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CONTENTS

President's Message	1
From the Desk of Editor-in-Chief	2
Associate Editor's Column	4
Obituary	7
Headquarters Activities	11
Report of Editorial Committee Meeting of MGMI	
News About Members	14
Upcoming Events	14
From the News	15
Perspective Piece	21
Lessons from COVID-19 for Environment Protection: <i>Dr. Sukumar Devotta</i>	
Interview	
Future Pathways for the Energy Sector and Climate Change: <i>Prof Amit Garg</i>	28
Technical Note	
i. A Note on the likely impact of COVID-19 Pandemic on the Global Mining Industry <i>Prof. S. P. Banerjee</i>	30
ii. The current scenario of the Polymetallic Nodules Programme in India: <i>Jayant Singh and R. Srikanth</i>	35
Down Memory Lane	
Pangs of Mines Vocational Training JN Johari	39

The Advertisement Tariff for Insertion in MGMI News Journal

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President's Message



We are living in troubled times. In a matter of a few months a little known microscopic organism, infamously known as Covid-19, has wreaked havoc sending the world into an economic tailspin. It destabilized financial and social structures. My priority concern is that I hope all the members of MGMI and associated allies along with their members of the family are safe and healthy. Our way of living and lifestyles have been irrevocably changed. As history is the witness, humanity has endured many calamities like plague, cholera and Spanish flu and managed to emerge stronger. We as the human race have that resilience and fortitude. We shall overcome this time too.

The pandemic has forced us to re-look at the way we balance our business and life. New short term measures and norms are emerging which were not considered earlier. Technology has come to the fore again in how we are harmonizing our day-to-day life. Few of the examples are Video Conferences, online reading of news dailies, online ordering of commodities. But, over the time these may become established procedures. Creativity and Adaptability are the need of the hour. MGMI is adopting efficiently to the situation. For example, for the first time MGMI's new editorial board completed the annual paper presentation online – a commendable out-of-the-box achievement

to maintain the continuity. Creativity is giving way to convention.

This is not the time to despair but develop. The Hon'ble Prime Minister of India gave a clarion call for a self-reliant India. As professionals in the mining, mineral, geological and metallurgical sectors, we must within our domains contribute to that cause. Indigenous coal production should go up replacing the imports to the extent possible saving the forex outgo especially when we are endowed with abundant, affordable reserves. Infusion of updated mining and information technologies is imperative.

I am particularly touched by the tenacity and devotion of our coal miners who even during these testing times never let down the country, but continued to mine coal in meeting the country's energy demand. I salute their bravery and commitment.

We, at MGMI, welcome discussions on novel big data techniques and how they could influence research and development in safe and sustainable mining. I consider it a privilege to present this issue on "Rebuilding a Resilient Mineral and Mining Sector". We are hopeful that the breadth of the coverage will inspire the members of MGMI to explore frontiers of science and engineering for the betterment of a self-reliant India.

Anil Kumar Jha
President, MGMI

Using COVID-19 as a currency to buy and encourage indigenous growth

World is passing through a very testing time. However, such situations have come up many times in our long history of evolution, and



each time, sheer human creativity and skill have been used to overcome them. Like those other adversities, the COVID-19 is indeed a pandemic that will affect people and jobs worldwide. As a result,

there is a new concept of a **new normal** in the society and it is expected to be reflected in every sphere - individually, socially, politically and economically. These walks of life, especially in the political and economic sections, are heavily influenced by the living standards of each individual. In that regard, today we want to save ourselves from an invisible, mysterious virus whose origin we are still quite unsure of. Inevitably, we want to save ourselves while maintaining our best standards of living.

Mining industry is indispensable for the quality of life that has evolved over the years. If we imagine a world with no mining activities, it is safe to assume that there will be a major crisis in providing most of the materials required to build infrastructures and instruments of daily use. It would also be difficult to obtain large amounts of energy, as well as to supply agriculture with fertilizers which enables a large portion of food production.

The industry has been facing the challenges of maintaining a **consumable environment** in the mining region and beyond. Still the operations were going on. However, the tiny, invisible coronavirus has brought the working of the entire industry (and more) to a halt. The necessary steps of lockdown and social

distancing have led to a significant drop in the consumption of minerals and thus, mineral demands. Nevertheless, these steps are only a temporary measure, and the future will definitely bring in steady demands of minerals and energy. When that happens, the industry will have to be ready with the contemporary world's continuous modernization and modifications along with the novel technologies. This in turn means that there is an urgent need for a rapid preparedness for the New Normal of the 21st century. To that end, Investment Risk Index in Indian Mining and mineral industries will have to be scientifically assessed considering the contemporary Legal, Governance, Social, Fiscal and Infrastructure issues and operational problems that might have risen due to the approach of controlling the pandemic.

The first and foremost priority of mining and mineral industry in the New Normal would be to ensure worker safety and minimise the risk of the virus transmission. During the lock down the mining sector kept on producing minerals to continue the supply system particularly for the coal fired power stations. Mines will have to introduce and follow new practices like temperature testing of miners on arrival at mine site, rotational systems of workers and officers working for critical jobs, limiting entry of people to attend non-critical functions, more regular disinfection of shared areas and manned machines, regular testing for COVID, and making sure all contractors (those still allowed on site) are compliant with new setups.

By necessitating the use of Aarogya Setu, the mining companies in India can avoid the self-assessment forms that are to be filled in by the employees and contractors prior to being

given site access to establish: if they have symptoms; have been in contact with someone with symptoms; have been in contact with anyone who has tested positive; or have cared for someone who has tested positive. Mining must take necessary steps to procure and operationalize rapid diagnostic test (RDT) kits at its sites and in their community health care units for the early detection of the antibodies caused by the virus. Such attempts must be in compliance with the protocol developed by competent doctors. The final confirmatory test for corona virus is the quantitative ***Real Time Reverse Transcription–Polymerase Chain Reaction*** (real time RT-PCR) test performed by certified laboratory or government authority. When a worker is not feeling well or has been in contact with an infected person, contact tracing can help to identify all persons who may have been in contact with that worker. The companies will now require proper facility development for isolation and testing.

Currently, there is no alternative in mining sites to adopt and implement frequent handwashing, wearing of masks and social distancing, even though many mining work site may demand otherwise. Number of buses for workers transporting will have to be increased to maintain social distancing. Vehicles must be operating with open air ventilation, and daily cleaning must be reinforced with disinfectants and rigorous inspection. Number of administrative and planning jobs will be carried out online in the coming days. Many administrative offices may remain closed without much difference in outcome. Many engineers and officers will now deliver more output by working in the relaxed conditions of their homes. Many of the canteens and eateries of the mining sites will now be allowed to operate under constant vigilance of safety and cleanliness resulting in improvement in overall hygiene and health.

The mining industry under the grip of COVID-19 has faced the challenge of maintaining critical services and production whilst ensuring safety. For CIL, it will be a challenge to meet the target of 710 Mte of coal and 1580 Mm³ of OB. This target, against last fiscal year's production of 602.14 Mte of coal, is fixed to reduce the import of non-coking coal by 100Mte. Difficulties in working with the social distancing norms has led to the suspension of 22 underground mining operations in Singhereni coal fields and a large number of miners are getting only half of their pay. It is feared that the centre and key mineral producing states will suffer a heavy revenue loss of about Rs 12000 crores due to lower coal and mineral consumption under the prevailing corona situation. With the reduction of mining activities, the government will also lose revenue from explosive industry, oversize tyres, bulk logistics and number of allied mining services.

Operationalization of recently auctioned iron ore mines also will get delayed and overall scenario of steel, cement and manufacturing sector is also challenging. However, the national demands and potential to produce wide range of items through MSME to eliminate or reduce importing of low cost goods can bring in a good opportunity.

In conclusion, it is time for us to make a calculated move and strengthen ourselves for quality assurance which will be decisive in capturing the market. The real strength of India will be tested in using COVID-19 as a currency to buy and encourage indigenous growth.

From the MGMI Editorial Board, I hope for the very best in the coming three quarters of 2020-21. Let us pledge to make our target a reality!

Khanindra Pathak
Editor

The need for a Resurgent Mineral Sector in India's low-carbon energy transitions



At the outset, I thank the MGMI Council for their continued trust and look forward to working with new colleagues in the Editorial Board. One of the pleasures of working with such an esteemed body of colleagues is acquiring understanding of novel research dimensions and cross-disciplinary perspectives. In this editorial, I wish to discuss some of the critical challenges flanking India's mineral industries and some directions for its growth compatible with international environmental agreements.

It is understood that the Paris Climate Agreement lays the groundwork for multinational efforts on low-carbon energy. The Government of India renewed its commitment for a sustainable future in 2015 with a Nationally Determined Contribution indicating a 33% decrease in the greenhouse gas (GHG) intensity of the economy by 2030, as compared to its 2005 levels. A large thrust of these efforts has been laid on increased investments for renewable energy technologies such as solar and wind. India is on its way to achieve the 100 GW of solar and 60 GW of wind power capacity addition by 2022, and this is reinforced by the Prime Minister's flagship initiative, the International Solar Alliance. The annual investments in these renewables in India are expected to be US\$ 67 billion in the 2°C scenario and US\$ 79 billion in the 1.5°C scenario (McCollum DL et al, *Nature Energy*, 2018, 3, 589-599).

How are these developments pertinent to the membership of MGMI? The amount of minerals requirement by solar and wind energy are considerably higher than conventional power sources. For a coal-fired

power plant, the mineral use is conventionally less than 2500 kg/MW as per the International Energy Agency's estimates. On the other hand, onshore wind and solar PV use more than triple this amount of minerals, and offshore wind consumes 7 times this amount. The nature of these minerals requirements is also varied. Thus, solar PV requires large amounts of silicon for panels, and wind power has large zinc needs for turbine coatings. Certain specific minerals such as dysprosium and indium are also required in such power plants. A combination of macroeconomic modeling and life-cycle assessment revealed that in renewable-rich scenarios, mineral resource depletion may rise to as high as 1000 MtFe-eq/yr for solar and wind by 2050, which is more than ten times today's total mineral consumption by the energy sector (Luderer G et al, *Nature Communications*, 2019, 10, 5229). This points to a considerable challenge for the Indian power sector. Relying on imported minerals for power generation could create vulnerabilities for India's "electricity for all" mission. Accordingly, analyzing future energy plans and creating compatible mineral strategies is essential in terms of ensuring long-term energy security.

Aside from solar and wind technologies, another prominent feature of low-carbon energy transition is the widespread proposed deployment of CO₂ capture and storage (CCS). Integrated assessment modelling has indicated that in scenarios with high carbon prices, countries might rely on the capture and geologic sequestration of CO₂ from large-point sources such as power plants and industrial sources (steel, cement, fertilizer and refineries). In a previous editorial in last year's autumn issue, I pointed out the need for readiness in India's earth science community

for adapting to CCS. A similar need exists in the mineral sectors as well.

The steel sector in India could play an important role in getting ready for large-scale CCS. The blast furnace gases emitted from steel plants depict a high-concentration source of CO₂, with multiple opportunities for CO₂ separation. Thus, while post-combustion capture from blast furnace emissions of 50-60% might be achieved at US\$ 60-80/t-CO₂, other routes such as shift reactions can help in reductions of 30% at costs less than US\$ 20/t-CO₂ (Leeson D et al, *IJGGC*, 2017, 61, 71-84). Identifying appropriate set of technologies for Indian conditions from these global estimates is therefore a key research task. Geospatial mapping in this context has revealed two crucial insights. First, the eastern part of the country has the potential to create hotspots or “clusters” for CCS. By leveraging the large power and industrial base in this part and utilizing geologic sequestration in coalbeds and basalts, the states of Jharkhand and West Bengal could meet one-fourth of India’s CCS needs (Garg A, et al, *IJGCC*, 2017, 66, 129-146). Geographical proximity, in this context, generates huge research opportunities for most of MGMI’s allied institutions in the region. Second, cross-sectoral clusters of power and industrial sources could lead to cost reduction in CCS by \$ 10/t-CO₂. This points to the role for an organization like MGMI with its high interdisciplinary nature to achieve these objectives.

