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this issue contains...

President's Message	5
Editor's Desk	7
The Potential of Mining Asteroid Resources for the Future of Mankind - P. V. Sukumaran & L. C. Anupama	9
Indian Mining Day Celebrations 2024	19
MEAI News	33
Conferences, Seminars, Workshops etc.	42

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President's Message.....

Dear members..

The 5th Council meeting was recently held at Hutti Gold Mines of HGML. It was very well organized, with the Chairman Hutti-Kalaburagi Chapter and his team ensuring quality hospitality arrangements. Discussions were mostly to the point, except for a few agenda items that reached no conclusion, as usual. It was decided to make a more serious effort by deputing special teams to visit two of the dormant Chapters to attempt their revival. Let's hope for the success of this effort.

Shri Lalit Mohan Soni, Chairman Rajasthan Chapter-Jaipur gave a good presentation about the progress made by the Chapter in the last couple of months. It was felt that the detailed agenda notes were circulated quite late, just before the meeting. As a result, the members didn't have time to go through them and deliberate over the suggestions. This effectively resulted in indecision. Some of the affected issues relate to:

1. Reconsideration of the date of IMD celebration
2. Induction of more Women Life members into the Council
3. Organizing a special event "by & for the Students"
4. Co-terminus of the Council and the Chapters' Executive Committees, etc.

The experiment of organizing Panel discussion over the impact of recent orders from the Hon'ble Supreme Court proved quite successful, with all panelists making some good recommendations. The Moderator Shri Sundara Ramam, VP-I, is expected to prepare a summary of recommendations which we propose to submit to the Ministry of mines and other relevant government authorities. We now feel that more such programs may be organized before every Council Meeting in the future.

The IMD was celebrated by different Chapters this time on different dates (from 1st to as late as 16th Nov.) due to overlapping Deepawali festival. This has happened in the past and may happen again in the future also. It's not a mere observing the Day by formal pledge taking and flag hoisting; many Chapters did celebrate it by organizing a varied activities. The brief reports and photographs uploaded on Council's & Chapters' WhatsApp groups suggest how much importance was given by some Chapters. Thus the matter needs serious consideration.

While visiting Hutti for the Council meeting, I had the opportunity to visit Bangalore and Bellary-Hospet Chapters and meet their Executive Committees and other senior members. I could also attend the IMD celebration by the Delhi Chapter virtually. I now propose to visit some more Chapters in the coming few months.

One important matter that remains pending is about organizing some events by and for the Students. I urge all nominated moderators of the Student Chapters to come forward and organize these events at earliest.

S.N. Mathur
President



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EDITOR'S DESK

Indian Mining Day: A Celebration of Heritage and Progress



Dr. P.V. Rao
Editor, MEJ

Indian Mining Day, celebrated annually on November 1, is a significant occasion to recognize the contributions of the mining sector to India's economy, culture, and infrastructure. *Officially designated by the Mining Engineers' Association of India (MEAI) in 2013, this day aims to raise awareness about the importance of mining and address the challenges faced by this critical industry.* The observance of Indian Mining Day reflects the historical significance of mining in India, its current state, and its future potential for sustainable development.

Mining in India has a rich history that dates back thousands of years. The earliest evidence of mining activities can be traced to pre-Harappan times, where rudimentary tools such as pickaxes and chisels were used to extract minerals. Over the centuries, mining practices evolved alongside technological advancements, transitioning from manual labour to more sophisticated methods involving machinery. India is home to vast mineral resources, including coal, iron ore, bauxite, limestone, barytes and chromite. The British colonial period marked a significant turning point in Indian mining history. The establishment of coal mines in the late 18th century laid the foundation for an industry that would later fuel India's industrialization. Despite its potential, mining has often been marred by challenges such as environmental degradation, regulatory hurdles, and socio-economic issues affecting local communities.

Today, the mining sector plays a key role in India's economy. It contributes approximately 2.2% of the Gross Domestic Product (GDP) and around 10% to 11% of the industrial sector's GDP. Furthermore, as per recent estimates, the mining sector in India directly employs approximately 2.3 million people, encompassing both organized and unorganized sectors. The potential for job creation in this sector is significant; with appropriate government support and reforms, it is projected that the mining sector could provide direct employment opportunities to about 5 million people by 2025. This figure reflects employment across various sub-sectors of mining, including coal, minerals, and other resources. The sector is particularly vital for rural economies where mining operations often serve as a primary source of livelihood. According to estimates from the Ministry of Mines, if effectively harnessed, this sector could contribute up to ₹1.25 lakh crore (approximately \$150 billion) to India's GDP by 2025 while creating around 15 million jobs. However, achieving this potential requires addressing existing challenges such as bureaucratic inefficiencies and public misconceptions about mining practices.

Despite its economic importance, the Indian mining sector faces several challenges. One major issue is government apathy towards regulatory frameworks that govern mining operations. Many stakeholders argue that excessive regulation can stifle growth and discourage investment in new projects. Additionally, public perception often views mining negatively due to its association with environmental degradation and displacement of local communities. Environmental concerns are paramount; unregulated mining practices have led to significant ecological damage in many regions. This includes deforestation, soil erosion, and contamination of water sources. Moreover, high-profile scandals involving illegal mining activities have tarnished the industry's reputation and raised questions about governance and accountability.

Indian Mining Day serves not only as a celebration but also as an opportunity for education regarding sustainable practices in mining. Events such as seminars and workshops are organized across various locations to discuss best practices in resource extraction while minimizing environmental impact. These initiatives aim to inspire new generations of professionals in the field by highlighting the importance of responsible mining practices. The lack of interest among students in pursuing careers related to mining is another challenge that needs addressing. Currently, India produces only a few hundred mining engineers annually compared to thousands produced by countries like China. By promoting educational programs focused on geology and engineering related to mining, stakeholders hope to cultivate a skilled workforce capable of innovating within the industry.

Looking ahead, the future of Indian mining appears promising if strategic measures are implemented. The government's push towards infrastructure development can facilitate better access to mineral-rich areas while ensuring compliance with environmental regulations. Furthermore, advancements in technology can enhance operational efficiency and safety in mines. Sustainable practices must be at the forefront of future developments in this sector. This includes adopting eco-friendly technologies for mineral extraction while engaging local communities in decision-making processes that affect their livelihoods. By fostering collaboration among stakeholders—government bodies, industry leaders, environmentalists, and local communities—India can pave the way for a more sustainable mining sector.

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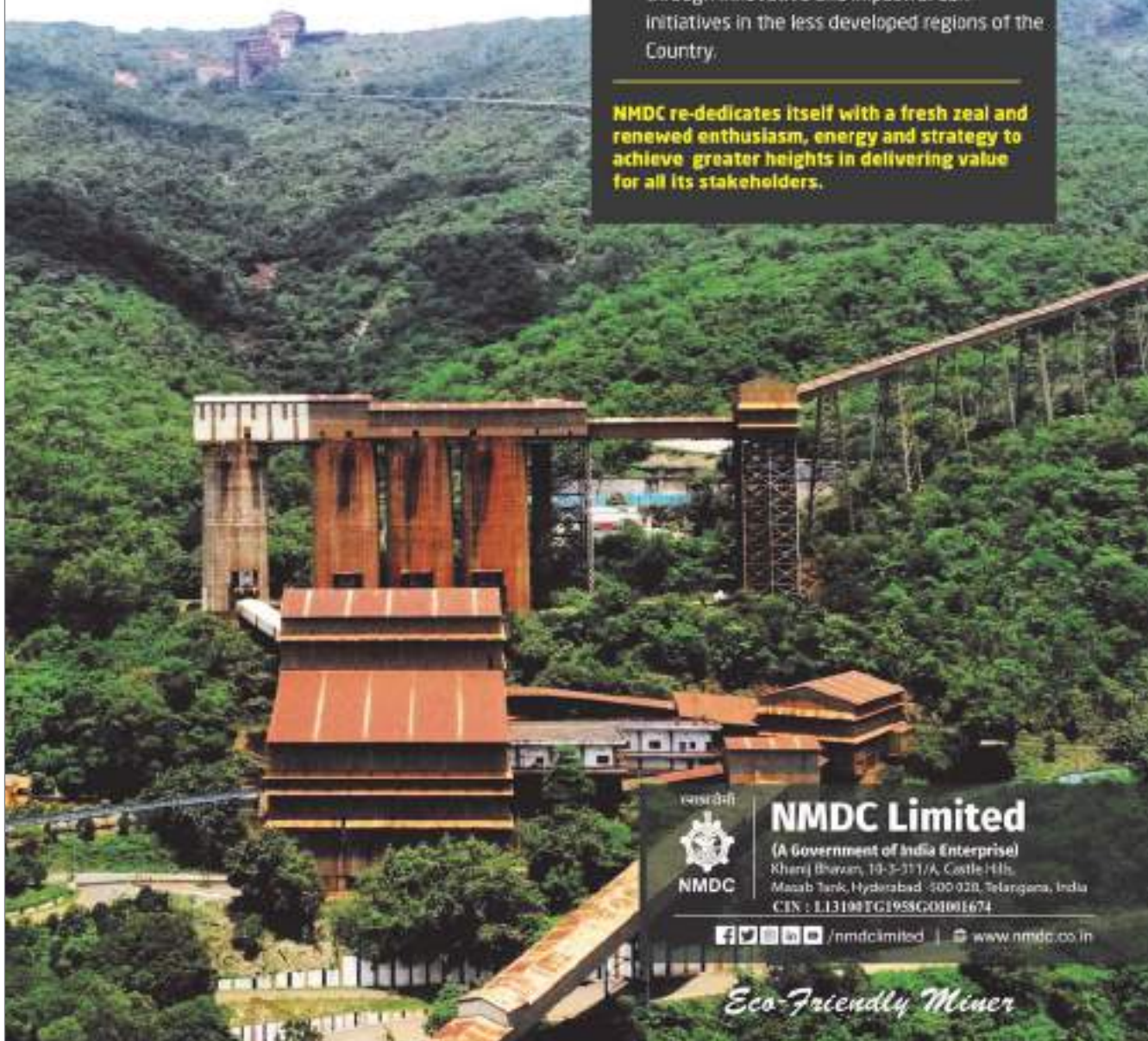


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THE POTENTIAL OF MINING ASTEROID RESOURCES FOR THE FUTURE OF MANKIND

P. V. Sukumaran* and L. C. Anupama**

Abstract

Depleting terrestrial mineral resources is no longer a concern because there are practically inexhaustible resources in the Solar System neighbourhood itself provided the human race could mine them. Asteroid mining would be the biggest game-changer in human history and could soon be the new gold rush. There are three reasons to go in for space mining: the terrestrial resources, particularly Platinum Group of Metals (PGM) required for a vast array of industrial and electronic applications are fast depleting; transportation of materials including rocket fuels from Earth for use in space exploration programmes is prohibitively expensive; and finally, there is a virtually inexhaustible resource available in asteroids. According to NASA the mineral wealth of the asteroid belt between Mars and Jupiter could be as much as \$700 quadrillion which appears a vicarious treasure, but illustrates the huge mineral wealth floating in the sky. For instance, the metal world asteroid 16 Psyche is valued at \$100,000 quadrillion in Fe, Ni, Precious Metals and PGM, a resource that is irresistibly tempting to exploit. More promising are the PGM in certain types of asteroids which are about 100 times more enriched in asteroids than their ores currently being mined on Earth. Given their fabulous wealth asteroid mining is going to be a lucrative business. A dozen or so mining companies are eying at this incredible wealth and are gearing up preparedness to harvest them albeit existing space law to exploit resources beyond Earth is ambiguous.

