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July - 2022



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Correspondence Address

MEAI National Headquarters

Contact: **Secretary General,**

Mining Engineers' Association of India

F-608 & 609, Raghavaratna Towers, 'A' Block, VI Floor,
Chirag Ali Lane, Abids, Hyderabad - 500 001.

Ph.: 040-66339625, 23200510

E-mail : meai1957@gmail.com

website : www.meai.org

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President's Message.....

Dear Members,

Greetings...

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

The Ahmedabad chapter held its silver jubilee Celebrations on 14.6.2022 focusing on unearthing the minerals treasures of Gujarat. The Government and mining industry stakeholders attended the Seminar and **B.K. Antia Memorial Lecture on "Recent advancements in the mining industry and their influence on environment and economy"**. The chief guest, Dr. D K Sinha, Director, Atomic Minerals Directorate inaugurated the Seminar.

The Bellary-Hospet Chapter jointly with the NMDC Limited successfully completed the First and Second Batch First Aid training at NMDC Donimalai Complex and issued First aid Certificates to all the Candidates. Candidates expressed their happiness that they could get certificates immediately after completing the training classes and examination and the training facility was nearer to their work area, which is very useful to pursue their career advancements.

I am happy to share with you that we have inaugurated the MEAI Students Chapter on 17.6.2022 in Bellary-Hospet Chapter circle. It started with 105 students' membership in the Bellary-Hospet Chapter. With this the MEAI has entered into a new era to encourage younger generations and thereby build its future leaders. I also request all the other Chapters Chairmen to seriously explore the possibility of opening Student Chapters in their region.

I attended the Workshop on **Geology, Mining & Mineral Processing prospects** that was conducted on 18.6.2022 at VSKU University Campus, Sandur. It was held jointly by the Bellary-Hospet Chapter & VSKU University, Sandur. Industry persons, students and retired professors participated in this workshop, which was found to be useful in knowledge sharing with the budding geologists and mineral processing engineers.

Four of our Chapters viz. Dhanbad, Goa, Rajasthan Chapter-Jaipur and Jabalpur elected their new Executive Committees. I congratulate all these new Executive Committee Members over their election and urge them to carry forward the good work in their regions.

It gives me pleasure to inform you that Mines Safety Association Karnataka and MEAI are conducting **MSAK Mine Conclave-2022** on 12 & 13 August 2022 at the Indian Institute of Science, Bengaluru. The Rajasthan Chapter-Udaipur & the Hindustan Zinc Ltd., Udaipur are jointly organizing a **National Seminar and Exhibition on "The Role of Innovation and Technology in Turnaround of Mining Industry"** during 26-28 August 2022. I request our members to participate in these programs in large numbers.

Based on the positive feedback received from the industry on our 1st MPDP Program and new requests received from the mineral industry, the MEAI has proposed to organize the **2nd MPDP (MEAI Professional Development Program)** from 9.9.2022 in virtual mode.

I wish all the members a Happy International Day of Yoga to strengthen body, mind and soul for a better & healthy life.

Regards,

K. MADHUSUDHANA
President



Mining Engineers' Association of India

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EDITOR'S DESK



Dr. P.V. Rao
Editor, MEJ

The book *Sustainable Mining in an AI driven world* written by Kash Sirinanda, PhD is now available. In view of the prevalent global mining setup and the topics covered in the book, I felt it opt to introduce its contents concisely for the benefit of our readers. The intended purpose of the book is twofold viz. a) to inspire and to provide a strategic direction for the successful transformation of a mining company towards a future-sustainable artificial intelligence (AI) driven mining company, and b) to encourage people to donate to charity.

This book is aimed at a general mining audience wanting to understand the future of the mining sector. In some of the areas covered in the book, there are mining companies that are leading and some that are falling far behind. In addition, some of the concepts discussed are starting to emerge in the mining sector; others are not. The contents of the book articulate a vision for futuristic mining. They discuss concepts of futuristic mining and operating models, and present compelling arguments about where the industry should be heading in terms of AI and sustainability.

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Dr. PV Rao
Off. : +91 (040) 23200510
Cell: +91 96180 91039
Email: editor.mej.meai@gmail.com

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1. Subscription for 1 Year	Rs. 1000/-	US\$120
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The book highlights how a mining company can thrive *AI and sustainable business models* in all the complex scenarios and highly volatile markets. *are rapidly becoming the new norm in the mining sector.*

It was written at a level to ensure that anyone in the mining industry or new to mining industry can easily follow the content, from university students to senior executives and people transitioning from operational roles to technology roles in mining. Technology is changing at an ever-increasing pace, so some new technologies will be emerging, and some may become obsolete. The book also highlights how technology and innovation will revolutionize the world of mining in the coming years.

It should be emphasized that each and every individual who works in this industry needs to make this futuristic mining journey happen. The author hopes that the ideas put forward will inspire members of the mining industry to think differently and to define, deploy and transform a particular mining company. AI and sustainable business models are rapidly becoming the new norm in the mining sector. Industries that do not constantly learn and adapt will fall behind and miss important commercial opportunities. Over time, this translates into missed profits and threats to company survival.

The book has been organized in three parts viz. 1. Futuristic mining organisation, 2. Technology evolving in mining, and 3. A sustainable mine starts here. Futuristic mining organisation deals with sections on modern mining philosophy, futuristic mining DNA, mining vs tech company, futuristic mining CXOs, diversity in mining. Technology evolving in mining deals with sections on road to mining in 2050 and beyond, the futuristic mining ecosystem, how to win at AI transformation in mining, mining start-ups, and exploration. A sustainable mine starts here deals with sections on mining and the UN Sustainable Development Goals, circular economy, renewables in mining, climate change aspects and mining, need for smart mining communities, and the need for smart mining communities.

The author is a futurist, an engineer, a mathematician, a consultant and a serial entrepreneur. He is the founder of Mine Connector, Mine Mutual, Elite Futurists and cofounder of MineCare. He has a doctorate in mine planning and optimization from the University of Melbourne, Australia. During his PhD studies and postdoctoral work at the university, he developed algorithms for generating designs that maximize the net present value (NPV) of a mining operation. That work provides the basis for software that assists mine planners to design mines that are more profitable. He was also a visiting scholar at the Colorado School of Mines in the United States.

He has been working on various mining projects, which include due diligence, operation, analytics, optimization, digital, artificial intelligence, and sustainability in different commodities around the globe. He is a keynote speaker and provides mining leaders with strategic direction and visionary leadership. Click on the link to purchase the book: <https://www.amazon.com/Sustainable-mining-AI-driven-world-Sirinanda-ebook/dp/B0B1254CMZ/>.

- Editor



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Registered Office: Prestige Minera, No 6, 3rd Floor, Main Guard Cross Road, Shivaji Nagar, Bangalore 01.
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T +91 80 25550559 / 4169 3666, 4666 **F** + 91 80 4169 1666 **E** info@mineragroup.com **W** www.mineragroup.com

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NEWS FROM THE MINING WORLD

► **Canada must overcome hurdles in 'urgent' critical minerals push**

The global clean-energy transition offers metals-rich Canada a “generational economic opportunity,” as long as the mining industry can get past some key hurdles, Natural Resources Minister Jonathan Wilkinson said. Wilkinson highlighted Canada’s resource strengths and stability at Monday’s opening ceremonies of the Prospectors & Developers Association of Canada conference.

Canada produces more than 60 minerals and metals, has more than 200 mines and is home to almost half of the world’s publicly listed mining and minerals exploration companies. Notably, he said, the country holds deposits of 31 critical minerals that will be “in greatest demand” as the world shifts to cleaner energy sources.

“There are still some barriers that we need to overcome in Canada if we are to capitalize on these emerging opportunities to capture market share and meet our climate action targets,” he said in a speech. “For example, going forward, it simply cannot be the case that it takes up to 15 years to develop and bring into production a new mine.”

Wilkinson noted “uniquely Canadian challenges in ramping up production” as he underscored the need to develop “end-to-end supply chains” for such key metals. Canada’s government, for its part, has earmarked C\$3.8 billion (\$3 billion) in its federal budget to implement a new critical minerals strategy over eight years. “As we transition to cleaner, mineral intensive forms of energy, democratic countries are going to need access to stable and secure sources of critical minerals,” Wilkinson said. “Clearly, rapid development of these sources is urgently required.”

Bloomberg News | June 13, 2022

► **Gem Diamonds unearths 245-carat stone in Lesotho**

Gem Diamonds (LSE: GEMD) announced on Monday the recovery of an exceptional quality 245 carat white Type II diamond from the Letšeng mine in Lesotho on June 11.

Following the recovery of a 129 carat diamond on 23 May, and a 125 carat diamond on 31 May, the 245 carat diamond represents the third diamond of over 100 carats recovered from the Letšeng mine within the past three weeks. In 2021, Gem Diamonds found only six

diamonds over 100 carats at Letšeng. This compares to 16 rocks of more than 100 carats discovered in 2020.



245-carat stone recovered June 11 at Letšeng

The find comes as prices for small diamonds have jumped about 20% since the start of March, as cutters, polishers and traders struggle to source stones outside Russia. State-owned Alrosa (MCX: ALRS), the world’s top diamond producer by output, was hit with US sanctions following Moscow’s invasion of Ukraine. Since acquiring Letšeng in 2006, Gem Diamonds has found more than 60 white gem quality diamonds over 100 carats each.

Staff Writer | June 13, 2022

► **BHP tests world-first automated shiploaders in the Pilbara**

The world’s biggest miner, BHP (NYSE: BHP), this week began testing two new automated shiploaders at its Port Hedland export facility in Western Australia’s Pilbara.



(Image from BHP)

In what is a world first, 3D laser scan technology has been used in the A\$50 million (\$36m) project, which will fully automate eight shiploaders by 2023. The eight shiploaders – at BHP’s Nelson Point and Finucane Island operations – are responsible for loading about 1500

bulk ore carriers every year, exporting approximately 280 million tonnes of iron ore to global customers in 2021. The project is expected to enable an increase in production of more than one million tonnes each year, through the combination of greater precision, reduced spillage, faster load times, and equipment optimisation, the company said.

“This is an exciting next step in WA Iron Ore’s autonomous journey and is expected to deliver significant safety, production and cost improvements as well as new job and development opportunities for our people,” BHP’s Asset President, WA Iron Ore, Brandon Craig said in the statement. “Automating our shiploaders will improve safety for our people and allow us to load our ships more precisely and efficiently, including through automatic adjustments for weather, hazards and other variable port conditions,” he said.

The shiploaders will transition towards becoming fully automated later this year. Once completed, BHP said the ship loading operations will be operated from the Integrated Remote Operations Centre in Perth.

Staff Writer | June 3, 2022

➔ **More commodity inflation beckons as war boosts coal**

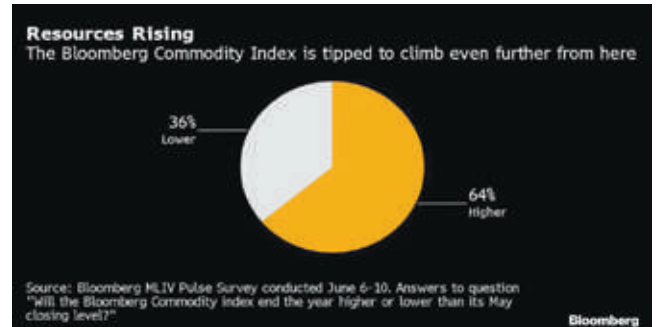
The global commodity business can get a whole lot more expensive — and dirtier, too.

The war and pandemic-fueled shortage of raw materials appear poised to fuel what’s already the biggest surge in commodity prices in decades, according to the latest MLIV Pulse survey conducted June 6-10. At the same time, demand for fossil fuels is only expected to rise as Europe seeks to shift away from Russian energy, dashing any immediate hopes that high prices will foster a shift to cleaner renewable sources.

A continued rise in prices would add to decades-high inflation worldwide, which is threatening to exacerbate hunger and instability in the developing world and slow growth globally as central banks raise interest rates aggressively to tame it. The pressure has increased sharply since the outbreak of the war in Ukraine, which has imperiled its grain exports and caused much of the world to sever economic ties with Russia, a major oil producer. That’s exaggerating supply bottlenecks and shortages that have persisted since the pandemic and driven up the Bloomberg Commodity Index by about 35% this year, putting it on track for the steepest annual advance since 1979.