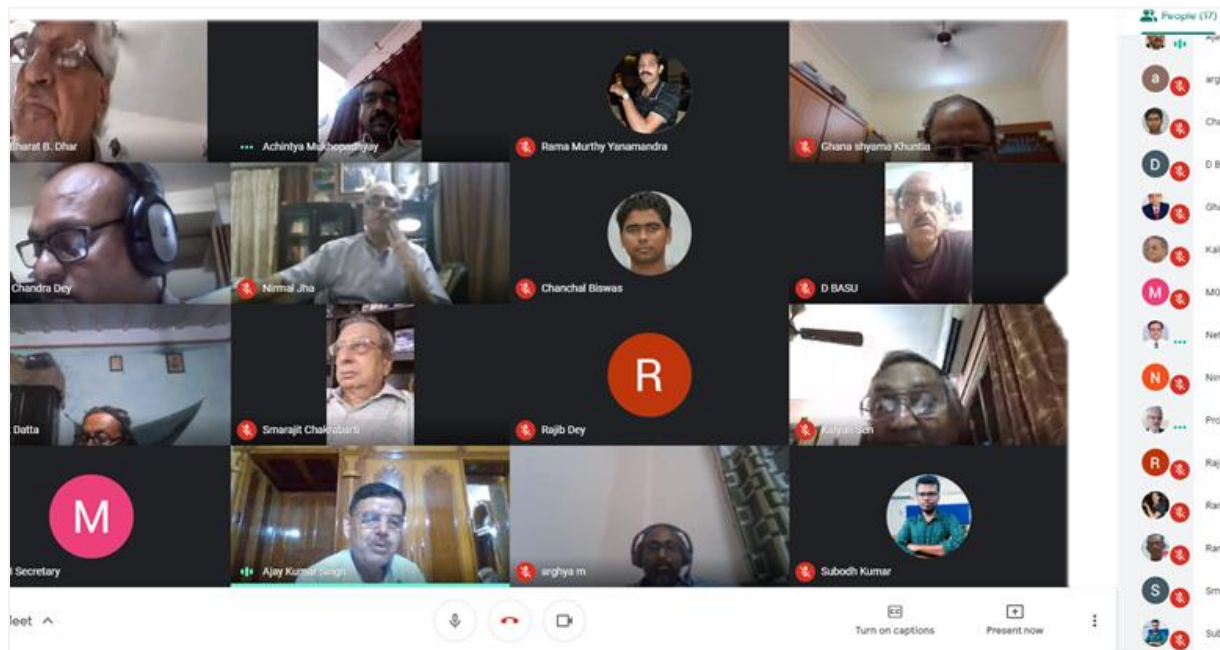
The aforementioned paragraphs point to the role of mineral sector in the supply side. However, the demand side impacts have also been noted by the same report of the International Energy Agency. Consider the case of electric vehicles that are projected to have benefits not just in terms of CO₂ but also air pollution reduction. An average electrical car is made up of more than three times the copper compared to a conventional car and

with substantial amounts of nickel as well. As electric, hybrid and fuel cell vehicles are projected to occupy 60% of India’s four-wheeler market by 2050 in 2°C constraints (Dhar S et al, *JCP*, 2017, 146, 139-148), it is incumbent upon the mineral sector to help provide infrastructural backup to the booming transportation needs.

We have seen above how there are substantial incentives to growing the mineral sector in line with decarbonization needs with the examples of renewable energy, CCS and electric vehicles. That said, the upscaling and investments also require a concise geopolitical strategy. In the case of this renewed mineral revolution, there is a great avenue to forge developing country partnerships. The continent of Africa, for instance, is rich in several of the critical mineral supplies discussed above. It has important ramifications for foreign policy. As the proportion of renewables increases, bilateral partnerships for acquiring critical minerals will have an enhanced role. A report from Dr. Marjolein de Ridder at the Hague Centre for Strategic Studies postulates that zones such as the Arctic and the South China will see global focus as is already being manifested by increased military presence. Ultimately, strong policy frameworks need to be created to ensure a push for the society to undertake renewable energy. Doing so could mean incentives in reduced CO₂ emissions accompanied by increased energy security and this august body has robust skillset to achieve these targets.

Dr Ajay K Singh
Associate Editor

Impact of Covid 19.....



MGMI Paper meet as webinar on 14.6.2020

- *This is an unprecedented crisis; we have to protect ourselves and move ahead as well. Making India self-reliant is only way to make 21st century belongs to India. India's self-reliance addresses concerns about world's happiness, cooperation and peace.*
- *India's self-reliance will be based on five pillars - economy, infrastructure, technology driven system, vibrant demography and demand*
- *Coronavirus is going to be a part of our lives for long time, but we can't let our lives revolve around it only'*

-Narendra Modi

OBITUARY



Late Kalyan Kumar Sen (MMGI, LM – 8653, 2003-04) passed away on 31st May 2020. With heartfelt grief MGMI members wishes his soul to Rest in Peace in his heavenly abode. May God give strength to his surviving family members and friends to bear the loss.

Late Sen was a member of MGMI since 2003-04. Born on 22nd August 1943 and a former Director (SG), Geological Survey of India, he obtained M.Sc. degree in Geology from University of Calcutta in 1967. He joined GSI as Assistant Geologist in February 1970 at Assam Circle, NER, where he was engaged in geological mapping of Tertiary shelf-

sediments in Khasi Hills and also the belt of schuppen in Nagaland. On promotion as Geologist (Jr) in 1973 he joined Manipur - Nagaland Circle, Dimapur, where he continued geological mapping till 1978 when he joined Coal Wing at Calcutta.

From Coal Wing, Late Sen carried out exploration for coal in Borjan Coalfield in Nagaland, Raniganj and Birbhum coalfields, West Bengal, Panchwara and Mahuagarhi coalfields, Jharkhand. In fact, it was the geological mapping and subsequent exploration carried out by him that led to the discovery of the virgin Birbhum Coalfield and establishment of coal resource of more than 2000 million tonnes below trap rocks. He was a joint recipient of National Mineral Award. He was promoted as Geologist (Sr) in 1985 and as Director in 2000 when he supervised exploration work in Singrauli and Tatapani – Ramkola coalfields till his superannuation in August 2003.

Very popular among colleagues, his door was always open to anyone who wanted any help or advice. A genial personality, he seldom lost his cool and his smile

जो व्यक्ति हमेशा अपनी
मृत्यु के सत्य को समझता है,
वह सदा अच्छे कार्य में लगा
रहता है।

OBITUARY



Late Dr. Dilip Kumar Ray (MMGI, LM – 7766, 1997-98) passed away on 24th May 2020. With heartfelt grief MGMI members wish his soul to Rest in Peace in his heavenly abode. May God give strength to his surviving family members and friends to bear the loss. Late Ray was a member of MGMI since 1997-98.

Born in July 1942, he postgraduated in Geology from Jadavpur University in 1964 and completed his Ph.D. on Hotsprings under Prof. Dr. S. Deb from the same University in 1968. After a brief stint he joined the Geological Survey of India, Kolkata in May 1971 as STA (Geology). His first posting was at Central Petrological Laboratory. He was promoted to Assistant Geologist in 1978. He was transferred from CPL to Coal Wing in March 1979 and was there till his superannuation in July 2002. During this

period he was promoted to Geologist (Jr) in 1983 and to Geologist (Sr) in 2001.

In Coal Wing he was looking after the geological mapping and exploration for coal in different blocks of Mand-Raigarh Coalfield. Each and every hill, valley, nalah – the entire Coalfield was at his fingertips. In fact, his efforts and contribution in most of the regionally explored blocks, e.g. Chhal, Kurumkela, Chimplapani, Gare – Palma, Telaipani, Kelo Dam, Phutamura etc, could give a shape to the coal resource evaluation of the coalfield, which later was taken up for detailed exploration by other agencies. Many valuable and informative geological reports, those emanated from mapping and explorations of the Coalfield, were under his credit. In 1998 Late Ray was posted in Map Division of Coal Wing, where he took up the job of updating of geological map of Indian coalfields based on the then available exploration data, one among those being the map of Mand-Raigarh Coalfield.

On the sudden demise of our beloved Dr Dilip Kr Roy, the geoscientific community has lost a competent person. He was an example of honesty, and sincerity. His dedication, meticulousness on and off the field can surely be exemplary to the future generation.

We pray to Almighty for his departed soul rest in peace. We convey our heartfelt condolences to his family members on their recent bereavement.

मौत जाने चुपके से क्या कह देती है
जाने वालो ने पलट कर कभी देखा ही नहीं

OBITUARY



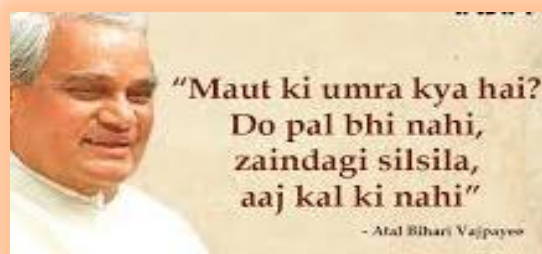
Late Manoranjan Das (MMGI, LM – 6296, 1992-93) passed away on 2nd May 2020. With heartfelt grief MGMI members wishes his soul to Rest in Peace in his heavenly abode. May God give strength to his surviving family members and friends to bear the loss.

Late Das was a member of MGMI since 1992-93. Born on 4th February 1943 and a former Director (SG), Geological Survey of India, he post graduated from University of Calcutta in 1964. He joined GSI, CRO, Nagpur as Assistant Geologist in early 1968 and subsequently was transferred to Maharashtra Circle, Pune. There he looked after the base metal investigation along with structural mapping in Nagpur – Bhandara districts. He was promoted to Geologist (Jr) in 1972 and transferred to Coal wing, GSI in 1973. During his long tenure in Coal wing covering about three decades he was actively associated with regional exploration for identifying additional resources of coal in the country. His endeavour resulted in considerable augmentation of national resources in hitherto unexplored areas of Korba (Chhattisgarh), Godavari Valley (Telengana), North & South Karanpura, Hutar and Auranga (Jharkhand) coalfields. Needless to say, the exploration efforts were rewarded with development of

new coal mines which contributed to dimensional growth of coal production commensurate with demand for thermal power and tempo of industrialization.

Promoted to Geologist (Sr) in 1981, Late Das was the member of a team of geoscientists to study the distribution of trace elements of coal, lignite and associated rocks. The results of this monumental study was embodied in GSI Bulletin, Sr. A, 1984, of which he was a co-author. In 1986, Late Das entered a new phase in his career as a techno-administrator when he took the responsibilities of Technical Secretary to Deputy Director General, Coal Wing. He assumed the charge of Director, Technical Coordination Division, Coal Wing in 1998. He was also the ex-officio secretary of The Sub-committee on Coal and lignite of Central Geological Programming Board, the apex body for planning and monitoring of regional exploration of coal and lignite in the Government sector, a responsibility he held till his superannuation in February 2003.

An able scientist and administrator, Late Das was universal ‘Monada’ to one and all in GSI. His door was always open to anyone who wanted any help or advice. A genial personality, he seldom lost his cool and his smile. In the early years of Calcutta Branch of MGMI, his active involvement in organizing its flagship event, Annual Get-together, will be remembered.



OBITUARY



Late Shri Chandra Shekhar Jha (1647-LM) breathed his last peacefully in his sleep at the age of 97 years in his residence at Ranchi on 20.6.2020. He was born on 2nd January, 1926 at Madhubani, Bihar.

His education was at Madhubani in his childhood. Thereafter his education was in Patna Science College. He passed from Indian School of Mines, Dhanbad as a Mining Engineer in the year 1948. Thereafter he got his further education in Sheffield University, United Kingdom.

He has four children, eight grandchildren and nine great grandchildren.