Key words: *asteroids, chondrite, meteorite, mining, platinum, volatiles, precious metals, space law.*

1. INTRODUCTION

The celestial wonder of rocks falling from the sky attracted human curiosity from immemorial times and were regarded as bad omens and messages from heaven. Though ancients around the world had observed objects falling from the sky for centuries, the phenomenon was associated with superstition, and it took a long time to understand their scientific reasoning. The fall of rocks from the sky was beyond belief and there was even widespread denial of the reality of meteorites falling from the skies. Antoine Lavoisier, the 18th century French chemist, for example, had rejected eye-witness accounts of the fall of meteorites for the common-sense reason that stones cannot fall from the sky as there were no stones in the sky. By the turn of the 19th century, scholars began to think logically and it was gradually recognised that rocks do fall from the sky. The discovery of the first asteroid Ceres (D: 945 km) in 1801 by a Sicilian astronomer, Giuseppe Piazzi led to the recognition of the Asteroid Belt between the orbits of Mars and Jupiter.

Mining the Solar System's riches was the subject of the 1981 British science fiction thriller movie *Outland*. Forty-three years since, mining ventures in the sky is no longer a fantasy: four American private companies, *Planetary Resources* (recently acquired by *ConsensSys Inc*), *AstroForge*, *Deep*

Space Industries and *Shackleton Energy* have already been floated to mine asteroid resources. Today there are a dozen start-ups in the space mining industry hoping to reap the riches of space resources. When realised asteroid mining would be the biggest game-changer in human history and could soon be the new gold rush. The idea of asteroid mining dates back to the Russian rocket scientist Konstantin Tsiolkovsky (1857-1935); it was revived recently by John Lewis (1997), an American planetary scientist and asteroid expert, in his book *Mining the Sky*.

But why go for the risky proposition of asteroid mining? The terrestrial mineral resources are finite and would not last forever; what would the human race do under such an impending eventuality? But nothing about this warrants concern: the resources in the earth's neighbourhood are essentially inexhaustible if humanity could make it there and harvest them. The precious metal abundances in some **Near-Earth Asteroids (NEA)** are so luring that the immediate destination of the asteroid mining enterprises would be cost-effective to reach and mine them for these resources. The asteroids may prove to be a veritable cornucopia of resources for the industrialisation of space and the NEA are probably the best prospects for early extraterrestrial resource recovery ventures. There are three important reasons to go

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in for space mining: the terrestrial resources, particularly of the Platinum Group of Metals (PGM: ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir) and platinum (Pt)), required for a vast array of industrial and electronic applications, are fast depleting; transportation of materials including rocket fuels from Earth for use in space structures for exploration programmes is prohibitively expensive; and finally there are virtually bountiful resources available in asteroids, comets and other bodies of the Solar System. A single asteroid has the potential to yield more PGM and Au than has ever been mined out of Earth since recorded history! Besides, many NEAs are energetically more accessible; ~10% of NEA are more accessible than the Moon, and at least 50% of these are likely to be potential ore bodies for PGM.

In addition to the threat of depletion, the acquisition of Earth resources is becoming increasingly expensive; at the same time acquisition of similar resources from space is becoming more and more affordable. Further, the market value of asteroids is mindboggling. For instance, the smallest positively identified metal asteroid, the D: 3 km **3554 Amun** (Fig.1A) is estimated to be worth \$20-30 trillion in metals (Lewis, J S, 1997) while the largest metal asteroid, the main belt asteroid **216 Kleopatra** (approximately 217 x 94 x 81 km; Fig.1B) is estimated to be a billion times more valuable than Amun. Yet another metal world, the 250 km wide asteroid **16 Psyche** composed almost entirely of Ni-Fe besides PGM and PMs, has enough Ni, Fe and PGM to meet humanity's demand for millions of years. In a recent estimate, Lewis puts the total value of ores in the NEA, at current market prices, at \$222 trillion. Asteroid **511 Davida**, a main belt C-type asteroid of ~320 km diameter is even more valuable with a resource value of \$27 quintillion (Business Insider June 2023; 1 quintillion is a million trillion). According to NASA the mineral wealth of the asteroid belt could be as much as \$700 quadrillion (a million billion makes a quadrillion); that is \$100 billion for each of the 7 billion inhabitants on Earth! This appears a vicarious treasure, but nevertheless illustrates the huge mineral wealth floating in the sky.

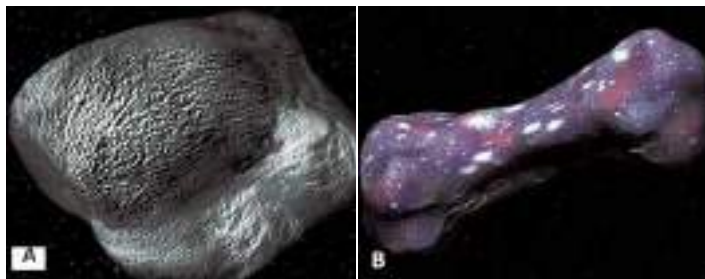


Fig. 1. (A) Asteroid 3554 Amun, a D: 3 km Near Earth Asteroid, is worth \$20-30 trillion in metals, (image: gkquesblog.wordpress.com); B: Dumbbell-shaped Asteroid 216 Kleopatra is a metallic asteroid billions of times more valuable than Amun (image wikisolarstsystem.com)

Besides eventual resource utilisation, asteroid exploration would enhance scientific knowledge about the early history of the Solar System and make it practicable to mitigate possible impact hazards. Of greater interest, however, is the fact that certain asteroids contain about 100 parts per million (ppm) of Au and PGM, nearly 20 times richer than average ores of these metals on Earth. At today's prices for these metals, a single small 200 m metallic asteroid could be worth ~ \$100 billion, thus proving to be a virtual gold mine. Moreover, ordinary asteroids consist of several percentages of Ni-Fe metal, which similarly contains a hundred ppm-levels of PGM. Further, carbonaceous chondrites are relatively rich in volatiles, which could be of great value to space explorations by providing H₂O, H₂ and O₂ for future space missions circumventing the need to haul these materials out of Earth's gravity. There are also strong environmental arguments for mining asteroids as an alternative to destructive mining on Earth: unlike Earth, asteroids do not have indigenous ecosystems that may be disrupted by mining activities.

2. WHAT ARE ASTEROIDS?

Asteroids are considered as “vermin of the skies” by astrophysicists, flotsams of planetary accretion representing primordial planetesimals that failed to form planets. Asteroid research thus could reveal a great deal about the early Solar System. Most asteroids condensed just after the formation of the Solar System, as reflected by their age (~4.7Ga). Large planetary bodies differentiated gravitationally allowing Fe, Ni, and PGM to settle to the core. Those accreting at the outer edge of the Solar System cooled more rapidly, slowing or stopping this differentiation process. Smaller bodies did not develop sufficient mass for gravity separation and reflect the original distribution of elements from the supernova event. PGM are quite abundant in these small bodies (chondrites), reflecting the original distribution of elements in the Solar Nebulae.

When asteroids land on the Earth they are called meteorites. It is by studying the meteorites that we gather much information about asteroids (GSI, 2014). Chondrite meteorites are fragments of undifferentiated asteroids and represent some of the most primitive material in the Solar System. It may be recorded that the Geological Survey of India, Kolkata, is the national repository and custodian of meteorite falls and finds in India. Most of the asteroids lie in the **Main Asteroid Belt (MAB; Fig.2A)** between the orbits of Mars and Jupiter, at distances between 2.1 and 3.3 AU from the Sun (AU = astronomical unit is the mean distance between Earth and Sun, ~150 million km). It is estimated that the MAB holds more than 200 asteroids >100 km in dia and two million objects >1 km. The largest asteroid is Ceres with a diameter of 945 km. Besides the MAB, others known as **Trojan and Greek Asteroids** share the orbit of Jupiter (Fig.2A).

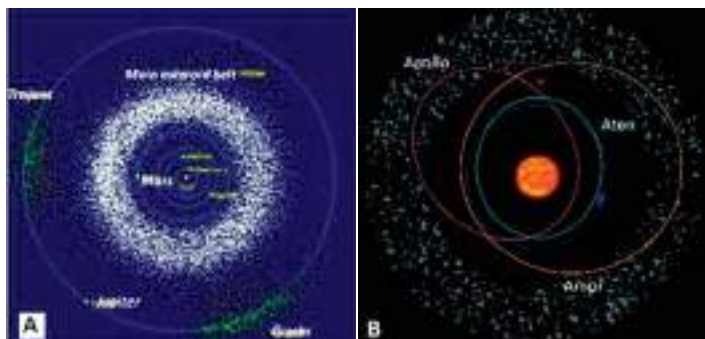


Fig.2A: The Main Belt Asteroids between the orbits of Mars and Jupiter (image: wikipedia.com) and B: the orbits of Near-Earth Asteroids (image: nineplanets.org)

The asteroid belt formed from primordial Solar Nebula as individual bodies that failed to fuse to form planetesimals, the starting materials from which planets accreted. Subsequent collisions shattered these bodies, losing most of the materials in the early stages of planet formation. However, the larger asteroids are differentiated into a metallic core, a rock-metal mantle and a stony crust. Those with orbits within 0.5 AU would be wholly inside the Earth's orbit and are called **Potentially Hazardous Asteroids (PHAs)**. These bodies pose collision hazards on Earth with the potential to wipe out civilizations.

Gravitational perturbations occasionally kick some of these asteroids out of the main belt closer to the Sun forming the class of asteroids called Near Earth Asteroids (NEA; Fig.2B). They are active asteroids or extinct comets which lie within the orbit of Mars between distances of 1.3 AU and 0.983 AU from the Sun. The NEA form three groups depending on their orbital parameters: Apollo, Amor and Aten (Fig.2B); besides, there are groups of Inner Earth Objects, Arjuna and Atiras with very Earth-like orbits forming ~6% of known asteroids. These are considered hazardous for their potential to sneak into Earth's orbit and cause catastrophic collisions, like the Chicxulub impact in Mexico 65 Ma ago that caused the dinosaur extinction, or the Tunguska event of 1908 in Russia. The Chelyabinsk event in Russia, where an 11,000-ton meteorite exploded 20 to 30 km above in February 2013 causing much havoc is still afresh in our minds.

The NEA range in size from Ganymede, (D: 31.7 km) down to fine micro-metre size dust particles. As of June 03, 2024, 35068 NEA have been discovered of which 860 are larger than a kilometre, and 2417 (152 >1km) are potentially hazardous (Centre for Near Earth Studies, CIT, June 03, 2024). There are more than a million NEA about 40 m in diameter, of which only about 1 % had been discovered by 2015. The NEA are compositionally very diverse but very similar to the MAB, ranging from metallic iron to stony to very black carbonaceous material. About half of the kilometre-sized NEA population is believed to be carbonaceous, and

thus carbon and water-rich. Despite their impact potential, NEA contains valuable resources and are prime targets for human exploration. The useful products that can be recovered from asteroids include volatiles (for use in space as rocket fuels), Ni-Fe-Co metals (for use in space structures), Ga, Ge, Si (semiconductors for use as solar arrays in space and electronics on Earth) and PGM (for use as catalysts, jewellery, etc on Earth).

2.1 Chemical Composition of Asteroids:

Much of our knowledge on the composition of asteroids comes from the study of meteorites, most of which originate in the asteroid belt, though a few are lunar or Martian material. The major element chemical composition of asteroids is determined by comparing their reflectance spectra with those of meteorites, but their minor and trace element composition can be inferred only by chemical analysis of meteorite samples. A rough spectral taxonomy of asteroid types groups them into three categories: *C-type* (Fig.3C; Carbonaceous: water, volatiles); *M-type* (Fig.3A; Metallic: metals) and *S-type* (Fig.3B; Stony: silicates, sulphides, metals).

Though there is no one-to-one correlation between meteorites and asteroids, M-type asteroids are comparable with IRON meteorites, S-type with Stony IRONs and Stony meteorites, and C-type with carbonaceous chondrites. The largest M-type asteroid to fall on Earth is the Hoba meteorite in Namibia which weighs ~60 tons and is formed entirely of Ni-Fe alloy.

The ordinary chondrite meteorites (Fig.3B; 4B) are fragments of undifferentiated S-type asteroids and represent some of the most primitive materials in the Solar System. The chondrite asteroids are subdivided into three groups, designated as H, L, and LL chondrites. H-types are **H**igh in total iron and metals, while LL-types are **L**ow in total iron and **L**ow in metals; the L-types are intermediate between H and LL types in their contents of total iron and metals. Most NEA are comparable to LL chondrites in spectral properties and mineral composition.

