Study on the Impact of Tailing Sand on Agriculture Land in and around Kolar Gold Field Area, Karnataka, India

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Abstract:

Century old mining activity for gold in Kolar Gold Field (KGF) has contributed about 820 tonnes of gold to the country. But the activity has resulted in accumulation 55 million tonnes of tailing of sand spread cover 13 on the surface around KGF mining area over the years which has caused a change in the whole topography and ecological disturbance. In the present study impact assessment of tailing sand on the agricultural land has been done. In the study area there are three main streams, of them two are perennial fed by mill water sewage of KGF town. Incidentally the flow through the mine waste dumps and cause flooding during monsoon transporting the tailing sand to the nearby lakes, reservoirs and spread over the fertile agricultural land. Here ever the deposition of the sand is more a foot, all the crops and vegetation including coconut plant leaves have turned to yellow and withered away prematurely. To know the cause of the infertility of the soil an attempt has been made to analyse the tailings. The results obtained have shown high concentration of heavy metals and other metalloids present in the tailings are particularly responsible for the infertility of the agricultural land in and around Kolar Gold Field area.

Keywords: Tailing Dumps, Agriculture, Chemical analysis

1. INTRODUCTION:

The valuable gold found in Kolar Schist belt is of low grade and finely disseminated n the host rock. The mineral processing operation therefore are necessary in transforming low grade ore into pure gold. These operations in KGF have generated large quantities of finely ground tailings. These tailings are dumped in large stocks on the surface of the mining area. Naturally they have come in direct contact with human environment and resulted in contamination of the local environment. At Kolar Gold Field around 55 million tonnes of tailing sand is dumped. Its disposal in the township has disturbed not only the hydrological condition but also possess prominent ecological changes.

At Kolar Gold Fields (KGF), Karnataka, about 40 million tonnes of mill tailings were generated during beneficiation of gold ore (Shettigher 1989), which have covered about 2-sq. km. of the area (Reddy 1980). Though plantations on the dumps are almost nil but some grasses have come on the dump surface. Particulate matter concentration beyond the permissible limit at KGF has indicated influence of tailings on air environment (Roy and Adhikari 2009). Formation of gullies on the dumps due to rain may also affect the surrounding. As agriculture lands are available at some distances around the dumps, therefore, it can influence the crop yields. Mill tailings contain minerals like amphiboles, chlorite, calcite, feldspar, mica, pyrite, quartz, etc and have micronutrients. The nutrients present in mill tailings can be used for the ecological restoration of dumps (Rao and Reddy 2006 and Divya 2009).

Direct threats to human health are most obvious aspects of environmental deterioration, and of these the phenomenon commonly lumped under the term ‘pollution’ is the most important. Pollutants reach us through the air we breathe, the water we drink, the food we eat, and the sound we hear. The mining activities, whether open cast or underground, cause serious

environmental problems. A certain amount of environmental degradation has to be accepted in mining industry or the society has to forego the industrialization and socio-economic change. Hence, with this background an attempt has been made to study the impact of mining and the consequential dumping of tailing materials in environment (Rajasekaran 2007)

2. LOCATION:

The world-famous Kolar Gold Field is situated at about 100 kms east of Bangalore. The capital of Karnataka (Lat. $12^0\,52'$ - $13^0\,2'$, Long. $78^0\,14'$ – $78^0\,17'$). Gold mining at KGF dates back to the 18^{th} century during the Tippu Sultan regime, but the systematic and organized mining since 1880 by the underground mining method. The initial miner was John Taylor, who was pioneer in mining in United Kingdom. At that time KGF became world famous for gold mining. During first six decades the mining industry at KGF prospered and the mines reached an ultra-depth of 3.3kms and at present it is the second deepest gold mine in the world (Fig. 1).

