CORRESPONDENCE

THE TRAGEDY OF KUDREMUKH - ONE OF THE LARGEST ACCUMALATION OF IRON ORE IN THE WORLD

The tragedy *of Kudremukh, as* highlighted by *Dr.* B.P. Radhakrishna in his recent editorial *(JGSI,* v.6l, pp. 127-130), is not the only tragedy in the mineral development in India. His views are applicable to every single mineral deposit explored and developed in India during the last 50 years. Since Dr. Radhakrishna along with Dr. M.N. Quershi (NGRI), late Mr. S.C. Mohanti (NMDC), Mr. R.H. Sawkar and myself were the first to visit the western side of Kudremukh range of hills. This visit took place some time in early 1964. Dr. Radhakrishna, being modest, has not stated this in his review. Since I had been involved in the early stages of conception of Kudremukh development, I would like to share some of my observations.

In October 1963, the National Mineral Development Corporation (NMDC) proposed "A Scheme for Airborne Surveys" to cover not only areas for the exploration of Cu-Pb-Zn and associated metals but also search for magnetite deposits near the coastal areas of India which could be explored and developed for export.

During a meeting in the Planning Commission near the end of 1963, one of the officers of the Geological Survey of India (GSI) stated that the GSI have been mapping the country for the last 125 years and have encountered no such deposits. Later at the end of 1963 or early 1964,1 was at Bangalore and met Dr, B.P. Radhakrishna and posed him the question of magnetite deposits near the coastal areas which could be developed for export. He suggested that I should return to Bangalore and he would make *arrangements to visit various magnetite-bearing areas.* I returned in March (?) 1964. Dr. Radhakrishna led a team of various persons mentioned earlier. We climbed the western side of Kudremukh hills, from the Gangamula side, near Sringeri Math.

Several kilograms of rock samples were brought back by me to Bangalore. I requested Atomic Mineral Division, Bangalore for assistance in preparing a magnetite concentrate. Mr. Krishnan of the Ore Dressing Division told me it will take three days. I enquired if I could use their machines myself. After little persuasion, Mr. Krishnan was kind enough to help in crushing, grinding and magnetic separation to prepare an iron concentrate averaging 67% Fe.

On return to Delhi, I prepared a brief for the Chairman, NMDC, late Mr. S.N. Bilgrami. The iron ore concentrates were to be shipped in slurry form by pipeline to Mangalore and then loaded into ships. Thus Kudremukh project was born. It was expected to be commissioned in 19&7-68. However, Met-Chem Canada Inc., a subsidiary of USX engineers, was selected as consultants only in 1974 to design, engineer and build the project. The project was to use Marcona flow for the transport of slurry to Mangalore.

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SOME QUESTIONS ON PRACTICE OF GROUNDWATER RECHARGE IN HARD ROCK TERRAINS

INTRODUCTION

Artificial recharge measures for augmenting groundwater recharge have been recently taken up with fervour in hard rock areas of Andhra Pradesh and other states of India. The age old practice of tank irrigation in conjunction with large sized dug wells is classic creation of harmony between man and nature. Recharge was incidental from the tank-bed, from the network of tiny canals and from the irrigated fields.

The purpose of this note is to pose a few questions on some of the groundwater recharge measures that are being advocated as very logical and powerful. These concerns are about the conversion of small irrigation tanks to percolation tanks and effectiveness of sub-surface dykes. It is hoped that hydrogeological community will react to these thoughts and come up with strong precepts and practical evidence either in support or disagreement of the conjectures put forth in this note.

CONVERSION OF SMALL IRRIGATION TANKS TO PERCOLATION TANKS

Small irrigation tanks (ponds) with capacity of about 0 035 MCM (1 mcft) or less are being converted to percolation tanks thereby suppressing the practice of direct irrigation from them The assumed benefits of this change are (1) increased percolation, (2) decrease in evaporation, (3) availability of water for longer time and (4) better environmental impact Some more benefits quoted are improved eco-system, improved quality of groundwater and so on Each of these supposed benefits appear to be on a weak foundation when viewed as follows

Increased Percolation

When the sluice of a tank is closed, the water spread area only acts as a surface that conducts water to the aquifers below But, when the tank water is used directly for irrigation the percolation shall not only be from the tank bed but also from the irrigated fields that are under its command Groundwater Estimation Committee (GEC, 1997) suggests percolation-factor as 0 45 (deep infiltration reaching aquifers) in case of canal irrigation

Decrease in Evaporation

When the water is let into the fields for irrigation, the evaporation increases as the surface area for the same quantity of water increases Logically, when the water is stored and allowed to percolate than letting it out, though more water appears to be conserved, the surface area for percolation also decreases But when the groundwater is used for irrigation, the surface area for evaporation gets recreated and therefore not reduced Thus the water that can reach the fields directly would after recharging the groundwater body is pumped up[1] In this process more minerals gets dissolved in the water and gradually the soil salinity and the EC of water would increase Why this circuitous route by spending money and energy to bring back the water, when the resource is directly available for irrigation from the tanks[9]

Instead of converting these tanks to percolation tanks efforts must be made to maintain and strengthen them Constructing check dams across first order streams and digging sunken pits along the stream courses that feed them will not only prevent silting but will also retard peak flow and recharge groundwater

SUB-SURFACE DYKES

Sub-surface dykes sometimes called clay-blanket-cut-off-walls are constructed in alluvial zones across small streams with width of less than 500 m and thickness of 4 or 5 m and sometimes even less with an aim to barricade the flow of groundwater They are also constructed in weathered rock across first order or second order streams No additional recharge is envisaged and hence it may not be apt to categorise them as recharge structures

As is well known, *{see* for example Thorburn, 1999) evaporation is effective up to a depth of 3 m and that leaves only a metre or so of alluvium from which the watei is prevented from flowing down Assuming that the alluvium has hydraulic conductivity of 10 m/d and that the hydraulic gradient is 1 in 1000, the outflow that is stopped per metre of the effective thickness can be worked out using Darcy's law

$Q = KIA$, where Q is outflow under hydraulic gradient I and across area A

Assuming that K is about 10 m/d

$Q = 10 \times 1/1000 \times 1 \times 500 = 5\ m^3/d$

This is a ridiculous low outflow for a metre of saturated thickness An average filter point well of 4 inch (10 cm) diameter can yield under such situations from 100 to 150 m^3/d

So how does sub-surface dyke of a few metres depth be effective, especially in an area where the hydraulic conductivity is low[7]

If exploitation of groundwater is high on the upstream side of the sub-surface dyke, the gradient of water table is anyway reversed or substantially reduced, making sub-surface dyke redundant

The above arguments appear to me very logical unless otherwise refuted by more convincing explanation

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