ISSN 0975 - 3001

Mining Engineers' Journal

Official Publication of
Mining Engineers' Association of India

Price ₹100/-

Vol. 24 | No. 12 | MONTHLY | July - 2023

Mining Engineers' Association of India
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ISSN 0975 - 3001

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this issue contains...

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President's Message.....

Dear Members,

Greetings...

I would like to inform you that our Association in the preceding month undertook the following activities.

I appreciate the celebration of ***"World Environment Day"*** by some of our Chapters by doing mass plantation and involving Schoolchildren. They have also conducted drawing & painting competitions on Environment for schoolchildren to bring awareness.

I had the privilege of visiting the MEAI Tamil Nadu Chapter on 10th June to attend the AGM of the Chapter and to inaugurate the ***Student Chapter*** for the students of Geology and Mining from the Institutions of Chennai and other parts of Tamil Nadu.

As a part of MEAI TECH SERIES (MTS) monthly online program, a talk on ***"Are we Mining groundwater? Can we renew the sources?"*** was delivered by Dr. Lingaraju Yale on 23rd June 2023 in MTS-12. We have completed the yearlong program of MTS. On this Occasion, I express my sincere thanks to Mr Deepak Vidyarthi & his Team and appreciate the efforts for successfully conducting the MTS program regularly every month. Request all the mineral industry professionals to avail this opportunity.

I am extremely happy to note that the ***Jabalpur chapter*** conducted a one-day National Seminar on ***"Present mining scenario"*** on 24th June 2023 at Katni. The papers presented were extremely informative and covered all the needs of the mineral industry today. I was also part of this Seminar during my visit to Jabalpur Chapter and shared my views on the status & future activities of the Chapter. I appreciate the Chairman, secretary and other Team members for bringing in quick changes in the activities of Jabalpur Chapter.

Rajasthan Chapter-Udaipur will be celebrating its Silver Jubilee celebrations on 5th July 2023 at Udaipur and arrange daylong Programs along with deliberations on the ***"Role of Artificial intelligence and Automation in mining".*** On this Occasion, I appreciate and congratulate the members of the Chapter and thank all the founder & senior members for their valuable contribution in nurturing the Chapter to this status.

I am delighted to notify you that the ***8th Council meeting, AGM, and Award function*** will be held at Ahmedabad on 25th August 2023 followed by a two-day ***"International Conference on Mining Vision 2047"*** during 25-27 August 2023 by the Ahmedabad Chapter. Request everyone to join the same.

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 news on the discovery of potentially significant resources of lithium in Jammu and Kashmir has been welcomed universally. Commentators and domain experts have called this discovery a boost for national prosperity and security though voicing serious concerns on the potential social and environmental impacts.

India electric vehicle market size was valued at USD 1.45 billion in 2021 and is projected to grow from USD 3.21 billion in 2022 to USD 113.99 billion by 2029, exhibiting a CAGR of 66.52% during the forecast period. India imported 548 million units of lithium batteries valued at $1.79 billion during April to November 2022, as against import of 616 million units for $1.83 billion in 2021-22, which makes the discovery and development of the domestic lithium resources a matter of very high priority for the nation. Scholars have argued that the ongoing global transition to low-carbon economies, the rapid expansion of artificial intelligence (AI) and 5G networks will greatly reshape global and regional geopolitics. The access to and control over rare minerals, such as lithium and cobalt, will play a crucial role in these monumental changes.

Large areas of land in India, including forests (which make up more than 22% of India's landmass), hills, mountains, and revenue wasteland are publicly owned. A three-judge bench of the Supreme Court of India ruled in July 2013 that the owner of the land has rights to everything beneath, "down to the center of the earth". The Supreme Court also recalled that the Union government could always ban private actors from mining sensitive minerals, as is already the case with uranium under the Atomic Energy Act 1962. In today's context, lithium is as important as, if not more, than uranium. In this context, the strategies adopted by two South American countries, Chile and Bolivia, which are known to host the largest known resources of lithium, are particularly instructive.

In Chile, the government has designated lithium as a strategic resource and its development has been made the exclusive prerogative of the state. The state has licensed only two companies viz. SQM and Albemarle to produce lithium in the country. In April 2023, Chile's president announced a new "National Lithium Strategy", which many in the corporate sector perceived it as his intention to nationalize the industry. On the contrary, he has clarified that his government would honour existing contracts. As a supplement, the new strategy calls for public-private partnerships for future lithium projects, which will allow the state to regulate the environmental impact of lithium-mining, distribute the revenue from lithium production more fairly among local communities, and promote domestic research into lithium-based green technologies.

Bolivia's new constitution approved by a popular vote in February 2009, gave the state "the control and direction over the exploration, exploitation, industrialization, transport, and commercialization of natural resources." The government nationalized lithium and adopted a hard line against private and foreign participation. This is believed to be one of the factors for the country's failure to produce any lithium at a commercial scale nearly 15 years after the industry was nationalized. Bolivia's current dispensation seeks to change that policy but instead of handing over lithium resources to the private sector, it wants to join hands with other Latin American countries to design a 'lithium policy' that would benefit all their economies.

Mexico also nationalized lithium in February this year, declaring, "Oil and lithium belong to the nation, they belong to the people of Mexico."

In general, the Latin and South American countries are exploring ways and means to pursue a multi-pronged strategy. While the national governments of these countries exercise a significant degree of control, the nature of private sector participation varies between these countries. The actions of these governments are also a response to the mobilization of Indigenous Peoples in the region who want to hold corporations as well as governments to account.

In this context, Praksah Kashwan, Associate professor of Environmental Studies at the Heller School for Social Policy and Management at Brandeis University, USA advocates that as India explores and develops its own lithium resources, it is notable that the appropriate development of this sector will require a very high level of effectiveness on the part of the Indian state. Much of India's mineral wealth is mined from regions with very high levels of poverty, environmental degradation, and lax regulation. Effective and careful management of the sector should be paramount if India's rare earth minerals development is to meet its multiple goals viz. social wellbeing, environmental safety, and national energy security.

- Editor

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SUBSCRIPTION RATES

	India	Foreign
1. Subscription for 1 Year	Rs. 1000/-	US$120
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NEWS FROM THE MINING WORLD

Competition Act applies to Coal India, issue to be decided on merits: SC

The Supreme Court of India on Thursday said that the Competition Act will apply to Coal India Ltd, a stand opposed by the PSU. The case has been remanded back to the Competition Commission of India (CCI) for deciding the issue on merits.

The CCI had imposed a penalty of Rs 1,773.05 crore on Coal India for imposing unfair/discriminatory conditions in Fuel Supply Agreements with the power producers for supply of non-coking coal. However, after the intervention of Competition Appellate Tribunal, the penalty was cut to Rs 591 crore.

ET online / June 15, 2023

New study quantifies violations of Indigenous peoples' rights by extractive industries

Mapuche Indigenous women in Chile. (Reference image by Ministerio Bienes Nacionales, Wikimedia Commons.)

A recent study led by the Institute of Environmental Science and Technology of the Universitat Autònoma de Barcelona found that extractive and industrial development projects, especially mining, threaten the fundamental rights of Indigenous peoples.

The research, carried out in collaboration with nine other universities from around the world, is the largest quantitative analysis of this type carried out to date at a global level.

Published in the journal *Science Advances*, the study is based on data collected over the past decade by the Environmental Justice Atlas (EJAtlas), which identified and mapped 3,081 socio-environmental conflicts around the world.

The results show that while Indigenous peoples comprise only 6.2% of the world's population and steward about a quarter of the world's land, they are directly affected by at least 34% of all documented environmental conflicts over extractive and industrial development projects. The article covers more than 740 different aboriginal groups affected by such activities, representing at least 15% of the approximately 5,000 groups worldwide.

The Quechua, Mapuche, Gond, Aymara, Nahua, Ijaw, Munda, Kichwa, Guarani and Karen communities are the 10 Indigenous groups that are featured the most in the EJAtlas dataset.

However, the researchers believe that the actual number of affected Indigenous groups is likely much higher as there are still significant data gaps, particularly in Central Asia, Russia and the Pacific.

Mining at the top

The paper notes that eight out of 10 environmental conflicts refer to only four sectors, with mining being the sector that most frequently impacts Indigenous peoples (24.7%), ahead of the fossil fuel sector (20.8%), the agriculture, forestry, fishing and livestock sector (17.5%), and the construction and exploitation of hydraulic dams (15.2%).

According to the data collected, landscape losses (56% of cases), livelihood losses (52%) and land dispossession (50%) are reported to occur globally most often in conflictive development projects.

Projects linked to the agriculture, forestry, fisheries, and livestock sectors were found to cause deforestation (74% of cases), land dispossession (74%), livelihood loss (69%), and biodiversity loss (69%).

"Land grabbing by agribusinesses and other extractive sectors continues to be a major threat to Indigenous peoples," Álvaro Fernández-Llamazares, ICTA-UAB scientist and co-author of the study, said in a media statement. "That is why Indigenous communities all over the world have been mobilizing for decades to have their rights recognized and respected."

For the research team, the findings demonstrate the sheer size of Indigenous rights violations associated with extractive operations. Thus, they remind industry that international instruments like the International Labour Organisation's Convention C169 on Indigenous Peoples and the United Nations Declaration on the Rights of Indigenous Peoples play an important role in advancing Indigenous rights.

"However, current levels of ratification, implementation and monitoring are insufficient to ensure respect for such rights," they argue.

Therefore, the researchers emphasize the need for governments to implement measures that further promote Indigenous rights and support environmental justice by ensuring real compliance with existing conventions and the protection of their land rights.

"Governments should apply a zero-tolerance policy towards violations of Indigenous rights and seek trade agreements that are conditional on compliance with the responsibilities of the UN Declaration by the companies involved," they propose.

Staff Writer, Mining.Com | June 18, 2023

Rio Tinto, China's Baowu seek to use low-grade ores for cleaner steel

Rio Tinto has signed a memorandum of understanding (MoU) with China Baowu, the world's biggest steelmaker by volume, to develop projects aimed at enabling lower grade ore to be used in low-carbon steelmaking, the miner said on Monday.

The demonstration projects include building a pilot-scale plant at one of Baowu's steel mills in China that will allow Direct Reduced Iron (DRI) steelmaking using low and medium grade ores.

"This MoU aims to address one of the biggest challenges faced by the industry – developing a low-carbon pathway for low-to-medium grade iron ores, which account for the vast majority of global iron ore supply," Rio Tinto chief commercial officer Alf Barrios said in a company statement.

China's Chalco is Rio's biggest shareholder and China is the biggest client for its iron ore.

Lower quality ores, which can already result in higher emissions because more rock has to be processed to produce the same amount of ore, typically cannot be used in DRI.

In contrast to traditional blast furnaces, DRI can use natural gas rather than more carbon-intensive coal as its energy source and should help to address concern on the part of investors and shareholders about the global warming impact of the steel and mining industries.

Steel production generates up to 9% of global emissions, according to the World Steel Association.

DRI requires feedstock in pellet form and Monday's statement said the companies would try to improve pelletisation technology for Australian ores and study production of low-carbon iron in Western Australia.

Rio and Baowu said last year that they would together invest $2 billion in a project in the Pilbara region of Western Australia.

They are also working together on the Simandou iron ore project in Guinea, as well as on expanding development of Baowu's HyCROF technology to reduce carbon dioxide emissions from the blast furnace process.

Baowu said last year the technology had lowered emissions in a trial at its Bayi steel mill by 21%, according to state media reports.

Reuters | June 12, 2023

Namibia bans export of unprocessed critical minerals

Windhoek, Namibia. Stock image.

Namibia has banned the export of unprocessed lithium and other critical minerals, the government announced on Thursday, as it seeks to profit from growing global demand for metals used in clean energy technologies.

