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November - 2022



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We were the first Indian unlisted company to publish a GRI compliant sustainability report way back in 2006. We are a large producer of renewable power in India. We were also the first mining company in India to get certified for OHSAS 18001:1999 and ISO 14001:2004. Across the years, we have invested more than ₹820 Crore in ESG. From building blood banks to adopting villages and combating climate change, we have been practicing ESG long before it became a buzzword.



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President's Message.....

Dear Members,

Greetings...

I would like to wish all the members of the Association fruitful celebrations of INDIAN MINING DAY (IMD) and request all the members to participate in IMD celebrations in large numbers.

I wish to put forth the activities undertaken by our Association in the preceding month. The month of October '22 was a very active month filled with events conducted across all Chapters.

Bellary-Hospet Chapter of MEAI had organized a One day seminar on "**Explosives and Blasting Techniques and Drilling Techniques**" on 1 Oct 2022. The event was based on the theme of "**need of safety in the mine**" to impart direct benefit to mining mates and blasters working in quarries and various iron ore, limestone mines etc. The event received overwhelming response and more than 300 people attended.

Quiz Master Mr Deepak Vidyarthi conducted online the Qualifying round of National Quiz program on Oct 9, 2022 wherein representative Teams from 17 Chapters participated.

Bellary-Hospet Chapter conducted sports activity and organized MEAI Cricket Premier League on 16 Oct 2022, where Members and Student Chapter members participated in large numbers. This event saw bursting enthusiasm and ended with nail biting moments of climax, particularly in slog overs of the matches.

The Mumbai Chapter Chairman & Secretary organized a meeting at Mumbai on 16.10.22 with me, Council member Mr M.C. Thomas and Editor of MEJ Dr. P.V. Rao to discuss the Chapter's activities.

Myself and Dr P.V. Rao attended the CRIRSCO AGM 2022 on 18 - 20 Oct 2022 at Johannesburg, South Africa. Representatives from 12 countries participated in this annual event. The deliberations in this meeting included current activities of CRIRSCO and on future strategies and road map for strengthening CRIRSCO in the member countries and its expansion in new countries as well.

As a part of our MEAI TECH SERIES (MTS) program, a talk on "**Enhancement of Blast Results: Critical Issues & Roles of Monitoring**" was delivered by Dr. V. R. Sastri on 15 Oct 2022. MTS program is an ongoing continuous program, which is held every month. Request all the mineral industry professionals to utilise this opportunity.

It gives me immense pleasure to share with you that on 6 Nov 2022, the Association MEAI will inaugurate the 27th Chapter, namely Ongole-Vijayawada Chapter, as per the request of Mining engineers located around Ongole, Andhra Pradesh.

The other upcoming events scheduled for the months of November and December are conducting the 6th Council Meeting on 19.11.2022 at Kothagudem and **MEAI All India Geologist Conference (MEGECON-22)** at Hosapete on 20 - 21 December 2022 by Bellary-Hospet Chapter.

My best wishes to all our members on the Indian Mining day celebrations and request them to join an online meeting at 5.00 PM, which will be followed by the Final round of Quiz. I request our members to participate in large numbers and make them a grand success.

I would like to congratulate the Bangalore Chapter, which is celebrating its **Silver Jubilee year**. It is one of the most active and vibrant Chapters with a fruitful mix of experienced and budding young mining professionals.

I conclude this with a hope that many more Chapters will celebrate their Jubilee years in future.

Regards,

K. MADHUSUDHANA
President



Mining Engineers' Association of India

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EDITOR'S DESK



Dr. P.V. Rao
Editor, MEJ

The in-person Annual General Meeting (AGM) 2022 of The Committee for Mineral Reserves International Reporting Standards (CRIRSCO) was held in The Fairway Hotel, Spa and Golf Resort, Johannesburg, South Africa on 17-20 October 2022 wherein 12 out of 14 member countries were present. This has gained greater significance and created enthusiasm as the preceding two AGMs viz. 2020 and 2021 were to be held in virtual mode due to restrictions enforced by the COVID-19 pandemic. Mr K. Madhusudhana (MEAI President & NACRI Co-Chair) and Dr P.V. Rao (NACRI Co-Chair), the NACRI Representatives of CRIRSCO, symbolized India in this Meeting.

The Executive Meeting of CRIRSCO and the Working Group Meeting on 'Standard Definitions' were held on 17th October. The Working Group led by Mr Ken Lomberg (SAMREC, South Africa) presented the draft modified Standard Definitions contained in the International Template to the National Reporting Organisations (NRO). Some of the notable Standard Definitions deliberated by the NROs included Exploration Targets, Exploration Results, Modifying factors (especially ESG), Life of Mine Study for operating mines etc. The house suggested circulating the draft modified Standard Definitions to all the NROs to enable them to further discuss

within each NRO and forward its comments to the Executive Committee for consideration. The Working Group also proposed that the CRIRSCO Template 2019 should be revised only after the release of the new version of JORC, which is in its final stages.

To maintain the future of CRIRSCO, the Executive Committee proposed that at least one of the two representatives, if not both the members, from each NRO should have a longer tenure of presence to maintain continuity of thought processes and rigour.

All the NROs present in the meeting presented their annual reports emphasizing the updates since the last AGM held virtually on 11-16 October 2021. The NACRI informed the house that the Mining Engineers' Association of India (PO) has already added new qualifications for the CP to address the growing needs of ESG factors. Each of the four Standing Committees (Finance and Funding; External relationships, education & new members; Communication and publicity; Administration, Policy and Strategy) met separately for an hour before presenting the progress made by each one of them. The ESG Working Group led by Mr Roger Dixon (SAMREC, South Africa) presented the progress made thus far and the way forward for CRIRSCO.

The Executive Committee proposed to enhance the annual membership fee of each NRO to USD 3,000 from the present USD 2,000. As some of the NROs (including NACRI) disapproved of it, the house agreed to continue with the present annual fee of USD 2,000 only. The International Council on Mining & Metals (ICMM), a strategic partner of CRIRSCO, made a virtual presentation from London on strengthening the strategic relationship between the two premier bodies and confirmed its commitment to extend financial support to meet at least 50% to 60% of CRIRSCO annual expenditure. The need for the continuing participation of CRIRSCO representatives in the UNFC and International Seabed Authority (ISA) was discussed, amid the updates presented by Mr Roger Dixon and Mr Edson Ribeiro (CBRR, Brazil) respectively.

As a precursor to the Working Group discussion on Reciprocity, Mr Peter Stoker (JORC, Australia) made a detailed presentation on the current requirements of a Competent Person (CP)/ Qualified Person (QP) by various CRIRSCO family codes. They include professional membership required, years of experience in the mining industry, years of relevant experience in the deposit type, years in a position of responsibility, areas of expertise, and disclosure regulation. The CRIRSCO Chairperson Mr Edson Ribeiro presented three preferred alternatives to establish Reciprocity between NROs/ Professional Organisations (PO)/ CPs/ QPs. After a brief discussion, the house decided that the NROs should review the proposed alternatives and submit their comments for finalisation of the Reciprocity system.

Mr Edson elucidated the simplified process of enrolling new member countries into CRIRSCO. On the final day of the AGM, eight countries that have been yearning for several years have made their virtual presentations on the progress made in fulfilling various requirements of CRIRSCO. As the applications of Philippines, Kyrgyzstan, Peru and Ecuador were assessed to be close to fulfilling the mandatory requirements to join CRIRSCO, the Chairperson of CRIRSCO assured them of their admission in the next AGM at Brazil.

Sao Paulo, Brazil has been decided as the venue for the next CRIRSCO AGM 2023.

- Editor

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NEWS FROM THE MINING WORLD

► Vedanta founder Anil Agarwal honoured with Global Indian Award in Canada



Anil Agarwal, Executive Chairman, Vedanta Resources

Vedanta founder Anil Agarwal was honoured with the Global Indian Award worth \$50,000 by the Canada-India Foundation at its 15th annual gala here at the weekend. Agarwal donated the award money to a Canadian health charity working for the welfare of native Indians.

Accepting the award at a star-studded gala event that included Ontario Premier Doug Ford, ministers and Indian consul general Apoorva Srivastava, the mining tycoon lauded the achievements of the 1.6 million-strong Indo-Canadian community in this country. "I have gone all over the world, but I have not seen the kind of bonding in the Indian diaspora anywhere that I see in Canada. Take your businesses to the skies and make Canada proud. You live in the best country in the world," Agarwal said. He said India and Canada have many similarities and they complement each other in many fields. "Together, the two countries can do phenomenal work."

The Vedanta founder said India has been a poor country. "But the time has reversed. The \$3-trillion economy is going to be a \$30 trillion economy in the coming years. The middle class that is 20 per cent today is going to be 80 per cent in the next six-seven years. We are going to build 150 big cities in India. Indians may be 20 years behind Canada in terms of lifestyle, but their aspirations are so high that with a population of 1.4 billion you can just imagine the (sheer amount of) demand."

Ontario Premier Doug Ford praised the Indian tycoon for this charity. "I cannot think of any more deserving person (for the award) than Anil Agarwal whose generosity has improved the lives of so many people. You are a role model and an inspiration, Anil," the

Ontario Premier said. Welcoming Agarwal to the gala event, Canada India Foundation chairman Satish Thakkar said, "Mr Agarwal's life story is one that should inspire every youngster growing up, to dream big and persevere to fulfill the dream. As a person who has pledged to give 75 percent of his wealth to charity, Mr. Agarwal is also a philanthropic role model for all. On behalf of CIF and all present, I extend a very very very warm welcome to Mr Agarwal."

Ratan Tata, Dr A.P.J. Abdul Kalam and Deepak Chopra among the past recipients of the Global Indian Award started by this premier Indo-Canadian organization in 2007.

IANAS, Toronto | October 3, 2022

► Scientists want to produce cosmic mineral to replace REEs in industrial magnets



Professor Laura Lewis. (Image by Matthew Modoono, courtesy of Northeastern University).

Engineers at Northeastern University have patented a process to accelerate the production of a mineral known as tetrataenite, whose magnetic properties make it a leading candidate to replace magnets made of rare earths.

Tetrataenite is not found in nature—at least, not on earth. It is only found in meteorites. This means that making the cosmic mineral requires manipulating the atomic structures of its iron and nickel components by arranging them into a crystal structure that resembles tetrataenite, thus speeding up a natural process that would take millions of years on our planet.

"The iron and nickel atoms have to rearrange themselves. And nature will do it, but it will take millions of years to do," Laura Lewis, one of the researchers involved in the study, said in a media statement. "So if we can do it in industrially relevant time scales, we will have a nice new addition to the permanent magnet portfolio."

According to Lewis, decoupling the scarce materials from magnet production not only provides sorely needed supply chain relief—there simply aren't enough magnets to meet the world's energy needs—but it will help rebalance geopolitical tensions by easing the US dependence on Chinese rare earths.

China controls close to 80% of the world's rare earths supply, while global demand for REE magnets is expected to reach \$37 billion by 2027. In Lewis' view, however, having a single source of REEs is not the only issue at hand. "It's beyond just scarcity," she said. "Because the methods necessary to process the ore that comes out of the earth are really environmentally hazardous—I would say even damaging. And for many decades, China not only has had a large supply of these rare earths but the means and will to produce them."

The researcher mentioned that while China has been using rare earths to meet the needs of its own green revolution, its virtual monopoly presents an obstacle to other nations looking to get their hands on the materials.

Discovering nature's rules

Industrial permanent magnets are used to transfer energy from mechanical to electrical sources. The list of technologies that rely on magnetic flux includes electric cars, wind turbines, computer hard drives, speakers, and military radars, among other devices and applications.

"They're absolutely everywhere," Lewis pointed out. "Once you start pulling things apart, you're going to find them everywhere." She and her team are, therefore, tasked with "discovering nature's rules for the creation of competitive magnetic materials comprised of non-critical elements."

Lewis is also a delegate to two US technical advisory groups representing the American National Standards Institute in the International Standards Organization. The advisory groups she contributes to focus on managing the supply chains for critical elements linked not just to rare earths, but also materials such as lithium that are used in both household and industrial technologies. "I've been meeting with my counterparts in China, Japan, Korea, Australia, and Europe to figure out how to fix these supply chains," Lewis said.

Staff Writer, Mining.Com | October 23, 2022

► **Coal import to be stopped by 2024: Pralhad Joshi**
Coal minister Pralhad Joshi on Thursday said that the

import of dry fuel which has declined considerably will be stopped by 2024. Speaking at an event at the office of the Comptroller & Auditor General of India here to release a 'Compendium of Asset Accounts on Mineral and Energy Resources', the minister said commercial coal mine auction which was institutionalised by the present government has made the auctioning process totally transparent. Joshi also complemented CAG's office for bringing out the first ever compendium of asset account on mineral assets of the country. The minister said that the report presents comprehensive picture of the mineral resources spread across different states in the country.

He said that the compendium will help in further strengthening sustainable mining process which is of great importance for ecology and future generation. Collating the information of the state asset accounts, the government accounting standards advisory board has prepared the compendium of asset accounts on mineral and energy resources in states.

The compendium includes details of all four fossil fuels, 40 major minerals and 63 minor minerals in 28 states and one Union Territory Jammu & Kashmir, and also covers the innovations and good practices noticed during the course of the study.