When the Earth condensed, most of the heavy elements sank to the core where they remain today and are totally out of reach. This is not the case with asteroids. Because of their formational processes, most lack a well-defined core. In the event that the heavy elements did have a chance to differentiate, they are still reachable because of the asteroids' small size. Fragmentation during collisions and evolutionary processes result in asteroids with exposed cores. In fact, during Earth's molten youth more than 4 Ga ago, the extreme temperature and gravity stripped all siderophile elements from the crust to the planet's core. All the Au, Co, Fe, Mn, Mo, Ni, Os, Pd, Pt, Rh, Rd and Ru that we presently mine from the Earth's crust, came originally from the rain

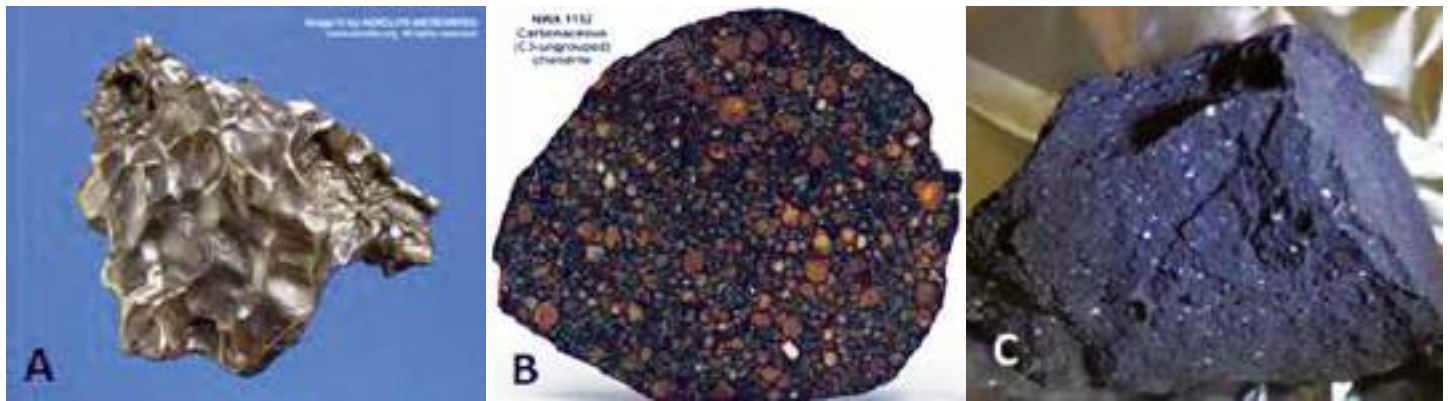


Fig.3A: M-type (metallic asteroid; image: aerolite.org); (B): S-type (stony asteroid, ordinary chondrite; rounded objects are chondrules); (C): C-type (carbonaceous chondrite; these are the most primitive materials in our Solar System consisting of a melange of minerals and organic compounds including amino acids and certain nucleobases. Their unique composition potentially carries important information on the earliest origins of water and the basic ingredients for life (image:virtualmicroscope.org).

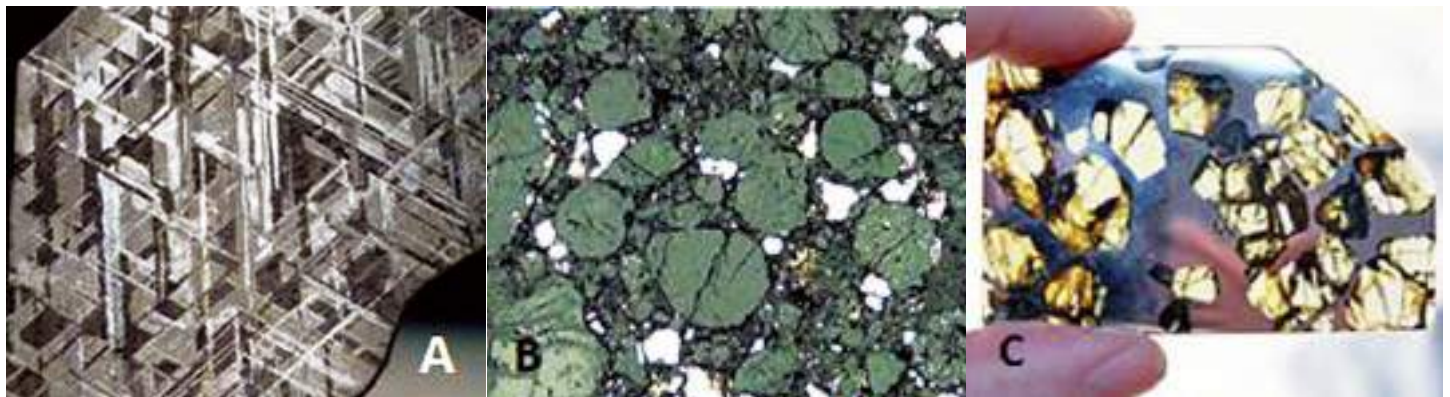


Fig.4A: M-type asteroid under reflected light showing Widmanstätten microstructures (an interlocking arrangement of two Ni-Fe alloy minerals namely kamacite and taenite in the metallic meteorite; image: aerolite.org); B: Ordinary chondrite (=S-type asteroid) under microscope; white grains are metallic Ni-Fe alloy and rounded gray objects are chondrules; C: Pallasite meteorite is an ordinary chondrite with gem peridot (yellow) embedded in Ni-Fe matrix (grey; image: wikipedia.com).

of asteroids and comets that hit the Earth after the crust cooled (Maier W et al, 2009).

2.2 Platinum Group of Metals (PGM) in asteroids:

Asteroidal materials in general are exceptionally good ores requiring a minimum of processing, since they have free metal already. The PGM are highly depleted in the Earth's crust as most of them have settled to the core during planet formation. On the asteroids, however, these metals are uniformly distributed in the body of asteroids making them easy to extract. The abundance of Pt and Pd are about 5 ppb in the Earth's crust while Rh, Ir and Ru are about 1ppb; PGM are enriched in ultramafic rocks such as peridotites in which Pt and Pd concentrations are 10-20 ppb (BGS, 2009). Operating Pt and Au mines in South Africa and elsewhere mine ores of grade 5 to 10 ppm. Compare this with many S-type asteroids that contain PGM at grades of up to 100 ppm (or 100 grams per ton) and with certain metal asteroids that contain 50-220ppm of PGM, and one will soon realize how spectacular is the bounty that asteroids hold.

Asteroid bodies are so rich in metals that they are stupendous gold mines of the future. The metal fraction of the typical LL chondrite has 50-60 ppm of PGM, and the concentration in the metal grains in certain types of chondrites could reach 100 to 200 ppm. In addition, platinum-rich ore may be ponded in loose regolith on some asteroid surfaces, making mining relatively easy. The most important target selection consideration besides asteroidal composition is the ease of mining and extracting the metal. Mining operations will be easier on larger asteroids because they are likely to have many deep ponds of mineral-rich regolith. Mining metal from an M-type asteroid is likely to be extremely difficult compared to extracting it from the chondrite asteroidal regolith.

PGM and Au are a thousand times more abundant in metallic and chondrite meteorites than in terrestrial rocks. Besides Type I and II carbonaceous chondrites contain granules of metals like W, Re, Mo, Ir and Os. Metallic meteorites and the metal fractions of other chondrites also contain PGM and Au. Spectra of sunlight reflected from asteroids, when compared

with those of meteorites and specific minerals, provide a guide to precious PGM in asteroids. PGM, Au, Ga and Ge, and some other precious metals are enriched thousands or even tens of thousands of times in some M-type asteroids compared to what they are in the average continental crust of Earth, and tens of times what they are in gold and platinum ore bodies on Earth. PGM are also abundant in certain types of NEA (Fig.5). NEA, mineralogically similar to ordinary chondrites, have PGM concentrations of 4.5 ppm that are comparable to those found in profitable terrestrial mines (3-6 ppm).

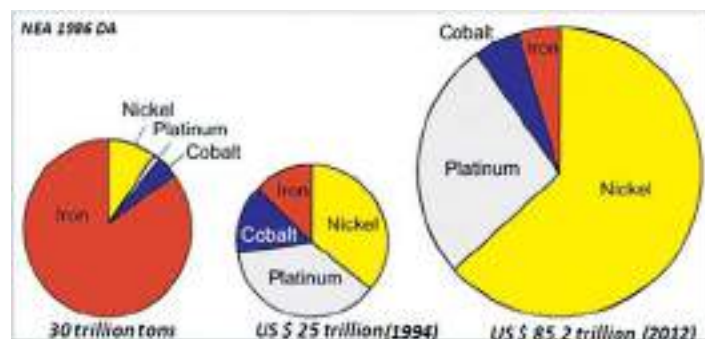


Fig.5. Metal contents and estimated value of Near-Earth Asteroid 1986DA. It is 3 km in diameter and is one of the most suitable targets for asteroid mining. The chemical composition of this asteroid was estimated (in 1994) by remote sensing and as such there are some uncertainties, and was revised in 2012 (image: Merle R et al, 2023).

Members of both metallic asteroids and LL-chondrite groups have been identified in NEA. The PGM value of a 200 m diameter asteroid mineralogically similar to H-type ordinary chondrites, with PGM abundances of ~4.5 ppm is over \$ 1 billion. Significantly higher metal concentrations may be found in asteroids mineralogically similar to a group IVB iron meteorite (Table-1) that has average PGM (in ppm): Ru 25.650, Rh 3.860, Pd 8.055, Ir 19.790, Pt 32.320; total PGM-5: ~90 ppm. The PGM-5 value of a 200 m diameter asteroid with elemental abundances similar to an IVB iron meteorite (PGM-5: ~90 ppm) is over \$25 billion (at January 2011 prices).

Table 1. Average abundance of metals in metallic asteroids and on Earth (From Dahl C et al, 2020)

Metal	Metallic asteroids gm/t	Earth's crust gm/t
Iron (Fe)	893,000	41,000
Cobalt (Co)	6,000	20
Nickel (Ni)	93,000	80
Ruthenium (Ru)	22	<1
Rhodium (Rh)	4	<1
Palladium (Pd)	17	<1
Osmium (Os)	15	<1
Iridium (Ir)	14	<1
Platinum (Pt)	29	1
Gold (Au)	1	1

2.3 Volatiles in asteroids:

There is a continuum from asteroidal to dormant cometary bodies, within the population of NEA. It is believed that as many as 50% of NEA may be volatile-bearing, containing clays, hydrated salts and hydrocarbons. In the case of those bodies which are dormant or extinct comets, there may be remnant primordial ice within their cores, and hence they are potential sources of volatiles for future space industry. Turning the ice into propellant would provide abundant fuel for space exploration.

The C-type asteroids make up about 20% of the known population of asteroids; they are the most compositionally diverse asteroids containing a rich mixture of volatiles, complex organic molecules, dry rock, and metals. They are easy to cut or crush because of their low mechanical strength, and can yield as much as 40% by mass of extractable volatiles, roughly equal parts water and carbon-bearing compounds. The residue left after volatile extraction is about 30% native metal alloy similar to M-asteroids. Besides, the two moons of Mars Phobos (~22 km in diameter) and Deimos (~12 km) are rich in water. The estimated potential amount of water on Phobos could be in excess of 100 billion tons and obviously these bodies could literally become fuel stations in Solar System voyages. Add to this the hundreds of billions of tons of water available as hydrated minerals on asteroids, and there is virtually an unlimited supply of propellants.