The southern African country has significant deposits of lithium, which is vital for renewable energy storage, as well as rare earth minerals such as dysprosium and terbium needed for permanent magnets in the batteries of electric cars and wind turbines.

"Cabinet approved the prohibition of the export of certain critical minerals such as unprocessed crushed lithium ore, cobalt, manganese, graphite and rare earth minerals," Namibia's information ministry said in a statement.

Only small quantities of the specified minerals would be allowed, after approval by the mines minister, it said.

Namibia is one of the top global producers of uranium and gem-quality diamonds, but its battery metals are

attracting growing interest as the world shifts away from polluting fuels to renewable energy.

Last year, Namibia signed an agreement to supply rare earth minerals to the European Union under the bloc's plan to reduce its reliance on China for critical minerals.

Some firms with critical minerals projects in Namibia include the Australia-listed Prospect Resources, Arcadia Minerals and Askari Metals. Celsius Resources and Namibia Critical Metals are developing cobalt and rare earth projects, respectively.

Another African lithium producer Zimbabwe banned lithium ore exports last December, allowing only concentrates to be shipped out. Zimbabwe has said it wants lithium miners operating in the country to work towards producing battery-grade lithium locally and could impose a tax on exports of lithium concentrate in future.

Reuters / June 8, 2023

Plan for one of world's biggest coal mines challenged in India

Coal India operation. (Image by Coal India).

Coal India Ltd. is holding talks with residents opposed to a mine expansion that would create one of the world's largest operations producing the fuel.

Protests against plans for the Gevra site in the eastern province of Chhattisgarh threaten to complicate the company's ability to win approvals to expand annual capacity to 70 million tons. Output at that volume would see the site become the single biggest global source of the fossil fuel, according to Coal India.

Rising power demand has pushed India to prioritize energy security and boost output of coal, which continues to account for about 70% of electricity generation.

Residents of the area close to Gevra have raised concerns over air pollution, the impact on ground water levels and compensation for acquired land, said Deepak Sahu, joint secretary for Korba district — where the mine is located — at Chhattisgarh Kisan Sabha, a farmers' union in the state.

Coal India and its subsidiaries have faced challenges in ramping up other operations, including in Chhattisgarh, and a public hearing was held this week at the Gevra site.

"The company has taken considerable measures to address the issue of pollution associated with the mining process," and studies have shown there's no impact on ground water levels in the Korba district, a spokesman at South Eastern Coalfields Ltd., the unit that operates Gevra, said by phone.

The Coal India unit gave 700 jobs in lieu of land last year, the most in a decade, and has increased financial compensation for land, he said.

Bloomberg News / June 9, 2023

India considers lithium mining royalty at 3% of LME price

Indian himalayas. Stock image.

India's federal government plans to fix the rate of royalty that mining companies must pay for extracting lithium at 3% of the prices prevailing at the London Metal Exchange (LME), two government sources said.

India, which has been exploring ways to secure supplies of lithium – a critical raw material used to make electric vehicle batteries – in February found its first lithium deposits in the federally administered region of Jammu and Kashmir.

The government is expected to auction the newly found lithium blocks, with estimated reserves of 5.9 million tonnes, later this year.

At least a dozen Indian and foreign companies such as Adani Enterprises, Vedanta Ltd, Reliance Industries, Jindal Steel and Power Ltd, Himadri Chemicals and Korea's LX International are likely to take part in the

auction, said the sources, asking not to be named as the information is not public.

India's cabinet is expected to consider the proposal of fixing the rate of royalty for lithium mining at 3% of the rates prevailing at LME, they said.

The Ministry of Mines did not immediately respond to a request for comment.

The rate of royalty – to be paid to the local administration of Jammu and Kashmir – would be a major step towards the country's first auction of its lithium blocks, the sources said.

India's federal mines ministry fixes royalty rates, but the revenue goes to state governments or federally administrated territories.

India has previously used the LME benchmark to fix the royalty rate for bauxite mining, the sources said. "We studied the royalty rates in other lithium mining countries," said one of the sources. "The royalty rates in Australia is also 3% of LME and (it) is 4.5% of LME in Argentina, Bolivia and Chile – called the lithium triangle."

India's plans to auction its lithium reserve – estimated as the seventh largest deposit – comes amid a push by major economies to secure lithium supplies.

The United States, Canada and other countries have established a new partnership aimed at securing the supply of critical minerals, including lithium.

Reuters / June 14, 2023

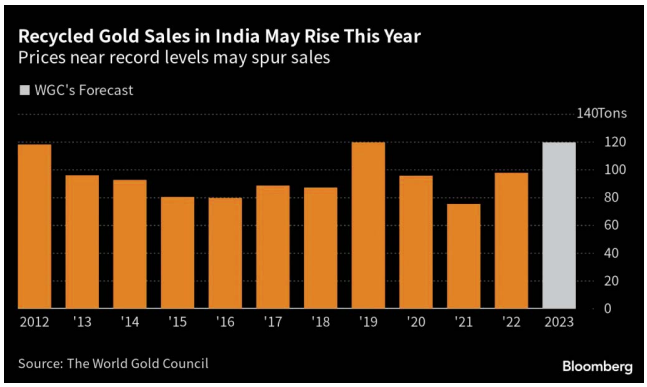
Gold jewelry recycling in India seen matching record this year

Image courtesy of Pixabay

Indians will probably sell a record amount of used gold jewelry this year to take advantage of a surge in domestic prices of the precious metal, according to the World Gold Council.

If local prices continue to rise, recycled bullion sales are expected to jump more than 20% and match the previous high of 119.5 tons set in 2019, P.R. Somasundaram, regional chief executive officer for India at the World Gold Council, said in an interview. That's likely to see India importing less gold this year, he said from Mumbai.

A cut in purchases by the world's second-biggest gold importer could put some downward pressure on international prices, currently near $1,960 an ounce. Indian gold prices have jumped by almost a fifth over the last 12 months, more than twice as much as globally, due to a weakening rupee making the precious metal more expensive.



Gold is a popular investment in India, especially in rural areas where it can be difficult to access banking services. Farmers often buy the metal after a good harvest and will then sell it, if needed, to buy seeds, fertilizer and other items. Indian households and temples collectively hold about 25,000 tons of gold.

A poor monsoon this year could further increase sales of used gold, but it's too early to say as the rainy season has just started, Somasundaram said.

Indian recycled gold sales, defined as bullion or jewelry sold for cash, jumped by a quarter in the the first three months of 2023 from a year earlier to about 35 tons, council data show. Purchases of bullion fell by 17% to 112.5 tons over the period.

"Historically, for every 100 grams of gold we transacted, generally 25% was old jewelry sales," said Ashish Pethe, former chairman of the All India Gem and Jewellery Domestic Council. The percentage may reach 35% to 40% this year as prices are rising, he said.

Bloomberg News / June 13, 2023

(Continued on Page 18)

LITHIUM DEPOSITS: POWERING THE RENEWABLE ENERGY RESOURCES

Santharam Adibhatla[1], T. Karuna Karudu[2], Dharmireddy Chinnari[3], and Potnuru Bhavani[3]

Abstract

Over the last 20 years, Lithium has become one of the essential commodities as a source of renewable energy due to its significant role in the production of Lithium-ion batteries. Market projections reveal that renewable energy industry will need more Lithium carbonate or Lithium Oxide as raw material to produce cathode material in the large-scale production of rechargeable batteries. Along with Lithium, there are several other raw materials required in batteries such as Cobalt, Nickel, Manganese, Copper and Graphite. Therefore, an abundant supply of these raw materials are required for the transition from fossil fuel based energy to clean energy. Although, lithium has become an important commodity, discovering a commercial deposit that yields desired mineral composition to produce Lithium carbonate or Lithium oxide for battery market is key success. Lithium extraction from mining to metal recovery involves a family of complex process to obtain the desired purity to meet the stringent battery specifications.

The paper addressed the occurrence of different types of lithium deposits, their mining, extraction methods, research in substitution, and its significance in the geopolitical context of supply value chain.

***Key words**: Occurrence of Lithium, Reserves, Extraction Processes, Uses and Environmental Aspects.*

1.0 INTRODUCTION

Lithium is a naturally occurring element that was first discovered in 1817 by the Swedish chemist Johan August Arfwedson in the mineral petalite on Utö, Sweden. It is an element located near the top of the periodic table, with Atomic number-3 and Atomic weight 6.9, is small, soft and light weight with high charge/radius ratio. However, because of its high reactivity, pure elemental lithium is not found in nature, but instead present as a constituent of salts or other compounds. Its use in medicine was recognized by Dr. John Cade, the Australian Psychiatrist in 1949. He used lithium carbonate as a drug for the treatment of bipolar disorder to stabilize mood as psychiatric medication. Later on, its industrial applications have grown manifold. Apart from batteries, Lithium is used in a wide range of products as shown in Fig. 1.

Fundamental work on lithium-ion batteries took place from the 1970s, due to oil crisis. As a result, remarkable progress on lithium extraction technologies has been made since the 1980s. The first commercial lithium-ion battery was developed in 1991, making it a rather short period of time between work in laboratories and the industrial production. As a result, several lithium bearing deposits were discovered in different geologically favourable terrains for the extraction of lithium bearing minerals.

2.0 OCCURRENCE OF LITHIUM IN THE EARTH'S CRUST

Estimates of the average crustal abundance of lithium vary, but it is likely to be approximately 17–20 parts per million (ppm). In igneous rocks, it is typically 28–30 ppm, but in sedimentary rocks, it can be as high as 53–60 ppm (Evans, 2014; Kunasz, 2006). Lithium -prone hypersaline brines can attain values as high as 6000 ppm, but such high levels are unusual.

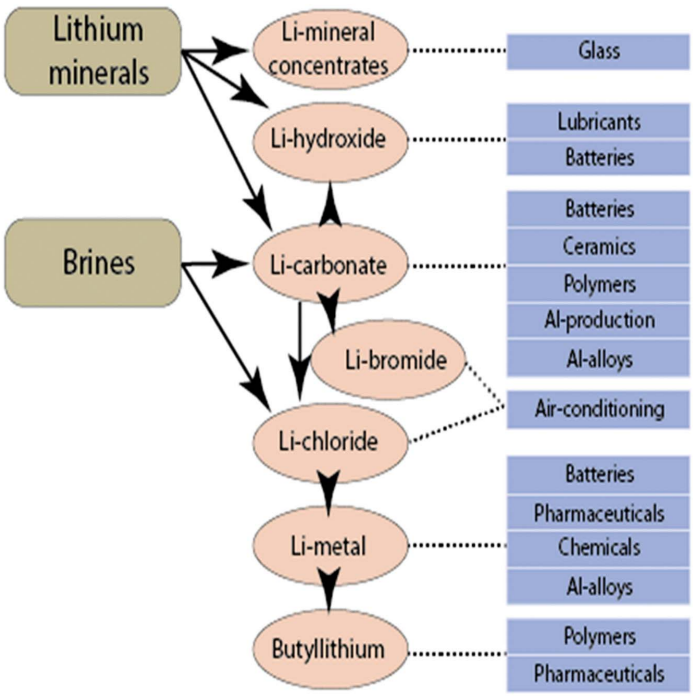


Fig. 1. Uses of Lithium (After Ziemann et. al., 2012)

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Even though, there are around 100 different minerals contain some amounts of lithium, out of which only five minerals are actively mined and used for commercial lithium production. These minerals include spodumene which is the most common in nature, as well as lepidolite, petalite, amblygonite, and eucryptite (Von Knorring & Condliff, 1987).

The types and Origins of Lithium deposits are presented in the Table 1.

