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MINING HAPPINESS



Mining Engineers' Association of India

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President's Message.....

Dear members..

Earlier in the month of April 24, we had the third meeting of the Council hosted by Bailadila Chapter jointly with NMDC Limited at Bacheli Project, Chhattisgarh. It was a very well organized event with a Technical session held in the morning followed by the Bacheli mine visit in the afternoon and then the Council meeting in the evening, which lasted for almost three hours. Shri B. Sahoo, Executive Director (Production Coordination) NMDC Limited & Jt. Secretary cum Treasurer MEAI and Shri B. Venkateswarlu, Executive Director BIOM, Bacheli Complex & Chairman Bailadila Chapter along with his entire team took good care of the Council members with pleasant hospitality.

The matter regarding maintenance and management of Mining Welfare Centre, Jaipur and a proposal from the Bellary Hospet Chapter to purchase a piece of land were taken up in the Council meeting. Meanwhile it was learnt that the Udaipur Chapter was also planning to buy a piece of land near Udaipur. But in absence of clarity on ownership of assets, no decision could be arrived at. As per the informal information shared by the Chapter, it has long outstanding liabilities of payment of Govt. dues to the extent of about Rs. 60 Lakh, which I believe the Chapter will never be able to clear on its own in at least next decade or so. It will definitely need the support and guidance from the Association Headquarters. The Rule 10 (12) of the Bylaws provides "*All the movable and immovable properties acquired by MEAI or its Chapters anywhere in the country or abroad shall lie and got duly registered only in the name of Mining Engineers' Association of India.*" Under the circumstances, all liabilities of the Chapters shall also to be owned by the Headquarters. As such it would be needed to develop and adopt a comprehensive Asset Policy by the Association before making any new investment on purchase or operation & maintenance of any asset.

In the meeting Shri Deepak Vidyarthi, Chairman Training, Development and Program Committee expressed his concern over very poor and discouraging attendance / response in MTS programs. It not only disheartens the organizers but also the guest speakers. Reasons for such poor response have to be identified and necessary corrective actions have to be taken on priority. The concerned Committee may look into it.

The visit to Bailadila Chapter was quite a memorable one due to the uncertainty of landing of an already delayed flight due to poor visibility. And then cancellation of flight to Hyderabad from Jagdalpur due to bad weather. We, the 15 Council members had no choice but to travel to Hyderabad by road in 5 comfortable vehicles, courtesy NMDC Limited.

The only lesson we learnt from this trip is that the Council meetings should henceforth be organized at well approachable locations only. And rightly it was decided in the meeting itself that the next Council meeting along with the AGM shall be hosted by Jabalpur Chapter at Jabalpur, sometime in the month of July 2024. But the enthusiasm and the active involvement of remotely located Chapters like Bailadila cannot be disregarded. Members from the remotely located Chapters shall be encouraged by organizing such events there from time to time to visibly show due recognition to all such Chapters.

S.N. Mathur
President



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EDITOR'S DESK



Dr. P.V. Rao
Editor, MEJ

As the environmental and land availability issues are progressively becoming severe impediments in performing sustainable mining on land, some countries have already started exploration for critical minerals and probable mining in the international waters, which are rich in metals that are essential for combating climate change while ensuring environmental sustainability. With the approval of the United Nations Convention on the Law of the Sea (UNCLOS) in 1994, exploration for mineral resources in the international waters began to be regulated under exploration contracts. UNCLOS outlines the areas of 'national jurisdiction' as a 12 nautical-mile territorial sea, an 'exclusive economic zone' of up to 200 nautical miles and a continental shelf. The UN affiliated International Seabed Authority (ISA) was established in 1994 to regulate activities in international waters. The international seabed area – the part under ISA jurisdiction – is defined as 'the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction'.

While Prospecting does not require ISA approval and can be done by notifying ISA of the approximate area and formally declaring compliance with UNCLOS and ISA regulations, Exploration requires ISA approval. Exploration contracts can last up to 15 years, extendable thereafter for periods up to 5 years. Exploitation by both the States and Private entities is required to obtain an approved contract from ISA, after evaluation by ISA's

Legal and Technical Commission (LTC). Based on the LTC evaluation, the ISA Council approves or rejects the contract.

Till now, ISA has entered into 15-year contracts with 22 contractors, with specific regulations, for the exploration for polymetallic nodules (PMN), polymetallic sulphides (PMS) and cobalt-rich ferromanganese crusts (CFC) in 31 exploration licenses, of which 30 are active. There is a growing interest in seabed mining with several countries, including China, France, Germany, India, Japan, Russia, and South Korea conducting numerous research expeditions in Clarion-Clipperton Zone (CCZ), the Indian Ocean, the Mid-Atlantic Ridge, and the Northwest Pacific ocean, despite delays in creating a Code to regulate seabed mining in international waters. Until 2010 the exploration activities were predominantly undertaken by national agencies. With the private companies becoming involved, a polymetallic-nodule-mining industry was born.

India has already obtained two deep-sea exploration licenses for PMN (75,000 sq. km) and PMS (10,000 sq. km) in the Indian Ocean and applied for two more licenses amid increasing competition between major global powers to secure critical minerals. PMN that contain metals such as copper, manganese, nickel, iron, and cobalt are found approximately 5,000 m deep, whereas PMS occur at around 3,000 m in the central Indian Ocean. India can effectively explore in both India's Exclusive Economic Zone and the Central Indian Ocean by equipping itself to operate at a depth of 6,000 m.

To unlock the potential of seabed resources, India's exploration efforts in the Indian Ocean and the development of advanced technologies like VARAH-1 are vital. Though the bulldozer-sized VARAH-1 machine can go down to a depth of 4-5 km, walk, dig, scratch and grab, it has the limitation of pumping materials up to 2 km only. So, a modernized version of the machine was being developed to overcome the pumping limitation. The USA, Russia, China, France, and Japan have already achieved successful deep-ocean crewed missions and India is poised to join the ranks of these nations.

India has a short-term target of increasing its renewable energy capacity to 500 gigawatts by 2030, and meeting 50% of its energy requirements from renewables by then, with the long-term goal of achieving net zero emissions by 2070. To meet these targets, experts say India will need to secure critical minerals from all possible sources, including the deep seabed. India is also open to private mining and signed an agreement with Russia to develop deep-sea mining technologies.

Proponents of deep seabed exploration opine that mining on land has almost reached a saturation point, resulting in low-quality ore production, and that many of the mineral source-areas are plagued by conflict or environmental issues. Its opponents, however, caution the deep seabed is the last frontier in the planet that remains largely unstudied and untouched by humanity and mining there could cause irreversible damage. Around two dozen countries - including the UK, Germany, Brazil and Canada - are also demanding either a halt or a temporary pause on deep-sea mining, given what they say is a lack of information about the marine ecosystems in those depths.

Since ISA is anticipated to finalise the mining code by 2025, India should endure its exploration efforts in the assigned license areas, develop improved technologies to mine at greater depths, and be prepared to commence sustainable mining when the Code for seabed mining is finalised.

- Editor

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NEWS FROM THE MINERAL WORLD

► Centre aims to conclude first round of critical mineral auction within week

The Centre has initiated the auction of 38 critical & strategic minerals to date. The initial tranche included 20 blocks, while the subsequent tranche consisted of 18 blocks

The Centre intends to wrap up the first phase of the critical minerals auction, which commenced in November last year, with the selection of the preferred bidders by April 8, officials said.

During the launch of the auction process, the Centre had initially announced March 19 as the commencement date for selecting the preferred bidders and April 8 as the deadline. However, due to the cancellation of 13 critical minerals blocks in the first round of the auction, the Centre is yet to announce the results for any block.

“The deadline was missed due to the limited interest in the 13 blocks, resulting in their eventual cancellation. However, the selection process for the remaining blocks will still be completed within the specified deadline,” a government official said.

On March 13, the government announced the cancellation of 13 blocks, with 2 blocks receiving no bids and 11 blocks having fewer than three Technically Qualified Bidders (TQB). The two blocks that did not attract any bids are molybdenum minerals in Tamil Nadu.

The maiden auction of critical minerals by the Centre has faced a setback with close to seven blocks, including the lithium block in Jammu & Kashmir (J&K), finding almost no takers, Business Standard recently reported.

A total of 56 physical bids and 56 online bids were received for 18 out of the 20 blocks, a Ministry of Mines statement said.

According to the Mineral (Auction) Rules, 2015, if the total number of technically qualified bidders is less than three, then no technically qualified bidder is considered a qualified bidder, and the first attempt of the auction is annulled.

Since the ministry failed to secure a minimum of three bids for these blocks, it announced a second auction round for seven blocks on March 14.

During the launch of the auction process on November 29, Union Mines Minister Pralhad Joshi expressed confidence that India would achieve self-sufficiency in critical minerals. He estimated the value of these blocks at Rs 45,000 crore.

However, experts expressed scepticism regarding India’s ability to achieve its ambitious target for self-sufficiency in critical minerals. This is due to a lack of clarity on the potential data of the reserves.

According to the United Nations Framework for Classification of Resources, the exploration of minerals is divided into four stages — G4 (reconnaissance), G3 (prospecting), G2 (general exploration), and G1 (detailed exploration).

The G4 stage entails estimating quantity with grade through regional assessments and limited subsurface sampling, resulting in low-confidence estimates.

Progressing beyond reconnaissance, the G3 stage maintains low-confidence estimates.

The G2 stage indicates a more comprehensive assessment with a moderate level of confidence in estimating quantity with grade.

At the G1 level, the most advanced stage, high-confidence estimates are derived from in-depth investigations, extensive sampling, and direct analysis.

In addition to the lack of clarity on reserves, the high cost of investment in exploration has deterred potential investors from participating in the bidding process.

This setback raises concerns about India’s ability to reduce its reliance on critical mineral imports. Most of these minerals are imported from China, which is the leader in global production and supply of these resources.

With investors failing to bid, experts suggest that India will continue to rely on China for securing its raw materials.

The Centre has initiated the auction of 38 critical & strategic minerals to date. The initial tranche included 20 blocks, while the subsequent tranche consisted of 18 blocks.

Nitin Kumar, New Delhi, BS | Apr 01 2024

➤ **Minor mineral industries facing unprecedented crisis with heavy tax burden, stringent license norms**

Thousands of people lost their livelihood and many industries are unable to clear their bank loans due to the crisis in the industry

Mining activity has been badly affected, both in Vizianagaram and Srikakulam districts, apart from other parts of the State with the unprecedented tax burden, stringent norms for sanctioning of licenses, involvement of third parties in the collection of fees and others. This has led to slump in the minor mineral industries, including granite factories.

Thousands of people lost their livelihood and many industries are unable to clear their bank loans due to the crisis in the industry. According to a study by the Federation of Minor Mineral Industry (FEMMI), total mining leases have come down from 5,935 to 3,373 in the last three years due to multiple challenges.

Speaking to *The Hindu*, FEMMI Secretary General Ch. Rao said that the mining activity witnessed a 43.17 percent decline in Andhra Pradesh due to various new rules such as premium tax, consideration tax, security deposit, enhancement of fees on lease renewals.

“Adoption of unscientific methods for pit measurements and imposition of huge penalties have led to closure of many mines in several places, including North Andhra region. Creation of wealth and livelihood opportunities were badly impacted with the stringent procedures,” said Mr. Rao.

“Minor mineral industries cannot attract new investments as long as there is an excessive tax burden on entrepreneurs. That is why we are requesting the Union government to adopt uniform mining policy across the State. It can make all the States follow the same norms so that the industry would flourish and create employment for locals and villagers, as mining activity is mostly done in remote areas,” Mr. Rao added.

According to information provided by granite exporters, the government taxes and other fees have gone up from around ₹6,000 to ₹22,000 per tonne of granite block. The granite mining activity was nearly shut down due to the huge losses for almost all industries. The orders which used to come from China and other countries are now being given to industries located in Tamil Nadu and Telangana, where granite blocks are available at reasonable rates compared to Andhra Pradesh.

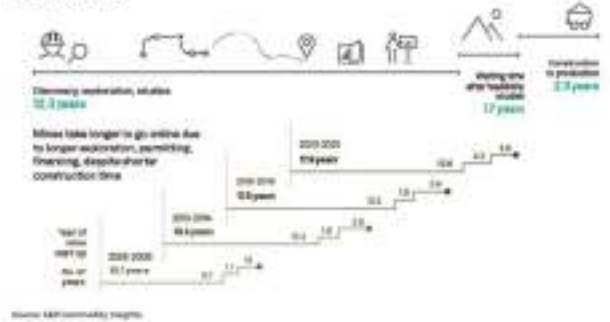
K SRINIVASA RAO, The Hindu March 30, 2024

➤ **New mines take nearly 18 years to build in 2020-23**

The average time to build new mines has increased to 17.9 years — almost 18 years — for new mines coming online in 2020-23, a significant jump compared to 12.7 years for mine projects started up 15 years ago, according to new research from S&P Global Market Intelligence.

The timeframe is from discovery to production, across gold, copper, nickel and lithium mines that have begun production since 2000.

Average lead time almost 18 years for mines started in 2020-23



Challenges include: longer exploration, permitting and studies phase, and a longer period between the end of feasibility studies and the start of construction, which can be attributed to time spent obtaining financing and construction permits.

Nickel mines take the longest, gold the shortest



“Our research confirms the industry belief that lead times are getting longer. The average lead time for mines from 2005 to 2009 was 12.7 years, which has grown steadily up to the present. From 2020 to 2023, the average lead time jumped to 17.9 years, fueled by a longer exploration, permitting and studies phase and a longer period between the end of feasibility studies and the start of construction, which can be attributed to time spent obtaining financing and construction permits”.

The Oregon Group | April 15, 2024

➤ **Ministry of Mines organizes Mining Start-up Webinar to promote Research and Innovation in Mining and Mineral Processing**

Ministry of Mines, Government of India organized a Special Webinar today for Start-ups, MSMEs, and Individual Innovators working in the Mining & Metallurgical sector to explore avenues for advancing research and innovation in mining and mineral processing. The Webinar was inaugurated by Prof. Abhay Karandikar, Secretary, Department of Science & Technology whereas the key note address was delivered by Shri VL Kantha Rao, Secretary Mines.