2.4 Super-heavy elements and ultra-dense asteroids:

While *16 Psyche* is valued at \$10 quintillion (1 quintillion = 1 million trillion; *Smithsonian Magazine*, January 4, 2022) in metals there is a still denser object in the main belt, asteroid “33 Polyhymnia” that is believed to be enriched in “super heavy elements” (SHE; mass number, Z = >103) unknown in terrestrial environments, and currently even outside the Periodic Table of elements. With a diameter of 54 km and an estimated mass of $6.20 \pm 0.74 \times 10^{18}$ kg Polyhymnia implies an extremely high density of 75.28 ± 9.71 gm/cm³ that was considered by earlier workers as puzzling and unreliable, as this mass is quite insufficient to squeeze minerals into ultra-dense phases. However, recent calculations (LaForge E et al, 2023) confirm that it's previously estimated density is not incorrect which means Polyhymnia is a Compact Ultra Dense Object (CUDO) made up of elements with Z of around 164 whose existence is not yet known to science.

Scientists have been intrigued by the density of certain objects in the Solar System that appear to be denser than Osmium (Os; Z =76; d = 22.5 gm/cm³), the densest naturally occurring element on the Periodic Table. These objects, such as certain asteroids, do not have the mass to compress minerals into an ultra-dense state like planetary cores. This has led to speculations about the existence of naturally occurring elements beyond the known Periodic Table. The

existence of these heavier elements could explain the peculiar observations about Polyhymnia, which has been classified as a potential CUDO with an incredible density of 75.28 gm/cm³. In fact, the incredible density of this asteroid may be a sign that it contains elements that humans have hitherto not observed in nature. Theoretical work suggests that there might be an “island of nuclear stability” around atomic number 164 with an unbelievable density of 75gm/cm³ where SHE could exist in stable states and be less prone to radioactive decay. Could the ultra-dense matter visualised in asteroids like Polyhymnia be composed of the hypothetical SHE? Possibly, yes. With humanity poised for asteroid mining the idea that some asteroids may be composed of SHE unknown on Earth is potentially motivating to “space miners” who are planning to exploit the PMs and PGMs present in certain asteroids such as *16 Psyche*.

3. MINING ASTEROIDS

Two types of asteroids offer particularly bright prospects for recovery of large quantities of PGM: the ordinary LL chondrites, which contain 1.2-5.3% Fe-Ni metal containing 50-220 ppm of precious metals, and metallic asteroids, which consist almost wholly of Fe-Ni phases and contain variable amounts of precious metals up to several hundred ppm. Successful recovery of 400,000 tons or more of precious metals contained in the smallest and least rich of these metallic asteroids could yield products worth \$5.1 trillion at recent market prices. The metal of ordinary chondrites is dispersed through silicate and sulphide phases. The average H-chondrite (high in Fe) contains about 18.7% Ni-Fe metal which in turn contains about 28 ppm of precious metals. LL-chondrites (low in Fe) contain from 1.2-5.3% Ni-Fe metal which in turn have 50-220ppm of precious metals. L-chondrites are intermediate between H and LL-chondrites in their content of Ni-Fe and in the richness of precious metals. *Thus LL-chondrites could be an optimum choice for exploitation.* They do not contain much metal, but the metal that they do have is extremely enriched in precious metals. Besides, there is a layer of pulverized regolith (Fig.6B) about 100m thick on rock-rich asteroids that is relatively easy to mine, then metal-rich asteroids that are difficult to mine being ductile because of these may not contain much regolith. However, the main problem in the exploitation of LL-chondrite asteroids is that they are relatively rare and difficult to identify spectroscopically. However, the richness of metallic asteroids in precious metals is luring and may be worth exploiting rather than LL-chondrites despite the difficulties.

3.1 Asteroid accessibility for mining:

To mine an asteroid, one must either travel to it with a complete set of mining and processing plants or bring it back to a stable location near Earth. NEA pass by Earth rapidly and usually don't return for a decade or more. This

makes it impractical to establish a mining operation on them; the solution therefore is to move and park them at stable locations near Earth. Some are small enough to be moved to stable locations near Earth for processing and there are about 1,100 of these moveable rocks so far discovered among NEA. One such location is the lunar orbit. Additional areas include the Earth-Moon Lagrange points where the pull of the Moon is almost exactly balanced by the gravity of Earth, or in High Earth Orbits (HEO). It is considered that asteroids with diameters < 30 m can be safely moved to the vicinity of the Earth. A captured asteroid puts vast resources into easy reach while protecting the Earth from a future impact at the same time. Even a smaller Earth-crossing asteroid such as **Apophis** (only 270 m wide) contains twenty-seven million tons of material, potentially including millions of tons of H₂O, Fe, C, N₂ and other materials valuable to life in outer space.

There are two options for processing an asteroid: bring back raw asteroidal material, or process it on-site to bring back only finished products, and produce fuel propellant, an important product of asteroidal mining, for the return trip. Almost 80% of the cost of space exploration today is in energy consumption while launching the vehicle and then the fuel it must carry for on-journey consumption. This can be circumvented if fuel depots can be created in LEO or in NEA from which vehicles could refuel the propellant. This would dramatically reduce the cost of sending missions to other planets and beyond. This fuel has to be obtained by mining the potential NEA.

Mining methodologies appear to be simple, requiring the separation of finely pulverized soil in a low gravity, high vacuum environment. Two primary mining and processing strategies emerge: sift through the pre-crushed regolith from a large NEA, or retrieve an entire small NEA for delivery to an Earth-orbital facility.

3.2 Safety Concerns of Asteroid Capture and Return:

Retrieving asteroids from their orbits and stabilising them in LEO has its own risks. The failure to stabilize the captured asteroid in an appropriate orbit would be suicidal leading to catastrophic impacts on Earth. Lewis, J S (2015) estimated that the minimum size of the asteroid that could completely disintegrate during accidental Earth entry is 100m, providing an upper size limit for assurance against damage. First, a small-sized asteroid would be the target for return so that even if the mission fails the asteroid will burn in the Earth's atmosphere. Second, a small carbonaceous asteroid would be an ideal choice as asteroids of this type and size are known to be too weak to survive entry through the Earth's atmosphere so that even if it approaches the Earth it would break up and volatilize in the atmosphere. Further, it would be more prudent to place the retrieved asteroid in an orbit from which, if all else fails, it would only impact the Moon, not

Earth. A high lunar orbit would be the preferred destination for the returned asteroid to be berthed. Thirdly the trajectory design for moving the asteroid toward the Earth would keep it on a nonimpact trajectory at all times so that if the flight system fails the resulting orbit would be no more dangerous than that of thousands of natural and man-made objects in near-Earth space. Fourth, the destination orbit would be a high lunar orbit so that even at the end of the mission the natural perturbations of the trajectory would cause an eventual impact on the Moon, not on Earth. Lagrange points between Earth-Moon and Earth-Sun are other potential gateways where asteroids brought back can be deposited for processing so that there is little chance of falling to Earth. Anything smaller poses no danger to the Earth, as they cannot penetrate the atmosphere intact.

To be able to return these objects to the vicinity of the Earth they must have orbital parameters that are very similar to Earth's. Consequently, these objects will have synodic periods (the time interval that a heavenly object takes to reappear at the same point in relation to two or more other objects) that are typically one or more decades long. This places an additional constraint on small asteroids to be candidates for return: they must have synodic periods of approximately one decade. This would enable the object to be discovered and characterized followed by a mission targeted to return the NEA by the next close approach approximately 10 years later. The asteroid *2008HU4* is estimated to be roughly 8 m in diameter that made its close approach to Earth in 2016 with a subsequent close approach in 2026.

4. NASA'S DISCOVERY MISSION TO 16 PSYCHE

NASA's real eyes seem to be focused on the MAB's *16 Psyche* (Fig.6A) for its fabulous mineral wealth. There are still contradictions in the data, and recent scientific analysis indicates that *Psyche* is unlikely to be a monolithic metal world but rather made of a mixture of rock and metal, with metal composing 30% to 60% of its volume.

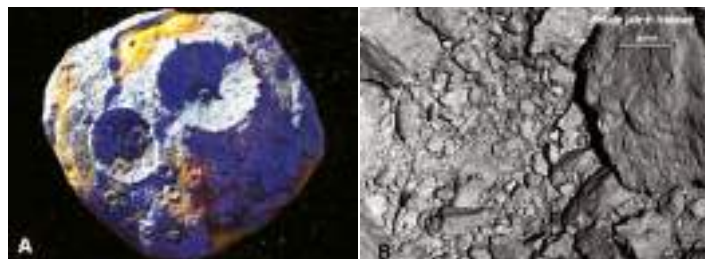


Fig.6A: *16 Psyche* is an M-type asteroid valued at \$10 quintillion in metals. New data suggest that it is a large grey space rock with huge craters on the surface and patches of brown material. NASA's Discovery Mission to *16 Psyche* lifted off from Kennedy Space Centre, Florida in October 2023 and is expected to enter *Psyche*'s orbit in 2029. The spacecraft will explore and gather data about the asteroid in terms of its surface features and chemical makeup. (Image credit: NASA/JPL-Caltech/ASU). B: Rubble piles such as these (in asteroid *Itokawa*) are easier to excavate than intact asteroidal bodies.

Besides, *Psyche* is considered to be the core of a planet that disintegrated due to collision and thus offers a unique opportunity to look into the cores of the terrestrial planets, through *Psyche*'s eyes that are otherwise inaccessible. The *Psyche* Mission of NASA, under its Discovery Programme, is a journey to this metal asteroid that lifted off on October 13, 2023 after years of uncertainty, from Kennedy Space Centre in Florida. The spacecraft will enter *Psyche*'s orbit in August 2029 and will orbit it for 26 months to explore and gather data about it.

5. SPACE LAW

Mining asteroids may be technically feasible in a decade or two, but does space law permit mining of asteroids or exploiting heavenly bodies? Substantial legal issues will have to be addressed before any kind of mining could take place in space. This is something akin to the legalities of exploitation of the seabed resources in international waters. Nobody bothered about the deep seabed until it was known to hold immense mineral wealth. Similarly, the asteroids or other celestial bodies do not matter to anyone till their resource potentials become apparent. The international laws are not very clear about utilization of outer space or ownership of resources therein. The UN Outer Space Treaty, 1967, forms the basis of international space law which stipulates that "outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means". There are claims for and against the stipulations contained in this treaty and legalities will become more apparent when parties venture into resource utilisation. In the backdrop of this President Obama unilaterally signed a bill in November 2015 empowering US citizens to obtain their own asteroids, mine them and own their wealth. Tiny Luxembourg announced in June 2016 its intention to invest \$227 million in space mining companies; it has also decided to take the initiative in developing a legal and regulatory framework on the future ownership rights of space minerals, heralding the entry of countries other than the US in the race for space mining. There is an imminent need for global cooperation in this emerging scenario to enact globally acceptable regulations; otherwise, it would be Star Wars for real. The Treaty will have to be expanded/modified for the benefit of all stakeholders.

6. FUTURE OUTLOOK

While there is no difference of opinion about the potential treasure asteroids hold in terms of their contained metals there are apprehensions about earlier data, particularly about PGM. The data that were available at the time of these claims were pretty old, incomplete and of questionable quality (Cannon K M et al, 2023). These authors drew on newer measurements and statistics from the vast meteorite collection to assess the concentrations of many elements in likely asteroid materials compared to terrestrial ore deposits.

A cursory comparison of 83 elements identifies a promising group that were examined in more detail: the PGM and the base metals Fe, Mg, Al, and Si. PGM is found to deviate from chondritic ratios concerning Ir at higher Ir values, such that maximum PGM contents in asteroids likely do not reach as high as previously thought.

Besides, the NEA may not be as promising compared to MBA bodies because they do not hold large volumes of mineable materials as the MBA. New data of PGM in iron meteorites vary between 6 and 230 ppm, higher than almost all terrestrial ores. Additionally, new understanding of M-type asteroids such as 16 Psyche shows that they are unlikely to be monolithic mountains of metal but more complex silicate-metal mixtures, so that meteorite metals provide only the likely maximum values for PGM. Volume-wise the NEA are neither very attractive compared to MBA. The approximate count of NEA exceeding 100 m size is 10 million unlike MBA where more than 1.5 million have sizes >1 km. Calculations show that the population of PGM-containing NEA >100 m size is roughly 20,000 out of the total count of 10 million and only 10 out of this will be commercially PGM-bearing (Cannon K M et al, 2023).