Deposit type	Source	Brief description		
Pegmatites	Magmatic fluids	Coarse-grained igneous rock formed during late-stage crystallisation of magmas	1.5-4% Li_2O	Greenbushes, Australia; North Carolina, USA; Bikita, Zimbabwe
Hectorite	Saline brine	Lenses of saline lacustrine smectite clay in association with volcanic centres	0.4% Li_2O	Kings Valley, Nevada, USA; Sonora, Mexico
Jadarite	Saline brine	Hydrothermally-altered boro-silicates in sediments of an enclosed saline lacustrine basin	1.5% Li_2O	Jadar, Serbia
Continental	Saline brine	Salt pans or salars in enclosed basins with lithium enrichment likely to be from hot springs	0.04-0.15% Li	Clayton Valley, USA; Salar de Atacama, Chile; Salar de Hombre Muerto. Argentina
Geothermal	Saline hydro-thermal brine	Elevated levels of lithium contained in steam at geothermal power stations	0.01-0.035% Li	Salton Sea area, California, USA
Oilfield	Basinal saline brine	Elevated levels of lithium contained in waters or brines produced in oilfields	0.01-0.05% Li	Smackover oilfield, Arkansas, USA Foxcreek, Canada

Table 1. Types and Origins of Lithium deposits.

3.0 LITHIUM EXTRACTION

Lithium can be extracted by two major methods namely from lithium brines and from Lithium bearing pegmatites.

3.1 Lithium bearing pegmatites

Lithium bearing pegmatites are related to granitoids and all pegmatites may not contain lithium bearing minerals. Usually, ICPMS and XRD are the best analytical techniques or methods available to detect lithium in the pegmatites. However, portable XRF cannot detect lithium directly in pegmatites due to its light weight and low concentration values. Most XRF units can detect elements associated with lithium bearing pegmatites, such as Rb, Cs, Ta, Nb. In more advanced stage, when the pegmatites are identified, a full mineralogical analysis with QEMSCAN (Quantitative Evaluation of Materials by Scanning Electron microscope). It can identify not only major minerals such as Quartz, feldspar, spodumene, lepidolite, petalite, microcline and muscovite, but also accessory minerals such as columbite, tantalite, spessartine, biotite, Fe-Ti oxide, tourmaline and apatite.
Therefore, finding a right pegmatite field is a challenging and important task in lithium exploration. Lithium bearing pegmatite are not easily identified with air borne geophysical surveys. On the other hand, pegmatites are easily identified if there is an out crop or exposures in the field. Presence of crystals of lepidolite, spodumene, petalite, quartz feldspar or presence of Holmquistite (blue or purple amphibole) in host rocks are favourable indicators of pegmatite field.

3.2 Hard rock / spodumene lithium extraction

Lithium found in hard rock forms in crystals that are hosted in Pegmatites which form when mineral-rich magma intrudes into fissures in continental plates. As the last stage of this magma cools down, water and other minerals become concentrated. These metal-enriched fluids catalyze rapid growth of the large crystals that distinguish pegmatites from other rocks. Pegmatites in the form of dikes that intrude into barren rock which can measure anywhere from a few to hundreds of meters.

While accounting for a relatively small share of the world's lithium production, deposits yield nearly 20 tons of lithium annually. These lithium bearing deposits are often richer in lithium content the lithium bearing pegmatites than salar brines, however, they are at least two to three times costly they must be mined from hard rock formations by open pit mining (SAMCO, 2018), which involving drilling and blasting conventional.

Lithium-cesium-tantalum pegmatites account for about one-fourth of the world's lithium production, which include the tantalum, and the cesium production. Major Deposits

include Tanco in Canada, Greenbushes in Australia, and Bikita in Zimbabwe. Due to the added energy consumption, chemicals, and materials involved in extracting lithium from mineral ore, the process can run twice the cost of brine recovery, a factor that has contributed to its smaller market share (SAMCO, 2018).

The process for recovering lithium from ore can vary based on the specific mineral deposits. In general, the process involves removing the mineral material from the mine. then heating and pulverizing it. The crushed mineral powder is combined with chemical reactants, such as sulfuric acid, then the slurry is heated, filtered, and concentrated through an evaporation process to form saleable lithium carbonate, while the resulting wastewater is treated for reuse or disposal.

3.3 Lithium Extraction from Salar brine fileds

There are some problems associated with lithium brine production namely reliability and geography. Weather has clear impacts on the production of lithium brine operations. Lithium brine operations are limited to select climates and regions that can support favourable weather conditions to ensure economic processing. Lithium brine recovery is typically a straightforward but lengthy process that can take anywhere from several months to a few years to complete.

Drilling is required to access the underlying salar brine deposits. Lithium brine evaporation operates as follows. Brine, typically carrying 200 to 1,400 milligrams per liter (mg/l) Li, is pumped to the surface and concentrated by evaporation in a succession of artificial ponds, each one in the chain having a greater Li concentration (Stock House, 2018).

The brine remains in the evaporation pond for a period of months or years until most of the liquid water content has been removed through solar evaporation. Apart from high lithium concentration, Salar brines also contain typically Potassium and Sodium. Extraction facilities usually operate several large evaporation ponds of various stages and may extract other metals (e.g. potassium) from younger ponds while waiting for the lithium content to reach a optimum concentration for further processing. In some cases, reverse osmosis (RO) is used to concentrate the lithium brine to speed up the evaporation process.

Once the brine in an evaporation pond has reached an ideal lithium concentration level, the brine is pumped to a lithium recovery facility for extraction. This process varies depending upon the brine field composition, but usually entails the following four steps:

- **Pretreatment:** This step usually employs filtration and/or ion exchange (IX) purification to remove any contaminants or unwanted constituents from the brine.
- **Chemical treatment:** A series of chemical solvents and reagents are be applied to isolate desirable products and byproducts through precipitation.
- **Filtration:** The brine is then filtered to separate out precipitated solids.

The brine is finally treated with a reagent, such as sodium carbonate to form lithium carbonate, and the product is then filtered and dried for sale. Depending upon the desired product, different reagents may be applied to produce other commercial forms of lithium, such as lithium hydroxide, lithium chloride, lithium bromide, and butyl lithium. Once the lithium extraction process is complete, the remaining brine solution is returned to the underground reservoir.

4.0 WORLD RESERVES

Mineral reserves are defined as those minerals that were extractable or producible at the time of estimate which are commercially viable and having proven extraction technologies. Chile is endowed with largest lithium reserves worldwide by a large margin from lithium bearing brines (Fig. 2). Australia comes in second, with reserves estimated at 6.2 million metric tons (Garside, 2023). Australia was also the major country in terms of lithium mine production in 2022, with an output of 61 thousand metric tons of lithium. Argentina holds 21% of Lithium of the world reserves. China holds less than 25% of its lithium reserves.

Fig. 2. Lithium deposits in Argentina

The top-producing spodumene pegmatite operation, known as the Greenbushes mine, is located in Australia (Fig.3).

China imports raw lithium from various countries, refine and processing of raw lithium takes place in China. As a result, 65% of world lithium is refined and processed in China. The United States produces 2% world's lithium. Brazil has 1.5% of shares in lithium production in the world. Lithium-cesium-tantalum pegmatites account for about one-fourth of the world's lithium production (USGS, 2019). Fig.4. displays the production and reserves of lithium deposits.

Fig. 3. Lithium bearing Pegmatite, Greenbushes mine (David Steele / Shutterstock).

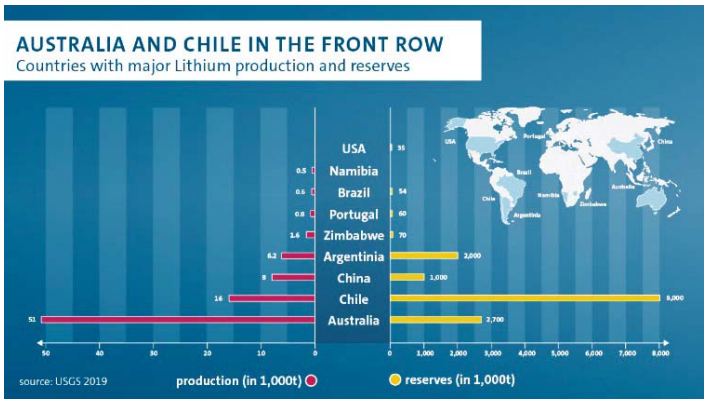

Fig. 4. Distribution of Lithium deposits (USGS, 2019)

5.0 OTHER SOURCES OF LITHIUM

Beyond salar brine and mineral ore, lithium can be produced from a few other sources, though such production is not widespread at this time. These other lithium sources include Hectorite clay, sea water, Recycled brines from energy plants and recovered oil field brines and recycled electronics.

While each of these poses a potentially valuable source of lithium, the technologies to extract brine from them are not yet developed enough to make them cost-effective or viable alternatives to salar brine mining or mineral ore mining.

6.0 ENIVIRONMENTAL ASEPCTS OF LITHIUM MINING

The major sources of lithium comes from Salar brine deposits and from lithium bearing pegmatites. Several deposits are being opened up recently for the mining and extraction of lithium from both these sources, because of high concentration of lithium. The processing of lithium involves a family of processing technologies, which is complex and pose environmental problems associated with these operations. The common environmental side effects of lithium mining are water loss, ground destabilisation, biodiversity loss, increased salinity of rivers, contaminated soil, toxic waste and water loss. In the Salar de Uyuni, water loss is the main cause for concern. After the brine is pumped out from underneath the salt flat, it is left to evaporate through a series of ponds for 12–18 months, forming a mixture of potassium, magnesium, borax and lithium salts. For a tonne of lithium, up to 2 million litres of water are required.

7.0 INDIAN LITHIUM DEPOSITS

In 2021, India's first lithium deposit was discovered in Mandya District, Karnataka, in the pegmatite deposits of Marlagalla-Allapatna area by the Atomic Minerals Division (AMD, Govt. of India).

More recently a much large deposits of Lithium discovered 2023, by the Geological Survey of India having 5.9 million tons of resources in Salal-Haimara area of Raesi district, Jammu & Kashmir., these resources were placed under G3 category.

These resources fall under inferred category, based on the interpretation of geological, geophysical and geochemical investigations. These investigations may serve as guide lines for further exploration. In the next stage, G2 (general exploration), more detailed investigations would be required to estimate the shape, size, extent and grade of the deposit. Finally, at the G1 stage (detailed exploration) in which the entire characteristics of the deposit are established with a high degree of accuracy. A decision whether to conduct a feasibility study next, can be made from the information provided by the G1 stage. The Geological Survey of India adopted the United National Framework Classification for mineral reserves of 2009.

7.1 Occurrence of Lithium in Bauxite deposits

The most important feature of bauxitic deposits is the complex composition of Al and clay minerals. Al minerals include diaspore, boehmite, and gibbsite. The lithium deposit of Reasi region, Jammu & Kashmir is associated with Bauxite and Clay.

Lithium is one of the secondary mineral horizon occurring in bauxite, where lithium content can reach up to 0.3% (as Li_2O) (Cao and Li (2017), Li and Huang (2005), Wang et.al., 2013). The correlations between clay minerals versus Li content show that illite and kaolinite may be the major host minerals of Li in the bauxite deposit. Furthermore, the positive correlations of Li versus Na_2O and MgO indicate that mineral "smectite" cab be another possible Li host mineral. Usually, Li enrichment occurs during the primary bauxitic formation stage. During this stage, the Li carried by surface runoff converged into the restricted basin where the primary bauxitic materials were deposited. After small-scale transgression, retention water formed in the basin

with the rise in the groundwater table. The retained water evaporated under a hot and dry climate, and Li carried by surface runoff accumulate in the basin and was finally adsorbed by clay minerals such as illite, kaolinite, and smectite in the primary bauxitic materials mainly controlled by the sedimentary environment and hydrologic and climatic conditions prevailing at that time.

Clay minerals include illite, chlorite, and kaolinite. Aluminous claystone mainly comprises clay minerals, diaspore, heavy minerals, and some rare earth element minerals, and Clay minerals are mainly chlorite and kaolinite. From the analytical values lithium is difficult to identify the mineral phase with the help of clay mineralogy by microscopy. Sometimes, it may be associated with mineral Cookeite, which exhibit higher values of lithium in the bauxite column. However, Lithium prospect in the bauxite column in the area of investigation appears to be promising.

