

# Mining Engineers' Journal



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Mining Engineers' Association of India

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No. 6

MONTHLY

January - 2023

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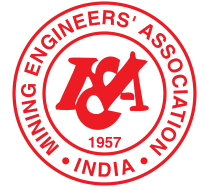
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## *President's Message.....*

**Dear Members,**

Greetings...

***Wish you all a Happy, Healthy & Prosperous New Year 2023...***

I wish to put forth the activities undertaken by our Association in the preceding month.

Bellary-Hospet Chapter organized MEAI-All India Geologists' Conference (MEGECON-22) on 20-21 December 2022. The aim of holding this conference was to bring together all the eminent geologists from across the country to learn, discuss thoughts, share ideas on recent innovations etc., in the field of Geology associated with the Indian Mining Industry.

The Conference was inaugurated by the Chief Guest Shri. Debkumar Bhattacharya (Deputy Director General, GSI). Dr. Yogesh G Kale (Controller of Mines, IBM) and Dr. PV Rao (Co-Chair, NACRI & Editor – MEJ) were the Guests of honour for the Conference. The event was presided over by Shri. K Madhusudhana (President – MEAI & CEO, MSPL limited). Shri. K Prabhakara Reddy, Chairman & Shri. SHM Mallikarjuna, Secretary of Bellary-Hospet Chapter were present on dais during the inaugural function. During the inaugural function, 5 geologists (above 80 years of age) Shri. D.A. Hiremath, Shri. C Sreenivasaiah, Shri. KS Paramaeswaraiyah, Dr. SK Sarangi & Shri. YL Patil were felicitated for their significant contribution to the field of Geology. Due to some personal reasons, Shri BK Mohanty & Shri. A .Bhandary could not attend the conference. However, arrangements will be made to felicitate them at their residence by the members of the respective Chapters.

There were 10 stalls represented by different companies promoting their modules, services & latest technologies related to both geology & mining. Around 300 delegates participated in this conference from various parts of the country and 16 technical papers were presented by the domain experts and the conference was well organised and made a grand success. I congratulate the team of MEAI BH Chapter for organising such a mega event at Hospet.

As a part of MEAI TECH SERIES (MTS) online program, a talk on “***Telematics in Mining Excavators and Practical application of Machine Data***” was delivered by Sri. Suresh Nair on 17<sup>th</sup> December 2022. The MTS program is an ongoing program, which is held every month. Request all the mineral industry professionals to utilise this opportunity.

NACRI members had a meeting at Hotel Hampi International, Hospet on 19.12.2022 to discuss the NACRI activities in its first physical meeting held after a long gap of more than 2 years.

We had an Election Committee meeting on 06.12.2022 to discuss the upcoming elections and initiated the election process as per the Association bye laws for the term 2023-25.

The Other upcoming events of the Association is - The Jaipur Chapter has proposed to organize a National Seminar on 12- 13 February 2023.

I wish all the members a great year ahead.

Regards,

**K. MADHUSUDHANA**  
President



# Mining Engineers' Association of India

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## EDITOR'S DESK



**Dr. P.V. Rao**  
Editor, MEJ

Press Information Bureau (PIB) Delhi posted the year-end review-2022 of the Ministry of Mines on 26 December 2022. I quote below a few notable points with respect to realising the objectives of mineral exploration in India, with a request to readers to send their views for publication & sharing with other members.

*Innovative mineral exploration activities using state-of-the-art technology by Geological Survey of India (GSI), stepped up efforts by Khanij Bidesh India Limited (KABIL) to source strategic minerals from countries like Australia, Argentina and Chile were some of the highlights of the important steps taken by the Mines Ministry during 2022.*

**Innovative Mineral Exploration Initiatives** - Geological Survey of India (GSI):

- GSI has completed 7,198 sq. km Specialized Thematic Mapping (on 1:25,000 scale) out of 19000 sq. km target during Annual Programme 2022-23 till the end of November 2022.
- GSI has completed 81,974 sq. km National Geochemical Mapping (on 1:50,000 scale) out of 250,000 sq. km target during Annual Programme 2022-23 until November 2022.
- Completed 29,506 sq. km National Geophysical Mapping (on 1:50,000 scale) out of 1,00,000 sq. km target of Annual Programme 2022-23 until November 2022.

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- GSI has completed 5,613 sq. km Large Scale Mapping (on 1:10,000/12,500 scale) out of 10,200 sq. km target during Annual Programme 2022-23 until the end of November 2022.
- National Aero-Geophysical Mapping Programme (NAGMP) is a flagship program of GSI to acquire uniform aero-geophysical data over the pre-identified Obvious Geological Potential area. During, Annual Programme of GSI 2022-23 until the mid of December 2022, around 25,086 line Km has been flown through NAGMP for identifying potential areas for further exploration. 322 mineral exploration projects have been taken up during 2022-23.
- To give impetus on exploration for strategic, critical and fertilizer minerals, GSI has taken 125 projects on critical and strategic minerals like REE, Li, Mo, fertilizer minerals, tungsten, graphite etc. during FS 2022-23.
- GSI has handed over 16 (G3/G2) reports to the State Governments in 2022. Out of these, there are 2 blocks each of limestone, copper, bauxite, molybdenum, PGE, potash and iron & manganese and 1 block each of iron and base metal.
- GSI has also handed over 50 potential G4 stage blocks in phase-III in March and 50 potential G4 stage blocks in phase-IV in July 2022 for auction as Composite Licence to the State Governments.

#### **Overseas Acquisition of Strategic Minerals:**

A JV Company among NALCO, HCL and MECL named Khanij Bidesh India Limited (KABIL) was formed in 2019 to identify, acquire, develop, process and make commercial use of strategic minerals in overseas locations for supply in India. KABIL is focusing on identifying and sourcing battery minerals like Lithium and Cobalt. Engagement with a few companies / projects is underway in Australia, Argentina and Chile.

**Australia:** MOU with detailed collaborative framework was signed on 10<sup>th</sup> March, 2022 between KABIL, India and Critical Mineral Office (CMO), Department of Industry, Science and Resources (DISER), Govt. of Australia for carrying out joint due diligence and further joint investment in Li & Co mineral assets of Australia. Under the agreed actions, Critical Mineral Market Scan was made by Australia in July, 2022, based on which identification of mineral assets will be done for further engagement.

**Argentina:** KABIL has signed three MoUs with JEMSE, CAMYEN and YPF (Govt. Companies of Argentina) in July – Sep 2020 to explore sourcing of lithium and other mineral assets in Argentina. In Oct 2022, CAMYEN, Argentina through the Indian Embassy at Buenos Aires, shared information regarding two prospective Lithium projects in la Aguada and El Indio in Catamarca, Argentina. A team of geologists visited Argentina from 20 Nov 2022 for a period of two weeks for evaluating and assessing lithium exploration projects proposed by CAMYEN in Catamarca province. Subsequent to preliminary assessment, KABIL expressed interest to partner with CAMYEN in December 2022 for prospecting two areas identified with the objective of establishment of projects for extraction of lithium in due course of time.

**Chile:** As advised by the Ambassador of India in Chile, KABIL has suggested certain modifications to the draft Non-Disclosure Agreement (NDA) and shared it with ENAMI for their acceptance before signing the NDA by ENAMI and KABIL for jointly pursuing lithium mining projects in Chile.

- Editor

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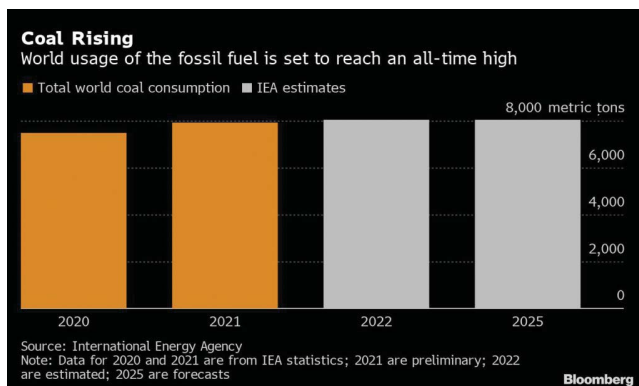


## NEWS FROM THE MINING WORLD

### World's coal consumption set to breach new record this year

World coal consumption is set to rise to the highest level ever this year despite ambitious global goals aimed at weaning nations off burning the dirty fossil fuel.

Coal usage looks likely to increase by 1.2% in 2022, surpassing 8 billion tonnes in a single year for the first time, according to an International Energy Agency report published Friday. It also said consumption will likely remain at that level until 2025, as declines in advanced economies are offset by demand in emerging Asian markets, such as China and India.



Europe's heavy reliance on coal this year is largely driven by Russia's curtailment of gas supplies to the continent, forcing it to draw on other other energy sources. It's at a time when European leaders are also attempting to shift toward renewables to secure a clean source of power going forward.

The analysis "underlines the urgent need to massively scale up renewable power and energy efficiency so that we cut people's bills, secure our energy supplies, and keep essential climate targets intact," Alexandru Musta a, a campaigner at Europe Beyond Coal said.

"Importantly, no European country has revised its plans to phase out coal completely by 2030, and Europe is still on track to be coal free by the end of the decade."

*Bloomberg News | December 16, 2022*

### India to invite bids for extracting gold from dumps at colonial-era mines

India plans to invite bids to extract gold from 50 million tonnes of processed ore in a cluster of colonial-era mines in the southern state of Karnataka, a senior government official with direct knowledge of the matter said on Thursday.



Image courtesy of Daniel Incandela via Flickr

The Kolar fields, located about 65 kilometres (40 miles) northeast of India's technology hub of Bengaluru, are among the country's oldest gold mines.

The Kolar mines, closed more than 20 years ago, held gold deposits worth around \$2.1 billion, and India is now keen to take advantage of new technology that can extract gold from even the leftovers of ore that was processed in the past.

Other than gold, the government also aims to extract palladium from the processed ore, or dumps, said the official who did not wish to be named in line with official rules.

"We are looking at how to monetise these gold reserves trapped in the processed ore," the official said.

He said the government expects to invite bids in the next four to six months.

"Our only constraint is that only foreign companies have the technology and experience of taking out gold from processed ore, but foreign companies can always tie up with local companies or even form a consortium," said the official who is directly involved in decision-making.

The federal mines ministry did not immediately reply to a *Reuters* email seeking comments.

India is the world's biggest gold consumer after China and meets most of its demand through imports.

In July, India raised the duty on gold imports to 12.5% from 7.5% to dampen demand in an attempt to bring

down the trade deficit and ease pressure on the Indian rupee.

India's demand for gold rose 14% from a year ago to 191.7 tonnes in the quarter through September, according to the World Gold Council.

*Reuters | December 15, 2022*

➡ **Allocation of all coal mines done through open auction, says Kishan Reddy**

Union Minister G Kishan Reddy refuted Telangana Chief Minister K Chandrashekar Rao's allegations and said that the Centre has given coal mines not as per its wish but through an open auction

Union Minister G Kishan Reddy on Saturday refuted Telangana Chief Minister K Chandrashekar Rao's allegations of allotting coal mines only to Gujarat, and said that the Centre has given coal mines not as per its wish but through an open auction.

Speaking to ANI, Reddy said that the government had given the allotment to Singareni Collieries Company Ltd. (SCCL) in Telangana before 2020, however, it decided thereafter that the coal mining allocation through an open auction.

"KCR is making a false accusation that the central government is allotting coal mines to government companies in Gujarat and not giving it to the Singareni Collieries Company Ltd. (SCCL) in Telangana. Before 2020, the allotment has been given to Singareni and also to Telangana GENCO for power generation. The same has been given to Gujarat. After 2020, the central government decided that the coal mining allocation will be through an open auction," he said.

"The country is facing a huge problem because of coal shortage as government companies that are allocated the mines are not mining coal. Power generation and employment generation have decreased," Reddy added.

Stating that coal should be made based on demand and supply, the Minister said that the private sector should also be made a part of this.

"The coal should be made based on demand and supply. The private sector should also be a part in this. The central government has not given any coal mines as per their wish, but through open auction to private or government companies. KCR is making the false accusation that there is a different justice to Gujarat and a different justice to Telangana by the central

government. The centre has given mines to Telangana also when it gave to Gujarat," he said.

*ANI | December 11, 2022*

➡ **No scope for special treatment to any state in coal block allocation: Govt**

The coal ministry said there is no special rule or scope for giving any special treatment to any state in allocation of coal blocks

The coal ministry on Friday said there is no special rule or scope of giving special treatment to any one state in allocation of coal blocks.

The statement comes in the wake of media reports about Telangana industries and commerce minister K T Ramarao's allegation that a large number of lignite mines were allocated to Gujarat Mineral Development Corporation (GMDC) following the nomination method.

"It has come to the notice of the ministry of coal about allegations of giving preferential treatment to one state government in allocation of coal blocks, which is false and not based on facts," the coal ministry said.

"...the question of preferring one state as claimed is baseless and misleading," the statement said.

The ministry further explained that two lignite blocks were allotted to GMDC in 2015 and similarly, three coal blocks were allotted to SCCL, a unit owned by the government of Telangana.

Out of three coal mines allocated to SCCL, Pengaddppa and New Patrapara blocks have been surrendered by the company under amnesty scheme of the Centre.

The Naini block allotted to SCCL in 2015 is still not operationalised by the Telangana government even though the Centre has facilitated in obtaining all the clearances.

"No coal/lignite blocks have been given through allotment route after launch of commercial mining to any state or central PSU," the statement said.

*Press Trust of India, New Delhi | December 9, 2022*

➡ **Extensive exploration programme to find minerals stepped up in Rajasthan**

Additional Chief Secretary (Mines and Petroleum) Subodh Agarwal said each part of the state was rich in some mineral

The Rajasthan government is extensively exploring minerals in the state, with possibilities of finding gold and emerald.

“An extensive exploration programme to find minerals, with financial help from the Rajasthan State Mineral Exploration Trust (RSMET), is being carried out in the Banswara-Nathdwara, Rajsamand, Barmer and Udaipur regions,” a senior official told Business Standard.

Additional Chief Secretary (Mines and Petroleum) Subodh Agarwal said each part of the state was rich in some mineral.

“It is being done in a modern and scientific manner with help from the RSMET and we are getting positive results,” Agarwal said.

He said initial surveys showed there was a possibility of gold reserves in the Banswara-Nathdwara belt, while in the Rajsamand belt there were chances of finding emerald. Similarly, phosphate reserves had been identified in the Udaipur region.