PTI | October 20, 2022

► **View: 10 steps to bolster bidder interest in India's mining sector**

The raft of legislative measures taken by the government over the past seven years has helped streamline the auction process for mines in the country. However, more needs to be done to bolster the mechanism and make bidding more responsive.

For a pointer, of the 108 mineral blocks put up for auction so far this fiscal, more than 50% have had to be annulled owing to either lack of bidding participation or getting less than the mandated minimum of three bids for a block or put on hold because of litigation. The amendment of the Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act) in March 2015 marked the adoption of auctions as a mechanism for allocation of mineral resources for prospecting as well as mining. Rules were notified under the Act, spelling out the method and process of auctioning a mineral concession by a state government.

A total of 203 mineral blocks have been auctioned since then, with Odisha leading the table, followed by Madhya Pradesh and Karnataka. Among minerals,

iron ore and limestone constitute more than half of the blocks auctioned, followed by manganese and bauxite. A smaller number of other minerals such as gold, graphite, chromite, copper, and diamond have also been auctioned. More than 80% of these blocks are for mining lease and the rest for composite licence, which involve exploration of the area at the first stage, followed by mining operations. There have been several amendments to the Act and the rules in the past seven years to enhance participation in auctions and allow for a faster transition of the mining rights to the new allottee in case of an expired mining lease. The process has gained traction in the past 3-4 years with many states joining the fray. Auction premiums have ranged from as low as 5% to as high as 452% of the sale price notified by the Indian Bureau of Mines for a mineral. Iron ore has witnessed the most aggressive bidding with average premium over 100% of its sale price. Yet, more than 75% of the auctioned blocks remain undeveloped so far due to the larger issue of procuring statutory clearances. Other reasons for tepid bidder interest include lack of clear demarcation of the block boundary without any overlapping area with the adjacent block(s) or non-availability of area for approach roads. Also, higher auction premiums and resultant unviability have led to blocks being surrendered or terminated. Further, despite removing the end-use restriction in participating for mineral blocks auctions, more than 80% of the resources have been obtained by end users, as they have outbid the merchant players due to the larger value chain of their business activity and by optimising their logistics costs. However, this has led to shrinking the market of merchant mining of minerals and overall higher market concentration.

In the context, the imperatives

Clearly, there is a need to undertake more extensive preparatory work prior to the auctions, whether it is for composite licence (prospecting licence cum mining lease) or direct mining lease. First, without adequate geological data, valuation of the block and related bidding strategy tend to become speculative. Hence, to give bidders a clear idea on the quantity, quality and mine-ability of the resources, there is a need to undertake due exploration and develop the geological report as per the reporting standards notified by the central government.

Second, the block area needs to be carefully demarcated to avoid any overlap with the adjacent block area and a plan thought through to tackle issues such as presence of wind turbines or transmission lines present within the concession area.

Third, new models need to be evolved for expanding exploration — especially of strategic minerals and

minerals that the country spends a lot of foreign exchange on importing — by utilising the existing National Mineral Exploration Trust more vigorously. In view of the high risk and high cost associated with exploration, the government may introduce a cost-sharing model wherein a part of the costs incurred would be reimbursed to explorers who have completed the minimum work programme and shared the relevant data, documents and samples. This will help boost private participation in minerals such as lithium of which there are limited reserves in the country.

Currently, reconnaissance level exploration is being carried out by the Geological Survey of India. The non-exclusive reconnaissance permit for an area can be acquired through an online application with payment of applicable fees, but the rights/permit of the explorer in the area is non-exclusive and there is no system for transitioning to prospecting or mining licence in case of a successful find. The government may pre-fix a certain percentage of auction premium that is payable upon successful exploration. The methodology for this may be notified in advance and could be based on the past premiums discovered in the auctions process.

Fourth, for the states to maximise bid participation and realise the auction premiums to augment their revenues, clearances for auctioned blocks need to be expedited. A committee at the highest level in state, with representatives from environment and forestry departments, can help the process.

Fifth, auction premiums have been unreasonably high for many deposits, especially of iron ore. While resource security can drive auction premiums higher, their unsustainability can derail the entire process and effort. Hence, the average sale price (ASP) published by the Indian Bureau of Mines — which the auction premium is linked to — needs to be made more robust to capture the market prices correctly.

Sixth, the central government is contemplating a national mineral index (NMI) on the lines of the National Coal Index. Clarity is needed on the role of NMI in the presence of ASP. In general, adequate technical data, proposed scheme for tackling any surface constraints and disclosure of the status of various statutory clearances, and any litigation at the auction stage can help more prudent bidding and obviate surrender.

Seventh, from an economics perspective, the resource will go to the party that is able to place the highest value on it. In view of large quantities of the auctioned resources of minerals such as iron ore being bagged by the end users, the policymakers need to ensure that alternative supply channels such as linkages from state-owned mining corporations are available to small and medium enterprises such as sponge iron manufacturers.

Eighth, the mineral administration and reporting requirements need to be made robust to ensure arm's length transactions between the miner and the buyer, and correct capturing of the sale price that goes towards calculation of the ASP.

Ninth, in view of limited merchant sale transactions, the IBM needs to formulate alternative pricing methodologies for ASP. Further, IBM needs to publish the ASP for minerals such as the rare earth group to enable their auctioning by state governments.

Tenth, given the change in the regime of allocation of mineral concessions and the resultant preparatory work and expansive monitoring required, state governments should develop the capacity of their departments of mines and geology to administer the mining activity within the state appropriately.

Satnam Singh, ET | October 06, 2022

► **Govt plans to auction 22 mineral blocks in 3 states within next two months**

The government plans to auction 22 mineral blocks in Maharashtra, Uttar Pradesh and Goa in November and December.

The mines to be auctioned include six iron ore blocks, three blocks each of limestone and gold, two blocks of bauxite, one block each of copper, phosphorite and glauconite, according to the mines ministry. The notice inviting tenders for the blocks were floated in September. While the mines in Maharashtra will be auctioned next month, those in Uttar Pradesh and Goa will be put on sale in December.

So far, more than 180 mineral blocks have been put on sale since the system of auctioning of mineral blocks began. The government started the process of allocating mineral blocks through auctions in 2015-16. The ministry has expressed hopes of auctioning 500 mines by the end of 2024. The Centre is aiming to increase the mining sector's contribution to the country's Gross Domestic Product (GDP) to 5 per cent from 2.5 per cent at present. The ministry has also notified the Minerals (Evidence of Mineral Contents) Second Amendment Rules, 2021, and the Mineral (Auction) Fourth Amendment Rules, 2021.

Press Trust of India, New Delhi | October 5, 2022

► **Most states failed to collect data on mining operations, says new report**

No states, barring Chhattisgarh and Odisha, have started the system of collecting data related to mining operations and failed to detect production loss and verify the mineral output claimed by miners, according to a report. Besides, states like Gujarat, Kerala, Rajasthan, Uttar Pradesh and West Bengal could not furnish the

extraction figures of major minerals, said the Natural Resource Accounting report.

The report prepared by the government accounting standards advisory board under the aegis of Comptroller and Auditor General of India further said that since states like Gujarat, Kerala, Meghalaya, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal could not provide the extraction figures of major minerals, their accounts had to be based on production figures only.

Further, Madhya Pradesh did not have extraction as well as production figures and accordingly their asset accounts were based on dispatch figures only. "Consequently, these states remained unaware about the production loss depicted and claimed by the lessees," it said.

The royalty is collected on the minerals dispatched and therefore more the production loss, higher is the revenue leakage. Moreover, cases of irregular claims of production loss also remained undetected on account of such system lacunae.

Only Chhattisgarh could provide the detailed position of extraction, production and dispatch of resources along with the production loss, which was within five per cent.

Most of the states have not prepared a comprehensive mineral map of the state. States, it said, should be encouraged to prepare the mineral maps as it would be the first step towards effective management of mineral resources. Besides, there are funds earmarked for this purpose under the National Mineral Exploration Trust (NMET) for carrying out the surveys.

There is no system for issuance of permits/transit passes for coal on advance payment of royalty, which is a pre-requisite as per the MMDR Act, 1957. There is no control and monitoring of the mining officers on production and dispatch of coal from the mine head. The lessees have their own system of issuing permits/ passes and weigh-bridges for measurement, which has no involvement of mines department personnel, it said.

The department also do not have any weigh-bridges or check gate to monitor actual dispatch of coal. Assessment of revenue is done solely on the basis of returns furnished by the lessees. "This system is highly susceptible to illegal mining, pilferage of minerals leading to windfall gains to the lessees and connected parties and monitoring system and may also look into

any case of pilferage of resources leading to revenue loss to the state exchequer.

PTI | October 20, 2022

► **Caterpillar surpasses 5-billion-tonne autonomous milestone**

In a mining first for autonomous haulage, trucks equipped with Caterpillar Cat MineStar Command for hauling have now moved over 5 billion [...]

In a mining first for autonomous haulage, trucks equipped with Caterpillar Cat MineStar Command for hauling have now moved over 5 billion tonnes. Cat autonomous trucks are on pace to eclipse previous record totals of materials hauled in a calendar year, projected to be more than 1.4 billion tonnes 2022.

Currently, more than 550 mining trucks are equipped with Command for hauling, operating across three continents. Over the last nine years, trucks equipped with Command for hauling have journeyed nearly the average distance between the Earth and Mars with zero lost-time injuries.

Caterpillar has enabled 13 customers at 23 different locations to succeed with full site autonomous haulage solutions.

Since the first autonomous trucks began operating in 2013 at Fortescue Mining's Solomon iron ore mines and BHP's Jimblebar iron mine in Australia, the trucks have travelled nearly 200 million km. The number of autonomous trucks in operation has increased by 40% in the last two years

Since 2019, Caterpillar has won eight of nine greenfield autonomy contracts, includingioneer [TE1] Ltd.'s Rhyolite Ridge lithium mine in Nevada.

The growth is continuing; new Cat 789 AC electric drive trucks are replacing BHP's entire haulage fleet at the Escondida copper mine in Peru.

Canadian Mining Journal Staff October 3, 2022

The Pacific Ocean Is Shrinking and Will Form a New Supercontinent, Scientists Say

The Pacific Ocean is shrinking by about an inch every year, and supercomputer simulations predict a new supercontinent called "Amasia" will form.

The Pacific Ocean is shrinking. Every year, it gets about an inch smaller as the tectonic plates that the Americas sit on are pushed westward. Now, thanks to calculations by a supercomputer, scientists say that a new "supercontinent" will eventually emerge due to this process: Amasia.

The current world map, with its recognizable pattern of continents and oceans, is just one snapshot of our planet in time. Earth has tried on all kinds of continental configurations over its 4.5-billion-year lifespan, including periods where almost all of Earth's land consolidates into one giant supercontinent.

We currently live in the broken remains of the supercontinent Pangaea, which formed 335 million years ago and disintegrated during the rise of the dinosaurs. The existence of even older supercontinents, such as Rodinia and Columbia (Nuna), suggest that Earth is locked into a "supercontinent cycle" that sees the formation and destruction of these immense landmasses on a rough timeline of 600 million years. The cycle raises the question of what kind of new supercontinent might emerge millions of years from now, prompting scientists to propose future landmasses with names like Novopangaea, Aurica, and Amasia.

To shed light on this mystery, researchers led by Chuan Huang, a geophysicist at Curtin University in Australia, simulated the future of Earth with a supercomputer. The results suggest that a new supercontinent, Amasia, will form when the Pacific Ocean shrinks into nothingness some 200 million years from now, causing North America to slam into Asia, according to a recent study published in *National Science Review*.

The future emergence of Amasia, a portmanteau of America and Asia, has been discussed by scientists for more than a decade, but there is debate over whether this supercontinent would form "inside in," a process known as introversion, or "outside in," which is called extroversion. Introversion involves the closure of younger post-Pangaea oceans, such as the Indian or Atlantic, whereas extroversion indicates the closure of the Pacific Ocean, which is the oldest ocean on Earth and is shrinking at a rate of about one inch per year.

"Earth's known supercontinents are believed to have formed in vastly different ways, with two endmembers being introversion and extroversion," said Huang and his colleagues in the study. "The former involves the closure of the internal oceans formed during the break-up of the previous supercontinent, whereas the latter involves the closure of the previous external superocean."

"With our modelling results, we speculate if the next supercontinent will likely assemble through the closure of the Pacific Ocean," which would be extroversion, "or the Indo-Atlantic oceans," which would be introversion, the team added.

(Continued on Page 26)



MEAI- ALL INDIA GEOLOGIST'S CONFERENCE MEGECON 2022

Date: 20th and 21st December, 2022



Organized by
Mining Engineers' Association of India
BALLARI – HOSAPETE CHAPTER

BACKDROP OF THE CONFERENCE

MEAI-All India Geologist's Conference(MEGECON-22) is being organized to gather all the eminent geologists across our country to learn, discuss thoughts, and share ideas, recent innovations etc. in the field of geology associated with the mining industry in India. The benefits of attending the conference are different for everyone. However, the prime purpose of this conference is to expand our knowledge of geology by discussing it with the subject experts.