Countries like China, USA have developed necessary in-house infrastructure and technological expertise, in processing and refining facilities for lithium battery manufacture. India would need energy, capital and the Government's support to develop the deposit to meet the requirements.

Unless appropriate technology is reached to profitably exploit and extract lithium from its lithium bearing deposit, the real benefits of the exploration may not be fulfilled including the economic benefits of the exploration efforts. It is important to note that the mining and extraction of the newly discovered Lithium resources is a complex process which may likely take 10-15 years of gestation period considering the existing regulatory frame work. It may require various levels of approvals from State and Central government departments including, feasibility, economic viability and social benefits.

8.0 LITHIUM COMPOUNDS

Lithium compounds are consumed in the production of ceramics, lubricants, glass, and primary aluminum. Its high specific heat capacity makes lithium ideal in heat transfer technology, where it is used in welding and metallurgical applications. Its light weight, high electrochemical potential and electrical conductivity make it amenable to battery applications requiring low weight and high storage potential.

Li-ion batteries are lighter, less bulky, and more energy efficient. Lithium batteries have three times the energy of nickel hydride at one-third of the weight, and they operate at very low temperatures with a longer battery life. Currently, lithium rich saline brines are the most economically recoverable Li source. (Kesler et al., 2012; Grosjean et al., 2012).

9.0 BATTERY MANUFACTURING TECHNOLOGIES

In total, around 74% of lithium currently produced goes towards battery production. Other industries also consume include 14% Li is used in Ceramics and Glass, while 3% goes to lubricating greases (Fig.5).

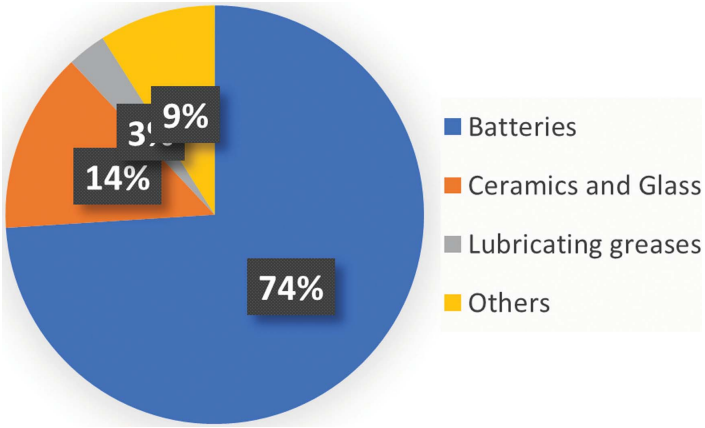

Fig. 5. Uses of lithium.

Commercial manufacturers use lithium carbonate or Lithium hydroxide rather than lithium metal. Although lithium is important ingradient in Li-ion batteries, they also include other important battery metals such as cobalt, graphite manganese, nickel and alumina. The raw material sources of batteries in world is given in the fig. 6. Lithium and the battery metals rush presented in Table 2.

Batteries account for the largest share of lithium end-usage. Propelled by the growth in the electric vehicle market, powered by rechargeable lithium batteries, global lithium demand is forecast to reach one million metric tons by 2025, and surpass two million tons by 2030 (Garside, 2022). As of 2022, Chinese CATL and Korean LG Energy Solution were the top producers of lithium battery cells, combined accounting for more than half of the global market.

Table 2. Lithium and the battery metals rush

S. No.	The Chemistry of Cathodes	Metals	Percentage	Example
1	**NCA** $LiNiCo\ AlO_2$	Nickel Cobalt Aluminum	80 15 5	Tesla Model S
2	**LCO** $LiCoO_2$	Cobalt	100	Apple iphone
3	**LMO** $LiMn_2O_4$	Manganese	100	Nissan Leaf
4	**NMC** $LiNiMnCoO_2$	Nickel Manganese Cobalt	33.3 33.3 33.3	Tesla power wall

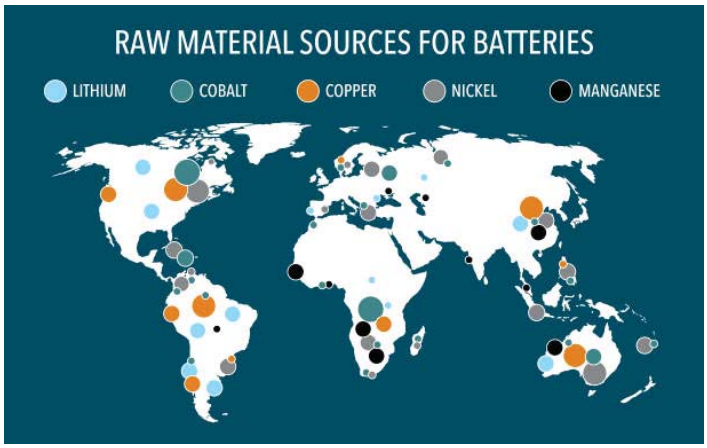

Fig.6. Raw Material Sources for lithium batteries

10. CONCLUSIONS

The major sources of lithium comes from Salar brine deposits and from lithium bearing pegmatites.

Lithium mining and extraction from pegmatites is more complex, and costlier in comparison to brine field deposits.

The discovery of 5.9 million tonnes of lithium deposit in Jammu & Kashmir has potential impact on India's economy and global lithium market.

Even though huge resources of lithium deposits being discovered in the country, there is a still a need for other important minerals such as cobalt, graphite manganese, nickel, copper and alumina which are not available in sufficient quantities and in grade to meet the specific requirements for commercial battery manufacturing. Therefore, our country may likely to depend on these scarce minerals or else the supply chain of battery manufacture will be hampered.

As a result of research in substitution, Sodium-ion batteries also slowly replacing the Lithium–ion cells due to cheaper manufacturing costs and high volume production.

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(Continued from Page 12)

Material intensity in EV batteries going down – report

A recent report by IDTechEx found that even though there is a trend to reduce the number of materials that provide core functionality to the battery pack, the rapidly growing EV market means that demand for such materials will continue to grow.

Among the materials analyzed in the report are aluminum, steel, copper, lithium, cobalt, nickel, manganese, electrolyte, iron, phosphorous, binders, casings, carbon black, silicon, separators, carbon nanotubes, carbon fibre-reinforced polymer, among others.

The whitepaper explains that much of the development to increase EV batteries' energy density is coming from how the cells are packaged together. In general, this means that the materials being used throughout the pack are decreasing in quantity.

"The key for all of these materials is reducing weight and costs. But for everything inter-cell, being multi-functional is becoming increasingly important," the dossier reads. "With a reduction in ancillary materials and structure within the pack, inter-cell materials have to carry out more functions. While it has been typical to apply multiple layers of materials to provide thermal and electrical insulation, compression, and fire protection, new materials will need to provide several of these functions. While these may cost more alone,

(Continued on Page 36)

COMPARATIVE STUDY OF ENVIRONMENTAL & SAFETY HAZARDS GENERATED FROM ROCK BLASTING, MACHINERY OPERATION AND TRANSPORTATION

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Abstract

Ground vibration is one of the major hazards which may affect structural stability. It also works as a source of environmental nuisance to the nearby inhabitants. The sources for ground vibration generation may be manmade or natural in nature. The major man made sources for ground vibration include rock blasting, machinery operation and vehicle movement. The intensity of safety and environmental threats from these sources are different. The safety hazards from ground vibration are measured in terms of peak particle velocity and frequency. The environmental nuisance on the other hand is severe for the events of longer duration. Accordingly, the duration of ground vibration sustenance is also important. The analysis of the safety and environmental concern from different nature of vibration can be done by analysing the waveforms. The waveform of different events has been recorded under this study. The analysis waveform reveals that the machinery operation and longer duration blasts generate more environmental nuisance. The nature of anger of the inhabitants in such cases is more, even if the intensity of ground vibration is less than the vibration threshold defined under statutory regulations.

***Keywords**: Ground Vibration; Peak Particle Velocity; Structural Safety; Environmental Nuisance*

1.0 INTRODUCTION

The rock excavation for mining and civil construction projects are dominantly accomplished by drilling and blasting. The blasting operation induces ground vibration. The vibration may induce structural instability and would work like a safety threat to the nearby inhabitants. The induced ground vibration also creates nuisance and thereby is an environmental concern for the inhabitants. There are other several sources apart from blasting, which also induces ground vibration. These sources may include natural phenomena (earthquakes, volcanic eruptions, sea waves, landslides, etc.), or manmade causes (explosions, machinery, traffic, trains, construction equipment, Pile driving, demolition activity, blasting, Traffic, including heavy trucks traveling on a highway etc.). Freight trains, mass-transit trains, and light-rail trains can also be significant sources of ground vibration and ground borne noise in the environment. Vibration sources may be continuous such as factory machinery, traffic and transients such as explosions. If amplitudes of vibration are high, ground vibration has the potential to damage structures, cause cosmetic damage (e.g., crack plaster), or disrupt the operation of vibration sensitive equipment such as electron microscopes and advanced technology production and research equipment.

Ground vibration is described by amplitude, velocity and frequency. In ground vibrations, amplitude is described by the local movement of soil particles. The amplitude of particle motion may be described in three ways as particle displacement, particle velocity and particle acceleration. In blasting related studies, the ground vibration is mostly represented in terms of Peak Particle Velocity (PPV) and Frequency. Both of these descriptors are taken together while correlating the structural safety with the induced ground vibration. The regulatory bodies of different countries have defined the ground vibration threshold considering PPV and frequency components. In Indian condition, the threshold has been given under Directorate General of Mines Safety (DGMS) circular 7 of 1997. Such a threshold considered the structural safety of the nearby habitats. However, the human acceptability to the ground vibration is even lesser than the threshold defined under this circular. The studies also suggest that the duration/sustenance of ground vibration produces more environmental nuisance to the inhabitants than two parameters considered under circular. Accordingly, the comparative study of the induced ground vibration from rock blasting and other sources would be beneficial to understand the possible threats to the structures and environmental nuisance from the ground vibration.

2.0 INDUCED GROUND VIBRATION FROM ROCK BLASTING

There are various controllable and uncontrollable parameters responsible for amplification and attenuation of PPV induced

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by rock blasting. The ground vibration can be restricted within safe limits after due investigations of uncontrollable parameters and thereby designing the controllable parameters hazards (Arthur et al., 2019; Bakhtavar et al., 2017; Mohammadi Azizabadi et al., 2014; Rajabi & Vafaee, 2020). Researchers have used various techniques to control the ground vibration during blasting. The most dominant techniques among these are based on reducing the maximum charge weight per delay (Duval & Petkof, 1959; Langefors & Kihlstrom, 1963; Ambraseys & Hendron, 1968; Ghosh & Daemen, 1983). It is achieved by distributing the explosive charges. The other techniques include the variations of hole diameter, total explosive charge, delay sequence, delay timings etc. (Himanshu et al., 2018; Agarwal & Mishra, 2020; Himanshu et al., 2021(a); Himanshu et al., 2021(b); Himanshu et al., 2022). Some controlled blasting patterns viz. line drilling, pre-split blasting etc. are also practiced to attenuate the intensity of ground vibration (Paswan et al., 2018; Singh et al., 2010; Vishwakarma et al., 2020).

The characteristics of ground vibration propagation under different geo-mining conditions are different. These characteristics can be studied by analysing the waveform of the ground vibration. The sample waveform of ground vibration recorded at an open pit mine blasting site is shown in Figure 1. The blasting at an opencast mining site is performed using non-electric delay detonators or electronic detonators. Short delays of 17 ms to 25 ms are kept between holes in such blasting. The total duration of blasting in most of the cases are below 1 s. Accordingly, the ground vibration waveform in such cases are of shorter duration, and thereby it creates comparatively less nuisance to the inhabitants. However, the PPV amplitude and frequency need to be restricted within the safe limits by modifying the blast design parameters in order to ensure the structural safety.