Ministry of Mines launched “Promotion of Research and Innovation in Start-ups and MSMEs in mining, mineral processing, metallurgy and recycling sector (S&T-PRISM)” in November, 2023 to fund research and innovation in start up and MSMEs which are working in the field of mineral sector, applied and sustainable aspect of mining and industrial applications. It is expected that this will bridge up the gap between R&D and commercialization as also to promote the ecosystem for a complete value chain in mining and mineral sector.

Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur, an autonomous body under the administrative control of Ministry of Mines is implementing agency for S&T – PRISM.

Fresh proposals under the S&T-PRISM program have been invited by JNARDDC and deadline is 30th April, 2024. Preference is given to Startups/MSMEs of North East region and women-led enterprises.

The webinar was attended by more than 200 participants which includes Startups, Experts and Industry.

During the webinar, participants engaged in insightful discussions surrounding the latest trends, challenges, and opportunities in mining and mineral processing. Dr. Anupam Agnihotri, Director, JNARDDC made a presentation on functioning and guidelines of S&T-PRISM. Amitesh Sinha, Head- Corporate Venture Capital & Vedanta Spark Initiatives and Shri Rohit Pathak, CEO & Business Head, Birla Copper, Aditya Birla Group shared their experience in dealing with startups in Mining Sector. Prof. Asim Tewari, Professor, Indian Institute of Technology, Bombay briefed on role of artificial intelligence in Mining Sector.

PIB Delhi | 10 April 2024

➤ **KABIL and CSIR-IMMT Forge Alliance for Critical Minerals Advancement**

KABIL and CSIR-IMMT have joined forces to enhance

India’s mineral security through technical collaboration. This partnership aims to leverage CSIR-IMMT’s expertise for mineral processing.

In a significant move toward bolstering India’s mineral security, Khanij Bidesh India Limited (KABIL) and the Council of Scientific and Industrial Research – Institute of Minerals and Materials Technology (CSIR-IMMT) have entered into a Memorandum of Understanding (MoU) for Technical & Knowledge cooperation. The agreement aims to leverage CSIR-IMMT’s technical prowess in various domains crucial for mineral processing and metal extraction.

Collaborative Endeavors: Enhancing Technical Expertise

Under the MoU, KABIL will tap into CSIR-IMMT’s expertise to undertake projects encompassing metallurgical test work-plans, process flowsheet development, and technology selection. Joint research initiatives and the exchange of scientific knowledge will also be facilitated to propel advancements in mineral and metallurgical sectors.

Fostering Innovation for Mineral Security

Expressing optimism about the collaboration, Shri Sridhar Patra, CMD, NALCO & Chairman, KABIL, emphasized the role of scientific research in fortifying India’s mining industry. He highlighted the significance of technological advancements in ensuring mineral security and meeting domestic requirements, aligning with the nation’s ‘Make in India’ initiative.

About KABIL: Spearheading Mineral Security

KABIL, a joint venture of NALCO, HCL, and MECL under the Ministry of Mines, aims to secure the nation’s critical and strategic minerals. Its mandate spans the identification, exploration, development, and procurement of essential minerals to bolster domestic supply chains and support national initiatives.

Piyush, Adda24/7 | 11 April 2024

➤ **Copper market grapples with a crucial question**

Over the past few days, the world’s copper traders and executives descended on Santiago for the annual Cesco Week gathering. The main debate: Is this the beginning of the big bull market everyone has been waiting for?

Prices touched a 22-month high of \$9,739 a metric ton on Thursday, up 13% since the start of the year.

Nick Snowdon, the Goldman Sachs Group Inc. strategist who has carved out a place for himself as the market’s most bullish voice, argued copper’s latest developments

are only “the foothills of what will be its Everest.” He forecasts prices will average an astonishing \$15,000 per ton next year.

Not everyone agrees.

“On a fundamental basis, the indicators suggest that the price has gone too far,” Alice Fox, commodities strategist at Macquarie Group Ltd., said in Santiago. She is no copper bear, but she thinks the current rally is “a little premature,” driven by bullish investors rather than any shortage of the metal.

That’s a view that many here in Chile agree with — even, speaking privately, some of the world’s biggest miners and traders, who point to lackluster indicators in top consumer China as a reason for caution.

The one part of the market where no one disagrees there is a shortage right now is semi-processed copper ore, known as concentrate.

That is a function of supply disappointments as well as a breakneck expansion in global smelter capacity. The result is deals in which smelters and traders are paying roughly the same price for cargoes of copper ore as the copper contained in it will fetch when processed.

That’s an unsustainable situation, Roland Harings, chief executive officer of European copper producer Aurubis AG, told us. With market participants from Trafigura Group to Mitsui & Co. seeing tightness in concentrates lasting into next year, the conclusion must be that at some point it will lead to smelter cutbacks and a tighter market for the metal.

The crunch point may come toward the end of 2024, when miners negotiate smelters’ fees under annual supply deals.

For this year, they agreed to so-called treatment charges of \$80 per ton. For next, miners are anticipating levels far below that, with some whispering forecasts for historically low rates in the \$40s or \$50s a ton.

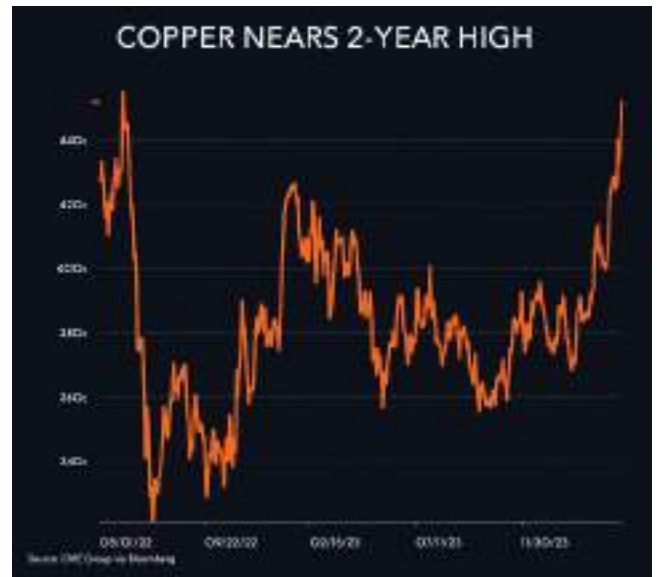
No matter what happens this year, a panel of six market participants at the CRU World Copper Conference in Santiago was unanimous on one thing: a prediction for higher prices in the medium term.

Bloomberg News / April 18, 2024

➤ **Spectacular copper price rally only gaining momentum**

With the annual copper industry gathering wrapping up this week, participants making their way home from Chile’s capital do so with the bellwether metal honing in on two-year highs.

In US trading on Friday copper for delivery in May hit an intra-day high of \$4.51 a pound or \$9,942 a tonne, up more than 16% so far in 2024 (most of that coming in April) and the highest since the beginning of June 2022.



The spectacular upward move over the last couple of weeks comes as so-called managed money build long positions – bets on higher prices in future – to the equivalent of more than 2 million tonnes on the London Metal Exchange, a new record. Likewise, long positions on Chicago’s CME copper futures contracts are at levels last seen in January 2018.

BMO Capital Markets in a Friday research note on CESCO Copper Week in Santiago summed up the mood at the conference as “Buoyant but not bullish”.

There was widespread agreement at the conference that, while most market participants were happy with the higher copper price seen over the past month, the recent run has been slightly ahead of fundamentals.

“In our view, this reflects the heavy inflows towards copper, and commodities as an asset class, a dynamic that many producers were keen to understand more about,” BMO said. “There is some confidence demand can improve further to backstop current price levels, but without this emerging soon the recent rally may prove vulnerable.”

Frik Els, Mining.Com / April 19, 2024

➤ **Canada’s planned capital gains tax hike may choke mining startups, dealmakers say**

Canada’s capital gains tax hike for

wealthy individuals and corporations in last week's federal budget risks turning away investments from mineral exploration by reducing incentives, the country's leading stock exchange operator and dealmakers told Reuters.



Mining Lithium at NAL in Quebec. Credit: Sayona Mining.

Prime Minister Justin Trudeau's Liberal government proposed increasing the share of capital gains subject to taxation to two-thirds for individuals with annual investment profits greater than C\$250,000 (\$181,752), companies and trusts, as it seeks to raise revenue to fund public programs.

The measure will be effective on June 25. The government could consider amendments.

Mining, oil and gas exploration companies listed on the TSX Venture Exchange have raised funds by issuing flow-through shares, at a premium to the trading price, that allow high net-worth buyers to take tax deductions renounced by issuers.

The minimum flow-through investment is C\$250,000.

"The increase in the inclusion rate on capital gains has been characterized as 'a tax on the rich,' but it is in fact a tax hike on investing in Canada that will serve as yet another barrier to economic growth," said John McKenzie, CEO of TMX Group, parent of the Toronto Stock Exchange.

Flow-through shares account for 65% of all funds raised in Canadian stock exchanges by exploration mining companies, said the Prospectors and Developers Association of Canada, a mining lobby group.

In 2023 junior mining companies, which are still in the exploration stage, raised about C\$1 billion (\$729.3

million) through flow-through shares in Canada. Lithium miner Sayona Mining (ASX: SYA) raised C\$50 million this way for its Quebec exploration project and investors paid a 40% premium from the stock's average listed price, public filings showed.

"Exploring for resources is venture capital at its riskiest," said Ron Bernbaum, CEO of PearTree Canada, an investment manager which facilitates flow-through share sales by mining companies, noting that flow-through shares offer a "successful incentive."

Canada's exploration companies have raised only C\$240 million in March, down from 79% a year ago, according to the Toronto Stock Exchange, which is home to over 40% of world's resource companies.

Industry lobby groups are hoping that the government will offer an exemption for flow-through share investors.

"If not it means the likely end of more than 70% of all resource exploration in Canada," Bernbaum of PearTree warned.

(\$1 = 1.3712 Canadian dollars)

Reuters / April 22, 2024

► **Volumes of domestic mining, construction equipment may drop in FY25: ICRA**

Additionally, the aggregate revenues for ICRA's sample set companies are expected to contract by 9-12 per cent and operating margins by 100-150 basis points in FY2025, the statement said.

Rating agency ICRA on Thursday said the volumes of domestic mining and the construction equipment (MCE) industry may drop in the current financial year on account of a slowdown in the new project orders amidst Lok Sabha elections and monsoon-related impact on construction activities.

"ICRA expects FY2025 to see a 12-15 per cent year-on-year decline (which translates into volumes of 114,000-118,000 units)," the rating agency said in a statement.

This drop is following two consecutive years of strong growth of 26 per cent in FY'23 and 24 per cent in FY'24.

"The reversal in this growth trend will be driven by a slowdown in the new project award activity in

Q4 FY2024 and Q1 FY2025, as the Model Code of Conduct will remain in force during the Parliamentary Elections in April-May 2024 (till the announcement of results on June 4, 2024).

“Additionally, the aggregate revenues for ICRA’s sample set companies are expected to contract by 9-12 per cent and operating margins by 100-150 basis points in FY2025,” the statement said.

The re-election push by the government on project execution led to a strong demand momentum for the domestic mining and construction industry in the last two years.

However, with a likely disruption in project award activity for two consecutive quarters -- in the fourth quarter of FY’24 and first quarter of FY’25, amidst the Lok Sabha elections and monsoon-related impact on construction activities in the second quarter, the first half of FY’25 is likely to see a moderation in sales, Ritu Goswami, Sector Head, Corporate Ratings, ICRA said.

Press Trust of India New Delhi | Apr 18 2024

➤ **Deccan Gold Mines board OKs fund raising up to Rs 59 cr**

Deccan Gold Mines announced that its board of directors has approved raising of funds upto Rs 58.70 crore for development of two projects.

The funds will be primarily utilised or invested for development of the Jonnagiri Gold Project of its associate company and the Kyrgyzstan Gold Project of its subsidiary company.

With the proposed funding as above / funds receivable upon conversion of warrants issued during September, 2023 the company said that it expects to meeting the timeline for commencement of gold production in Jonnagiri by end of October 2024 & Kyrgyzstan by end of 2024 as envisaged.

Deccan Gold Mines (DGML) is involved in gold exploration activities in India and overseas.

Deccan Gold Mines reported a consolidated net profit of Rs 9.46 crore in Q3 FY24, steeply higher from Rs 0.84 crore in Q3 FY23. Revenue from operations faced a marginal increase to Rs 0.06 crore in Q3 FY24 as compared to Rs 0.00 crore in Q3 FY23.

Capital Market - Live News | Apr 12 2024

PADMA SHRI TO Dr. SHAILESH NAYAK

Dr. Shailesh Nayak, Director, National Institute of Advanced Studies (NIAS), Bengaluru has been chosen for the prestigious Padma Shri Award 2024 by the Govt. of India for his contributions to the field of Science & Technology in the country. Founded by two visionaries – JRD Tata and Dr Raja Ramanna, NIAS is a truly interdisciplinary Institute, working towards contributing to the social good, through its Four Schools and multiple programmes.



L-R: Dr. H. S. M. Prakash, DDG, GSI (Retd.), Dr T. N. Venugopal, Council Member MEAI, **Dr. Shailesh Nayak**, Director, NIAS, Bengaluru, Dr. N. R. Ramesh, DDG, GSI, (Retd.), Dr. Godavari, GSI, (Retd.), Mr V. S. Prakash, Director (Retd.), KSDMC

Dr. Shailesh Nayak, although qualified as a geologist at the graduation level, blossomed in the field of earth science in the area of Oceanography and Remote sensing and made many outstanding contributions. He obtained a PhD. degree in Geology from the M.S University of Baroda in 1980 and joined the Space Applications Centre, Indian Space Research Organisation (ISRO) as a scientist and subsequently became the Director of Marine and Water Resources. He served the Geological Society of India as one of its Vice Presidents.

