

# MGMII

NEWS JOURNAL



**The Mining, Geological and Metallurgical Institute of India**



**Volume - 44, No. - 1**  
**April - June 2018**  
**A Quarterly Publication**  
**ISSN: 0254-8003**



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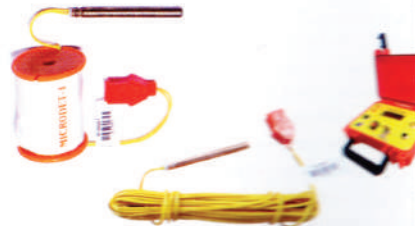
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The Advertisement Tariff for insertion in MGMI News Journal	
Mechanical Data	Advertisement tariff per issue
Overall size of the News Journal : 24 cm x 18 cm	Ordinary Full Page (B/W) : Rs. 8,000/-
Print Area : 20 cm x 15 cm	Coloured Full Page : Rs. 12,000/-
Published : Quarterly (4 issues per year)	Back Cover (coloured) : Rs. 15,000/-
Number of copies : Around 3000	Cover II (coloured) : Rs. 12,000/-
<b>Series Discount for four issues : 5 % which will be adjusted at the last insertion.</b>	Cover III (coloured) : Rs. 10,000/-
<b>Multicolour front cover page, size 16 X 17cms, Rs. 25,000/- per insertion, per issue.</b>	
<b>Special offer for four issues : Rs. 90,000/-</b>	

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# President's Message



Dear Friends,

I hope you are keeping well with your health and family and I take this opportunity to convey my good wishes to you and your family members.

In the context of present day competitive market conditions, higher consumers expectations and advent of high take area, quality of goods and services have assumed are unprecedented importance. We all know that the word quality has numerous meanings. It is a combination of performance, longevity, dependability, reliability, durability, maintainability, appearance and such other attributes. Quality involves investment of best skill and effort possible to produce the best result. Its presence or absence in some degree characteristics every man-made object or service. Quality is achieving or reaching for the highest standard as against being satisfied with mediocrity. It is honesty of purpose as against catering to cheap or sensational sentiment if does not allow, compromise with the second rate. However, Indian market scenario is something else.

Now, I would like to give you a good news specially to the Geoscientists that during May 25-26, 2018 organized a two-day workshop on Coal Resources and Reserves Estimation and Reporting in India at the hotel, Pride Plaza, Newtown, Kolkata. There was good no. of participation

The workshop organized by MGMI in association with the CRIRSCO and the National Core Committee (NACRI). The workshop conducted by Dr Harry M Parker from USA Dr Kerry John from Australia, Dr Abani R Samal from USA and Dr PV Rao, from Hyderabad.

It is often said that Workshop is a place where heat is generally generated and I believe that enough heat has been generated in the workshop.

I hope, the participants returned with increased knowledge that will show the way for development of the Coal Resources and Reserves Estimation Code in India which will acceptable to International professional agency.

Thank you,



Dr NK Nanda

## TECHNOLOGIES FOR BULK SOLID TRANSPORT AND TRANSPORTATION ECONOMICS DEMAND MORE ATTENTIONS IN INDIA



As per the thumb rule for quick calculation, for generation of 1000 MW in a coal based thermal power plant per annum, the coal required is 4 Mt. This implies that 4000 te of coal is required for generating 1 MW power in a coal based thermal

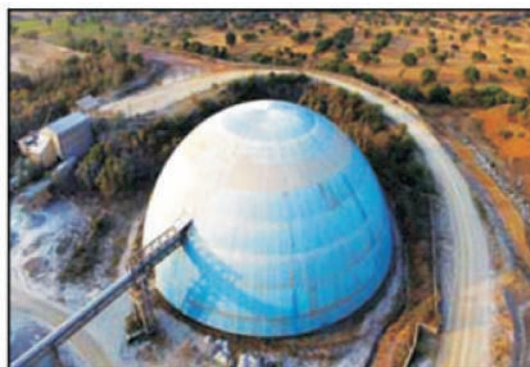
power plant. Thus, for the 193821.5 MW of installed capacity of the coal fired power stations in India (Table 1), the country needs 775.2 Mte of coal per year. Indian coal production is yet to reach this target

During 2017-18 Coal India Limited produced 567.37 Mt, achieving 95% of its targeted production of 600 Mt. The Singhereni Collieries Company Limited (SCCL) produced 62 Mt in this year. Production of lignite was 26.5 Mte. Most of this coal and lignite produced in India were from surface mines. Hardly 10% of the total production comes from the Underground Mining Operations. The average stripping ratios of Indian surface coal and lignite mines vary from 1.15 to 6.5. Thus, one can easily apprehend that the amount of bulk materials in the form of coal and overburden, are handled in Indian mining industry. Indian iron ore, chromite, zinc ore and bauxite also mined from surface mines.

Indian coal-fired Thermal Power Stations are distributed all over the country. Coalfields and the ports that import coal, need to dispatch the fossil fuels by railway or by road. Thus, it is envisaged that if the situations are not handled through modern technology and innovations, the

conventional coal and bulk material transport will create an unimaginable congestions in our roads and railways. Moreover, the diesel-powered transportation systems, used for mineral transports have environmental problems due to elevation of noise and dust, emission of greenhouse gas and most importantly, the acute crisis of diesel. Thus the conventional truck transport could not be a method of providing environmentally sustainable transportation of fossil fuels and minerals.

Indian academics and researchers, associated with mineral sector, have carried out very little R&D on bulk transport technology adoption and analysis of bulk handling economics. Business growth in international mineral trades would undoubtedly require revamping of mineral transport. A sign of hope is that Government of India is now taking a keen interest on this issue. Mining, if not carried out in environmentally friendly ways, may face critical disruption in business due to the emerging legislating controls. Therefore, it is time to take necessary organized steps to plan



Closed Stacker Reclaimer in a limestone mine



**Table 1 All India Installed Electricity Capacity (MW) Sector-wise as on 31.1.2018**

Region	THERMAL				Nuclear	Hydro	RES	Grand Total
	Coal	Gas	Diesel	Total				
	MW	MW	MW	MW				
State	64030.5	7078.95	363.93	71473.38	0.00	29858.00	1992.17	103323.54
Private	75096.0	10580.60	473.70	86150.30	0.00	3394.00	59352.44	148896.74
Central	54695.0	7490.83	0.00	62185.83	6780.00	11711.42	1502.30	82179.55
All India	193821.5	25150.38	837.63	219809.51	6780.00	44963.42	62846.90	334399.83

the elimination of transportation trucks in the mining industry. This can be done by introducing advanced technology, e.g., long distance single flight conveyors, pipe belt conveyor, RopeCon, Cable belt conveyor and flight conveyors. Green Technology will have to be incorporated by introducing covered railway sidings within domes, rapid loading of wagons and advanced wagon tippers at the coal receiving stations.

There will be new business opportunities

for the Indian manufacturers like BEML, HEC, L&T, Elecon etc.. Thus, there is a needs to engage in more R&D and industries must initiate innovation drive to develop new technology. Mining companies like CIL, NLC, SAIL, NALCO, Tata Steel etc. must encourage such R&D by providing necessary facilities for experimentation and promoting new developments by appropriate handholding and application of financial prudence.

**Khanindra Pathak**

## ANNOUNCEMENT

*For the next issue of this News Journal, we request all the members to kindly inform us the achievements and awards received by you or your company that you wish to share with the world.*

*International readers of our e-version of the News Journal are also invited to share their experiences and news items to share with the Indian peer groups. Student readers are also encouraged to send their brief review articles and discussions on areas of contemporary importance.*

*Please send your short write-ups and photographs to either of the following email addresses :*

1. *mgmsecretary@gmail.com, mgmihonysecretary@gmail.com*
2. *Khanindra.p@gmail.com*

***We look forward to receiving your contribution in application of advanced technology in mining for the next issue***

## HEADQUARTERS ACTIVITIES

### CRIRSCO WORKSHOP

A Workshop on Resources and Reserves Estimation and Reporting in India was held during May, 2018 at the Hotel Pride Plaza, Newtown, Rajarhat, Kolkata.



Shri Anjani Kumar, Coal Controller & Chief Guest of the Workshop lighting the Ceremonial Lamp : dignitaries are from (L to R) Mr Kerry Whitby, Mr Harry M Parker, Dr PV Rao, Dr Abani R Samal and Mr Rajiw Lochan

The Inaugural Programme started at 10.00 a.m. The Honorary Secretary, Shri Rajiw Lochan welcomed Shri NC Jha, Former President, MGMI and Former Chairman, CIL, Shri Anjani Kumar, Coal Controller to be on the dais as Chief Guest, Mr Harry M Parker, Former Co-chairperson, CRIRSCO.

Flora Bouquet was handed over to Shri Anjani Kumar, Chief Guest of the Inaugural Session and to Mr. Harry M Parker, Former Co-chairperson, CRIRSCO.

Chief Guest, Shri Anjani Kumar, Shri NC Jha, Chairperson, Mr Harry M Parker, Dr PV Rao and Dr Abani R Samal were requested to light the ceremonial lamp.

Shri NC Jha, Chairperson in his welcome address briefly apprise about the system

presently being followed in India in respect of estimation of coal resource and reserves. Coal mining and sales in India is permitted statutorily by a Government company only. Captive mining of coal has been allowed by the Government since 1993 for use of the mined coal in the End-use plants for generation of power and manufacture of steel and cement. As such, estimation of coal resource is being done on the basis of Indian Standard Procedure Code and the repository of Indian coal inventory is the Geological Society of India. GSI categories the coal resource as “Proved”, “Indicated” and “Inferred”, as per the ISP Code. We, in India, generally do not differentiate between a resource and reserve and we call all the inventories as reserve. However, when a coal block is considered for economic exploitation, additional two reserve terms come into consideration that are “Mineable” and “Extractable” reserves.