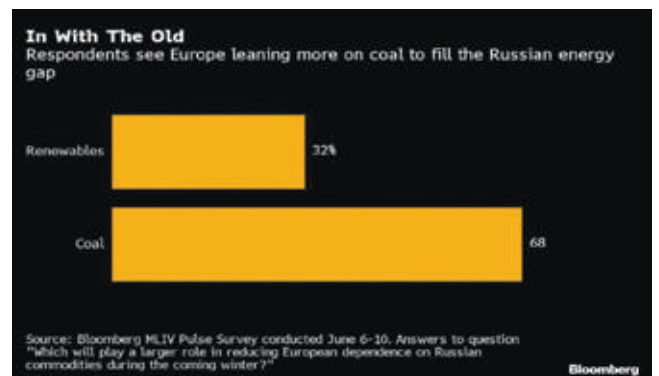
The cost of wheat will keep advancing this year, worsening an increasingly precarious global food situation, even as crude oil pulls back from its elevated

levels, according to the MLIV survey, which was completed by 805 participants. Meanwhile, coal looks set to be Europe’s go-to fuel to make up for Russia-related natural gas shortfalls this winter rather than more renewable sources of power.



“The combination of the war and the supply and demand imbalances that were already in place before the war began, especially in energy, will really push up ag, base metals, precious metals and energy together,” Paul Christopher, head of global market strategy at the Wells Fargo Investment Institute, said on Bloomberg Television. “We favor strongly a broad-based commodity basket there going into the end of the year.”

Europe’s decision to cut back on Russian fuels had been seen as a potential opportunity to shift to cleaner sources of energy, but Bloomberg readers appear doubtful this will happen in the short term. Coal is likely to play a bigger role in filling Europe’s energy gap in the coming winter according to 68% of respondents in the MLIV survey, while just 32% saw renewables leading the way.



While Europe is a leader in the transition to renewables, it will struggle to install wind and solar capacity quickly enough to make up for the Russia shortfall, which is being exacerbated by unforeseen problems with nuclear power generation in France.

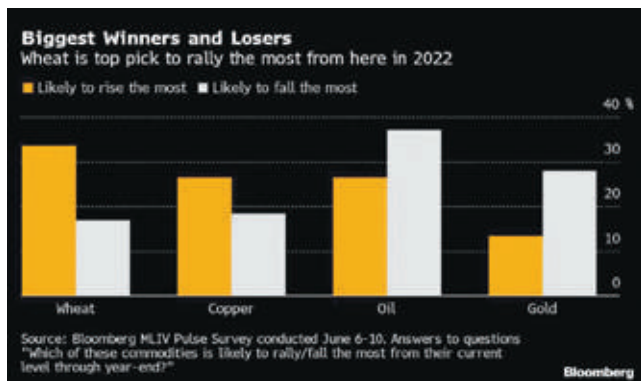
“The reality is they’re going to have to find their energy from someplace, and coal is going to increasingly fill

that gap in certain countries,” said Matthew Sherwood, senior lead commodities analyst at the Economist Intelligence Unit. “The green-energy transition is probably going to be slower even than we were expecting in the developing world.”

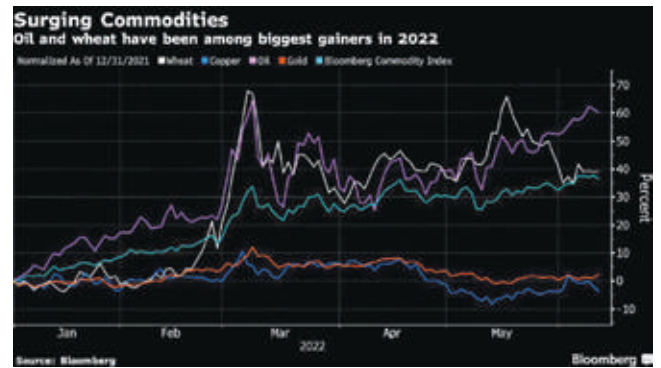
A degree of skepticism about how concertedly the world is actually shifting toward cleaner energy was evident across the survey, with three-quarters of respondents saying that the world has not yet reached peak oil demand. A majority of 57%, meanwhile, said that hydrocarbon producers should be eligible for inclusion in so-called ESG funds that focus on sustainable investments.

Increased demand for oil would also enhance the power of the world’s biggest petroleum exporters, such as Saudi Arabia. Close to four-out-of-five survey respondents believed that the OPEC+ alliance is likely to be a dominant force supporting crude prices for the remainder of 2022. That shift is underscored by the recalibration of the US administration’s stance toward a Saudi regime that President Joe Biden had previously vowed to turn into a “pariah.”

The goals of reducing greenhouse gas emissions and finding fuel to keep the lights on “are definitely in conflict now,” said Andrew Blumenfeld, director of data analytics with market research company McCloskey by Opus.



The MLIV survey shows that 64% expect the Bloomberg Commodity Index will end the year even stronger. Among four key commodities, the biggest proportion of respondents, 34%, thought that wheat would lead the gains. Close to 27% saw copper rallying most, with a similar number picking oil, with gold the laggard around 13%. Around 37% picked oil leading declines, compared with less than 17% for wheat. Crude fell a third day amid a global market selloff as Friday’s shock US inflation data put pressure on the Federal Reserve to tighten further.



The war in Ukraine has disrupted trade in a range of cereals, cooking oils and fertilizers, sparking a record spike in prices and prompting dozens of nations, including India, to respond with food-export restrictions. This could have a domino effect that aggravates shortages in net food importers, which in turn could provide a catalyst for the types of civil unrest sparked by the 2007-2008 global food crisis.

Upward pressure on food costs is “unlikely to abate in the short term,” and that probably will have social repercussions around the world, Massimiliano Bondurri, chief executive officer of SGMC Capital, said on Bloomberg Television. And while he is skeptical that resource markets will witness a big rally much beyond current levels, “commodities are very likely to remain supported.”



Even if raw material prices don’t climb further from here, though, most poll respondents expect inflation to remain above central bank targets. That suggests that readers see spiraling price pressures becoming more entrenched in other parts of the economy. That’s evident in the world’s largest economy, with new figures last week showing US consumer-price inflation unexpectedly accelerating to 8.6%.

“We’re planning for continued inflation for the foreseeable future,” Nick Hampton, chief executive

officer of London-based food-ingredient manufacturer Tate & Lyle Plc, said on Bloomberg Television. “We’re managing our business assuming inflation will continue and it’s very difficult to predict precisely how long it’s going to go on because things are evolving so rapidly at the moment.”

Bloomberg News | June 13, 2022

➔ **Anti-deep sea mining rally held on Ocean’s Day**



Image from DeepGreen Metals

A deep-sea mining pilot expected to occur later this year 1,300 nautical miles southwest of San Diego, California was the subject of a rally in Vancouver Wednesday. Wednesday was Oceans Day, and one of the companies blazing a path in the new frontier of deep ocean mining – The Metals Company (Nasdaq:TMC) — is incorporated in the Cayman Islands but headquartered in Vancouver.

Two of its early investors are from Vancouver — mining mogul Frank Giustra and Brian Paes-Braga, founder of Lithium-X (TSX-V:LIX), which he sold in 2018 for C\$265 million (\$209m). The Metals Company was formed last year through a C\$2.9 billion (\$2.29bn) merger between Vancouver’s DeepGreen Metals with a special-purpose acquisitions company, Sustainable Opportunities Acquisition Corp.

The company’s stock hit a high of \$12.45 September 13, 2021, but has since fallen to \$1.42 – perhaps a reflection of just how risky investors consider this new process for mining the ocean floor for minerals may be. No one has yet done it on a commercial scale. The company and its technology partner, Allseas, recently marked the commissioning of key components of the underwater mining system that will be used to scoop up metals-rich polymetallic nodules laying on the ocean floor in an area known as the Clarion Clipperton Zone between Hawaii and Mexico.

The company also released video of the trials of the collector vehicle designed to comb the ocean floor,

scooping up the nodules and pumping them to a platform on the surface of the ocean. “This latest development builds upon earlier successful trials of the nodule collector vehicle in deep-water in the Atlantic as well as harbour wet testing and shallow-water drive tests in the North Seas, and comes in advance of full pilot nodule collection trials...in the Clarion Clipperton Zone of the Pacific Ocean later this year,” the company says in a news release.

Deep ocean mining is governed by the International Seabed Authority (ISA), which has estimated that there could be 21 billion of tonnes of polymetallic nodules in the Clarion Clipperton Zone between Hawaii and Mexico, containing an estimated six billion tonnes of manganese, 234 million tonnes of copper, 270 million tonnes of nickel and 46 million tonnes of cobalt.

These metals are critical for making batteries, the demand for which is soaring for electric vehicles. The International Energy Agency (IEA) has estimated a sixfold increase in critical metals, including battery metals, will be needed to fuel the energy transition over the next decade, and there are concerns that terrestrial mines simply can’t be built in time to meet the demand.

The Metals Company holds exploration and commercial rights in the zone and has royalty agreements with three Pacific Island Nations — Tonga, Kiribati and Nauru. The company’s industrial and technology partners include Maersk and the Allseas Group S.A., a Swiss company that developed the harvesting machine that will be used. Last year the company released an environmental impact report. It notes that the Abyssal Plain where the nodules would be harvested is at a depth of 4 to 6 kilometres, and is relatively barren.

“Less than 10% of all marine life lives below 4,000 meters,” the report notes. “The abyssal plain is a very challenging place for organisms to live because of the enormous pressure, the lack of light and the poor availability of food at these depths. There are no plants. “A few large mobile species such as rattfish and shrimp do live on the abyssal plain and can swim, so they will be able to move away from the areas disturbed by nodule collection.”

Despite those assurances, Michelle Connolly, a project manager for Ecotrust Canada, says deep sea mining could put marine life at risk. “We want to stop deep sea mining before it starts,” she said in a news release. “There is a rising demand for minerals for electric cars and other technologies. We do not believe that putting ocean life at risk for energy is acceptable.”

Nelson Bennett- Business in Vancouver | June 9, 2022

GOOD PRACTICES IN MINING FOR GROUND WATER RECHARGE

Niladri Bhattacharjee*, Pankaj Satija**

Abstract

Water is the most important natural resource and only 3% of water is freshwater. Groundwater is the fresh water located in the subsurface pore space of soil and rocks. Ground water flows into the mine workings during the start of excavation on the surface or below ground, due to natural flow through pores and permeable zones. Hence, water impacts mining operations and mining too impacts water bodies. There is a major impact of mining on ground water and several processes in mining affect the quantity and quality of ground water which many a times have negative effect on the surrounding ecosystem & community. Such negative impacts have been observed all around the world at different times in different mines for different minerals. Governments around the world have therefore laid down rules for proper use of ground water by mining companies to avoid such scenarios. However, if we go back into the past to the Harappan civilization and study, we will find that conservation of water is not new and was scientifically practised even in those times. Today, mining companies all around the world and in India are creating their water plan and have successfully applied or are working on projects for conservation and recharging of ground water for the betterment of our ecosystem.

Keywords: groundwater, mining, impact, law, conservation, practices, ecosystem

1. INTRODUCTION

Water takes the most important place out of all-natural resources. It forms an integral part in survival of a living being both in the way of direct consumption and in maintaining the environment. The extent to which it is abundant or scarce, clean or polluted, beneficial or destructive, determines the quality of life to a large extent. It is generally believed that the total supply of water is estimated to be at 64.3 M Km³ and this remains constant on our planet.

There is a major impact of mining on ground and surface waters. Development of mining throughout the world, with advancement of technology is changing the shape of our planet, giving rise to fundamental transformation of the environment in which water plays a crucial role.

2. THE WATER RESOURCE OF THE WORLD

Water resources are natural resources of water that are potentially useful as a source of water supply. 97% of the water on the Earth is salt water and only 3% is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is found mainly as groundwater, with only a small fraction present above ground or in the air.

Natural sources of fresh water include surface water, under river flow, groundwater and frozen water.

Where is Earth's Water?

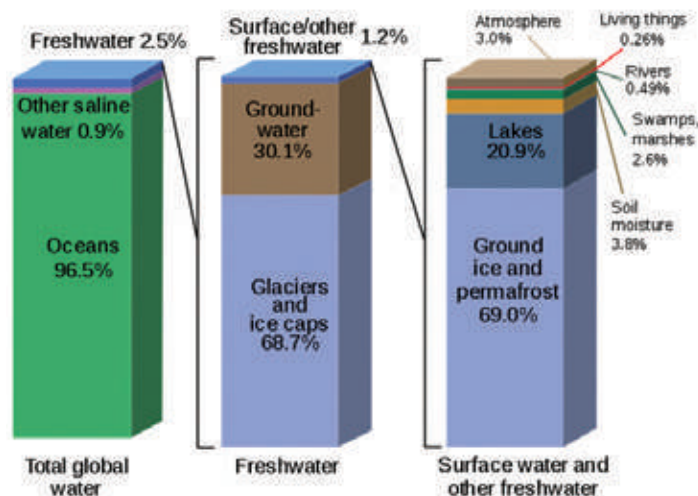


Fig 1: Earth's Water Content

3. GROUND WATER

Groundwater is freshwater located in the subsurface pore space of soil and rocks. Also, the water is flowing within aquifers below the water table. Groundwater can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, groundwater storage is generally much larger (in volume) compared to inputs than it is for surface water. This

*Additional Divisional Manager, Tata Steel Mining Ltd; **Managing Director, Tata Steel Mining Ltd

difference makes it easy for humans to use groundwater unsustainable for a long time without severe consequences. Over the long term, the average rate of seepage above a groundwater source is the upper bound for average consumption of water from that source. The natural input to groundwater is seepage from surface water. The natural outputs from groundwater are springs and seepage to the oceans.