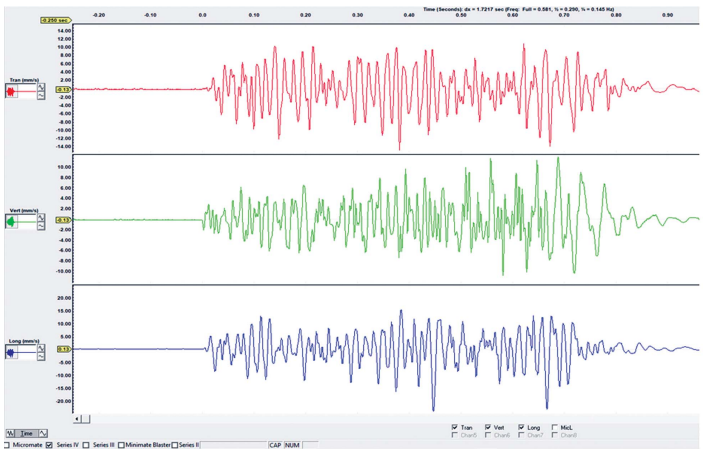

Figure 1. Sample waveform of the induced ground vibration from open pit blasting

The induced ground vibration in case of underground blasting for drivage/tunnel excavation is of longer duration. A sample waveform of ground vibration recorded for a drivage blasting site is shown in Figure 2. The drivage blasting operation is focused on enhancing pull and reducing overbreak. The blastholes are accordingly fired to ensure tensile breakage of the rock mass under tension. The initial free face to the cut holes in this blasting pattern is provided by relief/reamer holes. The excavated portion of the face blast works as the free face in subsequent rounds of blasting of easer, lifter and periphery holes. Since the movement of the face is along the medium transition from rock to air, the dampening of ground vibration is very fast in such blasting. The amount of explosive used is also lesser in such cases. So, the drivage blasting has lesser impacts on structural instability at a larger distance compared to the bench blasting. However, it creates environmental nuisance due to the longer duration of blast.

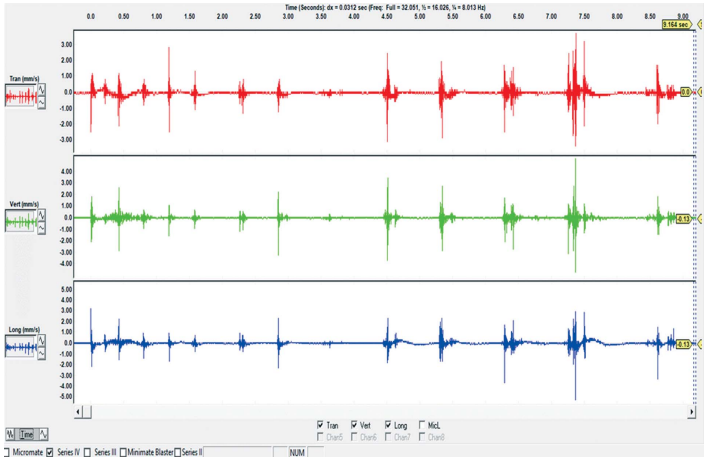

Figure 2. Sample waveform of induced ground vibration from underground drivage blasting

The large scale underground production blasting under Indian condition is performed using ring blasting pattern. A sample waveform from underground ring blasting operation is shown in Figure 3.

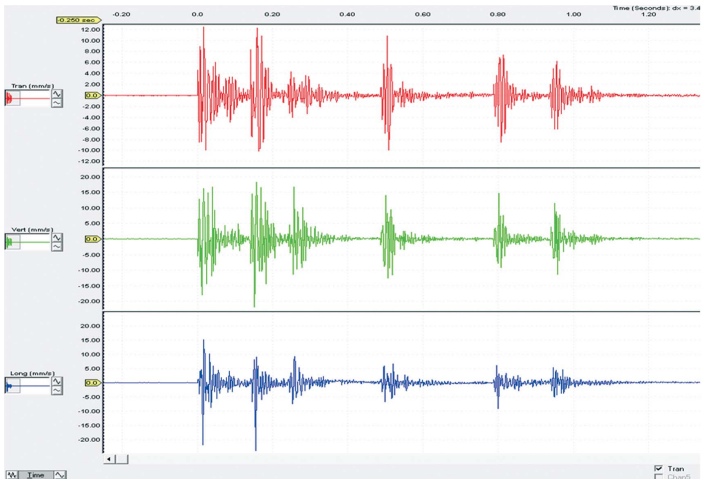

Figure 3. Blast vibration waveform of underground production blasting

The long delay non-electric detonators or electronic delay detonators are used in such cases of blasting. The ring holes are fired along the free face created by the excavated slot portion. The amplitude, frequency and duration of PPV in such blasting can be reduced by changing the blast design parameters. The optimum delay pattern is devised when the habitats are in the close proximity to the blasting location. Such blasting may induce both structural instability and environmental nuisance on a larger scale. But, the control may be achieved by judicious blast design to reduce the amplitude, frequency and duration of PPV.

3.0 ASSESSMENT OF VIBRATION FROM MACHINERY OPERATION

The operation of industrial machineries viz. crushers, rock breakers, excavators, mills, belt conveyors etc. also work as a source of vibration. The ground vibration level at immediate adjacent (within 5 m) from such sources are mostly below 5 mm/s. The view of monitoring of ground vibration near rock breaker location in an underground mine is shown in Figure 4. A sample waveform of induced vibration while working of the rock breaker is shown in Figure 5. Fast Fourier Transform (FFT) analysis of this waveform was also carried out. The FFT plot for this waveform is shown in Figure 6. The waveform plot shows that the crusher or other similar machinery produces a constant amplitude of PPV in periodic intervals. The waveform also shows that sometimes the amplitude of vibration varies. The variation depends upon the strength and intactness of the rock under indentation using breakers. The FFT analysis of this waveform shows that the frequency of this recorded waveform is very high (above 200 Hz). So, there is very less possibility of resonance of the induced vibration wave with the structures. Accordingly, the machinery operation produces lesser threat to the structural instability. However, as the operation is continuous in nature, it generates more nuisance to the nearby inhabitants. The continuous noise/air overpressure can also be seen in the waveform as MicL data. Such overpressure generated during the operation of machinery also works as a source of environmental nuisance.

Figure 4. Monitoring of ground vibration generated due to working of rock-breakers

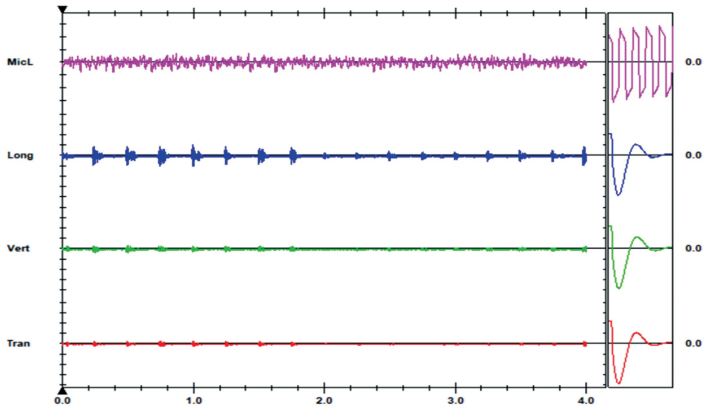

Figure 5. Waveform of induced ground vibration due to working of rock breakers

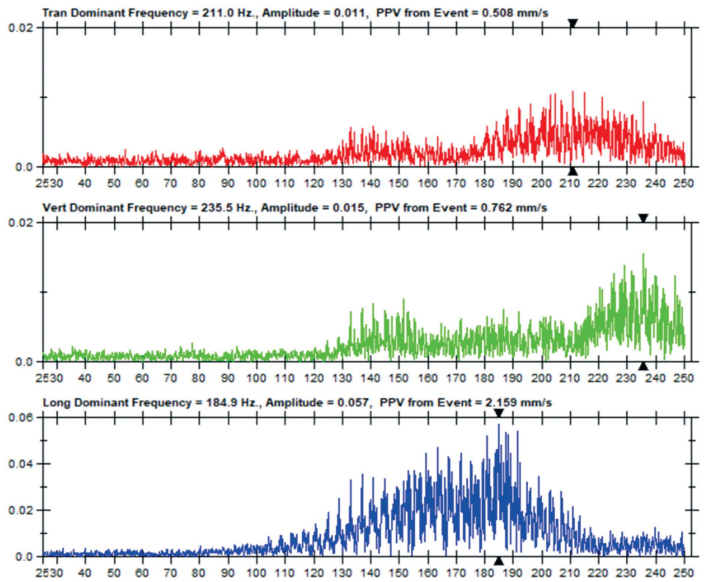

Figure 6. FFT plot of recorded waveform from the working of rock breakers

4.0 VIBRATION GENERATED FROM TRANSPORTATION

The transportation means viz. railways and road traffic also induce ground vibration. However, with the advancements in technology the attempts have been made to dampen the induced vibration from rail movement or traffic. Some countries have also fixed the threshold vibration criteria for traffic movement. California Department of Transportation (CALTRANS) report titled Survey of Earth-borne Vibrations due to Highway Construction and Highway Traffic (Report CA- DOT TL-6391-1-76-20) compiled a summary of results, findings, and conclusions of 23 studies completed in the 17-year period between 1958 and 1975. A Caltrans technical advisory titled Transportation Related Earth borne Vibrations (Caltrans Experiences) (Technical Advisory TAV- 02-01-R9601) that was prepared in 1996 and updated in 2002 provides information from 23 studies and other Caltrans vibration studies. Recommendations of the CALTRANS are given in Table 1.

Table 1. Vibration Damage Potential Threshold Criteria of California Department of Transportation

Structure and Condition	Maximum PPV (mm/sec)	
	Transient Sources	Continuous/ Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	3.048	2.032
Fragile buildings	5.08	2.54
Historic and some old buildings	12.7	6.35
Older residential structures	12.7	7.62
New residential structures	25.4	12.7
Modern industrial/commercial buildings	50.8	12.7

The characteristics of train induced vibration have also been measured by the authors for this study. A view of train induced vibration measurement is shown in Figure 7. The recorded vibration data suggests that the induced vibration in the sleeper of the railway track is in the range of 100-300 mm/s. The variations are dependent on the speed and load of the train. The induced vibration gets dampened very fast from the sleeper towards the adjoining rock/soil ground. The dampening is also provided while construction of railway tracks, by providing ballasts in between the tracks. The dampening results into the PPV in the range of 2-5 mm/s in the adjacent (within 5 m) of the railway track. A waveform of the train induced ground vibration is shown in Figure 8. The waveform suggests that the peak of vibration is for a certain interval. The maximum amplitude of PPV is observed just after arrival of the train, thereafter it goes on reducing. However, the amplitude of induced air-overpressure is always high for the whole duration of train movement. The FFT analysis of the waveform suggests that the train induced vibration generated a high frequency of more than 50 Hz. So, the possibility of resonance is very less.