Dignitaries on the dais are from (L to R) Mr Rajiw Lochan, Honorary Secretary, MGMI, Mr Anjani Kumar, Coal Controller & Chief Guest, Mr NC Jha, Former President MGMI & Chairperson and Mr Harry M Parker, Former Chairperson, CRIRSCO

These are absolutely necessary for any investment decision. The Mineable reserves



are those quantities that can be considered for mining from the block and Extractable reserves are those quantities that can be extracted and



Mr Rajiw Lochan, Honorary Secretary, MGMI, welcoming the dignitaries, participants and guests to the workshop

sold to earn revenues. These two categories of reserves are estimated after making a detailed feasibility study of the block. It may be noted that resource estimation as per ISP Code is done by a team of Geologists and the Feasibility study is done by a group of mine planning engineers and finance persons, led by a Mining Engineer as the Group Leader or Project Leader. Hence, what is termed internationally a proved reserve is in fact the Extractable reserve considered in our country for any investment decision.

The scenario of coal mining is fast changing now and the Government aims at enhancing the coal production at a faster rate for which domestic investment is not enough and foreign investment is being sought, both for captive mining as well as commercial mining. A foreign investor is comfortable in taking investment decision on a coal property on the basis of Coal Resources and Reserves Estimation and Reporting done on an internationally accepted Code. Hence, for attracting foreign investment, public reporting of the Coal Resources and Reserves Estimation on an internally acceptable Code is a pre-requisite. India also, therefore,

needs to develop its own Coal Resources and Reserves Estimation Code on international guidelines to attract foreign investment in coal sector.

In the light of what I have narrated this Workshop assumes great importance. We have experts from CRIRSCO from USA and Australia and the initiators of NACRI from India, who will make presentations on the theme and I suppose a thorough interaction would be made by the participants to understand the intricacies of develop an internationally acceptable Code(s) for Coal Resources and Reserves Estimation in India.

It is often said that Workshop is a place where heat is generated and I believe that enough heat will be generated in this workshop too to make it lively and engrossing. I hope at the end of the Workshop the participants will come out with increased knowledge that will pave the way for development of the Coal Resources and Reserves Estimation Code in India acceptable to International professional agency like



View of the participants of the Workshop

CRIRSCO. He welcomed all once again in this topical workshop.

Shri Anjani Kumar, Chief Guest of the workshop was requested to address the participants. The Chief Guest in his address highlighted the

present system followed by the Government, Private Sectors and the present scenario of Coal Mining in our Country and what more needed to attract the foreign investment.

The Vote of thanks was given by Shri Rajiw Lochan, Honorary Secretary.

The workshop on Coal Resources and Reserves Estimation and Reporting in India organized by MGMI in association with CRIRSCO and the National Core Committee (NACRI) was started at 11.30 with the introduction to CRIRSCO and its role in the public reporting systems in the world by Mr Harry M Parker the Former Co-chairperson CRIRSCO. Dr PV Rao, Co-chairman, NCC spoke on CRIRSCO activities in India. Dr Abani R Samal spoke about the IMIG - Importance to current Indian Scenario in India on \* The need for IMIG, IMIG Development and Comments of IMIG.

Mr Kerry White by spoke on Coal Resource and Reserves and Reporting as practice in leading mining Countries such as South Africa and Australia.

Mr Harry M Parker spoke on Aspects of Competent Person reporting and reasonable prospects for eventual economic extraction.

Again Mr Kerry Whitby spoke about Geological, Modelling and Resource Estimation of Coal deposits with particular reference to the JORC Coal Guidelines on \* Issues associated with extrapolation beyond data points \* Application of Rounding to Resources Estimates \* Use of domaining in coal quality estimations; importance of downhole geophysical logs

\* Review of other aspects of coal resource estimation detailed in the Coal Guidelines.

The workshop continued to second day, on 26th May, 2018 also and the session started by Dr Harry M Parker. Mr Parker spoke on Differences between Mineral and coal reporting in CRIRSCO Template. Thereafter, Mr Kerry Whitby spoke on Reasonable prospects for eventual economy extraction and role of Resource and Reserves Competent Persons in implementing PREEE in Coal.

Dr Abani R Samal spoke about NACRI proposed Competent Person registration system in India.

Mr Prasanta Roy, Coordinator of the workshop spoke on Implementation of Coal Resource and Reserve Reporting System in India – a broad perspective.

In the second session, Dr PV Rao spoke on Role of Government in Public Reporting of Resources in India. Thereafter, there was question answer session moderated by Dr PV Rao and Dr Abani R Samal.

In the closing ceremony, Dr Harry M Parker, Mr Kerry Whitby, Dr Abani R Samal, Dr PV Rao were invited to complement. Shri Roy requested Shri NC Jha to finally close the ceremony with few words. Shri Jha in his closing remarks said that it was really a grand success workshop and educative also and he thanked to the faculties and participants.

Vote of thanks was given by Shri Prasanta Roy and the workshop ended at 5.30 pm.□



## **BRANCH ACTIVITIES**

### **Calcutta Chapter**

#### **A Report on Workshop on Role of Geotechnical Investigation in Foundation Engineering & Mining**

The MGMI Calcutta Branch, a subsidiary of the century old parent body, was established



Guests on dais at Inaugural Session

in 1991 and has been promoting objectives of the Institute with its limited resources by holding Seminars / Workshops, Executive Development Programmes and various Publications on contemporary topics. The Branch often draws on the expertise of other reputed Institutions and industries for organizing such activities in the best interest of participants.

With this objective in mind a workshop on 'Role of Geotechnical Investigation in Foundation Engineering & Mining' was organized by Mining, Geological and Metallurgical Institute (MGMI) Calcutta Branch in association with Geological Survey of India (GSI) and National Institute of Rock Mechanics (NIRM) during May 24 – 25, 2018 at Bhubigyan Bhawan, GSI, Salt Lake, Kolkata. The event was sponsored by North Eastern Electrical Power Corporation Limited (NEEPCO).

The workshop was inaugurated by Shri N. Kutumba Rao, Director General, GSI in the august presence of Prof. Nitin Som, Former Head of Civil Engineering, Jadavpur University and an eminent expert on foundation engineering. The inaugural session commenced with invocation song followed by welcome address by Shri SR Panja, Convener of the workshop. Dr AK Moitra, Chairman, Organising Committee and MGMI Calcutta Branch briefed on the objective and contents of the workshop. He also stressed on social awareness of the subject for preventing unwanted accidents resulting huge loss of life and property. S/Shri Dinesh Gupta and SR Kisku, Additional Directors General, GSI thanked the organizers for arranging such a workshop. Prof Som, the Guest of Honour, dealt on the need of the study of foundation engineering in various spheres including mining and thanked for the invitation. Shri Kutumba Rao congratulated the participants, faculties and organizers



Lecture Session in progress

highlighting the importance of the workshop. The Souvenir of the workshop was released by the guests on dais. The inaugural session ended with vote of thanks by Shri Bhaskar Chakrabarty, Coordinator, workshop and Secretary, MGMI Calcutta Branch

Delegates participating in the workshop were from Western Coalfields Limited (WCL), Mahanadi Coalfields Limited (MCL), Eastern Coalfields Limited (ECL), NLC India Limited, NMDC Limited, Hindalco Industries Limited,



Shri SR Panja, Convener giving welcome address

NEEPCO, NIRM, AFCONS, ITD Cem, and GSI.

The faculties for the workshop were drawn from NIRM, GSI, IEST Shibpur, Afcons, ITD Cementation and MGMI. There were nine lectures interspersed with lively interactions, distributed into three technical sessions. Following is the list of technical sessions and lectures.

**Technical Session I** – Chaired by Dr. Anupendu Gupta, Member, MGMI and Former Dy Director General, GSI

1. Challenges faced during tunneling for Kolkata East-West Metro project -- Shri Satya Narayan Kunwar, Afcons.
2. Probabilistic Seismic hazard analysis for seismic risk assessment of structures in the Northeast Region of India Dr. Subrata Chakraborty, Professor, Department of Civil Engineering, IEST, Shibpur.
3. Challenges in TBM Tunneling in Urban Environment Shri SL Bhattacharya, Senior General Manager, ITD Cementation India.

**Technical Session II** – Chaired by Shri Akhilesh Chaudhury, Member, MGMI and Former Dy Director General, GSI

4. Determination of various Geotechnical parameters of Rock & Soil for Geotechnical investigation Mr SA Sufiyan, Member, MGMI and Former Dy Director General, GSI
5. Recent approach in rock bolting and roof support system in underground mines Shri Venkateswarlu, Former Director, NIRM.
6. Landslide Forecasting Techniques and Its Challenges Dr Saibal Ghosh, Director, Engineering Project Evaluation (EPE) Division, DGCO, GSI.

**Technical Session III** – Chaired by Dr AK Moitra, Chairman, MGMI Calcutta Branch and Former Director, GSI

7. Collection of engineering geological and geotechnical data for rock mass characterization Dr. Ajay Kumar Naithani, HOD, Engineering Geology Dept, NIRM.
8. A case history of Ranganadi Hydroelectric Project, Lower Subansiri district, Arunachal Pradesh Shri Somnath Sharma, Director, GSI.
9. Drill Core logging, geological and geotechnical mapping and rock mass characterization for mine, dam, tunnel, bridge, and foundation Dr Timir Baran Ghoshal, Director, Engineering Geology Division, GSI.



Visit to Kolkata East-West Metro Tunnel

The lecture sessions were followed by a **visit to Kolkata East-West Metro Tunnel**, courtesy ITD Cementation. The foundation engineering techniques applied to the tunneling process were amply explained by Shri SL Bhattacharya of ITD (Cementation) through his lecture at the workshop and demonstration at the tunnel site. This visit generated lots of enthusiasm among the delegates.



Panel Discussions in full swing

Next was the **Practical Demonstration at the geotechnical (Soil Mechanics and Rock Mechanics)** laboratories of GSI guided by Sri SA Sufiyan, Former Dy DG, GSI.

