily on the houses as well as on the vegetation. The trees are shrouded in red dust during the mining operations. This permanent dust mask, on the leaves cuts down the rate of photosynthesis. The mine workers are greatly affected as they constantly inhale the dust from the mines. People living in the nearby areas are found to be more prone to cold, fever, tuberculosis and various forms of pneumoconioses. In non mechanised mines, the dust release is not considered to be a major problem of air pollution.

WATER POLLUTION

Mining affects the hydrological regime by direct discharge of mine water to the streams and due to erosion and washoff/runoff from the mined out area and waste dumps (Chaudhari, 1994). In most of the mines in Goa, the ore is found below the water table and to extract this ore, the water is pumped out (150 million m^3/year) from the pits in turbid condition. This water also creates environmental disturbances in the surrounding areas. Collosal amounts of ore rejects are dumped here and there without bothering whether they are near lakes or rivers, fields and human habitations. The runoff carries the fine materials of the dumps to the water bodies and water courses, silting them up. So the rivers overflow the banks in some places (Shetty, 1986). The water may be acidic, charged with dissolved chemicals and toxic substances or suspended solid particulates. Water pumped out is generally hazardous to biotic life as well as for human consumption. The rivers polluted due to mining activities are Biocholim, Harvalem, Madei (Usgaon) and Khandepar. Bicholim river is polluted mainly from the runoff from the dumps and beneficiation plant at Biocholim mine, Onda Harvalem river from the washoffs and pumping of mine water from Pissurlem, Sonshi, Deulem and Cudnem mines, and Madei river is polluted from the washoffs of Pale mines. The extent of silting was not measured but it appears to be quite grave in the case of Pale mines from where the washoff to the Madei river. Besides the Usgaon river is polluted by the slimes of washing plants. Khandepar river which flows through the mining area is polluted due to the washoffs from the dumps of Codli Kirlapal, Bimbol-Sigao and Odamol-Tathodi group of mines. Some of these mines have their dumps right on the river bank, from which washoffs flow directly to the river during the rainy season.

Studies carried out have shown that the tributaries which pass through the mining zone contain very high concentration of total suspended matter (TSM). During monsoon, the tributaries and estuarine waters contain high concentration of TSM (3400 tonnes in Mandovi) which leads to

high turbidity (Nayak, 1993). Turbidity reduces the amount of light to planktonic life and therefore productivity. Mine tailings deposited in the estuarine zone suffocates the benthic fauna. Studies also showed that suspended matter and soluble iron had affected the quality and the quantity of the phytoplankton in the waterbodies. This, in its turn and the higher concentrations of iron in the water had adversely affected other organisms dependent on the phytoplankton (Hiremath and Shetty, 1987). Metals like Fe, Mn, Cr, Ni, Zn, and Pb which are carried by adsorption from the mines on clay, settle within the estuaries due to the high salinity. NIO studies have shown that various organisms like mackeral, Indian herring and shad are known to bioaccumulate heavy metals. The extent of pollution of estuarine and river sediments is calculated (Bukhari, 1994) by using the formula of Muller (1967) shows Mandovi sediments as moderately to strongly polluted by Fe, Mn and Cr.

DAMAGE TO AGRICULTURAL LAND

In Goa, the mines are situated on hillocks and invariably the agricultural fields and villages are located at the foot hills.

Naturally the rain water flows down the hills. Since the original land surface is disturbed due to mining, the unconsolidated surface is exposed. The rain water carries huge quantitites of silt into the agricultural fields, water courses and private and public lands are located at low levels. While mining the ore, large pits are created in the form of craters which leave a big scar in the area. A large quantity of mining rejects is being excavated and dumped on the hill slopes and the same occupy large areas of agricultural fields. Damage to agricultural land by the mining activity in Goa has been caused largely by reject dumps, pumping out of muddy waters from the working pits including those where the mine workings have gone below the water table, and slimes from the beneficiation plant. These mining rejects being mostly in the form of clays, flow alongwith the monsoon runoff and spread in the surrounding agricultural fields thereby affecting the low lying paddy fields. As such the agricultural yield is affected. It is found that the slimes and silts, which enter the fields get hardened on drying. According to studies carried out by Indian Bureau of Mines in 1981, about 253 ha. of agricultural land located close to the reject dumps has been adveresly affected (Saminathan, 1982). Also due to physical processes like flash floods, the reject material gets carried away and deposits in the agricultural fields. The mine material increases the acidity and reduces the porosity of the soil and hence the fertility (D Souza and Nayak, 1994). The germination of seeds as well as root growth is inhibited by concentration of iron (Dessai, 1990)