We need to converge with ideas, datasets, and resource potential of various aspects. Aligning well with the notion, "All India Geologist's Conference" is planned with high hopes of opening up new horizons for the torch-bearers in the field of Geology.

CONFERENCE THEMES

1. Latest advancement in exploration process.
2. Need of digital solutions for resource modeling & preparation of mining plans.
3. Mineral economics.
4. Recent amendments in minerals laws & its implications.
5. National Mineral Exploration Trust & its impact on Indian exploration scenario.
6. Need of adopting International exploration standards.
7. International reporting system of mineral reserves.
8. Auction & its implications on Indian Mining.

CALL FOR PAPERS

Papers are invited from industry professionals, experts in geology and allied subjects' practitioners, researchers, scientific & educational institutions, R&D organizations, companies involved in exploration, digital solutions etc. Authors are requested to send the papers of not more than 08 pages in the format of journal published by MEAI in soft copy (font size: 10, Calibri). The proceedings of the conference will be brought out through 'Digital Souvenir' (soft copy) containing messages and technical papers which will be presented in the conference. Advertisements are also invited from mining organizations, consultants, service & equipment providers etc. to publish in the Souvenir.

The authors are requested to send the title and abstract on or before 05.11.2022 to e-mail: meaihconference@gmail.com

The accepted papers are to be submitted in word format on or before 15.11.2022. Papers received after the due date will not be accepted.

SPECIAL NOTE

Felicitation for the Senior Geologists (Should have MEAI membership & above 80 years age) recognizing their contribution to the Indian Mining Industry is planned in this conference. The members are requested to share the details of such geologists to this email ID "meaihconference@gmail.com".

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“OPHIOLITE” - THE TARGETING GREEN-FIELD AREAS FOR NEW DEPOSITS IN INDIA WITH IMPETUS TO NORTH EASTERN REGION.

Somnath Bhattacharyya

Abstract

In India, bulk of the valuable minerals are mainly associated with three broad belts of metamorphic and igneous rocks of the peninsular region and are being explored for ages. The green-field areas in terms of the targeting of new deposits are in ophiolite belts in Indus-Tsangpo suture zones. Major Ophiolite belts of the Indian are emplaced along the western, northern and eastern margins of the Indian plate and within mountain belts of the Himalayas and its extension area. The pericontinental ophiolite suites of rocks in India have been proved to be potential sites for a) exploration of various metallic deposits like copper sulphides, cobalt-nickel-chromium bearing magnetite, podiform chromite etc. and b) favorable locales for occurrences of precious metals like PGE, micro-diamonds and gold. The ophiolite belt in NE India recorded occurrences of podiform chromite along with traces of nickel, cobalt, gold, platinum group of elements (PGE), copper-molybdenum sulfides. With upgradation of infrastructure facilities in NE India and other remote places of the country the areas exposing ophiolite suite call for detailed investigation both from government and private/young free-lance enterprising young talents.

Keywords: Green-field areas, Pericontinental, Ophiolites, N.E Region

Introduction

Several mining companies and geologists expressed widespread interest in certain mineral commodities and types of ore deposits that are known to be associated with ophiolites (mostly mafic and ultramafic) in USA, Canada and western countries. Ophiolites have been proved potential sites for exploration of various metallic deposits like copper sulphides, cobalt-nickel-chromium bearing magnetite, podiform chromite etc. and constitute favorable locales for occurrences of precious metals like PGE and gold etc. (Peterson 1984). Minerals are amongst the most important natural resources that dictate the industrial and economic development of a country. Sustainable mineral resources and wisdom in utilizing those resources properly have played, and are still playing a vital role in shaping the modern civilized industrial world. It has been well recognised that continental lithosphere and tectonic settings are broadly controlling factors for distribution of mineral deposits. The geo-diversity of India is as varied as most other aspects of the country. India's tumultuous geological past is recorded in rocks and terrains, and some may be categorised as our non-cultural heritage. In this paper, a recount of economic mineral resources associated with ophiolite and perspective area is presented.

Mining and major mineral provinces

India is endowed with huge resources of many metallic and

non-metallic minerals and home to nearly 1,531 operating mines (Mining/Make in India 2022). The GDP contribution of the mining industry varies from 2.2% to 2.5 % only but going by the GDP of the total industrial sector it contributes around 10% to 11%.

Understanding ophiolites

The name ophiolite means “snakestone” from “ophio” (snake) and “lithos” (stone) in Greek. The rock sequence is named for the brilliant green, snake-like serpentine minerals, which form in altered oceanic crust and upper mantle that is uplifted and are associated with continental mass. The ophiolite concept, first developed from European Alps in the early nineteenth century, went through several phases of evolution and irreconcilable conflict on the basis of evolution of geochemical-petrologic and structural-stratigraphic evidences, leading to the *ophiolite conundrum* (Moores, et al 2000). The conundrum was attempted to be resolved initially in *Steinmann trinity* (1905) and later at first *Penrose Conference on ophiolites* in 1972. Penrose ophiolite sequence was defined to have a layer-cake pseudostratigraphy and ophiolite–oceanic crust analogy was confirmed (Anonymous (1998). However, various views expressed significant changes in the mode and nature of emplacement of ophiolite and indicated that ophiolites form in a variety of tectonic environments including the Himalayas, Alps etc.

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Ophiolite- contribution to society

Y. Dilek (2014.) had written, “Ophiolites have been indispensable for human cultures and civilizations because of the wealth of mineral and ore deposits they host. The precious metals like gold, silver, and platinum-group elements (PGEs), the ferrous metals chromium, manganese, and titanium, and the base metals cobalt, copper, and nickel occur widely in the ultramafic-mafic components of Ophiolite suite. The discovery of copper in the Troodos ophiolite contributed to the existence of the Bronze Age (~2400 BC) and triggered a critical era in human history during which the use of bronze brought about drastic changes in farming, hunting, and warfare. Nonmetallic chrysotile asbestos was widely used as an effective insulator because of its resistance to fire, heat, and electrical damage but this had to suffer a change when asbestos was recognized as a human carcinogen. Jade is an important gemstone and occupies a special place in Asian cultures, where it is valued as a precious ornamental stone and is used in the finest art objects.”

Major loci of ophiolite in world and associated mineral deposits

The ophiolite distribution in the world has been broadly categorized in a) Asia-Pacific b) North American Cordillera c) Mexico and Caribbean d) Andes e) Brazil f) Eastern North America g) Mediterranean and Peri-Arabian areas h) Tibetan etc. (Wikipedia, 2022) The Tethyan ophiolites stretching from western Europe to India and China represent multiple suture zones within the Alpine, Mediterranean and Himalayan-Tibetan orogenic belts. Several ophiolitic slivers are exposed in several locations from Spain through the Alps, Turkey, Iran, Oman, Pakistan, India, Tibet, Burma and Indonesia (Jonnalagadda, et al 2022).

The Semail ophiolite in the Oman Mountains is the world's largest and best preserved thrust sheet of oceanic crust and upper mantle emplaced onto the Arabian continental margin during the late Cretaceous (~95 million years ago) (Coleman 1981). Another widely studied is Troodos Ophiolite hosting over 90 ‘black smoker’ copper rich mineral deposits from Mediterranean island of Cyprus (from which copper is named), a UNESCO designated “Geopark”.

The Semail ophiolite contains a large number of podiform-type chromitite bodies. with the moderate PGE-mineralisation. In the Central and Southern Batinah coastal area lower volcanic rocks in Semail Ophiolite sequence are hosts of VHMS mineralization (Yadav 2016). Since ancient time these ophiolites have been sources of Cu, which were reported to be supplied to Samirians and Roman Empire (Yadav op.cit.). Widespread weathering of the exposed surface of the Semail

ophiolite in early Tertiary time produced extensive laterites that are rich in Fe, Ni, and Cr (Coleman 1981).

The Troodos ophiolites on the Mediterranean island of Cyprus are associated with the massive sulphides, chromite and asbestos mineral deposits. Cyprus was famous in antiquity for its copper resources. In fact the very word *copperis* derived from the Greek name for the island, *Kypros*. Cyprus is regarded as one of the most ancient sources of asbestos. The usage of asbestos was found quickly, utilising its natural properties, particularly during the Classical and Roman periods, when it was used for the manufacturing of shrouds for the cremation of the dead, shoes, and wicks for lamps. The Troodos ophiolite of Cyprus hosts chromite deposits both as podiform bodies and as schlieren within the ultramafic and mafic rocks.

Reports of micro-diamonds and UHP (Under high Pressure minerals) in ophiolitic chromitites were received with much skepticism. However findings of microdiamonds in chromitites of different ophiolites with different ages around the world (Tibet, Russian Urals, Myanmar, etc. have shown that these microdiamonds widely exist in ophiolitic peridotites and chromitites (Dilek et al. 2019).

Ophiolite belts in India

In India bulk of the valuable minerals are mainly associated with three broad belts of metamorphic and igneous rocks of the peninsular region, viz a) North-Eastern Plateau Region covering Chotanagpur (Jharkhand), Odisha Plateau, W. Bengal and parts of Chhattisgarh b) South-Western Plateau Region extending over Karnataka, Goa and contiguous Tamil Nadu uplands and Kerala c) North-Western Region extends along Aravali in Rajasthan and part of Gujarat. There are definitely occurrences of mineral assets of economic importance in isolated pockets in parts of the country. But in consonance with demand for further resources *the green-field areas in terms of the targeting of new deposits are ophiolites, mainly nestled in the Indus-Tsangpo suture zones along which Indian plate collided with Eurasian plate in formation of Himalayan mountain.* Major ophiolite belts are : a) Shyok ophiolite exposed in Shyok and Nubra valleys, Ladakh, NW India b) Indus ophiolite belt exposed in the Indus valley of Ladakh, NW India c) Nagaland – Manipur ophiolite, exposed in the Indo-Burma (Myanmar) Range, NE India (Tripathi,1989). Far away from the Indian mainland, Andaman-Nicobar islands expose ophiolite, representing the locale of probable merge of suture zones of Indo-Eurasian plate with an oceanic subduction system along the Andaman–Sumatra–Java (ASZ).

Ophiolites from Ladakh area - The ophiolite from mainly Shyok and Nidar valleys, forming part of the NW and SE

of Indus Suture Zone in eastern Ladakh, displays the classical ophiolite sequence. The ultramafic unit consists of dunite and peridotites (Das, et al. 2015). Nearly a meter thick chromitites vein consisting of thin parallel layers is present within the basal dunite (Sachan et al. 2003 & 2007). Deep weathering of ophiolitic rocks often has resulted in formation of thin blanket Ni-laterite at places (Tripathi. op.cit.). The occurrences of copper mineralisation have been recorded from Shyok ophiolite area. In Indus Suture Zone disseminated chalcopyrite and native copper occur in the Dras volcanic, which maintain probable geological relation with adjacent ophiolites.

Ophiolites from Andaman–Nicobar area - Andaman–Nicobar group of islands form an arcuate chain extending for about 850 km. The Andaman Ophiolite Belt is considered to mark the southern extension of the Nagaland-Manipur and the Burmese Arakan Yoma Belt, which is the easternmost continuation of the Tethyan Belt (Ghosh et. al 2017). The Andaman Ophiolite Belt belongs to a region of distinct structural and topographical belt that trends north–south and then curves eastward from Sumatra towards Java (Vohra et. al 1989). The earliest recorded evidence of the search for economic minerals can be traced back to Mallet (1884) who documented Cu-, Fe-, Cr- and Pt-bearing rocks on South Andaman and Rutland islands (Bandopadhyay et. al. 2017). Post-independence investigations by GSI, ONGC etc. identified occurrences of magnetite, chromite, nickel, gold and sulphides, platinum group of elements (PGE), coal, gypsum and limestone in ophiolite and associated rocks (Bandopadhyay et. al. op.cit.). Scattered Chromites with Cr₂O₃ ranges from 49.50 to 55.50 wt% and high-Mg rocks (MgO 26.92 to 28.43 wt %.) have been recorded (Bandopadhyay et. al. op.cit.). So far prospecting for PGE in chromite bodies have revealed PGE values with sub-economic concentration (Ru , 10–56 ppb, Ir , 10–12 ppb, Rh , 10 ppb, Pd , 10–136 ppb and Pt , 10–28 ppb) (Pal et al. 2003). Ultramafic plutonic rocks such as dunite and peridotite contain 200–400 ppm of nickel on average, while nickel content in the serpentinite varies between 2000 and 3000 ppm. Occasionally the altered serpentinite immediately below the soil profile contains 4000–5000 ppm nickel. Average nickel content in grey brown soils rarely exceeds 100 ppm, but in lateritic soil it ranges between 1000 and 5000 ppm with an average of c. 2500–3000 ppm. (Bandopadhyay et al. op.cit.). Systematic investigation of base metal mineralisation from basalts, sometimes pillowed, may reveal above the occurrence level. A few and very much localised samples from the silicified gossan zone over the pillow basalts yielded gold values as high as 1.97 ppm (Bandopadhyay et al. op.cit.).