Final session was **Panel Discussions** with Dr Ajoy Kumar Moitra as moderator and Shri Venkateswarlu, Dr. Ajay Kumar Naithani and two young delegates, S/Shri Arunabha Duari from Hindalco and Akkiraju Sairam Teja from MCL as panelists. This session was very lively with interactions between the delegates and faculties.

The workshop concluded with Vote of Thanks by Shri Raj Narayan Biswas, Co-convenor of the workshop and finally with a group photo. At the end the delegates got the soft copies of the lecture presentations copied in their pen drives, which were provided to them in their kits.

### **Outcome of the workshop / Recommendations**

The workshop dealt with various aspects of

Geotechnical Investigations with its main facets being soil and rock mechanics for foundation engineering. Faculties from reputed Institutes and industries had joined the workshop who gave a thorough idea of dealing with geotechnical investigations to safe guard foundation of various types of structures. A continuous interaction with the delegates who represent various industries and institutions followed by laboratory demonstration made the workshop very meaningful. The delegates were also taken to ongoing site of Kolkata East-West Metro tunnel which added special dimension to the workshop.

During sessions followed by plenary session provided scope to decide about outcome and thereby recommendations based on interactions with the delegates and faculties. Based on deliberations the following recommendations are made :

1. It is felt now the Geotechnical investigation is essential to be done for any construction, mining, tunneling, etc. As such each state must have a full-fledged Geotechnical Laboratory with modern equipment including software to cater the requirements arising out of factors relating to foundation stability. This will ensure safety of life and property. The persons manning such laboratories should be trained adequately if need be by visiting reputed laboratories.
2. All mines must have their own geotechnical unit for execution and monitoring for keeping the stability safeguarded. The team should comprise at the least a mining engineer, a geologist, a structural engineer and a civil engineer.
3. A drive for social consciousness should be propagated through various publicities and continuous monitoring. The society should know what protections they must take to save life and properties by adhering to normal precautions against disturbing stability due to unwanted and or faulty constructions.□



## **NEWS ABOUT MEMBERS**

As on 05.04.2018

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It will continue till June 2018□

## **ACHIEVEMENT OF MEMBERS**



**Anil Kumar Jha**

Former Director (Production & Planning) of MOIL and former Chairman-cum-Managing Director (CMD) Mahanadi Coalfields Limited (MCL), **Mr Anil Kumar Jha** took over the charge of Chairman-cum-Managing Director (CMD) Coal India Limited on May 18, 2018

Mr Jha is M.Tech. in Mine Planning & Design from the Indian School of Mines, Dhanbad, Jharkhand, with distinction. He comes with a rich work experience spanning 35 years in the field of mine planning, production, management supervision, direction and control of underground as well as open cast coal mines. He has worked with Central Mine Planning & Design Institute Limited (CMPDI), Ranchi, for 14 years, planning both opencast and underground mines.

He has also undergone training in Australia in 1991 on various opencast and UG projects, safety and research institution, equipment manufacturer's facilities and introduction of new technologies. He also had technical tours in Finland and in China..

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**PK Sinha**

Former Director (P&P), SECL **Shri PK Sinha** has joined as Chairman cum Managing Director, NCL since 22nd Dec 2017, and is functioning with ultimate responsibility of the company's performance, people and ventures, including development and execution of company's business strategies. Born in January 1962, Shri Sinha graduated in Mining Engineering from Raipur Engineering College – Raipur in the year 1982. He completed his post graduation in "Mine Planning & Design" from ISM – Dhanbad in the year 1988. Shri Sinha is a seasoned professional with 36 years of experience in Opencast and Underground mining activities encompassing Operational, Man, Material &

Project Managements of Coal India Ltd.

He is honored with many prestigious awards viz. Excellence In Environment Management, as Project head, from MPCCB-Bhopal for the year 2010-11 and Best Mines Manager at HB Ghosh memorial award hosted by MGMI at Kolkata for 2 consecutive years (2012, 2013).

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**PM Prasad**

Former Regional Executive Director of NTPC, **Mr PM Prasad** has joined as Director (Technical/Project & Planning), NCL. A graduate of Osmania University of 1984 batch, Mr Prasad had his M.Tech in Opencast Mining in 1991 from Indian School of Mines, Dhanbad. He had pioneered the coal production of NTPC and is well known for his dynamic initiatives and starting new mining projects.□



## **NEW LIFE MEMBERS**

(As approved in Council Meeting on 28. 4. 2018)

10773-LM, Shri Rajesh Goel, B.Tech (Hons) Mining Engineer, Former General Manager/CEO Arcelor Mittal, Flat No. 821, Tower – 4, Ashiana Upvan, Ahinsa Khand – 2, Indrapuram Ghaziabad, UP – 201014, Mobile : 8860468688, E-mail : rajesh\_gl@yahoo.com

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10776-LM, Shri Ravindra Kishore Prasad, B. Sc (Hons) M. Tech (Apply Geol.), Dy. Director General (Retd.) Geological Survey of India (GSI), 102, Feacon Palace Jatin Chandra Lane, Lalpur, Ranchi, Jharkhand – 834001, Mobile : 9431927997, E-mail : rprasad089@gmail.com

10777-LM, Dr. Partho Biswapati Choudhury, Ph.D (Civil Engg.), M.Tech (Mine Plan & Dsg) BE (Mining Engg., Principal Scientist, CSIR – Central Institute of Mining & Fuel Research, CSIR-CIMFR, Nagpur Research Central, (Mining Technology), 17/C, Telangkhedi Area, Civil Lines, Nagpur – 440001, Maharashtra Phone : 0712-2510604 (O) 2582666 (R), Mobile : 7588313131, E-mail : parthonagpur@gmail.com

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10780-LM, Shri Kamlesh Kumar, M.Sc (Chem) M.Tech (Met), PhD (Chem), Asstt. G M (Chem), NDMC Ltd., A-317, Mayflower Heights, Opposite : Nomafunction Hall, Mallapur, Nacharam, Hyderabad – 500076 Ph : 040-271720721 (O)/40115167, Mobile : 9490491722 / 9441486084, E-mail : kamaleshkumar@nmdc.co.in

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10782-LM, Prof. Ishtiaque Ahmad, M.Sc (Chemistry) Ph.D (Chem), Sr. Principal Scientist, Mine Ventilation Divn., CSIR – Central Institute of Mining and Fuel Research, Barwa Road, Dhanbad – 826015 Phone : 326-2296024 / 2296003, Mobile : 9798715848, Mail : ishtiaque.cmri@gmail.com

## UPCOMING EVENTS

### September 2018

**10th Asia Pacific Congress on Oil and Gas**  
September 10, 2018 - September 11, 2018 China  
(<https://oil-gas.chemicalengineeringconference.com>)

**Conveying and Handling of Particulate Solids 2018,**  
10 September 2018 - 14 September 2018  
(<http://www.chops2018.org/>)

**International Conference on Oil and Gas**  
September 12, 2018 - September 13, 2018  
Singapore, Singapore  
(<https://oil-gas.pulsusconference.com>)

**Coal Association of Canada 2018 Conference**  
12 September 2018 - 14 September 2018  
Vancouver, Canada  
(<https://www.coal2018.ca/>)

**14th International Symposium of Continuous Surface Mining**  
September 23, 2018 - September 26, 2018  
Thessaloniki, Greece (<http://www.iscsm.gr>)

**National Seminar, 60th Holland Memorial Lecture and 113th Annual General Meeting organised by The Mining, Geological and Metallurgical Institute of India, (HQ)**  
29th September 2018 at 1, Viswa Bangla Convention Centre, Hidco Bhawan, Premises No. 35 - 1111, Viswa Bangla Sarani, 3rd Rotary, New Town,  
Kolkata - 700 156,

Contact : The Mining, Geological and Metallurgical Institute of India, GN - 38/4, Sector - V, Salt Lake, Kolkata 700 091, Ph. : 033-2357 3482/3987, Telefax : 2357 3482, Email : [mgmisecretary@gmail.com](mailto:mgmisecretary@gmail.com), [mgmihonysecretary@gmail.com](mailto:mgmihonysecretary@gmail.com), Web : [www.mgmiindia.in](http://www.mgmiindia.in)

### October 2018

**International SAP Conference for Mining and Metals, Prague, 2018**  
October 16, 2018 - October 18, 2018 Praha 9, Czech Republic  
([https://www.tacevents.com/uk/events-uk/international-sap-conference-for-mining-and-metals/?utm\\_source=Evvnt&utm\\_medium=Event%20Listing&utm\\_campaign=SAPMM18&utm\\_term=Homepage&utm\\_content=May%20Onwards](https://www.tacevents.com/uk/events-uk/international-sap-conference-for-mining-and-metals/?utm_source=Evvnt&utm_medium=Event%20Listing&utm_campaign=SAPMM18&utm_term=Homepage&utm_content=May%20Onwards))

**MME 2018 - International Mining & Machinery Exhibition**  
October 31, 2018 - November 03, 2018  
Kolkata, India (<http://www.immeindia.in>)

### December 2018

**Global Congress on Petroleum Engineering and Natural Gas Recovery**  
December 06, 2018 - December 08, 2018  
Dubai, United Arab Emirates  
(<http://petroleum-engineering.alliedacademies.com>)□

## **NEWS UPDATE**

### **Radioactive Chinese Coal Ash**

Duke University in November, 2017 that some Chinese coal ash are too radioactive for reuse. This information needs a careful consideration while dispatching fly-ash from the thermal power plants. It is found that coal ash from high-uranium deposits in China is too radioactive for this use. Some coal ash analysed in the study contained radiation 43 times higher than the maximum safe limit set for residential building materials by the U.N. Scientific Committee on the Effects of Atomic Radiation.

It is felt that detail characterization of fly-ash of all the coal fields as well as the imported coal needs to be mandatory to be displayed in the public domain.