Mines Director Sandesh Nayak said auction work in mineral blocks in the state had gained pace and recently two blocks of limestone -- in Nagaur and Jaisalmer -- were e-auctioned.

Officers have been told to complete the formalities for auction so that illegal mining could be stopped.

RSMET Chief Executive Officer N P Singh said efforts were being made to speed up drilling.

*Anil Sharma, BS, Jaipur | December 5, 2022*

#### ► **Centre ‘modifies’ 62 unsold coal mines to make them attractive for buyers**

Out of the 141 coal blocks which the Centre has put up for commercial auction, 62 mines are old which had gone unsold during previous attempts; hence they have been modified

Coal Ministry sources informed that the areas around these mines have been altered by removing hindrances and obstacles to ensure proper connectivity and easy transportation of dry fuel.

Excessive vegetation has been removed and unapproachable terrain around these 62 coal mines has been made accessible to ensure smooth passage.

After these modifications, the 62 old mines have been put up for commercial auction again, they added.

The remaining 71 mines out of the 141 are new reserves.

Of the 141 blocks, the ones which would be bid out, will be termed as monetised assets under the Government’s National Monetisation Pipeline (NMP), sources informed further.

Also, eight blocks among the 141 reserves are those which had received single bids in earlier rounds of auction, and have been put up for bidding again.

Coal Ministry has been holding roadshows across the country to attract bidders for these 141 mines.

Today it has organised an investor conclave in Bengaluru, where Coal Minister Pralhad Joshi and senior officials of both coal and mines ministries as well as Karnataka Chief Minister Basavaraj Bommai would be present.

The Ministry had organised a similar conclave in Mumbai last week.

It plans to conduct a series of investors’ conclaves at several locations across India to attract prospective bidders.

These mines are spread all across the country in states like Bihar, Jharkhand, Chhattisgarh, Madhya Pradesh, Maharashtra, Tamil Nadu, Odisha and Rajasthan, among others.

*IANS, BS, New Delhi | December 3, 2022*

#### ► **Canada places big bets on critical minerals**



*Highland Valley Copper mine operation owned by Teck Resources (Image courtesy of Teck Resources)*

Canada is blessed with an abundance of fossil fuels — oil, natural gas and coal.

But as the developed world tries to wean itself off of fossil fuels — largely through electrification — it is expected the demand for Canada’s fossil fuels will eventually decline, while demand for critical minerals and metals is projected to grow sixfold by 2040.

These metals and minerals are critical in manufacturing electric vehicle batteries, solar and wind power installations, transmission lines and all the other things that a global energy transition will require.

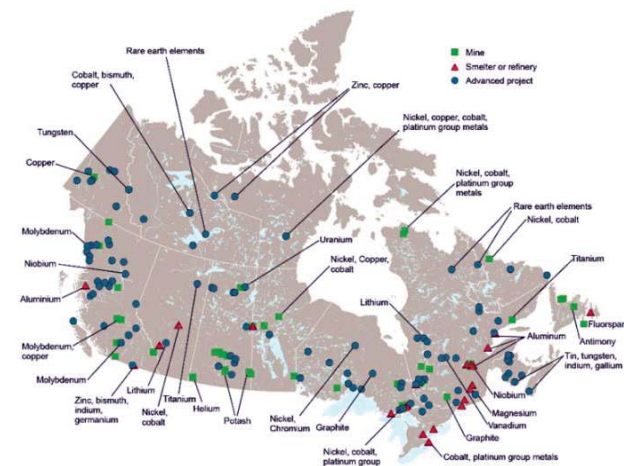
The Canadian government is hoping to capitalize on the opportunity this poses with a new critical minerals strategy — backed with \$4 billion in funding in the recent federal budget — that aims to develop a full critical minerals industry value chain, from exploration and mining, to processing, manufacturing and recycling.

Federal Natural Resources Minister Jonathan Wilkinson is in Vancouver today to release the new strategy.

“By investing in critical minerals today, we are building a sustainable industrial base to support emission-reducing supply chains that will address climate change for generations to come,” the *Canadian Critical Minerals Strategy* states.

Citing Clean Energy Canada, the strategy estimates \$5.7 billion to \$24 billion in GDP could be created by 2030 annually by developing a battery supply chain, creating 18,500 to 81,000 direct jobs.

“These figures grow to between \$15 billion and \$59 billion in annual GDP contributions, and 79,000 and 333,000 jobs, when indirect and induced activities and jobs are included,” the strategy says. “Once realized, these activities would contribute between \$2.7 billion and \$11 billion annually in combined federal and provincial government revenues.”



Map of mines and development projects in Canada. (Image courtesy of Government of Canada. | [Click on map to enlarge it](#))

Not everyone is convinced Canada has what it takes to become a critical minerals powerhouse, however. Namely, it just doesn't have the mineral reserves that

regions like South America and Africa have, say Philip Bazel and Jack Mintz of the University of Calgary's School of Public Policy.

In a brief published earlier this week, they suggest Canada will remain a minor player in critical minerals production, simply because it doesn't have the massive reserves of copper, lithium, cobalt and other critical minerals that countries like Chile and the Democratic Republic of Congo have.

Based on reserves and production of eight critical minerals and metals, among the top six producers, Canada ranks last, according to the Bazel-Mintz brief.

They estimate Canada's global share of copper reserves to be just 1.1% — compared to Chile's 22.7% — and production at 2.8%. It's estimated share of nickel and zinc reserves are roughly 2%. Canada's share of global nickel production was 6.7% in 2020; its share of zinc production was 6%. Canada's reserves share of cobalt is 2.9% and its production share 2.6%. Its global share of lithium, bauxite and manganese production is currently zero, according to the Bazel-Mintz brief.

“Most of North America's critical transition minerals will have to come from reserves in South America, Africa, and the Caribbean as well as Australia and China, which will see economic growth from mining jobs and capital investments,” they write.

“Shifting away from carbon-emitting fossil fuels toward cleaner, renewable sources of electric energy will require no less than an order of magnitude more mined minerals and rare earth elements, and Canada has a limited share of these transition minerals.”

But reserve estimates are based on what is known, and there may be more deposits in Canada yet to be discovered. The strategy earmarks \$79 million for public geoscience and exploration aimed at discovering potential new deposits. Moreover, Canada's new critical minerals strategy doesn't just focus on raw resources. It proposes an end-to-end industry value chain, from exploration and mining, to processing, manufacturing and recycling.

Ottawa is also hoping a Canadian critical minerals industry will be able to piggyback on American policies, like the Inflation Reduction Act, which will pump billions into things like electric vehicles, potentially opening up opportunities for Canada and the U.S. to cooperate on the development North American supply chains.

“Where critical minerals are not used solely for domestic manufacturing, there is value to be captured by

increasing exports for allies, and expanding domestic refining, processing and components manufacturing,” the strategy states. “Examples of these minerals are vanadium, gallium, titanium, scandium, magnesium, tellurium, zinc, niobium, and germanium, along with potash, uranium and aluminum.”

Of the 31 critical minerals identified in the strategy, six are “prioritized” – lithium, graphite, nickel, cobalt, copper, and rare earth elements.

Canada already produces some nickel, cobalt and copper – B.C. being the biggest copper producer. And Saskatchewan is a major producer of uranium, which is among the 31 minerals identified in the new strategy.

There are, as yet, no operating lithium mines in Canada, although a proposed new lithium mine in Quebec is now making its way through the Impact Assessment Agency process.



Quebec is home to lithium projects in varied stages of development. (Image courtesy of North American Lithium.)

The exploration and mining sector in Canada may need some prodding to convince it to switch its focus from gold and coal, however. A casual reading of the list of mining projects currently in the Impact Assessment Agency queue underscores that mining in Canada is still focused mainly on gold and metallurgical coal mining.

Of the 26 development projects listed, only five are for minerals and metals other than gold or coal. They include a nickel mine in Ontario, a lithium mine in Quebec, an iron mine in Labrador, a niobium mine in B.C. and also a lead-zinc mine in B.C.

“Although Canada does not possess large quantities of critical minerals relative to global totals, Canadian

reserves of cobalt, copper, nickel and zinc represent the best opportunities for growth,” Bazel and Mintz say in their brief. “However, with the majority of these critical mineral reserves abroad, we wonder if Canada’s industry is positioned to compete for the international mining investment.

“Given Canada’s limited share of global energy transition minerals, securing Canadian participation in the energy transition mining market may indeed hinge on the shape of its regulatory and taxation framework for mining companies.”

The strategy does provide some tax incentives, notably a new 30% flow-through tax credit for critical minerals exploration.

*Nelson Bennett — BIV | December 9, 2022*

### ➡ **Most Australian mine workers dissatisfied with their jobs – report**



Mine workers. (Reference image by Pranshu Goyal, Pixahive.)

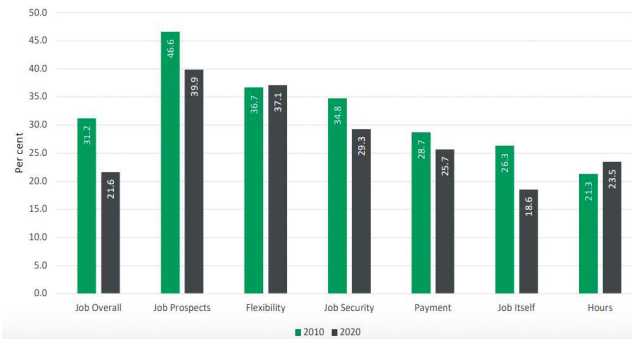
A recent report led by researchers at Curtin University has found that Australian mining companies have a stronger focus on employees’ physical health and safety than on their mental health and well-being.

The study examined employee welfare in the mining sector and found that only 22% of workers were very satisfied with their overall job, with employees experiencing poor job satisfaction, job security and job prospects compared to other industries.

By reviewing secondary evidence from the Australian Human Rights Commission, the authors of the report also found the mining sector is one of the worst five industries in the country in relation to sexual harassment issues, with 40% of workers and 74% of female workers reporting sexual harassment in the last five years.

The dossier develops a unique index to capture the prioritization of employee health and well-being based on mining companies' public reports and found that many of them, particularly those that are larger or have women at the helm, are prioritizing well-being. However, only 33% refer to loneliness, social connection, or isolation in their reports, and only 50% of mining companies refer to sexual harassment, assault, and sexism.

**Figure 2** Share of workers being very satisfied with different job aspects, mining industry, 2010 and 2020



(Graph from the “Towards a healthy and safe workforce in the mining industry: A review and mapping of current practice” report).

According to Astghik Mavisakalyan, co-author of the study and a professor at the Bankwest Curtin Economics Centre, all of these factors contribute to the mining industry rating the lowest among all Australian industries for job satisfaction.

“We found that while mining sector workers experienced good physical health and were more satisfied with their jobs now compared to 15 years ago, the number of very satisfied workers was the lowest of all industries,” Mavisakalyan said. “The report also showed that the levels of high distress of mining sector workers had risen considerably in the past decade, from 9% in 2009 to 15% in 2019.”

For Mavisakalyan and her colleagues, it is important to identify and support employees that are experiencing poor mental health and proactively create a healthy work environment.

“This means developing work cultures in which women are welcome and accepted, as well as, for all workers, having meaningful jobs with decent rosters, acceptable levels of job demands, and supportive managers,” Sharon Parker, a researcher at Curtin’s Future of Work Institute, said.

“Having anti-harassment and mental health policies is necessary but not sufficient. These policies need to be

backed up by on-the-ground support, such as effective systems for reporting harassment, and education and training of managers to effectively implement the policies.”

Parker and Mavisakalyan also mentioned this report is the first contribution to a major project that is intended to promote positive and effective change for those working in the mining industry who might be experiencing poor mental health and well-being, as well as those subjected to sexual harassment in the workplace.

*Staff Writer, Mining.com | November 30, 2022*

### ➔ Evaluating Reasonable Prospects

When is a resource not a resource? To answer this, we must look at a poorly defined aspect in the industry: the QP’s consideration for reasonable prospects for eventual economic extraction.

Under JORC Code definitions, “A ‘Mineral Resource’ is a concentration or occurrence of material of economic interest in or on the Earth’s crust in such form, grade (or quality), and quantity that there are reasonable prospects for eventual economic extraction.” While these terms are defined under CRIRSCO, the basis for the definition of what is ‘reasonable’ and what is ‘eventual’ remains relatively subjective and at the discretion of the QP.

Examples of these differences include the requirements and reporting for remnants, pillars, or low-grade mineralisation under JORC and SAMREC, which are not defined under CIM or S-K 1300. As another example, CIM guidelines include the requirement for ‘reasonable’ to be via demonstration of the spatial continuity of the mineralisation. At a minimum, these constraints should be addressed by creating constraining volumes, using costs and assumptions for operating mines or conceptual scenarios for new projects. In all cases, input parameters and methods should be documented.

The second consideration is the time scale. A notable change in the reporting codes under S-K 1300 is that the terminology excludes the term ‘eventual’. The SEC requires the assessment of the Mineral Resources to be demonstrated at the time of reporting. This could impact many assumptions being used to define key assumptions such as potential markets, price, or recovery technologies. The assumption of the time period should be disclosed within any technical report summary.

These issues were raised in a due diligence SRK completed in 2021. The client company had significant portions of polymetallic resources which on paper demonstrated a long future to the life of mine. Upon review, the 'Mineral Resource' was an inventory of all material remaining, and did not consider the impact of previous mining or the requirements to achieve the required minimum stope size. This reduced the available material by over 50%. This highlights that the one consistency across all the reporting codes is that the Mineral Resource is not simply an inventory of all mineralisation.

*Ben Parsons, SRK News Issue-Mining Project Evaluation*

### ► China reveals gold buying after quarter of mystery purchases

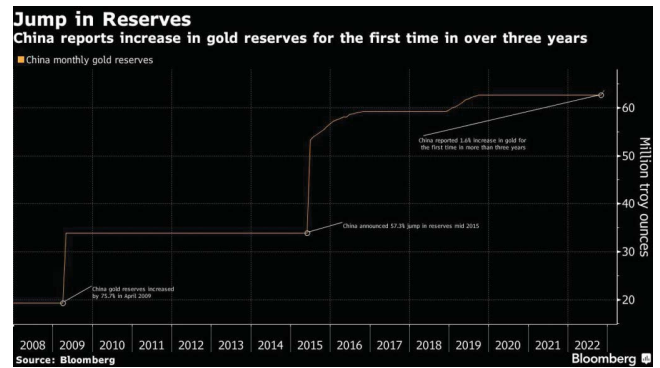


*Photo by Omar Hadad, Pixabay.*

China reported an increase in its gold reserves for the first time in more than three years, shedding some light on the identity of the mystery buyers in the bullion market.