As a result, many target asteroids need a closer look before embarking up on a mining mission to understand their surface characteristics including abundance of rubble piles, chemical composition and assessment in terms of their economic value. That may still be many years from now. TransAstra, the California-based firm is aiming at sustainably harvesting resources from the Moon and asteroids. Some start-ups are considering focussing on optical mining using concentrated sunlight to excavate and extract propellants from volatile-rich asteroids, moons, and planetary surfaces. Perhaps some space mining companies are eyeing on recovering Moon resources, REEs and ³He before venturing onto asteroids. An apprehension of asteroid mining is that a sudden influx of rare metals, such as PGM would drive down the price of those metals on Earth but at the same time facilitate a drastic reduction in manufacturing costs for products made with these metals. Nevertheless, platinum from asteroids appears to have the potential to significantly alter the long-term characteristics of the terrestrial platinum market.

Is mining asteroids practical and do we have the technical capability for this? Philip Metzger, a planetary scientist, contemplates that asteroid mining is absolutely practical, and with the technology already available we may find these dreams realized during our children's lifetime or perhaps during our own. The leapfrogging of space technology with SpaceX's reusable Falcon 9 rockets and similar venture of Blue Origin is a pointer that asteroid mining is no longer a distant dream as one might think, but an impending reality.

Asteroid mining is in its infancy. What would the asteroid mining scenario look like, say 20 years from now? Experts predict that an industry barely imaginable now could be sending refined materials, rare metals and even free, clean energy to Earth from asteroids and other bodies. The result would provide the most profound societal changes since the Industrial Revolution introduced large-scale machinery and manufacturing techniques. A robotic system could mine the materials in a NEA and refine them into usable metal or other substances. Those materials would be formed into pieces and assembled into another robot system that would itself build similar models and advance the design. This process of bootstrapping, using materials native to space for propellant, radiation shielding and other components of space infrastructure could lead to radical reductions in the cost of space missions.

Asteroid mining obviously would be a very complex endeavour being both a technical and political challenge. The venture involves detection and characterization of asteroids, designing, building and operation of robotic miners, transportation from Earth to low-Earth-orbits (LEO), LEO to NEA and NEA to Earth. Will there be an "asteroid rush" once mining proves to be remunerative? Besides, there is apprehension that asteroid mining will destroy pristine environments containing clues to the early Solar System, and possibly to the origins of life. There may be materials such as quasi-crystals on asteroids of great potential value, but of which we are now ignorant. Ultrapure iron is another by-product of asteroid mining. The fear is that mining would destroy these pristine materials once and for all. Finally, there are legal tangles as well to be overcome before sky mining becomes a reality, and the issues of apportioning the wealth among nations if, like the resources of the seabed, space wealth is a common heritage of mankind.

7. CONCLUSIONS

There is a huge potential of mining asteroid resources for the future of mankind. Asteroidal materials are exceptionally good ores requiring a minimum of processing. PGM are uniformly distributed in the body of asteroids making them easy to extract. While operating Pt and Au mines in South Africa and elsewhere mine ores of grade 5 to 10 ppm many S-type asteroids contain PGM at grades of up to 100 ppm and certain metal asteroids contain 50-220 ppm of PGM. PGM and Au are a thousand times more abundant in M- and S-type asteroids than in terrestrial rocks.

Type I and II carbonaceous chondrites contain granules of metals like W, Re, Mo, Ir and Os. Besides, the metal fraction of the typical LL chondrite has 50-60 ppm of PGM, and the concentration in the metal grains in certain types of chondrites could reach 100 to 200 ppm. PGM are also abundant in some types of NEA that are mineralogically similar to ordinary chondrites with concentrations of 4.5 ppm

that are comparable to those found in profitable terrestrial mines. Members of both M-asteroids and LL-chondrite groups have been identified in NEA. Volatiles constitute another resource in asteroids and comets that can be turned into propellants providing abundant fuel for space exploration. Nearly 50% of NEA may be volatile-bearing; besides there may be remnant primordial ice within the cores of dormant or extinct comets.

The C-type asteroids make up about 20% of the known population of asteroids containing a rich mixture of volatiles, complex organic molecules and metals. They can yield as much as 40% by mass of extractable volatiles and the residue left after volatile extraction is about 30% native metal alloy containing PMs and PGM. Many planetary scientists contemplate that asteroid mining is absolutely practical, and with the technology already available we may find these dreams realized during the coming decades. The leapfrogging of space technology with SpaceX's reusable Falcon 9 rockets is a pointer that asteroid mining is no longer a distant dream as one might think, but an impending reality.

However, asteroid mining obviously would be a very complex endeavour being both a technical and political challenge. Finally, there are legal tangles as well to be overcome before sky mining becomes a reality, and the issues of apportioning the wealth among nations if, like the resources of the seabed, space wealth is a common heritage of mankind.

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INDIAN MINING DAY CELEBRATIONS 2024

MEAI HEADQUARTERS

Indian Mining Day Celebrations held on November 5, 2024 “Women in the Mining Industry”

MEAI, Headquarters celebrated virtually the Indian Mining Day. Shri. Rajesh Chintak, Chief, HRBP Raw Materials Division has made a presentation on the Theme “Women in the Mining Industry”. Shri. M. Narsaiah, SG, welcomed all the participants.



Presidential address by Shri. S.N. Mathur



Address by Shri. Dhananjaya G Reddy, Vice President - II



Address by Shri. K. Madhusudhana, Immediate Past President, MEAI



Presentation by Shri. Rajesh Chintak



Ms. Gunjan Pande, Secretary, Ahmedabad Chapter and others addressed on the occasion

BANGALORE CHAPTER

The Indian Mining Day was celebrated by the Bangalore Chapter in the Auditorium of Institution of Engineers, Bengaluru during 10am to 1.30pm on 16th November 2024. Shri G. V. Kiran, Chairman Cum Managing Director -KIOCL Limited, has graced the occasion as the Chief Guest and Shri. Dhananjaya G Reddy, Vice President-II, MEAI presided over the function. Dr. H.S. Venkatesh, Chairman, Dr C. V.

Raman-Vice Chairman, Shri Sitaram Kemmannu-Secretary, and Shri K Ramani - Treasurer of the chapter were on the dais.

Dr. S. Venkatesh welcomed the guests, members, Women members, and invitees and students present on the occasion with his opening remarks on the Indian Mining Day celebration. Dr C.V. Raman administered the Indian Mining Day pledge to all the guests and the participants on this occasion and also addressed the gathering. As part of Indian Mining Day celebration, competitions such as Essay writing, Poster making etc were organized for the students on the theme of the Mining Day – Women in the Mining Industry. Dr. Binutha R -Manager (Environment), Ms. Pratiksha K -Geologist from Karnataka State Mineral Corporation Limited made presentations on IMD-2024 Theme –“Women in Mining Industry”. Ms. Sapna -Electrical Engr & Ms. P Navya -Mining Engineer from Vedanta Limited (IOK) also talked on the IMD theme. Ms. Vidhyashree L (Civil Engr) from KSMCL and Ms Tejaswini (Mining Engineer), Ms. Jnanaswini T (Mining Engineer, Ms. Monisha (Mech) and Ms. Maniteja from Vedanta Ltd (IOK) participated actively and shared their experiences as women employment in mining. Around 10 students from Dr. T. Thimmaiah Institute of Technology-KGF also actively took part in these competitions. 8 students physically participated and two of them delivered speeches on the IMD theme. The following students were declared as prize winners by the Judges Dr. T N Venugopal National EC member & Shri. Deepak Vidyarthi-Quiz Master.

Essay Competition

Shri. Atayib Basharat Qureshi, Dr. TTIT, KGF, 1st Prize
 Shri. A K Naveen, Dr. TTIT, KGF, 2nd Prize
 Shri. Sam Daniel R G, Dr. TTIT, KGF, 3rd Prize
 Shri. M. Manthan, Dr. TTIT, KGF, Participation Prize

Poster competition

Shri. Atayib Basharat Qureshi, Dr. TTIT, KGF, 1st Prize
 Shri. M R Suraj, Dr. TTIT, KGF, 2nd Prize
 Shri. Akash J, Dr. TTIT, KGF, 3rd Prize
 Shri. Kishore M S, Dr. TTIT, KGF, 3rd Prize

Speech Competition

Shri. M R Suraj Dr. TTIT, KGF, 1st Prize
 Shri. Sudharshan, Dr. TTIT, KGF, 2nd Prizer.

Cash prizes of Rs.3000/-, 2000/- and 1000/-and the certificates were presented to the students by the guests on the occasion and the certificates were also presented to the participants. Sri Ramani K -Treasurer readout the list of winners.

The Chapter, as a part of Indian Mining Day celebration, felicitated senior members that contributed significantly to the mining industry and the Bangalore Chapter. The following members were felicitated on the occasion:

1. Shri. M S Nagar, - LM/1958/BAN (Recitation)
2. Shri. Prabhakar S. K. -LM/098/CAL/BAN
3. Shri. Vasant Yallappa Kadam -LM/5724/GOA/BAN
4. Shri. V Nagaraj- LM/1881/BAN
5. Shri. Honnaiah Sreenivas Murthy- LM/2948/BAN

The citations of the above members were read out by Shri. Sitaram Kemmannu.

Shri. G.V Kiran -CMD KIOCL Ltd, in his address greeted all the members and students on the Indian Mining Day and highlighted the importance of the women employment in the mining industry and how it benefits the industry as women are masters in handling multitasking- which is very essential to mining. He also emphasized on women employment mandated in the Boards of the company by public sector organization.

Shri Dhananjaya G Reddy, spoke about the Indian Mining Day celebrations, history, purpose and importance of women employment in the mining industry. Shri. Deepak Vidyarthi requested all the members to participate in the National Quiz being organised by the MEAI HQ as a part of the Indian Mining Day. Shri. Sitaram Kemmannu -Secretary presented vote of thanks and anchored the event.

In all 62 members attended the meeting with 5 students from the Dr Thimmaiah Institute of Technology KGF.



Lightning of Lamp



A view of participants



Opening remarks by Chairman-Dr. H.S.Venkatesh



Address by Chief Guest Shri. G V Kiran -CMD, KIOCL Ltd



Oath administration by Vice Chairman Dr.C.V.Raman



Felicitation of M S Nagar -Mining Engineer



Presentation on IMD theme by Dr. Binutha R and Ms Prathiksha K



Felicitation of Shri Prabhakar Sampige -Mining Engineer



Felicitation of Shri Vasant Y Kadam -Mining Engineer



Felicitation of Shri V Nagaraj -Mining Engineer



Felicitation of Shri H.S.Murthy -Mining Engineer



President Shri. Dhanajay G Reddy VP-II addressing the gathering



Mementos to speakers -Ms. Navya & Ms. Sapna -Vedanta Ltd by Dr. T N Venugopal



Mementos to Chief Guest Shri. G V Kiran -CMD KIOCL Ltd by Shri Pichamuthu D V.

BARAJAMDA CHAPTER

Following activities were planned on Indian Mining Day on 1st Nov. 2024.

1. Flag hoisting by DDMS Mr. R Sudheer
2. Cake cutting by women employees



Flag hoisting by DDMS, Chaibasa Mr. R Sudheer

A flag hoisting ceremony was observed at Noamundi Iron Mine of Tata Steel. Mr. R Sudheer DDMS, Chaibasa graced the occasion and emphasized the importance of the mining industry in the country's economic growth.

He also appreciated Mr. Atul Bhatnagar, Chairman of Barajamda chapter for empowering the women in the mining industry and promoting the safe and healthy culture for women at mines.