### **Jindal Steel South Africa units file for business protection**

South African units of Jindal Steel & Power filed for a local form of bankruptcy protection known as business rescue.

Jindal Mining SA's main business is coal production at the Kiepersol mine. Business-rescue practitioners for the unit have scheduled a meeting with creditors for June 26.

### **Expansion of uranium mining in India**

Minister of state Mr. Jitendra Singh told the parliament that India is planning a tenfold increase in uranium production over the next 15 years. State company Uranium Corporation of India Ltd (UCIL) has outlined the expansion plans to meet the Department of Atomic Energy's (DAE) vision of achieving self-sufficiency in uranium production.

The expansion is planned in three phases, with the first expected to increase uranium production

to 3.5 times existing levels by the "12th year". Completion of projects in the second phase is expected to achieve a sevenfold expansion over current production, with the third phase of projects leading to a tenfold increase over current levels by 2031-32.

### **India produces minerals worth Rs 1.13 lakh cr in FY18**

The country has produced minerals worth Rs 1.13 lakh crore in FY18, registering an increase of 13 per cent over the previous fiscal.

The estimated value for metallic minerals is Rs 53,029 crore and that of non-metallic minerals, including minor minerals, is Rs 60,512 crore, according to the Annual Report 2017-18 of Ministry of Mines.

The mining sector in the country is characterised by a large number of small operational mines.

The number of mines, which reported mineral output, excluding atomic, fuel and minor minerals, in the country was 1,531 in 2017-18 compared to 1,508 in 2016-17.

Out of 1,531 reporting mines, 230 are located in Tamil Nadu, followed by 197 in Madhya Pradesh, 191 in Gujarat, 142 in Karnataka, 132 in Odisha, 129 in Andhra Pradesh, 112 in Chhattisgarh, 87 in Goa, 85 in Rajasthan, 75 in Maharashtra and 58 in Jharkhand. These ten states together accounted for 94 per cent of total number of mines in the country in the last fiscal.

### **Corporate Environment Responsibility (CER) : New Guidelines of GoI**

The office memorandum (F.No. 22-65/2017-IA.III Dated : 1st May, 2018) issued by the Impact Assessment Division of the Ministry of Environment, Forest and Climate Change of Government of India has now streamlined



the stand on the Corporate Environment Responsibility (CER). This is an attempt to have transparency and uniformity while recommending CER to greenfield or brownfield projects by Expert Appraisal Committee (EAC) / State level Expert Appraisal Committee (SEAC) / District level Expert Appraisal Committee (DEAC). The following guidelines are issued by this office memorandum in supersession of all earlier office memorandums and guidelines issued in this regard :

- (I) The cost of CER is to be in addition to the cost envisaged for the Implementation of the EIA/ EMP which Includes the measures for the pollution control, environmental protection and conservation, R&R, wildlife and forest conservation/protection measures including the NPV and Compensatory Afforestation, required If any, and any other activities, to be derived as part of the EIA process,
- (II) The fund allocation for the CER shall be deliberated in the EAC or SEAC or DEAC, as the case may be, with a due diligence subject to maximum percentage as prescribed below for different cases :

SIN o	Capital Investment / Additional Capital Investment (in Rs.)	Greenfield Project - % of Capital Investment	Brownfield Project - % of Additional Capital Investment
I	II	III	IV
1.	≤ 100 crores	2.0%	1.0%
2.	> 100 crores to <50 crore	1.5%	0.75%
3.	>500 crores to ≤ 1000 crore	1.0%	0.50%
4.	> From 1000 crores to ≤ 10000 crores	0.5%	0.25%
5.	> 10000 crores	0.25%	0.125%

- (III) The activities proposed under CER shall be worked out based on the issues raised during the public hearing, social need assessment, R&R plan, EMP, etc.

- (IV) The proposed activities shall be restricted to the affected area around the project.
- (V) Some of the activities which can be carried out in CER, are infrastructure creation for drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness to local farmers to increase yield of crop and fodder, rain water harvesting, soil moisture conservation works, avenue plantation, plantation in community areas, etc.
- (VI) The entire activities proposed under the CER shall be treated as project and shall be monitored. The monitoring report shall be submitted to the regional office as a part of half-yearly compliance report, and to the District Collector. It should be posted on the website of the project proponent.
- (VII) The District Collector may add or delete the activities as per the requirement of the District.
- (VIII) The EAC can vary the above percentage of CER subject to proper diligence, quantification and justification. The EAC based on appraisal, should clearly suggest the activities to be carried out under CER.
- (IX) This CER is not applicable in name change, transfer and amendment involving no additional project investment. In case of amendment in EC involving additional expenditure, CER will be applicable only on the additional expenditure as per column-IV of the table given in pars 6(II) above.□

(Thanks to Mr. A. Kumaraswamy, Member for sharing the information)

# **SPENDING OF REVENUE COLLECTED BY GOVERNMENT FROM MINOR MINERAL ASSETS IN DEVELOPING ECONOMICS OF THE AFFECTED AREA – A CRITICAL REVIEW**

**Er SC Agarwal FIE\***

## **ABSTRACT**

All Minerals, major or minor are the valuable assets of the nation and for consumption of every citizen for improving their living standard. As of now some 55 minor minerals are being mined which constitute +18% of total mineral value in the country. Minor Mineral industry provides employment to over a few lac of workers directly and indirectly, 90% are local resident and includes about 20% females. After grant of license or lease the operator owes many financial responsibilities such as providing living wages to mine workers, payments of Royalty, Dead Rent, Taxes, Road Tax, DMF, cess etc to Government as per norms decided time to time which are transparent and are verified, beside earning his business profits. In turn the Government uses this revenue for developing economics of the country. Some funds like DMF are collected for specific purpose of attending socio-economic and environment issues in the area affected by mining activities. Revenues derived from the extraction of a country's mineral wealth has an impact on reducing poverty or generating broader economic growth and benefit. It is expected of governments to effectively manage and disclose revenues received from mining industries and payments made for socio-economic development of people affected, creating clean and green environment. During last 3 years collective collection on DMF has been Rs. 13704 Cr including Rs. 996 cr from Minor Mineral while spending varied from 51% to less than 1%. State falling short of spending such low revenue that too only on Low Priority Areas and nothing on High Priority Areas is of great concern. The minor mineral mining sector, being in unorganised group expects Govt would spend sincerely revenue collected to take care of their health, social welfare, education of their children and economic development (High Priority Areas) of villagers affected directly and indirectly.

**Key words :** DMF, Minor mineral, High Priority Area, Low Priority Area

## **Introduction**

All Minerals, whether, major or minor, are the valuable assets of any nation and so essential for consumption of every citizen. Per capita consumption of mineral is an index of national development, living standard and prosperity. Mineral industry constitutes an important segment of Indian economy.

Some 24 minor minerals had been mined. Of recently on 15th Feb-17, 31 major minerals have been added to the list of minor mineral making a total of 55. The extraction of minor mineral constitutes to +18% of total mineral value in the country (as per IBM in 2012-13). Minor Mineral industry provides large employment to local, mainly unskilled labour.

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After obtaining license or lease of minor mineral the operator owes many financial responsibility, beside earning his business profits, fair labour practice and providing them living wages, towards the society and largely towards Nation for payments of various taxes, cess, and rents. In turn the Govt uses this revenue, fund/ collection for developing economics.

### **Sustainable Development of Mineral for Generation Adequate Revenue**

To meet economic challenges and generate good revenue, sustainable development of mineral is essential. The use of advanced technology solutions has helped achieve greater efficiencies in terms of increased production, better resource management, and enhanced safety, reduction of carbon emission and conservation of natural resources for the next generation and satisfy the customer.

Role of mining technology in the given context of economic challenges are likely to be compounded by the fact that mineral resources are geo-technically more complex, and companies have to pursue opportunities in new mining territory.

### **Revenue & Payment Transparency : IRMA Standards :**

Innovative Responsible Mining Assurance (IRMA) has issued drafted certain standards for the operators towards payments to Govt as per norms decided time to time which are transparent and can be verified.

### **Payments Transparency requirements Means Verification of :**

1. The host government's production entitlement.
2. National state-owned enterprise production entitlement.
3. Profits taxes.

4. Royalties.
5. Dividends.
6. Bonuses, such as signature, discovery and production bonuses.
7. License fees, rental fees, entry fees and other considerations for licenses and/or concessions.
8. Any other significant payments and material benefit to government.

### **Revenue Collection Agency:**

#### **A. State Govt :**

1. Dead Rent,
2. Royalty : Payable/unit of mineral excavated and sold as per schedule described respective State Govt. It is revised every 3rd year.
3. Land Tax,
4. DMF : 10% of Royalty to be paid by lessee.
5. (Sales Tax - Vat-) now GST: The old system of Sales Tax and then VAT has been revised and consolidated as GST : 5% on raw or unfinished mineral and 15-18% after finish.
6. Road Tax for all vehicles running on road.
7. Water Cess, Air cess - After getting Consent to Establish, lessee has to deposit this Cess with RSPCB for use of water and emitting dust particulate during mining operation before obtaining Consent to Operate.

#### **B. Govt of India**

1. IT (Direct and Indirect), CST, Entry Tax. Central Excise and now GST
2. Local Tax : various tax collected by local bodies



## **Utilisation of Revenue Collected from Mine Operators :**

THE capacity of governments to effectively manage and disclose material payments and revenues received from mining industries in resource rich countries is sometimes underdeveloped. Revenues derived from the extraction of a country's mineral wealth sometimes have a lower impact on reducing poverty or generating broader economic growth or benefit than may have otherwise been possible. Increased transparency of material payments to and revenues received by the host country government can be one step toward addressing this matter.

GOVERNMENT companies and civil society working together to improve openness and accountable management of revenues from natural resources allowing citizens to see for themselves how much their government is receiving from their country's natural resource.