The People's Bank of China raised its holdings by 32 tons in November from the month before, according to data on its website on Wednesday. That brought its total to 1,980 tons, the sixth-biggest central bank bullion hoard in the world.

The gold industry has been rife with speculation over the central banks behind nearly 400 tons of sovereign purchases during the third quarter. Only about a quarter of the buying was publicly reported at the time, causing market watchers to tout both China and Russia as potential culprits.



For China, the need to find an alternative to dollars, which dominate its reserves, has rarely been greater. Tensions with the US have been high since measures taken against its semiconductor firms, while Russia's invasion of Ukraine has demonstrated Washington's willingness to sanction central bank reserves.

The PBOC's purchases may be part of a plan to diversify its reserves away from the dollar, said Giovanni Staunovo, an analyst at UBS Group AG. "Gold holdings in China as part of the total reserves are still very low, so there is probably room for further purchases down the road," he said.

China has previously gone long periods without disclosing changes in its gold holdings. When the central bank announced a 57% jump in reserves to 53.3 million ounces in mid-2015, it was the first update in six years. It took another breather from the end of October 2016, before resuming reporting purchases in December 2018.

While central bank buying rarely drives sustainable gold rallies, it can provide an important pillar of support when prices fall. The precious metal has been under pressure this year from the Federal Reserve's aggressive monetary tightening, though it has held up relatively well against moves in the dollar and Treasury yields.

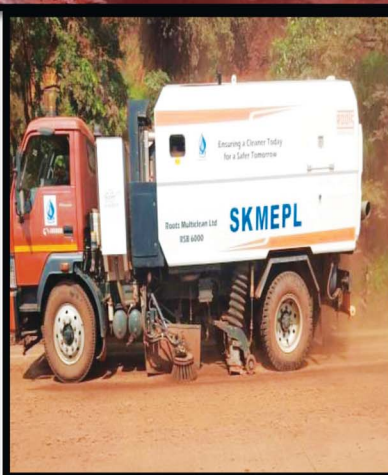
"As deglobalisation accelerates, the non-G-10 nations are expected to 're-commoditize' and ramp up gold holdings," said Nicky Shiels, head of strategy at MKS PAMP SA.

Gold edged higher to \$1,772.81 an ounce by 10:41 a.m. in London. Bullion had a short-lived rally back above \$1,800 on Friday, and is down about 3% this year. The Bloomberg Dollar Spot Index was little changed. Silver gained, platinum fell and palladium was steady.

*Bloomberg News | December 7, 2022*



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# DRILLHOLE PATTERNS, INITIATION SEQUENCES AND FIRING TIMES OF DRILLHOLES IN BENCH BLASTING - A REVIEW

M.O. Sarathy

## *Abstract*

*The pattern in which the drillholes are drilled, the sequence in which they are initiated and actual initiation delay firing times of the drillholes cause variations in fragmentation, muckpile looseness and muckpile profile. Regular production blasting aims at good fragmentation, a loose, well-spread muckpile and of a profile suitable to the excavator deployed. Special applications such as cast blasting of overburden requires a fragmentation which can be easily heaved-thrown over a long distance into the de-coaled area, thus minimizing mechanical handling by as much as 35-40%. Good fragmentation, loose muckpiles without oversize are prerequisites for efficient downstream operations of loading, hauling and crushing-communion, achieved by correct placement of drillholes (no collaring errors), accurate drilling (depth, direction without deviations), the pattern in which the drillholes are drilled and the sequence in which they are initiated. Accuracy of firing times of the initiators is a very crucial parameter for good fragmentation, muckpile looseness, for controlling ground vibrations and flyrock. Delay sequencing can be chosen as per requirement or end use, such as to control throw in a direction away from a mine structure or broken-down equipment in front of a bench and also for segregating ore-waste rock or high-low grade ores into distinct muckpiles.*

## DELAY BLASTING – VARIOUS DEFINITIONS

1. *“The practice of initiating individual explosive decks, boreholes, or rows of boreholes at predetermined time intervals using delay detonators, as compared to instantaneous blasting where all holes are fired essentially simultaneously” (Ref: Mindat.org)*
2. *“A method of blasting by which explosive charges are detonated in a given sequence with short time intervals”. (Ref: Great Russian Encyclopedia 1979)*
3. *“The use of delay detonators or connectors that cause separate charges to detonate at different times, rather than simultaneously”. (Ref: Terminology - National Park Service).*
4. *“A pre-planned and distinct pause between detonations or initiations to allow for explosives to fire separately”. (Ref: Blasting Terms Glossary TM International LLC)*

## 1.0 INTRODUCTION

Chiappetta<sup>2</sup> mentions quote... *“for many operations today, blasting is where it all begins. There is no other single unit operation within the total mining system that can affect economics more than when poor blast results are experienced. Detrimental blast results may result in oversize, excessive fines, backbreak, flyrock, irregular muckpile, tough digging conditions, potentially damaging ground vibrations and airblast”* ...unquote. Good fragmentation, muckpile looseness, muckpile profile commensurate to excavator in use, reduced ground vibrations, airblast noise and flyrock in primary blasts is due to: (i) Rock characteristics - mechanical properties and structure (ii) Explosive characteristics - density, velocity of detonation (VOD), strength - weight (k.cal/kg) / bulk (k.cal/litre) and detonation stability (iii) Drillhole diameter, blast geometry and design (iv) Drillhole pattern,

initiation sequence and firing time of drillholes. While rock characteristics have a more dominant effect on blast results, judicious use of the other parameters are essential which help to meet the objectives. Extract from Ash<sup>1</sup> is reproduced below which explains blasting mechanics lucidly: quote.... *The purpose of blast design is to distribute explosive energy in such a way that certain fragmentation and muck pile displacement requirements will be satisfied. The primary means by which this is accomplished is by selecting the proper borehole size and locating the respective boreholes making up a round in their proper positions. To develop a suitable pattern, however, requires a working knowledge of a borehole's blasting characteristics when acting independently and together with other blastholes. Because of its cylindrical shape, the typical blasthole directs most of its energy laterally, or perpendicular to its axis, not equally*

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Life Member – MEAI (sarathymo@yahoo.com)

outward in all directions as does a spherical idealized charge. For that reason, the burden dimension  $B$  is generally measured perpendicular to a borehole's length... unquote

## 2.0 NEED FOR DELAY BLASTING

Consider a simple bench blast in 3 rows consisting of 10 drillholes in each row with burden 'B', drilled as per blast design and having a free face in front (Figure-1). If all the 30 drillholes are initiated simultaneously, only the drillholes in the first row will get blasted properly since a free face is present in front. At the time of detonation, the drillholes in the second row will have a burden equal to  $2xB$  and third row  $3xB$ . The explosive's energy will not be able to break the second and third row as they have excessive burdens and no free face to move the material in front. Energy takes the path of least resistance and the blast tends to crater up and broken material moves upwards resulting in wild flyrock. Due to extreme confinement of the 2<sup>nd</sup> and 3<sup>rd</sup> rows, the

detonation products which are at high temperature, pressure and volume are unable to carry out useful work and rifle out of the drillhole by ejecting the stemming, resulting in venting and airblast noise. Venting of energy causes a sudden drop in borehole pressure. Only cracks are formed around the drillhole without any movement. This results in pillars of unbroken but cracked material, toe and very hard digging conditions for excavators. Since all the 30 drillholes are getting blasted simultaneously, the charge per delay would be proportional to the total explosive loaded in the blast viz  $30 \times$  quantity charged per drillhole (kg). Delay blasting enables individual drillholes in a row or the entire row to fire independently creating free face for the blast to progress. A bench normally has three free faces (a) in front viz the bench face (b) bench top viz surface and (c) in front and side (two faces). In multi-row blasting in a bench face, the drillholes in the front row only have a free face. In a corner blast, two free faces are present viz in front and on one side.

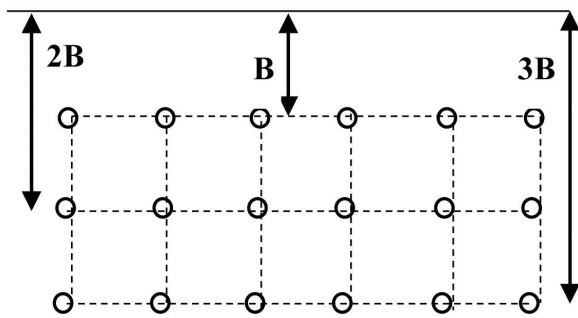
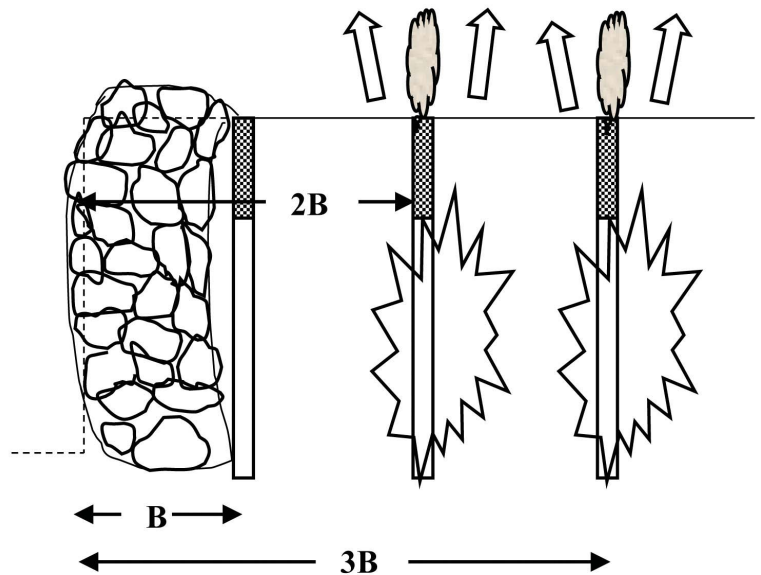


Figure-1: All drillholes firing instantaneously

As explained by Ash<sup>1</sup>, explosive charged in a drillhole is treated as a cylindrical charge which exerts the energy laterally or perpendicular to the axis of the drillhole. At optimum burden, the blasts are designed for the rock to move forward. The blast utilizes the free face on top only when the drillholes are heavily constrained as having excess burden or explosive strength being inadequate. Upon blasting (fragmenting), the in-situ volume swells by 30-40% and free space has to be created for the drillholes breaking in the second and subsequent rows to move into.

## 3.0 PRODUCTS-SYSTEMS AVAILABLE FOR DELAY BLASTING

The various options available to the blasting engineer at site in India for carrying out delay blasting are (i) electric (ii) non-electric and (iii) electronic. Delay sequences described later in this paper can be generated by placing the delay initiators



judiciously in the drillhole pattern to generate the desired sequence of initiation. Shock tube based non-electric detonators are being extensively used in India and has replaced use of detonating cord downlines and trunklines in many mines. The delay initiation systems available for bench blasting are given below:

- Detonating cord downlines initiated at the drillhole collar using electric millisecond delay detonators.
- Detonating cord downlines initiated using detonating cord trunklines and trunklines delayed using electric millisecond delay detonators or detonating relays.
- Shock tube based non-electric in-hole delay detonator and surface delay units.
- Fully field programmable electronic detonators provided with long lead wires.

**Note:** Use of long lead electric millisecond detonator was practiced before other types of non-electric initiation systems were developed. True bottom hole initiation is possible with this. Detonating cord downlines are initiated on the surface at the collar using electric millisecond delay detonators. The limitations of millisecond delay series (numbers 1-10 or 1-20) was enhanced through the use of Sequential Blasting Machine (SBM). Exploders discharge energy just once when the fire button is pressed. SBMs are provided with 10 internal circuits and each circuit can be pre-programmed to discharge the energy after a delay, as desired. The nominal delay firing time of the delay detonator and the delay between discharge of individual circuits generate multiple numbers of delayed firing times. With the advent of non-electric sequential blasting, the popularity of SBMs diminished significantly.

In bench blasting, it is desirable to set-off the explosive at the bottom of the drillhole (grade level and not in sub-grade) and any product that enables this requirement should be preferred. Conventional electric detonators with long lead wires can be used, but are susceptible for accidental or premature firing due to stray currents and extraneous electric sources such as static electricity, radio frequency (RF) energies released by walkie-talkies, mobile phones. Miniaturized circuits placed in electronic detonators have components which probably may offer superior protection from such sources. Detonating cord downlines are initiated at the collar and detonation travels from top downwards. Also, they are known to eject stemming and partly de-sensitize the booster-sensitive explosive in the drillhole. Detonating cord trunklines laid on surface and pigtailed of downlines present outside the drillhole generate severe airblast noise. Hence, shock-tube based non-electric detonators or electronic detonators become the obvious choice for the blasting engineer. Pyrotechnic delay elements used in delay detonators have inherent disadvantages such as timing inconsistency-accuracy, scatter ( $\pm$ ), and shifting of nominal delay time due to ageing. Electronic detonators are very accurate with timing variance of  $\pm 0.005\%$  of the programmed delay time and the timing remains unaffected by ageing.

#### 4.0 BLASTING USING DELAY INITIATORS

In multi-drillhole, multi-row blasting, using delay initiators has many significant advantages:

- Assists in individual drillholes in breaking the material surrounding it.
- Improves fragmentation and heave. Fragmented mass swells after blast and delay helps create free space to accommodate the increased swell volume and loose muckpiles
- Control throw direction - useful for segregating ore-waste-rock or high-grade-low grade, for protecting

structure or mining equipment under breakdown in the vicinity of blast.

- Helps in controlling the maximum charge per delay and consequently ground vibrations.