Shri Jha worked in Bird & Co. for more than 23 years in various capacities. During this time he was boss of Shri Amitabh Bachchan who worked Argada Colliery, the then under Bird & Co..After nationalisation of Coal mines, Shri Jha became Director (Tech.) of BCCL. Thereafter he became the CMD, ECL. He retired as CMD, BCCL. Thereafter he became the Chairman of Bihar State Mineral Development Corporation Limited (BSMDC) for a five year term.

He was awarded by various Organisation/Government. Shri Jha had a NGO in his native place Madhubani in the name of his late wife Veena Devi. Shri Jha was soft spoken, kind hearted and contributed to Mining & Mineral Industry in India remarkably.

May his soul rest in peace.

life asked death,
"WHY DO PEOPLE LOVE ME
BUT HATE YOU?"
death responded,
"BECAUSE YOU ARE A
BEAUTIFUL LIE
AND I AM A
PAINFUL TRUTH"

Death is the destination we all share. No one has ever escaped it. And that is as it should be because death is very likely the single best invention of life. It is life's change agent, it clears out the old to make way for the new.

-Steve Jobs

Headquarters Activities

Report of Editorial Committee

An Editorial Committee Meeting of MGMI was held on May 19, 2020 at 4:00 pm through Video Conference where in Prof (Dr) Khanindra Pathak, Hony Editor, Dr Ajay Kr Singh, Hony. Associate Editor, Dr Anupendu Gupta, Shri Smarajit Chakrabarti, Shri Ranjit Datta, Prof Netai Ch Dey, Prof Rajib Dey, Shri Rajiw Lochan (Hony Secretary & Ex Officio Member) were present.

ITEM No. 0 Opening of the Meeting

0.1 Shri Rajiw Lochan, Hony Secretary extended welcome to the members to the first online meeting of the newly constituted editorial board 2020-21, announced in MGMI News Journal, Vol 45, No 4, January-March, 2020 and thanked them for sparing time to be online to attend the meeting. Thereafter, he requested Hony. Editor, Prof (Dr) Khanindra Pathak to take up the proceedings.

0.1.1 Prof (Dr) Khanindra Pathak, Editor-in-Chief, while welcoming the new members, suggested that online meets are going to be the most accepted norm in this period and the post COVID-19 scenario. He pointed out that during the last 2 years, no meeting of the earlier editorial board could be convened as members were scattered. But online meets should be more comfortable.

1.0 The Theme of Vol 46 No1 April-June 2020 issue of MGMI News Journal

After a brief introduction on the publications of MGMI (quarterly News Journal and Annual Transactions), Prof Pathak sought help and involvement of the board members. As per the first agenda item, he wanted suggestions from the members on the theme of the next issue of

the News Journal (Vol 46 No1 April-June 2020 Issue).

Dr. Ajay Kr Singh suggested that the theme of MGMI News Journal, Vol 46 No 1, April-June 2020 issue may be "Rebuilding Strategy for Indian Mineral Industry Post-COVID-19" or any other suitably modified theme. Though COVID-19 is a disease and seems to be of interest for medical practitioners, there are financial and social implications on the mineral industry as well. Immediate and long-term impact on coal and non-coal mining company's operations due to the Government mandated shutdowns is bound to happen. The pandemic is likely to affect the demand for minerals as well. There may be a few articles in this issue of MGMI News Journal which will highlight the responses of the mineral sector to overcome the new set of challenges facing the industry.

Dr. Anupendu Gupta suggested that besides regular features, the issue should have Editorial and one or two articles on onslaught of COVID 19 vs New Economic Reforms in Mineral sector announced by the Hon'ble Finance Minister, Government of India.

Shri Smarajit Chakrabarti was of the view that the effect of COVID-19 on the mineral and related industries along with how they were tackling the pandemic could be covered as news items. That would be topical and relevant also. But it should not become the central or predominant theme. He also pointed out that since MGMI activities are confined to mineral industry, news/ articles on the biological and medicinal aspects of COVID-19 should not come in journal.

Prof. Pathak suggested if some interesting interviews could be obtained that may add to the flavour of the journal. This aspect was discussed by Profs N C Dey and Rajib Dey positively. Dr Gupta also suggested some

news item on *Atmanirbhar Bharat* and our (MGMI's) role. It was decided to collect articles/news items on post COVID-19 transition of mineral industry, economics/demand-supply of raw materials, Government directives /information on current changes in mineral fields. Shri Chakrabarti pointed out that as a professional body, our emphasis should be on the series of measures being taken to make the country self-reliant in terms of energy security and other inputs for the manufacturing sector as much as possible; avoid imports of coal, adopt newer technologies hitherto not tried in the country like gasification and exploitation of CBM as much as possible.

Shri Rajiw Lochan was of the opinion that the theme of MGMI News Journal, Vol 46 No 1, April-June 2020 issue may be "Opportunity and Way forward for Indian Mineral Industry" or any other theme to avoid mention of COVID-19 as it attracts negativity. We should look forward for opportunity which is a need due to this pandemic effect as nature allows survival of the fittest. Of course, there should be a few articles in this issue, highlight the responses of the mineral sector to overcome the new set of challenges industry facing.

After detailed deliberation it was decided that the theme of Vol 46, No1, April-June 2020 issue of MGMI News Journal should be **"Rebuilding a Resilient Mining and Mineral Sector"**.

2.0 Conducting online presentation of papers for the MGMI Transactions 2019-20.

The second item on agenda was decision on holding online meetings and online presentation of papers.

Shri Rajiw Lochan mentioned that in view of the present scenario, we should promote presentation of papers for MGMI Transactions 2019-20 on virtual platform which is now

very much feasible as reputed organizations started doing it. We may consider Microsoft Team Meeting platform or other suitable common platforms, viz. Google, Facebook etc.

Members felt that online presentation of papers for MGMI Transactions 2019-20 is the only feasible option in the present circumstances. This will also save time and efforts of the authors and that of the Editorial Board members and other experts. It was decided that the 1st online presentation of paper may be held from 6th June, 2020 the first Saturday of next month, from 11 AM.

3.0 Proposing to Springer/Elsevier for publishing the MGMI Transactions and for listing it for UGC recognized journal.

Prof Pathak informed that the last issue was not published due to paucity of papers/articles. The suggestion by Profs Pathak, N.C. Dey and Rajib Dey that the Transaction need to be accredited by a reputed/recognized publisher to attract good quality papers was unanimously accepted. Professors agreed that their colleagues and students may take interest in presenting papers for the Transactions and quality papers will be made available. Prof N C Dey commented that he was afraid that the current Transactions citation was too poor to recommend, rather hardly any Doctoral scholar would prefer to give paper out of their research work. Until and unless good R&D papers are not received for the Transactions, the compendium can never be upgraded to its newer heights. Even some leading institutes and their Faculty members do not reckon these Transactions within their Institutes' accepted list that has been made mandatory prior to submitting individual's Doctoral thesis. Prof. Dey informed that Prof Pathak requested him several times to ask research scholars to contribute papers. The scholars

were of the view that most of the papers here are compilation of some news, information, facts what are easily available nowadays in internet or in other equivalent places.

Shri Chakrabarti mentioned that since we are thinking of elevating it to a higher level by bringing in reputed publishers and a respectable peer-reviewed status, we will have to identify groups of authors with good domain knowledge and invite them to contribute, rather than waiting for papers to land on their own. Prof N.C. Dey added that this is the time now to think as Shri Chakrabarti stated, we have to leave no stone unturned to identify the areas of reputed faculty members field and request them to take up their doctoral research work on such thrust areas and then only majority of the papers would be not only interesting but also its citation would increase manifolds such that any Publisher like Springer, Elsevier, SME, AUSIMM would be interested to collaborate with us. Dr A K Singh opined that good papers are submitted to peer reviewed journals with SCI (Science Citations Index). Further, each subject category of journals is divided into four quartiles viz., Q1, Q2, Q3 and Q4. Since there are only limited number of journals in the field of mining, MGMI Transactions can easily occupy top 25% (Q1) or 25-50% (Q2) group if we tie up

with a reputed publisher. Such arrangements already exist. For example, the journal "Decision" of the Indian Institute of Management, Calcutta is published by the Springer. Therefore, MGMI may approach a good publisher to bring out MGMI Transactions with mutually agreed terms and conditions. Dr Singh suggested that MGMI Editorial Committee may approach Springer.

The MGMI Editorial Committee requested Dr. Ajay Kumar Singh to take up the responsibility of approaching some reputed publishers for this job and submit the proposals to the Committee for its consideration. Dr. Singh gave his consent for this.

Before concluding Prof Pathak requested board members to collate information, news, issues, comments, interviews for the News Journal and suggest directives for future. He suggested that the material for the next (April – June) issue of the Journal should be ready by 15th June and softcopy (.pdf) copy by 25th June, so that it may be mailed to MGMI members in time.

Meeting concluded at 6.00 p.m. with thanks to the Chair and Hony Secretary for nicely arranging and conducting the virtual meeting through e-platform.

How long does it take after exposure to COVID-19 to develop symptoms?

The time between exposure to COVID-19 and the moment when symptoms start is commonly around five to six days but can range from 1 – 14 days.

News About Members

As on 17.06.2020

Shri Awadh K Pandey (9932-LM) MMGI is now Dy. GM (M)/HoD, Innovation Cell, MCL,D-62, Jagruti Vihar, Burla, Sambalpur, PIN-768020,email: awadhpandey@gmail.com

Shri Abhit Mallik (9894-LM) MMGI is now General Manager, Satgram Area/ EC Ltd., PO Debchand Nagar, P.S. Jamuria, Dist. Paschim Bardhaman (WB) Pin 713332 email: gm.satgram@gmail.com

UPCOMING EVENTS

[WEBINAR] Total Mine Water Management

18 August 2020 - 18 August 2020

In this webinar the mine water management experts at Xylem will discuss how taking a holistic view can help transform water management from an expense into an advantage.

Website: <https://register.gotowebinar.com/register/5525789607263520783>

MINExpo INTERNATIONAL 2020

28 September 2020 - 30 September 2020

POSTPONED UNTIL 2021 MINExpo INTERNATIONAL® covers the entire industry—exploration, mine development, open pit, underground mining, processing, safety, environmental improvement and more.

Website: <https://www.minexpo.com/>

Future of Mining EMEA

06 October 2020 - 07 October 2020

The Future of Mining EMEA virtual show was created to connect C-suite, Heads and Managers of Mine Operations and Mining Equipment, Technology and Services (METS) providers from top enterprises around the globe to debate and define the future mining landscape across Europe, the Middle East and Africa.

Website: <https://emea.future-of-mining.com/emea2020/en/page/home>

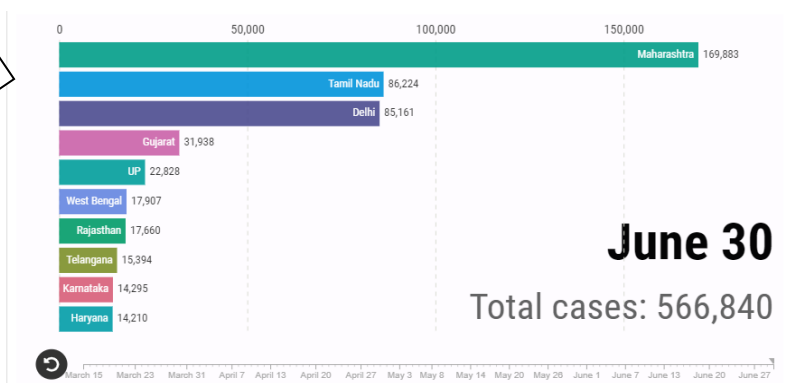
International Mining and Resources Conference & Expo (IMARC)

27 October 2020 - 29 October 2020

Where global mining leaders connect with technology, finance, and the future.

Website: <https://imarcmelbourne.com/>

CORONA in India



Revenue loss of Centre and States may be up to Rs 12k cr in FY21

KPMG India reports that Falling demand as a result of the nationwide lockdown, decreased consumption and supply chain issues have forced the miners to either run at significantly lower capacity utilisation, or close operations temporarily.