Cake cutting by Women employees at mine

Cake cutting ceremony was arranged in the presence of women working in the mine. Mr. D Vijendra, Chief Noamundi & Katamati Mines presented his views on women at mine, and he gave an overview of Tata Steel's plan regarding inclusion of Women at Mine in future

BELLARY - HOSPET CHAPTER

Date: 1st November, 2024

Venue: TMAE'S POLYTECHNIC, Hosapete

Time: 10:00 am

Attendance: 100 Members

Flag Hoisting

On the occasion of Kannada Rajyotsava, the Flag was hoisted by the Chief Guest Sri. Meda Venkataiah, Nominated Owner of M/s MSPL Ltd., and the Guests of Honor Sri. K. Madhusudhana, Past President MEAI, & CEO, M/s MSPL Ltd. Dr. H.K. Shankarananda, Principal of TMAES Polytechnic, Hosapete, Sri. K. Prabhakara Reddy, CEO, M/s SUMS Ltd., Sri. G. Laxminarayana, G.M. M/s RBSSN Pvt. Ltd. Sri. Anilkumar, GM (Mining) of M/s NMDC Ltd & other dignitaries with great respect and enthusiasm. Typically, the flag is a symbol of pride and unity for the state of Karnataka. It is a celebration of the formation of the state on 1st November 1956, and honors the rich cultural heritage, history, and language of the Kannada people.



Safety Pledge & National Anthem

Safety Pledge was taken by all the Mining Engineers as a symbol of commitment to maintain the highest standards in the operations of Mining and followed by the singing of National Anthem by all the participants after the Flag hoisting.



Plantation

In celebration of India Mining Day, a Plantation drive was organized in the premises of the Polytechnic college. The plantation drive was followed by a brief awareness session on the significance of maintaining ecological balance in mining regions.



Watering Plants

A symbolic watering ceremony was conducted by all Dignitaries to highlight the mining industry's commitment to environmental sustainability and biodiversity restoration. This event served as a reminder of the sector's ongoing efforts to integrate sustainable practices into mining operations, and the importance of environmental conservation alongside industrial growth.



Inauguration of Blood Donation Camp:

In commemoration of India Mining Day, a Blood Donation Camp was organized with the aim of supporting local hospitals and blood banks. The camp was set up in collaboration with the Red Cross Society, Ballari. A total of 20 units of blood was collected during the camp.



The Secretary, Sri P. Venkateswara Rao extended a warm welcome to all attendees and expressed deep pride in the dual significance of the day celebrating both the “Indian Mining Day” and “Kannada Rajyotsava”. He spoke on the initiatives undertaken over the years to engage the community, particularly students and industry employees on the occasion of IMD celebrations. These initiatives included Quiz competitions, Poster creation, Essay writing contest, Cricket league etc. aimed at fostering knowledge, creativity, and a deeper understanding of the mining Industry. The Secretary also highlighted about the “Blood Donation Camp”. This year’s theme for the celebrations, “Women in the Mining Industry,” was another focal point of the speech.



The Chapter Chairman, Sri. Mallikarjuna, SHM extended his heartfelt greetings to all the guests and the participants at the event. He highlighted the strong and enduring relationship between the TMAES and the BH Chapter that spanned over many years, fostering collaboration and the sharing of knowledge and resources between the two organizations. A key highlight of the speech was the discussion on the trade tests organized by the Mines Safety Association Karnataka (MSAK), an initiative that has been essential in improving the skills of employees in the mining sector.



Sri.K.Madhusudhana, CEO, M/s MSPL Limited congratulated the organizing teams for their hard work and creating an event that serves as a platform to celebrate the contributions of the mining industry and to engage stakeholders from all sectors, especially the youth, in discussions on the future of mining. Further, He highlighted the scope and opportunities of Mining engineering and peculiarity of Mining engineers and their role in the Industry.

He shared his experience as a student of Mining engineering and the career development and advised the students to utilize the MEAI platform for gaining the knowledge for their development and work hard in the field of mining and acquire skills of handling the issues.



On the occasion of Indian Mining Day, the gathering was addressed by Sri K. Prabhakara Reddy, the CEO of M/s SUMS, who delivered a thought-provoking and motivational speech to the mining professionals, students, and guests present at the event. In his speech, Sri K. Prabhakara Reddy took a moment to acknowledge the invaluable contributions of Dr. Meda Venkataiah and Sri K. Madhusudhana to the Mining Engineers’ Association and the industry at large. He recollected his college days and then opportunities for Mining engineer and referred to students to select hard jobs to become masters in the Mining Industry.

On the occasion of Indian Mining Day, Dr. Meda Venkataiah, Nominated Owner of M/s MSPL Limited, delivered an insightful and inspiring speech, acknowledging the significant contributions of the MEAI BH Chapter and TMAES Polytechnic in organizing the event. He began by congratulating both organizations for their exceptional efforts in making Indian Mining Day a grand success and commended them for their commitment to promoting the mining industry’s growth and development. He highlighted that mining is an essential pillar of India’s industrial framework and that events like Indian Mining Day provide a platform to raise awareness about its value. Further, He discussed the mining industry’s growing contribution to India’s GDP and supply of raw materials to the processing industries.



Special felicitation ceremony was held to honor contributions of senior professionals in the mining industry over the years. The Senior personnel were presented a token of respect and appreciation for their exemplary service to the industry.

Prizes to the winners of the competitions, including the Quiz, Poster Presentation, Essay Writing & Cricket match were presented by the Sri. K. Madhusudhan, CEO, M/s MSPL Ltd. & Sri. Anilkumar, GM, M/s NMDC Ltd. These activities were designed to engage students in the mining sector's themes and foster creativity, knowledge, and awareness about the mining industry.

Cash Prize Distribution to Academic Toppers

A special Cash Prize was awarded to honor the academic toppers in Diploma in Mining Engineering Mr. Parashuram from TMAES Polytechnic, Hosapete & Mr. Vinay Patil, K. M. Tech. in Mineral Processing from VSKU, Nandihalli, Sandur in their academics with Rs. 5,000/- cash prize to both the students, along with a certificate of excellence.



- The Felicitated Seniors are:
1. Sri. Domnic Savio
 2. Sri. P N Krishna Murthy
 3. Sri. Sunku Nagabhushanam



Cash Prize to Single Girl in Diploma in Mining

An amount of ₹10,000 cash prize was awarded to a single girl student who has shown determination in pursuing a career in mining by joining the Diploma in Mining Engineering at TMAES Polytechnic, Hosapete. This award was given to appreciate and encourage girls who aspire to join into similar fields.



Vote of thanks was proposed by Sri. Radraiah as concluding note of the Indian Mining Day celebrations. He thanked all Mining Companies that participated in the event, the Dignitaries, the Participants, and the Sponsoring Companies M/s NMDC Ltd, & M/s BKG Pvt. Ltd. that were involved in the successful celebration of the event. He also thanked the Red Cross Society, Ballari, for collecting blood in association with Vijayanagar Institute of Medical Sciences (VIMS), Ballari.

BHUBANESWAR CHAPTER

Bhubaneshwar celebrated the Indian Mining Day on 1st November 2024 at the Administrative Block, Sukinda Chromite Mine of Tata Steel Limited. Office bearer of the Chapter, Shri. Shambhu Nath Jha (Secretary) and other members of Sukinda Valley attended the session physically to commemorate and acknowledge the significant contributions of the Mining Industry in India.



The session started by the welcome address of Shri. Shambhu Nath Jha in which he welcomed all the participants that attended the event.

He highlighted the theme of the celebration that was the focus on women empowerment in mining. Traditionally a male-dominated field, the mining industry has seen a rise in the inclusion and advancement of women across various roles. Today, women are contributing as engineers, geologists, machine operators, and leaders within the mining sector. Indian Mining Day served as a platform to celebrate these achievements and to discuss pathways for further inclusion and equality.

He emphasized the importance of creating safe, supportive environments for women in mining, fostering skill development, and promoting policies that encourage gender

diversity. Efforts to increase women’s participation in mining not only enhance the industry’s workforce but also bring fresh perspectives that can drive innovation and efficiency.



Welcome Address by Shri. Shambhu Nath Jha

Speaker 1: Mr. Nihar Ranjan Mitra (Mine Manager, Sukinda Chromite Mine): He explained the purpose of annual Indian Mining Day celebrations to recognize the essential role mining plays in India’s economy, society, and infrastructure. Celebrations like this foster a sense of unity and pride within the industry, reaffirming commitments to sustainable and responsible mining practices that can drive economic progress while preserving natural resources for future generations. As the mining industry continues to evolve, gatherings like Indian Mining Day underscore the collective vision of a sector that is more sustainable, inclusive, and resilient. By celebrating achievements, reflecting on current challenges, and discussing future strategies, the event strengthens the commitment of all stakeholders to shape a progressive mining industry that serves India’s developmental goals.



Speaker 2: Mr. Ananga Kumar Mahanna (Sr. Area Manager, Supply Chain): He highlighted the Scenario of Mining in Today’s World. In today’s world, mining faces complex challenges yet stands as a crucial sector for sustainable economic development. With the demand for minerals and metals

growing globally, the industry must balance increased productivity with environmental stewardship. In India, mining is a significant contributor to the economy, supporting millions of jobs and supplying essential raw materials for various industries, from construction to high-tech manufacturing. Current discussions also revolve around the adaptation of advanced technologies like automation and artificial intelligence to improve safety and efficiency in mines. However, stakeholders emphasize the importance of maintaining a workforce-centered approach that prioritizes health, safety, and community welfare.



HYDERABAD CHAPTER

The Indian Mining Day was observed on 5th November 2024 in the Association’s auditorium at Hyderabad. Over 60 participants from OU & JBIT Colleges, as well as members of the Hyderabad Chapter attended the program.

Shri L. Krishna, Secretary, Hyderabad Chapter extended a warm welcome to all the Guests and attendees of the program.



The program started with the participants taking the Indian Mining Day pledge.



Participants taking the Indian Mining Day pledge

Past Presidents of MEAI Shri VS Rao, Shri MD Fasihuddin, and Dr. V.D. Rajagopal, and Shri V Lakshimnarayana, Shri. M. Narsaiah, Secretary General, Shri. Venkata Ramayya, Vice Chairman, Hyderabad Chapter & Shri. V. Balakoti Reddy. Jt. Secretary cum Treasurer, Hyd Chapter addressed the program and delivered a speech on Women in the Mining Industry.



Shri M Narsaiah welcoming the Guests and participants

Shri Md. Fasihuddin made a detailed presentation on the efforts made by the Mines Division of Tata Steel in practicing sustainable mining.



Women employees from GMMCO Technology Services Ltd and Students from OU shared their thoughts on becoming Mining Engineers and Geologists.



The esteemed guests honored the women for attending the program and appreciated for becoming and become to be Mining Engineers.



The following students were awarded medals for winning the events held in the celebration of Indian Mining Day.

S. No	Event Topic	Winner	Runner
1	Essay Writing	M. Srinivasa Rao	N. Poojitha
2	Quiz	G. Akhil	L. Prashanth
3	Elocution	K. Sampath	Md. Irfan
4	Poster Presentation	K. Thirumal	P. Jagadish



Group photograph of the attendees in the program

RAJASTHAN CHAPTER - JAIPUR

The Rajasthan Chapter-Jaipur celebrated the Indian Mining Day under the chairmanship of Sh. Lalit Mohan Soni. While the flag hosting and symbolic celebration happened on 1st November, the formal event took place on November 5th and centered around the theme “Women in Mining Industry.”



Sh. Lalit Mohan Soni addressing on the occasion

The event was graced by Sh. Nirmalendu Kumar, SBU Director - Hindustan Zinc, Head Kayad mine, as the Chief Guest. He was accompanied by the women’s team from Hindustan Zinc, who shared their invaluable insights and experiences in the mining sector. The program brought together a diverse group of women professionals from various organizations including Hindustan Zinc, Geological Survey of India (GSI), several consulting companies and freelance consultants.



Sh. Nirmalendu Kumar addressing on the occasion

The event provided a platform for women to share their experiences, insights, and thoughts on their journey in the mining industry. Dr. Archana Sharma and her team from GSI shed light on their valuable contributions to the field of geology. Sh. Nirmalendu Kumar highlighted the initiatives undertaken by Hindustan Zinc to promote gender diversity and empower women within the organization. The women team that came from the Kayad project also shared their experiences of working in the mining industry. Mr. Lalit Mohan Soni, shared his extensive global work experience and highlighted the increasing prominence of women in leadership roles within the mining and technology industries. He emphasized the significant contributions of women to technological innovation and digital transformation in the mining sector. Dr. Manoj Gaur, Chapter Treasurer provided valuable insights into the substantial role of women in mining and exploration.