Delay blasting helps to create the desired free space between individual drillholes and rows by providing the time interval commensurate to burden distance and sonic velocity (longitudinal wave velocity). Effect of insufficient delay is shown in Figure-2 (a). Typically, blast movement should take place as shown in Fig 2 (b), where each drillhole is expanding its burden and broken mass as moved forward before the drillhole behind gets initiated. [Dyno Nobel<sup>3</sup>](#) suggests that the row in front should move at least 1/3 burden distance and this would provide-create the desired free space before the drillhole behind gets initiated. [Onederra and Esen<sup>11</sup>](#) recommend that for free face to be available, at least two adjacent drillholes in front of a drillhole should have detonated at a defined time earlier to provide sufficient burden relief. *If one drillhole fires out of sequence, choking of several drillholes around this can occur.*

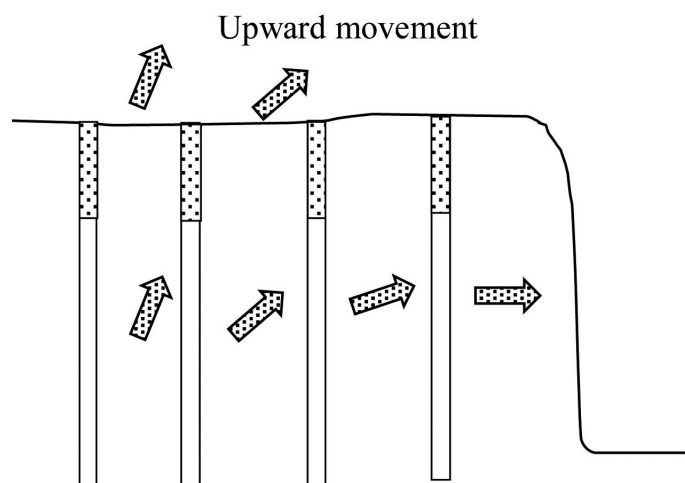


Fig-2(a) Inadequate delay in back rows

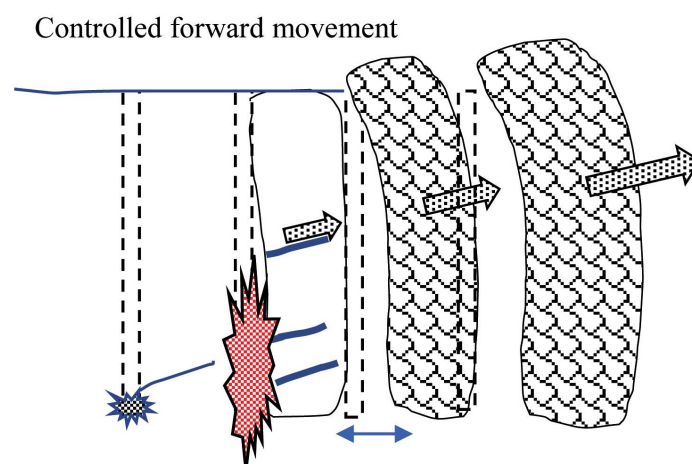


Fig-2(b) Adequate delay between rows

## 5.0 BLASTING MECHANICS - BENCH CRATER PROFILES

Bench crater profile is basically a plan view (looking from above) of angle and extent of breakage of a drillhole in relation to its position with a single free face (burden) or two free faces (as in a corner). Each drillhole is expected to break the amount of material present around it in a satisfactory manner. At optimum burden the breakage angle from a single drillhole with a single free face in front, would be between 45° to 60° with a triangular profile and where two free faces are present, the breakage is trapezoidal. Plotting the anticipated bench craters on paper helps in identifying probable areas of good fragmentation, areas where coarse fragments may generate and zones of overbreak. Ash<sup>1</sup> has established bench crater profiles which are reproduced below for the benefit of readers to understand the nuances of crater profiles from single drillholes and multiple drillholes / rows initiated with delay initiators. At optimum burden, viz drillhole is correctly positioned, there would be little or no radial cracking behind and no overbreak at collar. A narrow crater angle with back shatter indicates excessive burden. Pre-existing corner angle and distance from the two free faces will determine the crater angle (Figure-3,3a,3b). Patterns being the same, single row blasts in massive and blocky strata results in poor fragmentation while multi-row blasts result in better fragmentation (Hustrulid<sup>6</sup>).

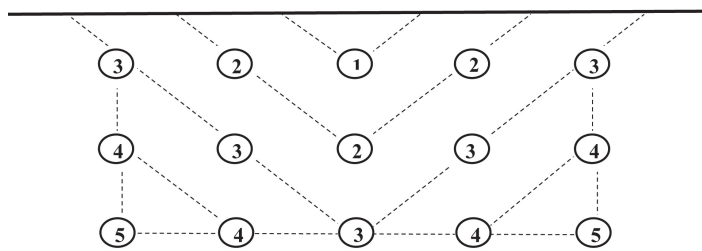


Figure-3a: V-Sequence with single delay along spacing and burden

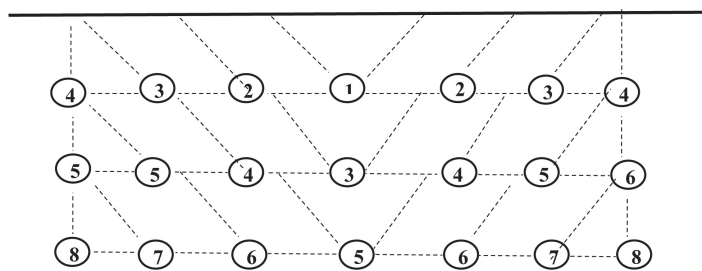


Figure-3b: V1-Sequence with single delay along spacing and double delay across burden

## 6.0 DRILLHOLE PATTERNS

Drill patterns used in bench blasting are mainly:

- (i) In-line: drillholes are drilled one behind the other, also described in some literature as square.
- (ii) Staggered: drillholes in the row behind are placed between two of the front row. In a staggered pattern it is recommended to decrease one drillhole in the 2<sup>nd</sup> and

subsequent rows in order to prevent excess breakage at the sides (Figure-6).

- (iii) Square (drilled spacing  $S_d =$  drilled burden  $B_d$ ).
- (iv) Rectangular (drilled spacing  $>$  drilled burden, normally  $S_d = 1.16 B_d$  to  $1.4 B_d$ ).

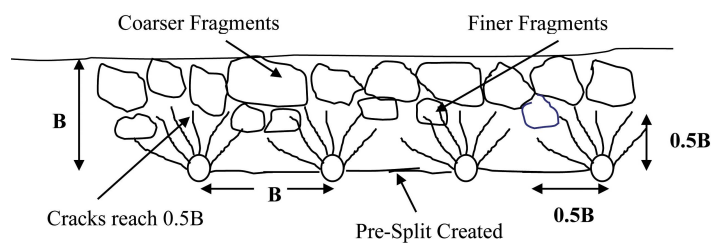
Drillhole initiation sequences in multi-row blasting include:

- (i) Row delay
- (ii) 'V', 'V1', and 'V2' sequence.
- (iii) Diagonal - pattern is one half of a V sequence (left or right), used with two free faces.
- (iv) One drillhole firing at a time (for ground vibration control and improving fragmentation).

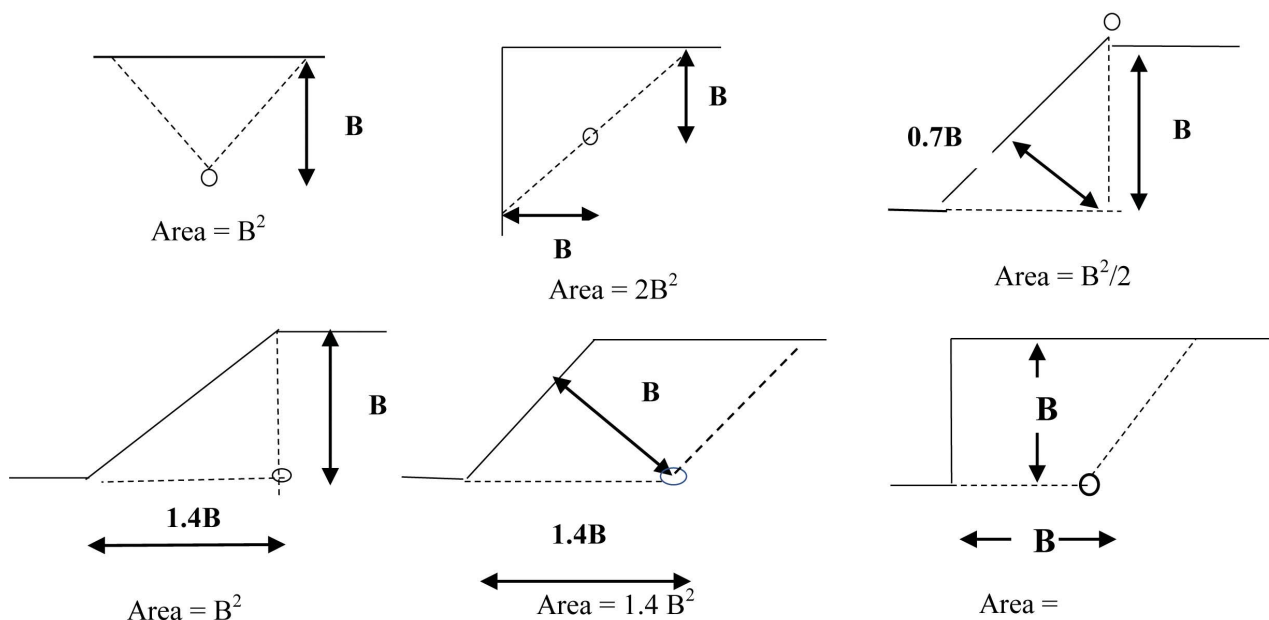
Blast in the middle of a bench having free face only in front is known as 'face blast' and blast having two free faces viz in front and side is known as 'corner blast' (Hustrulid<sup>6</sup>). Figure-6 gives various drillhole initiation patterns at a glance. Each pattern has a distinct breaking mechanism which can be adopted for specific end use or requirement.

### 6.1 Row Delay (In-line Delay Sequence)

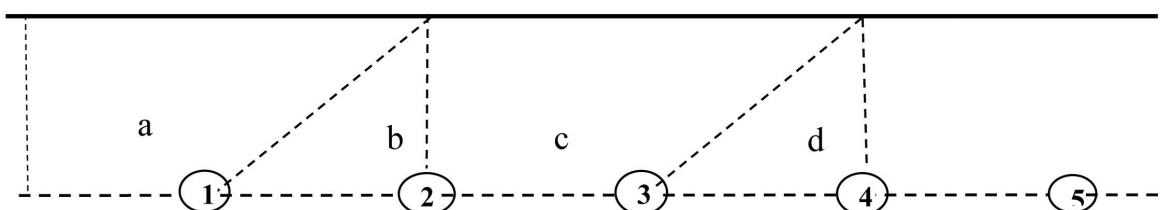
Row delay is also known as in-line delay and is a face blast. All drillholes in a row are initiated together and the desired delay interval is provided between rows viz across the burden. Blasters prefer this method since it is simple, easy for hook-up and less time consuming. Upon detonation of explosive, cracks develop around the drillhole. When  $S_d=B_d$  or  $S_d = 1.4 B_d$ , while cracks travel a distance of  $0.5B_d$  or  $0.7 B_d$  towards the free face in front, the cracks between the drillholes also travel the same distance and join along spacing resulting in a pre-split plane. This results in venting of gases (energy) and a drop in borehole pressure. Since crack formation does not effectively occur near the free face, row-by-row delay generates coarser fragments. The simultaneous initiation causes the broken mass to heave over a longer distance (longer throw). When  $S_d=2B_d$ , the cracks reach the free face at the same time the two adjacent drillholes meet. Fragmentation will not be satisfactory and large fragments (boulders) will get generated.



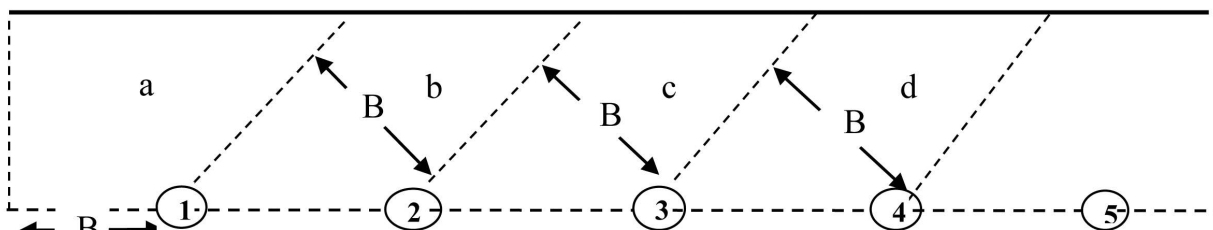
Side break cracks will be more pronounced as drillholes on the extremities (either end) of the second and subsequent rows do not have adequate free face. While staggered drillholes have a natural breakage angle, modified in-line pattern works better where drillholes at the extremities are initiated along with the row behind (Figure-6).



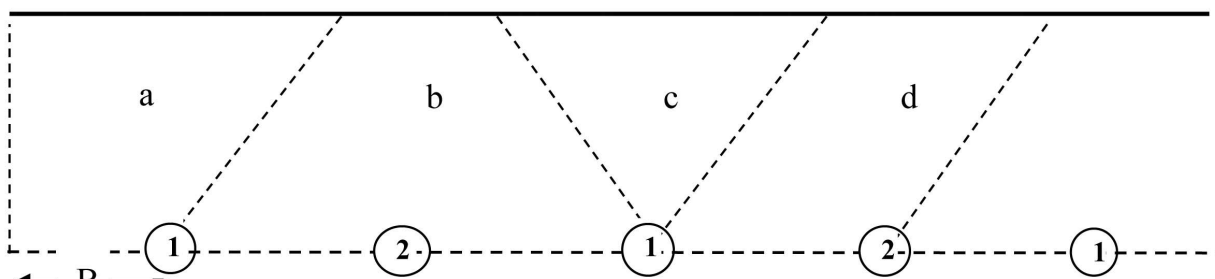
Single drillhole bench crater profiles



Single free face in front, Spacing = Burden ( $S=B$ )  
 a, b, c, d - Bench crater profiles. a, c (larger area), b, d (smaller area)



Single free face in front, Spacing =  $1.4 \times$  Burden  
 a, b, c, d - Bench crater profiles. a (larger area), b, c, d uniform area



Single free face in front, Spacing =  $1.4 \times$  Burden. Alternate delays are used  
 a, b, c, d - Bench crater profiles. b (large area), a, c, d varying areas

Figure 3 – Bench crater profiles – NOTE: 1,2,3,4,5 is delay sequence, NOT detonator delay number

### 6.2 V, V1, V2 and V3 Sequence

The nomenclature of V, V1, V2, V3 initiation sequences with in-line and staggered drilling are pictorially depicted in Figures 4 (a, b) (Esterhuizen<sup>4</sup>).