As per the National level report by Govt. of India, the Annual Replenishable Ground Water Resource for the entire country is 433 billion cubic metre (bcm), Net Annual Ground Water Availability is estimated as 399 billion cubic metre whereas the Annual ground water draft for irrigation, domestic & industrial use was 231 billion cubic metre and their Stage of Ground Water Development for the Country as a whole is 58%. India is the largest user of groundwater in the world and its use of groundwater per year is over a quarter of the global total.

More than 89% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater. Despite the valuable nature of the resource, 29% of groundwater blocks in India are semi-critical, critical or overexploited, and the situation is deteriorating rapidly (2004 nationwide assessment).

Moreover, aquifers are depleting in the most populated and economically productive areas. Climate change will further strain groundwater resources. This will have serious implications for the sustainability of agriculture, long-term food security, livelihoods, and economic growth. It is estimated that over a quarter of the country's harvest will be at risk.



Fig 2: Water Stress Areas of India

3.1. Ground Water in Mining Areas

Ground water flows into the mine workings as soon as excavations are made either on surface or below ground, due to natural flow through pores and permeable zones. Turbulent flow occurs in the joints, cracks and crevices connecting the mine-workings to water sources like waterlogged old workings, aquifers, aquitards or surface bodies of water.

4. IMPACT OF MINING ON GROUND WATER

Due to mining, there are significant changes in surface contours, drainage system, natural profile and surface reliefs in and around the mines. One of the major effects of mining is its impact on ground and surface waters.

The impact of mining on ground water may be considered under the following areas:

- a) *Lowering of water table:* Pumping operation in various points due to mining in the region will cause resultant depression of water level. This is the cause of lowering the water table.
- b) *Subsidence:* Subsidence depressions, cracks, pits and trough, often induce, disrupt and divert the flow of water on earth's surface and therefore may adversely affect catchment areas.
- c) *Reduction of moisture content in soil and atmosphere:* Moisture content of soil is related to the proximity of water table and extent of surface bodies of water. The moisture content in the atmosphere is dependent on the available evaporating surface of bodies of water and moisture content of soil. Thus, when both the above factors are affected by mining, the moisture content of the atmosphere invariably reduces.
- d) *Rise of temperature due to Albedo effect:* As mining is continued there goes on considerable reduction in green cover, which has controlling effects on temperature due to evaporation & transpiration. This further effects lowering of the water table.
- e) *Disturbance on hydrological cycle, rainfall and climate:* Green cover declines due to mining over the area thereby playing a role in disturbance of hydrological cycle.
- f) *Spontaneous heating and chances of fire in carbonaceous remains:* Coal and carbonaceous material are susceptible to spontaneous combustion. Continuous fire of such nature would affect moisture contents in soil and air and indirectly affect adjacent water bodies.

Nature of Process/Activity	Groundwater Impacts and Concerns
Groundwater supply for mining processes	Mixing with existing well water in the community.
Groundwater pressure relief for slope stability	in low-permeability formations and a geotechnical issue.
Dewatering for mine access drifts and faces	in big mines/quarries, it results in large cones of influence with impacts on well water users and groundwater dependent ecosystems.
Sudden groundwater in-rush to mine galleries	potential fatality, capital equipment damage and stoppage of mining continuity.

Mine closure with water-table rebound	new groundwater discharge zones and mobilisation of poor-quality groundwater into ecosystem.
In-situ leaching of mined minerals	risk of strongly acidic or alkaline contaminants polluting the groundwater and effecting the ecosystem.
Accidental/incidental groundwater pollution from mining operations	mine-water drainage and tailings-dam seepage impacting groundwater quality.

5. WATER STRESS, INCREASINGLY A CHALLENGE FOR MINING INDUSTRY

Earlier, mining companies measured success in profits, stock prices, and dividends. Mining nations measured success in jobs, investment, exports, growth, and revenue. But now, mining companies and their host countries are well aware that the contest for water will steadily grow more severe with the rise in global temperatures.

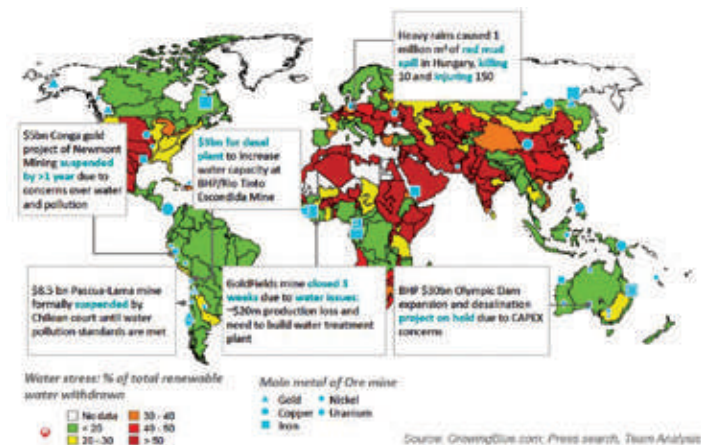


Fig 3: Water Stress Condition and Mining Concentrations around the World

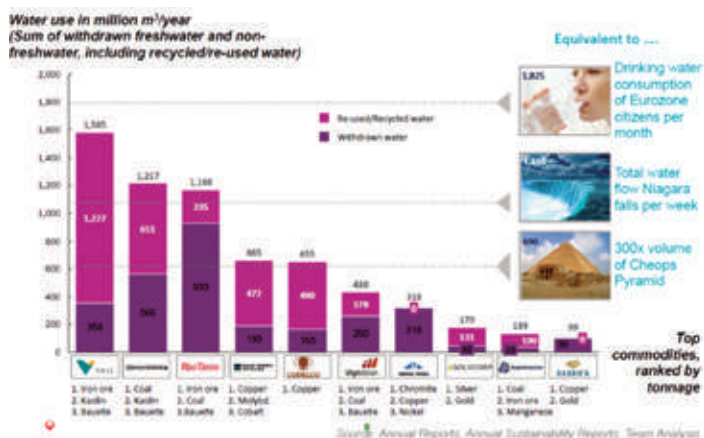


Fig 4: Water Withdrawn vs. Water Recycled by Major Mining Companies

Mining requires exceptionally large quantities of water. But droughts, floods, and pollution are more intense, and seasonal

variability in water supplies has become much more erratic globally, weakening the industry's water security. 77 percent of the annual economic value of global mining, representing \$US 770 billion in revenue, is in countries with moderate to extremely high-water risk, according to assessments by the World Resource Institute.

6. CASE STUDIES: IMPACT OF MINING ON GROUND WATER

6.1. Uranium Mines in China & Kazakhstan:

The northern region of Guangdong Province, China, has suffered from the extensive mining/milling of uranium for several decades. Results showed highly elevated concentrations of the studied radionuclides and metals in the discharged effluents and the tailing seepage of the U mining/milling sites.

Investigations of uranium concentrations in water in Kazakhstan mining areas shows uranium concentrations exceeding the WHO guideline level for drinking water. There is serious concern about pollution of underlying regional aquifers where uranium mining practices in-situ leaching with strongly acidic or alkaline solutions. This pollution is impacting the surrounding flora and fauna dependent on the water.

6.2. Berkeley Pit Cu Mine, USA:

The Berkeley Pit Copper Mine is filled to a depth of about 900 feet (270 m) with water that is heavily acidic (2.5 pH level). As a result, the pit is laden with heavy metals and dangerous chemicals that leach from the rock, including copper, arsenic, cadmium, zinc, and sulfuric acid.

By 2017, about 3000 to 4000 migrating geese have died in the pit. \$19 million has been spent to prepare a treatment facility that will be able to treat ten million gallons of water per day.

6.3. Belchatów Lignite Mine, Poland:

Following mine closure and cessation of mine water pumping a slow recovery of ground water system occurred & water table rebound. This was accompanied by radical changes of groundwater quality, associated with acidification. The ground water around the mine became unusable for irrigation.

6.4. Tui Cu, Pb & Zn Mine, New Zealand:

The Tui mine is an abandoned mine on the western slopes of Mount Te Aroha in the Kaimai Range of New Zealand. It was the most contaminated site in the country.

In the 1960s, the Tui mine extracted copper, lead and zinc sulphides. The mine was abandoned in 1973, after the mining company Norpac Mining went bankrupt. Waste, rock ore dumps and mine tailings were left behind. The tailings had significant amounts of zinc and cadmium. The mine tailings

are stored behind a dam in a large pool-like area which has an oxidised, solid surface layer. The dam contains over 100,000 cubic metres of very acidic, sulphide-rich tailings.



Remediation of the mine site was completed in 2013, at a total cost of \$21.7 million.

6.5. Historical Tailing Pond Disasters Pollute Water:

Tailings dam failures involving significant ecological damage include:

1. The Brumadinho dam disaster, Brazil, January 25, 2019, where as many as 252 people are unaccounted for, and at least 134 are dead. The disaster released 12 million cubic meters of iron waste leading to the Paraopeba River.
2. The Bento Rodrigues dam disaster, Brazil, November 5, 2015, considered the worst environmental disaster in Brazil's history, killed 19 people when an iron ore containment dam failed and released 60 million cubic meters of iron waste.
3. The Mount Polley mine, British Columbia, August 4, 2014, which released 10 million cubic metres of water and 4.5 million cubic metres of metals-laden tailings from a holding reservoir.
4. The Ok Tedi environmental disaster in New Guinea, which destroyed the fishery of the Ok Tedi River, continuously from 1984 through 2013.
5. The Sotkamo metals mine, Finland, 4 November 2012, released "hundreds of thousands of cubic metres" of wastewater which raised concentrations of uranium, nickel, and zinc in nearby Snow River, each to at least 10 times the harmful level.
6. The Ajka alumina plant accident, Hungary, October 4, 2010, which released one million cubic metres of red mud, a waste product of aluminum refining, flooding the village of Kolontár and killing the Marcal River.
7. The Baia Mare cyanide spill, Romania, January 30, 2000, called the worst environmental disaster in Europe since the Chernobyl disaster.
8. The Doñana disaster, southern Spain, 25 April 1998, which released 4 million-5 million cubic metres of acidic tailings containing heavy metals.

9. The Church Rock uranium mill spill in New Mexico, July 16, 1979, the largest release of radioactive waste in U.S. history.
10. Three uranium tailings dams near the town of Ak-Tüz, present-day Kyrgyzstan, collapsed in a December 1964 earthquake, releasing 60% of their radioactive volume (600,000 cubic metres (21,000,000 cu ft)) into the Kichi-Kemin River and its agricultural valley.
11. An incident on April 7, 1961, released 700,000 cubic metres (25,000,000 cu ft) of uranium mine tailings from operations of the Soviet-era Wismut organization into the Zwickauer Mulde River in the village of Oberrodenbach.
12. The Mailuu-Suu tailings dam failure also in Soviet-era Kyrgyzstan on April 16, 1958, caused the uncontrolled release of 600,000 cubic metres (21,000,000 cu ft) of the radioactive uranium-mine tailings in to spill downstream into a portion of the densely populated Ferghana Valley.

7. WATER LAWS IN INDIA: FROM HISTORIC TO RECENT TIMES

The water law system in India is a culmination of different Acts and Rules practiced and implemented over many years. Arthashastra mentions the utilisation of water for the advancement of water related infrastructure, water system, and navigation, indicating that ownership of water vested with the king; however, users were supposed to pay charges for withdrawal of water. Tax exemptions of different periods ranging from 3 to 5 years were provided in case of creation of new tanks, repair of tanks and cleaning of tanks. Arthashastra elaborates the system of collection of water in detail and Chief Superintendent of Crown land was authorised to collect water taxes.

Not much emphasis on water law was given during the Mughal period as India was a water rich country compared to the middle east and the area from where the rulers came.