Ophiolites from Nagaland and Manipur area - Highly disrupted and deformed slices of ophiolitic rocks occurring along a linear belt in Nagaland and Manipur states, NE India, are known as the Nagaland-Manipur Hills Ophiolites (NMHO). The NMHO forms a part of the Indo-Myanmar Ranges (IMR) comprising the Naga Hills, Chin and Arakan Yoma (Rengma.K et al. 2021). The ophiolite belt extends for about 200 km from Pang (Nagaland) in the north to Moreh (Manipur) in the south with width ranging from 5 to 16 km. The part of the ophiolite belt within Nagaland extends for about 90 km and is a tectonically accreted, dismembered complex encompassing of various lithounits which includes dunite, harzburgite, lherzolite, pyroxenite and mafic volcanic rocks and meta-sedimentary rocks of oceanic environment (Fareeduddin et al. 2015). Two distinct metallogenic episodes have been established in the ophiolite belt, viz., (i) syngenetic deposit of podiform chromite containing traces of nickel, cobalt, gold, platinum group of elements (PGE) in cumulate peridotite and serpentinite and native gold in olivine gabbros of layered cumulates at places (ii) deposits of epigenetic (syn-to late-orogenic) remobilized disseminated and vein-type copper-molybdenum sulfides associated with mafic volcanic (Agrawal and Ghose 1989). A number of small dimensions of chromitite pods, lenses and streaks occur within the NHO peridotites (dunite and harzburgite) and serpentinites. The chromite-bearing bodies are classified into massive, granular, disseminated and nodular types (Ghose and Shrivastava 1986). Probable potential and workable chromite-bearing rocks are confined to the Manipur sector in the south, viz. Sirohi, Moreh, Gamnom and Kwatha. Thin, isolated and scattered laterite cappings are developed at favourable physiographic sites over serpentinitised peridotites and the cumulate ultramafics. They are rich in goethite or garnierite with high Ni abundances (Ghosh and Goswami 1986). Nickel (Ni) - cobalt (Co) - chromium (Cr) - bearing magnetite deposit associated with Naga Ophiolite Belt is a rare type of occurrence (Rengma et al. 2021). The main deposit, popularly known as the Phokpur magnetite deposit, occurs at eastern-most part of Nagaland. It is located at the Matungse Kein Hill, about 4 km east of Phokpur village in Kiphire district of Nagaland. Phokpur The chemical analysis of Phokpur magnetite indicated iron content ranging from 40.51 to 55.95% and nickel and chromium in the magnetite band of 0.14 to 0.91 % and 1.33 to 3.79 % respectively. Small concentration of cobalt (0.008 to 0.14) has also been reported in the magnetite samples (Rengma. et al. op.cit.). It is worth mentioning that National Metallurgical Laboratory, Jamshedpur and the Directorate of Geology and Mining, Govt. of Nagaland, jointly took the responsibility of investigating the multi-metallic deposit

of Phokpur, Nagaland with a view to extract the valuable metals from this ore body in the product of 'Special Iron Alloy'. This technology of special iron alloy production has been developed under a National project entitled "Pilot scale smelting and pre-feasibility studies on Nickel-Chromium-Cobalt bearing magnetite ores from Nagaland". The project has been completed and ready for commercialization in small/medium scale (7.5 MVA/10 MVA) Submerged Arc Furnace commercial plant which is likely to bring several benefits to the state of Nagaland and the Country as India depends on import for nickel and cobalt (Rengma, et al. op.cit.). Nayak et al. (2017) reported manganilmenite (Mn-ilmenite) from the Pokphur magnetite body. Manganilmenite is usually not a standard diamond indicator mineral but Tompkins et al. (1985) and Kaminsky et al. (2001) recommended that it be included in the list of diamond indicator minerals. Over the last three decades, there have been a number of reports of diamonds in ophiolitic peridotites. Ophiolites are a newly documented host of diamonds on the Earth, and abundant diamonds have been separated from peridotites and chromitites of ophiolites in China, Myanmar and Russia. Diamond grains have been recently discovered in chromitite from the Cretaceous Luobusa ophiolite, Tibet and also from Myitkyina ophiolite, Myanmar. Business Standard, (published on January 18, 2017) mentioned research work by Nayak et al and highlighted occurrence of "microdiamonds" from part of Pokphur magnetite body. Occurrence of native gold and gold-silver alloy formed in high-temperature olivine gabbro of a layered cumulate body is reported 2 km northwest of Sutsu, distt. Phek (Ghose 2014). Nagaland and Manipur have enormous limestone resource nesting in the Ophiolite, and from associated Naga Metamorphic Complex and Tertiary sequence and will provide raw materials to cement, metallurgical and chemical industries etc. Serpentinites (Green Marble), meta-volcanics, major units of ophiolite suite can be contributor as have a huge market potential, both as finished products and in raw forms.

Ophiolites from Arunachal Pradesh area The ophiolite assemblage around Mayodia, Dibang Valley district, Arunachal Pradesh falls in the eastern extension of the Indus suture belt and is represented by peridotite tectonite, hornblendite (dyke) and amphibolites. The entire succession is overlain by metabasalt carapace interlayered with metapelitic pelagic sedimentary rocks (Ghosh et al 2007).

Conclusion

Indian pericontinental ophiolite suites of rocks were emplaced along the western, northern and eastern margins of the Indian plate within mountain belts of the Himalayas

and in extension area. In discussion about possible mineral potentiality from ophiolites of NE Region, the Nickel (Ni)-cobalt (Co)-chromium (Cr)-bearing magnetite ('Special Iron Alloy') deposit associated with Naga Ophiolite Belt is a rare type of occurrence (Rengma, K. et al. op.cit.). IBM in Monograph on Chromite (2013) indicated that Manipur has 6.66 MT (3% of total chromite reserves in India) chromite resources of ophiolite belt in Ukhrul (5.5 MT) and Chandel (1.1 MT) districts. The ore is high grade with Cr₂O₃ (chromium oxide) content varying from 44% to 59%. Limestone of various dimensions are located in different geological milieu of mafic unit and mélange zone associated with ophiolite and also in associated Nimi and Disang along western and eastern tectonic of NMHO. Ministry of Mines, Govt. of India in the report (2021) informed about G4 and G3 stage of exploration by GSI in parts of Nagaland-Manipur Hills Ophiolite Suites to assess the Cr, Co, Ni, V, and base metals potentials along with PGE. The Government of India also announced the execution of several rail, road and air connectivity projects worth several crores in the northeast, Andaman-Nicobar Island and remote areas in Himalayan region of the country. With these facilities, there is vast possibility of locating more and more mineral deposits/occurrences and to add to huge resources of many metallic and non-metallic minerals of the country. With upgradation of infrastructure facilities remote places of the country especially in NE India, these areas call for detailed investigation both from government and private/young free-lance enterprising young talents to add to mineral resources of the country.

It may not be out of context to mention that Pre-Cambrian greenstone belts appear to include various units of ophiolite suite (Furnes, et al, 2013). The greenstone sequence in India like from Iron Ore Group and Sargur sequences, Bastar, Hutti, and Gadwal sequences, Phulad and Daba/Kui may be explored as part of ophiolite sequence.

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DIGITIZATION IN MINING – ANALYSIS OF WORK DONE, AND FUTURE WORK REQUIRED FROM TATA STEEL PERSPECTIVE

Piyush Srivastava

Abstract

Digitization in mining is being addressed today by various terms as “Mining 4.0”, “digital transformation”, or “Smart Mining” to ensure mining operations to be more efficient, productive, safer, and sustainable. Use of Information technology, Data Analytics, Artificial Intelligence and Machine Learning have provided modern miners competitive advantage in the mining industry. Digitalization in mining is focused at making mining better in terms of lower operating costs, optimization, more actual yield in compliance with plans, improved safety standards and a higher regulatory compliance. Linking automation, robotics, and operational software and hardware with integrated enterprise platforms and ecosystems have leveraged mining processes and techniques like drone-based survey, Mine planning and scheduling simulation models, Fleet Management System etc. Regulatory Changes and increased use of technology by statutory authorities for mine monitoring is forcing the mine management to adopt technology for higher visibility, productivity and compliance. In this journey of digitization Tata Steel has taken many initiatives in automation and digitization of its mines and beneficiation plants as well as logistics. With improved bandwidth of Internet for digital communication & data transfer Tata Steel has implemented IT systems for safety through e-permits, Suraksha Card, video-analytics, online safety management system. Automated Sampling & Analysis system has integrated the sample data with the laboratory data and its online transmission to customers. In the last 12 months, Tata steel has deployed 1. Digital Mapping of Mines using drone technology and GIS software-based Mapping. 2. Creating a dedicated cloud-based platform for storage and secured access of the output obtained from photogrammetry and other GIS based software such as geo-referenced land use maps, orthomosaic, Digital Elevation Model, 3-Dimensional mine view, volume survey reports, haul road analytics, mine/dump slopes, etc. 4. Use of Artificial Intelligence enabled applications for analysing and using the voluminous data captured by the Fleet Management System. 5. Integrating use of photogrammetry software used for drone data processing and resource modelling software. 6. Using drones for face mapping as input to understand distribution of cleats, faults, weak planes for use in geo-technical analysis using Numerical Modelling software and many others. As a way forward Tata Steel is planning parallel deployment of various digital technologies to all the remaining mines of Tata Steel and offer these services in the market on commercial basis, to use drones with high resolution camera along with laser sensors for ground mapping at any point of the day, and use of virtual reality modelling/ simulations to visualize current/future mine state using the point cloud data & 3 model obtained from drone survey.

Abbreviations: MoEF- Ministry of Environment and Forests, MoM- Ministry of Mines. MoC- Ministry of Coal, IBM- Indian Bureau of Mines, MCDR – Mineral Conservation and Development Rules, DTM/DEM- Digital Terrain Model/Digital Elevation Model, AI- Artificial intelligence, ML- Machine Learning, IT- Information Technology, FMS-Fleet Management System. GIS- Global Positioning System, RGB-Red, Green, Blue. LIDAR- Light Detection and Ranging (in remote sensing), CAD- Computer aided design. LAN/WAN- Local Area Network/Wide Area Network. TSIC- Tata Steel Industrial Consulting. IOT- Internet of Things. OFC- Optical Fibre Cables. HEMM- Heavy Earth Moving Machinery.

Keywords: Digitization, Mining, Automation, ArcGIS, Sustainable, Compliance, Safety, Operation, Quality, Simulation, Decision Matrix, Digital, Technology, Mine, Scheduling, Beneficiation, Productivity.

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1. Introduction

Digitization in mining is being addressed today by various terms as “Mining 4.0”, “digital transformation”, “Smart Mining” etc. Although these terms have different connotations, they all aim towards making our mines more efficient, productive, safer and sustainable.

Competitive advantage in mining industry does not come only from the ownership of geological resources and its quality & mining attractiveness but also the ability of the company to exploit its resources using immaculate and sustainable mine planning, use of digital means for mine monitoring for increased productivity, operational efficiency & safety, use of digital means to measure higher compliance to plan and use of automation to reduce the man machine interface to a bare minimum. Integrating the mining capability with beneficiation capability and efficient mineral transportation capability is also the key to sustainable development and this is also an area which can best be addressed through careful planning. An integrated supply chain monitoring from operations to beneficiation to stacking and transport to customers requires digital means to have visibility across operating verticals for proper monitoring and control.

Those companies that are using digital means to deliver best in class productivity, efficiency and mining techniques have made the difference between the very best performers and the rest. Digital technologies also help the mid-size mining companies to remain competitive.



Source: World Economic Forum / Accenture analysis

Fig-1: Impact of industry trends on the Mining and Metals industry (courtesy- <https://reports.weforum.org/>)

2. Advantages of Digitization in Mines

Digitalization in mining is focused at making mining better than before. And “better” really means lower operating costs, more actual yield in compliance with plans, improved safety standards and a higher regulatory compliance. Digital means provide visibility and integration across many mining verticals and which helps in taking decisions in real time. This integration and visibility are the key to higher efficiency and productivity. As an example, consider plant yield and

mining cost, which may be at crossroads with each other. If there are proper tools to provide visibility and decision matrix, then it may be worthwhile to improve plant yield at the cost of higher mining cost by feeding a particular kind of ore mix at the cost of lower equipment efficiency.

The data thrown up by digital means need to be analysed and understood using AI tools or some deep analytical tools to understand the interdependency and create decision matrix algorithms. Even in the simplest form, the creation of visibility and remote control helps greatly to take decisions that are optimum for the integrated supply chain.

What digitalization also delivers is automation of common manual tasks, some of which are very slow. Digitalization works to identify and eliminate inefficiency such that the mine is always able to perform at its best. Common problems such as inaccurate task allocations, misplaced equipment, inaccurate data, delayed communication and more, are taken care of by a central system in a digitized mine.

Although there are non-digitized systems which can take care of these common problems, where digitalization really shines is in its ability to provide the right information to the right people at the right time (actually, in real-time) – without anyone even making an effort.

This may sound very simple, but in an industry that is centuries old, and which is facing some of the most difficult economic challenges, digitalization in mining is proving to be an indispensable tool to keeping costs low, profits high, and decisions strategic.