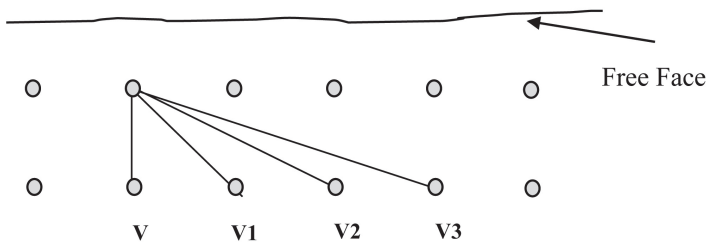


Figure 4 (a) – In-line pattern

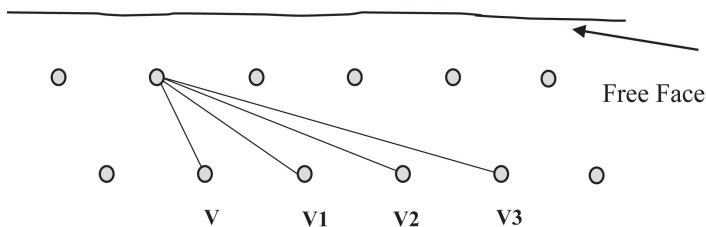


Figure 4 (b) Staggered pattern

These are used in face blast. The blasted muckpile gets heaped in front due to movement of blasted fragments from two diagonal initiation sequences starting in the centre of a face, and blast progressing in the shape of alphabet 'V'. By choosing an appropriate initiation sequence the 'as-drilled' spacing  $S_d$ ; burden  $B_d$  orientation and ratio ( $S_d/B_d$ ) can be altered so that the 'as-firing' in-situ effective spacing  $S_e$ ; effective burden  $B_e$  orientation and ratio will change the dynamics during the blast. From as drilled  $S_d/B_d=1$ , the as firing  $S_e/B_e$  can be changed. In-line square pattern shot on 'V' sequence will result in  $B_e = 0.7B_d$  and  $S_e = 1.4S_d$  resulting in  $S_e/B_e = 2$  (Figure-5a). In equilateral triangle pattern ( $S_d = 1.16 B_d$ ) initiated on 'V1' sequence results in  $B_e = 0.575B_d$  and  $S_e = 2S_d$  resulting in  $S_e/B_e = 3.48$  (Figure-5b). Both patterns are 'balanced' during firing viz  $x = y$ . As explosive charged for  $B_d$  is acting on reduced  $B_e$ , it will result in improved fragmentation, and heave (muckpile looseness). Distance of throw can be controlled by firing times as required.

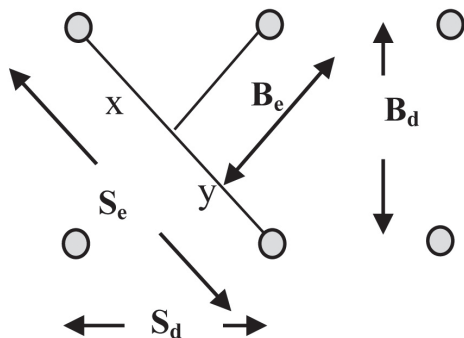


Figure 5a In-line pattern.  $B_d=1, S_d=1, S_d/B_d=1, B_e=0.7, S_e=1.4, S_e/B_e=2$

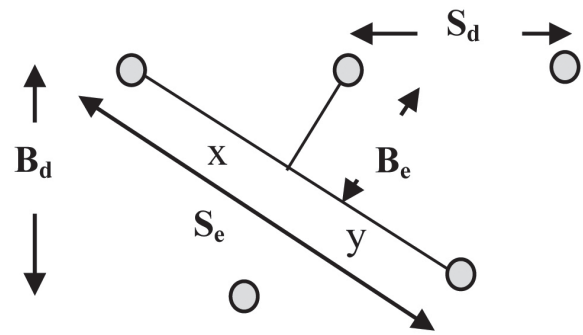


Figure-5b Staggered Equilateral Triangle pattern.  $B_d=1, S_d=1.16, S_d/B_d=1.16, B_e=1.15, S_e=4.1, S_e/B_e=3.5$

**Note:** (i) It can be observed from Figure-5a that even though the drillholes have been drilled as 'in-line', the orientation becomes 'staggered' during delay initiation. (ii) These sequences induce in-flight collision during heave which acts as a secondary fragmentation mechanism. (iii) Fragmentation improves when  $S_e/B_e$  ratio reaches up to 4 (Hustrulid<sup>6</sup>).

### 6.3 Diagonal Sequence

Diagonal sequence is advantageous when used in corner blast where two free faces are available viz in front and on one side of the bench being blasted. The side face can be either perpendicular or at an angle in relation to the front free face. This can be adopted with both in-line or staggered patterns. The orientation of  $B_e$  and  $S_e$  is the same as the left half or right half of V or V1 pattern (Figure-6). The blast is initiated in the corner of the front row where the two faces meet. This sequence results in uniform fragmentation and good horizontal movement of blasted mass and generates a low muck profile suitable for front end loaders.

### 7.0 FIRING TIMES OF DRILLHOLES

The longitudinal wave velocity (sonic velocity) of soft, low-density, coarse-grained rock is much slower than hard, high-density, fine-grained rocks. This implies shock wave generated upon detonation of explosive would travel at a slower speed in materials such as sandstone, shale and faster in granite, quartzite, taconite etc. As the burden distance increases, the time taken for the shock wave to reach free face would also be higher thus implying larger burdens and materials with lower sonic velocities require longer inter-hole/inter-row delays. A discrete time lapse occurs between detonation of explosive in the drillhole and burden mass displacement (except in very short burdens commensurate to drillhole diameter in use). Changes in rock face in front of drillhole are observed using high speed videography. This is termed as 'burden response time' denoted as  $T_{Min}$  (in milliseconds) which is dependent on the burden mass, explosive characteristics and dynamic response of the material being blasted to the explosive stimulus.  $T_{Min}$  can be decreased by employing smaller burdens, using higher

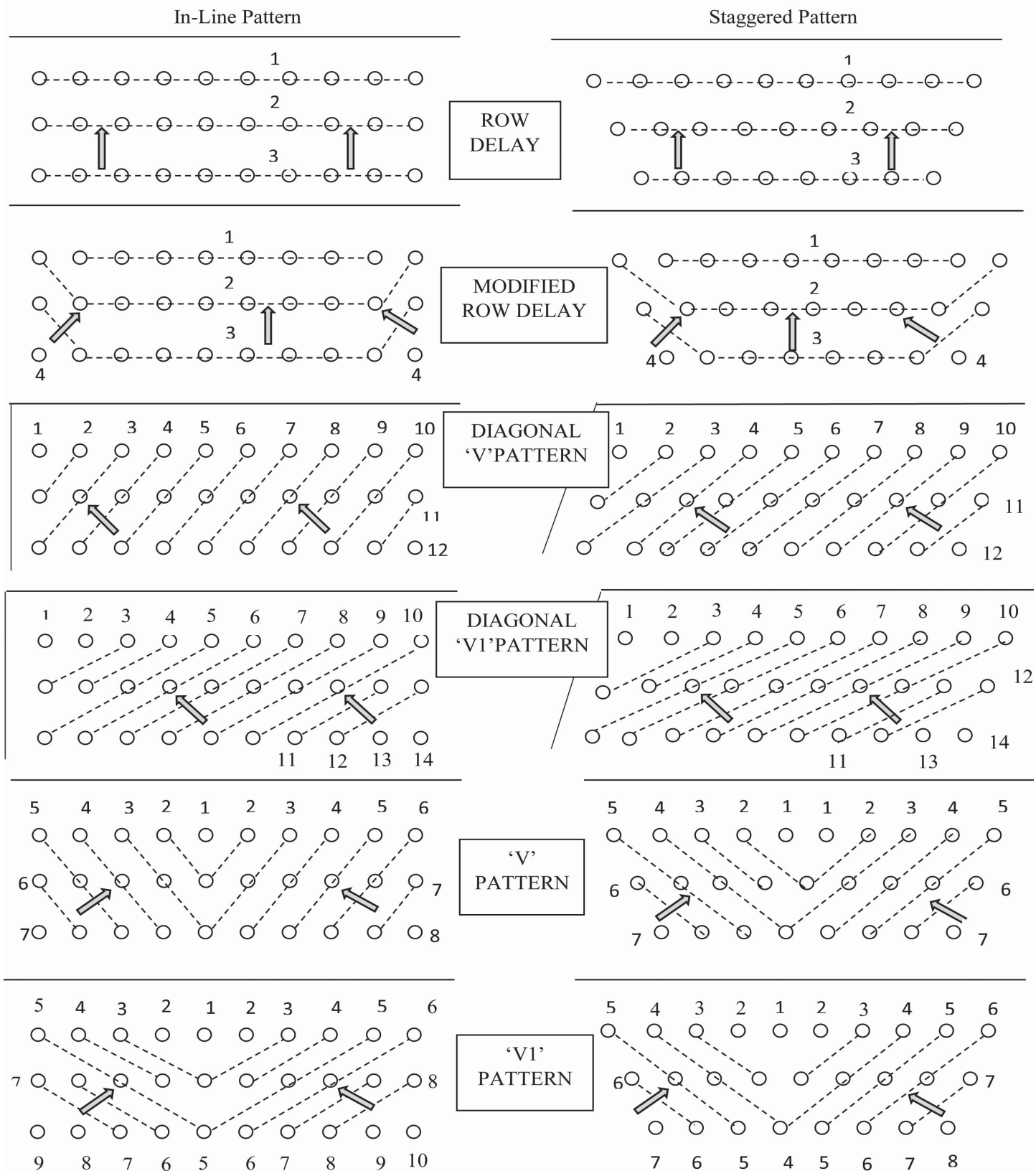


Figure-6 - DRILLHOLE INITIATION PATTERNS

Note: Numbers indicate sequence of initiation of drillholes. NOT Delay Detonator Number

energy explosives or a combination of both (Chiappetta<sup>2</sup>). Explosives generate two types of energies namely shock energy (SE) or brisance and heave energy (HE) or gas energy. High VOD explosives generate more brisance while low VOD (slower reacting) products react for longer duration resulting in lower brisance and higher heave. Emulsion, Watergel/Slurry, AN-FO and Heavy AN-FO exhibit different VODs and partitioning (ratios) of SE: HE, which in turn cause variations in burden response. Burden response time and burden velocities would be different when same explosive is used in various rock types and burden distances. Conversely, in the same material, various types of explosives would generate different burden response and burden velocities. These aspects primarily help in arriving at the optimum delay time between drillholes in a row (along spacing) and across burden (across row). According to Chiappetta<sup>2</sup>, if the application requires maximizing fragmentation with minimal movement, then delay of  $T_{min}$  or less is used. For maximizing throw as in cast blasting operations, then 1.5 to 3 times  $T_{min}$  is appropriate. The objective is to move the mass over a small distance without affecting the confining pressures and yet allow space for swelling. Delay time selection is of utmost importance in any blast design and hence for arriving at optimum delay, study using high speed videography is recommended.

Onederra and Esen<sup>11</sup> have derived a mathematical relationship to calculate burden response.

$$T_{min} = (K_{mass} ERI) \left[ a \left( \frac{B}{d} \left\{ \frac{1}{K_{mass} ERI} \right\} \right)^b \right]$$

$T_{min}$  = Minimum response time (ms)

$K_{mass}$  = Rock mass stiffness ( $GP_a$ )

B = Burden (m)

d = Drillhole diameter (m)

ERI = Explosive-rock interaction term

(Note: 'a' and 'b' are two fitting constants and the authors from their database have determined the values as 2.408 and 1.465 respectively. The model is empirical in nature and predictions are restricted to B/d ratios between 12-45, drillholes are fully coupled and properly stemmed).

$$ERI = (0.36 + \rho_e) \left\{ \frac{D^2}{1 + \frac{D^2}{v_p^2} - \frac{D}{v_p}} \right\} \left( \frac{D}{D_{CJ}} \right) \rho_e$$

ERI = Explosive-rock interaction term

$\rho_e$  = Density of explosive (g/cc)

D = Actual (non-ideal) VOD of explosive m/s

$V_p$  = P wave velocity of intact rock (km/s)

$D_{CJ}$  = Chapan-Jouguet VOD (km/s): derived from computer codes

$$K_{mass} = \frac{E_d}{1 + V_d}$$

$E_d$  is Young's Modulus and  $V_d$  is Poisson's Ratio

The blasting engineer at site may be able to use above formulae only if ready values of  $T_{min}$  (obtained through burden response studies),  $V_p$ ,  $V_d$  (by testing material sample in rock testing laboratory) and  $D_{CJ}$  value (which should be provided by the explosive manufacturer whose product is in use), are available. While a field study would be most appropriate, Table-1 below summarizes the recommendations made during late seventies and eighties by experts, on delay interval to be provided along spacing and across burden as guidance for trial blasts (IDL<sup>7</sup>).

Above guidelines have been suggested by researchers who carried out studies using model-scale, laboratory-scale (15-ton granite, limestone blocks) and blasts in actual field conditions. Katsabanis<sup>10</sup> observed that very short or very long delays resulted in coarser fragmentation, while delays within a time-window resulted in good fragmentation. Better fragmentation has been observed with the use of electronic detonators and the benefit associated is more with precise firing times rather than the ability to detonate drillholes at very short intervals. Softer, altered rocks move slower than hard, brittle rocks. For better primary breakage-fragmentation, faster timing promotes stress wave interaction. If ground vibration is an issue, a timing that reduces stress wave reinforcement is desirable (Kanchibotla<sup>9</sup>). Johnson<sup>8</sup> carried out field tests in a granite quarry having bench height of 21 m and burden x spacing of 4 x 5 m and an extract of observations is reproduced - Quote... *Timing is now a crucial part of the blast design process, along with traditional parameters such as powder factor and blast geometries (burden, spacing and hole diameter). Often, timing has to be altered to accommodate vibration control, for example. It is important to understand how any change in timing can affect the overall efficiency of a blast and consequently the overall mine operation. Precise timing of electronic detonation provides a mechanism for controlling the collision of shockwaves or detonation waves when the blaster understands strata characteristics...* Unquote.