The British presented the idea of government command over surface waters. The presidency area was subject to British rule while mofussil regions followed plural law and far away areas, local laws were still respected. (Cullet and Gupta 2009)

Water law in the post-independence period was inspired by a plethora of factors like the legacy of British times, constitutional developments, state centre federal structure, importance of surface as well as ground water, awareness on socio political issues, impacts on environment, issue about dams, collaboration with bordering countries, right of food and right to good environment.

The concept of right to life was first articulated in the case of *Bandhua Mukti Morcha Vs Union of India*. In *M.C. Mehta Vs. Kamal Nath*, the court declared that the legal system of India believes in public trust doctrine. The common man is the beneficiary of all-natural resources and the State is merely the trustee to ensure that all the natural ecosystems are preserved well for the public to use judiciously.

8. RESPONSE TO WATER RISK BY DIFFERENT COUNTRIES

With mounting evidence of the economic, environmental, and social risks of water scarcity and pollution, national governments are enacting legislation to limit the damage and improve the governance of natural resources.

CHINA: In 1997, China enacted water-conservation legislation in the Yellow River Basin, which drains nine provinces in the country's energy-rich and dry north. The law requires mines to recycle their process water and to prove that there is sufficient water in their regions to operate without compromising other water users.

INDIA: In 2010, India approved legislation to form the National Green Tribunal, a high-level court to hear and decide environmental cases. The Tribunal has issued stunning decisions, many of them focused on reducing damage to water supplies from mining. In 2013, the Tribunal issued a national order to shut down the sand mining industry to bring the industry into compliance with national water quality laws.

PERU: In 2011, Peru approved separate legislation that established a new agency to review environmental assessments and approve or reject authorizations for new mines and other industrial operations. The law was passed, and the 150-member SENACE agency was established specifically to withdraw the permitting authority from the Ministry of Energy and Mines and to restore credibility to the permitting process.

8.1. Specific Guidelines by Govt. of India on ground water abstraction:

Specific Guidelines for mining were pointed out by the CGWA rules are below:

1. All existing as well as new mining projects will be required to obtain No Objection Certificate for ground water abstraction.
2. It shall be mandatory for all the mining industries to ensure that water available from dewatering operations is properly treated and should be gainfully utilized for supply for irrigation, dust suppression, mining process, recharge downstream and for maintaining e-flows in the river system.

3. Construction of observation well(s) (piezometers) along the periphery in the premises, for monthly ground water level monitoring, shall be mandatory for mines drawing/ proposing to draw more than 10 m³ /day of groundwater. Depth and aquifer zone tapped in the piezometer shall be commensurate with that of pumping well/ wells.
4. In addition, the proponent shall monitor groundwater levels by establishing observation wells (piezometers) in the core and buffer zones as specified in the No Objection Certificate.
5. In case of coal and other base metal mining, the project proponent shall use the advanced dewatering technology (by construction of a series of dewatering abstraction structures) to avoid contamination of surface water.

The National Green Tribunal (NGT) has set stringent conditions for commercial groundwater use. NGT has also struck down the Central Ground Water Authority's (CGWA) 2020 guidelines, saying they were against the law.

Conditions:

1. Industries must expect a complete overhaul in the manner in which the permits are issued for the extraction of groundwater for commercial activities. They must ensure that all the conditions are complied with.
2. The tribunal has specifically banned the general permission for the withdrawal of groundwater, especially to the commercial entities without an environment impact assessment.
3. Permits must be for the specified quantity of water and must be monitored with digital flow metres and audited every year by the third parties.
4. Strict actions, including prosecution and blacklisting, must be taken against those who will fail the audit.
5. All overexploited, critical and semi-critical (OCS) assessment units must undergo water mapping.
6. Authorities are given three months to make water management plans for all the overexploited, semi-critical, and critical areas.

9. GROUND WATER TECHNOLOGY IS NOT NEW - CONSERVATION IN ANCIENT TIMES

As early as the Harappan civilization (Indus-Saraswati), wells were the primary means of drawing water. Wells also apparently were used as a form of purifying water with the earth as a filter. It is quite amazing to see wells in the Harappan excavations, at Sarnath and at Konarak.

Each with its own character based on soil and groundwater conditions.

An engineering marvel helped the Harappan civilization to harvest water. Scientists have discovered a Harappan water-harvesting system. The structures are buried 2.5 metres beneath the ground and located along Manhar river in Khadirbet in Bhachau taluka of Kutch district. This flourished from about 3000 BCE to 1700 BCE. The city is sloped westwards, with 48 hectares under fortification and spread over 100 hectares.

Radar data have revealed an intricate system of interconnected water reservoirs, bunds, channels, drains, and check dams. The system, the experts surmise, was used to divert water from Manhar river to the reservoir at Dholavira's Harappan site.

The Harappans possibly knew how to reduce the turbidity of flood flow in the Manhar river by diverting its silt laden water and letting it pass through several interconnected small reservoirs to allow sediments to settle. Then the water reached the large eastern reservoir for consumption.



Fig 5: Water Management in Prehistoric Times

10. BENCHMARK PRACTICES BY MINING COMPANIES ON GROUND WATER CONSERVATION

10.1. BHP Billiton:

1. Water Stewardship at Olympic Dam:

Most of the water used at Olympic Dam is supplied from the Great Artesian Basin (GAB), a resource shared with Indigenous peoples, communities, agriculture and other industries. The GAB is the largest groundwater basin in Australia, covering more than 1.7 million square km.

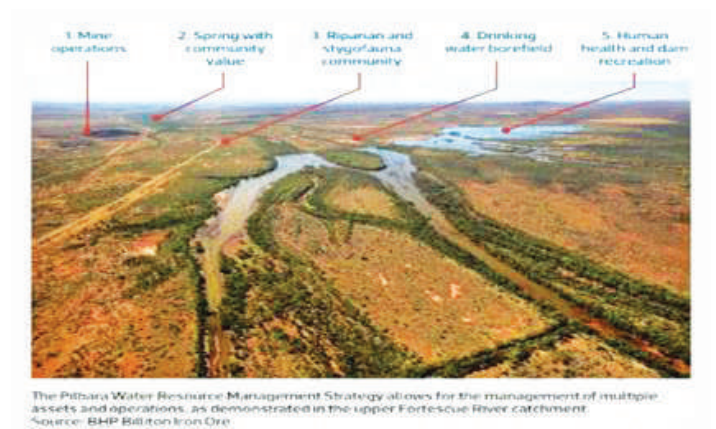


Effective and appropriate water stewardship at Olympic Dam is not only essential to BHP's mine's operation, but for its long-term sustainability and contribution to social value. Different types of water are used at Olympic Dam, including Drinking Water, Mining, Ore Processing & Grinding, Smelter, Acid Plant.

2. Managing excess water at Pilbara:

BHP has extensive iron ore operations in Western Australia's Pilbara region. The region is underpinned by aquifers

of groundwater that support local ecosystems and have important spiritual and cultural significance for Indigenous communities. BHP's preference is to return surplus water to the aquifer to minimise impacts to springs, ecosystems and/or spiritual and cultural values as a result of groundwater extraction. Returning water to the aquifer occurs using sumps and wells, a process known as managed aquifer recharge.



10.2. Rio Tinto: Water Conservation - Oyu Togloi Mine

Water is precious in the arid South Gobi region, which receives on average 97 mm of rainfall each year. Local herders rely on shallow sources of groundwater from springs and wells for their animals and Rio uses water to produce

copper, which is used in everything from computers and smartphones to solar panels and electric cars.



Rio's Oyu Tolgoi team uses its allocated water efficiently and balances its needs with those of the local community. To find a sustainable source of water that would not impact local supplies, they surveyed the area seeking a new underground water supply. The work uncovered the Gunii Hooloi aquifer – which was more than 150-metres deep, holding around 6.8 billion cubic metres of non-drinkable saline water.

They also work with herders, local people and the government to protect the water in boreholes, existing wells and other community water supplies. They have also invested in recycling and conservation practices that make Oyu Tolgoi one of the most water efficient mines of its kind in the world.

More than 80% of the water used in production is recycled, and on average Oyu Tolgoi uses 520 litres of water to process a tonne of ore – around half the industry average.

11. BEST PRACTICES BY INDIAN MINING COMPANIES

11.1. Coal India:

Coal India has planned to enhance the total community water supply to 4300 L Cu.m. in 2023-24; Total Irrigation potential creation – 3.20 Lakh Acres. (considering 40 Ha/L Cu.m considering 3 cycles of irrigation of 6.35 cm water depth each for CIL & SCCL and 54 Ha/L Cu.m for NLCIL); Drinking/domestic water supply potential – 45 lakh people @ 50 LPCD.

Further, on Community water supply, MoU with the State Government has been signed. Under the MoU, responsibility of providing raw mine water at surface reservoirs lies with Mine Management. Whereas the responsibility for filtration, operation, quality control and distribution falls in the domain of State Government. One such initiative brought us the mineral water product “Coal Neer”.

11.2. Ambuja Cement:

Coastal Salinity Prevention, Kodinar, Gujarat: In the 1990s, Ambuja Cement Foundation (ACF) observed that the salinity had seeped inland in the Gujarat coastline to up to 15 kilometres and the Total Dissolved Solids (TDS) was found to be as high as 4000 mg/litre for certain seacoast villages.

The situation worsened owing to the intensive agricultural patterns in the area and the over exploitation of ground water. As a result, the local community in Kodinar had no potable water available and agricultural yield was adversely hit, impacting the major source of community livelihood.

The solution: addressing salinity in a cost-effective way:

1. Surface water harvesting structure: Construction of check dams, revival of traditional water bodies, farm ponds, pond deepening and interlinking canals.
2. Groundwater recharge: Construction of nala bunds, farm ponds, percolation well, tube well recharge.
3. In-situ moisture conservation: Drainage line treatment, nala plugs, etc.
4. Creating water reservoirs from mined out pits: ACF initiated the conservation of mined out pits into water reservoirs as a major sustainability initiative to address salinity. These pits were a low-cost solution for storage of rainwater

The impact: In an independent study conducted, the programme was reported to deliver 13 times social return on investment.



Collaboration for scale and sustainability: In the initial days of the programme, ACF partnered with the Tata Trusts and pooled in their resources for funding, technical expertise and innovation to impact more villages in a robust, sustainable manner. In six years, they were able to demonstrate a robust model and impact. The government was convinced and agreed to fund close to 60-80% of all future initiatives of this nature. Following the success of the project, ACF now works closely with the government, NGOs, corporates and development agencies with an aim to facilitate pooling in resources and technical knowledge.

One such collaborative initiative is the ‘Coastal Salinity Prevention Cell’, with ACF as its founding member along with Aga Khan Rural Support Program India and TATA trusts. Established in 2008, the cell acts as the advisory body to address salinity in the coastal regions of Gujarat.

11.3. Tata Steel:

11.3.1. Effluent Treatment Plant (ETP) & Water Treatment Plant (WTP) at Mines

We have effluent treatment plants at our mines with Zero

liquid discharge with online effluent monitoring. It also provides fresh water to the community.

The effluent treatment plant of Tata Steel Mining is the largest in the Sukinda valley with a capacity of 108 million litres/day. We also have a Water treatment plant in all mines.



Fig 7: Effluent Treatment Plant (ETP) and Water Monitoring at Sukinda Chromite mine

11.3.2. Rainwater Harvesting Structures at All Units:

The rainwater harvesting parks and reservoirs created across raw material locations including Joda, Noamundi, Jharia, Sukinda and West Bokaro across Odisha and Jharkhand have the potential to store a total of 12.38 million cubic meters of water.

Installation of these rainwater harvesting structures have helped in channelizing precious rainwater to percolate down and replenish underground water tables.



Fig 8: Rainwater harvesting structures across Tata Steel's mining locations

11.3.3. Spring Based Water Harvesting Structure for Agriculture:

Spring water comes from an underground source from which water naturally rises to the surface. Although the water must rise to the surface on its own in order to be classified as natural spring water, we collect spring water at the source. With the help of the community, Tata Steel Foundation (Tata Steel's CSR arm) personnel searches for sources for spring water. Once the source is discovered/identified, excavation is carried out to link the spring water to the nearest available plain land. Nala, outlet, check dams & retention area is developed, thus helping in channelizing the spring water to the reservoir for the use of villagers.



Fig 9: Process for developing Spring Based Water Harvesting Structure for Agriculture

12. CONCLUSION

Mineral extraction is necessary for the development of a country but the impact of mining on ground water must be considered during the opening of the mine, its development and finally its closure. Mining has many opportunities to serve the community by improving the water table after its closure, similar to how Chennai city converted the mining quarries in its vicinity into water storage reservoirs to counter drought and water stress. These conservation techniques are not new to Indians and have been followed from ancient times and now, it needs to be done again. A bold line environmental management plan is thus strongly required by all mining companies to negate the impact of mining on groundwater.