Some of the major advantages of digitization in mines are:

- Higher Mine Safety
- Sustainable Mining through better mine planning and Mineral Resource Visibility
- Data from digitization will help in developing targeted Strategies
- Providing visualization and decision matrix tools to predict failure
- Optimize Scheduling and material flow
- Improve Beneficiation Plant capability through online monitoring of quality data
- Improving Productivity through remote control and reducing man-machine interface.
- Improving productivity through real time monitoring of equipment, plant and operator performance.
- Helping to improve sweating of capital-intensive mining equipment by improving maintenance / operating parameters to increase operating hours as well as productivity

- Improving Statutory Compliances through accurate land use plan, visibility about restricted areas, visibility about actual mine footprint against plan on real time basis and remote monitoring of mine through accurate 3D models.



Fig-2: Benefits of Digital Transformation in Mining and Metals (courtesy-<https://www.veritis.com/>)

3. Components of Mine Digitization

There are many technologies that are being used for improving mine digitization that can help in remote control of mine for higher productivity, efficiency, safety and sustainable development. Some of these technologies are described below:

- Automation, robotics and operational hardware.** Deploying digitally enabled hardware tools to perform or improve activities that have traditionally been carried out manually or with human-controlled machinery. Key initiatives in scope are sensors, videos, video analytics, robots and 3D printing
- Digitally enabled workforce.** Using connected mobility, and virtual and augmented reality to empower field, remote and centralized workers in real time. Key initiatives in scope are connected workers and remote operating centres.
- Integrated enterprise, platforms and ecosystems.** Linking operations, IT layers and devices or systems that are currently separate. Key initiatives in scope are information technology (IT) and operational technology (OT) integration, asset cybersecurity and integrated sourcing, data exchange and commerce. Secure cloud services for easy data storage and accessibility across locations goes a long way in making timely decisions.
- Next-generation analytics and decision support.** Leveraging algorithms and artificial intelligence to process data from sources within and beyond the traditional value chain to provide real-time decision support and future projections. Key initiatives in scope are advanced analytics, simulation modelling and artificial intelligence
- Integrated Mine Planning** through visualization of resources through a 3D geological model and its periodic correction with actual field data, quality and

production scheduling as per plant capacity and customer requirement using mine modelling software and automated sample collection, preparation and analysis from mine as well as various flow junctions in the beneficiation plant so that mining operations and plant performance is integrated for optimum yield and efficient as well sustainable mining.

- Using drone based, laser or high-resolution satellite imagery** along with geo-referencing tools to visualize the mine against the real background and compare the plan vs actual for statutory compliances.

4. Challenges faced by Miners

There is a lack of trust between the mining companies and the local communities, with vested interests adding fuel to the fire. For example, there is delay in getting public hearings, delay in getting *gram-sabha* resolution under Forest Right Act, etc.

There is an increasing awareness about environment protection and sustainable development. There is a definite shift by IBM in seriously looking at non-compliance related to mineral conservation and compliance to mine plan. The Ministry of Coal, IBM, MoEF, and the Forest Department are using digital means to monitor the mine using satellite imagery by superimposing the current land use plan against the real background to compare the plan vs actual. MoEF and Ministry of Mines (MoM) have also issued circulars to encourage mine owners to use drone technology for mine mapping. IBM is constructing a Mine Tenement system at Hyderabad for digital mapping of mines. There is also a greater emphasis on using the low-grade ore through various beneficiation methodology. The Ministry of Mines has issued a draft in Jul '22 inviting comments for making low-grade iron ore utilization almost compulsory for all iron ore mines. Similar regulatory interventions may be expected in future for other mineral commodities. Inspecting a mine remotely through drones and laser scanners to get surface quality is now a reality. Thus, the actual inventory and quality of inventory can be monitored by statutory bodies using digital means. The miners will have to take into account these developments in the interest of mineral conservation.

There is an increasing use of online web-based systems by Government Authorities. This includes online e-way permissions, online weigh bridges, online submission of various statutory applications, submission of digital land use plans for comparing plan vs actual, etc.

The penalties for non-compliance whether in case of forest violation, violation of compliance to statutory mine plan, violation of conditions imposed by Environment Clearance, etc. have become huge especially after the Shah Commission enquiry and cancellation of various coal

blocks as per Hon'ble Supreme Court decision in 2014. The penalties not only include high penal charges but also threat of closure of mines.

The monitoring of metal mines under IBM has matured over the years and compliance to plan from mineral conservation and sustainable development has become a norm rather than exception. The rigor shown by IBM for metal mines is bound to be replicated in coal mines in the next one or two years with the Coal Controller Office under MoC playing a role akin to IBM. Thus, coal mines will have to now make a 5-year statutory mine plan and compliance to the plan will be closely monitored. Revision/Renewal of mine plan will become difficult if there will be gross violation of mineral conservation principles and provisions as per MCDR 2017.

There is an increasing Human Resource challenge of recruiting the right set of skill sets for adapting to the new digital approach to mining and increasing emphasis of mine planning for sustainable development of mine including compliance to plan. The bright mining engineers from the premium institutes are preferring white collar jobs and those from other institutes have almost negligible exposure to using various software used in systematic mine planning and monitoring using digital means.

Adopting digital means can be capital intensive in the beginning as it involves establishing data transfer through strong web-based technologies, use of sensors in plants, equipment and material flow to understand quality, flow rates, load, cycle time, operating parameters, stock levels, etc. Integrating this inflow of digital data requires a platform that can integrate various inputs to generate online reports, warnings, decision support system and also analytical data to analyse failures. Mine Management with a long-term perspective will invest in digital technologies but this is a challenge for mid-sized and small mines as scale of operations does have a bearing on capital cost. This also throws a business opportunity to consulting companies who can provide mine consulting business to small mining enterprises. Tata Steel has started the journey of providing integrated mine technical services through Tata Steel Industrial Consulting (TSIC) in the area of digital mine mapping, drone survey, resource modelling, mine planning, geo-technical services, testing of physico-mechanical properties of rocks/soil and laboratory analysis of samples.

Additionally, from technology perspective, there are 5 main problem areas where further work needs to be done:

- Integration of siloed operating system
- Manual Control to be replaced with higher level of automation
- Providing visualization of not only the flow of material in the plant through automation/PLC controls but also

providing visualization of mine operations in real time through GPS technology and drone technology.

- Online monitoring of quality and flow rates through online analysers, auto samplers and flow meters/weightometers not just in pockets but also in totality including real time inventory monitoring.
- The change management of making the old guards start using the various software and other digital means of monitoring and decision making.

5. Regulatory Changes and Increased use of technology by statutory authorities for mine monitoring

- MoEF, MoC, IBM, etc using more and more digital support systems to see the plan vs actual for statutory compliance.
- IBM is building a Mine Tenement System at Hyderabad that will enable remote monitoring of mines using mobile technology by comparing the plan vs actual and compliance to Environment Clearance, Forest Clearance and Mineral Conservation norms/conditions.
- IBM and MoC in future will ask for digitized mine plans and not just .pdf format or hard copy and which will make it easier for them to check statutory compliance by simply comparing the stage plan or land use plan with the actual ground condition.
- MoC is making changes in norms for mine planning in coal mines. Now the Coal Controller Office will play a role akin to IBM in metal mines.

6. Digitization Journey of Tata Steel Mines and the Gap Area to be addressed to making remote control of mining operations a reality

Tata Steel has taken many initiatives in the area of automation and digitization of its mines and beneficiation plants as well as logistics. Some of these initiatives are:

- Improved Bandwidth of LAN/WAN for digital communication & data transfer. With the 5G network round the corner, this should get a further boost.
- IT in mine safety through e-permits, Suraksha Card, video-analytics, online safety management system, online safety management plan, etc. Most of these systems have been implemented but, in some areas, horizontal deployment is in the advanced stage of implementation.
- Digital Data Capturing and Integrated Online Reports for production, Quality as well as Safety. Online generation of reports containing production, quality and key KPIs is helping in monitoring performance. The DNeWs (is an internal Automated Sampling & Analysis Reporting System of Tata Steel) system has integrated the sample data with the laboratory data and its online transmission to customers.

- Automation / Sensorization of plant equipment and mining equipment for automatic capturing of data using IOT or digital data transmission using OFC. The degree of progress of these activities which aim for improving maintenance varies from place to place but the uniform implementation across mines is being taken up as a focussed approach.
- Centralized monitoring of operations of plant and mine
- Fleet Management System for real time capturing of mine equipment performance and operator performance.
- Remote controlled belts, pumps and other beneficiation plant equipment
- Using state of the art auto-samplers for sample collection from belts, automatic coning/quartering, return of unused material back on belt and automatic collection of final samples.
- Integrating use of photogrammetry software used for drone data processing and resource modelling software like MINEX and SURPAC.
- Using drones for face mapping as input to understand distribution of cleats, faults, and weak planes for use in geo-technical analysis using Numerical Modelling FLAC3D software.
- Using orthomosaic background in the FMS to see the dumper movement and other HEMM deployment against the real background for more effective equipment utilization.
- Understanding green cover in reclaimed and other areas.
- Understanding flow of water using contours obtained from drone survey and certain advanced modules of ArcGIS software.

Tata Steel has also started work in the following areas in last 12 months:

- Digital Mapping of Mines using drone technology and ArcGIS software. This is proving to be a great initiative in improving statutory compliance, detection of illegal mining in remote areas, detection of encroachment, providing visualization of land ownership for better implementation of R&R, using features of photogrammetry software to calculate cut & fill volume of proposed haul roads, better planning of haul roads to reduce lead & lift, etc.
 - Digital Mine Surveying using drone and laser technology against the current system of Total Station and AutoCAD.
 - Creating a dedicated cloud-based platform for storage and secured access of the output obtained from photogrammetry and other GIS based software such as geo-referenced land use maps, orthomosaic, DTM/DEM, 3D mine view, volume survey reports, haul road analytics, mine/dump slopes, etc.
 - Automation of sample collection from slurry pipes for better understanding of quality parameters, pulp density and fine particles. This will go a long way in improving the yield from washing plants.
 - Use of AI enabled applications for analysing and using the voluminous data captured by the FMS.
 - Further improving use of automatic online analysers for real time capturing of key quality parameters such as alumina in case of iron ore and ash in case of coal.
 - Integration of control rooms across functions within a location and then across locations (this may be done in phases over next 3 years).
- 7. Way Forward**
- Tata Steel has taken a number of steps to automate its operations and use digital technologies for improving information flow, data transparency and decision making. These initiatives have helped in improving efficiency, productivity and safety. Efforts are on in the following areas:
- Parallel deployment of various digital technologies to all the remaining mines of Tata Steel and also offer these services in the market on a commercial basis.
 - Use of AI and ML to make sense of hoard of data captured online by various sensors and instrumentation in another area where work needs to be done.
 - An area of interest is the visibility of the mine in almost real time (or shorter interval of time) using drones and other GIS technologies.
 - Improving the speed of processing using offline workstation based or cloud-based photogrammetry software from current 5 days to less than 3 days.
 - Integrating output of photogrammetry software with mine resource modelling software is already being implemented.
 - We are also working with a vendor to give a more immersive visualization of mine.
 - There are numerous other engineering applications of drone technology that can also be implemented in near future such as using drones to analyse blast quality, collection of air samples just after blasting, collection of water samples, etc. Similar solutions have been implemented in other areas.
 - Using drones with both LIDAR and RGB cameras for ground mapping at any point of the day.
 - Providing visibility to front line persons like overman and Asst. Manager to get a 3D view of the mine as well as planned vs actual shape of dumps and slopes using

a host of software residing in mobile or tabs that can pull the data from the cloud.

- Use of virtual reality modelling (e.g. Visualizing an overland conveyor against real mine background) and simulations to visualize current/future mine state using the point cloud data obtained from drone survey.
- Training green stick freshers in area of mining engineering, surveying and geo-informatics to use host of software used for digital mine mapping. This is one area where availability of talent in the market is negligible.

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(Continued from Page 13)

As Huang and his colleagues ran their supercomputer simulations, they noticed the strength of the lithosphere, the stiff top layer of Earth that encompasses the crust and surface, is an overlooked variable in the emergence of the next supercontinent. The oceanic lithosphere has been weakening over time as a result of Earth’s slow cooling, a shift that clearly predicts the rise of Amasia from extroversion, or the closure of the Pacific Ocean.

“Our results show that the yield strength of the oceanic lithosphere plays a critical role in determining the assembly path of a supercontinent,” the researchers said. “We found that high oceanic lithospheric strength leads to introversion assembly, whereas lower strength leads to extroversion assembly.”

“This predicts that the next supercontinent Amasia could only be assembled through the closure of the Pacific Ocean,” the team concluded.

In this way, the new study offers a glimpse of our planet some 200 to 300 million years from now, when an enormous landmass could unite over the ashes of the long-lived Pacific Ocean. It’s a reminder that humanity has existed for a mere split-second in geological time, and that our planet in the deep past and far future may as well be an alien world.

“Earth as we know it will be drastically different when Amasia forms,” said Zheng-Xiang Li, a professor

at Curtin’s Earth Dynamics Research Group who co-authored the study, in a statement. “The sea level is expected to be lower, and the vast interior of the supercontinent will be very arid with high daily temperature ranges.”

“Currently, Earth consists of seven continents with widely different ecosystems and human cultures, so it would be fascinating to think what the world might look like in 200 to 300 million years’ time,” he concluded.

