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Vol. 23 No. 10 MONTHLY May - 2022

this issue contains...

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President's Message.....

Dear members,

Greetings .....

I wish to share with you the activities undertaken by the Association in the preceding month....

Our Rajasthan Chapter - Jaipur conducted a Workshop on ***State of Mining in Rajasthan-Present Scenario: Environmental Clearances and Mining Regulations*** at Mining Welfare Centre on 9th April -2022 of and it was an apt subject in the prevailing situation at Rajasthan.

The 3rd edition of Professional Development Course on "The Indian Mineral Industry Code for reporting Exploration Results, Mineral Resources and Mineral Reserves in India (IMIC) was inaugurated by me on 18.04.22 and it will be continued over a span of four weeks until 13 May 2022. Overwhelming response was received from various mining organisations, consulting companies and individual professionals.

The meetings of our various committees such as Training & Development Committee, Minor Minerals Committee, Website Committee, Apprenticeship Committee and Election committee were held to review the ongoing activities of the Association and to discuss future strategies. I along with Dr P.V. Rao, the representatives of NACRI on CRIRSCO, attended an online meeting of ***CRIRSCO ESG Global Subcommittee Meeting*** on 13 April 2022. I also attended an online meeting of the members of ***Global Aggregates Information Network (GAIN)*** on 20 April 2022.

Bhubaneswar Chapter organised 3rd National Council meet of MEAI on 23rd April 2022 at Bhubaneswar in hybrid mode. A national Seminar on ***Technological and Digital advancements in Mining and Mineral Beneficiation*** was organised on 24 April 2022, which has witnessed a good participation and deliberations from the government and industry stakeholders on the recent advancements in mining and mineral processing.

The Chief Guest of the occasion Sri. Prafulla Kumar Mallik, Minister, Steel and Mines and Works, Government of Odisha inaugurated the National Seminar in the august presence of Sri. Debidutta Biswal, Director of Mines, Government of Odisha, Sri. B.L. Gurjar, RCOM, IBM Bhubaneswar, Sri. D.B. Sundara Ramam, Vice President -III, MEAI and Vice President, Raw Materials, Tata Steel, Sri. Pankaj Satija, Chairman, Bhubaneswar Chapter and the Managing Director, Tata Steel Mining Limited, and other dignitaries.

Recently, MoEF & CC had issued several notifications related to EC validity for 50 years, with conditions and provision for expansion of 50% Production Capacity without Public hearing, decentralisation of the EC process for facilitating clearances at State level. These are crucial steps towards ease of doing Business.

It is also my pleasure to note that some of our Chapters have also planned to conduct technical talks and workshops in their respective regions in the month of May. Belgaum Chapter has proposed to organize a one-day National Seminar on ***Sustainable Mining and Waste management*** at Basaveshwar Science College, Bagalkot on 8 th May 2022.

I call up on our Chapters' Chairmen and secretaries to plan and open ***Student Chapters*** to encourage and involve students in our professional activities from their respective regions. This is an essential step to promote networking between students and the industry leaders, and to prepare future leaders for the mining sector.

Regards,

K. MADHUSUDHANA
President

Mining Engineers' Association of India

Regd. Office : Rungta House, Barbil (Odisha)

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EDITOR'S DESK

Dr. P.V. Rao
Editor, MEJ

The International Seabed Authority (ISA) has 168 members, including 167 member States and the European Union. It has mandate under the UN Convention on the Law of the Sea to organize, regulate and control all mineral-related activities in the international seabed area for the benefit of humankind as a whole. In doing so, it has the duty to ensure the effective protection of the marine environment from harmful effects that may arise from deep-seabed related activities. Its role is broadly similar to that of national governments with respect to on-land mineral resources. It permits, regulates and receives royalties from the exploitation of seafloor mineral deposits, when mining starts.

In July 2014, ISA appointed CRIRSCO as an Observer. Dr Harry Parker represented CRIRSCO as delegate from July 2014 to December 2019. He was aided by Dr Caitlyn Antrim, Executive Director, Rule of Law Committee for Oceans, USA, who did much to facilitate CRIRSCO's involvement with the ISA. Mr Patrick Stephenson, past Co-Chair, CRIRSCO has been CRIRSCO's interim representative from December 2019 to February 2022. In March 2022, CRIRSCO formally appointed him as its delegate to the ISA.

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SUBSCRIPTION RATES

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At the ISA 2014 workshop on "Classification of Polymetallic Nodule Resources", held in Goa, India, Mr Stephenson and Dr Antrim spearheaded development of a document, based on CRIRSCO's November 2013 International Reporting Template, that established the ISA's requirements for reporting of Mineral Exploration Results, Mineral Resources and Mineral Reserves. This document, entitled "Reporting Standard of the International Seabed Authority for Mineral Exploration Results Assessments, Mineral Resources and Mineral Reserves", was adopted (with some changes) by the ISA with effect from 1 January 2016. It forms Annex V to the ISA Legal and Technical Commission report number ISBA/21/LTC/15 dated 4 August 2015. While the Goa workshop was concerned only with the classification and reporting of polymetallic nodules, the reporting standard finalized by ISA in 2015/16 was made applicable to all three main seabed deposit types viz. Polymetallic nodules, Polymetallic sulphides and Cobalt-rich ferromanganese crusts, which resulted in some inconsistencies between the 2016 ISA reporting standard and the document produced in Goa. *CRIRSCO proposed suitable modifications to the ISA reporting standard to address these inconsistencies*.

Polymetallic nodules are golf ball to tennis ball sized concretions that contain nickel, cobalt, iron and manganese in varying concentrations. The nodules precipitate from seawater over millions of years on sediment that forms the surface of the vast abyssal plains underlying the deep ocean (4 to 6 km water depth). The most promising deposits occur in the Clarion-Clipperton Zone (CCZ) of the eastern Pacific Ocean between Hawaii and Central America. The CCZ stretches over 7,000 km in E-W direction covering around 4.5 million sq. km.

Polymetallic massive sulphides are modern equivalents of ancient volcanogenic massive sulfide deposits (VMS), which have been mined on-land for many years. Deposition occurs around seafloor hot springs, such as black smokers, that are heated by magma upsurge beneath a submerged volcanic mountain range or ridge. Such upsurge can occur along mid-ocean ridges and in back-arc settings, where they tend to be richer in precious metals. The deposits, which can range from several thousands to about 100 million tonnes, are located at depths from 1-4 km. They contain copper, iron, zinc, silver and gold in varying amounts.

Oxidized deposits of cobalt-rich ferromanganese crust are found throughout the global oceans on the flanks and summits of seamounts (submarine mountains), ridges and plateaus, where seafloor currents have swept the ocean floor clear of sediment for millions of years. These seamounts can be huge, some as large as mountain ranges on the continents. Only a few of the estimated 30,000 seamounts that occur in the Pacific, where the richest deposits are found, have been mapped and sampled in detail. The crusts form pavements up to 25 cm thick and cover an area of many sq.km.

The ISA has entered into 15-year contracts for exploration of polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts with 22 contractors. Draft Exploitation Regulations [ISBA/25/C/WP.1] were prepared and await adoption by the Council before any contract for mineral exploitation can be issued. In June 2021, the Pacific island nation of Nauru notified the ISA of its intention to start mining in the CCZ. This triggered the so-called "2-Year Rule" under which the ISA apparently has two years to finalize regulations governing mining of polymetallic nodules in the CCZ. If it is unable to do so, the ISA is apparently required to allow mining contractors to begin work under whatever regulations are in place at the time.

- Editor

NEWS FROM THE MINING WORLD

Cabinet clears policy allowing use of CBA land to set up energy, mining infra

The new policy provides a framework for unlocking lands no longer suitable or economically viable for coal mining activities and lands reclaimed after coal has been mined out, an official statement said. The act provides for acquisition of coal bearing lands and their vesting in government companies, free from any encumbrance.

The Union Cabinet has approved a policy for use of land acquired under the Coal Bearing Areas (Acquisition & Development) Act, 1957 for setting up of infrastructure relating to coal mining and energy. The new policy provides a framework for unlocking lands no longer suitable or economically viable for coal mining activities and lands reclaimed after coal has been mined out, an official statement said.

The act provides for acquisition of coal bearing lands and their vesting in government companies, free from any encumbrance.

Sarita C Singh, ET Bureau | Apr 13, 2022

Govt in discussion with World Bank on framework for coal mine closure

Coal Additional Secretary M Nagaraju said the government is committed to ensuring that mines are properly and scientifically closed for the benefit of the society

The coal ministry is in discussions with the World Bank for collaboration on the mine closure framework, a government official said on Wednesday. Coal Additional Secretary M Nagaraju said the government is committed to ensuring that mines are properly and scientifically closed for the benefit of the society.

"We are now actually collaborating with the World Bank to develop a coal mine closure framework," Nagaraju said during a webinar. Vast experience of the World Bank in handling mine closure cases in different countries will be highly beneficial and facilitate the adoption of the best practices and standards in handling mine closure cases.

The additional secretary also said both renewable energy (RE) and coal will go hand in hand complementing each other for some more time and then RE will take over the energy security of the country. The ministry had earlier said it is in the process of finalising a robust mine closure framework on three major aspects - institutional governance; people and communities; and environmental reclamation and land re-purposing on the principles of just transition.

The ministry had earlier said that as of now, the Indian coal sector is doing its best to fulfill the country's energy demand by augmenting coal production. At the same time, it is also taking various initiatives towards adopting the path of sustainable development with an emphasis on care for the environment and the host community.

However, the Indian coal sector, the ministry had said, is relatively new to the concept of systematic mine closure. Mine closure guidelines were first introduced in 2009, re-issued in 2013 and are still evolving. "As coal mining in India had started long ago, our coalfields are replete with several legacy mines remaining unused for long. In addition, mines are closing and will close in future also due to reasons such as exhaustion of reserves, adverse geo-mining conditions, safety issues, etc," the ministry had said.

These mine sites should not only be made safe and environmentally stable but the continuity of livelihood should also be ensured for those who were directly or indirectly dependent on the mines, it had said. Reclaimed lands will also be repurposed for economic use of the community and state, including tourism, sports, forestry, agriculture, horticulture and townships.

The coal ministry has, therefore, envisaged building an all-inclusive comprehensive nationwide mine closure framework to cover legacy mines, recently closed mines and mine closures scheduled to happen in the short term, the statement had said.

Press Trust of India, New Delhi | April 14, 2022

Coal India to launch its own e-auction platform, asks bidders to register

E-auction sales account for around 120 million tonnes annually for Coal India, while the rest is sold through fuel supply agreements and other special sales windows

Coal India Ltd is set to launch its own e-auction platform, and the mining major has informed new and existing bidders to register on the portal, a top company official said. At present, the e-auction portal is managed by mjunction and state-owned MSTC Ltd. E-auction sales account for around 120 million tonnes annually for Coal India, while the rest is sold through fuel supply agreements and other special sales windows.

The miner's dedicated e-auction portal has been developed by National Informatics Centre and

supported by CIL subsidiary Central Mine Planning & Design Institute Ltd. "We expect to commence in-house coal e-auction in the next six months. Let the auction happen with volume, and then we will come to know about the cost benefits," the official told PTI. E-auction of Coal India is executed in a 60:40 ratio between mjunction and MSTC.

"We value Coal India's decision. We had designed, developed and introduced the e-auction 15 years ago, and are still carrying on with the service without any grievance," a senior executive of mjunction said on the development.

The Centre is also planning to introduce a coal exchange after taking into account consumer feedback. It had appointed Crisil as consultant for the proposed exchange, and a report in this regard is expected in the next six-nine months. We want to create a robust platform for private coal mining companies where buyers and sellers can meet when there is a lot of coal on offer after commercial mines begin production. It will have a regulatory oversight, Coal Secretary A K Jain had recently said in Kolkata.

Press Trust of India, Kolkata | April 18, 2022

India to invest in exploring lithium, cobalt mines in Australia

NEW DELHI (Reuters) - India has committed to jointly invest $6 million with the Australian government to explore lithium and cobalt mines in Australia over the next six months, in a bid to firm up supplies of key minerals needed to further its electric vehicle plans.

India's KABIL, a mining joint venture between state-run firms National Aluminium Co, Hindustan Copper Ltd and Mineral Exploration Corp Ltd, has signed a preliminary agreement with Australia's Critical Minerals Facilitation Office (CMFO), the Indian government said on Tuesday.

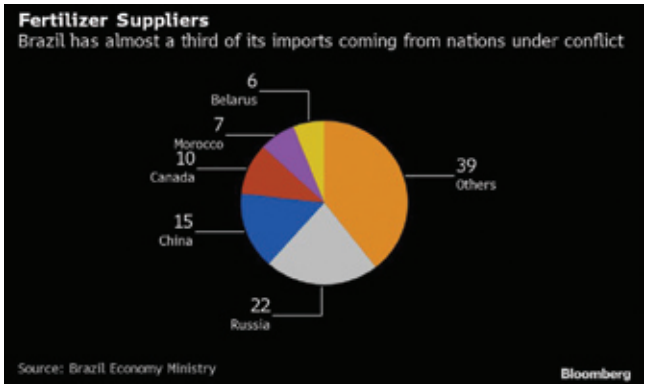
The move comes at a time when India is offering $2.4 billion of incentives for companies to build battery cells locally for electric vehicles. Lithium, whose price has surged in the recent days, is a key raw material used to make electric vehicle batteries. CMFO and KABIL will carry out "joint due diligence of select greenfield and brownfield projects to identify Lithium and Cobalt mineral assets for final joint investment decisions and acquisition," the Indian government said in a statement.