THE purpose of this chapter is to increase the transparency of material payments made by mining companies and/or received by governments, providing communities and the general public with the information they need to understand and assess the fairness of financial arrangements related to mining operations.

## **Avenue of Spending, by Government, Collection from Mine Operators as District Mineral Fund (DMF) :**

Beneficiary : Areas and persons affected by mining related operations undertaken in the area and includes the eligible patients and their legal heirs for ex- gratia payments under provisions of State Environment and Health Board.

DMF shall be utilised. In implementing Pradhan Mantri Khanij Kshetra Kalyan Yojna and other welfare schemes. These welfare schemes

are to benefit villager/villages who have been adversely affected directly by mining operations and also those families who have been adversely affected, indirectly, economically, socially and environmentally due to mining operation in their vicinity.

## **Utilisation of Funds**

THE State Govt has created DMF Trust and the funds so collected shall be utilised under two different heads:

- A. 60% of the fund has been allocated to High Priority area which includes :
  1. *Drinking water* - Developing centralised purification, setting up distribution network for supply drinking water.
  2. *Environmental preservation and pollution control measures* - Environmental preservation, control measures, prevention of pollution of stream, lakes and ponds, ground water, controlling air and noise pollution, restoration, reclamation and rehabilitation of mined out area, mechanics for eco-friendly and sustainable development of mineral.
  3. *Health Care* - Creating primary/secondary health centers, provision of required staffing, equipment, medicine and transportation of patients in emergency.
  4. *Education* - Construction of school buildings, additional class rooms, Labs, library, hostels, sports, adequate teachers, and nutrition etc.
  5. *Welfare of women and children* - programmes and schemes for maternal and child health, malnutrition, infectious disease etc.
  6. *Welfare of aged and disabled people* - special programme for welfare of old and disabled people.

7. Skilled development - Skill development through training for livelihood support, income generation and setting up Skill development centers.
  8. Sanitation - collection, transportation and disposal of municipal waste, treatment plant, proper drainage, and cleaning of public places.
- B.** Remaining 40% has been allocated for other priority area which includes :
1. Physical infrastructures like roads, bridges, and railway and waterways projects.
  2. Irrigation - developing alternate source of irrigation, adoption of advance irrigation techniques.
  3. Energy and Watershed development - development alternate source of energy and rainwater harvesting. Restoration of catchments.

### **Present Status of Revenue Spending by Government in Minor Mineral Mining Sector :**

Coefficient of employment per unit of mineral excavated is much higher in minor mineral sector than in major mineral; hence need more attention. A few lacs of workers are employed both in directly and indirectly activities. Of this 90% are local resident including 20% females. This sector, being in unorganised group, needs preferential attention for care of their health, education, drinking water, other welfare, social and economic development through adequate spending of DMF.

60% of DMF has been allocated for investment on high priority areas but no investment has been made of Govt. There appears to be no road map or detailed planning for adopting control measures and investment in High Priority areas covers basic amenities, environmental and pollution protection in the affected area

safeguarding the affected people living in mine area. Remaining 40% has been set aside for Other Areas. Whatever investment has been made so far is only in Others Area head.

### **High Priority Area require immediate attention :**

1. *Drinking water* : Investment on this provision comes on priority. In many mines working minor minerals, in spite of availability of adequate rain water from quarries, safe drinking water is not available and they suffer from water born disease.

Adequate investment is required on measures for central purifying, treatment and supply to miners and others living in close-by villages, at least in each affected area.

2. *Occupational health* : Much is yet to be done on prevention of air pollution especially in Sandstone mines. Dr SN Singh, Rtd bureaucrat and Social Activist reports that in absence of resources, unawareness among workers and negligence of mine operators, the Silicosis is spreading exponential in Sand Stone (minor mineral) mines. There are no proper health centers in mine area equipped for treatment of Silicosis. The patients reports in advance stage of Progressive Massive Fibrosis but Dr are treating the patient for TB. Even District hospitals have no special programme of training the Dr for diagnosing the Silicosis. This is of serious concern.

Instead of giving compensation to miners suffering from this dreaded disease, investment on control measures is more essential. More health centers need to be set up in each panchayat of affected areas and staffing, equipment and supplies is equally essential.

## Other Priority Area

1. **Education** : Adequate investment has not been made by Govt. Except constructing school building, there are no sufficient class room, no arrangement of adequate drinking water, insufficient teachers what to talk of library, labs, transport facility and nutrition facility.

2. **Public transports** - Normally minor minerals occur in isolated places having no road connection or any basic infrastructure. For smooth and safe transportation of mineral, good road connectivity is very important and essential.

In absence of roads connecting villages falling in mine area, there is scanty facility of public transport and the villagers depend on their own two-wheeler for any commutation even for medical urgency.

3. *Providing electricity to villages in mine area* - Villages in mine area are worst affected; low voltage, limited time, and frequent interruptions makes thing still worst.

4. *Housing for mine workers* - there is no such scheme for building houses for mine workers except granting limited subsidy through Limestone & Dolomite Trust.

AS per the report from Ministry of Mines, collective collection of DMF, during last 3yrs since March 2015, both for coal and non-coal sector has been about : Rs 13704 Cr.

Coal sector : Rs. 6549 Cr

Non Coal Sect : Rs. 4879 Cr

Minor mineral : Rs. 996 cr

State wise DMF collection and spending is given in table-1

**Table-1 : Collection of DMF**

State	Amount (Rs. CR)	
	Collection	Spending
Odisha	3548	257
Chattisgarh	2331	1202
Jharkhand	2314	260
MP	1449	157
Rajasthan	1235	
Telangana	603	
Karnataka	566	
Maharashtra	487	
AP	322	
Gujarat	244	
Goa	140	
Tamilnadu	117	

SPENDING during the period varied from 51% to as poor as -0.1%. In state of Rajasthan one of the mineral richest State, where a sum of Rs. 1235 Cr has been deposited by mine operators in DMF but spending, as per recent survey by leading newspaper of Raj, has been only Rs. 96L (less than 0.1%) that too in Other Priority areas like constructing roads, hospital, school, old age home but least on High Priority area like regenerating clean and green environment in mine area.

The revenue collected under DMF is in addition to revenue collected through usual sources like Royalty, Dead rent, Sales tax (now GST), Road tax, multiple cess etc but DMF fund is exclusively earmarked for Socio-Economic development of persons affected directly and indirectly due to mining operation in their area.

## Conclusion :

Minor mineral mining sector expects that Government would sincerely spend the revenue collected, from Lessee, in core activity under High Priority Area aiming at the sustainable development of the mine area, the welfare of villagers directly and also those indirectly affected, for improving general environment, remove their hardship, take care of their health and of women, education of their children.

Ease for transport for mineral, better availability of power, public transport, and connectivity to villages improving economy of the area. There has to be transparency in the payouts by Government also. Revenue so collected should not be diverted to other heads or other regions.

With huge untied DMF fund trust has free hand to address needs of mining affected areas and people. Awareness among affected

communities to their rights of the benefits is essential. The effect of sound implementation of DMF will be far reaching and its success lies in institutional set-up and sound accountability mechanism.

Chinmayi, Shalya. DMF : Challenges or Opportunity? State of India's Environment, Down To Earth-2018, On pp 242-246.

Dr SN Singh, Senior Administrator and Hindi Column Writer.

Dr Harry Parker Chairperson CRIRSCO rightly spoke of "Good, bad and really bad scenario in respect to the use of these payments by certain govts in developing economies".

## References :

The District Mineral Fund Trust Rules-2016, Government of Rajasthan □

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## GOVERNMENT APPROVES RESTRUCTURING OF INDIAN BUREAU OF MINES

IBM was set up by the Centre in March 1948 under the Ministry of Works, Mines and Power, primarily as an advisory body to help in formulation of policy and legal framework for the mining sector and advising the Centre and state on development and utilization of mineral resources. Engaged in handholding the states for auction of mineral blocks for greater transparency in allocation of mineral concessions, IBM helps states in preparation of auction blocks, publishing of average sale price, assisting in post auction monitoring and approval process. A committee worked for a Review and Restructuring of the Functions and Role of IBM after the adoption of the National Mineral Policy 2008 and submitted a report in 2012. The government has now approved the restructuring of Indian Bureau of Mines to reform the mineral

sector regulation that will involve upgradation, creation and abolition of certain posts of Joint Secretary-level and above.

The restructuring would enable the adoption of IT and space technology by the bureau to improve its effectiveness in mineral regulation and development, the mines ministry said in a statement. It is now expected that this will create direct employment opportunities for technical personnel with higher responsibility for contribution in faster development of mineral sector. The total cadre strength of IBM has been maintained at the existing strength of 1,477. The restructuring at IBM consists of creation of one post of Chief Controller of Mines in Level 15 and three posts of Controller of Mines in Level 14.



# **THE GEOMORPHIC PROVINCES OF GONDWANIC SEDIMENTS OF INDIA-ITS SIGNIFICANCE WITH SPECIAL REFERENCE TO TECTONISM AND PALAEOGEOMORPHIC EVOLUTIONARY HISTORY AND AREAS OF PROSPECT FOR FUTURE CONSIDERATION**

**Akhilesh Choudhury\***

The sedimentary prism of a few kilometer thickness preserved with variable thicknesses in the scattered areas of India are grouped as 'Gondwana' with floral, faunal and sedimentological records, document the geological history of about 230 Ma from late Carboniferous to Jurassic depicting an array of depositional environs. With updating database of these mainly terrigenous lithic fill, the postulated concepts of paleogeographic, paleoclimatic tectono-geomorphic evolutionary history and depositional models are under constant refinements.