Women working in different organizations and consulting companies also joined the celebration and shared their valuable insights, experience and contribution to the mining industry. The participation and contributions of women were highly appreciated by the MEAI executive team, council members, and esteemed members present in the event. Jaipur Chapter team also recognized and congratulated the women rescue team of Hindustan Zinc who secured second position in International Women Rescue competition recently.

The Jaipur Chapter’s celebration of Indian Mining Day not only highlighted the invaluable role of women in mining but also reinforced the commitment to gender diversity and inclusion in the industry.



The MEAI Jaipur Chapter acknowledged the significant contributions of women in the mining sector and, as a token of gratitude, presented mementos to all the women participants.

RAJASTHAN CHAPTER - JODHPUR

Rajasthan Chapter Jodhpur organized IMD celebrations today at Seminar Hall of Mining Engineering Department, MBM University, Jodhpur, where 25+ MEAI members and 60+ students participated with girl students around 20 odd. Indian Mining Day was celebrated in a grand manner by the Chapter on 12th November, 2024 on the theme “Women in the Mining Industry”.

Program started with Saraswati puja followed by hoisting of IMD flag and pledge received from Association HQ by all attendees. Shri A. K. Jaiswal, Chapter Chairman, welcomed the Chief Guest, Keynote speakers, dignitaries and all the attendees and took oath of pledge with all attendees. Keynote addresses were also delivered by two prominent women speakers about women empowerment, women’s role in underground mining, their performance in the mining industry as well as other industries. First speakers were Prof Vimla Sheoran from Zoology department of JNV University, and Dr Akansha Choudhary from School of Liberal Art, IIT, Jodhpur. Chief Guest was Er PR Prajapat, GGM, RSMML. He announced financial assistance to provide equipment etc to the First Aid Centre proposed to be established at FAG-MIL Jodhpur after due certification/authorization by DGMS.

An Essay competition on the subject theme "Women in Mining Industry" was also organized among mining students of MBM and prizes of Rs 2000, 1500 and 1000 given to 1st, 2nd and 3rd winners. In the end, mementoes were presented to dignitaries as a mark of respect. Professionals from DMG, IBM, RSMM, GAGMIL, MBM faculties and other members attended it. Dr. R. P. Choudhary, Chapter Secretary presented a vote of thanks. Program ended with the national anthem followed by refreshment. The support from MBM was well appreciated. Program was anchored by final year student Ms. Prachi Sandu.



Gathering at Indian Mining Day celebration in November 2024 at Department of Mining Engineering



Welcome address by Shri. A. K. Jaiswal, Chapter Chairman



L-R: Dr. Akansha Choudhary, Assistant Professor, IIT Jodhpur, Prof Vimla Sheoran; JNV University, Jodhpur; Sh. P. R. Prajapat, GGM, RSMM; Sh. A. K. Jaiswal, Chapter Chairman

RAJASTHAN CHAPTER - UDAIPUR

The Indian Mining Day was celebrated on 1st November, 2024 by the Mining Engineers' Association of India, Rajasthan Chapter-Udaipur with great enthusiasm and zeal. MEAI invited all eminent mining engineers, mine owners, stakeholders of the region to witness the occasion. Every year,

this day is observed by the Mining Engineers Association of India to discuss various issues related to the current scenario, technological advancements, and other aspects of the mining industry. Women play an important role in the mining industry but gender equality, safety concerns, hazardous environment, heavy machinery accidents and extreme working conditions are still challenging for them. To overcome these challenges and to promote, empowerment, and participation of women in the mining industry a theme of the event on Indian Mining Day was kept "Women in Mining Industry".



(L to R): Sh AK Kothari, Former President MEAI, Sh Dileep Kumar Saxena, Chief Speaker, Sh RP Gupta, Former President MEAI, Sh Praveen Sharma, Chairman & Sh Asif M Ansari, Secretary of Udaipur Chapter

Nearly 40 mining engineers, geologists, stakeholders, and students participated in the event. During this occasion a function was organized under the chairmanship of Sh Praveen Sharm, Chairman, MEAI-Udaipur and Chief Speaker was Sh Dileep Kumar Saxena, Dean-Mining Engineering, Vishvakarma Skills University, Jaipur & Director of Mines Safety (Retd.), DGMS.



Sh AK Kothari, former President, MEAI administered oath to all present in the hall to adopt Best Scientific Methods & Practices, to prospect, Produce and Preserve the one-time crop from mother earth in the form of valuable mineral resources for the Probity and Prosperity of our nation.





Pledge administered by Sh AK Kothari, Former President, MEAI.

Sh Praveen Sharma, Chairman, Udaipur Chapter welcomed all the distinguished guests and informed that MEAI is providing unique services to the mining industry. Also, Indian Mining Day is celebrated every year by MEAI all over India with the objective of discussing the current scenario of mining, technological progress, various issues related to the mining industry and discuss the future development. Today's theme of the event is "Women in Mining Industry" and discussion on women empowerment in mining will definitely set milestone for them. He further said that Hindustan Zinc Limited are promoting women's employment in mining. Ms Sandhya Rasakatla has appointed first woman Mines Manager of UG mines and recently the rescue women team of Hindustan Zinc Limited got the runner position in the international competition of rescue in underground Mines at Colombia. He further told that Dr. Chandrani Parsad Verma was the first Woman Mining engineer of India, who set the example that women are equally capable to do Mining.



On this occasion, a technical presentation was delivered on the topic of "Women in Mining Industry" by Sh Dileep Kumar Saxena, Dean-Mining Engineering, Vishvakarma Skills University, Jaipur & Director of Mines Safety (Retd.), DGMS. He told that woman employment was regulated in 1929 and again prohibited in 1937. Their employment was again reinstated in 1943 which was prohibited in 1946. Again in 2019 the prohibition has been lifted. Under section 46 of Mines act 1952 provided employment women states that no woman shall be employed in any part of the mine

which is below ground and above ground including opencast working between 10 pm to 6 am. Further, under section 83 of the Mines Act 1952 exempted by a Gazetted Notification 393 (S.O.506(E) published on 29th January, 2019, all mines from all provisions of Section 46 the said Act and allowed women to be employed above ground between 10PM and 6AM and in a mine which is below ground subject to conditions. He further said that safety, sexual and gender-based violence, lack of supportive legislation, wage gap, lack of mentorship are the barriers in employment of women in Mines. Whereas the diversity of women leads to better risk management, effective decision making, and improved overall performances in the industries. He further said that to promote women in Mining corporate has to take initiative and support gender equity policy, create an inclusive culture.



Announcement of Result of Essay competition by Sh Asif M Ansari, Chapter Secretary

Udaipur Chapter organized an Essay Writing Competition on the topic of "Women in Mining Industry" in which students from four Mining Engineering colleges of Udaipur region participated. The first prize in the essay writing competition was awarded to Babli Choudhary of CTAE with a certificate and Rs. 3100/-, Second prize was awarded to Mr Virendra Singh Chouhan of Department of Geology, MLS University with Rs. 2100/-, and third prize was awarded to Ms Khushi Gandhi, of SIR Padampat Singhania University, with Rs. 1100/-. The Consolation prize and certificate was given to Mr Sumit Prajapat of CTAE and Ms Pooja Suthar of Pacific Polytechnic College with Rs. 500/-each.





Shri Ram Shankar Sharma was felicitated by the Udaipur Chapter of Mining Engineers Association for receiving the MEAI - NMDC Award – 2023.

Prize distribution to the participants of Essay Writing competition by Chief Speaker.



Shri RP Gupta, former National President, MEAI, Udaipur, in his address said that the percentage of women's employment in mines must be increased at par with international level.

Shri Akhilesh Joshi, former CEO HZL, in his address said that when women can operate a Raffle plane, then why

(Continued on Page 40)

MEAI NEWS

MEAI HEADQUARTERS

MEAI National Quiz 2024

The annual event of “MEAI National Quiz” was successfully concluded on 5th November 2024.

Out of total membership of about 6000 spread over 26 chapters round the country, the Quiz was conducted in two phases- 1. Qualifying Round held Online in October 2024.

In all, seven teams had qualified for the Final round. 2. The Final Round held Online on 5th November 2024 along with Indian Mining Day Celebrations.

In a keen contest, Dhanbad Team represented By Sri Nilabjendu Ghosh & Sri Vivek Kumar Himanshu emerged Winners while Barajamda Team represented by Sri Kannuri Prudhvi and Ms Yogita snatched Second Spot in a neck to neck fight.

Udaipur Team represented by Sri Asif Mohammad Ansari and Dr Hitanshu Kaushal had to be content with Third Spot.

After the Grand finale, special “Audience Round” was conducted to pick Top 10 scorers for special award and certificates.

Winners will receive cash award of Rs 30,000/- FIRST PRIZE, Rs.18,000/- Second Prize and Rs. 10,000/- Third prize!

MEAI specially thanks Sri K. Madhusudhana, CEO MSPL and Immediate Past President of MEAI and Sri SN Mathur, President MEAI for the generosity !!!



MEAI NATIONAL QUIZ 2024
AUDIENCE ROUND (Top 10)

SR	NAME	TEAM	SCORE
1	Aravind Sharma	BITSI	50
2	Asif Md	3418	40
3	Chaitanya Maheshwar	3880	38
4	DEEPTI	3884	38
5	Shank	3411	37
6	Dr. Hitanshu	3381	35
7	GOPI (Eng. Chaitany)		32
8	Kannuri	3411	30
9	Manojkumar Singh	3400	30
10	Prasad Yad	3411	30
Special Congratulations Prize		["Women in Mining"]	
11	Ms. Inqil		31

Dr. Hitanshu Kaushal
- Quiz Master

MEAI NATIONAL QUIZ 2024
GRAND FINALE RESULTS

FIRST PRIZE	SRI NILABJENDU GHOSH SRI VIVEK KUMAR HIMANSHU ... Dhanbad Team
SECOND PRIZE	SRI KANNURI PRUDHVI Ms YOGITA ... BARAJAMDA Team
THIRD PRIZE	SRI ASIF MOHAMMAD ANSARI SRI HITANSHU KAUSHAL ... Udaipur Team <i>Congratulations Winners !!</i> - Dr. Hitanshu Kaushal Quiz Master





Vote of thanks proposed by Shri. B. Sahoo, Jr. Secretary cum Treasurer

MEAI 5TH COUNCIL MEETING

Held on 9th November 2024 at HGM Officers Club, Auditorium, Huttu Gold Mines, Karnataka



L to R – Shri. D.B. Sundara Ramam, Vice President – I, Shri. M. Narsaiah, SG, Shri. S.N. Mathur, President, Shri. Dhananjaya G Reddy, Vice President – II & Shri. B. Sahoo, Jt. Sec cum Treasurer on the dais



Council Members group photo that attended the meeting: Shri. S.N. Mathur, President, Shri. D.B. Sundara Ramam, Vice President – I, Shri. Dhananjaya G Reddy, Vice President – II, Shri. M. Narsaiah, SG, Shri. B. Sahoo, Jt. Sec cum Treasurer Dr. V.D. Rajagopal, PP, Shri. Sanjay Kumar Pattnaik – IPP, Shri. K. Madhusudhana, IPP, Dr. T.N. Venugopal, Shri. V. Lakshmi Narayana, Shri. Vijay Singh, Shri. K. Laxminarayana, Shri. K. Prabhakara Reddy, Shri. Kumar Mohan Singh, Dr. C. H. Rao, Shri. Lalit Mohan Soni, Shri. Prakash, Shri. Mallikarjuna SHM, Shri. P. Venkateswara Rao, Shri. L. Krishna, Shri. Sitaram Kemmannu & Shri. Amit Ghooli and members of Huttu – Kalburgi Chapter.