The agreement also provides for inclusion of any other Indian state-run firm as an investment partner, and envisages the due diligence process will be completed and further investment decisions taken over the next six months. India has also shortlisted Latin American countries such as Argentina, Bolivia, Chile for exploring mines of strategic minerals abroad, the statement said.

Reuters, Sudarshan Varadhan |29 March 2022

Brazil needs potash and Belarus is looking for ways to supply it

Agricultural powerhouse Brazil is desperate for fertilizers. Belarus, a sanctioned regime friendly to Russia's Vladimir Putin, is looking for ways to ship more of the nutrients.



Belarusian President Alexander Lukashenko gave his stamp of approval to small companies trying to export potash to cash in on skyrocketing fertilizer prices. But the U.S. and the EU banned the country's shipments of the nutrient, leaving Brazilian farmers scrambling. To secure enough potash for the soybean planting in September, Brazil may need to resort to barter or using yuan and Chinese intermediary.

"Companies in Brazil are up for business in almost all ways: payments, barter, exchanges," said Jeferson Souza, fertilizer analyst for Agrinvest Commodities in Brazil. "We are getting dangerously close to the planting in Brazil and we are short several tons."

Belarus controlled about a fifth of the global potash market and was a major seller to Brazil until Lithuania in January cut off a key transit route amid U.S. sanctions

imposed in 2021. Then Russia, the second-biggest potash producer, invaded Ukraine, further limiting supply of fertilizers from the region. Brazil has been seeking exemptions that would allow some potash purchases to avoid hunger and food inflation.

Belarus can still sell potash to the Russian market, a move that could push Russian companies to export more. But as of today, Russians are not able to export sizable quantities, according to CRU Group analyst Humphrey Knight. Even amid all that distress, some vessels are slowly being booked to bring fertilizers out of Russia to Brazil, but the volumes are small and buyers are not disclosing details. Russia limited sales of its nutrients abroad and many ports and shipping lines balk at Russian freight.

The South American nation ships in more than 85% of its fertilizer demand, with the dependency on imports exceeding 90% in potash and nitrogen. Russia and Belarus account for 28% of the total.

Bloomberg News | April 6, 2022

Chinese mining industry seeks to monopolize the market and make the world dependent on it

China is the most populous country on the planet and needs enormous resources to continue to grow its volatile economy. As a result, the Chinese communist regime has invested millions over the past few decades to develop a significant focus on mining non-renewable natural resources.

Beginning with significant mining within China, the Chinese regime continued with determined strategies to expand mining in the rest of the world, especially in developing countries in both Latin America and Africa. Mining has been at the forefront of much of China's strategy of commercial advancement in the so-called "Belt and Road" project through which the Chinese regime managed to penetrate emerging countries. The project entices officials and citizens with huge investments of money into various projects, including mining, usually putting at risk the national sovereignty of the nations supposedly benefiting from the investments.

The European Union has identified a list of 30 mineral commodities as critical products. The conflicts and commercial monopolies surrounding their exploitation endanger their supply chain, especially when controlled by a dictatorial regime such as the Chinese Communist Party (CCP), which is accused of great corruption and a constant tendency towards imperialist advance.

These 30 products, together with the exploitation of the so-called "rare earths," are crucial for the defense, technology, and renewable energy sectors. The world production of these critical raw materials barely reaches a few thousand tons per year, and unfortunately, their exploitation is shared among a handful of countries, including China. The Chinese communist regime produces 45% of critical raw materials, while the next ten largest producers account for a combined share of 35%.

China's regime leads in the exploitation of crucial minerals

China not only has significant reserves of mineral resources but also leads the world in the extraction of many of them. Thus it has a remarkable geopolitical advantage as a source of the resources essential for global technological production. It has become the leading supplier of many of these raw materials in just two decades, far ahead of its main commercial competitors in the United States and Europe. This dominance is partly due to China's deposits and deliberate planning to extend its mining apparatus throughout the world, including isolated regions such as the Brazilian Amazon and marginalized countries in Africa.

China stands out in two main groups: base metals and technological elements when it comes to these raw materials. The basic materials group comprises five metals from the periodic table; iron, copper, aluminum, magnesium, and zinc (sometimes lead and tin are included). All these metals are found in everyday objects and are the backbone of the development of the modern industry. Therefore, all countries need them, which puts those with the largest deposits of these metals at a strategic advantage over the rest.

A country's mineral wealth is not necessarily related to the volume of existing minerals in the ground but is also measured by the ease and feasibility of extracting the product. In the case of China, both variables coexist since the country has the largest deposits of many of these minerals in the world, and they are relatively accessible, leading the ranking with magnesium (79% of global extractions) and tin (43%), and zinc (31%).

As for metals used in the technology industry, it is essential to note that it includes several minerals, such as rare earth elements, precious metals, and semiconductors. Quantitatively speaking, these metals needed are minimal, although their availability is crucial to producing today's technology. For example, some of the most common technological metals include lithium, yttrium, palladium, cerium, and neodymium, which can be found in smartphone batteries, medicines, magnets, or catalysts. In these cases, China also leads with the largest deposits of some of these elements, especially tungsten, rare earths, and molybdenum.

In short, the Chinese regime not only has the largest deposits of these valuable minerals used as critical materials in the modern industry but is also the world's number one exporter. Moreover, apart from extraction, the country refines and manufactures components from these minerals and, in many cases, manufactures the final product. In other words, it is involved in the entire production process.

The Chinese regime seeks prominence in international mining exploitation

During the last few years, Chinese companies have managed to develop sufficient technology to exploit the mining deposits and process the extracted products. Thus, China has become a significant importer of these raw materials, which are processed in China and then exported again, either as minerals or transformed into finished products.

The Chinese regime has lax environmental and labor regulations, which allows them to considerably reduce their production costs in all industries, including mining. This situation forced many international competitors to withdraw from the market, giving way to the Chinese advance. Despite record mineral extractions in China in recent years, the country cannot meet its annual demand for minerals such as copper, zinc, nickel, and a range of other raw materials used in its industry.
As a result, China now imports more than $100 billion worth of base metals each year, consuming more than 25% of global supplies. Companies of Chinese origin have been at the forefront of the wave of mergers and acquisitions experienced by the mining sector over the past few years. In their commitment to move away from fossil fuels, Chinese groups are targeting the minerals needed for electric car batteries and so-called "clean energy" generation.

According to a study published by JETRO (Institute of Developing Economies), Chinese mineral imports include 30% of world zinc production, 25% of world lead production, and 22% of refined copper production. In addition, the Chinese economy absorbs 27% of the world's iron and steel and 25% of aluminum production.

The Chinese communist regime has managed to take a leading role in the world mining industry, either by directly importing minerals, buying existing international mining companies, participating in its own mining companies abroad, or investing in developing countries to take control of their mining products.

Latin America and Africa are being plundered by bad local policies that allow the Chinese regime to take much of the natural resources of these continents while at the same time flooding the markets with their cheapest products, destroying the national industry, generating dependency, and finally breaking the financial system.

In the case of minerals, China depends almost exclusively on sub-Saharan Africa for its imports of cobalt and manganese, the latter mainly from Gabon, South Africa, and Ghana. At the same time, Latin America's Brazil and Chile became its principal iron ore and copper suppliers. The Chinese regime has secured direct shareholdings in mineral reserves in local mining companies and multinational holding companies, within several countries, with contracts that ensure the flow of raw materials for decades.

Within a few years, the Chinese regime managed to displace the countries that historically led the international mining industry, so much so that for several editions, the annual "Mine" report published by the consulting firm PricewaterhouseCoopers (PwC) highlighted the appearance of at least nine companies of Chinese origin among the most important. PwC analyzes the mining industry based on the economic and financial behavior observed in the top 40 mining companies by market capitalization.

Environmental disasters, inside and outside China

As it has in other industrial sectors, the Chinese mining regime adopted low environmental standards as a strategy for mining, which, together with low labor costs, led to super-competitive international prices, enabling rapid gro. Still, in the long run, the environmental costs have been exorbitant. One of the main obstacles to mining, in general, is the complexity of the chemical processes used and the high costs of cleaning up the environmental pollution caused by the resulting toxic wastewater.

The traditional method of extracting these metals involves injecting ammonium sulfate and ammonium chloride into the ground to help separate the ore. As a result, "thousands of rivers in China have disappeared, while industrialization and pollution have spoiled much of the remaining water. As a result, 80% to 90% of China's groundwater and half its river water are too dirty to drink. According to some estimates, more than half of its groundwater and one-quarter of its river water is unusable even for industry or farming," reported Bloomberg last Dec. 29.

In particular, pollution resulting from rare earth mining has created soil incapable of supporting crops. In addition, the ravages left on the large exploited areas can take 50 to 100 years to recover. Pollution from existing mines threatens the places they are located and neighboring cities and countries downstream.

The critical water situation was publicly acknowledged by the CCP itself in 2008 when China's State Council warned that China's water resources would be basically depleted by 2030. "Taking into full account water-saving, by 2030, our country's water use will reach or approach the total volume of exploitable water resources, and the drought-fighting situation will be increasingly serious," stated a directive issued by that body and Reuters reported.

Pollution levels due to carelessness in mining exploitation in their own country, it is assumed, can be much worse when companies linked to the Chinese regime participate in mining projects in foreign countries where the environmental consequences are not suffered by the Chinese people. Many social movements, especially in Latin America, are protesting because of the devastating effects on the environment due to mining activity near sources rich in drinking water, such as in the Patagonian mountain range in Chile and Argentina.

Strategies of other powers to halt China's advance in the mining industry

Specific political sectors of certain world powers such as the United States and some European countries have warned about the dangerous tendency to depend on the Chinese regime for critical raw materials produced by the mining industry. In this regard, former President Donald Trump signed an executive order to boost mining production and cut this dependence on essential minerals, especially from adversarial countries such as China.

In December 2017, Trump had already signed another executive order. He directed the Secretary of the Interior to identify which minerals were essential to reduce the country's vulnerability to a possible interruption in the supply of these minerals. As a result, 35 minerals were identified as essential, 31 of which were imported and 14 of which were not produced domestically.

Faced with these results, Trump expressed his concern and, in his executive order, said, "The United States now imports 80% of its rare earth elements directly from China, with portions of the remainder indirectly sourced from China through other countries.

"In the 1980s, the United States produced more of these elements than any other country in the world, but China used aggressive economic practices to strategically flood the global market for rare earth elements and displace its competitors." Trumps' Executive Order differentiates the role of adversary countries from allies and emphasizes the importance of incentivizing allies to increase their production of these minerals as well. Trump points out that the Chinese regime exploited its dominant position in the minerals market and coerced industries in other countries to move their facilities, intellectual property, and technology to China, generating total dependence on the Asian giant. The order also seeks to boost U.S. domestic mining production by reviewing the possibility of granting loans and reforming the mining permit system.

At the same time, some European countries are also taking initiatives to address the Chinese regime's encroachment on this sensitive industry. To reduce its dependence on external suppliers, the European Union considers two main approaches. First, as expressed in its 2020 action plan, the bloc proposes diversifying the sources of its raw materials. The Commission spokesman said that member states have been asked to identify extraction and processing projects on their territories "that can be operational by 2025." A business alliance has even been formed to facilitate investments.

The second main focus is "reducing dependency through circular use of resources." However, it is unclear whether recycling will have a significant impact or whether the industry will eventually have to find substitute inputs.

Rare earths

The minerals known as rare earths are vital inputs in the production of smart electronic devices, smartphones, microchips, wind turbines, electric cars, and military equipment, among others, whose demand has skyrocketed in recent years and is projected worldwide with even greater development. China has struggled to maintain its monopoly on the production of these materials. Still, as mentioned above, some world powers have understood the geopolitical threat posed by the development of this monopoly and have begun to take actions that are gradually reversing this situation.

Thus, China, after producing 86% of the world's rare earths, has now dropped to 58%, losing almost 20% of the production it had some years ago, which has delivered a hard blow to the Chinese regime, according to last year's U.S. Geological Survey (USGS) report.

For analysts, the importance of counteracting the global dominance of the Chinese regime in the production of rare earths is urgent, given the geopolitical implications. In the same vein, researcher Liam Gibson writes: "Breaking China's grip on rare earths should be an AUKUS mission." AUKUS is a strategic military alliance between the United States, the United Kingdom, and Australia announced in September, focusing on the Indo-Pacific region.

He added in the Nikkei Asia media in December 2021, "The economics of rare earths means that commercial companies will always be beaten on price by state-backed companies who exist not so much for profit as for the geopolitical gain of monopolizing such a strategic asset." Countries such as the United States, Australia, and Myanmar (Burma), among others, have increased the production of these scarce minerals to a much higher proportion than processing in China has grown, reaching a contribution of about 40% of the world's total, according to Statista.