In its preserved areas, the different stratigraphic horizons rest unconformably on Proterozoics of diverse ages like Pakhal/Sullavai (Godavari—Wardha Valley), Chattisgarh/Bijawars (Son—Mahanadi) or unclassified metamorphics/granitoids of Archaean(?)/Proterozoics. But rocks of Cuddapah/Vindhyans (Mid. to Late Proterozoic or even upto early Palaeozoics) though occurs in close proximity of different Gondwanic domains, yet to be reported their occurrence as basement rock and still probably an intriguing problem continuing Gondwanas in turn are found to be overlain in certain restricted scattered areas by younger sedimentaries (Cretaceous/Tertiary at places of marine nature or by effusive (Deccan and Rajmahal Trap). These cover rocks, not

only rests directly on various stratigraphic horizons from the basalmost Talchir (Late Carbonaceous) as thin veneer (as in the coastal Palar Basin of Tamilnadu or in its numerous occurrences of Son-Mahanadi areas etc.) to the uppermost Jurassic and even overlies on the adjacent basement directly without intervening Gondwana sediments.

Though the original depositional spread of the Gondwanas have been postulated to be much larger than what is seen today, but the exact limitation, so far knowledge goes is yet to be properly assessed. The innumerable Gondwana occurrences of lesser aerial, extent occurring much beyond the main basins of Gondwana, such as those over the Chotanagpur Granite gneiss of Bihar/Jharkhand Mica belt (at 50-200m R.L.) or in Hazaribagh Plateau or in Natarhat Plateau (+1000m R.L.) of Jharkhand, in the uplands of Surguja (500m-800m R.L.), in the low lying plains of Son-Mahanadi Valley of Chattisgarh, M.P. or on the Proterozoics of Godavari etc. but definitely attracted attention and studied whether in totality or not may be a debatable issue.

The relief map of India presents varied geomorphic provinces of Gondwana domains from a peneplained flat rolling terrain to rugged uplands often peneplained or of sudden abrupt

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topographic prominences (300m+) amidst surrounding low lying tracts of Gondwanas or basement. Analysis of the geomorphic expressions of the different stratigraphic horizons of Gondwanas, vis-a-vis the basement flanking them, as well as the cover rocks of individual basin or basin - belts and of the coastal tracts with their relative occurrences with respect to MSL has brought to light significant data on tectonic, denudational and related facets of geological processes operative through time and space since late carboniferous till late Tertiary time.

Keeping in view of the concept of Gondwanaland, its fracturing, drifting with evolution of continental margins, the changing palaeoslope of the sub-continent, the 90° E ridge and deep sea research project data in conjunction with the major tectonic lineaments and distributive pattern of Gondwana sediments with their geomorphic expression has aided to some extent in visualizing the original extent of Gondwanas of India. The peneplanation processes and the tectonic pulses through time and space were distinctly different leading to a non-uniform geological set-up in adjacent basin or amongst the basin belts. It is felt that after about more than half a century (or precisely since 1962) of roaming through the terrain of known Gondwanic domains of the country, it seems that perhaps in comparison to other areas, Son-Mahanadi and Satpura Gondwanas offer better opportunity for insight in unraveling many intriguing unresolved problems of Gondwana geology. The distributive pattern of the Gondwanas, vis-a-vis, the cover rocks geomorphology and relative level of their occurrence has not only played a dominant role in preservation of Gondwanas and simultaneously visualizing the extent of denudation, but has aided as a major tool in dating of tectonic episodes.

There are a general consensus of opinion among the main Agencies (GSI, CMPDI, SCCL State DGMS) and perhaps others viz. researchers/ Institutions etc.) are of the opinion that all the Gondwana occurrences of the country are

known by now, which either have already been explored or existing awaiting exploration. However, the author of this brief write-up holds a different opinion. During the fag-end of his service career in GSI (Superannuated in Aug 1997) or even after that during all these two decades of his engagement as Consultant to various Multi National and National Companies, his observation prompted him to give a re-look to certain areas of covered nature, in the vicinity of known Gondwana occurrences having adequate economic potentiality. Such areas are located in the ambit of Wainganga Basin of Maharashtra (to the east of active coal exploitation area of Umrer, earlier known as Hidden Coalfield beneath Deccan Trap) and the other one is in the domain of perhaps Son Valley (located to the north of Chota Nagpur Granite Gneiss Plateau of Hazaribagh on which two remnants of Gondwana are still preserved and known as Chope and Itkhor). Both of the above areas are peneplained terrain covered by Alluvium or soil.

The author during his postings during long tenure of period both in Ranchi (then it was Bihar) and Nagpur (as Supervisory Officer in both the places) from GSI have extensively toured/roamed through the areas of his jurisdiction and later also as Consultant had the opportunity of revisiting some of the areas, where exposed small outcrops of Lower Gondwana rocks have come to his notice. Geological settings of both the areas (though covered) according to his meagre knowledge of Gondwana provinces (Son-Mahanadi, Satpura Gondwana, Wardha Godavari, Damodar-Koel Valleys, Birbhum-Rajmahal, or even the small occurrence of Singrimari between the Brahmaputra and to the west of Meghalaya's Garo Hills) in the different States of the country, as well as knowledge of Gondwana occurrence in the north-eastern part at great depth beneath the thick sequence of Territory of Nagaland, east of Dimapur or coastal tract of Tamil Nadu) and a reasonable analysis of the Geomorphic signature of the **areas seems to be favorable locales of hidden Gondana in those areas,**

**which needs to be probed by modern State-of-the-Art & Scientific techniques by appropriate agencies.**

The above noted observation of the author with available published/personal knowledge of the author have been brought to the notice as Agenda Item from MGMI (a stake holder of CGPB of Ministry of Mines, GOI) not only to CGPB a few years back, but also to the notice of CGPB's Committee V (Energy Minerals etc.) of Mission II-B (erstwhile Coal wing). My interest prompted me to have information from GSI what was the outcome of the Agenda Item of MGMI on the issue. **However, I gathered that perhaps, attempts from GSI failed to prove justification of the Agenda Item of MGMI.**

In the above context, verbally, even I have expressed my willingness to GSI's Mission II-B's Senior Officers that if situation so demands (even at this old age of 79 yrs) at my own expense I am ready to extend co-operation for field visit. But I am yet to know about the decision of the appropriate authority.

**My observations on certain points of HPC's report are listed and enclosed as Annexure I.** Before concluding I want to record that Ministry of Mines (GOI) Resolution New Delhi, the 7th January, 2008 II (39)/2007 M.I and Resolution no II (39)/2007 – MI dated 27th March, 2008 and a list of other Resolutions (dated 8.7.2008, 6th November, 2008, dated 12.01.09 and 21.01.09) and published in the **Gazette of India**. Extraordinary, part I – Section I, published by authority, New Delhi, Wednesday, January 9, 2008/Pousha 19, 1929 (in the pages 315-321 of the High Powered Committee, GOI, MOM's Report), **The composition/members of the HPC has been shown. To my understanding and knowledge, perhaps at least none of the member representatives from GSI have any background expertise of Coal/Lignite Geology of the country.** Regarding other members of the Committee I am ignorant about their expertise on Coal etc..

Lastly summing up the things I like to mention the **GSI and other agencies are embarking** on different projects for **exploration of different economic minerals of deep-seated occurrences** by modern technology, by Aero-Space survey and with marine surveys. **The areas which have been mentioned in this write-up having significant signature are on the ground and not located in inaccessible areas.** The author is not claiming that his observation or scientific reasoning's definitely will lead to a positive result. His submission is based on filed observation, scientific analysis of the terrain and its adjacent areas and rather long (more than half a century) association with coal exploration (both in GSI and post GSI days). If GSI don't venture to find out where there is any tangible/logical database or not and whether it is within the preview of Regional Exploration or not (which according to the Charter of GSI's Functions accords a priority area), then what other Department/Organization/Agency will venture for exploration of an hitherto unknown area having no previous data exists. Before I conclude, I am tempted to **mention a statement** in one of the published literature (the actual reference I am unable to recollect) of GSI long back in early 1990's **by late Dr Prakiti Kumar Ghosh** (then Superintending Geologist of GSI and who was the Founder of the Atomic Energy Commission of India, but perhaps had a sad early demise due to an air crash in one of the flights of AMD's aircraft in the remote areas of the Himalayas). Dr Ghosh probably wrote **"Negative data due to exploration is a Data also, because once for all, we know that the area should be kept outside the purview of any future exploration"**. Due to my association with GSI for more than 35 years (1962-1997), I hope if **I am not wrong that how much percentage of GSI's exploration programme culminate into positive result oriented and vice-versa.** I am aware that in future my suggested areas GSI may or may not consider for any probing and if probed, I may not be in this world (as now I am 79 years) to know the result of my dream. The decision is left to the choice/wisdom of GSI experts.□

## **ARTIFICIAL RECHARGE AND WATERSHED MANAGEMENT AT NEYVELI LIGNITE CORPORATION**

**S Kumaraswamy\***

### **Introduction**

Water is an integral and inseparable part of all living beings on earth. It is unfortunate that the water, nature's gift which is so important to all of us, is no longer available adequately and equitably to all human beings.

The demand for water is increasing day by day not only for household and agriculture but also for industrial purposes. Hence there is an urgent need to augment our water resources which are depleting at an alarming rate.

One of the main component of Earth, water is very precious to all living beings. However, 97 % of earth's water is salt water & only 3 % is potable water that occurs in the following form:

- ❖ 77% ice form
- ❖ 11% groundwater above 800 m depth
- ❖ 11% groundwater below 800 m depth
- ❖ 1% lake, pond & rivers

Nowadays the water is served as door delivery like milk.

### **GROUND WATER MANAGEMENT IN NLC**

According to the prevalent concept aquifers are classified as Unconfined aquifer (water table aquifer), Semi confined aquifer and Confined aquifer.

### **Unconfined aquifer :**

This aquifer under water table condition is the first aquifer to be identified below the ground level. It extends to different depth range in this area maximum being 50 m. The aquifer material consists of lateritic sandstone and mottled sandstone of varying grain sizes. The water level in this aquifer is as high as 2 to 6 m in the rainy season and as low as 10 to 15 m in the summer. At few places, pockets of perched aquifer are also observed in this area.