Disclaimer:

The article is an amalgamation of data collected from various sources and authors' own views and thoughts. Tata Steel Mining Ltd does not necessarily subscribe to the views and thoughts expressed in the article and should not be held responsible for the same.

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Mrs. Sangita Jindal,
Chairperson - JSW Foundation

JSW Foundation is the social development arm of the US\$ 22 billion JSW Group, one of India's leading business houses. It has a long track record and a rich legacy of empowering rural communities to enrich their lives since the last three decades. The Foundation's focus areas are Education, Health & Nutrition, Skill Development & Livelihoods, Agri-Livelihoods, Water, Environment & Sanitation, Sports Promotion, Community Development and

Art, Culture & Heritage. Through a strong field presence, it operates across 33 districts in 14 Indian States with priority on communities around JSW's plant & port locations. JSW Foundation also reaches out to communities beyond these locations to contribute towards India's social development in a meaningful way. JSW Foundation's holistic life-cycle based interventions have positively impacted more than a million underprivileged people across India.

JSW Group dedicated 1000-Bedded Oxygenated Covid Care Hospital in Ballari

JSW created mega Covid care hospital in collaboration with the District Administration and dedicated to the nation and the people of Karnataka. This was one of India's biggest Covid-Care facilities with a dedicated 4.8 km oxygen pipeline originating from its steel factory and supplying medical oxygen directly to the hospital for treatment of ailing patients. This mega healthcare facility was constructed in a record period of 15 days. The unique notion of providing direct oxygen supply to the patients stems from our Group Chairman Mr. Sajjan Jindal's inclusive vision that if oxygen in such huge quantities cannot be taken to the patients, then we must work to find ways and means and bring the patients closer to the oxygen source.



The impact of Covid-19 wave has a crushing impact on the nation's health as the number of patients as well as fatalities keep rising at an alarming pace. Given the chronic need of medical facilities, bed requirements and oxygen supply, we quickly swung into action and decided to establish this jumbo 1000-bedded oxygenated Covid-Care Field Hospital and we remain committed to support the Government's efforts in flattening the Covid infection curve while helping patients recover by providing them the best healthcare facilities at this hospital.

Focus areas



Health & Nutrition

To enhance health and nutrition at all levels of healthcare systems, JSW Foundation maintains its efforts by increasing awareness on ailments, contributing to healthcare infrastructure development, and encouraging community engagement to support the nation's efforts.



The Foundation augments healthcare delivery by building multispecialty hospitals and supporting government facilities such as Primary Health Centres (PHCs), Community Health Centres (CHCs), hospitals and special care units, to provide access to safe, effective, and affordable healthcare services to all.

It employs a strong focus on early childhood nutrition and healthcare by strengthening Anganwadis and building the capacities of Anganwadi Workers.

By conducting outreach camps, it makes communities aware of the available solutions and support strong referral networks in remote areas and provide ambulance services for timely healthcare delivery.



Water, Environment & Sanitation Ensuring a healthy environment



The Foundation strives to create a healthy environment around its area of operations by undertaking an integrated approach towards water, environment and sanitation by ensuring access to safe drinking water, implementing long-term plans for sustainable water resource management and enabling water security for domestic and agriculture usage in our communities.

We work towards increasing access to drinking water through an integrated approach to water and water resource management. The interventions range from integrated watershed management, rejuvenating water bodies, recharging groundwater, augmenting surface water to rainwater water harvesting structures and more.



To improve environmental conditions, we nurture aquatic and terrestrial ecosystems in varied geographies. We are promoting sustainable resource usage and are partnering with ecosystem enablers to create a lasting impact.

We also work towards Increasing green cover by undertaking tree plantation, nursery development, silvi pasture plantation, developing our own Miyawaki Forest Cum Biodiversity Park.



Waste Management
Awareness and innovation in Waste Management



With rapid urbanisation, systematic management of waste from households, industries and markets is crucial in our country to prevent adverse impact on the environment and people's health. The challenges are more poignant in smaller towns and villages that may lack the advanced large-scale operations observed in large cities. JSWF is aligned to the government's Swachh Bharat Mission and focuses on reducing and eliminating the practice of mixed waste from its communities and Direct Impact Zones (DIZ) villages.



Art, Heritage and Culture
Enriching lives with art, culture, and heritage

The irreplaceable contribution of art, culture and heritage is evident in the way it brings together societies and inculcates a sense of identity, pride and belonging. The JSWF has developed a long-term preservation and restoration strategy to protect our heritage for future generations. Through active collaborations with organisations and initiatives that preserve and promote the art, culture, and heritage of India, we are integrally involved in establishing art precincts, restoring heritage structures, and preserving our history

As individuals part of a multi-hued cultural mosaic and beneficiaries of one of the most layered civilizations in the world, JSWF with a multitude of partners has undertaken multiple initiatives to preserve and conserve a multitude of magnificent structures in India.





Agri-Livelihoods Towards sustainable farming



Across India, farmers continue to battle challenges arising from poor production and/ or poor returns. At JSWF, we are working to support our communities, farmers and the agricultural sector while protecting our environment and resources. Our inclusive agri-livelihood model lays emphasis on the entire value chain.



To elevate the income levels in the agricultural space, we promote sustainable agricultural practices among farmers through multiple demonstration farms, training and grassroots capacity building. In addition, we collaborate with leading technical institutions and provide value-added services to help farmers increase their productivity. Our

interventions are sensitive to the varied requirements of each region. We endeavour to meet local conditions and mitigate the risks from erratic weather conditions through the promotion of climate-smart agricultural practices and climate-smart crops.

Over time, these interventions have successfully contributed to crop diversification. Through farmer producer organisations (FPOs), we facilitate strong market linkages that facilitate incremental income for farmers.



Education & Learning Creating tomorrow's leaders today

The focus of the JSWF's Education initiatives is on working with students from Anganwadi to graduation in association with education partners from India, while also lending support through the Jindal Educational Trust towards their school education.



Our education programs focus on a spectrum of aspects, including the construction and maintenance, school infrastructure, interventions in early childhood education, e-learning, scholarships, teacher training, remedial classes, additional teacher support, career guidance, exposure to science and math activities, the provision of science labs and libraries.



Skill Development & Livelihoods

To leverage India's unique demographic advantage of 60% of youth population, employability has to be improved. In tandem with the government's efforts to promote skillbased training, we are focusing on ground realities to increase the employability of graduates and women in rural areas with innovative solutions and vocational trainings.



Enabling the economic empowerment of low-income families is important to our goal of inclusive community development. We are assisting women artisans in various geographies to enhance their incomes from indigenous arts and crafts. The project is developing entrepreneurial skills of the women by infusing new designs and facilitating market linkages. Trainings for each aspect of the trade are carried out such as product training, marketing training, product diversification, upselling and more.



To further our vision of empowering communities with sustainable livelihoods, we are employing

innovative approaches such as the Recruit-Train and Deploy Model and are outcome funders for India's first Skill Impact Bond, a multi-stakeholder partnership.

Sports Promotion & Development

India's success in various sports is the result of the hard work of our athletes, sacrifices of their families and support of the communities that make it possible.

JSWF nurtures rural talent, provides holistic and integrated solutions ranging from infrastructure, equipment, training of trainers to partnering with government bodies and other associations for growth. Hoping to bring powerful transformation in the field of sports in India, JSWF is promoting sports and providing a strong support system for the institutions of our country and its sports persons.

Currently, we are working across the board on a multitude of sports such as Mallakhamb, Football, Swimming, Boxing and more.

Inspire Institute of Sports is India's best sports coaching center training athletes for Olympics, Commonwealth games and more in Boxing, Judo, Athletics, Wrestling and much more.

The institute is cutting edge environment founded to craft champions in India with an eye on success at the Olympic games. It has been stitched together with the state of the art facilities and sports science, and has some of the finest coaching minds from across the world to guide our athletes towards the Indian Olympic dream,



VEDIC NOMENCLATURES ON OCCURRENCES OF GOLD - THEIR MINING AND RIVERINE CONNECTION

Dr. A. K. Grover

Abstract

Many rivers in India have been identified as having gold in their sands and bear the Vedic gold names given in Nighantu. Some of these rivers are outside India. The work, thus, clearly demonstrates that coining of the Vedic gold nomenclatures was primarily based on those rivers from where the gold was mined during that period. There are many Vedic gold names or nomenclatures present in Nighantu, a collection of Vedic words similar to a modern dictionary. However, it does not provide the basis of the formation of these gold nomenclatures. Later Sanskrit and Hindi texts mention more gold nomenclatures; but the etymological study of these for their origin is also rarely dealt with. Vedas are considered the oldest texts; and so is the knowledge of placer gold mining (as compared to the gold extracted from rocks) to humans. Thus, considering a close relationship between the Vedic nomenclatures of places/ rivers and the placer gold, it is attempted through detailed literature survey and available information obtained from various sources, both offline and online, and prognosticate gold bearing regions.

Keywords: *Placer Gold, Vedic Gold Nomenclature, Vedic gold linkages with names of Rivers*

1. Introduction

The lustrous gold is said to be the first metal known to human beings, who must have been attracted to it for its brilliant sheen in the riverine sands. Therefore, the placer gold mining and artisanal panning from riverine sediments are considered much older than the gold mining from rocks (Jensen and Bateman, 1979). In Indian context, the antiquity of metal gold may be judged from its mention in Hindu sacred texts such as Vedas, Ramayana (9,300 years/ Vartak, 1999), Mahabharata, Purans, etc. In Atharvaveda, the mother earth has been referred to as 'hiranyavaksa', i.e., the one containing gold in her chest; which implies that mother earth has gold within her. Three types of gold (alluvial placer, vein and liquid gold) were known in India during the ancient period, for which renowned Kautilya also mentioned in his famous treatise on economics (Kangle, 1972).

The present Indus (Sindhu) River has been described in Rig-Veda as *hirnyamayobhayakula*, which means that both the banks contain gold (Dube, 2001). In fact, there are many rivers in India known since long past to have gold in their sands. Extraction of gold through washing or panning from river sands has been well-described in Vedas and later Hindu texts. Finding of gold objects at archaeological sites of Neolithic-Chalcolithic sites, Megalithic burials, Indus-Saraswati Valley Civilization and Early Historic sites in India (Rajni Nanda, 1992; Upadhyay, 2007) are testimony to it. Besides, a large number of ancient gold mining sites (old workings) are located in almost all the States of India (Grover and Pandit, 2015); one of them even showed presence of

gold panning sites in Rajasthan, where the gold-ore was powdered and panned (Grover, 2006).

As the gold remained the most sought-after metal since its discovery, its prevalent names or nomenclatures, thus, are highest in numbers belonging to different cultures/ languages in the world. In India too, there are large numbers of gold names in Vedic and later Sanskrit-Hindi texts besides in many local languages. Many of these gold names exhibit their places of origin, process of their formation and special features. However, in this paper only the Vedic nomenclatures of gold and their source riverine connections are dealt with.

2. Vedic Nomenclatures of Gold

These forms the oldest-most names/ nomenclatures of metal gold as per *Nighantu*, the Vedic dictionary (Anon., 2020); and include *Ayya, Amritum, Bharmam, Chandram, Datram, Hema, Hiranyam, Jatrupam, Kanakam, Kanchanam, Krshnam, Loham, Maruta, Pasha, Rukmam*; and *Suvarna*. Many of these continued later in Sanskrit, Pali, Hindi and local languages though with some phonetic changes. There may be more meanings of these nomenclatures but in the present context their meaning for gold is taken.

3. Riverine Connection of Vedic Gold Nomenclatures

The Vedic gold nomenclatures seem to be related to names of rivers, from where people of that time used to mine it. Such a system of naming gold is present in other cultures/ countries too. Attempts have been made to identify such rivers, which might have their connection with Vedic gold

Former Dy. D.G., Geological Survey of India, Jaipur-302018, akgroverg@yahoo.com

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names/ nomenclatures; and are alphabetically detailed below.