A proud moment for the entire geosciences fraternity.

Dr T.N. Venugopal
Council Member, MEAI

A BROAD OVERVIEW ON LITHIUM MINERALS AND INDIA'S STANDING ON THIS CRITICAL MINERAL

Ranjit Choudhuri

Abstract

Currently there has been a perceptible interest for accessing to lithium resource on account of its enormous capability to render a carbon free world, to act as an important source of raw material for energy development and storage. It has the immense potential to reduce the carbon emission level produced due to burning of fossil fuel, particularly in the automobile industry with the use of rechargeable and chargeable batteries in electric vehicles, mobile phones, laptops, digital cameras and also for items like heart pacemakers, toys and clocks; use of lithium and its alloys in the aero-space. Lithium also finds its use in the glass and ceramic and thermo-nuclear warheads.

With the presence of 002%, lithium is the 25th abundant constituent of earth crust but has become a major component of technology and industry. Sea water also has a very large reserve of lithium content estimated at 230 billion tonnes. It is also found in a limited way in volcanogenic sedimentary rock.

The pegmatite hosted lithium mineral formation is an important hard rock source of lithium though maximum valuable lithium resources, reserves are found globally in saltwater bodies and underground aquifers. Limited sedimentary type lithium deposits are mostly confined in North America.

The global distribution pattern of lithium deposits is highly skewed in favour of a very few limited countries with Australia dominating for production of hard rock lithium while the countries like Argentina, Chile and Bolivia hold the maximum lithium reserve in their brackish water lakes or salars.

Conventional opencast hard rock pegmatite mining or extraction of lithium from brine are the two broad extraction routes of commercial lithium. Interestingly, the production cost of lithium carbonate concentrate from hard rock is almost half to that of the concentrate produced from brine hosted lithium, yet the latter is a much preferred intermediate product since the final product produced through the brine route fetches almost double the price to that produced through hard rock lithium sources.

Contemporary scenario points to the dominance of Argentina, Bolivia and Chile as the largest repositories of lithium mineral resources. Australia however, predominates as the biggest lithium concentrate producer in the world while China has emerged as the biggest lithium technology holder, manufacturer and producer of lithium ion batteries, controlling 77% of the world's cell capacity and 60% of the world's component manufacturing and dominates the global lithium scenario. However, of late, there has been a global endeavor including India as a country to get rid of the Chinese monopoly.

India's lithium situation is rather bleak in spite of Geological Survey of India for the first time establishing lithium Inferred resources (G3) of 5.9 Million tonnes (Mt) in Salal-Haimana area of Reasi District of Jammu & Kashmir (UT). The concentration level of lithium in the above prospect is extremely low, reportedly varying from 350 to 700ppm. Current auction process notwithstanding, initiated by the Department of Mines Government of India, establishing the techno commercial viability of the above lithium prospect will be a prior and critical prerequisite.

In view of the unsatisfactory indigenous exploitable lithium reserve status, the country is critically dependent on import of the lithium end product. It is in the above context that the move by the Khanij Vikash Nigam Ltd to acquire and develop 5 lithium assets in Argentina is a step in the right direction.

Key words: *lithium, carbon free, pegmatite hosted, highly skewed, technology holder, bleak, techno-commercial viability, critically dependent, lithium assets.*

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1. INTRODUCTION

As an important source of raw material for energy development, lithium ore is widely used in batteries, electronics, chemicals, medical and other uses. The importance of lithium as an element is on account of its capability to affect transition to a carbon free world.

Lithium is one of the three elements, along with hydrogen and helium, to be created in the Big Bang. Lithium is rare in the Universe. The element was discovered on Earth in 1817 by Johan August Arfvedson in Stockholm when he investigated petalite, one of the first lithium minerals to be discovered [1].

In nature, lithium mineral species occurs as Halide, Oxide, Carbonate, Sulphate, Phosphate/Arsenate/ Vanadate and Silicate. The main important lithium minerals are the following: spodumene, petalite lepidolite, amblygonite, zinnwaldite and Jadar. There are 82 valid mineral species of lithium.

Traditionally lithium has been extracted from various lithium silicate minerals such as spodumene and petalite. However, the majority of lithium is now produced from lithium rich brines.

Lithium is a chemical element; it has symbol Li and atomic number 3. It is the lightest of all metals, very soft and the least dense solid silvery-white alkali metal element and can be cut with a kitchen knife. Freshly cut surface shows a metallic luster. It reacts with oxygen in the air, giving it a coat of dark lithium-oxide. Mostly, it is usually found locked up in minerals and salts. Lithium is highly reactive and flammable, and needs to be stored in vacuum, inert atmosphere, or inert liquid such as purified kerosene or mineral oil. It is usually stored in oil.

The most important use of lithium is in rechargeable batteries for mobile phones, laptops, digital cameras and electric vehicles. It is also used in some non-rechargeable batteries for things like heart pacemakers, toys and clocks. Lithium finds its use in the thermo-nuclear reaction. Besides, it is used to make alloys with aluminium which are very light but strong and used in aircraft, high speed train and bicycle frames. With magnesium, because of the strength, lithium alloy is used in armour plating. Industrial applications of lithium would include heat-resistant glass and ceramics, lithium grease lubricants, flux additives for iron, steel and aluminium production.

2. MODE OF OCCURRENCES AND DISTRIBUTION OF LITHIUM

Lithium does not occur as metal in nature, but is found combined in small amounts in nearly all igneous rocks

mainly as pegmatite minerals and in the waters of many mineral springs. Lithium is the 25th most abundant element in the earth's crust, and its content ranges from 20 to 70 ppm by weight. Lithium constitutes about 0.002 percent of earth's crust. Due to its solubility as an ion, it is present in ocean water and is commonly obtained from brines. The total lithium content of seawater is very large and is estimated as 230 billion tonnes, where the element exists at a relatively constant concentration of 0.14 to 0.25 parts per million (ppm) [2].

The distribution of lithium occurrence of commercial significance is highly skewed in favour of a few select countries as could be seen from the illustration reproduced below.



Fig. 1 Map showing major (source wise) lithium producing countries and also the global distribution pattern of lithium occurrences [3]

Map above shows the distribution pattern of lithium mines and mineral occurrences globally. The larger red and blue circles represent hard rock pegmatite/granite and the brine derived lithium mines respectively. Correspondingly the smaller dots represent both the hard rock (red+) and brine hosted (blue+) lithium occurrences. Occurrences of several volcano sedimentary type lithium can be seen in the western part of North America. Limited occurrences of lithium associated with the geothermal and oil field related brine can also be seen in the map in N America (No-12) and in Europe (No-40). Interestingly, a bi modal latitudinal distribution pattern of lithium deposits in North and S America has also been observed.

3. ON THE GENESIS OF LITHIUM

The world's lithium currently comes from two main geological sources: lithium-enriched brines, chiefly in the salt lakes, or salars of South America and pegmatite, an unusual type of granitic rock, enriched in a range of rare metals.

Salt Lake brine-type lithium deposits are mainly located in the three major plateaus, namely the Andes plateau in South America, the western plateau of the United States and the

Qinghai-Tibet plateau of China. The genesis of such types of deposits is mainly controlled by tectonic background, fault activities, climate and altitude [4].

The lithium-rich brine systems share six common (global) characteristics that provide clues to deposit genesis while also serving as exploration guidelines. These include: (1) arid climate; (2) closed basin containing a salar (salt crust), a salt lake, or both; (3) associated igneous and/or hydrothermal activity; (4) tectonically driven subsidence; (5) suitable Li sources; and (6) sufficient time to concentrate lithium in the brine [5].

Lithium in pegmatite is most commonly found in the form of mineral spodumene, but also may be present in other minerals such as petalite, lepidolite, amblygonite and eucryptite. Australia, the US, Canada, Ireland, Finland and the Democratic Republic of Congo are known to host pegmatite lithium deposits.

Knowledge about lithium columbium and tantalum (LCT) pegmatite which represent the most dominant types of hard rock source of lithium, particularly from an exploration standpoint, is limited. Two classical hypotheses exist on the genesis of pegmatites (a) As the product of either extreme fractionation of a parental granitic body or (b) Low-degree partial melting of a metamorphic rock [6].

4. GLOBAL RESERVES, PRODUCTION, CONSUMPTION AND THE DEMAND-SUPPLY STATISTICS

4.1 Global Lithium reserves

Owing to continuing exploration, identified lithium resources have increased substantially worldwide and total about 89 Mt. Identified lithium resources in the United States—from continental brines, geothermal brines, hectorite, oilfield brines, pegmatites, and Searle site—are 9.1 Mt. Identified lithium resources in other countries have been revised to 80 Mt. Identified lithium resources are distributed as follows: Bolivia, 21 Mt; Argentina, 19 Mt; Chile, 9.8 Mt; Australia, 7.3 Mt; China, 5.1 Mt; Congo (Kinshasa), 3 Mt; Canada, 2.9 Mt; Germany, 2.7 Mt; Mexico, 1.7 Mt; Czechoslovakia, 1.3 Mt; Serbia, 1.2 Mt; Russia, 1 Mt; Peru, 880,000 tonnes; Mali, 700,000 tonnes; Zimbabwe, 500,000 tonnes; Brazil, 470,000 tonnes; Spain, 300,000 tonnes; Portugal, 270,000 tonnes; Ghana, 130,000 [7].

4.2 Global lithium production

World's largest Lithium producing countries rank-wise and mine production wise (estimated) during the year 2022 would include 1) Australia (61000 tonnes), 2) Chile (39000 tonnes), 3) China (19000 tonnes), 4) Argentina (6200 tonnes), 5) Brazil (2200 tonnes), 6) Zimbabwe (800 tonnes), 7) Portugal (600 tonnes), 8) Canada (500 tonnes), and Other Countries (700 tonnes).

Total production trend of lithium worldwide (2010-2022) in tonnes of Li- content has been as reproduced in the graph below [8].

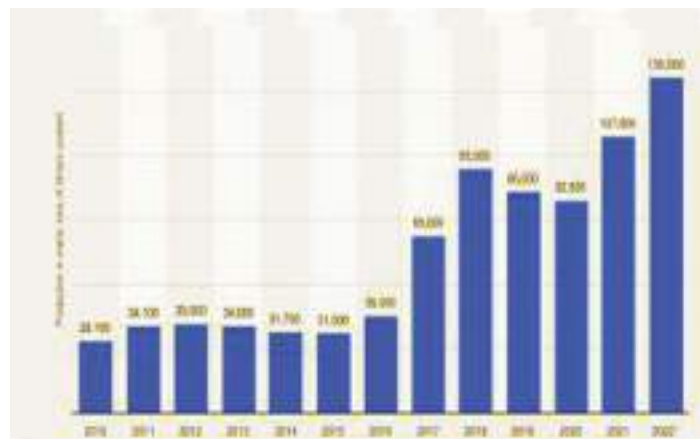


Fig. 2 Graph showing the production (tonnes) trend of lithium world-wide during the period 2010-2022

Lithium mines produced an estimated global total of 130,000 tonnes in 2022, a peak in production. This is a significant increase from 2010, when global lithium production was just 28,100 tonnes

It is forecast (Oct 2023) that in 2025, the global market volume will be 570,000 tonnes from 130.000 tonnes level in 2022 in metric ton of lithium content.

Supply of lithium worldwide in 2022 with projected figures for 2023 to 2030 in tonnes is given in the diagram below [9].

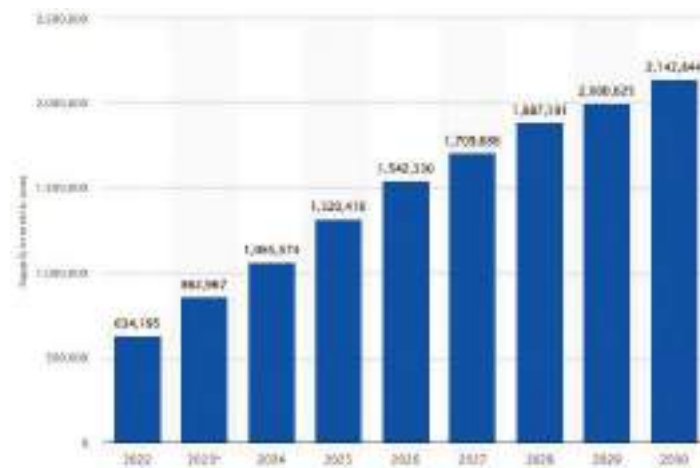


Fig. 3 Graph showing world-wide lithium supply including projection up to the year 2030

The total global supply was more than 634,000 tonnes in 2022. By 2030, the world's lithium (projected) supply will increase to more than 2.14 Mt [10]. It is expected that there will be a supply shortfall relative to the projected

lithium demand in 2030 of 2.3 to 2.45 Mt (depending on the source). With the yearly increase of global lithium demand, in the next decade, significant lithium deposits will need to come online every year, in order to keep supply pace with the increasing demand.

4.3 The average grade of Lithium in hard rock and brine hosted deposits

All of Australia’s current resources and production are from lithium minerals, chiefly spodumene and through other Li-bearing minerals such as lepidolite typically have an average grades of 1 to 3% Li₂O. The lithium concentrate has an average grade of 6 Li₂O. Bulk of the lithium concentrates are consumed by China.

Average lithium content in brine hosted deposits of South American Countries on the other hand has a fairly high concentration (typically more than 500 milligrams of lithium per liter of brine), and processing costs are low i.e. about 500gm or 1/2 kilogram in one tonne of brine. It is on account of this factor coupled with almost double the price of brine-hosted lithium end product fetched, in comparison to hard rock sourced lithium end product, continental brines provide approximately three-fourths of the world’s Li production due to their relatively low production cost.

4.4 China’s Current Dominance in the Lithium Sector

In terms of the lithium-ion battery supply chain, data from Bloomberg NEF suggests China controls 80% of the world’s raw material refining, 77% of the world’s cell capacity and 60% of the world’s component manufacturing [11]. Because of its high consumption rate, China also imports much of its lithium to supplement domestic production, most of which comes from Australian operations.