Notably, some of this increased production, particularly from Myanmar, has been imported by the Chinese regime to supply its technology industry. Reports also indicate that illegal trafficking of these rare earths has increased considerably in recent years, with China being the big buyer of these goods.

The United States increased its production of rare earths by 36% in 2020, obtaining 38,000 tons, while in 2019, it extracted 28,000. On the other hand, as part of its strategy to reduce its dependence on China, it began installing a processing plant during the Trump era, which would avoid sending it to the Chinese for processing.

This processing plant is located in Hondo, Texas, some 45 miles west of San Antonio. It is financed with $30.4 million by the U.S. Department of Defense in a joint venture with the Australian rare earths company Lynas Rare Earths Ltd. Initially announced in 2019 with private investors; the facility is still under development. However, it could be a step toward an effective risk management strategy.

Final comments

The productive concentration in a few hands of basic materials for the normal functioning of the economic system puts the stability of democracies and world peace in a situation of extreme weakness. The problem is even more serious when this concentration occurs in a country governed by a communist regime such as China, characterized by imperialist ideas based on repression, violence, no respect for individual freedoms, and a general lack of values based on its atheism.

Only the concrete action of the rest of the strong countries can guarantee a more equitable and democratic production of the exploitation of the scarce resources of this world and thus prevent it from falling into the hands of authoritarian regimes that seek to monopolize markets to increase the concentration of power.

Andrés Vacca, TheBL | 2 March 2022

Metals world agonizes over war but keeps buying from Russia

Last month, 13 copper-industry representatives at the London Metal Exchange were asked whether Russian metal should be blocked from its warehouses. Ten of them said "yes." But when advisory groups for nickel and aluminum discussed the same question, the general consensus was "no."

The LME, which is the ultimate decision-maker, says it won't take action that goes beyond government sanctions — which, so far, have left most of the metals industry untouched. But the behind-closed-doors discussions reflect a wider angst over whether to keep buying from Russia, as the industry weighs the stigma from the war against its own commercial interests — and the fact that vital metals like aluminum and copper were in short supply even before the invasion of Ukraine.

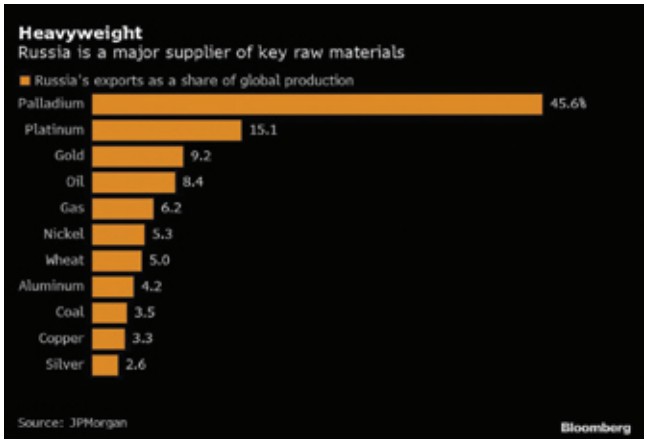
For now, Russian metal is largely still flowing to the world's factories and building sites. Many traders and fabricators who buy from Russian companies are tied in to pre-existing purchase deals that can extend over years. And commodities merchants have a well-earned reputation as buyers and financiers of last resort when others have long backed away. Still, a growing number in the industry say they won't take on new Russian business, and some are actively working to disentangle themselves. That's making it ever-harder for Russia's metals producers to sell whatever output is not already contracted, and may ultimately force them to cut production if there's no change by the time long-term deals come to an end.

For the LME, the risk is that material mined in Russia starts piling up in its warehouses because it has nowhere else to go, creating dangerous dislocations at the nexus of the global metals trade.

"We see from our customer base there is hardly any interest to buy Russian metal if they can avoid it — and they can," said Roland Harings, chief executive officer of copper giant Aurubis AG, which is represented on the LME copper committee. If the metal flows to the LME instead, "then you have this phantom stock which has an influence on the market because it shows high stock levels but nobody wants it."

The question of what happens to Russia's metal exports is of vast consequence to global markets — it's a key supplier of palladium, nickel, aluminum, steel and copper. Prices for all of those metals set new all-time highs in March, although steel is the only one to be the direct target of sanctions so far. Aurubis,

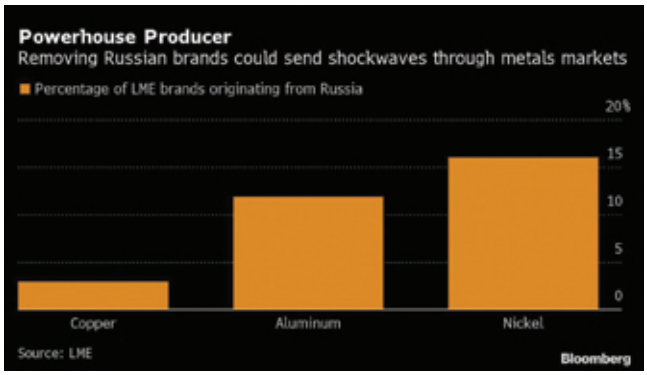
Europe's largest copper smelter, is "trying to get out" of its contracts for Russian supplies, and is in favor of sanctions against metals, Harings said in an interview last week. "I believe in the end whatever money we pay will end up in the wrong pockets," he said. Norwegian aluminum company Norsk Hydro ASA said it was taking the minimum possible under its contracts with Russian companies and was aiming to reduce that further.



There are still buyers for now — even in Europe. Russian metals producers like MMC Norilsk Nickel PJSC and United Co. Rusal International PJSC tend to sell on annual or multi-annual deals to big industrial groups, and for the most part these contracts are still being fulfilled, according to people familiar with the matter. Traders like Glencore Plc, which has a deal to buy aluminum from Rusal until at least 2024, and Trafigura Group, which has a long-standing relationship with Nornickel, are also fulfilling contracts in Russia.

Still, there are big challenges. Most container shipping lines have stopped calling at Russian ports. Precious metals like gold and palladium are typically sent to Switzerland or London by plane — but most flights out of Russia are now grounded. And few new deals are happening. Glencore, which has been one of the largest traders of Russian commodities since the days when founder Marc Rich struck agreements with the Soviet Union, announced last week it would do no new business in Russia. Traders say it's nearly impossible to find banks willing to finance new purchases of Russian metals, even in China, the world's biggest metals consumer. That's where the debate over the LME comes in.

Producers generally prefer to sell their metal to end users, but delivering onto the exchange is also an option. Buyers on the LME don't know whose metal they will receive until the contracts expire. Those arguing for a ban on Russian metal say there's a risk that the country's producers could dump large volumes of metal into LME warehouses to raise cash quickly. If it became clear that LME stocks were dominated by Russian metal that no one wants, the exchange's contracts could be priced differently from the rest of the global market.



Already, Trafigura has been delivering Russian copper to LME warehouses in Asia in recent days after failing to sell it in China, Bloomberg reported. The two copper committee members who voted against a ban — representatives of China's Minmetals and IXM, a trading house owned by China Molybdenum Co. — argued that it wasn't the LME's place to impose sanctions, and that doing so would disrupt an already febrile market. A third, from French cable maker Nexans SA, abstained, according to people familiar with the matter.

The LME committees only have an advisory role. But the exchange is also wrestling with the issue: Chief Executive Matthew Chamberlain told Bloomberg TV the LME wanted to make sure it "can't be part of financing any type of atrocity," and was in talks with governments. The LME has said it will not impose restrictions on Russian metal that go beyond government sanctions. Still, any move by the U.S., U.K. or EU to target Russian metal flows would probably lead the exchange to block new deliveries.

On Friday, the LME made the largely symbolic decision to ban deliveries of newly exported Russian aluminum, copper and lead from its warehouses in the U.K., in response to a new import duty imposed by the U.K. government. "The western world is going to have to work out ways of using less Russian metal," said Duncan Hobbs, research director at metals trader Concord Resources Ltd. "We will see some redistribution of trade flows as a result of what has happened, even if the fighting stops tomorrow."

Bloomberg News | April 4, 2022

PEOPLE FIRST - NATION FIRST

COVID-19 has been a challenge for humanity across the globe. The pandemic has had serious health, economic and social impact throughout the country. Jindal Steel & Power, being a responsible corporate in India, made several efforts to join its hand with the Government and the community, especially around its operational areas to defeat the pandemic in India. Pursuing the vision of its Chairman, Naveen Jindal under the leadership of JSPL Foundation's Chairperson Shallu Jindal the Company started on-ground services to mitigate the pandemic induced drudgery of poor and vulnerable right from the day of lockdown in March 2020. During the Second Wave, the company supplied liquid oxygen to various hospitals across in to save hundreds of lives.

In March 2020, JSPL Foundation launched 'Mission Zero Hunger' across three states (Odisha, Chhattisgarh and Jharkhand) to provide food to the needy, especially truck drivers, stranded migrant labourers and people living in destitution. The Mission Zero Hunger spread its services to Delhi, Uttar Pradesh and Maharashtra Under this programme, The Foundation served both cooked food and also dry rations. Persons living in different old age homes, child care homes, shelter homes, etc. were received dry rations. The Company served more than one million meals during the three waves COVID-19 pandemic in the country.

With the vision of People First - Nation First JSPL came forward to supply liquid medical oxygen (LMO) to hospitals during the second wave of the pandemic when the hospitals were in dire need. To save several lives, the company ramped up the LMO production in its oxygen plants at Angul and Raigarh and supplied more than 5000 tonnes of LMO across 13 States in the country by road and oxygen express of Indian Railways. It also provided two cryogenic tankers to Odisha Government for transportation of LMO within the state.

For facilitating health care services during the pandemic, the company earmarked 302 beds in its Fortis OP Jindal Hospital & Research Centre at Raigarh and Tamnar in Chhattisgarh. It also established a dedicated COVID Care Centres at its operational locations with 600 oxygen supported beds, ICUs, ventilators and other facilities.

In addition to these, JSPL Foundation supported the manufacturing and distribution of face cover masks, hand wash and phenyl among the community and COVID warriors. The Women SHGs promoted by the Foundation manufactured more than 300,000 Face Masks, which helped the women members to earn about Rs. 250 each every day. The Foundation helped more than 10000 vegetable and dairy farmers by assuring buyback from them at fair price during the pandemic. This helped in protecting the farmers from distress sales and earning their livelihood.

The Foundation also carried out a massive awareness drive across rural and tribal areas in and around the operation of Jindal Steel & Power to sensitise the community about the prevention of the COVDID-19 pandemic. The Company also contributed Rs. 25 Crore to the PM-CARES fund for fighting the pandemic.

The multidimensional initiatives by Jindal Steel & Power to fight COVID-19 and help the community during the pandemic has earned huge appreciation for the steelmaker and its chairman Naveen Jindal. The timely response by the Company saved many lives and helped several vulnerable people during the tough times. JSPL Foundation has won the coveted Mahatma Award 2021 for mitigating Human miseries during Covid 19 from the US based CSR Live Week.

JINDAL STEEL & POWER: THE CORPORATE SDG CHAMPION

'Passion for People' is one of the core values of Jindal Steel & Power. To enrich people's lives, Jindal Steel & Power has been partnering with the people for their sustainable prosperity through responsible industrialisation. Our sincere efforts have consistently been contributing to developing economies, industries and societies in the communities and countries where we conduct business by integrating our business priorities with community aspirations as envisioned by our Founder Chairman, Shri O P Jindal.

Naveen Jindal,
Chairman, Jindal Steel & Power

Sustainable Development Goals (SDGs), adopted by United Nations in 2015, is the universal call to action to end poverty, protect the planet, and ensure peace and prosperity in the world by 2030. The SGDs recognise that action for ending poverty and deprivations should be taken together with strategies to improve healthcare and education, reduce inequality and drive economic development while tackling climate change and preserving oceans and forests. The SDGs calls for mobilising globally efforts for achieving social, economic and environmental sustainability in the world. The Indian Government, as a signatory to the 2030 Agenda for Sustainable Development, has been making various efforts to achieve these global goals.

In line with the ethos of sustainable development and community empowerment inculcated by its founder Shri OP Jindal, Jindal Steel & Power (JSP) is making various efforts to contribute to India's effort to achieve SDGs. Under the leadership of its Chairman Mr Naveen Jindal, the leading steelmaker has been taking up multi-faced social initiatives to improve the quality of life of the community, especially in and around its business locations. All the social interventions of JSP are spearheaded by its social arm JSPL Foundation under the leadership of Ms Shallu Jindal and are aligned to the SDGs to build a cohesive model of sustainable development of the society. JSP is one of the few corporate organisations in India that address 16, out of 17 SDGs.

JSPL Foundation is focused upon improving the human development index by promoting community healthcare, quality education, developing critical civic infrastructure in rural areas, facilitating livelihood generation opportunities, promoting sports, art & culture and several other programmes on a sustainable basis.