IMPACT OF MINING ON FLORA

During mining, the natural soil horizons get disturbed and the nutrient rich top soil is usually buried. The higher concentrations of iron and less amount of plant nutrients in the soil of the dumps make them not ideal for the plant growth (Shetty et al., 1987). Physical analysis of the mine reject reveals that it is mostly made up of clay which hinders the plants growth especially the penetration of the roots into the soil because of its compact nature. Chemical analysis shows that the reject has a high concentration of iron, alumina and manganese which have deleterious effect on the growth of the plants. It is deficient in the three micronutrients, i.e., Nitrogen, potassium and Phosphorours and also deficient in macronutrients like Calcium and Magnesium which are very much essential for the proper growth of the plants. Reject material is also very poor in organic matter content (Veeresh, 1989).

Studies carried out by Dessai (1990), have indicated that the inhibition in germination and reduction in root length of the germinated seeds may be due to the action of heavy metals present in the ore rejects.

IMPACT OF MINING ON FAUNA

The mining activities not only remove the vegetation but also bring up soil which is not suitable for the growth of fauna (Detwyler, 1971). Deforestation as well as the continuous use of explosives on the mines lead to the migration of animals. These altered factors disrupt the element cycles and release toxic metals. They expose the organisms to a changed environment that is often beyond their tolerance capacities (Colin Vaux, 1973; MacMohan, 1983) and cause extinction of most, if not all organisms. Iron was found harmful to the fishes even in low concentrations as ferric hydroxide clogs up the gills (Hiremath and Shetty, 1987). The reject material from the mines and slimes from the beneficiation plant flow into the rivers and streams, thus acidifying the water and has adverse effect on the aquatic life.

IMPACT OF MINING ON MICROBIAL ACTIVITY

Micro organisms form one of the most important living components of soil. Cycling of the nutrients is the main function of these organisms. Microbial life in the soil is essential in order to influence

plant growth. Mining is found to have an adverse effect on the activity of micro organisms. Micro organisms need certain minerals in minute quantities for their activity. Large quantities of the minerals are toxic to the micro organisms and their activity may be stopped. The quantity of metal that is needed and/or tolerated for the growth of microbial cells can be quite different from that required by the organism to carry out a physiological process. Nitrogen fixers, Ammonifiers, Cellulolytic bacteria, phosphorus solubilizing bacteria which are important organisms to generate the essential nutrients to the plants via the food chain cycle are reduced due to the toxic effects of mine materials (D Souza and Nayak, 1994). Earlier work (Shirley and Sextone, 1989), demonstrated that the number, diversity and respiration rate of micro organisms in mine soils were lower than in adjacent native soils. Studies carried out by D Souza (1993) also showed very low activity of most types of microbes in the mine soils while the undisturbed area shows higher microbial population. Nitrogen fixing bacteria are also drastically reduced in soil polluted by mining rejects. Besides, important soil enzymes responsible for soil fertility are nearly absent.

IMPACT ON HUMA POPULATION

A detailed questionnaire was prepared to establish the impact of mining activities on the villagers. From this study (Nayak, 1994) it is seen that air pollution is the major problem faced by the people. Besides this, noise pollution and damage to agricultural land is also present on large extent. Impact of mining is seen on forest land, ground water and health of the people residing close to the mines. Blasting is found to cause damage and have adverse effects on the people.

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