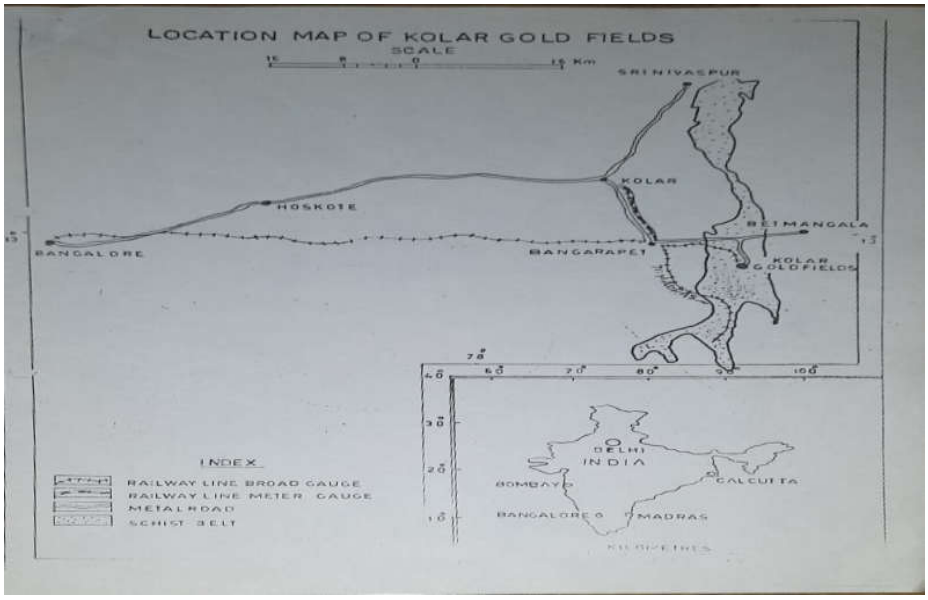

Fig.1: Location map of the Kolar Gold Fields

3. GEOLOGY OF THE AREA:

The Kolar Gold deposit is located in the Kolar greenstone belt of Precambrian age. The Greenstone belt is surrounded by the rocks of the regional Peninsular gneissic complex. The formations of the belt are essentially basic meta-volcanics. Also, acidic, ultramafic and volcanoclastic exhalates and intrusive are present. The different formations of the belt have experienced repeated cycles of metamorphism. These rocks are folded tightly and have dep dips. Later cross folding, faulting, granite emplacement and intrusion of dolerites dykes had taken place. The champion gneiss is found all along the eastern margin of the belt. It consists of feldspathic quart-sericite, polymict conglomerate and locally developed silica rich variant of the schistose rock. The central part of the belt is characterized by amphibolites, essentially metamorphosed basic volcanics. The amphibolites are massive, schistose, fine-grained, fibrous and tuffed. A prominent ridge of banded iron formation associated with granitic schist is present in the western part of the belt. Dolerites dykes cut across the formations and also run along the gold bearing formations. Pegmatites are seen in some places at deeper underground workings. Th above formations have been highly disturbed and have become tectonites in the areas of

mineralization. Faulting especially diagonal faults (NW-SE) have dislocated the formations. The major faults are Balghat North fault which defines the northern limit of ore body, Mysore North fault in the Champian reef and Giffords system of faults. Gold mineralization is in the form of quartz veins occurring in ampbhibolites. The quartz veins have general NS strike with moderate dip at surface and steep dip at depth.

4. ENVIRONMENTAL IMPACT:

Anything that lived more than a century is bound to have an interesting history behind it. The Bharath Gold Mines Ltd celebrated its centenary in 1980 has not only contributed about 820 tonnes of gold but also has dumped 55 million tonnes of tailing sand spread over 13 dumps on the surface of the mining area leading to ecological disturbance. At KGF there are three main streams flowing towards east. Two of these streams are perennial fed by the waste water from the milling unit of the mine and sewage of the KGF town. Incidentally all these three streams originate in tailing dump area and flow via these tailing dumps (Fig. 2).