4.5 Global consumption of Lithium

Global consumption of lithium in 2021 was estimated to be 93,000 tonnes, a 33% increase from 70,000 tonnes in 2020. China is the largest consumer of lithium because of its booming electronics and electric vehicle industries. In the year 2020-21, India, on the other hand had imported lithium worth more than ₹6,000 crores and of this, more than ₹3,500 crore-worth of lithium was bought from China, (according to IANS 8 May 2023) to meet the domestic needs of Lithium to be used in automobile, electronic, glass and ceramic and in other Industrial sectors. Incidentally, one ton of lithium is reportedly priced at INR 57.36 lakhs in 2023 [12].

The comparative picture of the sectoral growth of lithium consumption trend during the last decade spanning from 2010 to 2021 indicates some interesting developments

including the staggering increase of lithium consumption by 283% during the above period.

Further, during the said period of 2010-21, it will be interesting to note how the sectoral growth trend has behaved from the table provided below.

Table 1. Sectoral lithium consumption growth trend during the period 2010-2021

Sr No	Name of the Sector	Year 2010 in tonnes	Year 2021 in tonnes
1	Ceramic and Glass	7285	13012
2	Batteries	5405	68820
3	Lubricant Greases	2350	2790
5	Continuous casting	940	1860

4.6 Pricing aspect of Lithium

Average lithium carbonate price during the period 2010-2022 was around US \$ 37000 per ton. Lithium price however, fluctuated violently in recent times. Thus the spot price per kg of lithium CIF Asia came down to bottom level at 9.5\$ or 9500/per tonne in Feb 21 and then started soaring up and by June 22 the per Kg CIF-Asia price zoomed up to an unprecedented high peak level at around 75\$ or 75000 \$/t only to get-crashed at less than half at around 31.5\$ or 31500\$/t by April 2023 [13].

The relative prices of lithium concentrate and different lithium salts as they prevailed as of 2019 is as given in the chart below.

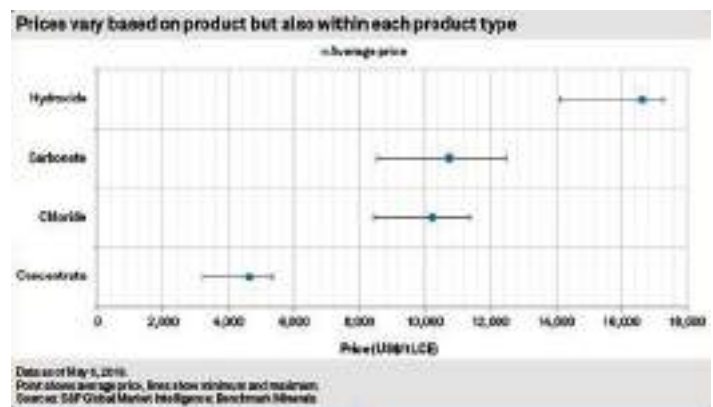


Fig. 4 Chart showing the relative average product wise price of lithium during 2019

In 2022, the average price of battery-grade lithium carbonate was estimated at 37,000 U.S. dollars per metric ton. This figure was by far the highest price for battery-grade lithium carbonate recorded in the period of consideration.

Then followed the period of price melt down and the price plummeted by a margin of almost 40% in the year 2023.

5. MINING AND CONCENTRATION OF LITHIUM

5.1 Conventional opencast mining as the most widely accepted practice for hard rock

There are two ways to mine/extract lithium involving (a) hard rock mining of granite or pegmatite bodies in which lithium minerals such as spodumene and petalite remain associated or (b) through the extraction of lithium dissolved in brine deposits, found in saltwater bodies and underground aquifers both serving as a valuable source of lithium.

The hard-rock method extracts lithium directly from pegmatite, with the deployment of common and conventional surface mining techniques. Mineralised mined pegmatites are then crushed, milled, and separated according to ore mineral identification.

5.2 Concentration of hard rock lithium ore

Large front-end loader discharges the blasted rock into the primary crusher and the primary crushing is followed by secondary cone crushing. Staged-crushed spodumene ore is conveyed from crushed surge pile to milling plant for powdering. The crushed lithium ore is ball milled to liberate the spodumene mineral grain from the associated gangue minerals. Spodumene mineral then is selectively floated in the froth by the use of long chain fatty acid in an alkaline circuit. In some cases, instead of flotation, heavy media separation is also used. After thickening in large thickeners, the lithium bearing fraction is dewatered in belt filters. Storing of concentrate mostly after sun drying is undertaken in a specially designed silo or shed. The dried concentrate is then generally bagged in 1000 kg Jumbo bags for export/conversion into downstream products like lithium carbonate.

5.3 Concentration of brine hosted lithium

The extraction of lithium from brine is carried out through a series of precise steps. Lithium-rich brine is brought to the surface and poured into shallow evaporation ponds. Here, the sunlight and wind dually act as agents to facilitate water evaporation, progressively concentrating the brine solution. The brine from the saline aquifer usually contains 0.01 -0.2% lithium. Through solar evaporation, depletion of aquifers takes place and the concentrated brine containing around 6% lithium is precipitated. Subsequently following the rejection of soda ash as solid waste, lithium carbonate is precipitated and is further refined using a very large volume of fresh water-approximately 500,000 gallons (1.9 million litre) per metric ton of lithium. To extract lithium, miners drill a hole in salt flats and pump salty, mineral-rich brine to the surface. After several months the water evaporates, leaving a mixture of manganese, potassium, borax and lithium salts which is then filtered and placed into another evaporation pool. After 12 to 18 months of this evaporation process, the

mixture is filtered sufficiently so that lithium carbonate can be extracted.

South America's Lithium Triangle, which covers parts of Argentina, Bolivia and Chile, holds more than half the world's supply of the lithium metal beneath its salt flats. But it is also one of the driest places on earth. In Chile's Salar de Atacama, mining activities consumed 65 percent of the region's water, which is having a large impact on local farmers to the point that some communities have to get water elsewhere.

The percentage wise contributing sources for Lithium (LCE) extraction pattern and percentage share of Hard rock, Brine and Shale hosted lithium in the market have been depicted in the two pie diagrams reproduced as below [14].

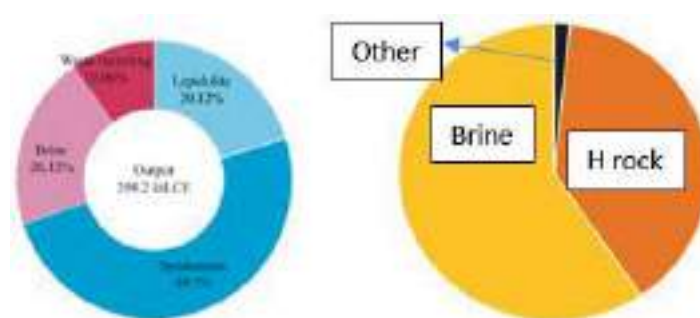


Fig. 5 Contributing sources of lithium and their % shares for commercial scale extraction

Battery manufacturing in electrical vehicles represents the most important down-stream use sector of lithium. Further, lithium ion battery value chain (illustrated below) from mining onwards to original equipment manufacturer (OEM) product line, reckons six intermediate production/product stages including mining/concentrating, refining, cathode production, cell production, modular assembly and their eventual consumption by the original equipment manufacturer has been shown in the drawing below.



Fig. 6 The lithium ion battery value chain from mining to OEM product stages (after Volkswagen module)

6. THE INDIGENOUS LITHIUM AVAILABILITY SITUATION

As per the historical data available, the apparent rosy picture about the indigenous lithium availability situation is on account of the recent reporting of lithium in Jammu and Kashmir (J&K) (UT) by the Geological Survey of India which has for the first time established lithium inferred resources (G3) of 5.9 Mt in Salal-Haimana area of Reasi area of the state. Besides GSI, Atomic Mineral Division is also involved in the exploration of lithium.

It is important to provide some clarification about the above reporting which is a misnomer and should actually be referred to as 5.9 Mt of bauxite resources with unofficially reported average content of 750 ppm, which as per the version of the State Geology of J&K further stands revised to 350-400 ppm. The lithium associated bauxite deposits occur as isolated pockets at Salal -Mutual region in Udhampur district and considered as basalt derived in-situ reworked kurst type bauxite of Pre Eocene Age, occurring as 6-10 cm thick soil / clay horizon. Further, some bauxite pockets have reportedly shown sedimentary features with 1mm -3mm thick individual bed/lamina [15].

Preliminary survey also showed an estimated lithium reserves of 14,100 tonnes in a small patch of land surveyed in Southern Karnataka's Mandya district. Other possible sites would include the Mica belts in Rajasthan, Bihar, Andhra Pradesh; Pegmatite belts in Odisha and Chhattisgarh and the Rann of Kutch in Gujarat.

The Salal-Haimana prospect with the reported lithium values in a hard rock assemblage essentially represents a challenging prospect of sub-paramarginal type with anomalous concentration that needs to be probed thoroughly by a team of experts, experienced not only in finding a deposit, delineating its extent, assessing the economically mineable grade distribution but must have the capability to establish feasibility of the prospect. Incidentally the original reporting of lithium in J&K is reportedly attributed to the outcome of the findings of two former geologists of GSI, engaged in a geochemical survey of about 350 sq. km area in Reasi.

7. INDIA'S RECENT LITHIUM INITIATIVE

In November 2023, the Ministry of Mines, Government of India, initiated the process to auction 20 blocks of critical minerals, including the 5.9-million-tonne (Mt) lithium resource block for auction [16]. Outcome is awaited. Simultaneously India has taken initiative to acquire lithium assets abroad. India's state-owned firm Khanij Bidesh India Ltd (KABIL) signed a 2 billion-rupee (\$24 million) lithium exploration pact for five blocks in Argentina, the Ministry of Mines, Government of India said on Monday. (15th January 2024 Reuters).

Similarly, National Mineral Development Corporation (NMDC) Ltd also through their Perth based subsidiary- Legacy has acquired a lithium mining lease in Mt Bevan Region of West Australia .and engaged Ms Hancock Prospecting as its partner and action for prospecting and pre-feasibility study report preparation is likely to be precipitated in April 2024.

Reliance New Energy Limited, a subsidiary of Reliance Industries Ltd, had also acquired in 2017 all of the assets of

Lithium Werks BV for USD 61 million, including funding for future growth. The assets include the entire patent portfolio of Lithium Werks, manufacturing facility in China, key business contracts and hiring of existing employees

In the meanwhile the Tata Group signed in 2023 a memorandum of understanding with the State Government of Gujarat to set up a 20 GWh lithium-ion cell manufacturing factory in Gujarat. It will build the proposed facility with an estimated investment of INR 13,000 crore (\$1.57 billion) in the initial phase.

8. SUSTAINABLE FUTURE OF LITHIUM ION?

From the industrial perspective lithium raw material represents a much needed commodity and is going to have sustained demand in the near future. Authoritative sources like Dr. M Stanely Whittington, the Chemistry Nobel Prize winner and the father figure of battery being used today maintains that the long term prospect of lithium raw material will remain important and it will be lithium for the next 10-20 years [17], which is not a very long time span.

Lithium ion battery driven Electric Vehicle EV is expected to dent the existing automobile industry enormously and is likely to result in a situation, analogous to the disappearance of camera and film manufacturing companies with the advent of digital technology.

9. CONTEMPORARY LITHIUM SCENARIO

It is anticipated that Australia would dominate for a reasonable period of time as the biggest producer of lithium in the world with 50-54% market share in recent times.

Dominance of Argentina Bolivia and Chile (known as li-golden triangle) as the largest repository of lithium mineral resources with over 50% global lithium accumulation (Peru is likely to get included in the above triangle soon).

Dominance of China as the biggest lithium technology holder, manufacturer and producer of lithium- ion batteries. China has ensured the lithium supply chain by acquiring mining rights (mostly in JV mode) in Australia, Argentina, Canada, Chile, and in DRC.

Till recent times China acquired around \$ 5.6 billion worth of lithium - assets. India with her significant projected requirement has every reason to try acquiring lithium mining assets in JV mode in advantageous countries endowed with adequate lithium reserves.

On the indigenous front, there has been an increasing and welcome awareness in some of the leading Indian companies, both in public and private sectors, to get involved

in the business of lithium to make India self-reliant in the lithium ion cells manufacturing value chain domain.

10. CONCLUSION

As a country India is poised to become one of the largest consumers of lithium in the world. In view of the non-availability of economically exploitable lithium resources, the country is left with no other option but to secure assured supply-source of lithium. It is in this context the move by KABIL to acquire lithium blocks in the exhumed basins of Atacama in Argentina or the move by NMDC in the development of Australian lithium assets can be reckoned as a move in the right direction. However, the requirement of precious water in exceedingly large quantities in the processing stage represents an area of concern and should be kept in mind in the project development strategy.

The acquisition effort of li-ion battery technology by Reliance and the step by TATA Group to set up li-ion cell manufacturing units in Gujarat, India, should be reckoned as excellent moves to render the country significantly self-sufficient in the lithium domain.

It needs to be mentioned however, that in the midst of an ever-changing commodity life cycle span, the conceivable action plan has to be time bound, fast and tangible.

11. ACKNOWLEDGEMENT

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LOCKING FATE OF DIMENSIONAL STONE RESERVES - A WAY FORWARD

Dr. Pramod Rajmeny¹ and Dr. Mohammad Alam²

Abstract

On 21st Feb 2024, a pit wall collapsed at Panna Mishri Granite mine in Pali (Rajasthan) killing 3 miners and injuring an equal number. It is not an isolated case, but it is the curtain raiser of what is brewing in the cauldron of dimension stone reserves in the country. Many horrendous conditions are prevailing in the Makrana Marble mining belt and soon going to engulf other dimension stone fields like Granite and Sandstone reserves, etc, if no remedies are undertaken. Most of these fields carry out unscientific mining without excavating pit walls in proper benched profile and with no spade of slope management. It results in - unsafe working conditions which do not permit their continuance down the depth. This premature closure of mines (a) locks the reserves of precious reserves to an unprecedented scale and consequent immense loss to state revenue, (b) escalates the burning problem of unemployment, and (c) major safety concerns along with gross degradation of the environment. It is locking the fate of the dimension stone mining.