Becky Ferreira, Motherboard | 05 October 2022

➔ **Visualizing the World’s Largest Iron Ore Producers**

Iron ore comprised roughly 93% of the 2.7 billion tonnes of metals mined in 2021. It is used primarily (98%) to make steel, with the remaining 2% becoming magnets, auto parts, and catalysts. Using data from the U.S. Geological Survey, the above infographic lists the world’s largest iron ore producers in 2021.

Pilbara and Carajás Iron Ore

Iron is the fourth most abundant element on the planet after oxygen, silicon, and aluminum, constituting about 5% of the Earth’s crust. Australia produced 35% of the iron ore mined last year. Almost **90%** of identified iron ore resources in the country occur in Western Australia, especially in the **Pilbara region**.

The large and dry region is known for its Aboriginal peoples and also for its red earth as a result of a chemical reaction of iron exposed to air and water. The three major Pilbara iron ore producers are also among the top mining companies in the world: BHP Group, Rio Tinto Ltd, and Fortescue Metals.

Country	2021 Production (Tonnes)
Australia	900,000,000
Brazil	380,000,000
China	360,000,000
India	240,000,000
Russia	100,000,000
Ukraine	81,000,000
Canada	68,000,000
South Africa	61,000,000
Kazakhstan	64,000,000
Iran	50,000,000

After Australia, Brazil is the second biggest producer, with iron ore accounting for 80% of the country’s mining exports.

(Continued on Page 37)

WOMEN@MINES: DEPLOYMENT OF FEMALE WORKFORCE IN THREE SHIFTS AT NOAMUNDI IRON MINE OF M/S TATA STEEL LIMITED

Sanjit Kumar Adhya ¹, Ritika Chandra ²

Abstract

Tata Steel is the first company in India to deploy women in all shifts in mines; and OMQ (Ore, Mines & Quarries) division became the first division in Tata Steel to deploy women in all shifts with effect from September 1, 2019. In line with the recent modifications in the Law, the Human Resource Management division and the Raw Material division have undertaken an initiative called "Women @ Mines".

Inception

The mining sector has been predominantly considered a patriarchal industry but in the recent times there has been concentrated efforts from both, the industries as well as the government, to make the workforce more inclusive, thereby tweaking the policies and schemes to be more gender inclusive. The participation and inclusion of women in Mining has been slow compared to other industries. The government reforms exempting women employed in mines from Section 46 of the Mines Act, 1952, have opened up new possibilities and broadened the horizon for women in mining as well as for employers. Tata Steel is known for its pioneering initiatives and gender inclusive norms and policies. The journey to inclusivity began decades back with the introduction of several policies meant exclusively for the welfare of the company's women employees like the first maternity benefit scheme and many other initiatives, which ushered in a sweeping change in India's approach to labour welfare. Project Tejaswini was a programme undertaken by the company in 2002 to focus on its female workforce with an aim to reskill and retain the women mazdoors, wherein intensive training was imparted to the women employees on various technical skill sets to operate heavy equipment such as EOT cranes. Thus, what started as an experiment gradually turned out to be a phenomenal success.

Tata Steel has a target of 25% diverse workforce by FY'25 and is working aggressively towards improving the participation of women in core operations through various recruitment and upskilling strategies.

Phase I: Women @ Mines Initiative- Deployment of female workforce in three shifts at Noamundi Iron Mine

Step 1: Ideation and Buy-In from Union

An ideation session for 'Women@Mines' initiative was held at the senior management level wherein a roadmap was drawn

for deployment of women in all shifts at Noamundi Iron Mine. A structured plan towards a gender – neutral administration was made and recruitment of female officers from various backgrounds like mining, electrical engineering, mechanical engineering, and mineral processing was done to make the initiative a success.

At Tata Steel, following the ideology of Joint Consultations-Working Together. Communication sessions with the Union Committee Members was done through various forums wherein the union members along with members from the management were communicated about the Women@ Mines initiative and the company's aspiration to deploy women in all three shifts.

Step 2: Communication to the female employees

After getting the buy-in from the union, a D&I (Diversity and Inclusion) sub-committee including Management and Union was constituted for Noamundi and was made functional under the chairmanship of the Agent of Mines of Noamundi Iron Mines.

Communication regarding the amendment of Mines Act, 1952, DGMS guidelines, amenities, conveyance facilities, plan for security, safety, occupational health and POSH was done to women employees in a phased manner with the help of top management, union officials and the D&I Sub-Committee. The doubts and apprehensions were addressed, and the female employees were motivated to come forward and make the most of this opportunity. Communication regarding the initiative was done to business partners in order to deploy women in security, canteens and sanitation as well. Though the notification specifies that deployment will be done in not less than 3 women per shift, our internal target was to have at least 10 women in the shift. Written consent from each

¹ Head (Operations), Noamundi Iron Mine, M/s Tata Steel Limited

² Senior Manager HRBP, Noamundi Iron Mine, M/s Tata Steel Limited

National Seminar & Exhibition "Role of Innovations & Technology in turn around Mining Industry" Aug.26-28, 2022

woman employee was obtained prior to deployment in all three shifts. Communication sessions with male employees were conducted in all shifts regarding the amendment of Mines Act, 1952, creating an inclusive work culture for women, gender sensitization and POSH.

Step 3: Preparing the ecosystem for deployment of women in three shifts

With the help of the Diversity and Inclusion sub-committee, ground-level survey of existing infrastructure and amenities was carried out and a detailed action plan was chalked out to prepare the ecosystem for deployment of females in all three shifts in the mines. Additional washrooms and rest rooms were constructed, and existing ones were renovated and equipped with adequate furniture keeping in mind the comfort of women as well as occupational health, safety and security. Through regular inspection by top management and timely implementation of action plan, amenities and facilities such as sanitary napkin vending machines, canteens for women, female security guards and more were put in place to aid the process. The D&I Sub-Committee visited the creche which was constructed as per the Mines Creche Rules, 1966 and appreciated the facilities provided. Transportation facility for pick up and drop was provided to all women working in shifts. A set of robust security measures, including GPS & CCTV monitoring, were implemented. Additional CCTV cameras were installed in the area where women are deployed as well as along the bus route. Female security guards have been provided handheld devices (Motorola) through which they are connected to the security control room at all times. All the norms stipulated by Directorate General of Mines Safety (DGMS) are being adhered to ensure effective deployment of women at the mines. Tata Steel is committed to diversity and inclusion and will continue to invest in creating new support structures, systems and processes to enable this. The entire ecosystem is being developed for making life comfortable for women working in mines. After months of meticulous planning, recruitment and concerted efforts, the first batch of 30 women were deployed at Noamundi in all three shifts. The deployment is for officers, non-officers and contract employee categories.

Phase II: Tejaswini 2.0- The first batch of 22 female HEMM operators

With **Women@Mines** being a huge success, the next phase to recruit female employees as Heavy Earth Moving machinery operators was laid down.

Step 1: Recruitment

In 2020, an advertisement was released for the employee wards as well as for the local community to apply for the

position of HEMM operators. More than 360 applications were received. After a rigorous assessment process comprising of written test and interview, the first batch of 22 females were inducted at Noamundi under the “Tejaswini 2.0” initiative on 1st February 2021.

Step 2: Training

The selected female operator trainees did not know how to drive a four-wheeler and had no idea about HEMM (Heavy Earth Moving Machinery). A training plan was chalked out and first they were trained on driving a four-wheeler (LMV). All of them obtained the LMV license and through a blend of classroom and simulator training, were trained on HEMM operations. Based on their performance during the training period and their learning aptitude, they were divided into different trades such as Dumper Operators (12), Dozer Operators (4), Drill Operators (3) and Shovel Operators (3). The trainees were then deployed in the mines for rigorous on-the job training, along with the experienced operators. Throughout the training period, monthly assessments were conducted to gauge their performance and confidence level to operate the equipment independently. Based on the gaps identified, they were imparted training.

Apart from training imparted on HEMM, special training plans, including visits to our Jamshedpur plant and to the coal mines at West Bokaro were planned for the batch to understand the value chain and the impact of our operations. They have also visited the L&T Central Training Centre at Kanchipuram, where training was imparted on different equipment and their operations to get a holistic view.

Step 3: Deployment in all three shifts

After completion of training period and a rigorous final assessment, all 22 female HEMM operators have successfully been deployed in all three shifts at Noamundi Iron Mine. All facilities and amenities, including transportation facility, security, CCTV coverage have been extended to Tejaswini 2.0.

Phase III: Recruitment of one more batch of female HEMM Operators

With the success of the first batch of female HEMM operators, another advertisement was released for the next batch in 2022. Around 2010 applications were received, compared to 360 applications received for the first batch. This has given us the confidence that the initiative is sending out a positive message in the local community and is encouraging women to step out of their comfort zone and break stereotypes.

Way forward: Learning from the Tejaswini 2.0, the training curriculum will be revamped to ensure the trainees face the same rigor and syllabus and the time required for training is reduced and the operations get the benefit of operators early.



CRIRSCO REPRESENTATIVES AS ON 17 OCTOBER 2022

CRIRSCO EXECUTIVE BODY



Chairperson

Edson Ribeiro, CBRR, Brazil



Past Chair

Ken Lomborg, SAMREC, South Africa



Deputy Chair

Garth Kirkham, CIM, Canada



Secretary

Wilfredo Lopez, CCRR, Colombia



Treasurer

Peter Stoker, JORC, Australasia

MEMBERS



Steve Hunt
JORC, Australasia



Thomas L Brenner
CBRR, Brazil



Deborah McCombe
CIM, Canada



Fernando Flores
Comision Minera, Chile



Aquiles González
Comision Minera, Chile



Mauricio Castañeda
CCRR, Colombia



Mark Burnett
PERC, Europe



Edmund Sides
PERC, Europe



PV Rao
NACRI, India



K. Madhusudhana
NACRI, India



Lufi Irwan Rachmad
KCMI, Indonesia



Dudy Setyandaka
KCMI, Indonesia



Saule Urazayeva
KAZRC, Kazakhstan



Nikolai Yenshin
KAZRC, Kazakhstan



Bat-Erdene Dash
MPIGM, Mongolia



**Oyungerel (Gerlee)
Bayanjargal**
MPIGM, Mongolia



Igor Svintitski
OERN, Russia



Oleg Ilyin
OERN, Russia



Cem Sacit Yuceer
UMREK, Turkey



Dr. Atiye Tuğrul
UMREK, Turkey



Roger Dixon
SAMREC, South Africa



Don Hulse
SME, USA



Brian Groff
SME, USA

MEAI NEWS

BELGAUM CHAPTER

Minutes of Monthly Meeting Held On 09-10-2022 At 11.00 AM, Shiva Hotel, Belgaum

The meeting started with a welcome note by Shri Amit Ghooli, Secretary. Secretary requested the Chapter Chairman to conduct the proceedings. He welcomed all the senior members and also all invitees and members to actively participate in the meeting. He welcomed all new members formally to Belgaum Chapter. There were fourteen members who expressed their desire to become the MEAI members.

Dr. Purandara Bekal, Chairman briefed the Five Day workshop organised by MEAI, Belgaum chapter in association with Centre for Studies on Natural Disaster Management and Skill Development and SG Balekundri Institute of Technology, Belagavi. The workshop was conducted on "Natural Disaster Management" at SGBIT, Belagavi from 21-25 September, 2022. More than fifty candidates have registered for the workshop. It was inaugurated by Shri Prakash Koliwad, Director, Kyathil Institute for Climate Modification as the Chief Guest. He gave a keynote talk on Cloud seeding and Climate modification. Dr. Purandara, Chairman and other honourable members were present in the function. Special lectures were given by Prof. Hanamgond, Shri. Sagar Waghmare, Shri D. S. Malkai and others. Secretary read out the minutes of the previous meeting.

Later the following agenda were taken up one by one.

- Celebration of Indian Mining day
It was unanimously decided to Celebrate the Indian Mining Day 2022, on 1st November, 2022 at Lokapur under the leadership of Shri Narasimhamurthy and JSW Company. The venue was Muddapur Limestone & Dolomite mines of South West Mining Ltd. (JSW) Lokapur, Bagalkot District.
- Planning to Organize the Workshop in Belgaum
It was decided to organize a workshop in Belgaum under the leadership of Shri Malkai. The tentative date was proposed in January 2023. An attempt will be made to include all Quarry owners and related industries such as M-sand, which are located in Belagavi district. Workshop in Ilkal addressing the issues related to Granite Quarry's in the month of February 2023.
- Introduction of Student Chapter in Belgaum, Dharwad, Bagalkot, Kolhapur.
It was discussed about the formation of Student Chapter in all possible colleges in Belagavi, Dharwad, Bagalkot and Kolhapur. The first one will be initiated from GSS College, Belagavi.
- Any other points need to be discussed/ addressed
Shri Malkai and Hegde requested the Chairman and

Secretary to present the account status in the next meeting without fail. It was also decided that the office bearers should inform the Chairman/Secretary for the absence on meeting days. They should hand over the details if they are going to abstain from the meeting. In the next meeting, it was requested to present the half yearly accounts without fail by Secretary/Treasurer.

- Introduction of New Life Members to our MEAI Belgaum Chapter In all, 14 new members are added and a few more will be added in the next meeting.