The Centre and key mineral producing states are likely to incur a revenue loss of up to Rs 12,000 crore in FY21 due to lower coal and mineral consumption during the coronavirus lockdown. The report says from the 5 mineral producing states (Odisha, Rajasthan, Chhattisgarh, Andhra Pradesh and Karnataka) the Central government is expected to lose Rs 1,000-1,500 crore - as its share of taxes such as NMET, CGST and Corporate tax - due to fall in mineral sales (excluding coal).

District Mining Fund may get differently used

Created under a new law in 2015, the so-called District Mineral Foundation funds have nearly Rs 23,800 crore, after less than 40 per cent of the amount accumulated over the past five years was spent, according to data from the country's mines ministry. The funds were created from contributions by miners in addition to royalty payments and were aimed at improving the lives of people in areas affected by mining.

Under the expected financial crisis state governments may use this fund for other purposes than it was meant for. The post mining mine site rehabilitation and sustainability plans are not much discussed in the public domain and not many progressive plans execution is also visible. Not many

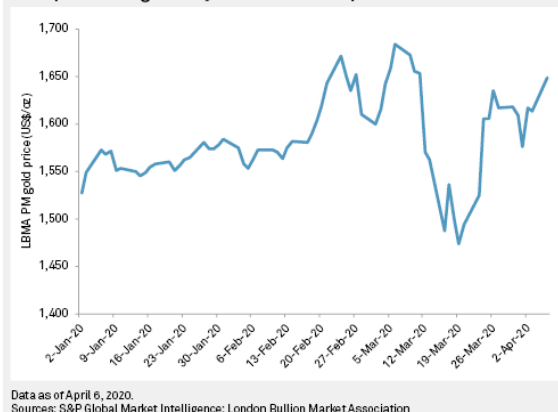
mega multipurpose projects for post COVID societal strengthening of the mining region using DMF are visible in the public domain where the nation's Mining academics, researchers and entrepreneurs contribute.

Corona and Mining

In most of the countries mining operations continued during the lock down, except in Peru. Philippines has banned vessel entering into their Surigao del Norte port from March 18, 2020 affecting the export of Nickel from this world's largest exporter of the raw material for stainless steel and nickel pig iron (NPI).

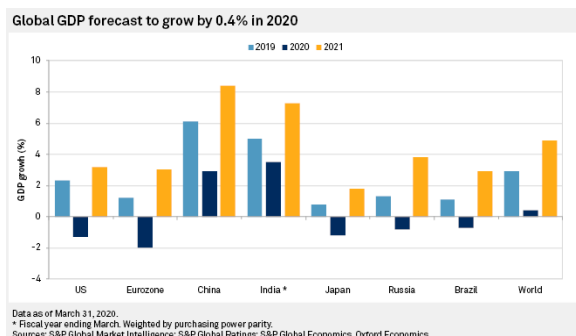
The reduction in the demands of raw materials in the industry has affected the global mining industry. Prices of Cobalt and Lithium also fell due to reduction of export of batteries from China. The Gold price was fluctuating but still a upward trend as seen in the Figure.

Gold price swings wildly but continues upward trend



Researchers on mineral economic examine how the COVID-19 pandemic is expected to impact the metals and mining industry, with particular emphasis on iron ore, copper, zinc, lead, nickel and key battery materials.

2020 could be a very bad year with negative GDP growth in countries like US, EU, Japan, Russia and Brazil as shown in Figure below:



Blow Out in OIL's Baghjan Oil Fields

Part of the Oil India Limited's Greater Chandmari Fields, located approximately 25 kilometres northeast of the Naharkatia field in Assam covering an aggregate area of 20 square kilometres, the Baghjan oil field along with the Barekuri and South Chandmari fields have been engaged in active oil production since 2003. The Baghjan BGR Well No 5 is located south-west of Baghjan village and north-west of Dhakuwal in Barekuri where drilling was done up to 4,045 metres for natural gas. It has been said that the Well No 5 at Baghjan oil field, where the blowout happened, started producing crude in 2006.

On 27/05/2020 the producing well No 5 suddenly became very active while work over operations were on. As a consequence, the ongoing operations had to be immediately suspended and the well started releasing natural gas in an uncontrolled manner. This led to the blowout and 14 days later on 9 June the catastrophic blaze started.



The unabated fire, which spread horizontally, has made a severe impact on human habitation, agricultural fields, wildlife and wetland.

OIL has received environmental clearances from the Centre for extension of drilling and testing of hydrocarbons at seven more locations under Dibru-Saikhowa National Park Area.

The inferno threatened Dibru-Saikhowa National Park, famous for wild horses has a core area of 340 sq-km, while the biosphere reserve spreads across an area of 765 sq-km. The park has a variety of tree species ranging from deciduous, semi-evergreen, wet evergreen, salix swamp to riverine grasslands. There are at least 36 mammal species including the Royal Bengal tiger, sloth bear, Chinese pangolin, Asian elephants, Asian water buffalo and feral horses in the national park, he said, adding that presence of more than 440 bird species has been reported.

Maguri, a large wetland, is an Important Bird Area (IBA) with the presence of nearly 300 species.

Are we playing safe with conservation of Natural Resources in commercial use?

The next issue of MGMI News Journal will highlight health, safety and environment in mining and allied industry. Readers are requested to send their contributions before 31st August 2020.



Adjacent biodiversity and the threat by the geohazard caused by handling of gas well by OIL at Baghjan, Assam

Impact of COVID-19 on Iron Ore Demand and Supply

Iron ore production in India in calendar year (CY) 2019 surpassed 231 million tons (MnT) compared to CY18's 204.7 MnT. In CY19, iron ore production grew by a whopping 12.9%. Odisha, which is the eighth largest state in India (area-wise), alone took the biggest chunk of India's iron ore production at 130.04 MnT or 56.29% in CY19 which accounts for more than half of India's total iron ore production. Compared to last year (CY18), this year, Odisha's contribution to India's total iron ore production has increased significantly.

Steel Authority of India Ltd (SAIL) ramped up iron ore production and dispatch to 29.26 million tonne (mt) and 29.43 mt in 2019-20, notching up growth of 3.2% and 5% respectively. Mines of SAIL's Raw Materials Division (RMD) produced 22.47 of iron ore in FY 2019-20 posting a growth of 4.7% over

FY19, an official statement on Monday said. The mines also recorded all-time best iron ore despatch of 22.37 mt, a growth of 7% over the previous fiscal. RMD also scored best ever performance since inception.



Kiriburu Iron Ore Mines, SAIL with IBM's Rating of 4-Star

Production in 2020 is expected to decline to 205.7Mt; a delay in mineral auctions in Odisha, coupled with regulatory approvals, will be of major concern for Indian miners. Production over the forecast period is expected to grow at a Combined Annual

Growth Rate (CAGR) of 7.2%, to reach 271.2Mt in 2024. This growth can be attributed to the commencement of new projects and the expansion of existing ones, such as the Kumaraswamy mine, the Daitari and Gandhamardhan mines and the Chiria iron ore mine.

Impact of COVID-19

The production scenario in 2020 will be different from what Indian Iron ore mining exhibited in 2019. Company wise import of pellets and iron ore as shown in Figure indicates that there is scope of growth of mining operations. Though there are mineral deposits, environmental clearances and development of environmentally friendly and environment supportive mining systems are yet to be developed. Global impact of COVID19 and restrictions on international cargo movement is to be taken as national opportunity of self-reliance. However, environmental conservation and mining development agenda needs careful alignment under the prevailing laws and regulations.



Company-wise iron ore & pellets imports into India (CY19)



Tata Steel and COVID 19

Tata Steel announced the temporary closure of its Jamadoba coal mine after a mine manager tested positive for Covid-19 on 25th June 2020. The mine manager has been admitted to Tata Main Hospital in Jamshedpur.

Mining operations have been stopped as a precautionary measure to stop the spread of coronavirus and sanitization work of the coal mine as well as of the surrounding areas has been launched. All mine staff and associates of the mine manager have been directed to undergo necessary health check-ups as per the government protocol.

Which are the first symptoms of the coronavirus disease?

The virus can cause a range of symptoms, ranging from mild illness to pneumonia. Symptoms of the disease are fever, cough, sore throat and headaches. In severe cases difficulty in breathing and deaths can occur.

Peru in grip of Corona

Vancouver-headquartered Trevali Mining has suspended operations at its **Santander zinc/lead mine**, in Peru, after 19 workers tested positive for Covid-19.

The company said that the workers were asymptomatic and that they were in preventative quarantine.

Operations had been suspended at the mine to allow for additional testing on site. No timeline

Mineral Source Crisis?

Globally no major new copper sources are established. There were 224 major copper discoveries since 1990, but only 16 were found in the past decade, and there has been just one major discovery since 2015.

for the restart of operations had been defined yet.

Trevali explained that, On June 23, prior to a roster change, 69 workers were screened with Covid-19 serological rapid tests, of which 19 yielded positive results. These tests detect the presence of antibodies that have been produced in response to a Covid-19 infection.

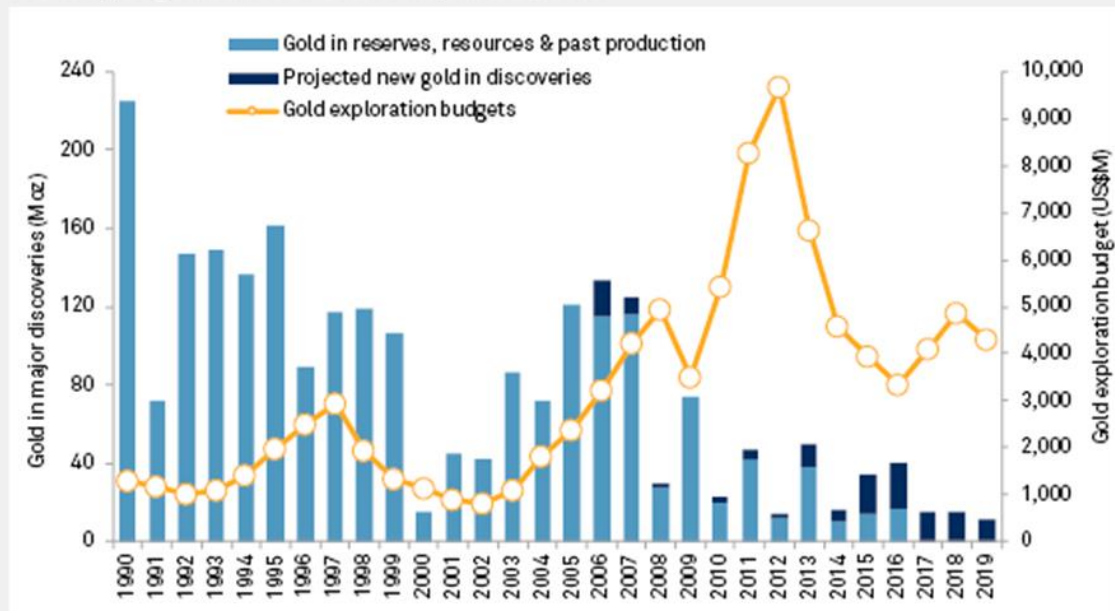
Considering that typically it takes more than 15 years to steer discoveries to production in the mineral sector, it is apprehended that copper will face crisis.

The scenario for Gold is also similar as can be seen from the following graph.



Do you have a story of mining hazards, environmental issues or impacts on health in mining industry? Please pen it down and send to any of the members of the Editorial Board. We respect each piece of experience analysis and practical recommendation.

No major gold discoveries in past 3 years



Data as of May 1, 2020.
Source: S&P Global Market Intelligence

Trend of Gold discoveries



Kudos to BEML!

Maximum Payload: 186 MT

Capacity (Heaped) SAE / ISO 2:1: 110 m³

Gross Power: 2300 HP (1716 kW) @ 1900 RPM

Lessons from COVID-19 for Environment Protection

Dr Sukumar Devotta

Former Director, CSIR-National Environmental Engineering Research Institute, Nagpur.