On the technical front, years of marble extraction at Makrana has created a mega-sized over-hanging trench (having length more than 14km) as a single slope. Major foliation in the hangwall of the mammoth trench is oriented parallel to the slope, adding further grit to it. All these conditions are making the Makrana mining belt prone to a major safety concern. The other dimension stone fields like granite and sandstone are just one spade behind and fast galloping towards it.

Since these issues are affecting the whole of country, they require a quick redressal. Nevertheless, most of these mines are run by small mine owners and obviously, remedial measures to these issues are much beyond the economic and intelligence capabilities of these individual lease holders. But the net result is gruesome- whether the knife falls on watermelon or vice versa, it is huge national loss.

The paper evaluates geotechnical status of these dimension stone fields, specially the Makrana marble belt along with Granite, Sandstone fields etc. and suggests certain remedial measures- the way forward. It is appropriate time for all stakeholders including the Government machinery- to ponder over these measures and come up with robust remedial plans so that extraction of world famous Makrana marble can be revived, while that of granite, sandstone, etc. can be saved from falling prey to it before it becomes too late.

1 INTRODUCTION

The country, specially - Rajasthan, is bestowed with valuable dimension stones resources like marble, granite, sandstone, etc. Confining to the former, extraction of marble has been carried out at Makrana for centuries. However, the state of art of stone extraction has still remained in its primitive stage. Many of the pits have been excavated to a depth of 80-100m depth following the trend of the mineral unscientifically and landed in clamping of Sec 22 of Mines Act. This situation leads to unemployment of the workforce engaged along with locking of valuable minerals forever.

Extraction of marble since construction of Taj Mahal (Alam, 2024), has been carried out in about 26km long belt in and around Makrana (Rajasthan) and the pits are owned by a large number of small lessees who have unfortunately myopic vision. Succession of family over these centuries has divided the large belt into innumerable tiny leases having sizes as small as 10mx20m. These lessees extracted the marble following the state of arts- i.e. following the extension of the marble deposit along its dip direction. Out of about 80% mines have been prematurely closed due to unsafe mining conditions (threatening employment of about 50,000

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miners) and clamping of Sec 22 of Mines Act. As of now, the once a bustling town is now turning into a ruined look.

Likewise, Granite extraction, concentrated mostly in Jalore, Sirohi, Pali belt, has reached as deep as 70-80m. Again, these mines extract the granite vertically downwards leaving hardly any benching thus turning as vertical cliffs. Thus, some of the mines have turned into deep vertical excavations with unsafe working conditions and are attracting clamping of Sec 22. Sandstone lying around Jodhpur is no better. It is almost akin to the granite state.

In most of the cases, these mines are operated by small mine owners who could not modernize with time. They could not adapt to scientific mining technology like bench profile, slope management, etc. Had they followed the latest techniques of mining, the extraction would have continued for another 300-400m down. Again, the scale effect might have prevented them to brace the latest technologies.

To continue or revive these mines, the expected expenditure and acquiring additional land of influence zone are beyond their financial and intelligence capabilities. It requires a multi-pronged integrated approach – (a) reviving the already entangled leases (b) re-defining lease allotment rules–specifying a minimum lease area for future allocation of leases, etc.

1.1 Wall collapse of a granite quarry: Tip of Iceberg

Granite is, generally, extracted by progressing vertically downwards. A quick look at the accident at the Panna Mishra granite mine, Pali (Rajasthan) (Fig.1) on 21st February, 2024 reveals that though the pit walls are benched (7-8m high) but most of the benches are almost merged together and even undercut.



Fig.1 Panna Mishri Granite Mine, Pali

The main reasons of the accident may include:

- Too steep a pit wall (vertical face) against its design value,

- Ground water seepage,
- No provision of regular visual inspection nor following slope management plan, etc.

The top three upper benches were not only merged but under cut too. In the Granite part, most of the benches are merged with bench widths varying from 1 to 3m (Fig.1). Ground water was profusely seeping which deteriorated the basal phyllitic rock and facilitated the failure. The pit walls are mostly vertical to sometimes undercut. In the instant case, the 28-30m high wall with under-cutting and non-benched profile permitted sudden and catastrophic falling of a large chunk and resulted in burying the people. It is well a known fact that no slope failure occurs instantaneously, it always emits failure symptoms and these were neither observed nor heeded.

In most of the cases, the granite is being extracted up to the lease boundary by vertically descending. Under such conditions, it is very difficult to revive the granite pit as no land is available for making scientifically designed benched profiles. Again, loss of valuable minerals and loss of employment along with environmental degradation. The statute rightly clamps Sec 22 to some of these granite pits closing their extraction- landing in premature mine closure and locking the precious resources.

1.2 Ideal Mining configuration

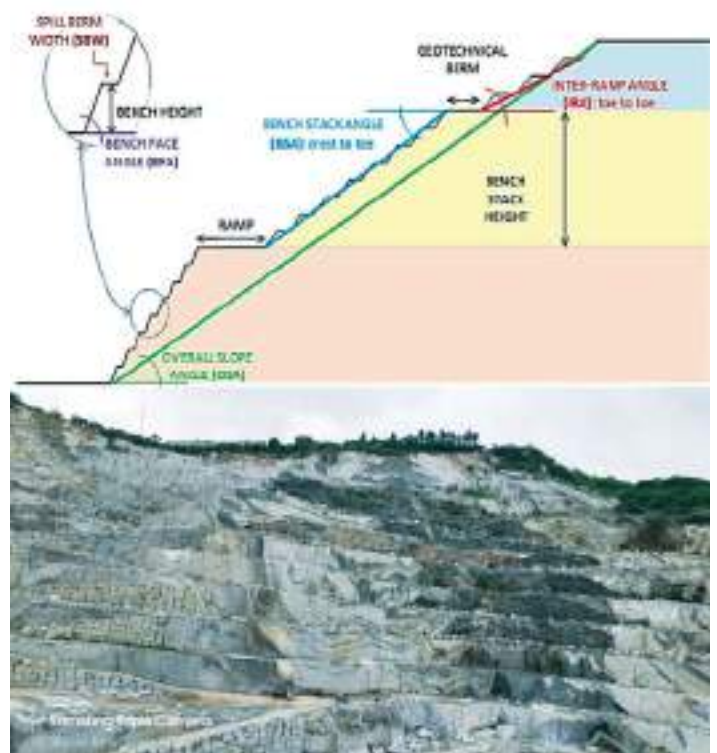


Fig.2 Slope profile terminology and scientifically design pit walls in a marble mine

Respecting geology, physico-mechanical properties, hydro-geology of the area, a pit should be designed. The design (Fig.2) includes specifying bench height, bench width, bench slope, overall slope angle, ultimate pit depth, etc. While carrying out the extraction, the slope should be managed-including slope monitoring and stability enhancement measures – like controlled blasting, supporting geological faults, dealing with groundwater, etc. Likewise, to access lower benches or pit bottom, it should excavate a ramp. This is standard practice of open pit mining. There are plenty of mines which carried out systematic and scientific mining, the mines not only increased their production manifold but also could deepen the pit safely by three times – as deep as 400m. In Marble field, M/s R.K Marble – Morwad pit is a beacon which has reached safely to a depth of about 200m.

Looking to other dimension stone mining- against vertical pit walls in granite, Makrana marble mines are much more dangerous because their pit walls are over-hanging and not at all benched. Pit wall collapse is very common in Marble mining with double digit toll figures every year. Let's take the worst example of locking the fate of world famous marble reserves.

2 MINING SCENARIO AT MAKRANA MARBLE

Makrana (Rajasthan), once a flourishing town, famous for supplying marvellous building stone material to the Taj Mahal, now bears a deserted look. The rusted over-head Derek cranes installed side by side at the crest of each pit seem to be looking like iron-clad vultures gazing at the skeleton of marble pits lying down below. Carrying out marble extraction for centuries has resulted in creation of a 14km long overhanging trench (70-100m deep)- literally it is sitting on the brink of a major mishap.

Marble at Makrana is occurring in three layers/horizons. With increase in depth, the quality improves. The marble beds dip at about 65°. Strictly following the depth extension of the marble, the extraction has been carried out to a depth of about 70-100m. It is learnt that out of 750 pits, Section 22 (3) of Mines Act has been clamped in more than 525 mines under Sec 22(3). Officially these mines are closed but illegally being mined.

Absolutely no benches are left either on either the Hangwall (HW) or in the Footwall (FW). Instead, the hangwall is undercut, un-supported and really hangs without any lateral support. With extraction of the mineral in adjoining leases, pits of these leases have been merged into one mega trench.

Normally, to reach the bottom of the pit, one continuous iron fixed ladder is clamped in the footwall but with no sollars.

Still worse, miners are lowered using Derek Crane without any statute approved man winding arrangement.

The marble field has following special features:

2.1 Small size of leases

The marble leases were awarded to the mine owners by erstwhile kingdoms of Taj Mahal era while their size kept on decreasing due to family succession. These owners, unfortunately, have myopic vision to maximize extraction as long as possible without thinking for long term vision and after effects. As a result :

- the area has not been explored at all for the presence of marble in depth by any traditional exploration method like diamond drilling, etc. There might be more bands of marble in the immediate footwall or hangwall which could become a game changer.
- these smaller size leases do not permit adoption of scientific mining methods like benched profiles as practically no land is available to develop its pit slopes.
- With progress of mining down depth, the small size leases enabled lesser stone production and consequently resulted in lesser revenue generation.

All these internecine factors are metamorphosing the marble sector in a vicious loop of strangulating mine production and unsafe mine conditions.

2.2 Geometry of individual lease

With the marble extraction following the mineral bands which is about 10-20m wide at bottom and 50-60m wide at surface and dipping at 65 to 75° (Fig.3), (Purohit et al. 2024). As a result,



Fig. 3 Makrana mines: Mega sized over-hanging trench

inclined trapezoidal shaped openings/ excavation are created in due course of time following the hangwall and footwall. Currently, the excavation has reached about 80-100m depth.

With division and sub-division of each lease as a part of succession, individual lease size is as small as 10m wide or even less.

2.3 Stability status of the steep walls of individual lease

A quick estimate of rock mass characterization of the immediate hangwall of Gunwati mine area reveals that it has Rock Mass Rating of 60-65 accounting for disposition of phyllites, dolomites and Marble rocks, main joint or bedding running parallel to the hangwall, coarser spacing of joint sets, their uniaxial compressive strength, low degree of weathering, etc., Experience suggests that given geo-mining condition at Makrana (having Rock Mass Rating of around 60-65 and working depth), the overall slope angle may be around 50-55° against the footwall inclined at 65-75° while the hangwall is contrarily over-hanging. Thus, the footwall is steeper than its designed value while the over-hanging and undercut hangwall is prone to collapse. As clear from the Fig.4, steeper the wall inclination from the designed overall slope angle, more wall rock gets unstable. Thus, a sizeable rock envelope beyond the ultimate pit angle is in relaxed mode and unsafe.

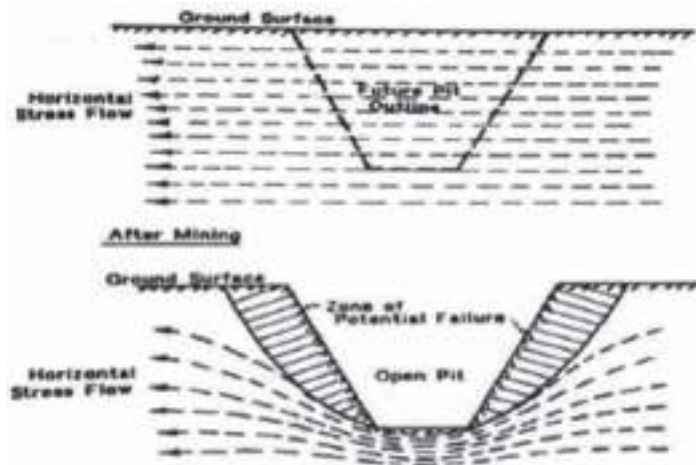


Fig.4 Stress relaxed zone around the pit walls of an open pit (schematic)

Hence the rock volume between 45 to 75° is in a stress relaxed zone and is unstable in case of the footwall while the hangwall is entirely unsafe.

2.4 Robbing of boundary pillars

With continuous decrease in size of each mine, the reserves present in the boundary pillars blocked sizeable wealth. As a result, these boundary pillars were also extracted gradually, thus, depleting the natural support provided to the hangwall. As a resultant, excavations of these adjoining leases kept on merging with each other, thus, now turning out to be a mega slot or trench with its length running in something around 14km. It is, thus, about 50-60m wide at top, 10-20m wide at bottom and about 100m in vertical height.



Fig. 5 showing a network of thin boundary pillars and their robbing

The situation is worsened by the joints or foliation dipping parallel to the hangwall. The Fig.5 shows relics of some remnant rib pillars left between two adjoining leases in Gunawati belt.

2.5 Creation of a mega-sized over-hanging trench & assessment of its stability

The current configuration- a trench about 50-60m wide at surface level, dipping at 65-75°, about 100m deep and 10-20m wide at bottom is more of an underground excavation than an open pit (Fig. 6). Accordingly, to determine maximum free stand-up span of the hangwall, (Mathews et al.1981) approach was used. The hydraulic radius of the current mining configuration of Makrana pits comes out to be around 10-15m and falls within caving zone (Fig.7). The hydraulic radius per kilometre length of the pit (long span) comes out to be around 50. Hence the current configuration of the Makrana area is very much prone for caving.



Fig.6 Major joint set present in the hangwall and possible failure mode

Unfortunately, presence of wide cracks in the immediate hangwall during the field visit by the author validates the above apprehension. The current scenario is even worse than Chuk-Dungri mine collapse (involving about 500m span) occurred a few years back. Thus, there is a global threat of hangwall collapse involving a larger area- running in a couple of kilometres rather than a single mine lease.

