

The mill tailings of Kolar gold mines

B. R. Krishna and F. H. Gejji (*Curr. Sci.*, 2001, **80**, 1475–1476) have highlighted the environmental pollution being caused by the dumping of the mill tailing (sand) in the Kolar gold mines area. It is true that there are about 32 million tonnes of this sand, which makes up the 15 dumps spread out along 8-km long distance in the mine area. These sands have been causing considerable environmental health hazards to the people of the Kolar gold field. During the months of June/July when the weather is dry and windy, these sands are carried eastward to Robertsonpet and Andersonpet areas, over a distance of 3 km. The finer particles get air-borne and finally settle down up to a radial distance of 4 km. With the onset of monsoon, the rain-water carries these sands further down onto tank beds. These sands are essentially made up of grains of quartz and amphibole minerals, with a fineness varying the < 100–< 200 mesh size in the proportion 30 : 70, respectively. The major constituents of these sands are given in Table 1.

The authors' apprehension that these sands cause health hazards like silicosis, lung cancer, etc. is not based on facts. According to Gowda and Shenoi¹ of M/s Bharat Gold Mines Medical Department, 'although the gold mines are 100 years old, so far there is no reported occurrence of silicosis in any of the employees of the Kolar gold mines. They further confirm that silicosis, as seen in the famous Rand gold mines of South Africa, does not exist in the Kolar gold field. However, a form of pneumoconiosis (lung disease) is commonly found in underground mine workers and

their most recent study (1973–1978) on 5893 workers has shown a decline in the prevalence rate of pneumoconiosis. The mill tailings have so far not caused any respiratory health hazards or skin diseases or allergies to the people of Kolar gold field area. At best, these sands can be considered as a nuisance and should be ignored as innocuous.

As for the possible industrial use of these mill tailings, so far all attempts made in the past have proved to be either futile or uneconomical. In the early fifties, the British engineers mixed these tailing sands with Portland cement and after reinforcing with steel rods, manufactured fence-posts pillars, slabs, etc. Since these products lacked the required strength, they all cracked up and broke. In another attempt, during the 1980s the Bharat Gold Mines Ltd (BGML) supported a S&T project by the Cement Research Institute of India (CRII) for manufacture of Portland/Pozzoland cement by blending these tailings with high-grade limestone obtained from Bagalkot in Belgaum district. Although technically it was found feasible, the final assessment was that economically it was not viable for two reasons: (1) For each tonne of mill tailings, four tonnes of high grade limestone had to be procured from Bagalkot area and transported over 400 km distance. (2) All the major constituents like SiO₂, Al₂O₃, MgO and Fe₂O₃ were almost double in percentage compared to specifications.

Krishna and Gejji's contention that about 20–22 million tonnes of these tailings has been lost due to denudation is not correct. The total quantity of tailings generated during the last 120 years is about 35 million tonnes and the present (1999) estimate is 32 million tonnes. The difference of 4 million tonnes is accounted for as follows: (i) Tailings used for filling voids underground for sand stowing; during 1956–1980, 1.6 million tonnes²; during 1980–2000, 1.4 million tonnes (BGML source); total, 3.0 million tonnes. (ii) The balance 1 million tonne may be accounted for denudation.

During 1981–1989 about 2,03,500 tonnes of tailing sand found around Walker's shaft in the Nundydroog area

was treated and 106 tonnes of scheelite (tungsten ore) was recovered as a by-product by BGML. The mill tailing sands contain about 0.75 g of gold/tonne of sand. So during 1986–1998, BGML treated 3.8 lakh tonnes of sand and recovered 328 kg of gold by heap leaching technology. This involved transportation of sand for 3 km distance to an uninhabited area which in turn created air pollution enroute. This apart, the cost of other inputs like labour, power, cement, cyanide, transport, etc. was prohibitively high and hence in January 2000 BGML closed down this plant also, as part of its final winding-up operations.