SDG 1 calls for ending poverty in all forms. Jindal Steel & Power, under its corporate social responsibility, have made multidimensional efforts to reduce poverty by promoting income generation activities in the rural areas. JSPL Foundation facilitates inclusive economic growth by assisting small farmers and vulnerable communities to have sustainable earnings and improved quality of life. Promotion of community diary to generate additional income and formation and strengthening the farmers' groups for better access to finance information on backward and forward linkages are two major initiatives by the Foundation in this direction. The Foundation promotes LEISA (Low External Input on sustainable agriculture) practices by switching over from HEIIA (High External Input for Intensive Agriculture) in both Seasonal Agriculture and Cash crops including Horticulture and Tree based Agriculture. For the underprivileged and the vulnerable who are not in a position to take up income generation activities for physical/mental debilities, JSPL Foundation provides social security support.

Poverty and hunger are closely related and the SDG-2 calls for zero hunger, food security and improved nutrition. Under the project Sneh, JSPL Foundation provides nutrition support to underprivileged and vulnerable children and senior citizens in Odisha's Angul and Barbil and Chhattisgarh's Raigarh and Tamnar benefiting 1500 families, 5000 children and 300 senior citizens. This initiative has been very helpful in combating malnutrition and improving the educational performance of the children as well. **During the COVID-19 pandemic the Company provided more than one million meals to the poor and vulnerable across India under its Mission Zero Hunger programme**.

JSP Foundation believes that ensuring healthy lives and promoting well-being is crucial to achieving sustainable development. **In line with SDG-2, which calls for Good Health and Well-Being,** the Foundation has taken up a number of initiatives to create and enhance health services and spread awareness about public health issues. Under the aegis of JSPL Foundation two multi-speciality Hospitals namely OP Jindal Hospital & Research Centre at Raigarh and Tamnar with 100 and 27 beds, respectively are operational providing state-of-art tertiary health care services. These two multi-speciality hospitals provide affordable health services to the community, besides free treatment for underprivileged sections of society. With an objective to make quality healthcare services accessible to rural communities, the Foundation has set up Telemedicine centres across the 7 locations in 3 Eastern States of India.

JSPL Foundation, the Social Arm of Jindal Steel & Power, has evolved and grown as a responsible Change Maker in India, shaping up the lives of nearly 2 million people across the country. The Foundation is consistently working to improve the Quality of Life of people across the country, mainly the underprivileged and socially vulnerable sections of society. While executing the sustainable CSR Programmes of JSP, the Foundation has stood firmly beside the needy during the Calamities and Pandemic and has ensured to orient its contribution as a dependable enabler of People's action for a better Tomorrow

Shallu Jindal,
Chairperson, JSPL Foundation

These centres, connected with the above two Hospitals and a few State level Govt Hospitals provide advanced health services from super specialists to around 25000 people every year. Project Vatsalya, implemented by JSPL Foundation, has contributed to substantial improvement in maternal and child health in total 88 villages of Chhattisgarh, Jharkhand and Odisha. The Foundation's innovative programme **Kishori Express** has been addressing anaemia in adolescent girls and women in rural areas. A customised vehicle known as Kishori Express reaches out to villages and schools and conducts regular haemoglobin check-ups

and community sensitisation to eliminate anaemia among girls. It also provides nutritional support as per requirement. So far the programme has reached more than 1.8 lakhs, adolescent girls, across 537 villages in Odisha and 15 villages in Jharkhand. Programme Kishori Express is also being implemented in 87 villages of Haryana under the GOI's Aspiration District Programme launched by the Hon. Prime Minister Mr Narendra Modi. As a part of its preventive healthcare programme, JSPL Foundation organised regular health camps and community sensitisation programmes in remote and tribal villages. In order to mitigate the social stigma and to identify and assist HIV positive members of the local community, JSPL Foundation often undertakes HIV screening and awareness camps. To date, more than 3.6 lakhs of people have been screened voluntarily through the Integrated Counselling and Testing Centres (ICTC), operational at business locations of JSP based on NACO guidelines.

The SDG-4 focuses on quality education and JSPL Foundation has taken a series of initiatives to improve the quality of higher education, mass education, school education, skill education and special education for Persons with special needs. In order to bridge this gap and strengthen classroom processes, JSPL Foundation has supported the engagement of 178 community teachers in 113 vernacular schools across Odisha, Chhattisgarh and Jharkhand. O.P. Jindal Global (Institution of Eminence Deemed to Be University) founded by Jindal Steel & Power has been awarded the prestigious 'Institution of Eminence' status by the Government of India. Ranked among the top 800 universities in the world in the QS World University Rankings 2020, the University brings international learning experiences to the Indian higher education system and ranks as no 1 Private University in India . At Punjipathra, Raigarh, the OP Jindal University has been established as the only University in India dedicated to Steel Technology and Management. The OP Jindal Schools located in Angul, Barbil, Raigarh, Taraimal, Tamnar, Kunjemura, Rabo and Patratu have been facilitating quality education among 12500 students from more than 100 villages/ small towns.

ASHA –The Hope Centres, are vocational and rehabilitation centres for children with special needs and seek to empower people with disabilities. The Centres located near JSP's operation in three states have provided support for cognitive, social and psychological development, opportunities for skill development, and special education to about 5000 specially-abled children. In order to enable the meritorious needy and vulnerable students for higher education, JSPL Foundation has provided more than 10000 students across India.

In line with **the SGD-5** that calls for Gender Equality, JSPL Foundation has been taking various initiatives for the socio-economic empowerment of women. The Foundation's initiatives are focused

on minimising the economic vulnerability of women in rural areas and augmenting their access to cash income on a sustainable basis. It supports the formation and capacity building of Women SHGs and facilitates backward and forward linkages for their income generation through training, seed money and marketing support. The Foundation has helped more than 12000 women SHG members to enhance their income.

SDG-6 calls for Ensure availability and sustainable management of water and sanitation for all. JSPL Foundation is facilitating the community's access to clean and safe drinking water through the Installation of Water ATMs and overhead tanks, running Mobile Water Vans and installation of tube wells in villages. The Foundation has also set up two excess Iron Removal Plants to make potable water

available for the rural community. Foundation's Drinking Water initiatives have benefitted more than 18 lakh people across three states. In line with the Government of India's Swachh Bharat Programme, the Foundation has also taken up multifaceted measures to make villages Open Defecation Free and improve sanitation.

For Affordable Clean Energy, as per SDG-8, JSPL Foundation promotes renewable energy by installing solar lights and solar operated pumps for irrigation. It also promotes smokeless cooking stoves as a part of its effort to provide clean and safe cooking fuels.

Decent Work and Economic Growth is the 9th SDG and Jindal Steel & Power helps the community to have better economic opportunities by developing their skill in various areas. The Foundation has established OP Jindal Community Colleges at three locations and has skilled more than 100000 youths in various vocational trades. In order to refine the traditional skills, the Foundation supports the capacity building of traditional artisans and women, which has contributed in better earnings for them.

In line with **SDG 9**, the Centre of Steel Technology and Product Development (CSTPD), established by Jindal Steel & Power at OP Jindal University is conducting research on reducing carbon footprint and thereby promoting green steel making.

The **SDG-10** calls for reducing inequality. JSPL Foundation makes various efforts to eliminate gender

inequality by encouraging women's education, promoting women in sports like hockey and football, supporting women entrepreneurs for better income, strengthening and capital formation for Self Help Groups and regular gender sensitisation programmes in the rural and tribal areas. The Foundation has been actively working on not only the economic empowerment of the Women but also on their health front and in the facilitation of enhanced decision making power of the Women in families, Gramsabha and Panchayats.

Jindal Steel & Power, as envisioned in **SDG-11**, promotes building eco-friendly building technology for a sustainable future. It has developed its township with Schnell Home technology equipped with the building materials for reducing in-situ temperature and replacing wood and built its plants with zero outside discharge. The Company manages its waste in a responsible manner. The **SDG-12** calls for responsible consumption and production. The Company focuses on reducing its energy and water consumption, recycling water and paper and reusing water paper and industrial slurry with no to plastic use. The JSPL Foundation in collaboration with NABARD has been implementing an Integrated Watershed Project over a catchment of 4000 acres in Angul district resulting in groundwater recharge across all slopes and controlling erosion of the topsoil and thereby doubling the farmers' income on a sustainable basis. In line with the **SDG-13,** JSPL Foundation promotes community plantation in the peripheral villages across operational locations of JSP. More than one million saplings have been planted under this initiative. It has also set up 250 ponds, which act as carbon sinks. Jindal Steel & Power is the first Corporate in Odisha to implement watershed projects in partnership with NABARD.

As per **SDG-15**, JSPL Foundation is implementing WADI development programme, an agro-horti-silvi-pasture-pasture-based at Tamnar in partnership with NABARD. It has converted 500 Acre of barren land to orchards with intercropping of vegetables, transforming the lives of 500 tribal farmers and their families and enhancing their income by more than 3 times. It also promotes the use of vermin-compost SRI methods of farming and Azolla Cultivation.

In order to maximise the outcome of its social interventions, JSPL Foundation, as envisioned in **SGD-17**, operates in tandem with the Government and other development agencies to bring radical transformation in the lives of the communities and integrate them into the mainstream development process of the country. JSPL Foundation has been working with the local community consistently to build social capital by facilitating social investments in a participatory mode. In addition to the Government departments, the Foundation works with reputed organisations like NABARD, Sight Savers India, NACO, OSACS, Asia Heritage Foundation, Prayas, RAWA Academy and various other non-government organisations.

GREEN LITHIUM ENERGY THAT WILL DRIVE THE 21ST CENTURY WORLD

P. V. Sukumaran and L. C. Anupama

Abstract

Lithium (Li) is a resource whose future demand will surpass all forecasts as Li-ion Batteries power electronic gadgets and electric vehicles (EV), while the latter is poised to revolutionise transportation. Lithium is a critical metal today as its supply is vulnerable to shortages due to unprecedented demand and current production being geographically restricted to the Lithium Triangle countries of Latin America, and Australia and China. The propagation of EV globally and a reduction in the number of fossil fuel-burning vehicles, would effectively reduce greenhouse gas (GHG) emissions leading to a green energy future. There is understandably no dearth of the Li metal even with current unprecedented demand as supply from brine and pegmatite resources and Li rich clays and recovery of the metal from the spent LIBs will obviously jack up reserves. India is on the right road to meet the impending demand for EV, but our Li resources need to be systematically and urgently explored and assessed lest we will have to be at the mercy of Li-exporting countries.

Key Words: *lithium-ion batteries, salars, brines, pegmatites, lithium triangle countries*

1.0 Introduction

Lithium is an energy critical metal. As an integral component of Li-ion Batteries (LIB) the metal is required in almost all storage batteries, from as little as 2-3 grams in smartphones to 10-63 kg in EVs. This lightest metal on earth finds myriad uses in industry and medical applications also. The element is a critical metal today as its supply in the world market is vulnerable to shortages due to unprecedented demand, and current production being restricted to the *Lithium Triangle* countries of Latin America, and Australia and China. Here in the Lithium Triangle, it is concentrated in various salt pans that exist along the Atacama Desert and neighbouring arid areas.

Lithium belongs to the LCT (lithium-caesium-tantalum) group of resources associated with the late tectonic S-type granites. Crustal abundances of Li are in the range of 17-20 ppm and in igneous rocks 28-30 ppm while in sedimentary rocks the abundance is much higher, 53-60 ppm. Lithium is concentrated in later stage fluids of magmatic differentiation and is enriched in ferromagnesium minerals, biotite or amphiboles. It is widespread in clay minerals as impurities, as inclusions in lattice cavities, adsorbed on the surface or as isomorphous substitutions. Lithium deposits occur as the mineral concentration in pegmatites and as Li-brines in closed inland basins. The metal is also often produced as a by-product of potash extraction operations. Continental brines typically have Li contents of 200-1,400 ppm while in economic brines the concentrations may even be as high as 4,000 ppm. Oilfield brines, occurring at depths of >2 km, can contain 0.1-700 ppm Li. It occurs in trace amounts (0.001-0.020 ppm) in surface waters whereas the concentrations are higher in groundwater, but are much more variable (0.5-19 ppm) mainly due to geological factors. Seawater also contains Li in very low concentrations (170 ppb).

2.0 Lithium Minerals

Of the two-main economic Li-bearing minerals, spodumene has a maximum theoretical percentage Li_2O of 8.03% (3.7% Li) and petalite Li_2O of 4.88% (2.2% Li). Other minerals with less Li, which are mined, are lepidolite and amblygonite. The principal Li minerals are tabulated below:

3.0 Uses of Lithium

Lithium is a versatile metal with remarkable uses (Fig.1L), ranging from medical industry to manufacture of lightweight Al-Li alloys for the aeronautical industry. The properties of lithium make it particularly suitable for light weight batteries for electric automobiles. The glass and ceramics industries are the major consumers of Li as a fluxing agent. Lithium fluoride crystals are used in specialised optics such as in the ultraviolet (UV) and infrared (IR) optics. Lithium chloride and lithium bromide are extremely hygroscopic and find use as desiccants, and in sophisticated air conditioning systems. Organo-lithium has many industrial applications.