Figure 7. Monitoring of induced ground vibration while movement of train

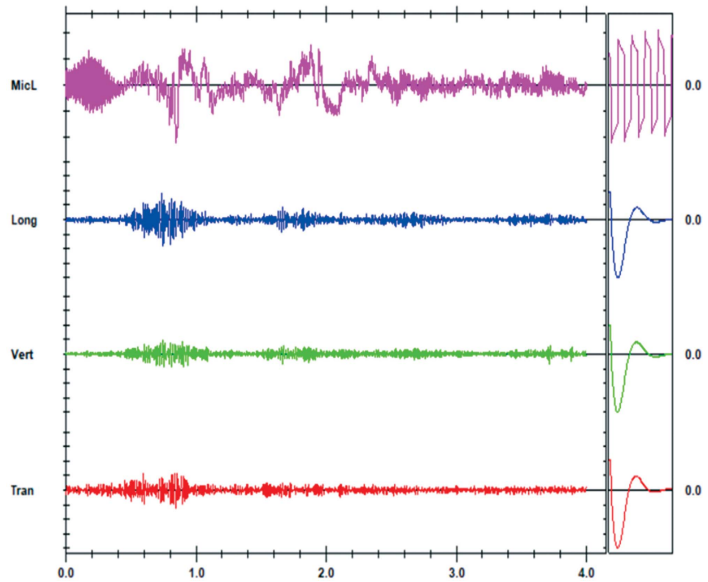

Figure 8. Waveform of the induced ground vibration from movement of the train

The heavy trucks and other vehicles are also a potential source of vibration. Road traffic induced vibration was measured by installation of seismographs near active roadway. The measurement was part of different projects sponsored by CSIR-CIMFR. A view of monitoring of road traffic induced vibration by placement of seismographs is shown in Figure 9. The summary of recorded vibration at different locations suggests that at a distance of 2-3 m from the vehicle, the maximum magnitude of PPV is 0.619 mm/s having frequency of 51 Hz. Sometimes the PPV is even below 0.25 mm/s.

Figure 9. Installation of seismographs for measurement of road traffic induced vibration (Source: CIMFR Report No. CNP/R/2862/2011-12)

5.0 COMPARISON OF INDUCED GROUND VIBRATION FROM MANMADE SOURCES WITH EARTHQUAKE

From the perspective of damage due to ground vibration induced by manmade sources and earthquakes, the

frequency of these events plays the main role. The frequency of vibration due to vehicle movement/rock blasting could range from several hertz (at greater distances) to 700 to 1000 hertz or higher (in close proximity). Earthquake frequencies are so low that they are not normally measured in hertz but rather in the number of seconds for a full cycle or period. Due to this reason, the acceleration level due to vehicle movement may be high, but the displacements would be so low that they would not cause damage. On the other hand, an earthquake may cause damage at rather low acceleration levels because the displacements could be quite high.

The seismographs for blast vibration monitoring are capable of measuring PPV having frequencies more than 2 Hz. So, the vibration due to earthquakes cannot be measured using this instrument. The size of an earthquake is measured in terms of the Richter scale. The major difference between the two measurements is that PPV is the intensity of ground vibration at a point, whereas the Richter scale gives the magnitude of earthquake.

6.0 CONCLUSIONS

The induced ground vibration from rock blasting, machinery operation and transportation produces different natures of safety and environmental hazards. The ground vibration wave has been measured for different cases in this study. The nature of these waves has been analysed using waveform analysis. The analysis of waveform reveals that the opencast blasting event may generate safety threats to the nearby structures if PPV is high and frequency is low. However, the controlled blasting may result in the reduced vibration level to ensure structural safety. The instability to the structures is not directly linked with the duration of the blasts. However, it causes environmental nuisance to the nearby inhabitants. The machinery operation and vehicle movement produces continuous vibration data, which work as a source of nuisance to the residents. Sometimes the blasting events with longer delay intervals may also create environmental nuisance and a factor of anger among the inhabitants. This factor of anger may be even at the vibration threshold below the statutory limits. So, the control of PPV, frequency and duration of blast is altogether required to ensure structural safety and reduce environmental nuisance while blasting.

7.0 ACKNOWLEDGEMENT

Authors would like to thank the Director, CSIR-Central Institute of Mining and Fuel Research, Dhanbad for giving permission to publish this paper. The authors would also like to express their thanks and gratitude to the management of case study sites for necessary support during field experimentation.

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LAW CORNER

Supreme Court Prohibits mining activity within 1 km form protected Forest Area including ESZ

Judgement dated 28.4.2023 in IA No 3949 of 2016 in WP(C)202 of 1995 **(**T.N. Godavarman Thirumulpad Vs Union of India & Others**)** by the bench consisting of Hon'ble Justice B.R. Gavai & Justice Vikram Nath.

The issues involved

An application was filed seeking clarification that whether mining activities would be permissible beyond a distance of 1 km from the boundary of the Protected forest Area, even though such area falls in Eco sensitive zone (ESZ).

This clarification was necessitated as the Hon'ble Supreme Court had earlier while dealing with protected forest areas, issued directions on 3.6.2022 in WP(C) 202 OF 1995, stating that no mining activity is permitted within 1 km from the protected area and 1 km area should be kept as buffer area and ESZ. Subsequently, the Supreme Court vide its judgement dated 26.4.2023 modified certain paras of its previous judgment and directions, to the extent of specific cases where ESZ boundary is situated in less than 1 km distance from the protected area. However, the Supreme Court had maintained its stand that no mining activity is permitted within the 1 Km distance of the protected area.

Facts of the Case

The Applicant, M/s Puntamberkar Minerals was granted permission to execute a mining lease as early as in 2005, subject to clearance from MoEF as well as the National Board for Wild Life. The area where the applicant proposes to carry out the activity is beyond 2.26 km from the nearest boundary of the Radhanagari Wildlife Sanctuary and it falls beyond a distance of 1 km from the boundary of the protected area.

The Applicant sought clarification that if the Eco sensitive zone extends beyond 1 KM area of the protected forest area boundary, whether the mining activity is permitted or not.

The decision of the Supreme Court of India

The Supreme Court clarified that, the permission of activity beyond 1 km from the protected Forest area, which falls in ESZ category is not applicable to prohibited activities under MOEF notification on ESZ. Mining is a prohibited activity under the MOEF notifications and as also as per the Supreme Court order stated above. As such the Supreme Court had finally put to rest the ambiguity if any vide this judgment dated 28.4.2023, stating that all mining activity including quarrying is strictly prohibited within 1 km distance from the protected area boundary and also within ESZ zone even if such ESZ area is extending beyond 1 km in cases where the proposed mining area falls within such ESZ area. Thus, the law applicable today is that no mining activity is permitted within the 1 km from the protected forest area and also within the ESZ area.

Author: **K.A.V.PRASAD**
Corporate Legal Professional

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MEAI NEWS

MEAI – HEADQUARTERS

Mr K. Madhusudhana, our Association President, had a meeting with the office bearers at MEAI Headquarters on June 26, 2023.

(L-R): Mr BRV Susheel Kumar, Mr M Narsaiah, Mr K Madhusudhana, Dr PV Rao, and Mr BSP Raju

Mr Ravi Chandran Raj, Chairman, Mumbai Chapter in MEAI Headquarters on 19-06-2023

FIRST AID TRAINING (BATCH – 2)

Held from 22-05-2023 to 01-06-2023

In Batch – 2, 13 candidates joined First Aid Training

First Aid Training (Batch 2) received certificates from Mr M Narsaiah and Dr. Naveen, First Aid Officer

BELGAUM CHAPTER

World Environment Day 2023

Dr BK Purandara giving his presidential address

Watering by Dr BK Purandara, Chairman & Mr DA Hiremath, Council member

BELLARY-HOSPET CHAPTER

PLANTATION ON WORLD ENVIRONMENT DAY

On World Environment Day, the Bellary-Hospet Chapter organized a plantation program on June 5, 2023. The event took place at the Director Mines Safety (DMS) Office in Ballari. The primary objective of the program was to improve the green cover in the area and promote the overall environmental health.

Around 20 members of the MEAI, including MEAI Life Members and DMS office staff, along with other individuals, participated in the event. The program commenced at 12:30 pm and involved the planting of approximately 30 different types of plants within the compound of the DMS Office.

Sri. Yohan Yejerla, DMS Zone-2, introduced himself and appreciated the Chapter for organizing the plantation program. He also thanked them for sponsoring a breakfast and tea for all the participants.

Sri. Nagendra Kumar Sriram, DDMS Ballari Region, also appreciated the Chapter for its efforts in organizing the plantation program and conveyed his gratitude.

The Chairman of the Chapter Sri. K Prabhakara Reddy expressed his thanks to all the participants and organizers for their contribution to the success of the event. He also extended his thanks to the team involved in organizing the event.

Following the plantation activity, all the participants enjoyed the process of planting saplings and later gathered for a high tea session.

On World Environment Day, Chairman MEAI, BH Chapter, extends the wish to DMS Zone 2 by presenting a plant

On World Environment Day, all present members took an oath

The members carried out the plantation

RAJASTHAN CHAPTER - JAIPUR

Workshop held at Jaipur on May 6, 2023

A Workshop-cum-Focused Group Discussion on Industry 4.0 and Innovation in Mining and Neighbouring Industries was organized in collaboration with Prof. Nikunj Kumar Jain of Indian Institute of Management, Nagpur, on 6th May 2023,. This path breaking event, probably first of its kind, was attended by many stakeholders, physically as well as online. Some great insights emerged.

Professor Jain also shared about the event on LinkedIn platform as below:

What happens when theory meets practice! Conducted a #FGD on how #Industry4.0, Institutional Pressures and Process Innovation influence sustainable development of mining industries at Mining Engineers' Association of India, Rajasthan Chapter– Jaipur with our Executive PhD participant Lalit Soni, MAusIMM, MSAIMM, ECSA, MMEAI.

Anil Mathur, Chairman of the Chapter; Jitender Yadav, Deputy Manager in Rajasthan State Mines & Minerals (RSMM-A State PSU) Jaipur; Dr Manoj Gaur, MAusIMM, Director/ Principal Geologist; Naveen Kanoongo, Technical Manager,

PwC; Aakash Gehlot, Director & VP, IoT, Automation & Cloud Solutions; Brajesh Shandilya, GM (Mining) – NTPC; R.S. Sharma, Ex-CMD (NTPC); K S Yadav, Retired Regional Controller of Mines (IBM); P C Bakliwal, DDG (Retd.) Geological Survey of India (GSI); Somnath Bhattacharyya, Director (Retired), GSI; J V Natani, Ex-Director (SG),GSI; S K Bhattacharya, Ex-TISCO and B. Bishnoi shared their thoughts on the same.

National Seminar on Collective Bargaining held on May 16, 2023

After a lengthy and concerted effort of various stakeholders, Rajasthan State Government constituted a Mine Workers Welfare Board on 16th May 2022. Due to the lack of welfare activities for mineworkers, the Board has been mandated to give suggestions for the same.

Even after passage of one year, the non-official members to the Board have not been appointed. To address this issue, a National Seminar on Collective Bargaining was organised jointly by Mine Labour Protection Campaign Trust and Rajasthan Chapter-Jaipur on 16th May 2023 at Mining Welfare Centre, Jaipur. Representatives of different labour unions attended the seminar wherein state labour minister Shri Sukhram Vishnoi was the Chief Guest.

It turned out to be a very successful event. The vice president of INTUC, who participated in the seminar, also met the State Chief minister in this connection.

RAJASTHAN CHAPTER - UDAIPUR

National Technology Day Celebration

Rajasthan Chapter-Udaipur celebrated National Technology Day on May 11, 2023 in association with Vigyan Samiti, The Institute of Engineers (India), Udaipur Local Centre & Jain Engineers' Society, Udaipur in the premises of Vigyan Samiti, Udaipur in their Auditorium.

(L to R) Mr CP Jain, Dr KL Kothari, Prof AJit Karnatak, Dr Gariman Mehta, Mr AK Kothari, Mr MS Paliwal & Dr BL Chawat

Prof. Ajit K Karnatak, HVC, MPUAT, Udaipur graced the occasion as Chief guest of the program. Prof. Karnatak while discussing agriculture and production, food security in India said that agricultural production has increased many fold but at the same time rate the population has also increased and the arable land is continuously decreasing. He stated that there is a need to encourage farmers to use advanced technology using Agri farm machinery.