Until 1956, all the underground workings where the gold ore has been extracted, were being supported by timber of granite, which was very expensive. After studying some of the Australian gold mines, BGML also started making use of these sands with water to fill up the stoped-out areas. From 1956 to 2000, BGML used about 3 million tonnes of sand for supporting the underground workings. Perhaps, this is the best use the mill tailings have been put to so far.

The suggestion of Krishna and Gejji of making use of these sands for the manufacturing of hollow bricks, solid columns, reinforced slabs, an additive for Portland cement, for manufacture of stoneware pipes, bottles and bangles, etc. may not be feasible as these tailing sands do not possess the required physical and chemical attributes as specified for the respective industries.

According to Ganapathi Prabhu³, BGML under technical guidance, undertook an afforestation programme on the tailing dumps, to contain the dispersal of these sands. Hybrid eucalyptus saplings were successfully grown after spreading red-earth and green manure as foundation on the dumps. With good care, the saplings grew into adult trees. The greenery was evident and prevented the sand from denudation. Since January 2000, the maintenance of these plantations has been given up by BGML, as it has wound up all its operations. Now it is left to the Karnataka Forest Department to look after these plantations, to mitigate the environ-

Table 1. Major constituents of sand in the Kolar gold mines area

Constituent	Percentage	
	Light-coloured	Dark-coloured
Calcium oxide	8.4	7.6
Silica	56.0	51.8
Aluminium oxide	11.9	8.2
Ferrous oxide	10.2	18.9
Magnesium oxide	8.6	6.3
Loss of ignition	2.0	3.9

mental pollution of the Kolar gold field area.

About 6 years ago, an Australian company came up with a project of recovering the residual gold (0.75 g/tonne) from the mill tailings by *in situ* heap leaching technology. However, due to the proximity of these dumps to the dwellings of workers, etc. the project did not materialize.

Now that BGML has abandoned its mining and metallurgical operations since January 2000, there is nothing anybody can do. The people in and around Kolar gold fields have to co-exist with the dumps and tolerate its nuisance until a new solution is found. The Building Research Institute at Roorkee may have some answer for the utilization of these sands.

1. Gowda, A. M. S. and Sheno, B. V., Bharat Gold Mines Ltd (BGML), Centenary Souvenir, 1980, pp. 43–45.
2. Devaraj, V. G., BGML Centenary Souvenir, 1980, pp. 104–106.
3. Ganapathi Prabhu, K. in National Seminar on Recent Development in Exploration, Exploitation of Minerals in India, Mining, Geological and Metallurgical Institute of India, 1990, pp. 165–166.

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Response

Para 1 of the article by J. V. Subbaraman confirms the prevalence of environment pollution hazard. It also substantiates the same, not only on the mine workers, but also on the local population living at a considerable radius surrounding the mining area, where the mill tailings are heaped as dumps.

Para 2 identifies pneumoconiosis (lung diseases), which is invariably associated with the respiratory system of all living beings. As far back as from 1917, various miners' diseases resulting from the gold mining by milling process are being studied and identified by the National Institute of Miners' Health founded at site in the Kolar Gold Field.

Afforestation efforts towards retarding the environment pollution hazard, affirm the pollution hazard – a very expensive scheme, but not yet a permanent remedy. The major constituents of the mill tailings being about 55 to 60% of silica dust and the balance also of other amphibole minerals, establish the fact that lung diseases are caused by inhalation of the silicious dust. (ref: Souvenir of the 50th year of Independence – 1997).

Coming to bulk productive utilization of the tailings, the technical feasibility of developing the puzzolonic character-

istics is in consonance with our scheme. Only the research and experimentations are conducted in the wrong direction by the Cement Research Institute of India, with support from Bharat Gold Mines Ltd, as a S&T project. As far back as in 1974 we had suggested the scheme for the same, since fast-consumption of the tailings is the only permanent solution.

The statement that the total mill tailings generated over the past 120 years is only 35 million tonnes, of which only one million tonne is lost by denudation, is not correct. The historical gold production data of the Kolar gold mines are: 51.124 million tonnes of ore are milled and gold produced is 800.3 tonnes, as furnished by the Indian Bureau of Mines for the total period of a little over 120 years, ending on 31 March 2000.

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