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Table.1 The principal Li-minerals (Cronwright M: CSA Global, Mining Industry Consultants, 2019)

Principal lithium minerals in pegmatites	Formula	Density (average; g/cm³)	Lithium % (calculated)	Li_2O% (calculated)
Spodumene	$LiAl(Si_2O_6)$	3.2	3.7	8.0
Petalite	$Li(AlSi_4O_{10})$	2.4	2.3	4.9
Eucryptite	$LiAl(SiO_4)$	2.7	5.5	11.8
Amblygonite	$LiAl(PO_4)$ (OH)	3.0	4.8	10.2
Lepidolite	$K(Li,Al)_3(SiAl)_4O_{10}(OH,F)_2$	2.8	3.5	7.6
Lithiophilite	$Li(Mn_2)PO_4$	3.5	3.3	7.1
Zinnwaldite	$K(Al,Fe,Li)_3(Si,Al)_4O_{10}(OH)F$	3.0	2.9	6.2

Note: actual content of Li in natural minerals may be lower than calculated. Density and Li contents rounded to first decimal place.

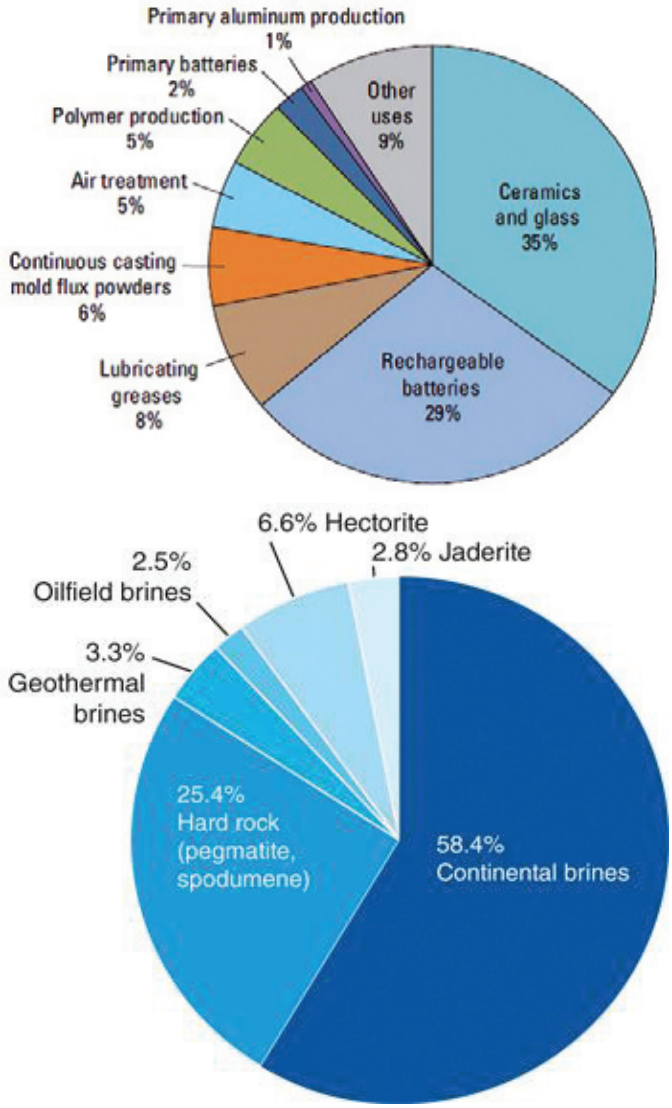

Fig. I (L) Application areas of lithium; battery, glasses and ceramics account for nearly 65% of the Li application, (Image: Bradley D C et al, 2014), (R) Geologic source of global Li resource. Continental brine and pegmatite deposits constitute the major sources of lithium (idmin.com)

Li is also used in some non-rechargeable batteries such as in pacemakers, toys and clocks. A magnesium-lithium alloy is used for armour plating. Aluminium-lithium alloys are used in aircraft, bicycle frames and high-speed trains. Lithium oxide is used in special glasses and glass ceramics. Lithium chloride is one of the most hygroscopic materials known, and is used in air conditioning and industrial drying systems (as is lithium bromide). Lithium stearate is used as an all-purpose and high-temperature lubricant. Both stable isotopes of lithium **^{6}Li** and **^{7}Li** are used in the production of nuclear weapons. Li is the first-line treatment for chronic depression (bipolar disorder, BD) for its prophylactic action. Li was seen as a miracle neuroprotective agent and was added to tonics to boost mental fitness.

4.0 Lithium Mining and Processing

Commercial Li has two major sources: underground brine deposits called *continental brine* deposits and mineral ore deposits called *pegmatite ores*. Besides, there are also Li-bearing clay type deposits.

4.1 Li from brines: Li extraction from brines involves drilling and pumping of the brine into open man-made ponds, and letting the brine to concentrate Li salt by solar evaporation (Fig.2L). Once the brine in an evaporation pond has reached an ideal Li concentration, it is pumped to a Li recovery facility for extraction by chemical means, as LiCl or Li_2CO_3. Salar brines are very concentrated and, in addition to Li, typically also contain K and Na salts which are recovered as by-products during the extraction process.

Li is commercially marketed as lithium carbonate ($Li_2CO_{3)}$. Other commercial forms of Li, such as lithium hydroxide, lithium chloride and lithium bromide are produced from Li_2CO_3 using different chemical reagents. Li metal is separated from LiCl by electrolysis. Recovery of Li from geothermal waters is by reverse osmosis (RO), ion exchange (IX) and membrane filtration processes, obviating the need for evaporation ponds. Mineral-rich oilfield brines are waste products of the oil recovery process, from which Li is directly extracted.

Fig.2 (L) Lithium extraction from brine: At the Salinas Grandes salt flats in Argentina, lithium is extracted on a large scale by evaporating ancient brine (image: Kramer D, 2021); Bolivia holds the world's largest lithium resources that are yet to be commercially developed. S. America's Lithium Triangle supplies ~30% of world lithium (R) Crushed pegmatite ore at the Greenbushes lithium mine, Australia (Credit: www.talisonlithium.com)

4.2 Li from hard rocks: The process for recovering Li from hard rock pegmatite ore entails removing the mineral material from the earth then heating and pulverizing it [Fig.2(R)]. The crushed mineral powder is combined with chemical reactants, such as sulphuric acid, and then the slurry is heated, filtered, and concentrated through an evaporation process to form saleable Li_2CO_3. Besides Li brines and mineral ores, Li can be produced from a few other sources such as hectorite clay, seawater, geothermal brines, oil field brines and recycled electronics, each of which is a potentially valuable source of Li.

5.0 Geological Li-deposit Types

Geological Li deposits are principally of three types: Li-brine deposits, hard rock Li-pegmatite deposits and Li-clay deposits, of which the first two are the major deposit types currently being exploited (Fig.3). The Li-clay deposits have great potential for future exploitation when the demand for Li in LIB becomes huge as EVs replace the gasoline-driven mode of transportation.

***5.1 Continental Li-brine deposits*:** The Li brine deposits are closed basins containing a playa or Salar, tectonically subsided. They are associated with igneous or geothermal activity, with suitable Li source-rocks, one or more adequate aquifers and sufficient time to concentrate brine. The most important examples of Li-brine deposits are the Salar de Atacama, Chile (6.3 Mt of Li) and Salar de Uyuni, Bolivia (10.2 Mt of Li). Globally Li-brines occur in the arid latitudinal belts on either side of the equator (Fig.3C), with the favourable zones lying between about 19° S and 37° N or S.

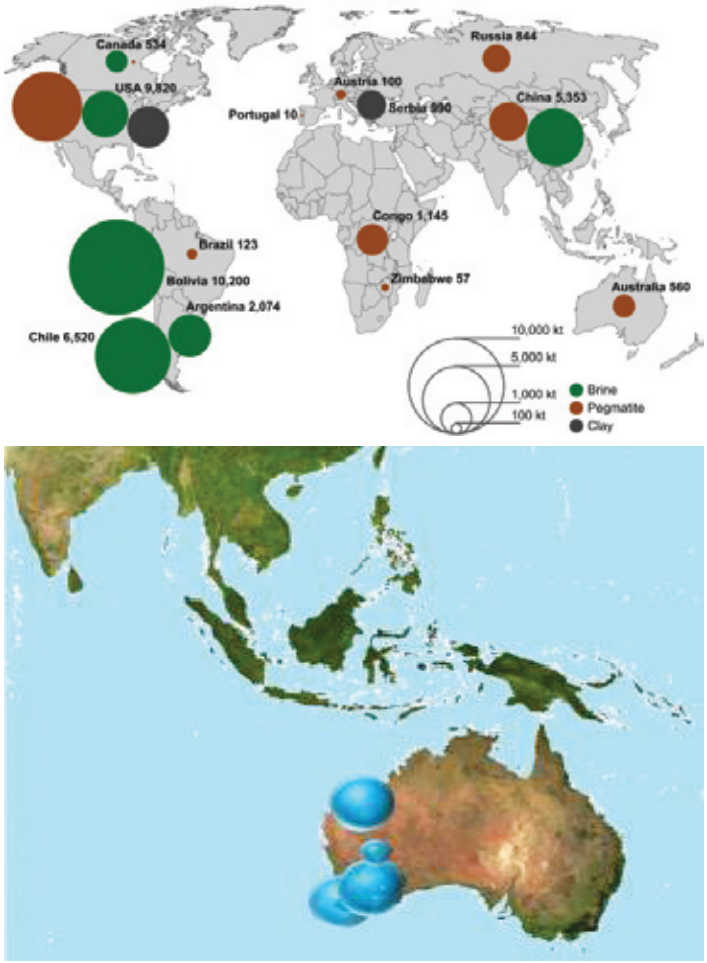

Fig.3 (L) Global distribution of Li deposits types: continental brines, Hard rock pegmatites, and clays (Image: Ziemann M W, 2014) (R) Western Australia's hard rock Li-deposits; bubble size reflects the relative size of the deposit by contained Li. (image: Sykes, 2019).

Salars exist in three countries, Argentina, Bolivia and Chile in the Lithium Triangle (Fig.4L), where 50% of global Li reserves are found. Argentina has several Salars, all of which contain substantial amounts of Li. The *Salar de Atacama* in Chile (Fig.5L) is currently the largest producer of Li from a brine source. By far, the largest reserve base of Li in the world is in the *Salar de Uyuni* (Fig.6) in the southwest of Bolivia. Salars in South America are largely in the Puna Plateau (Fig.5R), an area of about 400,000 km^2 that includes north-western Argentina, western Bolivia and northern Chile forming the

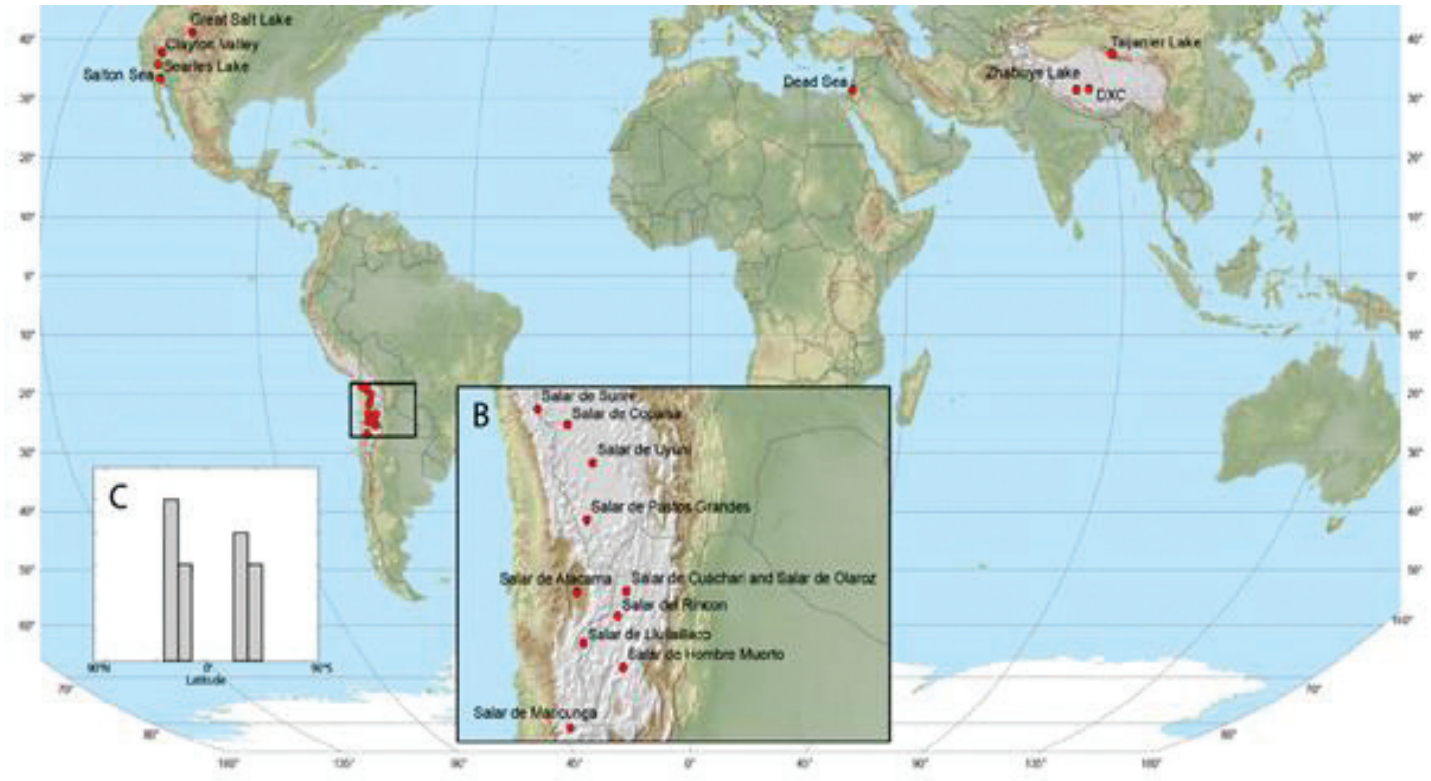

Fig.3 (A) World map of Li-brine deposits (red dots). (B) Detail of Salars in South America, (C) Histogram showing the bimodal latitudinal distribution of Li brine deposits in northern and southern arid belts (image: Bradley D C, 2014).

so-called Lithium Triangle. Local depressions in this region, which host the Salars, have undergone rapid subsidence followed by abrupt uplift and exhumation contributing to the formation of thick lacustrine sediments.