The Vedic name/ nomenclature of 'Ayya' for gold, appears to be the gold coming from Ayyad/ Ahar River on which Ayyad/ Ahar culture developed; with the main town of Tambavati at present Udaipur in Rajasthan (Fig. 1A). Interestingly one Ayya River, tributary of Kolva, is in Russia (Wikipedia). The gold nomenclature *Amritum* is said to be that gold which was obtained from Amrita River of Plakshdweep as per Vishnu Puran and Mahabharata. Plakshdweep is correlated in Puranic geography with Asia Minor (small countries) between Black Sea and Mediterranean Sea (Ali, 1966); and specifically, the north-western part of Turkey as per the Bible. Placer gold has been mined there in the last 3000 years (William et al., 2017). Aboriginals of the area were 'Hatti' people who worshiped Goddess as mother. Their religion-concept was 'everything in nature was sacred and possessed a divine spirit' (<https://www.worldhistory.org/hatti/>), which with antiquity of gold mining makes them to be Vedic people. Name Hatti is similar to Hatti (gold mine; Sanskrit *Hatak* for gold) in south India, supporting their gold seeking nature. *Amuta* could be after *Amrita*, which is a river and also a gold prospect in Nigeria.

The *Chandra/ Chandram* appears to be the gold obtained from *Chandra* River in Lahaul, Himachal Himalaya (Fig. 1B). Punjab's Chenab River was once known as *Chandrabhaga* (Abhimanyu, 1937) as it is formed by joining Chandra and Bhaga rivers. Chandrabhaga River is in Maharashtra too. *Chandra* gold might be obtained from the rivers draining from *Chandra Parbat* in Uttarakhand Himalaya; one of its glaciers joins Gangotri from where emerges the Bhagirathi River, the main tributary of Ganga River, which bears gold in sands (Dube, 2001).

The gold name *Datram* seems to be after Datram River, a tributary of Kanhar originating in Jashpur area, which is well-known for gold panning since long past in Chhattisgarh region. Vedic *Harit* gold name is after its greenish tinge (<https://nicolevanderwolf.com/>). The gold nomenclature *Hem/ Hema* seems to be the gold obtained from gold bearing *Hemavati* River of Karnataka (Fig. 1C). Another source might be *Hemkoot/ Hemakuta* Mountain located north of Himalaya, with gold reference in Par khyatantra (<https://www.jatland.com/>); or from the high altitude lake area of *Hemkunt* in Uttarakhand. North of Himalaya in Ladakh and Tibet, the gold was collected from rivers and was mined since ancient times.

Vedic gold name *Hiranya* seems to be after the Hiranya River of Kushinagar (Fig. 1D) in Uttar Pradesh, which bears gold in its sands or Hiranya River flowing near Somnath in Saurashtra (Fig. 1E). The 'Hiran' River near Jabalpur, Madhya Pradesh; and of south Rajasthan and north Gujarat are the phonetic variants of '*Hiranya*' developed by shortening. One Hiranyakeshi River is in Maharashtra and

Karnataka. In addition to above, many rivers were called Hiranyavati or Hiranyavahini, which means 'gold bearing' e.g., Indus/ Sindhu River (Dube, 2012), and one passing from Kurukshetra. Gold washing or panning at the banks of Indus River and other Himalayan rivers have been recorded by many Britishers. The Son or Sone River of central India was earlier known as *Hiranyavaha* or bearer of gold.

The *Jatarup* or *Jatrupa* name of gold seems to be after 'beauty of baby'; baby is still called *Jaatak* in north India. Gold bearing 'Jatra Gora' River in Jharkhand may be the source of this gold. *Kaachnam* term for gold, a variant of *Kanchan*; was obtained from Kanchan Ganga River near Badrinath in Himalaya or from the Kanchan River located between Ganga and Son rivers, north of Sasaram, Bihar. Another Kanchan-Saraswati River in Bihar is flowing east of Nalanda. One Kanchi River (Fig. 1F) with gold in sands is a tributary of the Subarnarekha River in Jharkhand (Singh and Giri, 2018). A Kanchana River is present near Pushkar, Rajasthan; Kanchan River in Bangladesh; and Patakancha (for descending gold) River in Peru (Anon., 2020).

Vedic gold *Krshnam* indicates a close relationship with the present Krishna River (Fig. 1G), as it is seen flowing between major goldfields of Hutti and Mukangavi in Karnataka. The *Loham* gold was probably obtained from the ancient Lohitya kingdom around Brahmaputra River and its tributaries such as Subansiri and Lohit River, which have gold in their sands (Maclaren, 1904). *Lojhara* (after Loham-Jhara/ panning) area could also be the Vedic source of gold, which is a known placer site in Sonbhadra district in U.P.

The Vedic *Marut* gold must be that, which was obtained from 'Marut' people, who are still known expert gold washers in Ladakh and Kashmir including the Pakistan occupied Kashmir, POK (Vernier, 2020). Name of the Marusudar River (Fig. 1H), a tributary of Chenab, seems to be related to Maruts. The Markanda River in Himachal Pradesh and Haryana is known for placer gold (COI, 2011) and might be the source of Vedic *Marut* gold. Etymologically the word *Markanda* could be after Marut-kan-dai (giver of gold particles). Marut gold might also be from Maru River, which passes through gold deposits in Maharashtra and whose sands are still washed by locals for gold. 'Maru' seems to represent '*Marut*' by way of shortening (Rao, 1996). The Manmaru placer gold locality in Jharkhand might be the gold source. It is very likely that wherever Marut people washed/ extracted gold, those rivers/ areas retained the name Marut or Maru.

The Vedic gold name *Pesha*, seems to be after Pesha River located in Komi republic, NW Russia, known for placer gold (Wikipedia). The Heshakocha gold occurrence seems to represent the Vedic *Pesha* ('p' replaced by 'h'; kocha for Kosh/ for store) located close to the Subarnarekha River in Jharkhand. For *Rukmam* gold no riverine source is found, but there is the Rukmini Island within Brahmaputra River,

which at places carries gold in its sands. Vedic gold name *Satkumbha* in old texts is meant for a river as well as for a mountain; but their location is not found. But one *Satkumbha* pilgrimage place is located near Sonipat in Haryana, where the Yamuna River flowed in the past. *Satkumbha* (seven pots) might be the gold obtained from *Satkui* (gold-copper prospect at the base of hill) in north Rajasthan (Grover, 2015), where seven (*sat*) old mining shafts (pots/ store) are clustered at one place.

The gold name *Suvarna* (*su* for good + *varna* for colour) seems to be the gold obtained from those rivers which bear 'Suvarn' in their names. These include Subarnarekha River (Fig. 1I) in Jharkhand and Odisha (Singh and Giri, 2018); and Subansiri River (Fig. 1H) in Arunachal Pradesh and Assam, all known for placer gold. One Swarnamukhi River is also in Andhra Pradesh. In India there are some rivers, which show nomenclature modified after '*Suvarna*', e.g. Sona, Sonai of Sonapet Valley in Jharkhand; Son Dodha in Maharashtra; Sonabera in M.P.; Sonajori in Chhattisgarh; Sona Wadi in U.P.; Sonai in Assam; Sonajuli in Arunachal Pradesh; etc. These rivers are also known for gold washing.

4. Discussion

The relationship between names of rivers and the gold occurrences during ancient times became so strong that the names of rivers having placer gold got adjective *Hiranyavati*, *Hirnyaskandavaha*, *Hiranyavahu* and *Kanchanaksi* (Dube, 2001). Some of the Vedic gold nomenclatures continued in Pali, Sanskrit-Hindi and got into other Indian languages. Some of these names got modified with time, e.g., Hiranya to Hona; Suvarna to Sona.

Most of this Vedic gold nomenclature bearing rivers are located in Indian territory (Fig. 2); however, some of these are found in far-off places i.e. African, European and SE Asian countries, which indicate their past link (trading or otherwise) with the Vedic/ Hindu culture. Some such placer gold bearing rivers include Ayya, Pasha, Chandalash (after Chandra), Marakan (after Marut-kan) and Krasnaya (after *Krshnam*) in Russia; Hamdah (after *Hema*) in Arabia, etc. (Wikipedia). Suvarnabhumi and Suvarnadwip were famous lands of gold in SE Asia. Several Sanskrit root words are identified in the names of rivers, lakes and towns in many countries (<http://vediccafe.blogspot.com/>) which indicate a global Vedic link. The ancient Indian connection with African lands and gold mining is also known since long past (Moor, 1884; Anantharamu et al., 1992).

The study, thus, demonstrates that the Vedic names or nomenclatures of gold given in Nighantu were coined primarily based on their riverine sources of gold; which also suggest their nature of being the placer gold and related panning or artisanal mining.

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A - Ayyad River



B - Chandra River



C - Hemavati River



D - Hiranya River



E - Hiranya River



F - Kanchi River



G - Krishna River



H - Maru Sudar River



I - Subarnarekha River



J - Subansiri River

Fig. 1: Photographs of Vedic gold nomenclature bearing rivers



Fig. 2: Distribution of Vedic gold nomenclature bearing rivers in Indian Territory



Mining Engineers' Association of India

2nd COURSE OF MPDP (MEAI PROFESSIONAL DEVELOPMENT PROGRAM)

Encouraged by the guidance & support of the President MEAI, Sri K. Madhusudhana ji and Enthused by the phenomenal success of the first Course of MPDP, MEAI launches the 2nd Course in the month of **September 2022**, Online.

The previous course was successfully held online on **WebEx** platform in the month of **March 2022** on three consecutive week-ends and was well attended by **35** participants from **10** reputed mining organizations including NMDC, Tata Steel, MSPL, HGML, JSW, OMC, NALCO, BAUMA, Sai Universal Mining Services besides a few independent consultants.

26 technical sessions were held by **15** eminent faculties and industry experts covering **20** relevant subjects. Participants were awarded Certificates of participation.

Attendance and Assessment test are mandatory for all participants to be eligible for the "**MPDP Certificate**".

An added attraction of the MPDP Course is that the **RCPs** who attend the course would get a credit of **40 points** !

TOPICS & FACULTIES

TOPICS	FACULTIES
Elements of Blast Design Parameters	Dr More Ramulu, Chief Scientist, CIMFR
Implementation of IT in Mining Industry, NMP	Mr BRV Susheel Kumar, Director, Gov of Telangana
Forest Clearances	Mr K. Madhusudhana, VP (Mines & CC) MSPL
New Technological Trends in Opencast Mining Machinery	Mr Suresh Nair, VP, Tata Hitachi Sales & Marketing
Mineral Auction	Mr Sabyasachi Nayak, Director Mine Magma
Hypraspectral Technology, Mineral Exploration, EIA & Management	Prof. Anup Krishna Prasad, IIT (ISM)
Mine Costing; Innovative Technologies in Opencast Mining; Safety Management; EHS	Mr Deepak Vidyarthi, Consultant (Mining), Assessor on National Accreditation Board, Ex ED (Mining) NMDC
Digitalization in Mining	Mr Mahesh Kumar Thautam, Minematics, IT Consultant
Mineral Resources & Reserves - Classification & Reporting	Dr Abani R Samal, Principal GeoGlobal, LLC, USA
Geological Exploration	Mr Saradchandra Rao Peshwa, Consulting Geologist
Geostatistics in Exploration & Mining	Prof Bhabesh C. Sarkar, IIT(ISM)
Mineral Laws & Environmental Clearances; MCDR	Mr AR Vijay Singh, BE (Mining), FCC (R), FCA, Chartered Accountant
Open-pit Optimization, Mine Planning & Scheduling	Mr Suryanshu Choudhury, DGM (Planning) Adani Enterprises
General Management	Dr Debabrat Dash, VP - HR & Admin, MSPL
Evolution of Environmental Laws	Mr KAV Prasad, VP - Legal, MSPL
Mining Plan & FMCP	Mr TR Rajasekar, Consultant

WHO SHOULD ATTEND

The MPDP Course will benefit Mining Professionals, Engineers, Geo-technical Engineers, Mineral Exploration Geologists working in the mineral industry (*mid level to senior level*)

Additional attraction for **RCPs: Those who attend the course will get a credit of 40 points !!!**

SCHEDULE

The 2nd Course is scheduled as follows:

September 2022: 09th (Fri), 10th (Sat), 16th (Fri), 17th (Sat), 23rd (Fri), 24th (Sat) & 25th (Sun).

Sessions: 09:00 AM / 05:15 PM

Inauguration: Sept 09th (Fri): 09:30 AM / 10:30 AM

Participants feedback & Assessment: Sept 25th (Sun): 10:45 AM (followed by Session-I)

Valedictory Function: Sept 25th (Sun): 11:15 AM / 12:15 PM

COURSE FEE

For MEAI Members: **Rs. 15,000.00 + 18% GST**

For Non-Members of MEAI: **Rs. 20,000.00 + 18% GST**

Interested professionals may please contact the **Secretary General**, MEAI at meai1957@gmail.com / Phone no: 040- 66339625/ 040-23200510 or Mr. Deepak Vidyarthi, Chairman, Training, Development & Program Committee of MEAI at vidyarthikud@hotmail.com for more details.