The meeting was followed by Lunch.



NAGPUR CHAPTER

AGM and Election of New body

The Annual General Body Meeting of the Nagpur Chapter was held on 16th October 2022 at Hotel Tuli Imperial, Nagpur. Shri C.S. Gundewar, former Controller General, Indian Bureau of Mines had presided over the function as the Chief Guest.

At the outset Dr. Y.G. Kale, Secretary, Nagpur Chapter welcomed all the members and invitees. This was followed with welcome address by Shri P.N. Sharma, Chairman of the Chapter. In his welcome address, Shri P.N. Sharma expressed concern over the challenges being faced by the Indian mining industry and urged that platforms like MEAI can be used to find out apt solutions for the sustainable development of the industry. He insisted that the committee should organize a calendar of the events so that the complete programme of the series of activities to be carried out by the Chapter during the entire year can be chalked out and future course of action in performing the activities of the Chapter can be decided. Shri Sharma further apprised the house that the 75th Foundation Day of Indian Bureau of Mines will be celebrated on 1st March 2023. In this context, he has given a proposal to organize a National Conference during the year 2023. As a series of activities to be performed by the Chapter, he also proposed to observe Indian Mining Day-2022 on 1st November, 2022 as per the theme given by the National Headquarter of MEAI, Hyderabad and advised the Executive committee to organize a technical pa-

per meet on the day on suitable topic. He also requested to propagate the membership drive of the Chapter.

The Annual general Meeting was further followed by the presentation of Secretary's report by Dr. Y.G. Kale. He briefed on the activities carried out by the Nagpur Chapter during the last tenure and highlighted the events of paper meets organized by the Chapter. He also briefed about the participation of some members of the Chapter and their achievements in the National Quiz-2021 as organized by the National Headquarter of MEAI, Hyderabad. He also cited that Dr. P.K. Jain, member of our Chapter has been nominated to the National Council of MEAI. Dr. Kale also apprised the house that due to pandemic of COVID-19 and restrictions imposed by the local administration, the subsequent AGM for election of office bearers could not be held in the past and other activities could not be carried out in true spirit. Therefore, in the Executive Committee Meeting held on 21.09.2022, this issue was deliberated at length and decided that due to expiry of the term of existing office bearers of the Chapter, the new executive body of office bearers is required to be elected for the subsequent term of two years.

During the AGM, the audited accounts of the Nagpur Chapter for the years 2020-21 and 2021-22 were presented by Shri A.D. Gupta, Treasurer, The audited Balance Sheet was adopted by the house. This was followed by the presentation of audited accounts by Shri Mohan Rahangdale, Treasure for the International Conference organised by the Nagpur Chapter in December 2017. This was also adopted by the house with a suggestion to merge the account with the main account of Nagpur Chapter and also to close the said account and GST cancellation. Shri Rahul Trivedi, Chartered Accountant clarified the audiences on different queries raised on the matter of GST during the meeting.

Thereafter, Dr. Radhakrishnan acted as Election Officer for electing new Executive body of the Chapter. As per suggestion given by the house, the new Executive Committee of the Chapter is to be elected for the term 2022-24. He informed the house that as per constitution of the MEAI, members were requested to suggest the names for the new body. However, he regretted to inform that only 4 members have suggested the individual names in the ballot paper. Therefore, it was decided that new body will be elected unanimously by inviting suggestions from the members present with the permission of Chair. Accordingly, the following new body has been elected for the term 2022-24 unanimously and unopposed.

Chairman: Shri P.N. Sharma,
Chief Controller of Mines
(In Charge), IBM

- Vice Chairman: Shri R.C. Sanodia,
Ex-Chief General Manager,
Western Coalfield Limited
- Secretary: Dr. Y.G. Kale,
Controller of Mines, IBM
- Joint Secretary: Shri Arun S. Chachane,
Assistant Controller of Mines, IBM
- Treasurer: Shri A.D. Selokar,
Mineral Economist (I), IBM
- Ex-Officio Member: Dr. J.C. Jhanwar,
Immediate Past Vice-Chairman,
Nagpur Chapter
- Executive Members
1. Prof. Dr. M.S. Tiwari,
RKNEC, Nagpur
 2. Dr. A.K. Raina,
Chief Scientist, CIFMR, Nagpur
 3. Shri Rajesh Bhattacharya,
Joint General Manager
(Mine Planning), M/s MOIL Limited
 4. Shri V.R. Parida,
Joint General Manager
(Environment), M/s MOIL Limited
 5. Shri B.K. Shukla,
Legal Consultant, Nagpur
- Special Invitee
1. Shri C.S. Gundewar,
Ex-Controller General, IBM
 2. Shri H.R. Kalihari,
Mining Consultant, Nagpur
 3. Shri Sitaram Lomaror,
Chief Manager (Env),
Central Mine Planning
and Design Institute Ltd

The new Executive Committee was installed in the presence of Chief Guest Shri C.S. Gundewar, former Controller General, IBM. Speaking on the occasion as presiding officer, Shri C.S. Gundewar congratulated the new young team of the Nagpur Chapter and wished them all the success. Shri P.N. Sharma, new Chairman sought co-operation of all the members for the healthy growth of the Chapter. He expressed confidence that MEAI will be more vibrant to put forward the industry's view point before the policy makers. Dr. Y.G. Kale, new Secretary while expressing thanks requested the members to encourage their colleagues to become members of the MEAI. He also sought contribution from the members for dissemination of technical knowledge on topics of interest. The AGM ended with vote of thanks proposed by Shri Parag Tadlimbekar, member of the Nagpur Chapter. Shri Arun Chachane and all the team worked hard to organize the event successfully. Large number of members participated in the AGM.



(Sitting front row from L to R): Shri Sitaram Lomaror, Shri R.C. Sanodia, Shri P.N. Sharma, Shri C.S. Gundewar, Shri Arun S. Chachane, Shri A.D. Selokar, Speaking on the podium Dr. Y.G. Kale



(Sitting on dais at front row- L to R) Shri Sitaram Lomaror, Dr. J. C. Jhanwar, Shri P.N. Sharma, Shri C.S. Gundewar, Shri Arun S. Chachane, Shri A.D. Gupta



Presentation of audited accounts of MEAI, Nagpur Chapter by Shri A.D. Gupta



Members attending the Annual General Meeting and election of New Office Bearers

RAJASTHAN CHAPTER-UDAIPUR

Minutes of the Second (2nd) Executive Committee Meeting

The meeting was held on 12th October 2022 at 6:00 PM at Hotel Hilltop Palace, Udaipur.

The Second Executive Committee Meeting of the Chapter held under the chairmanship of Sh MS Paliwal, Chairman. The following members were present.

1. Sh MS Paliwal - In Chair
2. Sh AK Kothari - Former President MEAI
3. Sh RP Gupta - Former President, MEAI
4. Sh Akhilesh Joshi - Patron
5. Sh Praveen Sharma - Vice-Chairman
6. Dr SK Vashisth - Council Member & Joint Secretary
7. Sh Asif M Ansari - Secretary
8. Sh YC Gupta - Ex-Chairman
9. Sh MK Mehta - Treasurer
10. Sh R Harlalka - Member
11. Sh RC Purohit - Executive Member
12. Sh SC Suthar - Executive Member
13. Sh Hitanshu Kaushal - Executive Member
14. Sh AK Porwal - Member
15. Dr Anupam Bhatnagar - Member
16. Sh SL Sukhwal - Member
17. Sh SM Ahmed - Member
18. Sh NK Kavdia - Member
19. Sh RP Mali - Member
20. Sh K Baregama - Member
21. Dr Neeraj Shrivastava - Member

and all representatives of sponsors & advertisers.

At the outset Sh MS Paliwal welcomed all the executive members & all representatives of sponsors & advertisers of the seminar and expressed his thanks to each and every one for their excellent contributions to make the national seminar & exhibition a grand success. Sh RP Gupta, Sh AK Kothari, Sh Akhilesh Joshi, Sh Praveen Sharma and Sh Asif M Ansari were on the dais. Thereafter agenda items were discussed and following decisions were taken.

1. Last minutes of meeting held on 6.08.2022 & action taken report were readout by the Chapter Secretary and confirmed by the house.
2. Sh Praveen Sharma, Vice-Chairman thanked to all sponsors and members for their valuable contribution in the national seminar & exhibition and for the success of this gala events. He further, told that the quality of papers presented during this occasion were of excellent standard.
3. Sh RP Gupta, Former President of MEAI, Sh AK Kothari, Former President of MEAI, Sh Akhilesh Joshi, Patron,

Sh MS Paliwal, Chairman felicitated to all sponsors, advertisers by providing uparna and certificate. During this occasion representatives of sponsors and advertisers Sh Mukaya Simubali, Sh Snehal Purohit, Sh KP Singh, Sh SM Ahmed, Sh R Harlalka and others expressed their thanks to MEAI for this honor. During this occasion Ms Anushka Chattopadhyay, Geologist of HZL was also recognized for her best anchoring of the programme.

4. Regarding, Maintenance Charges of Indraprasth Complex Society, MEAI settled the matter by paying full amount.
5. Regarding celebration of Indian Mining Day on 1st November, 2022, it was proposed to organize this event at RSMML Ltd. The subject of Indian Mining as decided by the National Head Quarters for the year 2022 was "Sustainability & Circular Economy". Sh DD Shripath of RSMML was advised to take necessary action and inform to Sh MS Paliwal accordingly.
6. Sh RP Gupta, Former President, MEAI, Sh AK Kothari, Former President, MEAI and Sh Akhilesh Joshi also addressed appreciated the efforts of all members for the success of this seminar.
7. Sh MK Mehta, Treasurer presented Income & Expenditure Statement before the house and the house has approved the same.
8. Regarding plantation program for Large Mines & Small Mines, it was decided to bring proposals by the respective committee chairman and the Chapter chairman will decide accordingly.
9. The travelling expenses for office staff was approved equivalent to one month of their allowances, for the services rendered in the National Seminar & Exhibition by Sh Satya Narayan Joshi, Office Assistant, MEAI-Udaipur & Sh Chunni Lal Bhoi, Office Boy at Rs. 11000 & 4000 respectively. This has approved by the house.

The meeting ended with the vote of thanks proposed by Dr SK Vashisth.



(L to R) Sh AK Kothari, Former President, MEAI, Sh Akhilesh Joshi, Patron, Sh RP Gupta, Former President, MEAI, Sh MS Paliwal, Chapter Chairman, Sh Praveen Sharma, Chapter Vice-Chairman,,Sh Asif M Ansari, Chapter, Secretary,



A View of Audience & Addressing in Executive Committee Meeting

OBITUARY



Shri AMRITH RENALDY T
(LM No. 5671 -
Bangalore Chapter)
17/06/1981 to 22/09/22

Shri Amrith Renaldy was working as Scientist E1 at National Institute of Rock Mechanics, NIRM at Bengaluru. He holds BE (Mining) degree from VTU, Karnataka. He joined NIRM on October 2008. He worked as senior research fellow at Department of Mining Engineering, Anna University, Chennai, for a period of four years. He was having experience in various S&T and Sponsored Mining Projects involving in Strata Control Studies in both Coal and Metal Mines, GIS and real time kinematics GPS survey, 3D Digital Terrain Modelling, High resolution micro seismic monitoring, base line data generation for EIA and EMP, and Environmental pollution modelling.

Shri Amrith Renaldy is survived by his wife and only son. The members of the MEAI pray for the departed soul to rest in peace and express their profound condolences to the bereaved family members.

MEJ RIDDLES

Dear Readers of MEJ,

In order to increase the readership of MEJ, which has been felt essential in the interest of our ardent members, the mineral industry professionals as well as the mining sector, the Editorial Board of MEJ has decided to hold a monthly QUIZ. The monthly QUIZ will be designed and printed in MEJ based on the content published in the previous month's MEJ. The MEJ readers will be given five objective questions with multiple choices to choose; and expect them to respond with their correct answer by email to the Editor at editormejmeai@gmail.com by 20th of the current month. If more than three members responded with the correct answers, then the three winners will be decided by draw. Each winner will be issued a certificate of merit and a nominal cash prize of Rs 500.

Encourage the EMJ readers to participate in the QUIZ in large numbers and benefit from the enhanced knowledge by reading the Journal from the first to last page.

Questions based on MEJ October 2022 issue

- 1. Which Indian company is venturing into commissioning a 3 Mtpa steel plant in Chhattisgarh?**
(a) NMDC (b) Tata Steel
(c) Vedanta (d) MOIL
- 2. Which Indian mining company claims ESG-Ready since 1961?**
(a) GMDC Ltd (b) Baldota
(c) MECL (d) OMDC
- 3. Who presented the paper on Gold exploration in September 2022 in MEAI TECH SERIES program?**
(a) Mr PC Bakliwal (b) Dr SK Vashisth
(c) Dr Prabhakar Sanguramth (d) Prof SS Rathore
- 4. Which country accounts for more than 50% deforestation caused by largescale mining?**
(a) India (b) China
(c) Australia (d) Indonesia
- 5. What is the latest identified OGP area (sq. km) by GSI in India?**
(a) 688,000 (b) 671,000
(c) 771,000 (d) 571,000

WINNERS OF RIDDLES PUBLISHED IN THE MEJ OCTOBER 2022 ISSUE

Congratulations to proud winners

Mr Deepak Vidyarathi

E-mail: vidyarthikud@hotmail.com

Mr Vikas Kumar Jangir

Sr. Manager, RCCPL Pvt Ltd

E-mail: vicky_mbm@yahoo.co.in

Dr. Ashok Kumar, Scientist

CSIR-Central Institute of Mining & Fuel Research, Dhanbad

E-mail: ashok.bhu.min09@gmail.com

To receive the cash prize of Rs 500, the winners may please contact the Secretary General, MEAI on email at meai1957@gmail.com or Mob. 9177045204.