In Qinghai-Tibet plateau, China, lithium is concentrated in basins and is produced from a zone of magnesium-sulphate lakes generated during the Himalayan orogeny. The most important Li-bearing deposit in the zone of carbonate-type lakes is Zabuye for which the lithium carbonate mineral zabuleyite (Li_2CO_3) is named. Brine in the lake has a lithium content of about 1500 ppm.

Resources at Clayton Valley brine deposit in Nevada, USA, are estimated to be only about 0.3 Mt Li. Lithium is present at low concentrations, usually <100 to 200 ppm, in brines from many other salt lakes, including Great Salt Lake, northern USA, the Dead Sea and Algeria.

5.2 Oil field brine deposits: In these deposits significant amount of brine rich in dissolved metals is brought to the surface. In secondary recovery of oil and gas from reservoir rocks, high pressure brines are injected into underground fractures. The process is called hydraulic fracturing or "fracking." When the injected brine is brought back to the surface, it contains not only the water, oil, and gas, but also dissolved materials from the surrounding rock.

Fig.4 (L)Latin America's Lithium Triangle: Most of South America's Li-brine deposits are located in Argentine, Bolivia and Chile in what is popularly known as the "Lithium Triangle" in the Atacama Desert, one of the driest places in the world often considered as a Martian analogue terrain (image: Barbera Jeraz et al, 2021). (R): Chile's Salar de Atacama is the largest producer of Li from a brine source (Image: Bull A T et al, 2018).

5.3 Geothermal brine deposits: Found in rocky underground formations with high heat flows, geothermal brines are highly concentrated, often with significant dissolved metal content. The brine is typically pumped to the surface by a geothermal power plant, used for energy generation, and then returned to the underground deposit via an injection well, or discharged to a surface waterway. In an effort to maximize efficiency and cut waste, some facilities have

implemented technology to extract valuable materials, such as Li, Mn, and Zn, from the brines prior to disposal.

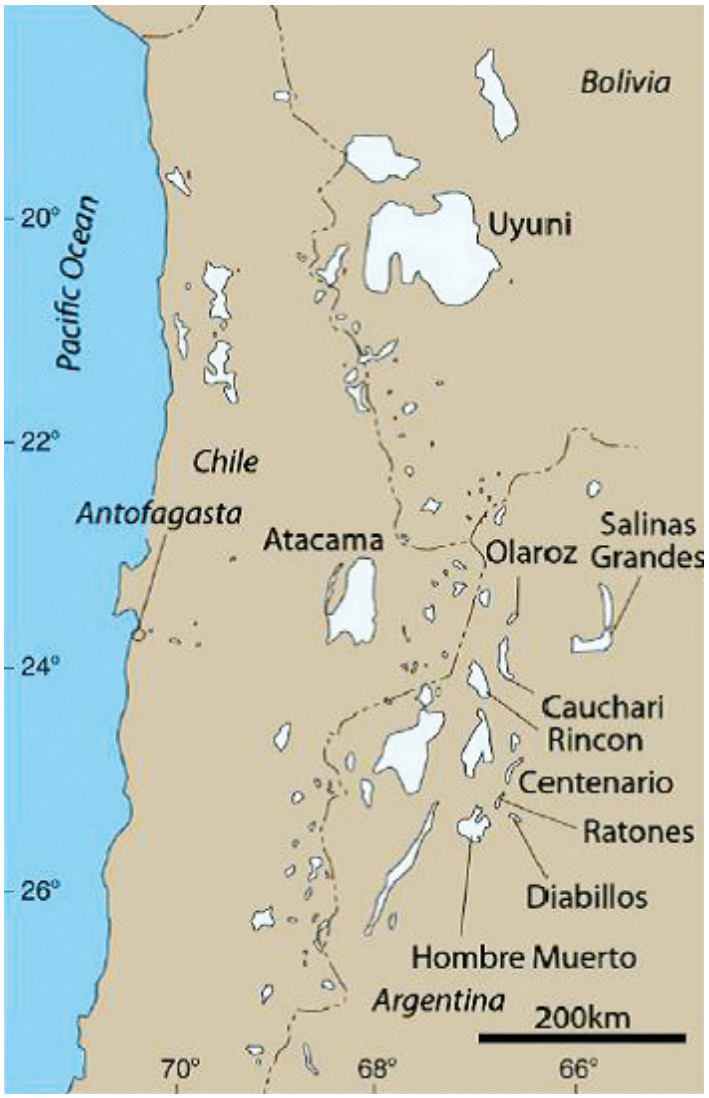

Fig.5L. Salar de Atacama, Chile is currently the largest producer of Li from a brine source (Image:Catherine Highland, 2018); R. Location of Salars in the Puna Plateau (image: Kesler et al, 2012)

Fig.6 L Bolivia's Salar de Uyuni Salt Lake is the largest salt flat in the world (image: Boissoneault L, 2015); (R) Lithium mining in Salar de Uyuni which holds ~50% of world's Li reserves (Image: perureize.net)

5.4 Hard rock pegmatite deposits: Pegmatite grades of about 0.6% Li_2O (0.28% Li) are required for economic extraction of lithium. Spodumene is the most important lithium mineral in pegmatites while amblygonite is widespread but rarely of economic importance, and petalite, eucryptite ($LiAlSiO_4$) and lepidolite ($KLi_2AlSi_4O_{10}F_2$) less common.

The three main global suppliers of Li from pegmatite sources today are Australia, Canada, and Zimbabwe. In Australia, the Greenbushes pegmatite mine in southwest Australia is currently the largest producer of Li from a pegmatite source. In Canada, there are numerous pegmatite mines, where caesium, lithium, and tantalum are mined from LCT pegmatites. Sub-Saharan Africa is exceptionally rich in minerals. The Bikita mine in Zimbabwe is one of the largest Li mines in Africa and has been operating since the 1950s. Li mineralisations are also known to exist in other regions of Zimbabwe. Other countries in Sub-Saharan Africa, such as Namibia, the Democratic Republic of Congo, Rwanda, Mozambique and South Africa also have Li pegmatite mineralisations. Li pegmatites also exist in Mali, as the mineral amblygonite. In South America Li pegmatites are known in the Republic of Suriname. In the EU, old tin mines are receiving renewed interest as sources of Li in places like Cornwall in England and the Czech/German border town of Cinovec.

5.5 Li-clay deposits: A small percentage of the world's clay deposits is enriched in Li. Li-clay deposits contain an estimated 7% of the world's Li resources. Two significant Li-bearing clay minerals that can also be economical sources of Li are hectorite and Jadarite. Hectorite is a (Mg, Li) smectite clay mineral, and jadarite, a monoclinic clay mineral. Hectorite deposit occurs in the Kings Valley, California, USA, where it has an estimated reserve of 2 Mt, while jadarite is found in the Jadar Valley, Serbia, with an estimated reserve of 1.4 Mt. Jadar is a place containing the only known recorded occurrence of jadarite and the only known deposit of jadarite in the world. Global Li reserves, as hectorite and jadarite, have been estimated to be 9.9 Mt.

6.0 World lithium Market

The global Lithium demand has reached 180,000 t of lithium carbonate equivalents (LCE) in 2015, with forecasts as high as 1.6 Mt by 2030. The most important tradable Li-products are Li_2CO_3 and LiOH which together account for nearly two-third of the market. According to USGS, estimated world Li reserves are >14 Mt whereas resources are considerably greater than 34 Mt (Fig.7). The global Li production stood at ~32,000 t in 2014, corresponding to 170,000 t LCE. Approximately 4.4 Mt of Li resources are located in the USA and Canada, 5.4 Mt in China and 1.2 Mt in Europe. The brine Li resource of Chile is ~6.3 Mt and Bolivia 10.2 Mt with quite a low average Li content of 320 ppm. Presently, the most important Li-containing hard rock deposits are the pegmatite rocks contributing to 3.9 Mt of Li resource.

Australia is home to the majority of spodumene-pegmatite mines and presently the largest producer, is set to bring over 400,000 t LCE of new supply by 2025.North America's share of Li supply is set to increase to over 5%. Despite the present escalation in supply, demand could outweigh supply by 2026. According to some sources by 2030, the total global demand for Li is expected to reach 1.79 Mt of LCE. With the anticipation of increased demand from the battery sector, Li projects, exploration and investments have increased. New and expanding projects have seen the bulk of Li output shift from the much-hyped brine production in South America to pegmatite rock mining in Australia.

7.0 Lithium-Ion Battery (LIB)

Batteries are at the heart of EVs and a key technology for combating GHG emissions. However, batteries must exhibit ultra-high energy and power performance approaching theoretical limits, outstanding lifetime and reliability, and enhanced safety and environmental sustainability. Over the past several decades, the number of EVs has dramatically increased to over 10 million, half of which is in China. It is estimated that worldwide, more than 145 million EVs will be on the roads by 2030 and some projections put it at 200 million in another decade. According to the International Energy Agency, 145 million is nearly 15 times today's and 7% of the global vehicle fleet. These figures are a pointer to the future of EV markets.

Lithium, cobalt, nickel, and graphite are integral materials in the composition of LIBs for EVs. There are three primary functional components inside a LIB, namely the positive and negative electrodes, and an electrolyte. Generally, the negative electrode is made from carbon or graphite, while the positive electrode is made from layered oxide (such as Li-Co oxide, Li-Fe phosphate or Li-Mn oxide), and the electrolyte is a Li-salt in an organic solvent (a mixture of

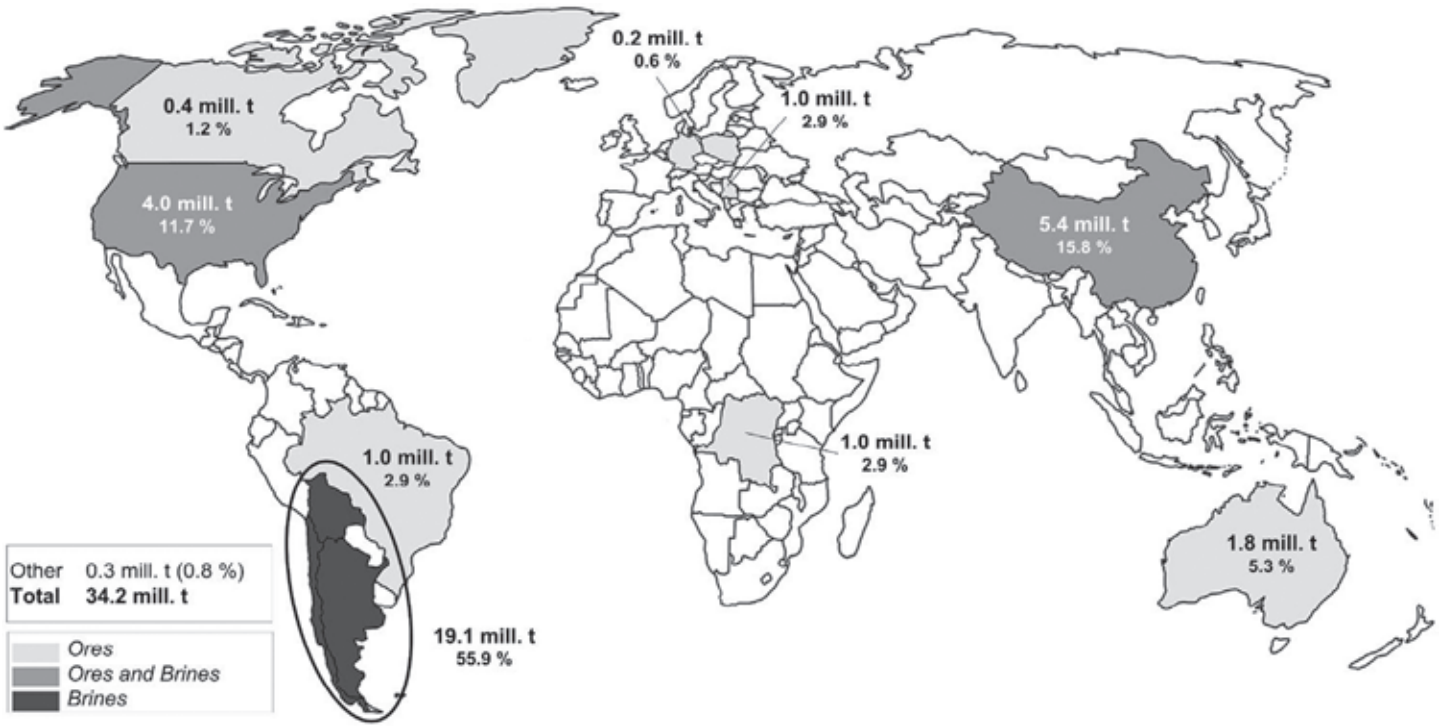

Fig.7. Geographical distribution of global lithium resources; almost 60% are found in the countries of the Lithium Triangle of South America (Gunther Martin, et al, 2017).

organic carbonates such as ethylene carbonate or diethyl carbonate containing complexes of lithium ions). However, LIBs are more fragile, has safety hazards since they contain a flammable electrolyte. Nevertheless, they are efficient, which makes them common in consumer electronics and suitable for portable electronics.