Email: sdevotta@gmail.com

Introduction

Corona Virus Disease, a respiratory disease known commonly as Covid-19 (SARS-CoV-2 as per WHO nomenclature), is caused by a new extremely tiny but deadly corona virus. None in the modern world would have thought such a miniscule protein matter can create such a pandemic and agitate the entire world and bring it to stand still. Such themes have been subject of some of the modern novels and movies and now it is a reality and no longer a fiction. All countries in the world, regardless of their economic and scientific status, are under lock down. Globally, as per WHO, more than 10.41 million people have been infected so far and more than 508,000 have died due to Covid-19, with US alone accounting for more than 128,000 deaths as on 30th June 2020. Travels across the globe have been suspended. Even travels within a country across state or provincial borders were closed. Still, the world is struggling to contain the deadly disease and restore normalcy across the globe. It is anybody's guess when normalcy is likely to be restored. There are many uncertainties.

The Global Economy Slowdown

This global pandemic has raised many scientific, ethical and political questions, which have not been faced in the modern era. According to the UN's Trade and Development Agency (UNCTAD), the global economy slowdown caused by the coronavirus outbreak is likely to cost at least US\$1 trillion. It may take few years for the turnaround. According International Labour Organisation (ILO), globally there may be about 1.6 billion

in the informal sector who have suffered losses. According to UNICEF, about 1.6 billion children around the world are unable to attend school in person and the schools and colleges are using online teachings to keep the students learning at home.

International air and land traffic have been suspended around mid-March 2020 and many countries announced local lock down, at various levels. In many countries, local public transports, including train, metro, buses, metros and taxis have also been suspended. All mass gatherings and public celebrations have been barred. Shopping malls and stores were asked to allowed to operate only for essential goods. Offices, educational institutions, factories and many such organisations have been closed indefinitely. Towns, villages and residential complexes, including condominiums and building societies have been advised to restrict the movements of residents around and "social-distancing" to maintain a threshold distance between two persons. As a consequence of such extraordinary measures, we are seeing some flattening of the Covid-19 growth curves of various countries. After a long lockdown, a few countries are opening up gradually. This situation is still hazy.

Origin of the Pandemic

The origin of corona virus itself is still under debate. WHO has stated that the current data suggests that this virus is not a result of laboratory construction but most likely zoonotic source. Further, it stated that the genesis of the outbreak resulted from a single point introduction in the human population in China in December 2019. With an onset of

symptoms in early December 2019, the local authorities in Wuhan had reported it to WHO about the possible virus in January 2020.

The most common speculation is that the virus originated from a live wildlife sea food market in Wuhan, capital of Hubei Province, China. It is further speculated that pangolins, a scaly mammal, similar to anteaters, which were illegally sold in a market, for human consumption, were the source for the virus, which was transmitted to humans. This is not yet competently and convincingly established. Another speculative accusation is that a Chinese government laboratory in Wuhan was working on this virus and was leaked, leading to human contamination. This is also not proven yet, although a few countries have accused China for their negligence in handling the onset of pandemic.

United States is now officially accusing China that the Wuhan Virology Lab is responsible for the leak leading to pandemic; the Chinese Government did not inform in time about the local pandemic outbreak and concealed the death data to mislead the world. Earlier, US officially also blamed WHO for siding with Chinese on the origin and the intensity of outbreak in China initially. WHO is being held responsible for not taking independent decision but based on the data and information provided by the Chinese Government. US has withdrawn and stopped its funding to WHO. These are very serious developments as WHO, one of the arms of UN, is usually relied upon for all global health issues. WHO's independency and competence are being questioned, with very serious ramifications. WHO board has been reconstituted. There is a lot to do to restore the global confidence on WHO.

It was originally postulated that this virus cannot infect animals. However, now it has been revealed that tigers in zoos and pet animals like dogs are also getting infected. The virus, it looks like is getting mutated and

spreading into unknown territories. Still the world is fraught to identify the Case-1 of Covid-19. These mysteries are yet to be unravelled.

Any medicine for Covid-19?

Is there any vaccine for Covid-19 available? Global efforts to develop vaccines are underway. WHO claims that it is still not certain that when a vaccine will be available? WHO has stated that Covid-19 is likely to be with us for a long time. Some countries, including Germany and UK, have started some human trials. There are many remedies being suggested but not medically demonstrated or approved. There are many unverified claims on traditional and herbal concoctions as remedies. Until it is scientifically proven with adequate confidence, we have to live with uncertainty. One should avoid consuming some dangerous concoctions or remedies. About 100 Iranians were reported to have died after consuming methanol as a remedy!

Lessons learnt for environment protection

Where does the world go with the advent of Covid-19 and its experience? Has Covid-19 taught us any lessons, particularly for environment protection?

As a person involved in a few UN committees, including UNEP, WHO and IPCC, I would like to discuss some issues related to UN committees. All UN reports are written by authors drawn from all the member countries, both developed and developing. When a statement is made, it can be a perspective but based on authenticated data or publications from peer reviewed journals. Sometimes, authors from developing countries are handicapped to highlight their views as it may not yet be published although it may be genuine. Most of the emerging issues are researched and assessed in developed countries earlier, so that the views of the authors from developing countries get relegated. This is not because of lack of

expertise but mostly lack of funds for facilities and research. It is also possible that the problem in discussion may not be still pertinent to developing countries in terms of impacts. Most of the international protocols emerge based on the research done in developed countries. Only when the problem gets highlighted, developing countries start assessing it.

Covid-19. According to UN, The Biological Weapons Convention (BWC) is the first multilateral disarmament treaty banning the development, production and stockpiling of an entire category of weapons of mass destruction and it entered into force on 26th March 1975. Currently, there are 109 signatories. Through periodic reviews, the Parties agreed to implement a number of Confidence-Building Measures (CBM) to prevent or reduce the occurrence of ambiguities, doubts and suspicions as well to improve international cooperation in the field of peaceful biological activities. Under BWC, the Parties are supposed to provide disclosures on many items related to biological research including: research centres and laboratories; vaccine production facilities; national biological defence research and development programmes; past activities in offensive and/or defensive biological research and development programmes; outbreaks of infectious diseases and similar occurrences caused by toxins; publication of results and promotion of use of knowledge and contacts; legislation, regulations and other measures. In 2006, the parties had adopted a detailed plan and decided to streamline the procedures for submission and distribution of the Confidence-Building Measures (CBMs). There has been an investigation on the alleged use of biological weapons by The Syrian Arab Republic and found to be true. Therefore, it is ripe time to strengthen BWC and its CBM, so that we do not have any such pandemic outbreaks in the future.

It is also time that appropriate UN agencies and the Parties to multilateral conventions, including BWC and Convention on Biodiversity (CBD, study some of the so-called traditional food, medical and health practices around the world and their ramifications, particularly on food and medicinal consumptions (both raw and processed) of exotic and wild animals and birds and evolve guidelines. This should also include issues related to potential threats to animals, particularly endangered ones and their protection under the existing multilateral conventions. The study should also include biological and health impacts.

The world learned to subsist and survive without any international, national and domestic travels. Although we have been discussing about our travels and related carbon footprint, none bothered beyond deliberations. Now it is time, to ponder on the global travel ethics. Travels for work or pleasure should be minimised so that we do not pollute more than inevitable levels. Many organisations, including technology-oriented ones, have adopted work from home strategies. On all fronts, technologies for communications should be fully deployed and utilised to minimise travels. This has happened during the current lock down. Many enterprises and educational institutions, all over the world, have learned to work through electronic communications. It is true that you cannot totally sidestep travel for work or to schools and colleges but it can be meaningfully reduced. Travels for pleasure should be explored locally and promoted. This will also lead to local developments and enhance cultural awareness.

There are hundreds of reports that due to lock down, the environment has seen incredible and also strange improvements in our ecosystems.

Shrinking of global energy demand

The most striking and revealing assessment of Global Energy Review released in April 2020 by International Energy Agency (IEA) states that the global energy demand has shrunk by 3.8% (coal: 8%, oil: 5% and gas: 2%). Electricity demand has been depressed by 20%. By the end of March 2020, the global road transport and aviation activities were contracted by 50% and 60% respectively of the monthly average of 2019. Global CO₂ emission has declined by 8% to the levels of 2010. These are unprecedented reductions which could not have been achieved by any business as usual or any concerted measures but coronavirus pandemic and consequent global lock down have brought about.

Eco System

Many video clips of some wild (e.g. elephants, leopards, pumas, crocodiles, rhino) and farm animals (sheep and cows) and exotic and migratory birds (e.g. flamingos, peacocks) invading cities and urban areas are going viral. It is the environmentally desirable to avoid any developments in areas of habitats of some of the faunas to avoid human-wild life conflicts. Most of the environmental impact assessments (EIAs) are essentially required to monitor and report, particularly if a project development site falls within or close proximities of wildlife habitats e.g. elephant, tiger or lion sanctuaries or breeding areas e.g. turtle nests on seashores. However, humans have violated such guidelines and developed those areas with highways or motorways, industrial and residential complexes. Sustainable development addresses economic, environmental and social issues. Most of the studies focus on economic developments but ignore ecology and biodiversity. It is the human invasion into their habitats so far. With the lock down, it looks like that these animals wish to regain their habitats and freedom. Great lesson indeed!

Air and water pollution

It is obvious that the current local environments can be improved, by controlling emissions from transportation and other industrial activities to some extent. Certain pollutions e.g. Ganga and Yamuna River water pollutions are considered to be irreversible, even after spending thousands of crores over a few decades. Within a couple of months of lock down, their water qualities have improved to notable levels under lockdown! We now know that environmental quality improvements are possible if you take certain measures. This also requires political will for strong measures as exhibited during lockdown. What we could not achieve after spending millions over decades, the lockdown has provided the way! From recent environment reports, it is evident that such phenomena are happening all over the world.

Covid-19 is generally supposed to get transmitted through aerosols from sneezing and coughing. This is the main reason for social distancing and maintaining certain minimum distance across persons. It is also believed that it can spread through other media and objects as deposits. This calls for much more stringent hygiene in treating all belongings and items of any infected person. In India, we still have a poor records of biological waste disposal, although we have Biomedical Waste Management Rules for about a decade. The main lacuna is in the implementation. Covid-19 adds an additional dimension to this rule owing to the pandemic situation. Central Pollution Control Board (CPCB) has recently issued guidelines for waste handling disposal for cities and residential complexes. If one assesses these guidelines, we will realise that these are supposed to be applicable for all times, nothing special for pandemics. We need to enhance our waste treatment and disposal practices significantly.

The recent finding that the virus can also spread through stools is dreadful and throws some additional challenges for wastewater

treatment and disposal. Industrial wastewater treatment and disposal do not generally pose any threat, unless the industrial wastewater is diluted with municipal sewage water, as this is being allowed in certain areas by PCBs. Under the Zero Liquid Discharge (ZLD) conditions, industries are supposed to recover water from their wastewater and recycle the recovered water as much as possible and use freshwater only for makeup. To achieve ZLD, Reverse Osmosis (RO) membranes are generally used. These are known to remove viruses effectively but cannot remove totally. However, the risk is reduced to substantial levels. In residential complexes, generally blackwater (from toilets) and greywater (from washings and bathing) are mixed, treated and recycled for toilet flushes and garden watering. This adds to the risk of infection, if there are infected persons in the residential complex. Therefore, ideally recycling treated wastewater should be avoided in hospitals and residential complexes with Covid-19 infected persons, unless the water is disinfected.

Many times, we wonder whether clear blue skies are the prerogatives and hallmarks of developed countries only. There were UN reports on atmospheric brown clouds (ABC), particularly over Asian region. This brown cloud is formed at an altitude of about 10 km, the normal aircraft cruising altitudes. The main contributing factor is supposed to be biomass and agricultural residue burning. If they monitor ABC now, there will be substantial improvements. Now it looks like that Indian cities too can have clear blue skies, if you control emissions, as evident from the current lock down conditions. Many times, flights are diverted owing to bad visibility. Now, many channels are flashing the news that people in Punjab can see the Himalayan ranges, which are a few hundred kilometres away, only because of air quality improvement within a short period of lock down. Apparently, this has not happened in the last few decades! Remediation towards

better air quality is feasible, provided we have a will.