Payment of **Course fee** may be made on line at A/c No. **037810100086016**; IFSC: UBIN0803782; Bank: UNION Bank of India Nampally Station Road, Hyderabad Telangana-500 001.

REGISTRATION

Please click on to the following link for Registration:

<https://forms.gle/Sb7Cg66Sanbr8QP98>

Hurry up ! We have limited Seats !! Allotment would be on First Come First Served Basis !!!

~ Deepak Vidyarthi,
Course Coordinator, MPDP /
Chairman, Training, Development
& Program Committee of MEAI

MINES SAFETY ASSOCIATION KARNATAKA



To Commemorate 75th year of
India's Independence
(Azadi ka Amrut Mahotsav)



Organising

National Mining Conclave-2022



In Association with
MINING ENGINEERS' ASSOCIATION OF INDIA

on 12th & 13th August 2022
at J.N.Tata Auditorium
Indian Institute of Science, Bengaluru
Karnataka-India

OUR GOAL - ZERO HARM



Supported by

Directorate General of Mines Safety

Ministry of Labour & Employment
Government of India



NATIONAL MINING CONCLAVE-2022

BACKGROUND

Minerals are basic raw material to all the Industries. Hence it is necessary to adopt best technology in every operation of Mining for Safe & Sustainable future.

MSAK proposed National Mining Conclave 2022 to be held on 12th & 13th August 2022 is to Commemorate the 75th Year of India's In-dependence (Azadi Ka Amrit Mahotsav). During the State level Final day function of "Mines Safety Observance Week 2021" at Malkhed, as advised by Mr. Prabhath Kumar, Director General, DGMS, Ministry of Labour & Employment, Govt. of India, Dhanbad & Dy. Director General of Mines Safety, Southern Zone and other officials, following aspects will be part of the seminar apart from other themes.

Main Themes

1. Recent trends in Mechanization for higher productivity.
2. Exploration of Major, Strategic & Minor mineral deposits.
3. Conservation of minerals – Beneficiation of lower grades
4. Health & Safety, Safe Environment, etc.,

Other Themes

1. Minor Mineral Quarries: Best practices and Safe usage of Explosives
2. Digitalization in the Mining operations.
3. Recent Amendments and proposed changes in the Mineral legislation.
4. Training Needs
5. Challenges : Getting clearances to open and operate mines

CALL FOR THE PAPERS

Original papers are invited from experts in Mining and Allied subjects from experts, practitioners, researchers from scientific & educational institutions and the paper will also be included in the Souvenir to be released during the Conclave. The authors are requested to send the title and abstract of the papers on or before 30.06.2022, to the Editorial, MSAK, C/o MSPL Limited, Baldota Enclave, Abheraj Baldota Road, Hosapete-583203, Karnataka.

DELEGATE FEE

Delegate Fee is Rs. 3,500/- (Inclusive of GST @ 18%) To register please fill up the attached Delegate/Sponsorship Registration form and return it along with the applicable fee

SPONSORSHIP REGISTRATION

Sponsorship Fee are as follows, It is non residential seminar. Individual delegates have to make their own arrangement to stay.

However, Sponsored delegates will be arranged at designated hotels on their request at concessional rates.

CATEGORIES of Sponsorship	Amount in Rs.	Privileges
Platinum Sponsor	5 Lakhs +18% GST	6 Delegates + inside full page Multi Colour Advertisement free
Gold Sponsor	3 Lakhs +18% GST	4 Delegates + inside full page Multi Colour Advertisement free
Silver Sponsor	2 Lakhs +18% GST	3 Delegates + inside full page Multi Colour Advertisement free
Sponsors for Lunch/ High Tea	2 Lakhs +18% GST	Sponsors names will be displayed by Banners+2 Delegate + Adv.
Sponsors for Delegate Kit	3 Lakhs +18% GST	Sponsors will be acknowledged by inserting the names printed inside the Delegate kit+3 Delegates free
Stall for Product Display Free	25,000 +18% GST	1 Delegate free

PROGRAMME SCHEDULE

12.08.2022	
8.00 am To 9.00 am	Registration
9.00 am To 10.00 am	Inauguration
10.00 am onwards	Technical Sessions
13.08.2022	
9.00 am onwards	Technical Sessions
5.00 pm	Valedictory

PAYMENTS

The Demand Draft/Cheque may please be drawn in favour of Hon. Secretary, Mines Safety Association Karnataka, payable at Hosapete and please be sent to The Hon. Secretary, MSAK, C/o MSPL Limited, Baldota Enclave, Abheraj Baldota Road, Hosapete - 583203, Karnataka. Alternatively the amount may please be transferred to the following mentioned bank account:

Bank Details

MINES SAFETY ASSOCIATION KARNATAKA

A/C NO.54039080221; IFSC: SBIN0040116

GST No: 29AADAM8942M1ZV; PAN No: AADAM8942M

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ACCOMMODATION

The conference fee does not include accommodation.



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MEAI NEWS

AHMEDABAD CHAPTER

Seminar on “Unearthing Mineral Treasures of Gujarat” & “B K Antia Memorial Lecture”

Ahmedabad Chapter held its Silver Jubilee celebrations on 14 June 2022 and organized a Seminar focusing on the theme of “Unearthing Mineral Treasures of Gujarat” along with the B K Antia memorial Lecture in memory of Chapter's Founder Chairman (Late) Sh. B. K. Antia at Hotel Courtyard by Marriott Ahmedabad.

The Chief Guest Dr. D K Sinha, Director, Atomic Mineral Directorate inaugurated the seminar in the presence of Mr. Roopwant Singh, IAS, Commissioner, Geology & Mining, GoG, and Managing Director, GMDC, Mr. H.K. Joshi, Chairman of MEAI, Ahmedabad Chapter, Mr. R. Subramanian, Former Director-General, DGMS, Mr. S D Vora, Rtd. IFS & Member (EAC) Coal, MOEF&CC, Mr. S N Mathur (Retd), GM GMDC, VP-1 MEAI and the Council members of MEAI.

Senior members of MEAI from various organizations attended the program, Guests at the seminar included members of the Chapter from mining companies in Gujarat like GMDC, GHCL, GPCL & GIPCL, and officials from GSI, CGM and DGMS. Students & Professors from MG Science College, Ahmedabad, and Government Engineering College, Palanpur also attended the seminar. Experts from reputed consulting firms like BCG, McKinsey, Deloitte etc., presented their papers and made the event successful.



Lamp Lightening by Dais Dignitaries



Address by Dr. D.K. Sinha, Director AMD

Welcome address was delivered by Mr. H.K. Joshi. He deliberated the history of Ahmedabad Chapter and congratulated the gathering on Silver Jubilee celebration and the members of Chapter for their active contribution to make it possible. In his address, he talked about the goal of MEAI to build awareness in the professionals regarding Mineral Treasures of Gujarat in particular and India in general. He also focused on sustainable mining with innovative, economic and fuel saver technological solutions. Mr. S.D. Vora, in his address, focused on the environment and he urged that if we start paying attention to the environment and save the environment, the environment would save us back. Mr. Roopwant Singh said, “Our approach at GMDC is to respect the environment and we are mindful of employing technology and expert knowledge to improve the working conditions towards this. Mining, the age-old industry, is at crossroads. On the one hand, the increased economic activity necessitates bold decisions to keep its machinery running; on the other hand, the environmental impact necessitates extra caution and sensitivity while mining activities are carried out,” added Mr. Singh.

The “B.K. Antia Memorial lecture” was delivered by Mr. R. Subramanian. He narrated his long and varied experience in Mineral Geology of Gujarat and termed the theme as highly focused. He quoted that Mining is the second oldest profession known to mankind and most vital profession for the economy of any nation and shared the strategical figure of contribution of mining industry in country's GDP and generation of high level of employment. He also highlighted the legislative and administrative reforms like Mines and Minerals (Development and Regulation) Amendment Act, 2021, introduction of Labour Codes, etc. ‘Role of Information technology in Mining Sector’ and shared the initiatives taken by DGMS. He also suggested setting up lecture series for knowledge sharing on the occasion of 75th Azadi Ka Amrit Parv.



Address by Sh. Roopwant Singh, IAS



Memorial Lecture by Sh. R. Subramanian, Former DGMS

Chief Guest, Dr. D K Sinha presented his views on the theme. He talked about, Geology & Minerals of Gujarat, Rare Earth Elements & Applications, Crustal abundances of REE elements with their Global distribution. Resource and Production, Exploration and Resource Augmentation in India, Monazite (Th +REE) Resources in Placer Deposits of India, REE Prospects of Gujarat, Ambadungar deposits, New Exploration target North of Ambadungar: Saidavasani Carbonatite Complex, Chhota Udepur district, Gujarat. He concluded by informing that AMD has intensified exploitation of REE resources mainly based on indigenous technology and expertise to contribute to the indigenous growth of industries under “Make in India”. Inaugural session concluded with presentation of mementos to dignitaries and vote of thanks proposed by Secretary of Chapter, Ms. Gunjan Pande.



Presentation of Memento by Sh. Joshi to Dr. Sinha

Technical Session-I was held with two paper presentations and Chaired by Mr. Manish Jaiswal, DMS Ahmedabad & Co-Chaired by Mr. R. D. Shah Retd. Prof. M. G. Science College. First paper on Strategic importance of Base metals in Gujarat was presented by Mr. Arjun Arya from BCG. He spoke about increased demand of base metals nationally and globally with rising commodity prices and brief about Gujarat’s scenario regarding base metals. Second paper was presented by Mr. Ashutosh Satapathy, from McKinsey

on Strategic Minerals. He talked about Gujarat’s position and strategy in mineral resources and megatrends such as electrification emphasizing the huge gap in requirement and demand over the next decades.



Mr. Manish Jaiswal & Mr. R.D. Shah Chairing Session



Memento presentation to Speaker Mr. Satapathy

Technical Session-II was held Post lunch with three paper presentations. This Session was chaired by Mr. Murlidhar Mishra, DMS, Surat & Co-Chaired by Mr. R.C. Kachhara-Former DGM, Govt. of Gujarat. Mr. N.V. Nitnaware, DDG, Western Zone, GSI presented a paper on Critical Mineral Potentiality of Gujarat and talked about REE bearing minerals and exploration. Second paper titled GMDC: A Gateway of Investment for the Cement Sector, Gujarat was presented by Mr. A. K. Sharma from GMDC . He spoke about the huge resources of Limestone available with GMDC, grades and the business opportunities. Mr. Rajib Maitra presented the third paper from Deloitte. He emphasized the revenue enhancement opportunities in the Bauxite sector.



Mr. Murlidhar Mishra & Mr. R.C. Kachhara, Chairing the Session



Memento presentation to Speaker Mr. A.K. Sharma

Post Technical sessions, a Valedictory Session was held with Chief Guest Mr. G.T. Pandya, IAS, Director Technical Education, accompanied with Mr. S.N. Mathur, Mr. Niranjn Sharma, Former DMS, Mr. Satish Kumar Former DMS, Mr. Anil Mathur Chairman Jaipur Chapter and Mr. A.K. Jain, Chairman, Veraval Porbandar Chapter on dais. All the delegates shared their views on the theme. The seminar concluded with the singing of the National Anthem and High tea. The proceedings of the seminar were streamed live on YouTube and a press release was published in leading dailies.



A view of Audience

26th Annual General Meeting of Chapter was organized on 14 June 2022 at Hotel Courtyard by Marriott Ahmedabad. At the outset, two-minute silence was observed to pay homage to the members of Chapter (Late Sh/ Ashok kumar singh Nirala, Pramod Kumar, Mehul K. Vora. Vallab Das K., C. K. Joshi, C. R. Patel), who left for heavenly abode during the past one year.

Mr. H.K. Joshi- Chapter Chairman delivered the Welcome Address expressing happiness over the consistent efforts made by the Chapter throughout the year. He praised the members' efforts in maintaining the flow of knowledge by organizing webinars periodically and made special reference to brilliant efforts made by all Local centers. Secretary's Annual Report for the year 2021-22 was presented by Ms. Gunjan Pande, narrating the various activities conducted by the Chapter. The Annual Audited Accounts of Year 2021-22 were also presented by the Treasurer Mr. G. C. Darji and the same were approved by the house.

Mr. S.N. Mathur presented the Chapter's Annual Awards. Kutch Local Center was awarded with the Best Local Centre Award to Mr. P K Samantray. Best Member of the Chapter

Award was presented to Mr. Sanjeev kumar Pandey and Mr. D. A. Bhimani. Mr. S.N. Mathur also felicitated members of the Chapter Mr. Kiran Bera, Mr. H.M. Patel, Mr. A.K. Makadia for their special contribution to the Chapter. A memento for compiling Best Logo was presented to Mr. N.S. Prajapati. Past Chairmen and Secretaries of Chapter were also felicitated on the occasion. The AGM was followed by Musical evening by "Thousand Beats Band" and family dinner.