A modern LIB contains a graphite anode, a Li metal oxide cathode, and an electrolyte solution doped with a lithium solution, such as lithium hexafluorophosphate in a mixed organic solvent. The advantages of LIB include high energy density, low self-discharge rate, long life cycle, low maintenance, fast charging, and low weight (40 to 60% less than lead-acid batteries). Some of the disadvantages of LIBs include the need for a protection circuit and travel restrictions. Current LIBs operate best at a temperature between 20^0 C and 60^0 C. LIB production is the largest consumer of Li resources today. A variant of LIB is the lithium polymer batteries (LiPo). LiPo are small, variable power packs, lightweight, powerful, long-lasting and astonishingly variable in design and capacity, particularly suited to small, flat, and mobile devices with typical applications in smartphones, tablets and notebooks.

Another future development that can contribute to better performance of EV batteries is magnesium-ion batteries. Rechargeable magnesium batteries (RMB) are potentially contributing more to the automobile industries after LIB due to its relative safety and abundance of magnesium in the earth's crust. Meanwhile, the University of Queensland researchers have developed a prototype of an aluminium ion battery (AIB) with much potential in the EV transportation. The Australian company Graphene Manufacturing Group (GMG) has announced exciting performance test results for the AIB that can charge 10x faster than LIB with longer endurance. Yet another innovation in the battery technology is anode-free zinc batteries that promise to be cheaper and safer than conventional LIBs. However, turning zinc cells into long-lived rechargeables faces several challenges. EVs thus hold a lot of promise and potential for creating a more sustainable future.

7.1 Future lithium availability for EVs: The levels of Li demand growth implied by EVs is significant, particularly where scenarios are consistent with global GHG reduction targets. The key variables in lithium availability are characterised by significant uncertainty which gives rise to a wide range of estimates for the future demand for Li, i.e., between 184,000 and 989,000 t of Li per year in 2050 with a 50% reduction in global emissions. However, Li production is forecast to grow between 75,000 and 110,000 t per year in the near future. Under this rate of production growth, it is plausible that Li supply will meet increasing Li demand over the coming decades to 2050.

8.0 Recycling Used LIBs

The widely used LIBs contain many valuable metals besides many toxic heavy metals and organic compounds

in electrolytes, which pose potential environmental hazards. The spent LIBs are a superior source of elements which can well be recovered for reuse. The grade of Co and Li in Lithium Cobalt Oxide ($LiCoO_2$) batteries is higher than that in their ores. There are many processes of LIB recycling and some hydrometallurgical and pyro-metallurgical processes have been reported or patented. However, a cheap and environment-friendly technology is yet to be developed.

The hydrometallurgical processes of recovery include acid leaching, bioleaching, solvent extraction, and chemical precipitation. Acid leaching relies on recovery of Li and Co from $LiCoO_2$ with the help of acids. Solvent extraction is done by the addition of an extractant to dissolve metals so as to separate the selected metal. Chemical precipitation makes use of a precipitating agent that reacts with the metal in solution producing an insoluble salt.

A simple process of recovery of battery grade quality (99.5%) of Li from spent LIBs was reported by Sandra Pavón et al (2021). It is a selective process to mobilise Li from LIB by leaching with supercritical CO_2. In contrast to all other studies, only Li and Al were mobilised, which allows for selectively precipitating Li_2CO_3 in high purity. Other valuable metals, such as Co, Cu, Ni, and Mn, remained in the solid residue, which can be separated selectively and recovered by established processes. The CO_2 released in these processes can be fed back to the recovery process. This kind of LIB recycling comes very close to the goals of zero-waste.

9.0 Indian Scenario on Lithium Resources and LIB

India is import-dependent for lithium and over 165 crore lithium batteries are estimated to have been imported into India between 2016-17 and 2019-20, at an estimated cost of $ 3.3 billion. Although India has well-known pegmatite rocks in the states of Andhra Pradesh, Jharkhand, Rajasthan, Chhattisgarh and Odisha and a few potential continental brine lakes such as the Sambhar, Pachpadra, Thob and Pokarann lakes in Rajasthan and Rann of Kachchh in Gujarat, they are poorly explored for their lithium content (Wadhawan and Sharma, 1997; Wadhawan, 2018). Approximately, 1600 tonnes of Li in inferred category have been reported by AMD in Marlagalla-Allapatna region of Mandya district, Karnataka. LCT pegmatites were earlier identified in the area by Sarbajna and Krishnamurthy in 1994. Efforts are being made to possibly extract lithium from the brine pools of Rajasthan and Gujarat and the mica belts of Odisha and Chhattisgarh.

Yamuna Singh et al (1991) reported the occurrence of Li-bearing pegmatites in the Bastar craton, Chhattisgarh, where some 500 pegmatites have been reported earlier (Babu, 1989) of which only 19 are Li-bearing. Preliminary estimates suggested that over 50,000 tonnes of lepidolite (1.0-1.5% Li) and an equal quantity of amblygonite (2.7-4.06% Li) of commercial grade may be available for exploitation. Li mineralisation has also been reported in the Sewariya granite pluton of Rajasthan. Mineral phases containing lithium phosphates were reported from leucogranites within the pluton by Banerjee and Pandit (1994) with an average Li content of 135 ppm in biotite granite and 65 ppm in leucogranite of the pluton.

Azaz A. Gogda et al (2017) has reported lithium contents of up to 2.98 mg/l (ppm) in the brines of Little Rann of Kutch and near Bhavnagar. Similarly, Wadhawan (2018); Menaria and Hussain (1995) mentioned potential Li-bearing brines in tectonically created pull-apart inland basins in Thar Desert of Rajasthan. The oilfield brines of the Cambay basin are studied by Babulal Rebary et al (2014) with reported lithium contents ranging from 0.06 to 2.90 mg/l. These sites are currently being explored by AMD for lithium resources.

India has been heavily reliant on the international market, mainly China, to meet its EV components, especially battery cells (Pramoda Gode et al, 2021). To bring an alternative, NITI Aayog, the Government of India's premier policy think tank, recently initiated the National Programme on Advanced Chemistry Cell (ACC) Battery Storage, meant to support the domestic manufacturing of 50 GWh of ACCs. NITI Aayog describes ACCs as battery cells with advanced storage technologies that can store electric energy as chemical energy and convert it back to electric energy when required. Analysis indicates that India will need about 3,400 GWh to 4,100 GWh of batteries for its EVs by 2035. Moreover, in the next decade, India's annual requirement could be 17% to 26% of annual global production. This highlights the need for India to set up its own *giga-factories* in the next few years which is imperative to make EV's cost competitive.

With trends in globalisation, many global and domestic companies have announced plans to set up battery cell manufacturing facilities in India. TOSHIBA Corporation, Denso Corporation, and Suzuki Motor Corporation have jointly invested US$180 million to set up India's first LIB *giga-factory* in Gujarat with initial production capacity of 2.35 GWh. Japanese multinational Amperex Technology Limited is planning to invest US$945 million over the next few years to produce LIBs for smart phones and EVs with a manufacturing plant in Haryana. Tata is planning to invest Rs 4000 crores for an LIB manufacturing plant in Gujarat. It is inferred that an investment of around US$65 million per GWh of production capacity is required. Additionally, it is estimated that about US$7 to $8 billion of investment is required in the cell manufacturing industry over the next 5 years, and an investment of US$50 to $70 billion is required in the next 10 years to build manufacturing capacity to keep up with domestic battery needs. The US$2.4 billion incentives that India has announced for the next 5 years are a strategic step in building a robust domestic battery industry.

10.0 Lithium Raw Materials Security: LIBs use lithium-nickel-manganese-cobalt oxide (NMC), lithium-nickel-cobalt-aluminium oxide (NCA), lithium-iron-phosphate (LFP) or to a limited extent, lithium-manganese-oxide (LMO) at the cathode and graphite at the anode. Scaling up the production of these batteries in India would require a secure supply chain of raw materials, especially Co, Li, Ni and graphite. To ensure consistent supply of critical minerals to the Indian market, GOI has set-up a joint venture of three central public service enterprises called Khanij Bidesh India Ltd. (KABIL). Recently, KABIL led a strategic partnership with the state-run mining enterprise of Argentina for the exploration and production of Li and is exploring similar possibilities with Bolivia. India has also committed to jointly invest $6 million with the Australian government to explore lithium and cobalt mines in Australia over the next six months, in a bid to firm up supplies of key minerals needed to further its electric vehicle plans. By promoting and incentivising cell chemistries with less Co and other sensitive materials, India can reduce its future reliance on mineral imports while developing critical technological capabilities.

Conclusions

The 2011 documentary film by the Italian director Andreas Pichler and the Bolivian director Julio Weiss first coined the term "*The Lithium Revolution*" with the theme: "In a time of global resource shortage and increasing energy prices, it is lithium that is on the way to becoming 'the' natural resource of the 21st century. Lithium is the basis for a new kind of battery technology and thus a prerequisite for the spreading of electronic mobility. Is lithium an answer to the imminent energy crisis and key to the future? We tell three stories about the vision of electronic mobility, and the extent to which it already has become reality today". That title effectively paints an optimistic vision for the future of lithium. If the alternative energy source is renewable such as solar and wind, then storing that energy in LIBs is an important element in the future of green technology. The propagation of EVs globally, and a reduction in the number of fossil fuel-burning vehicles, would effectively reduce GHG emissions and perpetuate the green energy economy.

The responsible mining of lithium resources could very well be the key on a path towards a low-carbon energy future in which no nation including India can afford to miss the bus. The demand for lithium is growing along with the LIBs to power the plethora of portable electronic gadgets of today and tomorrow and EVs that would revolutionise electric mobility in the near future. There are indications that the distribution of lithium deposits, both continental brines and hard rock pegmatites around the world, should be sufficient to meet future demand for the metal.

According to some, the demand for lithium may also overtake production in the future, unless lithium is recovered from the vast heaps of spent LIBs by recycling. Besides, some of the largest deposits of lithium exist in countries such as Bolivia and Afghanistan that lack the infrastructure to mine them; thus, an uninterrupted supply of cheap lithium in the future is not guaranteed. It is likely that demand for future lithium resources will be dominated by the battery industry, especially in the EV market.

There are also seemingly inexhaustible lithium resources in the oceans and enclosed inland basins such as the Dead Sea that remain untapped. Lithium extraction from potential marine resources will become cheaper and affordable in the future with commercialisation of successful lab-scale extraction technologies already known. Because of the efficiency and environmental cleanliness of lithium technology, worldwide financial and political support for its development is increasing. At the same time the world lithium market is also rapidly growing.

As far as India is concerned the country is on the right road to domestic battery manufacturing to meet the impending demand for EVs. But we are lagging much behind other countries in exploring and exploiting the raw materials, especially lithium, required for this novel technology. Our lithium resources are potentially high, thousands of pegmatite rocks are already known for instance, but need to be systematically and urgently explored and assessed in details, both hard rock and brine resources, lest we will have to be at the mercy of lithium-finished-product exporting countries such as China. Since mine to metal is a long and bumpy road the exploration should commence immediately on a war footing.

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MEAI NEWS

MEAI HEADQUARTERS

3rd Council Meeting at Hotel Swosti Premium, Bhubaneswar on 23-04-2022

The 3rd National Council Meeting was held at Hotel Swosti Premium on 23.04.2022 at 3.00 PM. The Bhubaneswar Chapter hosted the meeting.