Any air pollution is bad for health. There are veiled health costs to pollution and these are never accounted in our assessments for environmental benefits and related economics. Most of the air pollutions are related to power generation, transportations, industrial activities, solid fuel burning and such human activities. While some of the activities are essential, there are some activities which can be curtailed or avoided. WHO states that globally there are 4.2 and 3.8 million annual deaths due to outdoor air pollution and poor indoor air pollution, particularly from cookstoves and fuels but the world is doing very little to mitigate and alleviate air pollution. Contrary to millions of deaths due to air pollution impacts, the world is reacting very vigorously to Covid-19 pandemic with significant expenditure and restrictions. It is only because this is pandemic and can affect any one irrespective of cast, creed, religion, status and nationality, but poor air quality usually affects people who are exposed routinely and not necessarily everyone. We need to deliberate air pollution very seriously and implement some meaningful measures globally. Our investment for air quality is very much below the required levels. It is not just enough that we do some air quality monitoring and publish the data, mostly beyond the prescribed limits! It is the same with water quality of various surface and sub-surface water bodies. We need to invest significantly on mitigations. World has to evolve global strategies for better air and water qualities.

As mentioned earlier, Indoor air quality (IAQ) has always been a great concern for rural India. For air-conditioned households, a few guidelines have emerged. The Indian Society of Refrigeration and Air Conditioning Engineers (ISHRAE) has recently published guidance document for air condition under pandemic situation. The main aim is to

minimise the spread of pandemic through AC and ventilation systems in various types of dwellings. One of the striking points is that they recommend to keep the indoor temperature much higher than the normal practice, preferably above 24°C. The assumption is that the coronavirus may not survive at warmer conditions. Usually, indoor temperature in most of the public places in India is set at much below this recommended value; it is much worse in air-conditioned buses and railway coaches. Ideally, it is better to avoid in such compartments until the circumstances become better. There is a new thinking on the use of UV for disinfection of air being circulated. Such ideas should be immediately tried and implemented.

Recently it was reported that largest stratospheric ozone hole in Arctic closes. Ozone depletion is mainly occurring due the high-altitude atmospheric reaction between ozone and largely chlorofluorocarbons (CFCs) and to a smaller extent with hydrochlorofluorocarbons (HCFCs). Although CFCs have been phased out globally, HCFCs are still in use and are under phase down. During this lock down all industrial activities have also ceased and pollution levels would have also reduced. Therefore, it was assumed that this ozone hole recovery was due this ceased activities. Later, it has been explained by atmospheric scientists that the Arctic ozone hole recovery had nothing to do with corona pandemic but was probably driven by strong polar vortex. Yet, the truth to be recognised is ozone hole was healed during this lock down. How come healing was so fast while depletion took very long time?

Let me also cite a few examples where pollutions can be totally avoided by managing certain events. We all know cricket. Cricket test matches were mostly played during the day time. Now modern cricket, including T20, One Day International (ODI) and even test matches are played under floodlit stadia. The only consideration is making money for

selected few and there is only miniscule benefit for the common people. Are these essential? We have not witnessed any cricket match during this lock down period and one is not sure when this will start. For environment sake, the world cricket body should examine to avoid playing under floodlit conditions which can save enormous power wastage just for pleasure while there are people around the world who still do not have access to power. What a shame? This idea is not limited to cricket but we should seriously consider all sports, including football, rugby, hockey and so on, which can be played during day time. None of these sports events has taken place during this period and none has complained except who are affected by the loss of exorbitant revenues. Managing the match times can have many more co-benefits, if you dig deep.

Games which are based on natural conditions should not be extended to synthetic conditions. Skiing is one example. It is indeed a great sight to see snow covered mountains e.g. Alps or Himalayas and similar mountains and joy to slide down some parts of the slope. Does it mean that we need this on summer days too? There are many artificial dry ski slopes, including indoor ones. Similarly, indoor ice rinks or snow farms. These require a lot of energy to maintain icy conditions. The energy requirements increase, if the ambient temperature is higher. The world should learn to move away from such extravagant sports for environmental considerations.

We can extend the above idea to social, religious and political gatherings. Why do we have to have massive gatherings and then face the challenge of arranging temporary facilities for transport, water, sanitation (grossly inadequate and unhygienic) and so on. Indian marriages are conducted with pomp with massive expenses for decorations, food, travel and related expenses. We have seen even some celebrity weddings conducted with austerity due to lock down and related

restrictions. On religious front, we have learned to pray from home without going to any religious places of worship. All festivals have been celebrated without moving out of our residences. Most of the religious festivals invariably add to pollution. This may sound bizarre, if we have to continue this way, forever. However, the pandemic has forced us to avoid all unnecessary travel, energy usage, leading to less pollution (including noise) from wastes generated and strewn after festivities. We need to curb unwanted wastage of power, and food for festivities.

Industrial operations

The lock down is particularly a major hurdle for industrial operations involving hazardous conditions or chemicals. Most of the operations have their own standard operating procedures (SOPs). These SOPs are not only for steady state conditions but also for unsteady state conditions during start up and close down. These are particularly critical for boilers, chemical reactors, and many other unit operations. This degree of hazard becomes much more when runaway reactions (a reaction which become uncontrollable if the temperature is not controlled within a band). Usually, these SOPs are followed for monthly shut downs for maintenances. However, when the lock down was announced abruptly without much notice, many would have shut down in haste. This can lead to dangerous situations both during lock down and start up. This was evident from the recent accident in a chemical plant in Visakhapatnam. This accident, which has caused 11 deaths and hundreds have been hospitalised, has exemplified the risks in store for such operations. Another accident in a chemical industry has been reported in Gujarat. Therefore, industries should apply extraordinary precautions while restarting their operations, after lock down of more than a couple of months.

During this coronavirus lock down period, many activities had come to standstill, including food production and processing industries. Food crops have been harvested but not distributed resulting in colossal loss of food. Post-lock down, we may have shortage of food. How are we going to handle? We may have to change our food habits to shift to local produces and natural foods rather than processed foods.

Scientists have been working on many problems to unravel some of the mysteries of nature. In this process, we also meddle with nature by manipulations. We all know about genetic manipulation. There are sceptics who think that genetically modified crops and plants are likely to lead to disasters. We have to be extremely careful in such studies, as we do not know how nature will react to our perturbations. Covid-19 may be interpreted as a combination of meddling with nature and nature's retaliation to our interference. When we ignore signs from nature, we are likely to face catastrophic reactions, as we have now. Therefore, it is better we respect nature and reduce our interference and disturbances.

Concluding Remarks

Coronavirus pandemic has taught us many lessons. We can dispense with numerous current practices without affecting our lives. If policy makers are serious about environment, they can also do wonders, if their own rules and regulations are strictly adhered to. Development should be sustainable and beneficial for all stakeholders and should not be assessed only for economic development. We need to spend more efforts and funds for environment protection, health and safety of all the people. These are going to be extremely challenging, particularly due to the financial declines resulting from global lock down.

DISCLAIMER

The opinions expressed in this article are purely personal as an independent writer.

Interview

Future pathways for the Energy Sector and Climate change

The energy sector in India is headed for considerable transformation in the future. Investments of \$ 2.5-4.0 trillion are envisaged in an effort to meet global climate constraints. Our Associate Editor, Dr. Ajay Kumar Singh discussed some of these challenges with one of India's esteemed energy systems experts, Prof. Amit Garg, Professor at the Indian Institute of Management Ahmedabad, where he teaches courses on public policy and energy economics. He is involved with several international organizations on climate change mitigation, as Coordinating Lead Author/Lead Author of five IPCC reports, co-chair of the IPCC Emission Factor Database, Lead Author of two UNEP Emissions Gap reports and co-Editor-in-Chief of the *Carbon Management* journal. He is also actively involved with the Government of India's mitigation activities and serves on several expert committees constituted by different ministries.

Would you like to share with our readers some of your major contributions to energy and climate change?

Energy policy and governance are complex issues for a country like India where in myriad resources and fuels, technologies, consumption patterns coexist. The country is also in transition on multiple fronts, especially on many drivers of energy systems and economic developments. Climate change has two main dimensions – mitigation and adaptation. I have been working in these domains.



Prof. Garg delivered an invited address at the MGMI workshop, GEM-2020 in January 2020

In context of the above, how do you view the interactions that academic and industrial

organizations have in our country with policy-makers?

The interactions are decent but could be made deeper.

Since a large part of our readership is interested in the coal sector, could you share the way you see coal as a part of future energy portfolios? What are the approaches in which coal could be used even in a context of decarbonization?

This is a very interesting question. Coal is the mainstay of the Indian energy system and provides energy security to the country. This has to continue. However, coal use has to be made much cleaner throughout its supply chain. Decarbonization focuses on reducing negative externalities of coal and it is not against coal as an energy resource per se. Ideally decarbonization should be resource and technology agnostic. The energy systems have to be decarbonized gradually while simultaneously ensuring that the developmental aspirations of people are met. India is the only large developing country in the world that is well on track to meet its Paris climate change agreement commitments. India is a responsible country that is conscious of its

GHG mitigation responsibility and is doing much more than its Paris commitments.

On the question of just transitions within decarbonization, how do you think we could ensure sustainable livelihoods for our coal workers?

Their livelihoods have to be protected at all costs. Anyway, I do not see any major changes in our coal dependence for the near-term. Coal use will have to anyway become cleaner, but coal use will continue.

We read that low-carbon energy sources come with their own set of challenges. For example, solar and wind both have large requirements for sophisticated materials. For the metallurgists and material scientists in our readership, could you point out a few major ways their role comes to fore in energy security?

There are aspects of production of solar PV material and wind turbines, and then their installations, and then their operation and maintenance. It depends upon how much we produce in India and how much we import. Currently, we are mainly importing solar PV panels. As things change and we produce more in India, their roles and job prospects will increase much.

Currently, the world is deeply affected by the COVID-19 pandemic, and we are seeing positive and negative impacts on the environment? First in the short-term, do you think that the reductions in air pollution and CO₂ could be extended beyond just a temporary phase?

This is an open question and maybe nobody knows the precise answer at this stage. But I do not think that apart from some minor changes (e.g. work from home, low travels), there will be any major changes in the short-term.

In the long-term, do you perceive COVID-19 inducing such a huge impact on the economy

that investments in low-carbon energy might go down?

I do not think so at this stage especially for a developing country like India whose energy systems are dependent on coal and traditional biomass. Situation may change in the future.

Finally, as a professor and someone who collaborates extensively, how have you adapted to work-from-home and do you have any suggestions for productive practices?

I am enjoying it. When there is no option, one must make the best use of the circumstances.

To Live with Corona:

- Wash hands with soap and water for at least 20 seconds. Dry them thoroughly with an air dryer or clean towel. If soap isn't available, use a hand sanitizer with at least 60% alcohol.
- Stay home if you're sick.
- Avoid touching nose, eyes, and mouth. Use a tissue to cover a cough or sneeze, then dispose of it in the trash.
- Use a household wipe or spray to disinfect doorknobs, light switches, desks, keyboards, sinks, toilets, cell phones, and other objects and surfaces that are frequently touched.
- Create a household plan of action in case someone in your house gets sick with COVID-19. You should talk with people who need to be included in your plan, plan ways to care for those who might be at greater risk for serious complications, get to know your neighbors, and make sure you and your family have a plan for caring for a sick person.
- Plan visits with friends and family outdoors if possible. If you must visit them indoors, make sure the space can accommodate social distancing, and open doors and windows to make sure the space is well-ventilated.
- If you are going out in public, bring a cloth face covering that covers the nose and mouth, tissues, and a hand sanitizer with at least 60% alcohol, if possible. Avoid people who are not wearing cloth face coverings. Always wear a face mask in public settings where other social distancing measures are difficult to maintain, especially in areas where there is significant community-based transmission.