It is a very dangerous situation and calls for immediate attention.

Other dangers associated with the area include:

- In absence of any benches, any roll down anywhere from the slope will fall down with bullet speed posing a

serious threat to the miners working at the pit bottom. Every year 7-8 accidents do take place in this belt, out of which 50% are due to fall of stone on the head of the miners.

- Crest of the hangwall is laden with loose stones, even debris is lying on it, thus very prone for stone falling down

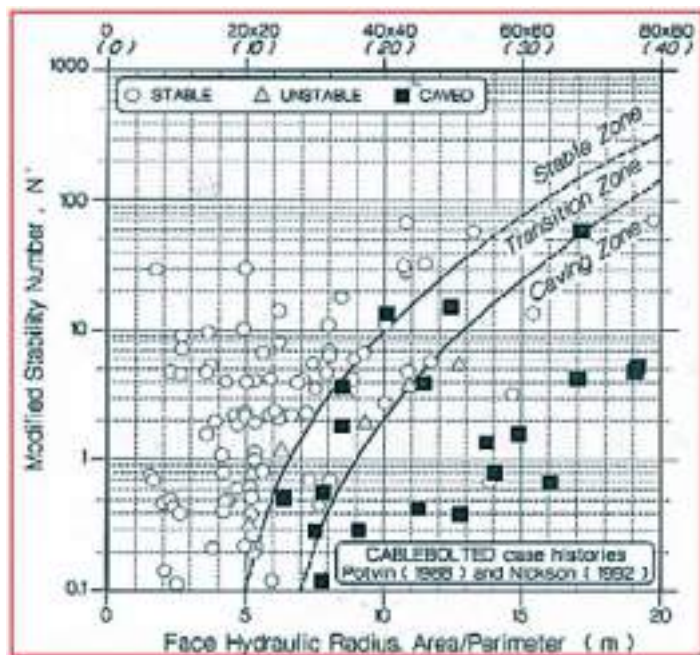


Fig. 7 Mathews Empirical model relating open span vs rock characterization

The immediate area of the hangwall is prone for collapse, thus it is the dangerous zone which should be fenced to prevent inadvertent entry of man and animals. To extract the locked marble deposit further down below, the hangwall needs to be revised to a stable overall slope angle and profiled in bench pattern or carry out underground mining after leaving a stable isolating crown pillar. As of now, since the influence zone of the hangwall is not in direct control of the quarry owners, the foremost step to revive the marble extraction is to acquire this zone and refine it.

2.6 The influence zone

Typically, hangwall of an inclined opening consists of a fracture zone and overlaid by deformation zone. The fracture zone, as name connotes, experiences a set of tension cracks radiating from the excavation to the surface (Fig.8). Beyond the fracture zone, lies the deformation zone which undergoes deformation- surface settlement, trough formation, etc. The caving envelop normally extends up to 60-70° from the horizontal plane passing at the toe of the opening.

The current configuration of the Makrana field is much akin to the classic zonation developed around an inclined opening

(Fig.8). The probable collapse zone of the hangwall can be determined by simulating the opening on suitable numerical modelling. It may engulf about 100m or more inbye of the immediate hangwall making it highly vulnerable and is a hot spot for safety of the persons deployed in the pits and habitats residing in the hangwall.

In present geo-mining condition, about 150m zone beyond pit boundary is unsafe and any collapse may have very serious consequences for habitation dwelling or plying in this strip of land. Therefore, the influence zone should be barricaded at the earliest.

For making safer marble extraction, the hangwall needs to be configured to be benched at an angle of about 45-50° (exact overall slope angle to be determined by detailed geotechnical investigations).

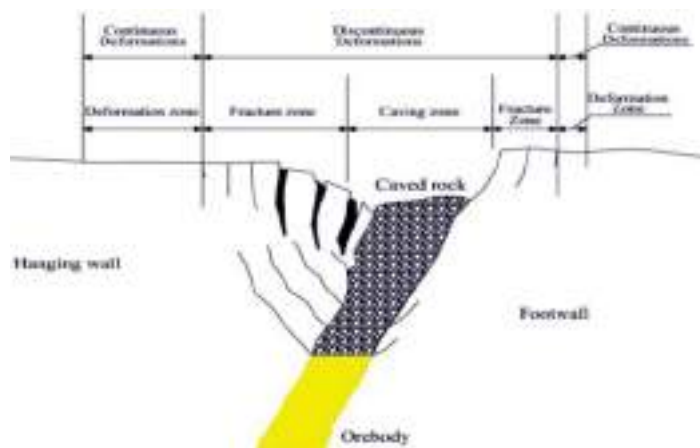


Fig. 8 Various zones of influence around an open overhanging opening

2.7 Some of the fatal developments

Due to experiencing difficulties in extraction marble at the pit bottom, a new trend is emerging at Makrana. In the hangwall of the mega-pit, there appears to be some marble bands which the miners have started extracting by making a trench/slit and deploying a smaller excavator.

A close look at Gunwati mine reveals a number of such trenches in the already hanging hangwall. Geotechnically, it is very dangerous development. Cutting any slit in the hangwall of the existing mega-pit would make the intervening beds detached from its roof and floor and would lead to large-scale collapse of these intervening beds into the larger hanging mega-pit.

3 CURRENT STATUS OF OTHER DIMENSION STONE RESERVES

After describing the marble field in detail, a quick appraisal of granite and sandstone fields is presented. The latter fields are comparatively better as the excavations are dug vertically making cliffs instead of inclined over-hanging excavation in

case of marble. The granite and sandstones have similar issues as outlined here:



Fig.9 Development of cracks and creation of trenches in the hangwall of the mega-pit of Makrana

3.1 Granite Mining Scenario

Granite mining is widely going on across the country. In Rajasthan, it is clustered around Jalore, Pali, Sheoganj areas. Some of the granite pits are 80m deep and have been excavated vertically down without leaving any berm or bench (Fig. 10). Again here the problem is of too small lease area to develop a mine systematically with bench profile and ramp to access.



Fig.10 A granite mine – vertical cliff with virtually no benching

3.2 Sandstone Belt

Sand stone mining is mainly concentrated around Jodhpur (Raj). The famous Fidusar belt of sandstone mining is no different than Marble or granite mining belts. The sandstone extraction is being carried out taking easy low hanging fruits (Fig. 11) with following key observations:



Fig.11 A Sandstone mine with near vertical cliff: Prone to roll down

- No scientific mining – no benched profile of the pit walls,
- Pit walls are either very steep or almost vertical profile making cliffs, which are prone to collapse,
- At many places, public roads are passing on the steep pit walls. These pose serious threat to stability of these public roads as their base is prone for collapse,
- There is no ramp excavated to access lower workings.
- Low quality sandstone is left as a vertical in-situ pillar, with loose hanging around creating highly unsafe working conditions.
- No barrier pillars are left between leases.

With the given mining conditions, the sandstone extraction will also have a similar fate as Marble or Granite, if unscientific mining is carried out.

3.3 Common observations

Looking at world class Makrana Marble mines, Granite belt and sandstone mining cluster, following are the common features:

- Mining leases consist of small areas like 1 hectare and no boundary pillars are left. No barrier pillars left.
- The reserve shape, size and quantity are not proved by any technique like diamond drilling.
- Extraction is carried out following a particular vein and no bench formation, single slope- large area is hanging and unsafe,
- No ramp or safe access to pit bottom, people use Derek crane to lower people instead of man winding,
- Because of a single large slope, mining is stopped by statutory bodies clamping Sec 22 of Mines Act.

4 THE WAY FORWARD

The unscientific extraction of marble at Makrana has resulted in their premature closure of precious deposits at a mere depth of 80-100m. It not only manifests in locking the valuable reserves, loss of employment but also safety concerns which no country can afford. Unfortunately, other dimension stone fields like granite, sandstone are closely following the unpleasant course.

Most of these leases are small in size and owned by small mine owners. Naturally, it is a lose-lose situation for the community and the government. It is not expected from the small scale mine owners to carry out scientific mining profiles by making benches and ramps. The current approach adopted in the dimension stone mining does not permit it to go down below 80-100m depth which otherwise could have gone as deep as 300-400m comfortably.

Reviving these locked reserves is beyond their vision and financial capabilities. It, therefore, becomes imperative to take remedial measures at community and government level. Naturally, Government needs to make a broader strategy to extract these precious minerals:

Some of the remedial measures suggested include:

4.1 For existing mines

- Existing small mine owners should themselves form a cooperative or a cluster to increase the size of mining and work under a single banner. It will enable us to adopt scientific mining methods and get loans. Increased

size would manifest in higher mine production and consequent increased revenue flow. Evidently, win-win situation for the community and the government.

- Explore the extent of these resources and reserves using techniques like diamond drilling, geo-resistivity, seismic survey, etc. so that their future course of action can be chalked out.
- Government should acquire land lying in the influence zone to (a) fence the vulnerable zone to prevent inadvertent entry in the influence zone and (b) allocate to the existing mine owners so that they can reprofile the walls of the pit—a step to make the current configuration safe,
- Assess stability of the existing slopes and carry out slope stability monitoring at once,
- No statute can grossly change the pathetic situation of dimension stone mining. The mine owners need to change their approach to self-regulation and look beyond merely statute compliance. They should seek expert advice from subject matter experts.
- Government, alternatively, should acquire the small mines/ leases and auction them as a larger block to bigger mining players so that larger funds and vision can be made available to carry out their extraction scientifically. The profit so acquired could be proportionately shared with the existing mine owners.

4.2 For future: For leases to be allocated in future

The Government should revise its policies of allotting new leases:

- Redefine the minimum lease size so that the mineral resources can be extracted scientifically carrying out benched profile and safely,
- While allocating the lease, an optimum design strategy of extraction should be made integral part of it, wherein any serious distraction should be dealt with heavy penalty.

5 REFERENCES

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2. Purohit Mahesh, Jaiswal A. and Rajmeny, P., 2024, "Extraction of Makrana Marble: Challenges & way forward", in proc 4th International Conference on latest techniques of Exploration and Exploitation of minerals, Jodhpur- 8-10th Jan 2024.
3. Mathews, K.E., Hoek, E., Wyllie, D.C., & Stewart, S.B.V. (1981). Prediction of stable excavation spans at depths below 1000m in hard rock mines. (Tech Report DSS Serial No. OSQ80-00081), Ottawa: Canada Centre for Mineral and Energy Technology.



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MEAI NEWS

MEAI HEADQUARTERS

3rd Council Meeting

The 3rd Council Meeting of the Association was held on 13-04-2024 at 5.00 PM at Training Institute Complex Conference room, NMDC Limited, BIOM Bacheli, Chhattisgarh. Bailadila Chapter hosted the Council Meeting in the Hybrid mode.

Shri. S.N. Mathur - President, Shri. D B. Sundara Ramam- Vice President – I (joined online), Shri. Dhananjaya G Reddy- Vice President – II, Shri. M. Narsaiah – Secretary General and Shri. B. Sahoo- Jt. Secretary cum Treasurer attended the meeting physically and conducted the meeting.

The Council members that attended the meeting physically were Dr. P.V. Rao, Dr. T. N. Venugopal, Shri B. Surender Mohan, Shri. V. Lakshminarayana Shri. Deepak Vidyarthi, Dr. S K. Vashisth, Dr. C H. Rao, Shri. A. R. Vijay Singh, Shri. K. Laxminarayana, Shri. M. S. Rachappa, Shri. Ravi Chandran Raj, Shri. T. Shiva Kumar, Shri. P V Rao, Shri. L. Krishna and Shri. Amit Ghooli. Several Council members also joined the meeting online.

After gruelling deliberations, some important decisions were taken in the Council Meeting.



L to R: Shri. B. Venkateswarlu, Chairman, Bailadila Chapter, Shri. M. Narsaiah, Secretary General, Shri. S.N. Mathur, President, Shri. Dhananjaya G Reddy, Vice President – II and B. Sahoo, Jt. Secretary cum Treasurer



View of Council members attending the 3rd Council meeting in person



Council members that attended the 3rd Council Meeting at Training Institute Complex, Conference hall, NMDC Limited, BIOM Bacheli Complex

The list of new life members approved by the Council are given below:

S. No	LM No.	Name	Chapter
1	6310	Mr Abdul Saleem	Hyderabad
2	6311	Mr Joyanta Chakraborty	Kolkata
3	6312	Mr Sujit Mohanty	Bhubaneswar
4	6313	Mr Aspari Kumaraswamy	Bellary-Hospet
5	6314	Mr Picchika Bala Surendranath	Bellary-Hospet
6	6315	Mr Kunal Meena	Udaipur
7	6316	Dr. Vikram Seervi	Udaipur
8	6317	Mr Sanjoy Gorain	Kolkata
9	6318	Mr Joshi Hiteshkumar R	Ahmedabad
10	6319	Mr Pathak Sudhirkumar	Ahmedabad
11	6320	Mr Kaila Jaydeep V	Ahmedabad
12	6321	Mr Boda Bipin	Ahmedabad
13	6322	Mr Vasani Ankit	Ahmedabad
14	6323	Mr Rathod Kirtikumar	Ahmedabad
15	6324	Mr Patani Ragaji Ratana	Ahmedabad
16	6325	Mr Vyas Mayur Hareshbhai	Ahmedabad
17	6326	Mr Grayden Sylvester Everett	Ahmedabad
18	6327	Mr Vivek Meena	Udaipur
19	6328	Mr Subhankar Saha	Kolkata
20	6329	Mr Mukul Anand Bhatt	Udaipur
21	6330	Mr Karunakar Gandarapu	Hyderabad
22	6331	Ms. Shirisha	Rayalaseema
23	6332	Ms. Pagidipalli Shiva Meghana	Rayalaseema

24	6333	Ms. Bairi Akhila	Rayalaseema
25	6334	Ms. Doddi Satya Sri	Rayalaseema
26	6335	Ms. Merugu Akanksha	Rayalaseema
27	6336	Mr Rodda Pavan kumar	Rayalaseema
28	6337	Ms. Pottipogu Archana	Rayalaseema
29	6338	Ms. Cholleti Saisrija	Rayalaseema
30	6339	Mr Narasimha Rao Takkeda	Hyderabad
31	6340	Mr Mayank Saxena	Hyderabad
32	6341	Mr B R Ravikumar	Bangalore
33	6342	Mr Pramod Kumar	Jaipur
34	6343	Mr Budiga Rakesh	Hyderabad
35	6344	Mr Appani Ravikumar	Hyderabad

BELLARY-HOSPET STUDENT CHAPTER

Report on Earth Day Celebrations 2024

During the World Earth Day celebrations on 22 April 2024 organised at Sandur by the Bellary –Hospet Student Chapter along with Institution of Engineers India at VSKU Post Graduate Centre Nandihalli, renowned geologist Dr HSM Prakash delivered a prediction regarding the upcoming monsoon season. Drawing on his extensive expertise and experience as a retired Officer of the Deputy Director General of the Geological Survey of India, Dr Prakash cautioned that a deficiency in rainfall may be on the horizon.