## 8.0 CONCLUSIONS

Placing drillholes accurately is the first step towards achieving good blast results. In addition to proper blast geometry parameters (blast design), explosive (characteristics, performance), the pattern in which the drillholes have been drilled, the sequence in which they are initiated and the firing times (delay times) at which they are getting detonated are dominant factors that result in good fragmentation, heave and muckpile looseness in blasting operations. Staggered drilling requires close supervision as drillholes are placed in equilateral triangle configuration where  $S_d = 1.16 B_d$ . With blasts carried out with correct delay timing, square in-line pattern fired on a V sequence and staggered equilateral triangle pattern fired on a V1 sequence result in good fragmentation and muckpile looseness, with the latter being superior. Blast monitoring and field observations help in assigning firing times of drillholes. Assigning firing



Table-1: Delay Timing Guidelines

Researcher	Delay across Burden	Delay across Spacing
ANDREWS. A.B.	2 - 3 times of timing provided for spacing	3.3 - 17 ms/m (1-5 ms/ft).
ASH. R.L.	Minimum delay between drillholes in same row (along spacing) more than 3.3 ms/m (1 ms/ft). Upper limit 16.4 ms/m (5 ms/ft). 2-3 times across burden	
BAUER. A.	3.2 - 4 ms/m to start movement. 5-7 ms/m for blasts	-
BERGMAN	3.3 - 6.6 ms/m (1 - 2 ms/ft)	-
HAGAN. T.N.	8 ms/m for long collars and low powder factor in soft, densely fissured low-density rocks. 4 ms/m for short collars, high powder factor in dense, tough massive rocks.	-
FLOYD. J	2 - 3 times of timing provided for spacing	0.3 ms/ft for blocky, massive rocks and 0.5 - 1.5 ms/ft in highly bedded, jointed rocks
KONYA. C.J. Sand, Loam, Coal Limestone, Shale Granite, Basalt, Gneiss Magnetite, Porphyry	6 - 7 ms/m (1.8-2.1 ms/ft) 5 - 6 ms/m (1.5-1.8 ms/ft) 4 - 5 ms/m (1.2-1.5 ms/ft) 3 - 4 ms/m (0.9-1.2 ms/ft)	-
LANG. L.C.	5 - 8.3 ms/m (1.5 – 2.5 ms/ft)	-
LANGEFORS. U	2 - 5 ms/m	-

(Note: 1 ms/m = 0.3048 ms/ft or 1 ms/ft = 3.281 ms/m)

times is ‘site-specific’ and is ascertained by studying ‘burden response’ in a scientific manner. Burden response is controlled by burden distance, longitudinal wave velocity of strata being blasted and the explosive characteristics, mainly VOD, strength, partitioning of shock energy and heave energy during the blast. The guidelines provided in Table-1 can be used to reduce ‘trial and error’ approach and carry out blasts with a fair degree of success. Shorter delays are used at times to enhance the interaction of shock waves for better ‘conditioning’ of blasted muck for improving efficiency of comminution in ore mining. A word of caution – the optimum delay for good fragmentation and muckpile looseness may be different from the delay for controlling ground vibrations in terms of peak particle velocity (PPV) and frequency (Hz). Delay blasting technique can be adopted for specialized needs such as segregating high grade-low grade ores or ore-waste rock in the same blast or for heaving the blasted material in a direction away from equipment under break down or an installation/facility in the vicinity of a blast. Cast blasting operations invariably use row delays due to the combined advantage of all drillholes in the row firing simultaneously to heave the blasted material onto the de-coaled area, enabling lower mechanical handling. The bench crater profiles described in the paper would help the blasting engineer and the crew understand why fragmentation size varies within a blast in spite of the fact that all drillholes are of the same size, charged with the same type and quantity of explosive, as areas-volumes vary. The actual firing time of the initiator during a blast is very crucial. Even when blast design parameters and explosive performance are

correct, blast results will be unsatisfactory due to inaccuracy of firing times of pyrotechnic based delay initiators which are inherently prone to variations in nominal firing times and timing scatter (+/-). High scatter in detonators of same delay period causes drillholes to fire independently. This has encouraged users to switch over to electronic detonators whose firing times are very accurate (0.005% timing variance of programmed delay), having a large programmable delay window (upto 30 seconds) and ability to programme firing times in increments of 1 millisecond.

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## MEAI TECH SERIES – DECEMBER 2022

### “Telematics in Mining Excavators and Practical Application of Machine Data”

As a continual improvement on Training, Development & Programs, under the banner of the Training, Development & Program Committee, with the backing and encouragement of the President MEAI, Mr. K. Madhusudhana, MEAI presented the Sixth disquisition in the Tech Series for the mining professionals on 17<sup>th</sup> December 2022 (Saturday) at 06:30 pm on WebEx platform.

After a warm welcome by the Chairman, TDPC, Mr Deepak Vidyarthi, The President, MEAI Mr K. Madhusudhana highlighted on the origin of MEAI TECH SERIES and extended a hearty welcome to the speaker Mr. Suresh Nair, Asstt. Vice President, Tata Hitachi Machinery Construction Co. Pvt Ltd, on a very important topic on “Telematics in Mining Excavators and Practical Application of Machine Data” and wished the presentation would be extremely fruitful, beneficial and helpful to the participants.

Mr Suresh Nair made an excellent presentation on “Telematics in Mining Excavators and Practical Application of Machine Data. He touched upon the use of GPS in Mobile devices to send and receive information to control remote objects in the industry.

Mr Suresh Nair further highlighted the operation of... Middle & Large Class Wheel Loaders Rigid Dump Trucks, Ultra large Class Mining Excavators and Attachments and Customized Applications and Consite Mine that helps to resolve the problems at Mine sites by remotely monitoring Mining Machines on 24x7 basis and the use of IoT and AI based analysis of equipment operation data.

With a very interactive session the Presentation concluded with thanks to the speaker for the wonderful disquisition and for having taken pains for preparation. Mr T.R.Rajasekar, Consultant proposed a Vote of Thanks.



## THE STORY OF DAZZLING KASHMIR SAPPHIRE

H.L. Mahajan\*

**Sapphire** (commonly known as 'Neelam') over the years has captivated the world and caught the imagination of the elite not only with its grace but also with its near natural perfection since times immemorial. Traditionally, sapphire has decorated the crowns and robes of royalty and clergy members for centuries.

A traditional Hindu belief holds that the sapphire causes the planet Saturn (Shani) to be favourable or unfavourable to the wearer depending upon his/her planetary configuration. It is said that if Shani /saturn is favourably placed, wearing Sapphire can make the person kinglike from extreme poverty ('runk' in hindi). On the other hand, if Saturn is unfavourably placed, wearing sapphire can make even a king lose his kingdom and go into extreme poverty.

Sapphire is a gem variety of the mineral Corundum consisting of aluminium oxide ( $Al_2O_3$ ). When, bluish in colour, it is known as Sapphire; however, when reddish, it is known as Ruby. Red colour of Ruby owes itself to the presence of trace amounts of Chromium in the mineral, while presence of trace amounts of Iron and Titanium lend the Sapphire its typical blue colour. Quite interestingly, sapphires are also used in some non-ornamental applications, such as infrared optical components, wristwatches and even in the

electronics industry. Corundum is very hard (on Mohs scale, hardness of Corundum is 9; Diamond at 10- the hardest and Talc at 1, being softest ) and is therefore highly resistant to wear and tear and weathering.

The Kashmir sapphire is mined out from rocks found in the most remote but rewardingly picturesque valley in a place known as Paddar in Kishtwar area of erstwhile Jammu & Kashmir State (presently a Union Territory). It is rated as the world's best sapphire, thanks to its velvet texture, azure blue color having poetic resemblance to a peacock neck.

The Paddar valley of Kashmir, covers the whole northern portion of Kishtwar district, bordering Zaskar mountains (Ladakh) on the north, Pangi, Himachal Pradesh on the east and Marwah-Wadwan on the west. Paddar mines are situated at an altitude of 4326 - 4697 m (14192 - 15411 ft) above mean sea level. Paddar village is now accessible through an all fair weather road 298 km from Jammu to Gulabgarh and onwards, considered as one of the deadliest roads in the world. From Paddar village, there is a steep rise to the sapphire mines. Generally, the temperature at Paddar mines remains minus 2-10 degree C even during the day time. During the remaining period, the area remains snow bound and inaccessible.



A Panoramic view of Paddar Mountains

*\*The author HL Mahajan is an alumni of IIT-BHU, year 1963. He served in J&K state for nearly 14 years and thereafter in Bharat Aluminium Co Ltd (a GOI Enterprise) for nearly 25 years. He is presently settled in Pune (Maharashtra).*

There are endless stories about the discovery of Sapphire in Paddar.

According to one story, Maharaja Gulab Singh, the founder of the Royal Dogra Dynasty of the princely state of Jammu & Kashmir, had a penchant for conquests. Having conquered many adjoining areas around Jammu, his sights were set on Ladakh and Tibet. To this end, he raised an army of more than 5,000 soldiers, gave them rigorous training under his very able and legendary General Zorawar Singh and marched them to conquer Ladakh and Tibet. The shortest route to Ladakh from Jammu at that time was through extremely difficult and rugged terrain via Omasi la (Dharlang) mountain pass from Kishtwar side, at an altitude of over 5434 m (17,770 ft). Since there was no road from Jammu towards this area in those days, it took months of very hectic travel through hills for General Zorawar Singh's army to reach Paddar. During his halt at Paddar village, the General was told by the local villagers regarding the presence of some light - emitting shining blue stones in the area. The villagers also told that traders from Udhampur (Jammu) used to bring salt for them on ponies and bartered it for these stones in exchange. Zorawar Singh is said to have collected some 2-3 kgs of sapphire pieces for presenting them to the Maharaja. Thus these gems emerged from their inconspicuous existence and attained prominence of their own. There is however, no confirmation of this story from texts.

Another story is that in 1881-82 there was a huge landslide of the Zanskar Mountains adjoining Paddar, which laid bare the rocks beneath the soil and disclosed the presence of the gems. A local hunter of Sumcham Village, near Paddar, picked up some of these gems and sold them to some traders from Lahaul, who later sold them in Shimla @ 1 rupee per seer (approx. 0.933 Kg), considered a good price at that time.

It was during the regime of Gulab Singh's successor, Maharaja Ranbir Singh's time that some sort of digging / mining of sapphire was started at Paddar. In 1882, the Maharaja stationed his troops in the area to prevent theft of sapphire. It is said that 72,207 tolas (1 tola = 11.66 gm) of sapphire worth 4 lakh rupees was mined during 1882-83. It is reported that during those days, Sapphire pieces as big as 3 inches x 6 inches were mined out which earned name and fame for Paddar sapphires. By the end of 1887, the revenue from Paddar started waning.

Taking serious note of it, help was sought by the Maharaja from the then British Government. The British Sarkar deputed an expert Geologist Mr Tom D. La Touche to J&K. The Geologist explored the area for over two months from July 1888 and put forth a suggestion to carry out organized mining of sapphire in Paddar area. According to La Touche's report, in 1887 a big sapphire weighing 6 oz (170 gm / 850

carats) was found. Somewhat regular mining of sapphire commenced thereafter.

In 1909, a department of Mining was established by the J&K Government, which was later named as Jammu & Kashmir Minerals Limited (in short JKML). JKML commenced underground mining operations at the world's highest altitude. The working season of these mines used to be only about 2 months from 1<sup>st</sup> July to maximum September 15, while the entire area remains snow clad during the remaining period.

It was in 1974-75, that the author, then an employee of JKML was assigned the job of mechanization of drilling operations at Paddar Mines. It required an air compressor to be specially designed and fabricated so that the parts could somehow be carried on ponies in knocked down condition from road head (Kishtwar) to Paddar and then reassembled over there. Other than Helicopters, ponies were the only means of carrying materials over such extremely difficult and arduous bridle / foot path climbing to heights of above 15000 ft (4572 m).

Extraction of Sapphire from Paddar mines varied very widely in each season depending upon various factors. During some seasons, extraction was 2,00,000 gm (1,000,000 carats) or even more.

As regards the quality and popularity of Kashmir sapphire in the world, following instances speak for themselves:

- i) On 19-05-2004, a single Kashmir sapphire was sold for US\$ 1.5 Million at Geneva Auction.
- ii) In November 2008, a 42.28 carat (1 carat = 0.2 g) cushion-cut Kashmir sapphire and diamond ring (Fig: A) was sold for US\$3,458,420 at Christie's Geneva auction.



Fig:A



Fig:B

- iii) In November 2013, a pair of Kashmir Sapphires weighing 26.66 carat and 20.88 carat, considered to be 'the Finest sapphire' of Kashmir (Fig C) at Southeby's Geneva Auction, was priced at US\$ 8,358,520.



Fig C

- v) In April 2014 a 28.18 carat Kashmir sapphire and diamond ring (Fig: B) was sold for US\$ 5,093,000 at Southeby's New York Auction



Fig D

- v) In May 2015, an exceptional 35.09 carat Kashmir blue sapphire ring (Fig D) was sold at Christie's Geneva sale for US\$ 7,357,999 to an Asian buyer. Fig D
- v) In November 2018, a superb sapphire and diamond necklace, known as 'Peacock necklace' 109.08 carat set with 21 top quality Kashmir Royal blue sapphires, 39.5 cm in length, (Fig E) was sold at Christie's 'Hong Kong Magnificent Jewels Auction' for a whopping HK \$ 116.5m ( US\$ 14.9m), equivalent to **Rs 112.522 Crores** ( at the present rate of Rs 75 per US \$), a world auction record.



Fig E

The list of such sales of Kashmir Sapphires at international auctions is endless.

According to the National Remote Sensing Agency, Hyderabad, which conducted a satellite survey, this area contains sapphire reserves worth Rupees hundreds of crores.

The J&K Minerals Limited, in the absence of detailed exploration and lack of resources and infrastructure, has only been carrying out screening of old dumps and mining operations up to a shallow depth.

The Company on 31 March 2018, selected a private party as a joint venture partner to carry out exploration and exploitation of Sapphire. The party has not yet started any operations.

The author is of the opinion that if extraction of sapphire at Paddar is carried out in a scientific and professional manner with proper exploration and requisite infrastructure, it can be a billion dollar industry, a treasure house for the country.

### References

1. Notice dated 09 8 2005 by JKML Expression of Interest for Exploration & Exploitation of Sapphire Mines in Jammu and Kashmir (India) through Joint Venture.
2. 'Sapphires of Paddar' published in Greater Kashmir Newspaper dated Srinagar, Feb 04, 2019
3. GemPundit.com Kashmir Sapphire
4. Astteria Magazine
5. The Value, 29 Nov 2018, 'World's Most Expensive Kashmir sapphire Necklace'
6. Paddarmachail.com. ' Paddar Sapphire Mines; A Million Dollar Industry' , by Ashish Chauhan dated Jan 18.2020
7. The Natural Sapphire Company news dated Feb 27, 2015
8. Pala International, La Touche's Report dated May 2, 1890
9. Journal. HARUNI.com, news bulletin '16 Record Breaking Sapphires sold at Auction Houses'
10. Expression of Interest ( EOI) dated April 4, 2013 by JKML to appoint a Joint venture partner for Exploration and exploitation of Sapphire from Paddar.