<https://www.yalemedicine.org/stories/2019-novel-coronavirus/>

A Note on the likely impact of Covid-19 Pandemic on the Global Mining Industry

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The origin and spread of the COVID-19 Pandemic and its impact

The instances of Coronavirus cases were first reported from the Chinese city of Wuhan in late December 2019. The Coronavirus cases spreaded rapidly to other countries (notably South Korea and Japan in January, Italy, Spain and cruise ship Diamond Princess in February). By 11 March 2020, the virus has spreaded to 114 countries with reported cases of 118000 affected persons and WHO declared that day the disease caused by the virus SARS-CoV2 (also known as the Coronavirus disease of 2019, or more popularly by the acronym of COVID-19) to be a pandemic, meaning it is a new disease with a worldwide spread. The WHO COVID Dashboard of 16.6.2020 (the date on which this note was penned) states of 7.89 million confirmed cases of COVID - 19 from 216 countries ⁽¹⁾. It is a new virus and there is no precedence of how to tackle or contain it. Most countries have adopted a system of complete or partial lockdown causing tremendous slowdown in many economic sectors. Tourism, Sports and games, Restaurants, Retail trading, Construction, Aviation, Transport and Automobile manufacturing - all sectors are in doldrums. Hundreds and thousands of persons in towns and villages have lost their jobs. Many new projects such as switchover to electric vehicles or development of new Hydrogen based energy systems or trials of carbon capture and storage technology for thermal power stations etc. have been temporarily put on hold. In today's interconnected world, economic downturn in

one country affects many others exporting or importing commodities from the affected one. In this note the author examines the possible global economic impact of the Pandemic in general and more specifically on the global mining industry.

The macroeconomic shock caused by COVID-19

The coronavirus pandemic has triggered a macroeconomic shock that is unprecedented in peacetime. As of 28th of April, the World Health Organization reported 3 million confirmed cases and over 200 000 deaths due to the illness, affecting almost 200 countries and territories. A peak in the number of cases has been observed in only a handful of countries so far. To slow the spread of the virus, governments across the world have imposed restrictions on most social and economic activities. These include partial or complete lockdowns, daytime curfews, cancellation of international flights, bans on public gatherings and closure of educational institutions and non-essential businesses.

An IEA Report (dated 28 April 2020)⁽²⁾ estimates that during the lockdown phase the affected countries can expect a 20% to 40 % decline in economic output, depending on the share of the most affected sectors and the stringency of measures. The IEA Report further opines that these lockdowns, at the global level, translate into a 2% drop in expected annual GDP for each month of containment measures. In a 17th April 2020 Press Conference, the World Bank President David Malpass⁽³⁾ expressed the fear of a

major global recession caused by the COVID-19 Pandemic. The World Trade Organization in a statement dated 11.6.2020 has estimated the fall in world trade between 13% and 32% in 2020 as the COVID 19 pandemic disrupts normal economic activity and life around the world(4). The International Monetary Fund, on the other hand, has predicted a 3% contraction in the global economy due to COVID -19 in 2020⁽⁵⁾.

The impacts of the Covid-19 crisis on global demand of energy minerals and job losses

The IEA has prepared a Report called Global Energy Review 2020⁽²⁾ containing an analysis of electricity use during the early 2020 period and projecting the same in estimating the energy demands for the year as a whole. The analysis of daily energy use data during January to mid-April 2020 shows that countries in full lockdown are experiencing an average 25% decline in energy demand per week and countries in partial lockdown an average 18% decline. Daily data collected for 30 countries until 14 April 2020, representing over two-thirds of global energy demand, show that demand depression depends on duration and stringency of lockdowns. The IEA data show global coal and oil demand to have been hit the hardest, falling by almost 8% and 5% respectively compared with the first quarter of 2019. The impact of the pandemic on gas demand in the same quarter was more moderate, at around 2%.

Economic slowdown due to COVID-19 resulted in reduction in demand for crude oil and consequent dramatic fall in oil prices. The world's top oil producers (OPEC Plus countries) pulled off a historic deal on 13.4.2020 to cut global petroleum output by nearly a 10th to regain the stability of the oil market⁽⁶⁾.

In some countries coal mining has been affected by miners contracting COVID-19. Poland has suspended operation in 12 coal mines from 8th June 2020 for fear of Covid-

19 transmission⁽⁷⁾. A Reuters report stated that China's coal output in the first two months of 2020 fell 6.3% from the same period a year earlier as the coronavirus outbreak stopped miners from getting back to work after the Lunar New Year holiday was extended in a bid to contain the epidemic. In India the demand for coal from the industry and power stations has greatly plummeted and it is reported that CIL is now allowing many opencast mines to concentrate on OB removal and exposing the coal seams rather than on actual mining of coal and stockpiling the same at the pithead.

It is difficult to foresee how the COVID pandemic will behave or be tackled in different parts of the world but based on a most likely scenario the IEA Report⁽²⁾ (April 2020) predicts for the world as a whole for the year 2020 a contraction of energy demand by 6%, oil demand by 9% , coal demand by 8% and gas demand by about 4%. CRISIL on 26th May 2020 predicted that the Indian economy would shrink by 5 per cent in the current fiscal because of Covid-19 lockdown. In the US, Covid-19-related disruptions have led to millions filing for unemployment benefits. According to a CNN Business Report dated 28th May 40.7 million Americans have applied for unemployment benefits in the previous 10 weeks. In 2019, the growth of the real gross domestic product in the United States was around 2.33%. In 2020 the expected decline is by -5.91% on year to year basis. Power generation in China in the first two months of 2020 fell 8.2% year-on-year to 1.03 trillion kilowatt hours. Chinese economy, the second largest in the world, shrank 6.8% in January-March 2020 from a year earlier but it is reported that Chinese economy has greatly recovered in the next quarter and is likely to reach normalcy soon.

The impacts of the Covid-19 crisis on demand of some major minerals other than energy minerals

The World steel association has made a forecast on 4th June 2020 that the world

steel demand will contract by 6.4% in 2020, dropping to 1,654 Mt due to the COVID-19 crisis⁽⁸⁾. The Iron Ore supply from the two top exporters of the world (Australia and Brazil) contracted in May 2020 and the rapid spread of COVID-19 in Brazil indicates that the supply of iron ore may be a problem if the Post-COVID economic activities in China quickly comes back to normalcy as being perceived now. No wonder, the international price of iron ore continues to defy the global economic gloom and has increased over the last few months Clyde Russell⁽⁹⁾. The Indian Steel Association (ISA), has forecast in April 2020 that steel demand in India would contract 7.7 per cent in 2020 in the wake of measures taken to contain the spread of Covid-19 pandemic⁽¹⁰⁾.

The Indian cement industry already had a bad year in 2018-19 from a slowdown of construction activities. India Ratings and Research Group expects a further decline in cement demand in FY 21 with growth plunging to a historical low of negative 4-5 per cent year on year basis given the nationwide lockdown continuing since March 24 2020⁽¹¹⁾. It is well known that mining in India is labour intensive and often dependent on migrant labourers. With operations being closed or scaled back during the lockdown, many such migrant labourers have returned to their village homes. According to Rajdutt Shekhar Singh of Business World the lockdown has not only restricted access to workforce but also placed constraints on the movement of goods. No wonder in early April 2020 Fitch Solutions have broadly revised downwards India's mineral production growth rates per mineral by an average of 4.0 per cent from previous rates⁽¹²⁾.

Economic downturn and reduced demand for mineral commodities have resulted in lower price of minerals and coupled with that the mining activity itself in many countries has been hit directly by Covid-19. Teck Resources has halted construction of a copper mine in Chile, along with reducing

production and crews at coal and copper projects. In Mongolia, Rio Tinto was forced to suspend non-essential operations due to government regulations⁽¹³⁾. Many mine workers in Burkina Faso, Ghana and Chile have tested Covid positive leading to shut-down of the mines.

South Africa (S.A.) is a major mining country with many mines of gold, platinum, coal, iron ore, diamond, chromite, vanadium, titanium and a number of other lesser minerals. The Mining industry accounts for around 7% of the GDP of the country. S.A. had its first confirmed case of COVID-19 on 5th March, and on 15 March, the President of South Africa declared a national state of disaster. A national lockdown was enforced in the country from 26 March 2020. Like many other South African mines Anglo Gold Ashanti's Mponeng gold mine (the deepest mine of the world) resumed operation on partial relaxation of lockdown in April. However, with commencement of large scale testing, many miners tested corona positive and the mine was again temporarily closed⁽¹⁴⁾. The Minerals Council of South Africa has estimated in June 2020 a fall in mining production of 8% to 10% this year due to the COVID-19 pandemic.

Along with disruptions in mineral production there is slow down in investment in mines and mineral exploration. This is having a ripple effect on equipment manufacturers and service industries also. Epiroc, a mining equipment maker of Sweden has announced a cut of 425 positions due to a worldwide drop in demand from mining and infrastructure companies in the wake of the COVID-19 pandemic⁽¹⁵⁾. The mining companies hope to reopen the mines after the slowdown of the spread of the Covid virus but have to take into account the additional future capital costs of re-opening the mines.

Everyone agrees that there will be an adverse impact of the Covid pandemic on the mining industry. But even within the mining industry there is likely to be a great

deal of variation from commodity to commodity. For example, the revival of coal-dependent Chinese economy will mean a lesser impact on global coal industry but the slowdown in transition to electric vehicles will result in scrapping of many lithium mining projects.

Governments across the world is supporting the mining industry in the crisis period

Soon after the initial lockdown and closure of the mines most countries of the world realized the need to carry on mining operations to avoid job losses and sustain the national economy. The Governments of these countries started various measures to encourage the mining companies to continue mining or resume mining operations as early as possible even though there has been a slump in demand.

The Government of India while promulgating the national lockdown law on March 24 2020 permitted operation of industries for manufacture of essential commodities with prior permissions. On 25th March “coal and mineral production, transportation, supply of explosives and activities incidental to mining operations” were included in the list of essential activities. An Odisha Government order (9015/H&FW dated 24.3.2020) removed all restrictions on “Operation of mines of iron ore, coking coal, thermal coal, limestone, dolomite, manganese, chromite etc. as well as operations of ferroalloys, iron ore pellet plants etc. which are supplier of critical raw material for steel making”.

The Government of Western Australia has partnered with major resources companies and WA’s leading researchers to roll out COVID-19 testing for FIFO (Fly in Fly out) mining and resources workers who do not have symptoms. The Minister for Mines and Petroleum (WA) has enabled an exemption from exploration expenditure to be considered if tenement holders are unable to meet the tenement’s expenditure requirements as a direct result of COVID-

19. Similar Exploration rent waiver is being provided by the Government of Queensland to all exploration permit and authority to prospect rents that are payable within 1 April to 30 September 2020. The Government of Queensland has granted Glencore’s proposed Valeria coal mine the status of a “coordinated project”, which will see it fast-tracked as the nation looks for alternatives to kick start the recession-ridden economy. Many other Governments like that of Indonesia, Chile, Peru etc. have announced fiscal incentives for miners to resume mining at the end of the lockdown period.

Concluding Remarks

At this stage the longer-term economic effects of the COVID -19 pandemic on global mining are difficult to predict. We don’t know how long the COVID Pandemic will last or spread further and when will man discover a reliable vaccine against the virus. We don’t know how deep will be the economic recession that the world is experiencing now. Even for short term prediction it is necessary to know how quickly will the market recover. What we do know is that this is an unprecedented event, and human ingenuity in the past has been able to tackle such unprecedented events. I shall end this paper only by saying that in my estimation the global mining industry has to brace for a difficult period for the whole of 2020, and we can be optimistic for a better future in the later years relying on the ingenuity and collective efforts of the mankind.