Speaking as the Chief Guest of the event, Dr Prakash highlighted the link between volcanic activity and precipitation patterns. He noted that while major volcanoes were active in 2017, 2018, and 2019, there are currently no indications of increased volcanic activity that could contribute to significant rainfall.

The activities of volcanoes play an important role in climate change, by studying the activities in the earth's layers, climate dynamics can be known more accurately than the methods currently followed by experts. He said that this new study that he is proposing can be called 'Geometeorology'.

Additionally, he underscored the necessity for governments to explore new sources of minerals to meet the growing demand for industrial materials.

Other speakers at the event echoed Dr. Prakash's concerns and emphasized the need for environmental awareness and action. Sri Pramod Ritti, General Manager (Geology) of BKG Mines, emphasized the symbolic importance of Earth as a mother figure and called for gratitude and stewardship

toward nature. Sri P Venkateswara Rao, Secretary of the Bellary-Hospet Chapter, advocated for the reduction of plastic usage to mitigate environmental pollution.

The event also featured interactive sessions between Dr. Prakash and students, demonstrating a commitment to fostering dialogue and knowledge exchange. Dr. P. Sharath Kumar, Head of the Mineral Processing department, set the tone for the event with an introductory speech highlighting the importance of finding solutions to global challenges such as climate change and pollution.

In his presidential remarks, Dr. SM Shashidhar, Chairman of the Institution of Engineers (India), Munirabad Centre, , emphasized the urgent need for collective action to address the pervasive issue of plastic pollution, citing alarming statistics about microplastic contamination in air, water, and food.

In the beginning, Asst. Professor Ms Lata welcomed the gathering. Ms Bhuvaneshwari anchored the program. Ms Rekha proposed a vote of thanks.



RAJASTHAN CHAPTER-UDAIPUR

Minutes of Ninth Executive Committee Meeting held on 13th April, 2024 at 6:00 PM at MEAI Office

The Ninth Executive Committee Meeting (Session year 2022-2024) of Rajasthan Chapter- Udaipur was held on 13.04.2024 in the office of MEAI, Udaipur. Sh MS Paliwal, Chairman of the Chapter chaired the meeting. The following members were present:

1.	Sh MS Paliwal	In Chair
2.	Sh RP Gupta	Former President, MEAI and Patron
3.	Sh Akhilesh Joshi	Patron
4.	Sh Praveen Sharma	Vice-Chairman
5.	Sh Asif M Ansari	Secretary
6.	Dr SS Rathore	Council Member
7.	Sh YC Gupta	Ex-Chairman
8.	Sh MK Mehta	Treasurer
9.	Sh DD Shripath	Permanent Invitee
10.	Dr SC Jain	Permanent Invitee
11.	Sh AK Porwal	Permanent Invitee
12.	Sh SL Sukhwai	Environment & Plantation (Large Mines)
13.	Sh SM Ahmed	Technical Talk & Seminar
14.	Sh Deepak Chandra Pandey	Member
15.	Sh Luggi Sassarini	Invitee

At the outset, Sh MS Paliwal welcomed all the members present in the meeting. Thereafter the Agenda items were discussed and the following decisions were taken.

1. **Confirmation of Minutes of Last Meeting held on 06th January 2024:** The Minutes of the last meeting held on 6.01.2024 were confirmed and no comments were received regarding the decisions taken and circulated among the executive members.
2. **Action Taken Report on the decisions of executive committee:** The Eighth Executive Committee Meeting was held on 6.01.2024 and action taken report was discussed by Sh Asif Ansari, Secretary of the Chapter.
3. **Land allotment for the Chapter:** Application is submitted by the Secretary at UDA, Udaipur. After Model Code of Conduct of parliament election is over it will be processed. Sh Y C Gupta suggested establishing Mineral Museum at Udaipur. Sh Gupta was requested to provide a keynote on its viability, applicability and purpose.
4. **Inauguration of Student Chapter:** In this regard, the Chapter has already established a Student chapter at CTAE College & Sangam University, Bhilwara in 2023. The inaugural announcement was made by Sh M S Paliwal with the Head of Department of Sir Padampat Singhania University, Udaipur.

In the last meeting it was decided to appoint Sh DD Shripath as mentor and Sh Deepak Chandra Pandey as Coordinator from MEAI Executive committee for Sir Padampat Singhania University Udaipur.

Student chapter Committee of Sir Padampat Singhania University, Udaipur

Name	Designation
Sh DD Shripath	Mentor
Sh Deepak Chandra Pandey	Coordinator / Assistant Professor
Mr Aman Singh	Convener / III Year Student
Ms Khushi Gandhi	Co-Convener / III Year Student

Sh Deepak Pandey HOD of Sir Padampat Singhania University, Udaipur was present in the meeting and he was felicitated by the Chapter.

5. **Training of Mining Mate & Blaster:** Next training program for "Mining Mate & Blaster" will be organized at RK Marble Rajsamand as per the new online examination pattern and committee will announce the dates soon. A token fee may be charged if chairman deemed it fit. Sh RC Purohit, Sh M. Ahmed, Sh RP Mali and Sh SC Suthar will update material and organize it.
6. **Newsletter publication:** Newsletter of Jan 2024 was published and the next issue will be published soon.
7. **Training programme on Datamine Software:** Secretary of the Chapter told that a Five-day workshop on Resource Estimation and Mine Planning was organized by the Chapter in collaboration with the College of Technology and Engineering (CTAE) during 19 - 23 February 2024. This training was organized at free of cost to upgrade the knowledge and skills of our members. Sh Akhilesh Joshi Suggested conducting this training by including overseas Experts.
8. **First Aid center:** A reply of DGMS letter regarding the first aid center has been sent. As per the decision taken, the materials have been procured / managed to comply with the norms. The visit of DGMS is expected soon.
9. It was decided to conduct overseas visit soon. This visit will focus on mining technology and some tourist adventure to explore the world. Approx. 25 members have shown interest in this program. Soon a meeting will be called to finalize the details by the Vice Chairman Sh Praveen Sharma.

10. A detailed discussion was held regarding speedy disposal of reappraisal of Environmental Clearance by SEIAA. It was decided to form a committee with Sh S L Sukhwal, Sh Nimesh Singhvi, and Sh Hitanshu Kaushal to suggest the speedy disposal of Environmental Clearance.
11. It was decided to conduct one-day training and plan a visit of student members to Chittorgarh limestone (cement grade) mine. Sh Ahatsham Siddiqui and Sh Maqbool Ahmed will coordinate it.
12. It was decided to print the Vision and Mission of the Association and display it in the office for ready reference.
13. Secretary Sh Asif Ansari briefed regarding Award and Honour given by the Association to the members. He requested the members to apply for suitable awards.
14. It was decided to display the all the reports sent to HQ. All Souvenirs, Proceedings and other publications should also published on the website of the Chapter.

The meeting ended with the vote of thanks proposed by Sh Praveen Sharma, Vice Chairman.



(L to R): Shri. Praveen Sharma, COO, HZL, Shri M S Paliwal- Chairman, Shri. D D Shripath- Mentor, CTAE Student Chapter, Shri. R P Gupta- Former President, MEAI, Shri. Akhilesh Joshi and Shri. Asif Ansari- Secretary



Inauguration of Student Chapter & Glimpes of Executive Committee Meeting

READERS' VIEWS

Readers' views

Your editorial in the April 2024 issue of Mining Engineers' Journal on Lithium, which is a much talked critical metal for the growth of economic development and national security, is very apt and timely. India boasts of a number of R & D organizations in the field of Mineral processing/ Mineral Beneficiation/ Metallurgy, under the umbrella of Central government organizations. It is high time, the government should set up a core committee of these experts to evaluate how the so called world class discovery of Lithium resources in Salala Block in Jammu & Kashmir can be taken to a logical conclusion of extracting Lithium and make use of it whatever quantity feasible and to demonstrate our capabilities to the world.

As was said, instead of putting the Lithium block for auction, with major PSUs making bee line visits overseas for mineral assets acquisition, should also focus on direct acquisition in India and carry out detailed exploration to its logical conclusion, even if we are not able to succeed in recovering Lithium of economic value. As the saying goes, all exploration projects need to lead to discovery of a metal which may not be economically viable or complications in the metallurgical process may not facilitate separation.

Regards

Suresh kumar

Life member | 6 April 2024

MEAI TECH SERIES (MTS-19)- MARCH 2024

EFFICIENT CONVEYING OF BULK MATERIALS by Mr M. F. Thomson, CEO & MD, VARTECH WEIGHING SYSTEMS

MEAI conducted the NINETEENTH PRESENTATION of MTS on 22nd March 2024 at 06:30 pm Online on WebEx platform. The speaker was Mr M. F. Thomson. Large number of professionals had joined and lauded the presentation.

MEAI is highly thankful to Mr M.F. Thomson for delivering the talk on the Latest Technology. The Presentation started with a warm Welcome extended by Sri Deepak Vidyarthi.

Mr. Thomson made an excellent presentation on the latest innovative Technology in conveying of Bulk Material, with couple of case studies to make the exposition more interesting. He laid emphasis on High Angle & Vertical conveyors adoptable in diverse conditions; Sandwich Conveyor Technology, High Angle conveyors, vis a-vis Conventional Conveyors. He introduced to the audience a legacy of Innovation with Overland Conveyors, Plant Conveyors, Two-way Conveyors, Trailing Conveyors, Horizontally Curving Conveyors, Downhill Conveying, Special Application in Steep Open pits etc. He described a Sandwich belt High Angle Conveyor with High Reliability and Availability with Low Operating and Maintenance Costs.

The session was very interactive with full involvement of participants, and concluded with a Vote of Thanks proposed by Sri M. Narsaiah, Secretary General, MEAI to the speaker for having taken pains for the preparation of the wonderful presentation on the latest Technology and to all the participants for their patient listening.

Deepak Vidyarthi

Chairman, Training, Development and Program Committee of MEAI



OBITUARY



Shri R. K. Bakliwal

LM/3419

(13/04/1944 - 07/03/2024)

Shri Rajendra Kumar Bakliwal, Life member and Patron of Rajasthan Chapter-Jaipur, left for his heavenly abode on 7th March 2024, at the age of 80. He kept guiding meaningful activities of the Chapter during its formative years. He actively participated in the Chapter's activities till health issues restricted him.

He graduated in Mining Engineering from MBM Engineering College, University of Jodhpur in the year 1966. He served private mining industry in India till 1975 and overseas in East Africa till 1990. He developed expertise in Gemstone mining. Thereafter he started his own business, trading in rough Gemstones. He was associated with many social groups also.

Shri Bakliwal is survived by wife, two sons and the whole family.

MEAI members pray the almighty to grant eternal peace to the departed soul and express their profound condolences to the bereaved family.





5th IN-PERSON PROFESSIONAL TRAINING PROGRAM ON IMIC 6th-10th, MAY 2024



Venue: MEAI HQs, Raghavaratna Towers, Abids, Hyderabad 500 001

Mining Engineers' Association of India (MEAI), the trusted voice of the Indian Resources sector, is the leading Professional Organisation (PO) recognised by the National Committee for Reporting Mineral Resources and Reserves in India (NACRI) and the Committee for Mineral Reserves International Reporting Standards (CRIRSCO). MEAI accepts the obligation of offering Professional Development Programs to its members, registering Competent Persons (CP) and supervising their ethical conduct. NACRI is the National Reporting Organisation (NRO) of India recognised by CRIRSCO.

The earlier four training programs on Indian Mineral Industry Code (IMIC) approved by CRIRSCO were successfully finished by NACRI in January 2021, April 2021, April 2022, and April 2023 with the overwhelming participation of over 25 professionals in each program, representing all leading mining companies viz. NMDC Limited, Tata Steel, HZL, MSPL, MOIL, OMECL, NLC, JSW Steel, AMNS, Adani Enterprises, HGML, SCCL, APMDC, KSMC, ERM Group, Deccan Gold, Orient cements etc., consulting organisations viz. DMT, SRG, Geovale, Data Code, Capstone etc. and individual professionals from across the country and overseas. Most of the delegates have successfully passed the IMIC evaluation test and more than a third of them have registered as Competent Persons (RCP) with MEAI. The list of delegates that attended the previous IMIC training programs and subsequently registered/ renewed as CPs may be found in the MEAI website at www.meai.org.

About the Professional Development Program on IMIC

NACRI has formulated a 40-hour (5-day) in-person but non-residential training program on IMIC. This course, conducted by the domain experts from India and abroad, includes sharing of basic knowledge on all relevant aspects of IMIC and Code of ethics, mineral industry Best Practices, and general guidance to the prospective RCP. The course has been formulated in line with the JORC Code training program conducted by the AusIMM and imparted under six major modules viz. Why the IMIC standard? Context and Principles, Exploration Results and Targets reporting, How to properly inform Technical Studies to investors, Reporting of Mineral Resources, Reporting of Mineral Reserves, and The role of Regulatory Environment. The objectives of the training program would be to appraise the obligations and liabilities of the Competent Person under the IMIC, Role played by the IMIC in the Resources sector, Interpretation of the IMIC within the context of your working environment, Recognise and counter common misconceptions about the IMIC, Identify good and poor technical reporting, and Demonstrate the correct application of the IMIC.