### **Semi confined aquifer :**

This aquifer is occurring just above lignite but it is predominant in the area mostly south of Vridhachalam - Cuddalore road and in some areas it is found North side of the road. Maximum thickness of this aquifer is about 20 m. General thickness may be assumed as 5 to 10 m. This aquifer consists of fine-grained sand mixed with clays at some places.

### **Confined aquifer :**

The confined aquifer is the most important zone as far as NLC is considered. It has a maximum thickness of 400 M in the central portion and pinches in the west. It is intersected by lenses of clay of varying thickness. There is comparatively thick barrier clay at depth of around 40 to 50 M below the top of aquifer, which divides the aquifer into upper and lower confined aquifers in the lignite bearing area. The upper aquifer with a high confining pressure of 5 to 8 kg/cm<sup>2</sup>

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\*Executive Director/Mines, NLC India Ltd. (Retd)



is alone being tackled for ground water control purposes in the Neyveli Lignite Mines. The water level in this confined aquifer varies from 60 m in the west to 8 m in the east. The West-East cross-section across the Neyveli Basin is exhibited below.

## Ground Water Problem for Lignite Mining

Mining of lignite from Neyveli lignite field is faced with a stupendous hydrological problem due to the confined water in artesian aquifers below the seam exerting tremendous upward pressure which, if not controlled, could jeopardize mining operations

### Solution

The hydro-geological investigation and pumping tests conducted in this field proved that most practical-cum-economic solution to this problem is depressurization of confined aquifer and maintaining the pressure head constantly below the lignite seam (initial technique) or just above lignite seam (positive head- improvised technique) by large scale continuous pumping operation from the series of large dia pump wells located/situated at hydro-logically pre-planned/calculated distances from the active excavation zone

### Storm Water Control Management

In addition to the ground water in the mines, the extraneous water collected from precipitation, mine wall & floor seepages and leakages from the pipe lines carrying ground water to the surface is collectively termed as “Storm Water”. The storm water is being handled and pumped out through high head centrifugal pumps placed in floating pontoons.

### Specific condition of MOEF

MOEF stipulated that ground water pumping should be maintained within 149.73 MCM per annum till commissioning of the mine II

expansion project. In addition, the project proponent should supply treated storm water to the township and power plants and complete switch over to dry disposal fly ash system in their power plants be implemented before the commencement of lignite production under mine – II expansion. A detailed integrated water management action plan indicating allocation of funds for implementing various water conservation schemes and compliance schedule should also be submitted to MoEF in two month's time.

The ground water management in NLCIL involves the following

GWC pumping MoEF allotment to NLC =  
149.73MCM

MINE	GWC PUMPING
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MINE I	39 MCM
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MINE IA	15MCM
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MINE II	46 MCM
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Total	100 MCM. All the water is sent to thermal power station
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MINE	SWC PUMPAGE
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MINE I	19.11 – 23.89 MCM
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MINE IA	9.56 MCM
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MINE II	31.06 – 35.84 MCM
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All the waters goes via canal irrigating an area over 20000 to 21000 acres benefiting 25 villages 40 hamlets

### Optimizing the Ground water extraction from the mines :

NLC has evolved the followings for ensuring water balance in the system :

- ❖ Optimizing the Ground water extraction from the mines

The ground water control operational plans have been drawn for all the three operating

mines to restrict the drawl within 150MCM/A to enable lignite excavation under positive head mining of 5 to 8m.

- ❖ Conservation measures for reduction in requirement of power plants

Introduction of dry ash disposal system in thermal power stations substituting the treated storm water from mines for raw water requirement of thermal power station – II and expansion unit.

- ❖ Conservation measures for reduction in quantum of drinking water for township & mines

Staggering the working hours of pumping in township by about 2 hours a day (stage-I). Substituting the treated storm water for township drinking water supply in lieu of ground water pumping in a phased manner. (Stage-II)

## NLC ARTIFICIAL RECHARGE

### Artificial Recharge studies in Neyveli Hydro-geological Basin by NLC :

Recharge is generally defined as the movement of water from the land surface into an aquifer. Recharge can be either natural, from precipitation that falls on the earth's surface and moves on its way underground or it can be artificial, from human activities that deliberately or inadvertently replenish an aquifer. Knowledge on the mechanism of recharge is necessary to effectively manage ground-water resources and protect them from pollution, and to determine how fast an aquifer be depleted when pumping and natural outflow exceed recharge.

NLCIL initiated studies with the following objectives :

- To study the effectiveness of three different artificial recharge arrangements (**percolation pond with percolation wells, recharge wells and check dams**)

for enhancement of recharge and to study the variability of recharge season-wise.

- To comparatively evaluate the different alternative artificial recharge arrangements and to suggest the suitable technique with reference to space.
- To delineate **strategies for maintenance of artificial recharge arrangements**, and
- To **study the combined effect of three different types of artificial recharge structures in a single area.**

The study included the effect of recharge structures in offsetting the deficit condition thus avoiding the possible adverse effects such as decline in water level, change in water quality, and salt water intrusion, if any.

Following two types of recharging were initiated:

### Induced Artificial Recharge

- ❖ NLC, first time took an induced artificial recharge by an injection well north of lignite boundary (5km north of Mine-I during 1999-2000 under US-India S&T project against a upward pressure of 5 to 8 kg/sq.cm. (Rs. 25 Lakhs)
- ❖ The aquifer was lying 140m below the ground level and closer to the cone of Mine pumping This was one of the methods suggested in the numerical model studies for NLC by ICB-consultants.
- ❖ A methodology was adopted. i.e., closer to the injection well (100m) distance, a pump well was constructed and the water pumped was injected in the artificial recharge well.
- ❖ Since not much proven techniques were available for recharging the deep seated confined aquifers occurring in Neyveli Hydro-Geological Basin,

- ❖ The selection of site and design for injection wells mainly depended upon configuration of the aquifer, hydrological evaluation and location of source of excess water.
- ❖ The injection well was designed (casing size and gravel packing) based on the aquifer characteristics. To evaluate the parameters, a pumping test was carried out prior to commencement of recharge test.
- ❖ The test was successful and has recorded that water can be injected against the confined aquifers with this method.

#### **Artificial recharge through gravity method :**

- ❖ NLC, under Government of India, Coal S&T Project undertook a "Study on Enhancement of Recharge Potential in the recharge area to the Neyveli Deep Seated Aquifers" with the technical assistance from IIT-Madras. (Rs. 75 Lakhs)
- ❖ Within the recharge area of Neyveli ground water basin two villages namely Nadiyapattu and Maligampattu were identified for experimental study. The study area in Nadiyapattu falls 15 km N-NW of Neyveli and Maligampattu village falls 15 km N of Neyveli.

#### **Inferences drawn from the above study and field work were :**

- ❖ It was concluded that the most influencing factors for recharge into aquifer are rainfall, the land use pattern, and geology of the area. From the sensitivity study it was found that maximum available water content and rooting depth are the major influencing factors for natural recharge into an aquifer.
- ❖ Among the different artificial recharge structures studied, **the percolation ponds with recharge wells were found to be**

**more effective in recharging the surface water into the aquifer** compared to other structures.

- ❖ It was also found that water quality has shown improvement by artificial recharge.
- ❖ The simulation results show that the observed and predicted heads match well. An average increase in water level of 2m-3m was noticed after artificial recharge in most of the places in Nadiyapattu.
- ❖ Predictions of water levels were done for a period up to 2011. There were no considerable variations in water level pattern in the future if proper annual maintenance of the structures are done.
- ❖ The influence area of the percolation pond with percolation wells comes to 500m parabolically towards the east. Wells had a radial influence area of 125m.
- ❖ The recharge basin scale study shows that on an average 80-90% of the change in volume in the percolation pond was contributing for recharging the aquifer rather than being lost to evaporation. This shows that the structure is efficient in recharging the aquifer and the site is favourable for artificial recharge.

#### **Artificial recharge through injection well Technique**

- ❖ Since not much proven techniques were available for recharging the deep seated confined aquifers occurring in Neyveli Hydro-Geological Basin, a further study was initiated in the year 2005 by NLC with the technical assistance from RE-Germany and IIT-Madras from Indian side. (Rs. 185 Lakhs)
- ❖ This experiment was carried out around 20 kms away from the zone of mine pumping influence, and the aquifers are

200 to 250m below the ground level. A numerical infiltration model for the proposed area was developed. As per the model, the sites have been identified.

- ❖ In the identified location two injection wells were constructed each 150m apart supported by a battery of 5 observation wells along the natural flow direction of the ground water.
- ❖ The surplus surface water available in the Perumaleri after suitable precautions has been injected.
- ❖ Successful implementation of the above experimental study would arm Neyveli Lignite Corporation to broadly maintain the ground water balance in the region besides checking the sea water intrusion, if any.

#### **Inferences from this included :**

- ❖ The present coastal line observation wells located near the coast does not show any salty sea water influence.
- ❖ The ground water is still meeting the standards of drinking water with low chloride values of around 100mg/l
- ❖ With the present pumping scenario of the region, the model study indicates the Propagation velocity of sea water towards the land as
- ❖ without infiltration @ 30m per year i.e it will take 33 years to travel a distance of 1Km
- ❖ with infiltration @ 5m per year i.e it will take 200 years to travel a distance of 1km
- ❖ The study ascertains the possibility of Injecting water in deep confined aquifers under upward hydrostatic pressure at about 150-200GPM per infiltration well in future if required.

## **RAIN WATER HARVESTING IN NEYVELI TOWNSHIP**

Neyveli Township is spread over an area of 35 Sq.km. The industrial township is a well-planned layout and has a well-laid out storm water drainage system. The run off water during rainy season is collected through three major drains running from west to east in parallel in township. The average annual rainfall is 1200mm. The run off rain water at present flows to the sea ultimately through natural streams. The proposed scheme is for harvesting run off rain water from two drains (parallel to Indra Gandhi Salai & Kamaraj Salai) which contribute about 60 to 75% of the total run off in Township. The project envisages construction of check dams, soak pits across the drains and one pond with infiltration wells etc., to increase the water resources in water table zone.