**(Arranged by Prof B.B. Dhar,  
Council Member (Nominated) MEAI)**

## NACRI MEETING HELD AT HOASPETE

NACRI Meeting was held on 19-12-2022 at Hosapete, Karnataka. The Bellary-Hospet Chapter provided the hospitality.

The meeting was attended by 8 members viz. Mr K. Madhusudhana, President – MEAI & Co-Chair - NACRI, Dr. P.V. Rao, Co-Chair – NACRI, Dr. A. Srikant – Member, Mr Shameek Chattopadhyay – Member, Mr. T. Rajasekar – Member, Mr. Kuldeep Singh Solanki – Member, Dr TN Venugopal – Member, and Mr M. Narsaiah, Secretary General – MEAI.

The following members expressed their inability to attend the meeting viz. Mr T Victor, Mr TN Gunaseelan, Dr Abani Samal, Mr Pankaj Satija, Dr AK Sarangi. Owing to health reasons Mr N Rajendran cancelled his visit at the last moment.

### The Agenda of the meeting included:

- To update: CRIRSCO developments by NACRI Co-Chairs
- To decide: Dates and Venue for organising in-person IMIC PDP in April 2023
- To deliberate: 7 years on - Relevance of NACRI in India!
- To discuss: Strategies for promoting IMIC (Indian Mineral Industry Code for reporting Mineral Resources and Mineral Reserves in India) as the official Reporting standard for Exploration Results, Mineral Resources and Mineral Reserves in India
- To finalise: Revision of IMIC in line with CRIRSCO International Template
- To review members contribution and decide: Add/ Remove members from NACRI
- To present: MEAI-NCC Account - by Secretary General, MEAI
- Any other points of relevance to NACRI: To create separate positions of NACRI Co-Chairs (2) and NACRI Reps (2) on CRIRSCO to ensure improved functionality

The NACRI members deliberated all the points mentioned above in detail and the decisions taken in the meeting will be circulated to the members.



*NACRI meeting in progress*



*NACRI members at the statue of self-uncovering*

The NACRI members passionately wish to acknowledge the MEAI president Mr K Madhusudhana, the B-H Chapter Chairman Mr K Prabhakara Reddy and his team for hosting the meeting and extending hospitality generously to NACRI members.

# MINING ENGINEERS' ASSOCIATION OF INDIA

## MEAI TECH SERIES– November 2022 - (MTS-5)

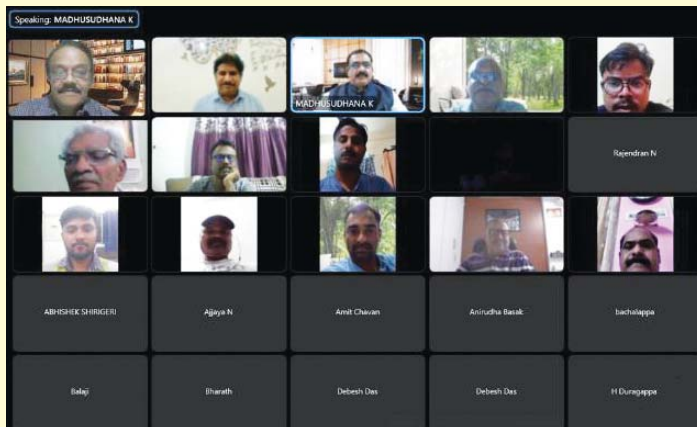
Topic: State of Ground Stress, It's Use and Measurement in Rock Engineering

The Fifth exposition at MEAI Tech Series was conducted on 26<sup>th</sup> November 2022 (Saturday) at 06:30 PM Online on WebEx platform.

After a warm welcome by the Chairman, TDPC, Sri Deepak Vidyarthi, the President MEAI, Sri K. Madhusudhana highlighted on the genesis of MEAI TECH SERIES that takes its roots from DUI Series of Kolar Gold Fields and extended a hearty welcome to the Speaker Dr D.S. Subrahmanyam, HOD, Geotechnical Engineering Division, NIRM, Bangalore.

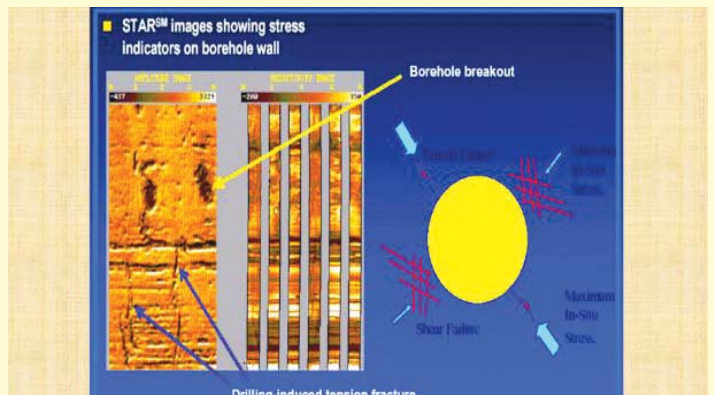
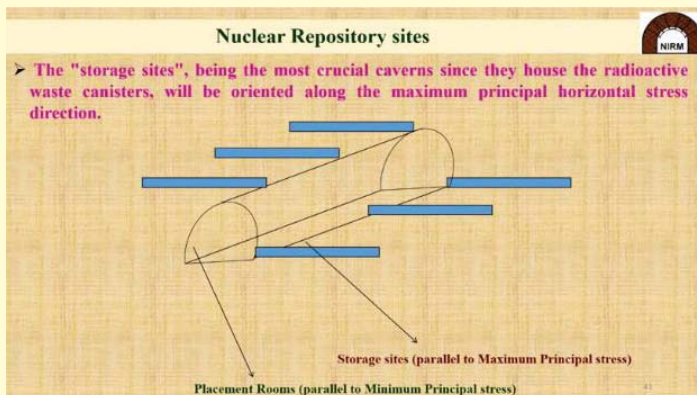
Dr Subrahmanyam emphasised on the State of Ground Stress, its use and measurement in Rock Engineering, explained what is in-situ Stress, forces acting on a unit area of Rock, laid emphasis on the in-situ stress parameters besides the origin of stress parameters!

With a very interactive session, the presentation concluded with thanks to the speaker for wonderful technical exposition. Sri TR Rajasekhar, (Consultant) proposed a Vote of Thanks!



### Origin of stress parameters

- The weight of the overlying rock mass was recognized for more than a century as a primary source of stress around underground openings.
- Heim (1878) postulated that the rocks in the earth crust are in the state of hydrostatic stress, similar to the stress state in liquids.
- This theory was later modified as Lithostatic stress field theory which assumes rock in the crust are in the state of isotropic state .  $\sigma_H = \sigma_h = \sigma_v$



## OBITUARY



**Shri Vinay Chand Shree  
Shreemal**  
LM/ 3404  
Rajasthan - Jaipur Chapter  
20/11/1941 - 10/12/2022

Shri VCS Shreemal, Charter member and founder Chairman of Rajasthan Chapter-Jaipur left for heavenly abode on 10<sup>th</sup> December 2022 at the age of 81.

He graduated in Mining Engineering in the year 1964 from Jodhpur University (MBM Engineering College) and went on to obtain FCC in Coal as well as Metal. From 1964 to 1973, he served in Jhagrakhard Collieries as District Manager and Safety Officer. From 1973 to 1977, he worked with Rajasthan State Industrial and Mineral Development Corporation as Manager.

Shri Shree Shreemal then joined Golcha group in 1977 and rose to General Manager's position. From 1995 to 2005, he was with Associated Golcha Group as General Manager. Post retirement, he was associated with many social groups.

In 2010, Shri Shree Shreemal joined the Mining Engineers' Association of India as amongst the founder members of Rajasthan Chapter- Jaipur and became the First Chairman of the new Chapter.

A humble human and dedicated Mining Engineer, he is, and will be fondly remembered by one and all, who came in his contact.

Shri VCS Shreemal is survived by his wife, son, daughter and the whole family. MEAI members pray to the almighty to grant eternal peace to the departed soul and express their profound condolences to the bereaved family.

## OBITUARY

**Shri. Mahajan S C**  
LM no. 468  
Himalayan Chapter  
05-12-2022

Shri Subhash Mahajan, Retd Geologist, State Geological Wing, Dept. Of Industry, Govt of Himachal Pradesh left for heavenly abode on 5<sup>th</sup> December 2022. He served the department in different capacities and retired from service in the year 2000 after serving more than 30 years. He was then based at his hometown Kangra.

On behalf of the Himalayan Chapter, the members of MEAI pay their deep condolences to the bereaved family and pray for the departed soul to rest in peace.

## LETTER TO THE EDITOR, MEJ

**By P.K. Govindaswamy**  
LM/628 /Tamilnadu Chapter

Dear Editor Dr. P.V. Rao

"How could anybody overlook this fundamental fact that sustenance of our civilization is largely, if not entirely, contingent on the usage of minerals & metals? The minerals and metals form the core of all the present and future technologies, in one form or the other, and extracting them by scientific methods for the benefit of society has to continue" (ref your Editorial -MEJ December 2022)".

How true! Yes, without essential minerals and metals there would be no homes, offices, factories, roads, rails, bridges, cars, trucks, planes, ships, dams, or waterways. In fact, no commerce or business can exist. Everything we depend on is either made from minerals for their production & distribution. These being indisputable facts, how come the mining community responsible for producing the essential mineral and metals has not yet been accorded the honor it rightly deserves?

To elaborate on this point, let us make an analogy—A forest officer—IFS cadre—takes care of Forest like conservation, protection, etc. confronting predictable and unpredictable situations and in return for that service he enjoys all the perks and prestige the IFS post entails, so do Mining Engineer takes care of mines confronting mostly unpredictable risky forces of Nature and what does he get in return?? The burden of qualifications and exams, needless to elaborate, is much heavier for a Mine Manager than that for an IFS Officer. Why not recognize our service at par with other All India Services, the Indian Mining Service (IMS)?

As you are aware in India as well as globally, fewer and fewer students are opting for a Mining career, rightly so, when there are jobs available with the least risk and relatively large perks, job security especially in Govt. services/IT-related industrial sectors – the irony of the situation is all these jobs /services cannot exist without the silent Mining community who sadly like Titan Atlas shouldering the World.

In order to meet the GNP target of 3% fixed for the Mining sector by NITI Aayog, it is imperative that the right talents also required to be inducted into the Mining sector, therefore, a comprehensive reformation with a view to making the Mining profession attractive has to be taken up to the Powers that be. Hope MEAI would ponder over these random thoughts and initiate appropriate steps so that Mining Community services are validated accordingly.

What is implied here by recognition is according due respect to the Mining professional services as important as other All India Services – debatable agree, but let us start somewhere— if that is not feasible for whatever reasons, officially recognize the value of services and extend some concession similar to that given to Armed Forces (check Googles—Concessions to Armed forces in India) just an example.

Maybe a Joint Committee of experts under the guidance of MEAI/FIMI to be formed to thoroughly study the issues raised above and recommend suitable steps to appropriate decision-making Authorities – a long shot yet worth doing for the overall healthy growth of the Mining Industry.

Regards



## MEAI NEWS

### BHUBANESWAR CHAPTER

#### Knowledge Sharing Session: Mining 4.0

The Bhubaneswar Chapter had organized a “Knowledge Sharing Session” on 23<sup>rd</sup> Nov’ 22 at Chrome Valley Club, Sukinda Chromite Mine of Tata Steel Mining Limited in physical mode. Office bearers of the Chapter, Shri Pankaj Satija (Chairman) & MD, TSML, Shri Sudhanshu Patni (Vice Chairman) & VP, IMFA and Shri Shambhu Nath Jha (Secretary) had graced the occasion. Various other members of the mining fraternity of Sukinda Valley attended the session in person.



The session started with auspicious lamp lighting by the dignitaries followed by the welcome address of Shri. Shambhu Nath Jha (Secretary) in which he welcomed all the participants that attended the event. He also thanked various speakers for sharing their technical expertise in the event.



Welcome Address by Shri. Shambhu Nath Jha

Four technical presentations on the following topics were presented by officials from M/s Dassault Systems, M/s Kennametal India Ltd, M/s PRDRIGS, and M/s IDL Explosive Ltd.



Shri. Sudhanshu Patni addressing the session

Speaking on the occasion, Shri Sudhanshu Patni (Vice Chairman) had emphasized on the importance of welcoming peoples with new ideas & thoughts for adopting best practices in mining operations. He also talked about new challenges in the mining industry like privatization, globalization. He had briefed about some of the technologies and automation used in mining operations. He also talked about commodity market challenges, optimization of resources and optimization of equipment. He also appreciated MEAI for its approach in providing opportunities to professionals in their career growth through frequent technical sessions and seminars to remain updated on current issues and concerns of the industry and different approaches to manage them.



Presentation by Mr. Amjath Basha, M/S Dassault Systems.

#### **Presenter 1: M/s Dassault Systems. Mr. Amjath Basha (M/S Dassault Systems.)**

He had shared his views on some of the Upstream and Downstream Mining Business Challenges Like Energy Efficiency and Geological Resources.

He emphasized on one of the best Digital practices, Automation in Mine & its effectiveness.



Presentation by Mr. Sushil Kumar, M/S Kennametal.

**Presenter 2: M/S Kennametal India Ltd.  
Mr. Sushil Kumar.**

He had presented on some of the standard approaches like solution of customer challenges in metal cutting technology and infrastructure business.

He had stressed upon use of technologies opted for upkeep of mining practices. He had stressed upon use of swing hammers, electric excavators, advance wear components etc.



Presentation by Mr. Mithunraj Paranthaman, M/S PRDRIGS

**Presenter 3: M/S PRDRIGS.  
Mr. Mithunraj Paranthaman**

He had presented on some of the standard approaches about process change technologies and automation in minerals and metal mining.

He had shared his views on some of the mining blast hole drills, drilling rigs line up, open pit mine, surface exploration, blasting in mine etc.



Presentation by Mr. Sudip Chakrawarty, M/S IDL Explosive Ltd.

**Presenter 4: M/S IDL Explosives Ltd.  
Mr. Sudip Chakrawarty**

He had shared his views on some of the explosive manufacturer facilities, bottom line blasting, delay initiators, detonator safety features, electronic long delay detonator, electronic short delay detonator etc.