CRIRSCO AGM 2022 HELD AT JOHANNESBURG, SOUTH AFRICA ON 17-20 OCTOBER 2022



CRIRSCO Members from 12 countries present in the AGM 2022



CRIRSCO Mmembers with a few senior SAMREC (South Africa) members



A Section of CRIRSCO members participating in the AGM 2022



Dr PV Rao (NACRI) presenting NACRI Annual Report 2021



Dr PV Rao (NACRI) & a Section of CRIRSCO members listening to NACRI presentation



(L to R): Mr Steve Hunt (JORC), Dr PV Rao (NACRI), Mr Roger Dixon (SAMREC), Mr Peter Stoker (JORC) and Mr K Madhusudhana (NACRI)



NACRI (India) Representatives with CRIRSCO Chairperson Mr Edson Rebeiro (Centre)



Mr K Madhusudhana (R) & Dr PV Rao (L)



Mr K Madhusudhana with CRIRSCO Chairperson Mr Edson Rebeiro



(L to R): Mr Peter Stoker (JORC), Mr Ken Lomberg (SAMREC) with Mr K Madhusudhana (NACRI)



CRIRSCO AGM 2022: Cocktail dinner

(Continued from Page 26)

Brazil's biggest public company, Vale, is the world's largest producer of iron ore and nickel. The company runs the **Carajás mine**, the largest iron ore mine in the world. Located in the state of Pará, in the north of the country, the mine is operated as an open-pit mine and is estimated to contain roughly 7.2 billion metric tons of iron ore.

Together, Australia and Brazil dominate the world's iron ore exports, each having about one-third of total exports. China is the largest consumer of iron ore,

used to feed its steel industry. Despite being the third largest producer, China still imports around 80% of the iron ore it uses each year. The country brought in 1.12 billion tonnes of the commodity last year.

Iron Ore's Role in the Green Economy

Iron ore demand is expected to rise in the coming years as steel plays a crucial role in producing and distributing energy. Steel is used extensively in agriculture, solar and wind power, and also in infrastructure for hydroelectric. Furthermore, steel is used for the production of transformers, generators, and electric motors, along with ships, trucks, and trains.

Bruno Venditti, Visualcapitalist.com | 05 October 2022

CONFERENCES, SEMINARS, WORKSHOPS ETC.

INDIA

20-21 Dec 2022: MEAI- ALL INDIA GEOLOGIST'S CONFERENCE. Organised by Bellary-Hospet Chapter at Hosapete. Venue: Hotel Malligi, J.N Road, Hosapete-583201, Karnataka. For details Contact: Shri. K Madhusudhana, President, MEAI & VP-Mines & CC, M/s. MSPL Limited or Shri. K Prabhakar Reddy, CONVENER & Chairman & MEAI-BH Chapter & CEO, M/s. SUMS.

ABROAD

08-09 Nov 2022: International Conference on Underground Mining Methods and Technologies ICUMMT. Istanbul, Turkey. Website URL: <https://waset.org/underground-mining-methods-and-technologies-conference-in-november-2022-in-istanbul>

18-19 Nov 2022: International Conference on Underground Mining Methods and Applications (ICUMMA). Singapore. Website URL: <https://waset.org/underground-mining-methods-and-applications-conference-in-november-2022-in-singapore>. Program URL: <https://waset.org/conferences-in-november-2022-in-singapore/program>.

29 Nov - 1 Dec 2022: AusRock Conference 2022. Melbourne, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

20-21 Dec 2022: International Conference on Design Methods in Underground Mining (ICDMUM 2022). Istanbul, Turkey. Website URL: <https://waset.org/design-methods-in-underground-mining-conference-in-december-2022-in-istanbul>; Contact URL: <https://waset.org>

27-28 Dec 2022: International Conference on Coal Resources and Coal Mining ICCRCM. Vienna, Austria. Website URL: <https://waset.org/coal-resources-and-coal-mining-conference-in-december-2022-in-vienna>

11-12 Jan 2023: International Conference on Land Reclamation in Mining Areas ICLRMA. Singapore. Website URL: <https://waset.org/land-reclamation-in-mining-areas-conference-in-january-2023-in-singapore>

21-22 Jan 2023: International Conference on Mineral Deposits and Mining Methods (ICDMM 2023). Amsterdam, Netherlands. Website URL: <https://waset.org/mineral-deposits-and-mining-methods-conference-in-january-2023-in-amsterdam>; Contact URL: <https://waset.org>

18-19 Feb 2023: International Conference on Bauxite Mining and Alumina Refining ICBMAR. Jeddah, Saudi Arabia. Website URL: <https://waset.org/bauxite-mining-and-alumina-refining-conference-in-february-2023-in-jeddah>

4-5 Mar 2023: International Conference on Mining and Refining of Metals ICMRM. Rome, Italy. Website URL: <https://waset.org/mining-and-refining-of-metals-conference-in-march-2023-in-rome>

4-5 Mar 2023: International Conference on Mining Intelligence (ICMI 2023). Rio de Janeiro, Brazil. Website URL: <https://waset.org/mining-intelligence-conference-in-march-2023-in-rio-de-janeiro>; Contact URL: <https://waset.org>

22-23 Apr 2023: International Conference on Recent Developments in Mining Technologies ICRDMT. London, United Kingdom. Website URL: <https://waset.org/recent-developments-in-mining-technologies-conference-in-april-2023-in-london>

22-23 Apr 2023: International Conference on Mining and Mineral Technologies (ICMMT 2023), Tokyo, Japan. Website URL: <https://waset.org/mining-and-mineral-technologies-conference-in-april-2023-in-tokyo>; Contact URL: <https://waset.org>

3-4 May 2023: International Conference on Mining Technologies and Sustainable Systems ICMTSS. Rome, Italy. Website URL: <https://waset.org/mining-technologies-and-sustainable-systems-conference-in-may-2023-in-rome>

29-31 May 2023: MetPlant Conference 2023. Perth, Australia and online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

15-16 Jun 2023: International Conference on Mining and Metallurgical Technologies (ICMMT 2023). Toronto, Canada. Website URL: <https://waset.org/mining-and-metallurgical-technologies-conference-in-june-2023-in-toronto>; Contact URL: <https://waset.org>

26-29 Jun 2023: 26th World Mining Congress. Resourcing Tomorrow-Creating Value for Society. Brisbane, Queensland, Australia. Contact: Kristina Liska, Event and Registration Coordinator at registration@wmc2023.org

16-17 Aug 2023: International Conference on Mine Mechanization and Mining Policies (ICMMMP 2023). Tokyo, Japan. Website URL: <https://waset.org/mine-mechanization-and-mining-policies-conference-in-august-2023-in-tokyo>; Contact URL: <https://waset.org>

8-9 Nov 2023: International Conference on Underground Mining Methods and Technologies ICUMMT 2023. Istanbul, Turkey. Website URL: <https://waset.org/underground-mining-methods-and-technologies-conference-in-november-2023-in-istanbul>

15-16 Nov 2023: International Conference on Design Methods in Underground Mining ICDMUM 2023. Jeddah, Saudi Arabia. Website URL: <https://waset.org/design-methods-in-underground-mining-conference-in-november-2023-in-jeddah>

8-9 Feb 2024: International Conference on Web Mining, Information and Knowledge Extraction (ICWMIKE 2024). Lisbon, Portugal. Website URL: <https://waset.org/web-mining-information-and-knowledge-extraction-conference-in-february-2024-in-lisbon>; Contact URL: <https://waset.org>

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TATA STEEL

#WeAlsoMakeTomorrow



#SteelFact

Globally, extensive

afforestation

programmes are converting mines
into habitats for local wildlife

Source: World Steel Association

*Currently, an area of 563 hectares
is covered via afforestation in
our mining locations.

*Data as on October 2021

PLANTING DOUBLE THE TREES FOR A BETTER TOMORROW

BOTANICAL PARK, NOAMUNDI

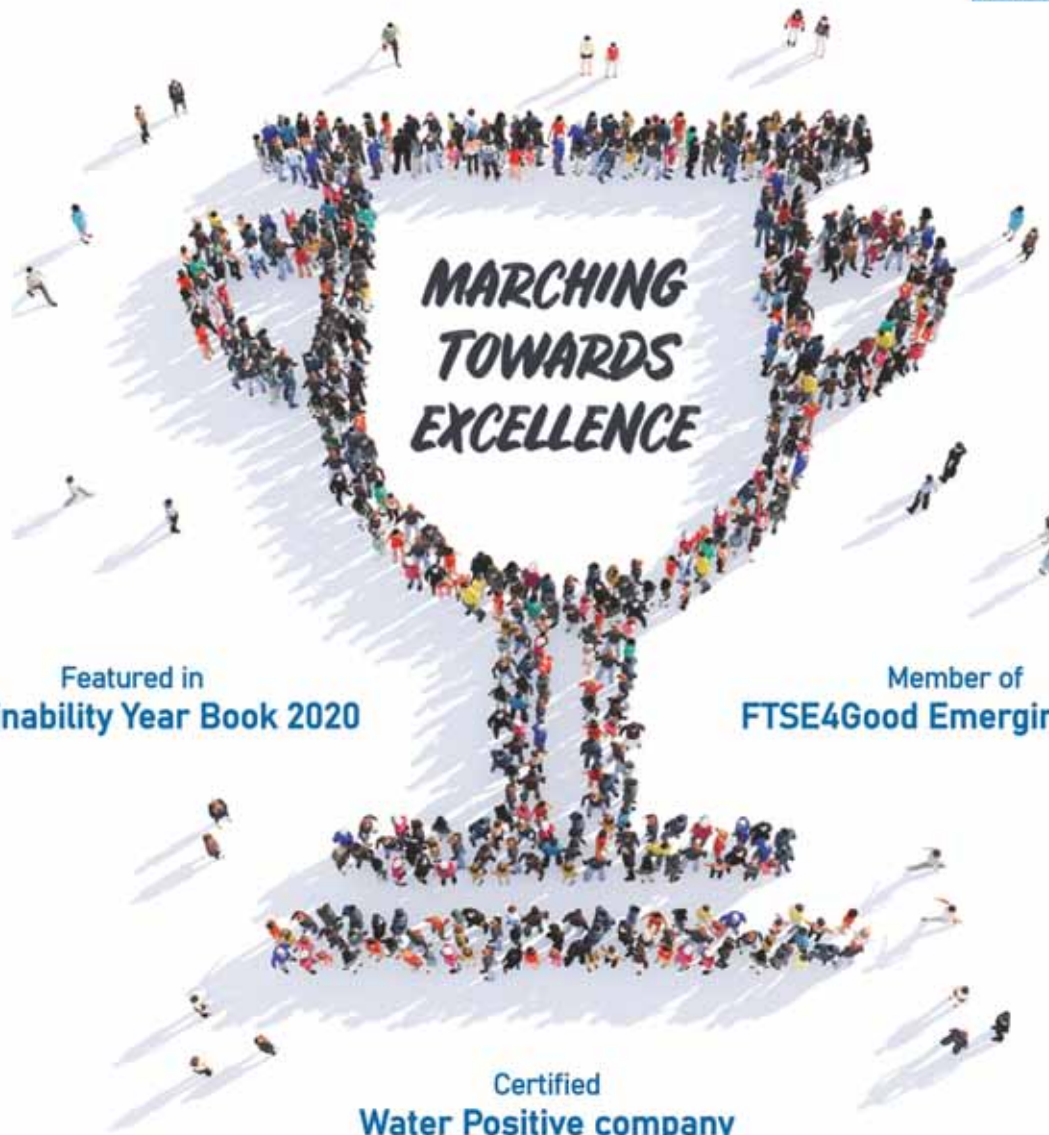
We are ensuring that the natural ecosystem in our mining locations is preserved. We have progressively implemented Biodiversity Management Plans at all our raw material locations in order to ensure no net loss in biodiversity.

Sure, we make steel.

But #WeAlsoMakeTomorrow.



HINDUSTAN ZINC
Zinc & Silver of India



Featured in
Sustainability Year Book 2020

Member of
FTSE4Good Emerging Index

Certified
Water Positive company

'Good Cultural Foundation'
in Great Place to Work Survey

Top 15 CSR spenders in India,
impacting 5,00,000 lives annually

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Asia-Pacific and globally 5th by Dow Jones Sustainability Index
in 2019 amongst Mining & Metal companies

World's leading integrated Zinc-Lead Producer | Among World's Top 10 integrated Silver Producer

Hindustan Zinc Limited

Yashad Bhawan | Near Swaroop Sagar | Udaipur - 313004 | Rajasthan | India

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