Overseas domain experts from JORC (Australasia), PERC (Europe and UK), CBRR (Brazil), SAMREC (South Africa) etc. may speak on Best practices and present practical examples on reporting of Exploration results, Mineral Resources and Mineral Reserves, wherever possible. As of now, overseas domain experts confirmed to present on the following topics:

1. **Mr Peter Stoker**, Dy Chairman JORC, Rep of Australasia on CRIRSCO, Treasurer CRIRSCO. JORC Chairman 2005-2014. Recipient of Medal of the Order of Australia for services to the mining industry in 2020. Contributor for Monograph 23 (Mineral Resources and Ore Reserves Estimation: The AusIMM Guide to Good Practice) & Monograph 30.
 - The role of the Competent Person under the CRIRSCO Template, look at the variation in requirements for Competent/Qualified Persons of CRIRSCO NROs, Codes of Ethics and enforcement and the importance of disciplinary processes to credibility of the CRIRSCO governance system.
2. **Mr Roger Dixon**, SAMREC, Rep of South Africa on CRIRSCO, CRIRSCO Rep on UNECE, Director SRK Consulting, Chairperson & Founder member of SAMREC
 - Reporting Mineral Reserves - a team approach
3. **Dr Edmund Sides**, Dy Chairperson, CRIRSCO/ Chairman PERC
 - Consideration of risk and uncertainty aspects of mineral projects.

- The CRIRSCO-UNFC relationship and the updated CRIRSCO-UNFC Bridging Document.
 - Effective use of the Table 1 Checklist
4. **Mr Edson Ribeiro**, Past Chair CRIRSCO, CBRR Brazil Rep on CRIRSCO since 2015, leading the Exploration and Mineral Projects area at Vale S.A.
 - Best practices in Mineral Resources estimation & reporting
 5. **Dr Abani Samal**, Former founder Co-Chair NACRI, Principal, GeoGlobal, USA
 - Mineral Resource Reporting, Practical examples of Mineral Resource reporting

Prerequisites for the registration of a CP

RCP definition under Clause #9 of IMIC 2019 is as follows:

RCP is a mineral industry professional who is a member of a professional organisation headquartered in India and approved by NACRI or a member of a 'Recognised Professional Organisation' (RPO), as included in a list of similar bodies headquartered outside India available on the NACRI website. These organisations have enforceable disciplinary processes including the powers to suspend or expel a member. An RCP must have a minimum of ten years professional experience, which includes five years relevant experience in the style of mineralisation or type of deposit under consideration, and in the activity which that person is undertaking.

In addition to the above, minimum professional experience required by the MEAI members for registration as RCP, the NACRI vide Article 2.2.ii further specifies that the potential RCP shall obtain at least 40 hours of mandatory professional development credits before making an application for registration and obtain at least 8-hour PD credits every year through participation in NACRI accredited seminars, conferences, workshops, training programs or webinars, for CP certificate renewal.

The initial CP registration fee as well as the yearly CP certificate renewal fee has been fixed at Rs 5,000 (Rupees five thousand only + GST @18%) and payable to MEAI. RCP certification shall be valid for a period of one year from the date of issue of the certificate and the same may be renewed thereafter.

IMIC training Venue

The 5th IMIC in-person training program will be held on 6-10 May 2024, in the state-of-the art Conference facilities available at MEAI Headquarters, Hyderabad. Working lunch on all 5 days, tea & snacks twice a day and a cocktail dinner on the inaugural evening are included in the course fee.

IMIC course fee payment details

The fee chargeable for attending the 5-day (40-hour) in-person but non-residential training program is Rs 25,000 (Rupees twenty five thousand only) plus applicable GST @18% for MEAI Members or Rs. 30,000 (Rupees thirty thousand only) plus applicable GST @18% for other delegates, and payable online to:

Account Name:	MEAI-National Core Committee Fund
Bank Name & Address:	UCO Bank, Abids circle, Hyderabad
S/B Account No:	14410110037089
IFSC:	UCBA0001441

Contact person

Interested mineral industry professionals may please contact Mr M. Narsaiah, Secretary General, MEAI at meai1957@gmail.com/ Office T: 040-66339625/ 040-23200510/ Mob: 9177045204 for seeking any additional details on this program.

Dr PV Rao

Co-Chair NACRI, drpvrao@gmail.com

CONFERENCES, SEMINARS, WORKSHOPS ETC.

ABROAD

7-8 May 2024: International Mining Geology Conference 2024 (IMG 2024). Perth Convention and Exhibition Centre, Perth, Australia. For details contact conference@ausimm.com

17-18 May 2024: International Conference on Surface Mining and Land Reclamation ICSMLR 2024. Sydney, Australia. Website URL: <https://waset.org/surface-mining-and-land-reclamation-conference-in-may-2024-in-sydney>

21-23 May 2024: Discoveries 2024 Mining Conference. Mazatlan International Center, Av. del Delfin 6303, Marina Mazatlán, 82103 Mazatlán, Sinaloa, Mexico. Website <https://www.discoveriesconference.com/>

17-19 Jun 2024: Molten 2024. Brisbane, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

17 Jun - 7 Oct 2024 (Online): JORC Reporting: Certification and Code Reporting Courses. 40 PD hours. Fee: Members A\$ 2644 – 2890 + GST; Non-members: A\$ 3454 + GST. Contact: AusIMM T: 1800 657 985 or +61 3 9658 6100 (if overseas). Po Box 660 Carlton, VIC 3053, Ground Floor, 204 Lygon St, Carlton VIC 3053.

18-19 Jun 2024: Direct Lithium Extraction Summit 2024. Denham Grove Hotel, Tilehouse Ln, Denham, Uxbridge, UB9 5DG United Kingdom. Website:<http://energy.apexevents.cn/>

22-23 Jul 2024: International Conference on Green Coal Mining Techniques and Waste Disposal ICGCMTWD 2024. Berlin, Germany. Website URL: <https://waset.org/green-coal-mining-techniques-and-waste-disposal-conference-in-july-2024-in-berlin>

5-6 Aug 2024: International Conference on Civil, Environmental and Geological Engineering ICEGE. Amsterdam, Netherlands. Website URL: <https://waset.org/civil-environmental-and-geological-engineering-conference-in-august-2024-in-amsterdam>. Program URL: <https://waset.org/conferences-in-august-2024-in-amsterdam/program>. Contact URL: <https://waset.org>

11-15 Aug 2024: International Mine Ventilation Congress 2024. The heartbeat of mining, Sydney, Australia. For details contact conference@ausimm.com.

16-17 Aug 2024: International Conference on Mine Mechanization and Mining Policies ICMMMP 2024. Tokyo, Japan. Website URL: <https://waset.org/mine-mechanization-and-mining-policies-conference-in-august-2024-in-tokyo>

29-30 Aug 2024: International Conference on Geology and Geophysics ICGG. Sydney, Australia. Website URL: <https://waset.org/geology-and-geophysics-conference-in-august-2024-in-sydney>. Program URL: <https://waset.org/conferences-in-august-2024-in-sydney/program>. Contact URL: <https://waset.org>

29-31 Aug 2024: International Conference on Graphene and 2D Materials. Valencia, Spain. Website: <https://www.pagesconferences.com/2024/graphene-materials>

2-4 Sep 2024: International Future Mining Conference 2024. #FutureMining2024, Sydney, Australia. 24 PD Hours. Contact: AusIMM T: 1800 657 985 or +61 3 9658 6100 (if overseas). Po Box 660 Carlton, VIC 3053, Ground Floor, 204 Lygon St, Carlton VIC 3053.

13-15 Sep 2024: International Conference on Mining, Materials, and Metallurgical Engineering. Johannesburg, South Africa. Website URL: <http://www.cmmme.org>. Contact E-mail: contact@cmmme.org

7-8 Oct 2024: International Conference on Design Methods in Underground Mining ICDMUM 2024. New York, United States. Website URL: <https://waset.org/design-methods-in-underground-mining-conference-in-october-2024-in-new-york>

21 – 23 Oct 2024: Mill Operators Conference 2024. #MillOps2024, Perth, Australia. 24 PD Hours. Contact: AusIMM T: 1800 657 985 or +61 3 9658 6100 (if overseas). Po Box 660 Carlton, VIC 3053, Ground Floor, 204 Lygon St, Carlton VIC 3053.

7-8 Nov 2024: International Conference on Geology and Geophysics ICGG. Istanbul, Turkey. Website URL: <https://waset.org/geology-and-geophysics-conference-in-november-2024-in-istanbul>. Program URL: <https://waset.org/conferences-in-november-2024-in-istanbul/program>. Contact URL: <https://waset.org>

7-8 Nov 2024: International Conference on Geological Engineering ICGE. Tokyo, Japan. Website URL: <https://waset.org/geological-engineering-conference-in-november-2024-in-tokyo>. Program URL: <https://waset.org/conferences-in-november-2024-in-tokyo/program>. Contact URL: <https://waset.org>

21-23 Nov 2024: International Professional Geology. Zaragoza, Spain. Website URL: <http://www.icog.es>. Program URL: <http://www.icog.es>. Contact URL: <http://www.icog.es>

18-19 Feb 2025: International Conference on Geology and Geophysics ICGG. Manila, Philippines. Website URL: <https://waset.org/geology-and-geophysics-conference-in-february-2025-in-manila>. Program URL: <https://waset.org/conferences-in-february-2025-in-manila/program>. Contact URL: <https://waset.org>

8-9 Apr 2025: International Conference on Geological Engineering ICGE. Rome, Italy. Website URL: <https://waset.org/geological-engineering-conference-in-april-2025-in-rome>. Program URL: <https://waset.org/conferences-in-april-2025-in-rome/program>. Contact URL: <https://waset.org>

10 – 13 Aug 2025: Application of Computers & Operations Research in the Mining Industry. #APCOM2025. PCOM Conference 2025, Perth Convention and Exhibition Centre, Perth, Western Australia. AusIMM T: 1800 657 985 or +61 3 9658 6100 (if overseas). Po Box 660 Carlton, VIC 3053, Ground Floor, 204 Lygon St, Carlton VIC 3053.

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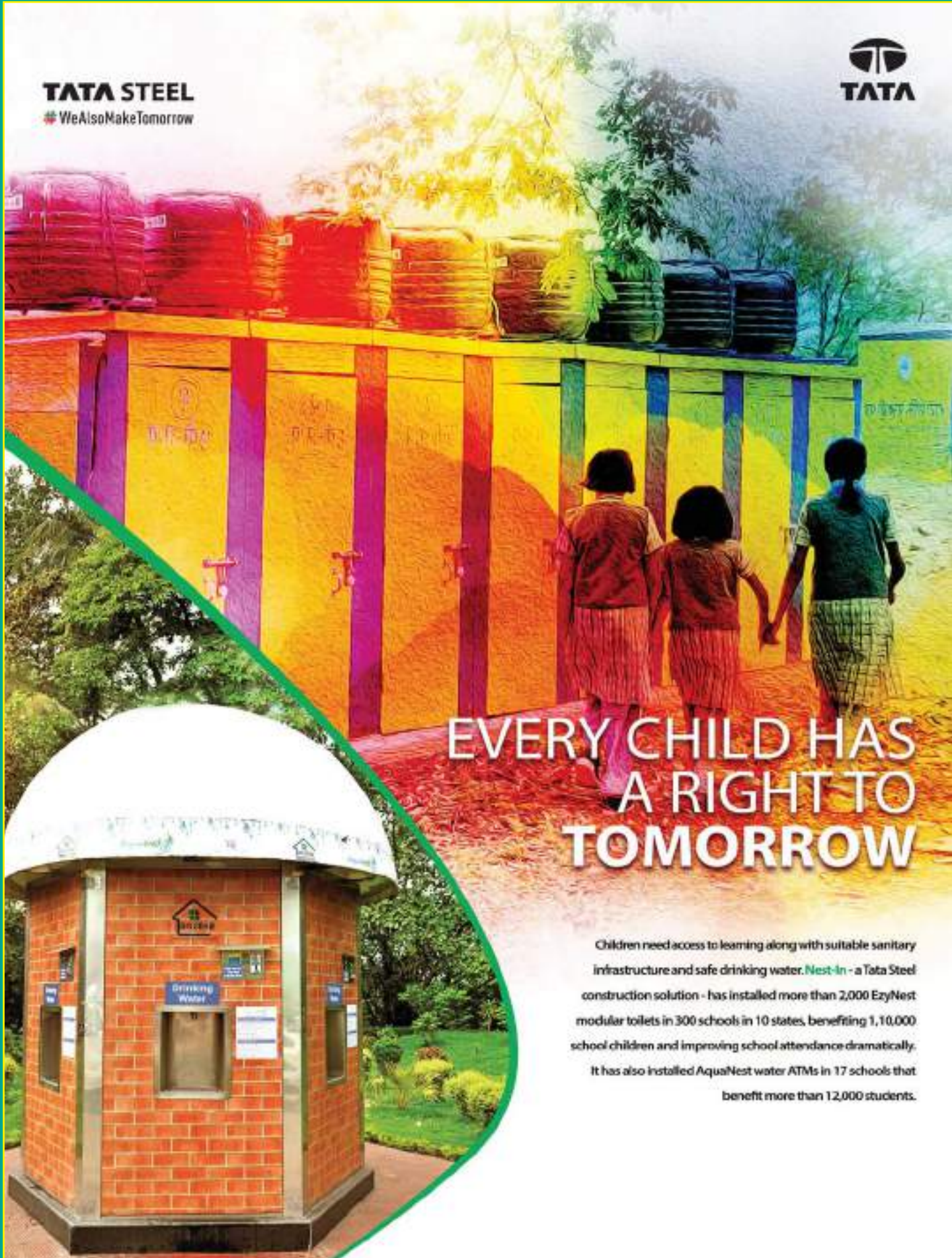
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