#### **The salient features of the scheme are as follows**

- ❖ To recharge the subsoil water table using rainwater-harvesting techniques.
- ❖ Utilizing part of run off rainwater carried through drains, inside the Neyveli Township to increase the water resources in the water table zone. The run off rain water at present flows to the sea ultimately through natural streams.
- ❖ Construction of Check dams and Soak pits across the course of the major storm water drains.
- ❖ Construction of a pond at a select downstream location to store run off rain water with a surplus weir.
- ❖ Construction of infiltration well inside the pond for recharge.



- ❖ Construction of observation wells along the drains and near pond area and at a downstream location of a drain to monitor subsurface water table.
- ❖ The surrounding villages are at present using sub-soil water for irrigation and domestic needs by means of bore wells and open wells. This project envisages increasing the sub soil water table for the benefit of the nearby villagers.
- ❖ Salient features of the work are
  1. Check dams constructed-8 Nos (about 1.00 M height and about 7.50 M length) across storm water drainage.
  2. Surplus Weir at storage pond-1 No. about 1.5M height and about 16 M length) with surplus canals at sides.
  3. Storage capacity of Pond is about 50,000 M3
  4. Percolation / infiltration wells – 6 Nos. at check dams and 5 Nos. at pond area (18” dia, 30 M depth)
  5. Observation wells – 5 Nos. at select locations.
  6. In addition, the rain water harvesting structures have been established in all the office building complexes of NLC

From the different rain water harvesting structures, it is observed that the considerable quantum of run-off water is being recharged into the water table aquifer which influences the raise in water level in the water table.

## Conclusions

Mainly, Conservation and harvesting of surplus monsoon run off in ground water reservoirs is very much necessary which otherwise was going un-utilized outside the watershed/ basin and to sea.

Benefits derived out of the water management activities at NLCIL are :

- ❖ Rise in ground water levels
- ❖ The ground water structures gains sustainability
- ❖ The ground water wells will become sustainable
- ❖ The cropping pattern in the benefited zone will undergo marked change due to enhancement of ground water source and cash crops will start growing
- ❖ Orchards which went dry earlier due to ground water scarcity may rehabilitate and new plantation may grow.
- ❖ Green vegetation cover may increase in the zone of benefit due to increase of soil moisture
- ❖ The quality of ground water will improve
- ❖ Besides, the direct measurable impacts, the artificial recharge schemes will generate indirect benefit in terms of decrease in soil erosion, improvement in fauna and flora, influx of migratory birds, etc.
- ❖ The mankind will get a major boost in the way of improved quality of living
- ❖ Storm water as runoff is 80%, which is going to the sea only.
- ❖ Owing to the above, the water table has to be replenished.□

### **Agarwal encouraging Anglo to accentuate South Africa link - report by : Martin Creamer**

Indian mining billionaire Anil Agarwal is encouraging Anglo American – in which he now holds more than 21% – to accentuate its link with South Africa, where the Vedanta Resources company he founded and chairs, is successfully turning to highly positive account the zinc assets that Anglo walked away from eight years ago. Anglo's South Africa connection receives high praise from Agarwal, who is pleased with the decision of the London-listed, South Africa-rooted company to retain South African assets previously earmarked for potential disposal.

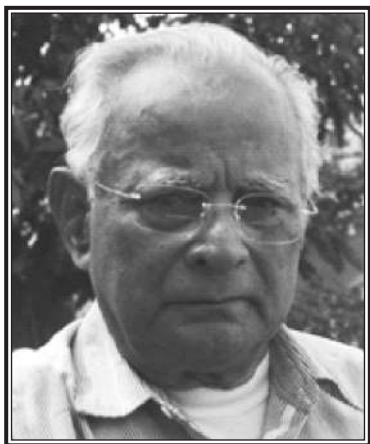
Agarwal's trust company Volcan Investments – through which he owns the Anglo shareholding and through which he also controls Vedanta – has witnessed the value of its shareholding in Anglo soar by 50%. He expressed the firm belief that Anglo's South African connection is of significant benefit to shareholders and recalled that when investors were being advised to disinvest from South Africa, he invested in the country “and I've been proved right”. Founded in South Africa 101 years ago, Anglo switched its primary listing from Johannesburg to London 19 years ago and disposed of its zinc assets to Vedanta in 2010.

Through decisive underground and near-pit mining, Vedanta quickly achieved payback on Anglo's former zinc assets in a mere two years, and is now implementing a far-reaching beneficiation plan for South Africa's needy Northern Cape, where its new \$400-million Gamsberg zinc mine is scheduled to reach full production later this year. Moreover, the Vedanta board has approved the go-ahead for a feasibility study into the development of a \$700-million, 250 000 t/y, first-phase smelter-refinery complex, with second and third phases matching the Gamsberg mine's own phased expansion plans.

“I'm looking at 20, 30 or 40 downstream industries coming here,” Agarwal told Mining Weekly Online in outlining his vision for zinc-related galvanising activity and sulphuric acid spinoff. Agarwal's, (64), company Vedanta, today employs 100000 people, has assets worth \$40-billion and is engaged in the mining and marketing of zinc, lead, silver, copper, iron-ore, aluminium and oil and gas, as well as the generation of electricity.

(From a report from Johannesburg in the Mining Weekly, 9 May, 2018 courtesy **Prof. (Dr.) Subir Kumar Mukhopadhyay**)

## Obituary



**Birendranath Mukerjee** left this material world on Tuesday, the 8th May, 2018. With heartfelt grief MGMI members wishes his soul to rest in peace in his heavenly abode. May God give strength to his bereaved family members and friends to bear the loss.

Late Birendranath Mukerjee was born on August 28, 1925. He was a Life Member of MGMI (1149-LM). He graduated from the Indian School of Mines in the year 1947. In 1950, he completed his post graduation with First Class in Mining. Subsequently, he received the First Class Mine Managership Competency Certificate in 1951. He began his career as Mine Manager and since worked in various Coal Mines like Angarpatra, Bhatidih, Dharmabandh, Bajna, Khas Kajora etc. He was appointed as the Inspector of Mines for Eastern India by the Directorate General of Mines Safety. He had been instrumental in carrying out the job of rescue after mine accidents, as well as, investigations into the primary causes leading to the disaster. Later on he joined Kilburn & Co. (now known as Macneill & Magor) as General Manager (Mining), and General Manager (Eastern Region). He was trained in UK for handling all technical aspects, design of equipment, service and marketing of such items over many years. He had also

introduced OLDHAM Cap-lamps to India in the late 50's and early 60's and helped towards integration and manufacture of the same in India through transfer of technology from UK to Indian Company Standard Batteries.

As the founder Chairman of Mine Line Pvt. Ltd., he developed flameproof range of Electrical Equipment for the first time in India from 1977 till the last day of his life. He signed a technology transfer agreement with SAIT Mining SA, France in 1984. He pioneered the design & manufacture of flame proof electrical equipment suitable for use in Indian Underground mines under this technology transfer & joint venture. He was responsible for successful adaptation of the latest European technologies for improvement of indigenous design, which are in extensive use on all India basis today. The Transwitch units developed by Mine Line in 1992 were also part of his innovation.

He was the founder President of the ISM Alumni Association – Kolkata Chapter (2004-09). He was the recipient of the Indian School of Mines Scroll of Honour in 2002. He has jointly authored the book “Electricity for Mine Engineers” in 2017 along with Dr. PK Chakrabarti, Former General Manager, CMPDI. A number of his writings were published in MGMI & ISMAA-KC Journals as well as publications like Shanibarar Chiti. He was a gifted writer versatile in both Bengali & English and has left behind an exhaustive journal of writings of his life. He was a total Outdoorsman, an Expert Shooter, Angler, Yachtsman, 12 Handicap Golfer, Rosarian, Horticulturist and Philanthropist. He was an excellent Photographer and an avid Reader as well.

He has left behind his wife, two daughters, a son and grandchildren.□

## LIST OF MGMI SPECIAL PUBLICATIONS

Name of Publication	Year	US\$	Rs
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Small Scale Mining in India and abroad*	1991	45	450
New Finds of Coal In India–Resource potential and Mining Possibilities	1993	30	300
Computer Applications in Mineral Industry	1993	40	400
Indian Mining Directory (4 <sup>th</sup> Edition)*	1993	40	400
Asian Mining 1993	1993	85	850
Mine Productivity & Technology	1994	75	500
Maintenance Management for Mining Machinery*	1995	60	600
High Production Technology for underground Mines*	1996	50	500
Mineral Industry Development in India–Issues, Perspective & Policy	1996	20	200
Disaster Prevention Management for Coal Mines, Vol I	1996	50	500
Disaster Prevention Management for Coal Mines, Vol II	1996	50	500
Business and Investment opportunities in Mining Industries (BIMI '96)*	1996	40	400
Indian Mining Directory (5 <sup>th</sup> Edition)	1996	50	500
Information Technology in Mineral Industry (MGMIT'97)*	1997	50	500
Technological Advances in Opencast Mining (Opencast '98)*	1998	80	800
Management of Mining Machinery (MMM 1999)	1999	80	800
Mining & Marketing of Minerals (MMM 2000)	2000	80	800
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Bridging the Demand Supply Gap in Indian Coal Industry*	2005	30	300
Asian Mining Towards A New Resurgence (Vol I & II)	2006	175	2400
Indian Mining Directory (6 <sup>th</sup> Edition)	2006	60	600
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Published by : Honorary Secretary, **The Mining, Geological and Metallurgical Institute of India**

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Price : Free to Members; ₹ 100.00 or US\$ 5.00 per copy to others

Printed at : Graphique International, Kolkata - 700 015, Phone : (033) 2251 1407