Welcoming the guests, Dr KP Talesara, President Vigyan Samiti, welcomed the distinguished guests in the program, which was started with lighting of the lamp and the divine song.

While addressing, the President of the Institution of Engineers, Local Chapter, Udaipur Mr CP Jain gave information about the nature and activities of his organization. He said that there is a need to change the condition and direction of the country with positivity.

While addressing on this occasion Sh MS Paliwal, Chairman of the Chapter informed about the association & highlighted the importance of mining industry. He emphasised that with the possibility of application of technology in coordination with regulatory bodies, any mining work can be started only with the permission of the government.

Mining activities in India commence with various techniques & tools based Exploration, followed by robust plans of mining, safety, environmental conservation & protection measures endorsed by Govt. regulators as necessary permissions and compliance. He emphasized exploration and mining of deep-seated ores is key to success and ensuring revenues and employment. He further emphasized on the big data driven mine planning & production scheduling.

While addressing on this occasion Mr AK Kothari, Chairman of Jain Engineers' Society, Udaipur introduced his organization

and threw light on its purpose. He highlighted the current status and future plans of various energy options. Long-term energy security requires making timely investments - to meet the future energy needs - while also - keeping up with the needs of the environment protection.

Dr Maheep Bhatnagar threw light on the activities of the newly established "Science Lab" & "Mobile Science Lab" in the Science Committee and Dr KL Kothari threw light from the origin of Science Committee to the present situation and apprised about the Dr DS Kothari Excellence Award.

On this occasion, "Dr DS Kothari Memorial Excellence Award" was presented to Dr Garima Mehta, ex Prof & Head Oncology, RNT Medical College Udaipur. She explained on cancer disease, prevention and treatment while presiding over Kothari Excellence Award function,

Dr BL Chawat, working president extended vote of thanks. The program was anchored by the Chairman Dr KP Talesara, Vigyan Samiti.

A Glimpse of National Technology Day

Fifth (5th) Executive Committee Meeting of the Chapter

The fifth Executive Committee Meeting of MEAI, Rajasthan Chapter, Udaipur was held on 7.4.2023 in the office of the Chapter, Udaipur. Sh MS Paliwal, Chairman of the chapter chaired the meeting. Following members were present.

1.	Sh MS Paliwal	--	In Chair
2.	Sh AK Kothari	--	Former President, MEAI
3.	Dr SS Rathore	--	Council Member
4.	Sh YC Gupta	--	Ex-Chairman
5.	Dr SK Vashisth	--	Council Member & Joint Secretary
6.	Sh Asif M Ansari	--	Secretary
7.	Sh MK Mehta	--	Treasurer
8.	Sh RC Purohit	--	Executive Member
9.	Sh SN Mali	--	Executive Member
10.	Sh Hitanshu Kaushal	--	Executive Member
11.	Sh AK Porwal	--	Member
12.	Sh NK Kavdia	--	Member
13.	Sh K Baregama	--	Member

The meeting ended with the vote of thanks proposed by Mr S K Vashishth.

Executive Committee Members Attending the Meeting

TAMILNADU CHAPTER

INTERNATIONAL MINING & MINE SAFETY EXPO-SYMPOSIUM HELD AT COIMBATORE

Tamil Nadu Mine safety Association, Stone Quarry, Crusher and Lorry owners Association (Tamil Nadu) and MEAI Tamilnadu Chapter jointly organised under the aegis of DGMS "International Mining & Mine safety and Expo-Symposium" from 16th -18th March 2023 at CODISSIA Hall B & F, Coimbatore Tamilnadu. It was attended by representatives from Quarry /Crusher/Lorry owners 'Association of Tamilnadu, Kerala, Karnataka and Telangana and MEAI Bangalore and Tamilnadu Chapters and TNMSA.

Objective of the symposium was to promote and foster Responsible mining, to create awareness about principles of Sustainable mining, to identify, develop and promote use of Best practices for proactive pursuance of the fundamental tenets of Sustainable development for continued improvement of their Environmental Social and Economic performance. It was also aimed at providing an interactive platform with all stakeholders including government organisations like DGMS, State department of Mining and Geology, PWD (for M sands), SEAC (Tamilnadu), Experts from industries and institutions for arriving at a sustainable development framework for stone Quarrying, Crushing, Screening, and Transporting with safety, health and quality conscious.

On 16TH March 2023 Symposium was inaugurated by Director General of Mine Safety, Mr Prabhat Kumar in the presence of officials of DGMS, Office Bearers of the Associations, and SEAC Expert committee members.

Shri. Prabhat Kumar DG, DGMS inaugurated the Symposium

Delegates from MEAI, TNMSA and SEAC Expert Committee in the Symposium

On 17th March 2023 morning, the EXPO with 148 stalls was inaugurated formally by Mr Jayakanthan, Commissioner, Directorate of Geology and Mining, Govt. of Tamil Nadu. Speaking at the conference, he said that the mining sector was essential for construction and infrastructure. During the last five years, several quarries were closed in the State. The Government was exploring measures to reopen these quarries to support economic growth and generation of jobs. Earlier, the annual revenue was ₹1,000 crore and in the current year, revenue for the government from the mining sector was ₹1,600 crore.

Technical sessions -Discussion and Recommendations

There were three technical discussions and one panel discussion on 17th and 18th March 2023.

Session I: Invited Special lecture on Safe and Healthy Environment in Quarries

1) Lecture on "Forest Act & Rules concerning the Mining Industry " by KSVVP Reddy IFS (Rtd) ,Expert member SEAC, Tamilnadu and emphasised the importance of scientific mining for balance of Ecology, food chain, food web and good practices for preserving the forest and forest dependent people, inhabitants and bio diversity and Mitigation of adverse impact of base level noise, vibrations, dust, fugitive emission, AMD and heavy metal contamination.
2) Lecture on" Statutory Permission for M sand stakeholders" by Er. C. Kalyanasundaram S.E, PWD Salem, discussed on E.C, Consent to establish, operate BIS Code for M-sand Quality, and Tamilnadu M-sand

policy 2023. He also insisted upon the quality of civil construction by maintaining proposition, workmanship, plastering and proper curing of a minimum of seven days for better application of Msand in construction.

3) Lecture on "Constraints in practising Occupational Health and Safety in small mines" by Dr. G. Jayaraj and elaborated the constraints and emphasised the need and steps for overcoming with special reference to 12th conference recommendations mainly to prevent incidence of Silicosis. Also suggested to Quarry Owners to avail the facility of Tamilnadu state government mobile testing laboratory for screening for silicosis.

Technical session II Legal interventions in Quarry planning and operations on 18-03-2023

Paper 1: Legislation for sustainable mining-Issues & concerns by Mr AR Vijay Singh, Charted Account. He explained in detail the issues regarding a) Royalty b) MMDR Act and Mineral concession Rules c) Service tax and GST on Royalty d) Patta Poramboke land users e) Rule 40-Provisional Assessment & Adjustment f) Rule 43-Publication of average sale price g) Runoff mine Royalty h) DMF & NMET. Regarding the green fund issue in Tamilnadu, he suggested paying with protest so that when judgement comes out in favour, it can be refunded. Similarly, GST is also be paid to avoid penalties. Also for Granite industry, he suggested to pay Royalty for waste Rock generated to avoid penalty. Regarding Explosives Rules2008, even though blasting is done by the contractor (possession and sale), he advised the owners to take licence to transport, possess and use. Also clarified on EC-EIA 19994 Vs EIA 2006 & EC violations.

Paper 2: Mine closure activities and better Asset management by Dr. R Sundar Singh and suggested to use the space in closed Quarries for a) development into Solar Park for power generations and there is huge potential for solar power of 4000M.W in the next 5 to 10 years, b) Use the below ground space for water storage and c) Carbon capturing and storing for carbon credits use.

Paper 3**:** Best Quarrying practices considering Slope Stability and Blasting operations in small scale Quarries by Dr. K Ramachander, Associate Prof (mining), NIT Surathkal, and emphasised that for a safe and sustainable Environment, Slope stability is very important and insisted upon a minimum factor of safety of 1.5 and to take control of rolling down of boulders before blasting. Instead of waiting for complaints from stakeholders, suggested to conduct a pre- blast survey, trial blast and study parameters influencing vibrations for controlled blasting if necessary.

Paper 4**:** Electronic Detonators for improving fragmentation and Eco-friendly quarrying operations by technical service managers from ORICA, Kolkata and highlighted the advantages of Electronic detonators in improving the fragmentations and in reducing noise and vibrations. Claimed a cost saving of 12% in drilling and blasting.

Panel Discussion on Best practices in Quarrying Industry with special reference to safety & sustainability

Panel discussion on "Best practices in Quarrying Industry with special reference to safety &sustainability" was moderated by Dr G Nagarajan, HOD/Mining Anna University, Chennai and emphasised the need for best practices for sustaining the climate, Environment, Socio economic, health and safety. He also mentioned about shortage of skilled workforce for mining industry and development of skilled workforce is necessary for safe and sustainable mining.

Dr D Narasimhan, Expert member, SEAC, highlighted the necessity of plantation of trees for reduction of carbon and suggested the Quarry owners to grow trees that are sustained in rock and develop nursery for medicinal plants jointly.

Dr R Sundar Singh indicated future energy requirements will be hydrogen based to bring down GHG and carbon. Breaking rock instead of overcoming compressive strength, we must try tensile strength which is only 1/10 of compressive strength. Mr VS Sambasivam, General Manager, Ramco cements highlighted the introduction of new technology like Surface miner for limestone mining without blasting and for thin seams, Magnetic Separator for removing Charnokite and Optical sorter sensor for removing coloured stones. He indicated that the Eco Park developed in Pandalkudi is a landmark for sustainable mining.

Dr. K Ramachandar Associate Prof Mining/ NIT, Surthkal suggested adopting mining students for developing new technology under CSR activities for sustainable mining.

Quarry owners should take up responsible mining, said Mr K. Deenabandu, Chairman of State-level Expert Appraisal

Committee, during his valedictory speech. He further said that the quarry owners should take measures to minimise environmental degradation due to quarrying. They should understand and adopt the existing legal procedures that would ensure sustainable development.

Mr K Dheena Bandhu IAS (Rtd), Chairman, SEAC-TN was the Chief Guest in the Valedictory function

The Symposium was concluded with a vote of thanks proposed by the Stone Quarry, Crusher and Lorry Owners' Association.

Annual General Body Meeting of the Chapter

Committee Members, Officials from various companies and sectors assembled at the Meeting Hall and the Meeting Commenced on 10.06.2023 at 4:00 pm.

Welcome address was given by Dr M. Ifthikhar Ahmed, Chairman of the Chapter. He welcomed the National President of MEAI Mr K Mudhusudhana, who attended the AGM as special invitee and was honoured by an adorning shawl with bouquet.

The Chairman welcomed the senior members including Mr M Palanikumaresan, Mr P Ramasamy, Mr Mayilrajan, Dr E Ganesan, Mr Suryakumar, and also welcomed Dr P Balamadeswaran, Dr T Subramani (Professor & HOD of Geology & Mining Engg, CEG, Anna University), Prof Dr Senthil Kumar (HOD, Dept of Geology, Annamalai University), all MEAI members and Students from Anna University, Chennai.

The audit statement of account for the past two years (2021-22 and 2022-23) was presented by Mr S Ramesh, Vice Chairman and the same was passed by the house.

NEW EXECUTIVE COMMITTEE

Mr K Madhusudhana delivered a speech on the importance of MEAI and appreciated the activities of the Tamilnadu Chapter. The Chairman of the chapter announced the new Executive Committee members for the period of 2023-2025 and the Committee will take charge with immediate effect.