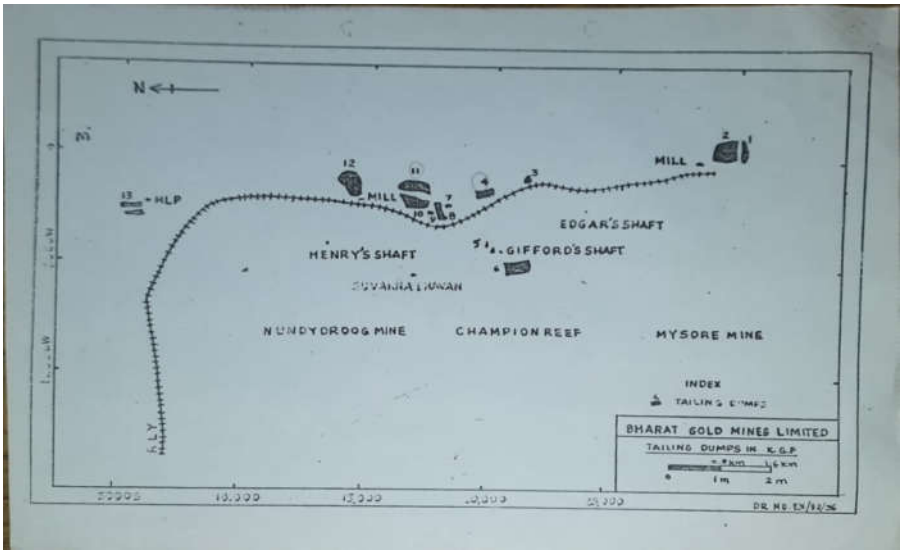

Fig. 2: Showing the Tailing Dumps in the study area

As these steams are passing through the waste dumps, they are easily silted by the fine tailing sand. Due to this the unprotected streams are flowing above the banks and during the monsoon the tailing sand floods into either sides and deposits over the fertile cultivated lands. It has been observed that once the tailing sand is deposited no edible crop can be cultivated and uneconomical plants such as Prosopis specijesal (Ballary Jally) and Croton sparcifiores etc. In Kolar district all the minor irrigation tanks were constructed across the streams. Once the tank is filled and overflown the water will move on to the next tank, so the silting of the fertile land is continuing without any obstructions.

In the southern part of KGF a huge Lakshmi Sagar tank is completely filled with tailing sand and is spread further into the paddy growing fields and then continues into the next tank by overflowing. The stream originates from Champion Reef dumps passes through the Nundydroog and Robertsonpet township. This stream is completely silted and the tailing sand is flooded to the residential areas and to the fertile lands on either side for more than 100 mts for a stretch of few miles.

5. VEGETATION:

Kolar district is a dry area which receives an average annual rainfall of 820mm and depends on the southwest and northeast monsoon for cultivation of crops. The important edible crops cultivated are Ragi, Paddy, and Vegetables like Tomato, Bringal, Carrot ete., In addition to these coconut plantations can also be grown.

Table 1: Chemical composition of the Tailings Dumps

Sl No	Constituent	Lakshmi Sagar	Oorgaumpet Stream	Oorgaumpet Stream	Down Stream of LK Sagar Tank
1	SiO_2	60.50%	54.25%	55.85%	63.00%
2	Fe_2O_3	17.70%	16.40%	17.75%	15.60%
3	Al_2O_3	3.50%	9.75%	7.35%	4.78%
4	TiO_2	0.40%	0.35%	0.30%	0.35%
5	CaO	9.25%	10.78%	8.75%	10.15%
6	MgO	6.85%	6.00%	7.35%	5.85%
7	WO_3	0.01%	0.01%	0.01%	0.01%
8	Copper	150ppm	160ppm	150ppm	200ppm
9	Lead	100ppm	150ppm	100ppm	120ppm
10	Cadmium	<25ppm	<25ppm	<25ppm	<25ppm
11	Cobalt	<25ppm	<60ppm	<25ppm	<25ppm
12	Nickel	<25ppm	<25ppm	<25ppm	<25ppm
13	Zinc	75ppm	85ppm	110ppm	80ppm
14	Arsenic	100ppm	280ppm	250ppm	150ppm
15	Manganese	1100ppm	1000ppm	1200ppm	1020ppm
16	Vanadium	<25ppm	<25ppm	<25ppm	<25ppm
17	Antimony	<25ppm	<10ppm	<25ppm	<25ppm

6. IMPACT OF TAILING SAND:

An intensive observation has been made the tailing sand accumulated area, Wherever the preposition of tailing sand is more than a foot the crops and other plant leaves, leaches to yellowish colour and withered away. Even seventy feet high coconut plant leaves have leached and withered away. The chemical analysis of the tailing sand samples collected from different places of the silt accumulated area and results are shown in Table 1. It is obvious that mining waste consists of contaminated materials with heavy metal toxicity by which natural growth will be very slow. Most of the constituents and heavy metals are need in traces for the plants and they are micro nutrients. Excess of these will retard the growth of the plants (Gilbert 2015). The toxicity of the tailing sand is so harmful, it is eliminating the vegetation in the sited areas.

7. CONCLUSION:

The tailing sand dumps are scattered in all 13 stocks which is easily accessible to the steams. The streams are easily silted as the tailing sand is very fine and free. The unprotected streams are flowing the fertile cultivated land and residential areas which is silted by the toxic tailing sand. The tailing sand after filling a tank flows to the next tank through the tank outlet.

Once the tailing sand is deposited soil composition will be altered and become unsuitable for cultivation. The samples of tailing sand analysis confirm the toxicity. No concrete efforts were made by the Gold mining company to check the erosion of the tailing sand. Growing of Eucalyptan plants over the waste dumps can check the de-siltation to certain extent but not erosion. The erosion from mine waste dumps possibly can be checked by covering them artificially as done in some developed countries.

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