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Help stop coronavirus

- 1 STAY home
- 2 KEEP a safe distance
- 3 WASH hands often
- 4 COVER your cough
- 5 SICK? Call the helpline



The current scenario of the Polymetallic Nodules Programme in India

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Introduction

India's mineral industry has grown significantly over the last few years to become an important contributor to the nation's economy. India produces as many as 95 minerals and the Index of Mineral Production has grown to 108.1 for the year 2018-19 (base year 2011-12 = 100). However, despite this growth, lack of strategic mineral reserves within the nation's boundaries enhances our dependence on imports to meet the demands in the future, if not today (Ministry of Mines, 2019). In addition to exacerbating the trade deficit, it

precarious situation can also be developed by the mining of Polymetallic Nodules (PMN) from the seabed. PMN are potato-shaped mineral concentrates found at certain locations on the ocean bed at depths of 4000-6000 m. These nodules are rich in manganese followed by Iron and Aluminium. It also contains metals like copper, cobalt, and nickel which makes the extraction economically viable. Moreover, India has just 1.8% of the world's copper reserves and does not contain any known primary reserves of Cobalt and Nickel. Additionally, the nodules are known to contain Rare Earth Elements (REE) and also

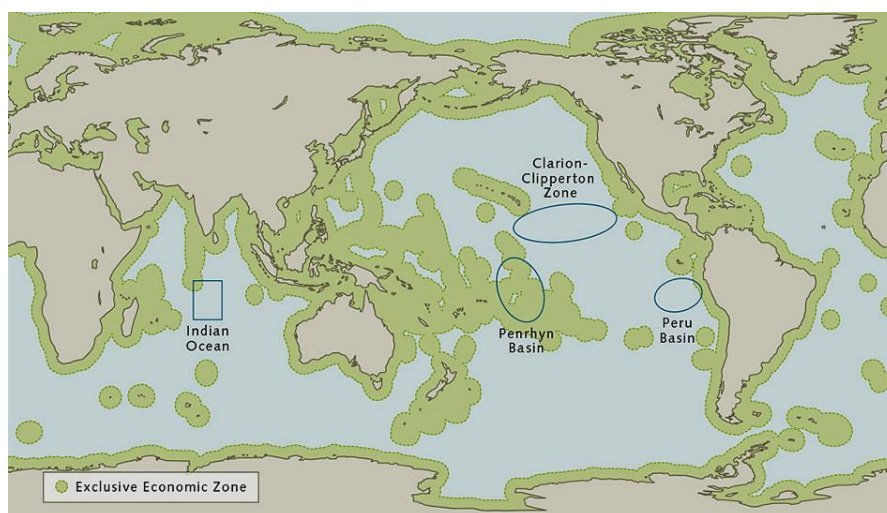


Figure 1 Map showing sites with abundant nodule concentration (Source: Mukhopadhyay et al. 2019)

may also become a question of national security due to the strategic importance of certain metals. A fitting solution to the

metals like Titanium, molybdenum, and zirconium which may prove to be crucial for India with its increasing investment in

Aerospace and defense. Harnessing this resource effectively may lead to reduced dependence on imports of these strategic metals. This will not only enhance our raw material security but will also boost the country's economic growth for many years to come. This will also help India to develop indigenous technologies for grid-scale batteries as energy storage solutions to tackle the intermittent nature of renewable energy sources since cobalt and nickel are critical for the manufacture of Li-Ion batteries.

PMN can be found anywhere on the seabed across the globe. However, four areas have been identified where they occur in composition and abundance to be economically viable for mining (shown in Figure 1). Three out of four such areas lie in international waters where all mineral-related exploration and exploitation activities are regulated by a UN body called International Seabed Authority (ISA). ISA after its foundation in 1994, has given out 18 PMN exploration contracts.

India signed its contract for PMN exploration with the ISA on 25th March 2002, of which it currently holds an area of 75000 km² in the Central Indian Ocean Bed (CIOB). Post signing the contract, India has made significant developments in the field like exploration, reserve estimations, collecting baseline data, and developing a mining equipment prototype, all of which have been discussed in this article.

India: Progress so far

Even before India signed its contract with the ISA for exploration of PMN in CIOB, in 2002, India was already a pioneer investor among other countries like Russia, France, and Japan. As a pioneer investor, India explored an area of two million sq. km. using exploration methods like echo sounding and free fall grabs, to obtain the bottom profile and the abundance of the resource. After the exploration study was complete, India was allocated an area of

150,000 km² in 1987. At present, India holds 75,000 km² of its pioneer area even after relinquishing fifty percent of the area. Sampling studies conducted for the entire area, at a grid-scale of 14 km indicate that the PMN reserves in the pioneer area have grades more than 2.2% (Cu + Ni + Co). On average, one square meter in this pioneer area is estimated to contain 5-7 kg of PMN reserves. The total reserve of PMN nodules in this area is estimated to be 380 Million tonnes (MT) with manganese, nickel, copper, and cobalt, accounting for 92.59 MT, 4.7 MT, 4.29 MT, and 0.55 MT respectively. After the grid-wise exploration exercise, a first-generation mine site of 7860 km² was identified and further studied at a grid-scale of 7 km. This first-generation mine site is estimated to have enough reserves to last for 20 years at the planned rate of extraction.

India's proposed mining complex includes an autonomous nodule collector (figure 2), a flexible riser system, and a surface vessel. A pilot-scale nodule collector, weighing 18.5 tons was developed by the National Institute of Ocean Technology, Chennai for the Ministry of Earth Sciences (MoES). It uses rubber tracker belts for movement and has a series of multiple modular units of collecting equipment attached across the collection swathe of 4 meters, which translates to a mining capacity of eight tons of nodules per hour. The prototype nodule collector, together with a flexible riser system and a



Launch and recovery system, has been

tested in an integrated set-up on the seabed at a depth of 500 meters by tasking them to collect artificial nodules. Results from the tests have been put to use towards the development of a similar mining system for 6000 m depth. As a part of the PMN program, NIOT has also developed and tested a Remotely Operated Vehicle (ROV) called ROSUB 6000 which can operate at depths of more than 5000 m. ROSUB 6000, has been used for the exploration of PMN and other minerals and in-situ soil testing.

Further, India has also tested three metallurgical processes in the Institute of Mineral and Material Technology (IMMT) at Bhubaneswar, the National Metallurgical Laboratory (NML) in Jamshedpur, and Hindustan Zinc Limited (HZL) in Udaipur for the extraction of Ni, Cu, and Co. The process proposed by IMMT involved Ammoniacal leaching followed by MnO₂ and solvent extraction and Electrowinning. This was demonstrated at a pilot-scale of 100 kg/day. NML's process begins with reduction roasting followed by ammoniacal leaching and solvent extraction and Electrowinning which was also demonstrated in a pilot plant on a 100 kg/day scale. HZL's process of metal extraction begins with acid leaching followed by Fe removal and solvent extraction and Electrowinning. HZL has also demonstrated a processing plant at a scale of 500 kg/day. Later, a pilot plant was also set up for the extraction of Mn as a byproduct to enhance the economic viability of the process. Mn was recovered from the leach residue as an alloy of Iron and Silicon.

Environmental Impact Assessment

The environmental impact assessment part of the PMN is conducted by the National Institute of Oceanography (NIO) at Goa and is funded by the Ministry of Earth Sciences (MoES). In 1997, India started its Benthic Impact Experiment (BIE) called the Indian Deep-Sea Environment Experiment (INDEX), which was aimed to study the impacts of plume generation on the local benthic environment without recovering any

nodules during the process. In this study, a plume was created using a Deep-Sea Sediment Resuspension System (DSSRS), which lifted around 580 tons (dry) of sediment from the sea surface over the nine days of the experiment. However, since the experiment did not exactly simulate the mechanism or the scale of the nodule mining, the results of the test did not cover the entire scope of the impacts of a commercial-scale mining exercise. It did however reveal the chances of lateral and vertical mixing of the plume which would directly affect the filter feeders and the burial of sessile species once it settles with a possible change in its physicochemical composition.

In 2021, MoES is planning to attempt a test trial of its prototype mining unit, for which it has already submitted an Environmental Impact statement to the ISA. This test, though even smaller in scale (maximum length of 1000 m) than the INDEX would involve an extraction device similar in mechanism to that proposed for commercial-scale mining of the nodules. This study would, therefore, help understand not only the effects of the resuspension of sediments but also the impacts of the compaction of the seafloor due to the movement of the collector and nodule removal or loss of hard surface. This test would be conducted in a block within the first-generation mine site and would be monitored with reference to an undisturbed site. This would be in addition to the study of the impact of light and noise pollution, contamination of the benthic environment due to hydraulic fluid leakage and induced ground vibrations. This will be the second planned experiment of its kind, the first being done in a combined operation by Germany and Belgium.

Concluding remarks

India has made significant progress towards commercial mining of polymetallic nodules since it signed the exploration contract with the ISA in 2002. It has completed its exploration exercise, including bathymetric studies, and has identified a first-generation

mine site. India has tested different metal extraction pathways at the pilot scale and developed a prototype miner with a riser system. India is also among the very few countries to conduct environmental impact assessment studies.

We have discussed the progress thus far of PMN projects in India. This however needs to be accompanied by strong technological innovation, robust environments assessment, and proactive policymaking. In summary, the PMN program will advance India's energy security as well as mineral security. This program will also help to reduce climate change by enabling the development of cost-effective energy storage solutions which are critical to enhancing the proportion of renewable energy in India's electricity mix.

Acknowledgment

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"The ultimate measure of a man is not where he stands in the moments of comfort, but where he stands at times of challenge and controversy."

— *Martin Luther King, Jr., Civil rights leader and minister*

Down the Memory Lane

J.N. Johari, LM, Dy. DGMS (Retd.), Udaipur, Rajasthan

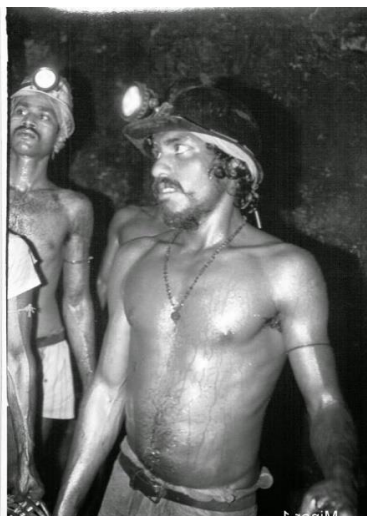
Pangs of Mines Vocational Training:

After completing 1st-year studies at ISM & AG, Dhanbad, in May 1958 three of us were directed to take training at East Angarpathra Colliery for one month and Kurhurbari (Giridih) thereafter. After reaching the Colliery we were told that our accommodation was a small room by the side of dispensary, which was near a settled goaf (pillars extracted area). This was the Isolation room, having a ceiling fan, but bereft of any latrine and bathroom; even a water tap was not there. After spreading the 3 beddings, the space left was less than a meter wide. For our morning ablutions, we had to go to the settled goaf, though not safe. For taking bath we were dependent on the (unfiltered) water tap in the house of a Time Keeper nearby. For breakfast, lunch, and dinner, we had to go to Sijua Hostel, 2 km away. The manager was one Gopinath and none was bothered about us. We had never imagined that we will have to live under such difficult conditions. As such our training was not very satisfactory.

Next month I along with other classmates went to Kurhurbari colliery, where our accommodation was a room of the servant's quarter of an official's bungalow, unfiltered water containing coal dust particles had to be used by us. Then we were shifted to the trainees' hostel, where conditions were only slightly better, more space and wooden chowki beds were there. Food served was hardly palatable, the quality of rice was poor and it had a mixture of small stones. My Punjabi friend Claire was not used to rice meals, so sometimes I prepared chapatis for him, as the cook was unable or not willing to do this. In olden days there was much brotherhood between seniors and juniors of ISM. If the manager happened to be from ISM, he will as a rule host a dinner for the trainees; which provided an opportunity to know each other.

From the Facebook of Mr Gouri Prasad Ghatak

Mr Pallab Chakrabarty's Photograph of 1981 from Madhaipuri Colliery of ECL



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