Officer Bearers:

Chairman:
Prof. Dr T Subramani, HOD, Dept of Geology & Dept of Mining Engineering, CEG, Anna University, Chennai – 25
Vice Chairman:
Mr A Sivaraj, Chief Manager (Mining & Resources). IREL (India) Ltd, Manavalakurichi.
Secretary:
Mr R Kamaraj, AGM (Mines), UltraTech Limited, Ariyalur
Jt. Secretary:
Dr E Ganesan, Dy Manager (Mines), TAMIN, Chennai
Treasurer:
Mr G Magesh, DGM (Mines), The Ramco Cements Limited, Ariyalur

Executive Committee Members:

Mr Muthukaruppan,
M/s Dhandapani Cements Limited, Trichy
Mr K Karthigeyan,
M/s Chettinad Cement Corporation Limited/HQ, Chennai
Mr R Kesavan,
M/s. The Ramco Cements Limited, Pandalgudi
Mr S Natarajan,
India Cements Limited, Sankari Durg
Dr E Kumar, Anna University, Chennai.

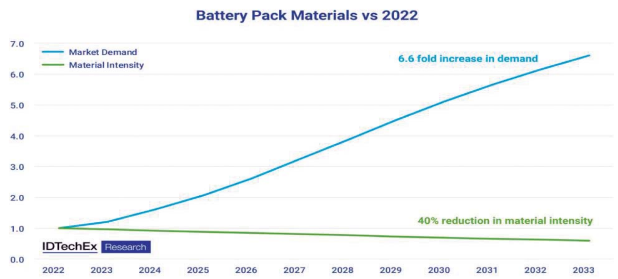
INAUGURATION OF THE STUDENTS CHAPTER

Subsequent to the formation of New Executive Committee of the Tamilnadu Chapter, the National President – Mr K Madhusudhana formally inaugurated the MEAI Students Chapter (TN) to involve students of Geology and Mining from the Institutions / Universities located across the state to get benefitted from the MEAI activities for the growth of their career. The first MEAI-Student Chapter will have a tenure of one year (2023-2024) and the committee members of the Student Chapter are given below.

Students Mentor:
Mr GR Senthilkumar, Professor & Head, Dept. of Earth Science, Annamalai University
Chairman:
Mr C Sivaraman, 3rd year BE Mining Engineering, CEG, Anna University
Vice Chairman:
Mr K Arunbharath, 1st year M.Sc Applied Geology, Anna University
Secretary:
Ms K Sandhya, 3rd year BE Mining Engineering, CEG, Anna University
Jt. Secretary:
Ms X J Janne, 1st year M.Sc Applied Geology, CEG, Anna University
Treasurer:
Ms G Sowmiya, 2nd year BE Mining, CEG, Anna University

(Continued from Page 18)

they could replace multiple other materials leading to simplified manufacturing and a reduced system cost."



The dossier notes that the battery enclosure will always remain a key component of the pack, even if this starts to become more integrated into the vehicle. For this component, metals are the most common choice, with steel often being used for structural support and aluminum being used for its lightweight nature.

"The automotive market has extensive experience in the manufacturing and application of these materials. However, there is an increasing interest in composite or polymer components in order to reduce weight, create more specific geometries, and provide other functionalities," the text reads. "IDTechEx estimates that a composite enclosure, not including structural changes could increase the energy density of a battery pack by up to 7% (further improvements may be possible with customized designs). While this number may seem small, as improvements to energy density start to decrease, any small change is significant."

The market analyst pointed out that composite battery covers are becoming increasingly common, with examples including Ford's Mustang Mach-E and F150 Lightning. However, challenges remain, for example, providing EMI shielding, fire performance, and overcoming the industry's reliance on metals.

Yet, in the view of IDTechEx, such challenges are all addressable. Thus, the researcher predicts a 19-fold growth in composite/polymer enclosure materials in the next decade.

"A full polymer battery enclosure is possible, although it may be ambitious in the current market," the paper states. "But replacing individual parts of the pack structure with fire-retardant polymers is certainly an excellent opportunity for the suppliers to the EV market."

Staff Writer, Mining.Com I June 18, 2023

MEJ RIDDLES

Dear Readers of MEJ,

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

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

Questions based on June 2023 issue

1. Who was the Chief Guest in virtual MPDP-III held on May 21, 2023?

(a) Dr More Ramulu (b) Mr Ajit Kumar Saxena
(c) Mr Mahesh Kumar (d) Mr Mr Suresh Nair

2. How many Life Members were approved in the 7th Council meeting?

(a) 39 (b) 40
(c) 41 (d) 42

3. In which laboratory of GSI, GH Kotnise conducted the Fluid inclusion studies and reported in his article published in pp 25-32?

(a) Kolkata (b) Jaipur
(c) Lucknow (d) Bangalore

4. Manganese orebodies in Tiringhpahar occur as stratabound in

(a) Shale (b) Limestone
(c) Quartzite (d) Sandstone

5. Who are looking to setup Buyers' club to strike supply deals and investment partnerships with critical minerals producing nations?

(a) USA (b) Russia
(c) USA & Europe (d) India

WINNERS OF RIDDLES PUBLISHED IN THE MEJ JUNE 2023 ISSUE

Congratulations to proud winners

Prof. D.P. Tripathy

National Institute of Technology, Rourkela, E-mail: debi_tripathy@yahoo.co.in

Mr Deepak Vidyarthi

Life Member, Benglauru, E-mail: vidyarthikud@hotmail.com

Mr GVVG Krishnarao

Hyderabad -500 055, Email: gvvgkrao@gmail.com

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

CONFERENCES, SEMINARS, WORKSHOPS ETC.

INDIA

22-25 Aug 2023: **Understanding and Assessing Slope Stability in Open Pit Mines**. Hotel Westin, Rajarhat, Kolkata. For details contact Dr Manoj Verman, Rock Engineering Expert at manoj@mverman.com.

25-27 Aug 2023: **International Seminar on Vision – Mining 2047**. Location: Ahmedabad. For details, contact Email - meaiahmedabad@gmail.com

11-15 Sep 2023: **Short Term Course on Assessment of Spontaneous Heating Liability of Coals and their Prevention**. Rourkela. Organised by the Department of Mining Engineering, National Institute of Technology, Rourkela. Contact Prof Devidas S Nimaje, Phone: 06612462604, 9437943121. Email: snimaje@nitrkl.ac.in.

6-7 Oct 2023: **International Seminar on Minerals: A Resource for Energy and Food Security**. Jaipur. For details, Contact – Mr Anil Mathur on Mob 9414119227, E-mail: chairman.jaipur@meai.org & meaijpr2010@gmail.com

6-9 Nov 2023: **International Mining, Equipment & Minerals Exhibition (IME 2023)**. Eco Park, Rajarhat, Kolkata, India. Organised by The Mining, Geological & Metallurgical Institute of India (MGMI). Contact Email ID: miningexpo@tafcon.in

ABROAD

2-5 Jul 2023: **GAIN Meeting New Zealand**. For details contact: Wayne Scott (he/him), Chief Executive Officer - AQA & MinEx at Mob +64 21 944 336 or wayne@aqa.org.nz

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

25 - 28 Oct 2023: **China Coal & Mining Expo 2023**. China's 20th International Technology Exchange & Equipment Exhibition on coal and mining is the largest international coal and mining exhibition in Asia. New China International Exhibition Center (NCIEC), 88 Yuxiang Road, Tianzhu Airport Industrial Zone, Shun Yi District, Beijing, China

31 Oct - 2 Nov 2023: **International Mining and Resources Conference (IMARC)**. Sydney, Australia. Contact: connect@imarcglobal.com. Phone: Australia: +61 (0) 3 9008 5946

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

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

01-02 Dec 2023: **International Conference on Design Methods in Underground Mining ICDMUM**. Auckland, New Zealand. Website URL: https://waset.org/design-methods-in-underground-mining-conference-in-december-2023-in-auckland.

11-12 Jan 2024: **International Conference on Mineral Processing and Mining ICMPM 2024**. Singapore. Organised by World Academy of Science, Engineering and Technology. Website URL: https://waset.org/mineral-processing-and-mining-conference-in-january-2024-in-singapore

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

18-19 Feb 2024: **International Conference on Bauxite Mining and Alumina Refining ICBMAR 2024**. Jeddah, Saudi Arabia. Website URL: https://waset.org/bauxite-mining-and-alumina-refining-conference-in-february-2024-in-jeddah

4-5 Mar 2024: **International Conference on Mining Intelligence ICMI 2024**. Rio de Janeiro, Brazil. Website URL: https://waset.org/mining-intelligence-conference-in-march-2024-in-rio-de-janeiro

22-23 Apr 2024: **International Conference on Recent Developments in Mining Technologies ICRDMT 2024**. London, United Kingdom. Website URL: https://waset.org/recent-developments-in-mining-technologies-conference-in-april-2024-in-london

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

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

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

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

Printed and Published by M. Narsaiah, Secretary General, Mining Engineers' Association of India,
on behalf of Mining Engineers' Association of India and printed at Deepu Printers, Raghava Ratna Towers, Chirag Ali Lane, Nampally, Hyderabad - 500 001.
and published at F-608 & 609, 'A' Block, VI Floor, Raghavaratna Towers, Chirag Ali Lane, Abids, Hyderabad - 500 001. **Editor: Dr. P.V. Rao**

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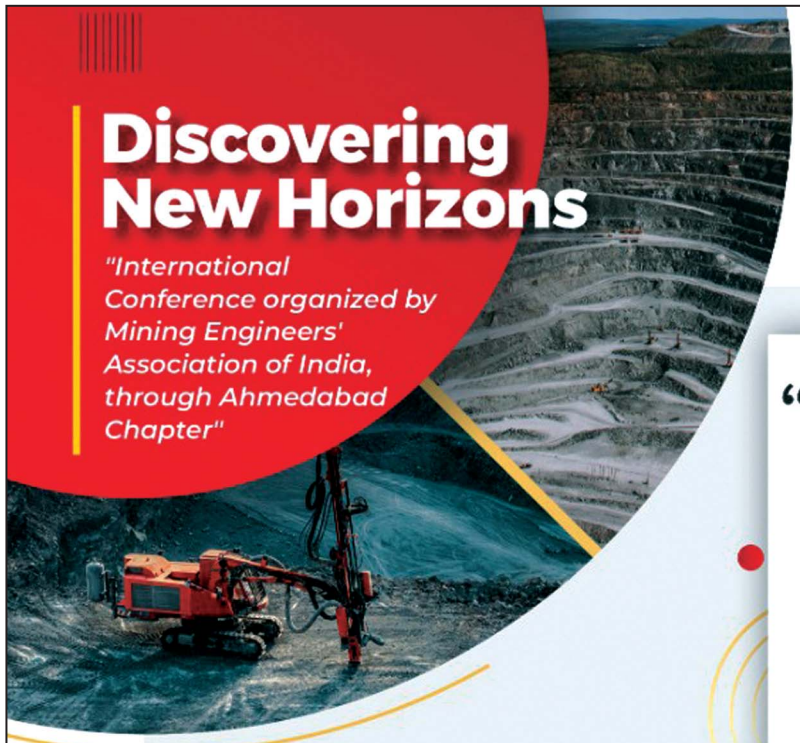

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- Future of Energy & Role of Critical Minerals
- Diversification for Sustainability, Net Zero & Circular Economy
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- Supply Chain Debottlenecking
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Venue

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We invite industry experts & professionals to submit abstracts on any of the aforementioned focus areas before June 10th, 2023.
Email your entries to: meaiahmedabad@gmail.com

MINING ENGINEERS' ASSOCIATION OF INDIA

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Conference Coordinator:

Swagat Ray, Member EC, MEAI Ahmedabad Chapter - 9727792696
Gunjan Pande, Secretary, MEAI Ahmedabad Chapter - 9978408608
For more details please visit : **www.meai.org**

Date of Publication: 28-06-2023
Date of Posting: 4 / 5 of every month

Regd. with RNI R.No. 71519/1999; No. of Pages: 36+Cover 4
Postal Regd. No. H-HD-GPO/024/2021 - 2023