The meeting was physically attended by MEAI President Shri. K. Madhusudhana, Vice President – III Shri. D.B. Sundara Ramam, Secreatry General Shri. M. Narsaiah, and others including Shri. Sanjay Kumar Patnaik, Immediate Past President, Shri. P.K. Satija - Chairman, Bhubaneswar Chapter, Shri. T.N. Venugopal, Council Member, Shri. S.S. Mohanty, Council Member, Shri. V. Jaya Prakash, Council member, Shri. K. Prabhakara Reddy, Chairman Bellary – Hospet Chapter, Shri. Deepak Gupta, Council Member, Shri. Shambhunath Jha- Secretary Bhubaneswar Chapter, Shri. A.R. Vijay Singh, Council Member, Shri. B.R.V. Susheel Kumar- Council member, Shri. P.T. Hanamgond – Council Member, Shri. Rachappa – Council Member and other life members from Bhubaneswar Chapter. Since the meeting was conducted in hybrid mode, 32 Council members joined the meeting virtually.

Shri. Pankaj Kumar Satija, Chairman and Shri. Shambhunath Jha, Secretary of the Bhubaneswar Chapter welcomed the Council Members with bouquet and shawl.

In the council meeting all the Agenda points were discussed. At the end of the meting the President announced that the 4th Council Meeting followed by AGM will be held at Bengaluru in the last week of June 2022.

The Meeting ended with vote of thanks proposed by Shri. M. Narsaiah.

Shri. Shambhunath Jha, Secretary, Bhubaneswar Chapter welcoming the guests. Sitting (L-R): D.B. Sundara Ramam, Vice President – III, Shri. K. Madhusudhana, President, and Shri. M. Narsaiah, Secretary General

Shri. K. Madhusudhana being felicitated by Shri. P.K. Satija, Chairman, Bhubaneswar Chapter

Members of the National Council that attended the 3rd Council meeting

RAJASTHAN CHAPTER-JAIPUR

A workshop titled “State of Mining in Rajasthan - Present Scenario: Environmental Clearences and Mining Regulations” was organised on 9th April 2022 at Mining Welfare Centre, Jaipur jointly by MEAI-Jaipur and Federation of Mining Associations of Rajasthan (FMAR). The State Envirnment Impact Assesment Authority, Rajasthan was present in full strength in the workshop. Shri Rajeeva Swarup, Chairman SEIAA, was the Chief Guest. With the efforts of Shri Akshaydeep Mathur, Honarary Secretary General, FMAR and initiative of SEIAA Chairman, we were fotunate to have Dr. Suresh Chandra, member SEIAA and Shri P. K. Upadhyay, Environment Secretary, Government of Rajasthan & member secretary SEIAA as the guests of honour in the workshop.

We also had Shri Surjeet Katewa, Dy. Director Mines Safety, Ajmer Region as guest of honour.

The workshop started with lighting of lamp by the dignitaries and floral welcome of guests. Shri Anil Mathur, organizing secretary gave a brief background of the workshop.

Presentations were made on behalf of stakeholders by Shri Akshaydeep Mathur of FMAR, Dr. M. K. Jain of M S Engineers and Shri R. K. Bansal of Recycling & Environment Association of India. The presentations covered a wide

range of difficulties faced by the stakeholders in the process of obtaining environmental clearance and making a mine operational.

The SEIAA members took note of issues raised in the workshop.

In his address, the Chief Guest touched upon all the major issues raised and assured to do the best to make doing business easy for the mining community. Shri Swarup assured the stakeholders of complete transparency in the process.

The inaugural session ended with a vote of thanks by Chapter Secretary Dr. Manoj K. Pandit.

After taking a networking tea break, the interactive technical session started.

The technical session was chaired by Dr. S. K. Wadhawan, DG, GSI, (Retd.), Co-chaired by Shri R. K. Bansal; and Shri K. S. Yadav, RCOM, IBM (Retd.) reported the proceedings. Shri Akshaydeep joined the panel on dais.

Speakers during the session talked about issues related to the workshop theme. They included Shri Akshaydeep with the opening statement, Dr. S. K. Wadhawan, Dr. Vivek Laul of Vivek Geo Services, Shri Brijesh Shandilya of YETSU Mining, Shri Lalit M. Soni, Principal Lead-Mining (Infosys), Shri Devendra Garg, mine owner and lead, young entrepreneur group of FMAR. Shri P. C. Bakliwal and Dr. L. S. Shekhawat from the Chapter added their views and the MEAI view point as and where required.

The Chair and Co-chair efficiently conducted the session with intermittent inputs during the entire proceedings. Shri K. S. Yadav shared a report of the session. Technical session ended with a vote of thanks by Shri Anil Mathur, highlighting the presence of the entire cross section of the stakeholders despite ongoing festivities and a major absence on account of medical conditions amongst the members and their families.

The proceedings concluded with a delicious lunch for the participants.

A section of audience

RAJASTHAN CHAPTER - UDAIPUR

Report of Technical Talk Session

Rajasthan Chapter Udaipur in association with Rajasthan State Mines and Minerals Ltd. organized a technical talk session on 28 March 2022 on “Application of Drones in Mining Industry-Rules, Guidelines and Case Study” in the auditorium of the Institute of Engineers India, Udaipur Local Center.

(L to R) S/Shri Rajendra HarlalKa of KBC, MS Paliwal, Secretary, Mukesh Kumar Chaturvedi, GGM, RSMML, RP Gupta, Former President MEAI, Rajneesh Purohit, Controller of Mining and Hitanshu Kaushal of HK Associates.

Two eminent speakers ***Sh Rajneesh Purohit***, Controller of Mining, North West Zone, Udaipur and ***Shri Hitanshu Kaushal*** of HK Associates and first Mining Engineer to get Drone Pilot Certificate delivered lectures on the subject covering all aspects of drones.

Shri Rajneesh Purohit told that previously it used to take about three days in making plans and sections, and now with the help of drone survey it can be done in a few hours. Drone surveying is fast and easy with less human intervention and low cost. Besides this, with the amendments to MCDR 2021, it has been now mandatory to conduct surveys by drones in large mines.

Shri Hitanshu Kaushal focused on the various uses of drones in mines such as mine planning, drilling & blast survey, forest survey, plantation, agriculture through a case study and informed that data accuracy and authenticity is better from drone survey as compared to traditional survey. It helps in creating a digital data base which can be easily retrieved in future. The data generated from time to time can be stored in the digital platform and the data can be compared over time. The data can be used for systematic and scientific mine closure planning, monitoring of recovery, rehabilitation activities in the lease area.

The technical session was presided over by Sgri R.P. Gupta, former National President, MEAI, and the Chief Guest on this occasion was Shri Mukesh Kumar Chaturvedi, Group General Manager, Rajasthan State Mines & Mineral Ltd.

On this occasion, the mines of Udaipur region, which were awarded “National Safety Award” by the Ministry of Labor and Employment, Government of India from 2017-2020 were also honored by memento and citation by the Rajasthan Chapter Udaipur. *Kayd Mines* of Hindustan Zinc Ltd., *Sanu Mines* of Rajasthan State Mines & Mineral Ltd., *Dhanlaxmi Soapstone* and *Dolomite mine* of Khaitan Business Corporation and *Dharmeta Marble Mines* of RK Enterprises were honored.

In the starting Shri M.S. Paliwal, Secretary of the Chapter delivered welcome address and apprised the activities of the Chapter.

The Program was presided over by Shri R. P. Gupta. The Chief Guest was Shri Mukesh Kumar Chaturvedi, GGM (Phosphate), RSMML and the Guest of honor was Shri Rajendra Harlalka of KBC. Shri Gupta, Shri Chaturvedi and Shri Harlaka also delivered their address.

On this occasion Shri A. K. Kothari, Dr. S. S. Rathor, Shri Praveen Sharma, Shri N.K. Kothari, Shri PR Ameta, Officers of Mines and Geology Department, IBM, DGMS , RSMML and mining engineers from across the industry were present. Vote of thanks was proposed by Shri SM Ahmed.

A view of Audience present in Technical Talk

MEJ RIDDLES

Dear Readers of MEJ,

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

Request the members to participate in the QUIZ in large numbers and benefit from the enhanced knowledge by reading the Journal from end to end.

Questions based on MEJ April 2022 issue

1. Lithium battery and energy metals conference 2022 will be held in which city?

(a) New Delhi (b) London
(c) Perth (d) Johannesburg

2. Who is holding the training program on IMIC (Indian Mineral Industry Code) in India?

(a) MEAI (b) MGMI
(c) NACRI (d) Geological Society of India

3. Who is heading the MEAI Committee on Training, Development and Program?

(a) Mr M Narsaiah (b) Mr K Madhusudhana
(c) Mr Deepak Vidyarthi (d) Mr Deepak Gupta

4. How many tons of gold was produced from Kolar Gold Fields?

(a) 670 (b) 740
(c) 800 (d) 890

5. Where is the Cojag Smart Technologies Pvt. Ltd located in India?

(a) Bengaluru (b) Kolkata
(c) Nagpur (d) Pune

WINNERS OF RIDDLES PUBLISHED IN THE MEJ APRIL 2022 ISSUE

Congratulations to proud winners

Mr Sanjeev Soni
ACC Limited, India. Mobile: +91-9771423629
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Mr Savan Pansuriya
4th year Undergraduate, Department of Mining Engineering
MBM Engineering College, Jodhpur. Mobile: 9978043065

Prof. D.P. Tripathy
Professor and former Head, Department of Mining Engineering, National Institute of Technology, Rourkela
E-mail: dptripathy@nitrkl.ac.in

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

CONFERENCES, SEMINARS, WORKSHOPS ETC.

ABROAD

3-4 May 2022: **International Conference on Mining Technologies and Sustainable Systems ICMTSS**. Rome, Italy. Website URL: https://waset.org/mining-technologies-and-sustainable-systems-conference-in-may-2022-in-rome; Contact URL: https://waset.org

4-5 May 2022: **Minesafe International Conference 2022 (#minesafe2022)**. Perth, Australia and online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

11-12 May 2022: **Gold Plant of the Future Symposium**. Blue Mountains, Australia and online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

20-21 May 2022: **International Conference on Recent Advances in Mining Technologies ICRAMT**. Berlin, Germany. Website URL: https://waset.org/recent-advances-in-mining-technologies-conference-in-may-2022-in-berlin; Contact URL: https://waset.org

24-25 May 2022: **International Conference on Mining and Mineral Processing ICMMP**. Montreal, Canada. Contact URL: https://waset.org. Website URL: https://waset.org/mining-and-mineral-processing-conference-in-may-2022-in-montreal

3-4 Jun 2022: **International Conference on Trends in Web Mining**, Information and Knowledge Extraction ICTWMIKE. Rome, Italy. Contact URL: https://waset.org. Website URL: https://waset.org/trends-in-web-mining-information-and-knowledge-extraction-conference-in-june-2022-in-rome

29-30 Jun 2022: **Mining World Congress**. London, United Kingdom. Website URL: https://miningconferences.org/; Program URL: https://miningconferences.org/agenda/; Contact URL: https://miningconferences.org/contact-us/; Contact E-mail: info@miningconferences.org

21-22 Jun 2022: **Open Pit Operators Conference 2022 (#openpit2022)**. Perth, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

18-20 Jul 2022: **International Conference on Design Methods in Underground Mining ICDMUM**. Dubai, United Arab Emirates. Website URL: https://waset.org/design-methods-in-underground-mining-conference-in-july-2022-in-dubai; Contact URL: https://waset.org

19-20 Jul 2022: **International Conference on Land Reclamation in Mining Areas ICLRMA**. Copenhagen, Denmark. Website URL: https://waset.org/land-reclamation-in-mining-areas-conference-in-july-2022-in-copenhagen; Contact URL: https://waset.org

9-10 Aug 2022: **International Conference on Green Coal Mining Technologies and Techniques ICGCMTT**. New York, United States. Website URL: https://waset.org/green-coal-mining-technologies-and-techniques-conference-in-august-2022-in-new-york; Contact URL: https://waset.org

12-13 Aug 2022: **International Conference on Mining and Mineral Technologies ICMMT**. Venice, Italy. Contact URL: https://waset.org. Website URL: https://waset.org/mining-and-mineral-technologies-conference-in-august-2022-in-venice

21-23 Aug 2022: **IMPC Asia-Pacific 2022**. Melbourne, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

14-15 Sep 2022: **Lithium Battery and Energy Metals Conference 2022**. Perth, Australia and Online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

10-12 Oct 2022: **Australian Mine Ventilation Conference 2022**. Gold Coast, Australia and online. Contact AusIMM. T: 1800 657 985 or +61 3 9658 6100 (if overseas)

17-19 Oct 2022: **International Mining and Resources Conference. IMARC 2022**. Melbourne, Victoria, Australia and online. Contact: connect@imarcglobal.com; Australia: +61 (0) 3 9008 5946

21-22 Oct 2022: **International Conference on Mineral Processing and Mining ICMPM**. London, United Kingdom. Website URL: https://waset.org/mineral-processing-and-mining-conference-in-october-2022-in-london; Contact URL: https://waset.org

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

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

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

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

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

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

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Globally, extensive

afforestation

programmes are converting mines into habitats for local wildlife

Source: World Steel Association

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

*Data as on October 2021

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