Shri. Pankaj Satija addressing the session

Speaking on the occasion, Shri. Pankaj Satija (Chairman of MEAI) had stressed on the importance of knowledge sharing sessions for benefit at individual and industry level by learning and sharing newer things by interacting in groups. He had shared his views on some of the issues influencing the Mining industry such as sustainable mining, CSR, high bid premium, cost and efficiency, liquidity in auction mine, health index of mining areas and per capita CO2 emission in Odisha. He shared some upcoming best practices through digitalization & automation in the Mining industry.



Vote of Thanks by Shri Naveen Shrivastava

The event ended with the vote of thanks by Shri Naveen Shrivastava, AGM-Mining, Tata Steel Mining Limited.

**OBITUARY**



**Shri. M. Satyanarayana**  
LM no. 2049  
Visakhapatnam Chapter  
01-07-1943 - 11-09-2022

Shri. M. Satyanarayana, Mine Owner, Dwaraka Tirumala, West Godavari, A.P. was graduated with Diploma in Mining Engineering. He worked in different Mines of A.P.M.D.C. Ltd for about 15 years and managed his Own Mine & Ceramic Unit.

The members of MEAI pray for the departed soul to rest in peace and express their profound condolences to the bereaved family members.

## MEGECON – 2022

### MEAI All India Geologists' Conference

MEAI – All India Geologists' conference was organized on 20<sup>th</sup> & 21<sup>st</sup> of December 2022. The conference was organized by the Bellary-Hospet Chapter to bring together all the eminent geologists working with the mineral industry and academic world from across our country to discuss and share new developments and recent innovations in the field of Geosciences.

The conference was inaugurated by the Chief Guest Shri. Debkumar Bhattacharya (Deputy Director General, GSI). Dr. Yogesh G Kale (Controller of Mines, IBM) and Dr. PV Rao (Co-Chair, NACRI & Editor – MEJ) were the Guests of honour for the conference. The event was presided over by Shri. K Madhusudhana (President – MEAI & CEO, MSPL limited). Shri. K Prabhakara Reddy, Chapter Chairman and Shri. SHM Mallikarjuna, Secretary of the Chapter, were present during the inaugural function. In the inaugural function, 5 geologists (above 80 years of age) viz. Shri. DA Hiremath, Shri. C Sreenivasaiah, Shri. KS Parameswaraiah, Dr. SK Sarangi and Shri. YL Patil were felicitated to recognise their noteworthy contribution in the field of Geology. Owing to personal reasons, Shri BK Mohanty and Shri. AK Bhandary, who were also to be felicitated, could not attend the conference. However, the President informed that the felicitation will be done at their residence by the members of the respective Chapters. The senior Geologists after being felicitated expressed their appreciation and thanks to the leadership of BH Chapter and the MEAI President Shri. K Madhusudhana for organizing such a memorable event & recognizing the services rendered by them in the field of Geology.

Geologists, Mining Engineers & other senior delegates from various parts of the country participated in this conference. In this conference, 16 technical papers were presented, which include key areas & subjects like need for adopting International Exploration Standards and public reporting of Mineral Resources and Mineral Reserves, Application of Drones in mining sector, Economic aspects of planning exploration programmes, Mineral auction scenario in India, Issues & concerns in the preparation of Mining plan from Industry perspective, Automation in thin section petrography & automated mineralogy and various case studies, Consideration of ESG aspects in the reporting of Mineral Resources etc. A musical concert was organized on 20<sup>th</sup> evening for the entertainment of the delegates followed by the Dinner.

10 stalls were put up, represented by different companies, promoting their modules, services & latest technologies related to both geology & mining. Nearly 300 delegates participated in this conference from various parts of the

country, which includes delegates Singareni collieries Company Limited, Hindustan Zinc limited, Gujarat Mineral Development Corporation Limited, Penna Cements, JK Lakshmi Cements, My Home cements, Hutti Gold Mines etc. The representatives from KIOCL, KSMCL, NMDC & Dept. of Mines & Geology, Karnataka also participated in the conference. Deputy Director Shri. MC Kumar (Dept. of Mines & Geology, Vijayanagara), Senior Geologist Shri. Chandrashekar Hiremani (Dept. of Mines & Geology, Ballari) and Shri. Omkesh Murthy, IBM witnessed the second day sessions and appreciated the efforts of the Association and suggested to organize such conferences in future for the benefit of the professionals and the mineral industry. The conference was also witnessed by the NACRI members Shri. Kuldeep Singh Solanki, Dr. A Srikant, Shri. TR Rajasekhar, Shri. Shameek Chattopadhyay, and Dr. TN Venugopal & Prof. Bhabesh C Sarkar. The members cherished the systematic arrangements made during the conference and the hospitality extended throughout their stay.

The Valedictory function was organized on the second day. Shri Chandrashekar Hiremani, Dr. Meda Venkataiah, Shri. M. Narsaiah were the guests for the function. All the guests appreciated the efforts of the Association in organizing the conference. They also expressed the importance and need of holding such conferences. These kinds of conferences will surely open up new horizons for the torchbearers in the field of geology. The MEAI President & the Chapter Chairman appreciated & thanked all the guests, delegates, sponsors etc., for their active participation and valuable contribution in organizing and making the conference a grand success.

Shri. Sudhir Y Wakhale from Chowgale expressed his views about the conference. He mentioned the efforts of the MEAI President & BH Chapter members for organizing the event systematically without any issues. Shri. Sitaram K from SKMEPL expressed that the conference was a grand success and it helped a lot of young geologists. Shri. U Vishwanath from MinTech solutions appreciated the idea of felicitating senior professionals and the selection of papers for presentation, which were very appropriate & need of the hour. The Vote of thanks was proposed by Shri. SHM Mallikarjuna (Secretary, BH Chapter) & the programme was anchored by Shri. Sumanth Bennihalli (Deputy Manager, SMIOR).



*Lighting the lamp by the dignitaries*



Dignitaries on the dais in the valedictory function



Felicitation of Shri. KS Parameswarai



Felicitation of Shri. DA Hiremath



Felicitation of Shri. C Sreenivasaiah



Felicitation of Dr. SK Sarangi



A view of the delegates participating in the Conference



Conference group photograph of some delegates

## 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](mailto:editormejmeai@gmail.com) by 20<sup>th</sup> of the current month. If more than three members responded with the correct answers, then the three winners will be decided by draw. Each winner will be issued a certificate of merit and a nominal cash prize of Rs 500.

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

### Questions based on MEJ December 2022 issue

- 1. Which Chapter of MEAI celebrated its Silver Jubilee year in November 2022?**  
(a) Bellary-Hospet Chapter (b) Barajamda Chapter  
(c) Bangalore Chapter (d) Belgaum Chapter
- 2. Who became the latest Life Institutional Member of MEAI?**  
(a) Sangam University (b) Skylark Drones Pvt. Ltd.  
(c) Gravitas Infra Equipment Pvt. Ltd. (d) Malla Reddy Engineering College
- 3. Which President of MEAI started the Indian Mining Day?**  
(a) Mr TV Chowdary (b) Mr T Victor  
(c) Mr A Bagchhi (d) Mr Arun Kothari
- 4. Who delivered the talk on Technology Vision for Sustainable Mining during Indian Mining Day?**  
(a) Prof K Ram Chandar (b) Prof Dheeraj kumar  
(c) Prof BB Dhar (d) Prof BC Sarkar
- 5. Which Chapter celebrated the Indian Mining Day at Jhamarkotra Mines?**  
(a) Rajasthan Chapter-Jaipur (b) Rajasthan Chapter-Jodhpur  
(c) Rajasthan Chapter-Udaipur (d) Ahmedabad Chapter

## WINNERS OF RIDDLES PUBLISHED IN THE MEJ DECEMBER 2022 ISSUE

*Congratulations to proud winners*

**Mr Satish Verma**

Group Operations Manager, RioZim, Zimbabwe  
E-mail: [satishverma29@gmail.com](mailto:satishverma29@gmail.com)

**Prof. D.P. Tripathy**

National Institute of Technology, Rourkela  
E-mail: [debi\\_tripathy@yahoo.co.in](mailto:debi_tripathy@yahoo.co.in)

**Mr Shisir Kumar Sahoo**

E-mail: [shisir.mn@gmail.com](mailto:shisir.mn@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](mailto:meai1957@gmail.com) or Mob. 9177045204.

# CONFERENCES, SEMINARS, WORKSHOPS ETC.

## INDIA

**24-28 Apr 2023: MEAI-IMIC Training program (in person) by NACRI. A Mandatory training program for registration of Competent Person under IMIC.** Location: MEAI Headquarters Auditorium, Hyderabad. For more details, please contact: Secretary General, MEAI. Mob: 9177045204/ 7382087618. Email: meai1957@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

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

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

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

**6-9 Feb 2023: Investing in African Mining Indaba 2023.** Succeeding for over 28 years, Mining Indaba has a unique and widening perspective of the African mining industry, bringing together visionaries and innovators from across the spectrum. CTICC, Cape Town, South Africa

**26 Feb - 1 Mar 2023: MINEXCHANGE 2023 SME Annual Conference & Expo.** Join industry professionals focused on ESG, new safety strategies, exciting advances in AI, and important initiatives for a sustainable future. Colorado Convention Center, 700 14<sup>th</sup> St., Denver, Colorado, 80202, United States

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

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

**5-8 Mar 2023: PDAC 2023.** The annual PDAC 2023 Convention – the world's premier mineral exploration and mining con-

vention. Metro Toronto Convention Centre, 222 Bremner Blvd., Toronto, Ontario, M5V 3M9, Canada

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

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

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

**4-5 May 2023: 17 International Conference on Mining Technology and Exploration (ICMTE 2023).** Amsterdam, Netherlands. Web: <https://waset.org/mining-technology-and-exploration-conference>

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

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

**26-29 Jun 2023: 26<sup>th</sup> World Mining Congress.** Resourcing Tomorrow-Creating Value for Society. Brisbane, Queensland, Australia. Contact: Kristina Liska, Event and Registration Coordinator at [registration@wmc2023.org](mailto:registration@wmc2023.org)

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

**25 - 28 October 2023: China Coal & Mining Expo 2023.** China's 20<sup>th</sup> 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

**28-29 Oct 2023: International Conference on Mining Technology and Exploration (ICMTE 2023).** Paris, France. Web: <https://waset.org/mining-technology-and-exploration-conference-in-october-2023-in-paris>

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Our founder Abheraj Baldota's core operating principle was 'I am not the owner of wealth, but a privileged trustee to serve the community with it'. Thus it is no surprise that ESG practices are ingrained in our corporate ethos, business strategy and operations since our birth in 1961.

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

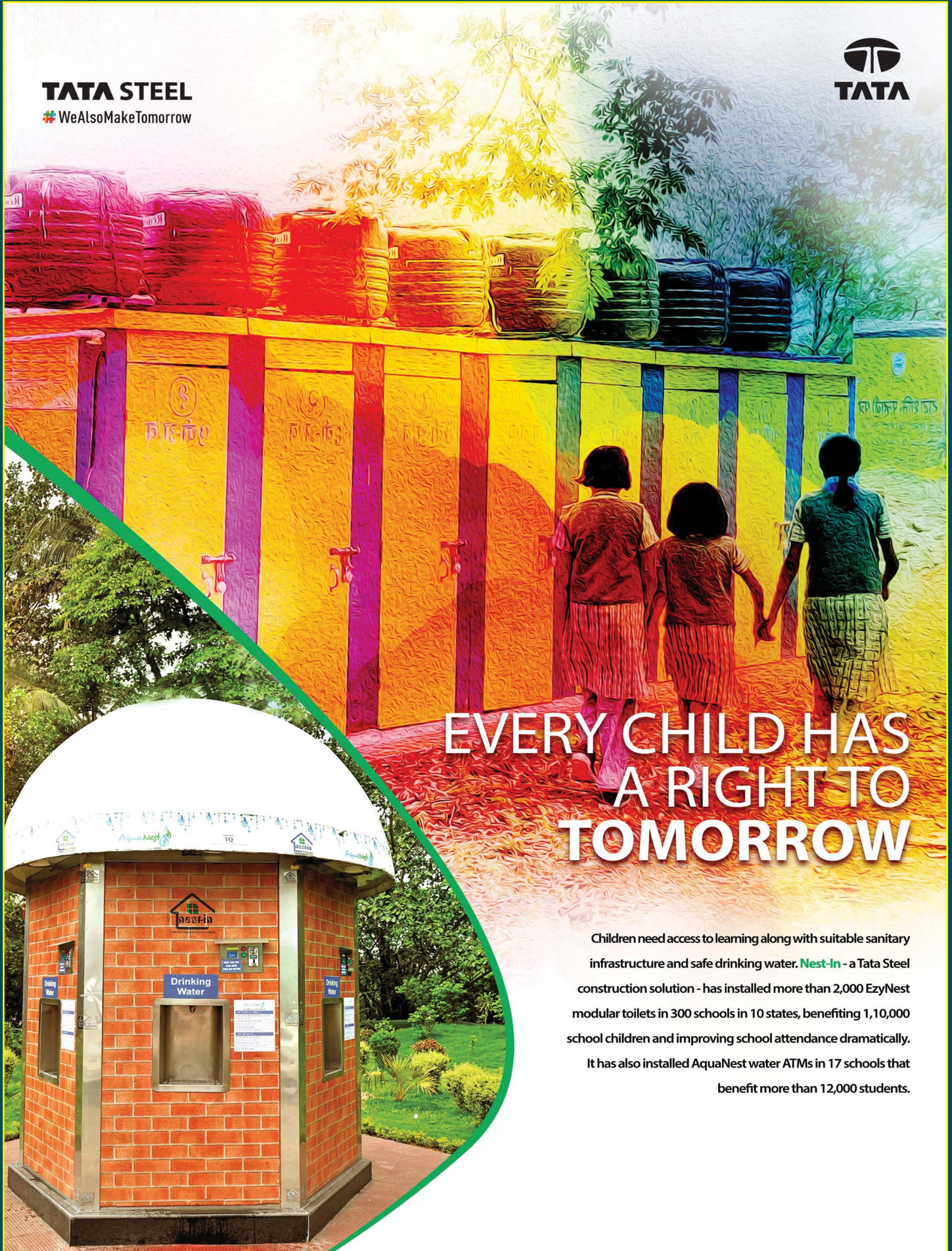


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