Proceedings of the AGM were also streamed live on YouTube.



Mr. H K Joshi presenting Welcome Address



Presentation of Award to Kuch Local Center

BELLARY-HOSPET CHAPTER INAUGURATION OF FIRST AID TRAINING CENTRE AT NMDC Limited

The BH Chapter obtained permission from the Director General of Mines Safety on 25.04.2022 to extend First aid training and issue of First aid certificate of competencies at the approved Centre "NMDC Limited-MEAI BH Chapter First Aid Training Centre, Donimalai". This is the first Centre approved for First aid training among MEAI Chapters.

Inauguration of the First aid Centre was celebrated in a grand way on 14.05.2022 morning at NMDC Limited Mines, Donimalai. The Management & staff of NMDC Limited organized the event in well planned and awesome manner.





Chief Guests of the function Sri. Umesh Sawarkar, DMS Ballary, Dr. Kaushik Sarkar, Inspector of Mines (OH), Hyderabad and Sri. B. Sahoo, the Executive Director of M/s NMDC Limited attended the celebrations in spite of their busy engagements. Guests of Honor Sri. Sanjeev Sahi, Chief General Manager of NMDC Limited, Donimalai, Sri. K. Madhusudhana, President MEAI & Vice President of M/s MSPL Limited, Hosapete and Sri. K. Prabhakara Reddy, Chairman of BH Chapter also made their presence in the celebrations.

Chief Guests of the function inaugurated the celebrations by cutting the ribbon at the Approved First aid training Centre, inspected the facilities provided in the Centre and appreciated the NMDC Limited staff for making decent arrangements.



Sri. Vinay kumar, Senior Manager of NMDC invited the Chief guests and the Guests of Honor to occupy the dais before starting the function. The Chief guests and the Guests of Honor have lighted the lamp to signify the inauguration of the meeting.

Sri. K. Prabhakara Reddy thanked all the Official of DGMS for granting approval of First aid Centre at NMDC Limited, Donimalai and congratulated the members of BH Chapter & the NMDC Training and Medical Staff, for sparing their valuable time in extending their support in getting the approval for the First aid Training Centre at NMDC Ltd. Sri. K. Prabhakara Reddy has recollected the support and co-operation received from the Officials of the NMDC Limited Sri. B. Sahoo, the Executive Director Sri. Sanjeev Sahi,

Chief General Manager Sri. Jagadish S.H., Sri. Vinay kumar, Senior Manager and Dr. Swarupa Padi.

The MEAI President Sri. K. Madhusudhana recollected the conceptualization and the efforts made in getting the approval of the First Aid Training Centre at NMDC Ltd., and the impediments faced in getting the approval, and the support and guidance received from the Directorate. He expressed gratitude to Executive Director Sri. B. Sahoo, Chief General Manager Sri. Sanjeev Sahi and Dy General Manger Sri. S.H. Jagadish for the leadership shown in obtaining the approval from DGMS. He congratulated the Executive and Development Committees of BH Chapter and all other members that supported for this good cause.

Sri. Sanjev Sahi told the efforts and pain taken by the Top Management of NMDC Ltd in getting the permission for First Aid Training Centre at Donimalai. He also appreciated the BH Chapter for its successful endeavors in getting the permission of Centre from DGMS.

Sri. B. Sahoo briefed the idea of First Aid Training and the endeavors in getting the consent from the Management of NMDC Ltd., for the benefit of the mining personnel. He recollected his strong relationship with BH Chapter as its Chairman. He appreciated that Sri. Prabhakara Reddy implemented new innovative idea for the benefit of regional mining fraternity as the Chairman of the Chapter for the past two terms.

Dr. Kaushik Sarkar, Inspector of Mines (OH) has expressed in his speech the role he played in the background consultations in making the new policy by the Government to approve the private Centre for providing First Aid training and issue certificates of competency under Mines Act & other DGMS provisions. The Doctor told some serious accidents happened in mining industry have become fatal where the first aid was not provided on time at the site of working and many lives involved in mining & public places could be saved if the immediate care of casualty by rendering Proper First Aid at the site. Dr. Kaushik Sarkar has expressed his satisfaction on the arrangements at the NMDC Limited for Training purpose and excellent training of candidates is expected at this Centre.

Sri. Umesh Sawarkar the Director of Mines Safety, Bellary spoke about the need for good training in First Aid and its use in mining industry. The Director of Mines Safety expressed his hope of imparting good first aid training to the persons employed in the mines of the region at the NMDC Limited approved training Centre.

Sri. Umesh Sawarkar the DMS Bellary congratulated BH Chapter and the NMDC Limited for their interest and effort towards providing the training for First Aid. He hoped all the

faculty and trainees will utilize the opportunity at NMDC Limited and advised all the Mine managers in the region to send their employees for First Aid training. The DGMS officials Sri. Umesh Sawarkar and Dr. Kaushik Sarkar met the first batch 30 trainees, who enrolled for training that commenced on the same day.



Sri. Rakesh M.M., Executive Member of BH Chapter proposed Vote of Thanks on behalf of MEAI and NMDC Limited to the DGMS Officials, NMDC Management, Guests, MEAI Members, NMDC Employees and other Participants.

Over 85 members were present in the Inauguration function of “NMDC Limited-MEAI BH Chapter First aid training

centre, Donimalai” from the NMDC Limited, BH Chapter and the Mangers, Employees of the local mining companies.

NMDC Limited Donimalai mine employees and Union representatives also participated and appreciated the arrangement of the First Aid Centre. They asked the NMDC Limited management to give opportunity to its employees to get trained in the First aid.



Sri. K. Prabhakara Reddy felicitated the Chief Guests and the Guests of Honor. The Management of NMDC Limited provided Snacks and Lunch in their premises.

Vision to Enforce Digital Base compliance

- Due diligence of mineral property.
- Digital arial mapping by drone and satellite image.
- DGPS geo-reference compliance.
- Volumetric measurement / Cut & Fill
- Mineral Resource Estimation.
- Mining Plan, Forest Diversion proposal & Environmental proposal.
- Regulatory Auditing & Assistance.

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(Under rule 34A of MCDR)

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OBITUARY



Shri R.H. Sawkar
{29.3.1935 –1.6.2022}

An eminent Geologist, Shri R.H. Sawkar breathed his last peacefully on the morning of June 1, 2022 at the age of 87 in his home at Bengaluru. Shri Sawkar is survived by his Wife, Son, Daughter and Grand-Children and their families that are settled in Bengaluru.

Born on March 29, 1935 to HemReddy Sawkar and Lingamma Hiregoudar, he is from Magala Village, Huvinhadagalli taluk, Vijayanagar dist, Karnataka. He had four brothers and two sisters. He graduated with B.Sc [Hons] in Geology in 1959 and M.Sc in Geology in 1961 from Mysore University followed by a Diploma in Aerial Photo Interpretation and training in I.T.C [Australia]-Mineral Exploration and Mine Development Programme under Colombo Plan. He was a sportsman, swimmer and wrestler.

Started his career in Dept of Mines & Geology, Govt of Karnataka as Assistant Geologist in 1959. During 1959 -1964, he was associated with the exploration of Iron ores in West Coast, Clay & Feldspar deposits in Goribidanur taluk, mineral resources of South Canara, Limestone deposits in Bijapur & Belgaum, and Gold deposits of Gadag Gold Fields, Karnataka. From 1964-1966 as Jr. Geologist, he was deputed to National Mineral Development Corporation Ltd [NMDC] where he was associated with the exploration of Iron ore deposits of Kudremukh area, for the preparation of a detailed project report for Visvesvaraya Iron & Steel Ltd for mining iron ore. During 1966 -1970, he was associated with the Dharwad division inspection of mining leases, exploration of Iron, Manganese ores of North Canara, Bauxite deposits of coastal area, and the site selection of Vijayanagar steel Plant, Karnataka. From 1970 -1976, on deputation, he was associated with the Mysore Minerals Ltd [Karnataka State Minerals Corporation Ltd] as Project Manager & Agent for ore production, sales, shipment, transportation, mine planning, exploration of various minerals, etc. During 1976-1985, on deputation, he worked as Project Manager of Karnataka Copper Consortium Ltd for the exploration and mine development of Kalyadi Copper Project, Ingaldhal Copper Mine, assisting the Karnataka State Govt in the merger proposal of these copper companies with the Hutti Gold Mines Co Ltd [HGML]. Merger of these companies with HGML took place on 12.07.1985. From 1985 -1995, he worked in different capacities in HGML for the Chitrdurga Copper Unit, Gadag Gold Project & Corporate Planning etc. and retired from HGML on 31.3.1995 as Executive Director. Subsequently, he worked with HGML as Technical Advisor until 1.6.1997.

He was associated with all the leading earth science Associations in India and abroad. At the time of his sad demise, he was the Secretary General of the Geological Society of India and he was actively associated with the MEAI, Rashtriya Jal Biradari, Water Development Rural and Urban societies, Dam Safety etc. He was a member of various State & Central Govt Committees. He has presented & published several technical papers in the national & international seminars and chaired the technical sessions. He was actively involved as advisor/consultant to exploration, mining and metallurgy industries. He travelled widely, a simple man with tons of curiosity to discover new things. He guided and inspired many fellow professionals. Shri Sawkar will remain in the hearts of the many. His family, friends and colleagues will deeply miss him.

Dr. Prabhakar Sangurmatah
Director, Hutti Gold Mines Co Ltd.(HGML)
E-mail: prabhakar_sangurmatah@ rediffmail.com

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 editormejai@gmail.com by 20th of the current month. If more than three members responded with the correct answers, then the three winners will be decided by draw. Each winner will be issued a certificate of merit and a nominal cash prize of Rs 500.

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

Questions based on MEJ June 2022 issue

- 1. Which Company is planting double the trees for a better tomorrow?**
(a) GMDC (b) Tata Steel
(c) Hindustan Zinc Ltd (d) NALCO
- 2. How many professionals attended the IMIC-PDP-3 held by NACRI?**
(a) 26 (b) 27
(c) 28 (d) 29
- 3. Which Indian Company is acquiring Holcim Indian operations?**
(a) Jindal Steel & Power Ltd (b) Ultra Tech Cement Limited
(c) India Cements Limited (d) Adani Group
- 4. What is the key to energy transition but not loved?**
(a) Mining (b) Information Technology
(c) Space technology (d) Tourism
- 5. In which country the Saskatchewan potash deposits are located?**
(a) USA (b) Canada
(c) Belarus (d) Russia

WINNERS OF RIDDLES PUBLISHED IN THE MEJ JUNE 2022 ISSUE

Congratulations to proud winners

Dr. Ashok Kumar, PhD

Scientist, CSIR-Central Institute of Mining & Fuel Research, Dhanbad

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

Sanjeev Soni

ACC Limited

E-mail: sanjeevkumar.soni@acclimited.com

Prof. D.P. Tripathy

Department of Mining Engineering, National Institute of Technology, Rourkela

E-mail: debi_tripathy@yahoo.co.in

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

CONFERENCES, SEMINARS, WORKSHOPS ETC.

ABROAD

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

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

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

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

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

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

19-20 Sep 2022: Global Conference on Geology and Earth Science. Paris, France. Presentation: Hybrid. Contact: Website L: <https://geology.magnusconferences.com/>; Contact E-mail: geology@magnusconference.com

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

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

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

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

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

Program URL: <https://waset.org/conferences-in-november-2022-in-singapore/program>.

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

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

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

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

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

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

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

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

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

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

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

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TATA STEEL

#WeAlsoMakeTomorrow



#SteelFact

Globally, extensive

afforestation

programmes are converting mines into habitats for local wildlife

Source: World Steel Association

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

**Data as on October 2021*

PLANTING DOUBLE THE TREES FOR A BETTER TOMORROW

BOTANICAL PARK, NOAMUNDI

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

Sure, we make steel.

But #WeAlsoMakeTomorrow.



HINDUSTAN ZINC
Zinc & Silver of India



Featured in
Sustainability Year Book 2020

Member of
FTSE4Good Emerging Index

Certified
Water Positive company

'Good Cultural Foundation'
in Great Place to Work Survey

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

Ranked 1st in
Asia-Pacific and globally 5th by Dow Jones Sustainability Index
in 2019 amongst Mining & Metal companies

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

Hindustan Zinc Limited

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

P: +91 294-6604000-02 | www.hzindia.com | CIN-L27204RJ1966PLC001208

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