Homage – Two minutes silence was observed in honor of departed members of MEAI in the last three months

Panel Discussion

‘Recent Supreme Court order on Mining Royalty’ held at HGM, Auditorium on 9th November 2024, at Huttu Gold Mines, Karnataka



Shri. S.N. Mathur, President addressing the Council



L to R – Panelists: Shri. A. R. Vijay Singh, Dr. V D. Rajagopal, Shri. D B. Sundara Raman, Moderator of the Panel Discussion, Shri. S.N. Mathur, Shri. R K Sinha and Dr. CH Rao



Shri. R K Sinha, Former Controller General of Mines, IBM speaking during the Panel Discussion

- The student's Chapter being opened at School of Mines where already 22 members enrolled and further discussions for opening of student chapters in NITK Suratkal & Dr. Thimmaiah Institute of Technology -KGF under progress.

The President emphasized on conducting activities by the students & for the students to create vibrant student's Chapters and also involvement of students in the activities of its main Chapter. During the meeting, the President was felicitated by the Chapter.



Glimpses of the Panel Discussion

BANGALORE CHAPTER

Interactive Session of the Association President Sri. S N Mathur with members of Bangalore Chapter

Sri. S. N. Mathur, who was on his way to attend the 5th National Council Meeting at Hutti Gold Mines, Hutti, was invited by the Bangalore Chapter to its office to have an interactive session with its members and office bearers on 6.11.2024, 11am to 2pm.

The President has been appraised about the activities of Bengaluru chapter especially,

- Planning of celebration of Indian Mining Day on 16.11.2024,
- A national level conference being proposed to organize by chapter during February 2025,



Welcomes National President Shri S.N. Mathur



Felicitatation



Felicitatation



Interaction



President with the members

BELLARY-HOSPET CHAPTER

Note on Cricket League

Date: 27th Oct 2024

Venue: Doni Ground, Donimalai Complex, NMDC

Attendance: 60 Members

Mr. Rakesh MM, Event Organizer, welcomed all the attendees and participants to the MEAI Cricket League, thanking everyone for their presence and support. Special acknowledgment was given to the dignitaries present: Sri S. B. Singh, Chief General Manager, NMDC Projects and Sri K. Madhusudhana, CEO, M/s MSPL Limited. Both dignitaries were invited to address the gathering.

Sri S. B. Singh expressed his gratitude for being part of the event and highlighted the importance of sports in fostering teamwork, discipline, and community engagement. He also spoke about NMDC's ongoing support for local sporting events and initiatives aimed at youth development.



Sri K. Madhusudhana thanked the organizers for inviting him to the event. He spoke about MEAI BH Chapter commitment to supporting initiatives that promote health, wellness, and sportsmanship within the community. He wished all teams the best of luck for the day's matches.

4 teams participated in the league, representing various local Mining organizations. Each team captain introduced his team members and briefly shared their objectives for the day.



The pitch was prepared and made ready for play. Volunteers were stationed to maintain the ground. Refreshments and snacks were available at designated booths. Restrooms were set up for convenience. A first-aid tent and an emergency medical team were available on-site.

Acknowledgement was made for the event's sponsors, particularly M/s SMIORE and M/s BKG Private Limited. Their contribution was instrumental in making the event a success. Special thanks were extended to the sponsors for their support in organizing the league.

A short break was scheduled after the first two matches, with lunch provided to all participants and attendees. Local delicacies were served alongside water and soft drinks.

Sri. Mallikarjuna SHM thanked everyone for their cooperation and commitment to making the MEAI Cricket League a successful event. The participants were encouraged to enjoy the day, respect the rules, and foster positive competition.

Glimpses of Match



Sri. S B Singh



Sri. K. Madhusudhana

Interaction Session of President Shri. S N Mathur with members of Bellary- Hospet Chapter



L to R: Shri. S.N. Mathur - President, Dr. Meda Venkataiah - PP & Shri. K. Madhusudhana - IPP



Group photo of dignitaries with members of Bellary-Hospet Chapter

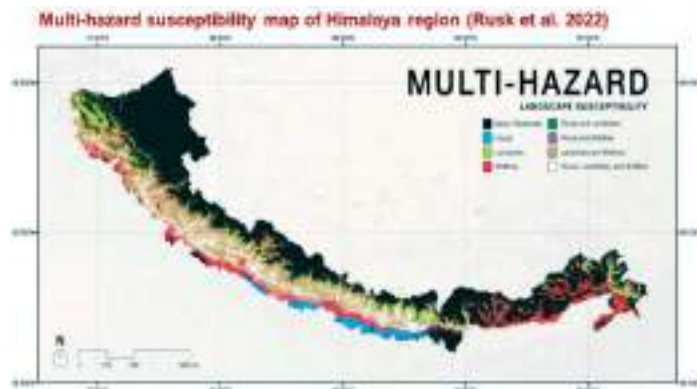
RAJASTHAN CHAPTER - JAIPUR

Lecture Series

The Rajasthan Chapter - Jaipur has organized a monthly lecture on 19th October 2024. Dr. S. K. Wadhawan, the former Director General GSI has delivered a lecture on a very special and important topic entitled “Extreme Weather Events and Multi Hazards – An overview”.



Extreme Weather Events are weather conditions that are more severe than normal and can be hazardous and have a negative impact on people and property



Dr. Wadhawan talked about how human beings have been the main driver of climate change in the era of industrial revolution.



He talked about the Disaster Management Cycle and its phases as Mitigation, Preparedness, Response and Recovery. He also emphasized on the role of different stakeholders and key players in disaster resilience. He mentioned that we cannot prevent all types of disasters that are endemic to our geology, geography, climate, social and cultural settings, but we can certainly strive to reduce risks and manage crises more efficiently so that hazards do not degenerate into disasters.



Dr. Asha, a member of Jaipur Chapter and a professional in the Department of geology at Rajasthan University attended the lecture along with university students. This provides an opportunity for them to interact with eminent speakers and experienced members to enhance their skills.

This time the lecture was organized in hybrid mode, where several participants, including MEAI president Shri S.N. Mathur, also joined through online mode.

The session was officially inaugurated by Mr. Lalit Mohan Soni, Chairman of the Chapter. Several distinguished members of the Chapter were in attendance.



Dr Wadhawan presenting during the session



Participants present in the Lecture

RAJASTHAN CHAPTER - UDAIPUR

Report on the 2nd Rajasthan Mining Summit

Organized by PHDCCI-Rajasthan Chapter and Mines and Minerals Committee in association with MEAI Rajasthan Chapter-Udaipur on 12th September 2024 at Udaipur Chamber of Commerce and Industry Auditorium

Theme: New Avenues in Marketing, Export, and Financing for the Mining Sector in Rajasthan



The 2nd Rajasthan Mining Summit was successfully organized on 12th September 2024 at the Udaipur Chamber of Commerce and Industry Auditorium. The event brought together over 150 delegates, including industry leaders, policymakers, and experts from across India, to explore new opportunities and challenges in the mining sector. The summit was supported by the MEAI Rajasthan Chapter-Udaipur, Udaipur Marble Processors Committee, Federation of Mining Associations of Rajasthan (FMAR), and CDO.



Shri Bhagwati Prasad Kalal, IAS, Managing Director, Rajasthan State Mines and Minerals Limited (RSMML), delivered the keynote address as the Chief Guest. He

emphasized the state government's commitment to sustainable mining development and highlighted key initiatives such as:



- The draft Rajasthan Mining Policy, available for public consultation.
- The establishment of a Post Auction Facilitation Center in Jaipur to expedite the exploitation of mineral blocks.
- Opportunities for investment in rare earth elements and deep-seated minerals.
- The need for value addition and processing of minerals within the state to attract investment and generate employment.
- Government efforts to enhance the utilization of mining waste for sustainable development.

Shri M.L. Lunawat, President, Udaipur Chamber of Commerce and Industry highlighted the pain points of the mining sector and urged the government to address key challenges to create an investment-friendly environment.

- Shri M.S. Paliwal, Chairman, Mining Engineers Association of India (Udaipur Chapter): Stressed the importance of zero-waste mining and the need to increase the export of mineral products from Rajasthan. He also encouraged innovation in mining practices and emphasized sustainable development.



- Shri Rajendra Harlalka, Vice President, FMAR urged the government to create a suitable policy framework for enhancing the Ease of Doing Business (EODB) in the mining sector and promote the value addition of minerals.
- Shri Abhay Agarwal, Controller of Mines (NZ), Indian Bureau of Mines: Presented key policy innovations in the mining sector introduced by the Central Government to facilitate growth and sustainability.

- Shri P.R. Ameta, Additional Director of Mines, Government of Rajasthan discussed departmental initiatives to enhance EODB and streamline processes for the benefit of mining entrepreneurs.



Several eminent speakers delivered presentations during the technical sessions, sharing insights on topics like new avenues for financing, mineral export possibilities, and survey techniques. Key presenters included:



- Shri. Sudipto Mukherjee, Director, Natural Resource Consulting Limited (UK)
- Shri. Arnab Majumdar, Vice President, Mines and Metals Division, LSI Engineering and Consultants
- Shri. Abhinav Sengupta, Associate Director, Price water house Coopers
- Shri. Kalpataru Behera, Branch Manager, ECGC Limited
- Shri. Lalit Kumar Kiri, CMD, Kiri Oilfield Services Private Limited
- Shri. Prabhat Kumar Jha, Chief General Manager, NSIC (Zonal Office)
- Shri. Abhishek Rungta, Assistant Vice President, Resurgent India
- Shri. Mithilesh Kumar, Head, Centre for Sustainability, PHDCCI

A Knowledge Report on the Rajasthan Mining Sector was jointly released by PHDCCI and LSI Engineering and Consultants during the summit. The report focuses on the abundant mineral wealth of Rajasthan and provides strategic insights for enhancing exploration, mining, and processing activities.

Key Discussion Points were

- The need to effectively present Rajasthan's mineral wealth at national and international forums to attract global investors.
- Introduction of new survey, prospecting, and exploration techniques.
- Opportunities for exporting Rajasthan's mineral products.
- New financing avenues for the mining sector.
- Policy reforms aimed at streamlining processes for mining approvals and increasing ease of doing business.
- Dr. Pawan Talesara, Honorary Secretary General of UCCI, moderated the technical session, ensuring smooth discussions between speakers and participants. R.K. Gupta, Resident Director of PHDCCI-Rajasthan, assured continued collaboration with the state government and industry stakeholders for the development of the mining sector in Rajasthan.

The 2nd Rajasthan Mining Summit successfully brought together key stakeholders to discuss and chart a path for the future of Rajasthan's mining sector. The participants emphasized sustainable development, innovation, and collaboration as the key drivers for growth in the industry.



View of Audience

(Continued from Page 32)

can't they operate dumpers in mines? We have to change our mindset and ensure women's participation for the development of mines.



A view of the Audience in Indian Mining Day Celebration.



At the end of the program, Sh Asif M Ansari, Secretary extended thanks to all the guests and participants to make this Indian Mining Day a grand success. The program was anchored by Dr SK Vashisth National Council Member, MEAI.

On this occasion, a heartfelt touching tribute was paid to Prof. B.B. Dhar.

OBITUARY

Mr. M S Ramanathan
LM- 0407, Bangalore Chapter

Mr. M S Ramanathan born in Munjihalli village of Mulabagal Taluk, Kolar district and Karnataka State on 1.5.1934. He completed his primary education in the same village, Secondary education in Sheshadripuram College & Technical education of Diploma in Mining from Jaichamendra Polytechnic Bangalore. Thereafter he worked in Baryte mines in Andhra Pradesh, Manganese Mines in Dandeli-Karnataka & limestone mines in North Karnatak for 7 years. Then he served almost 35 years in the Hospet-Ballari region for various iron ore mining companies during 1965-1999 including MSPL Ltd. He also acquired the First-Class Mines Manager Certificate of Competency. He was known for evoking the Section 22 of Mines Act, imposed on many mines in Hospet-Ballari sector by concentrating on systematic development of the mine benches by removing waste rocks. He was the oldest life member of the Mining Engineers Association of India in 80's.

He was facilitated by the Bangalore Chapter on 1.11.2023 during Indian Mining Day celebration. He left us to his heavenly abode on 30.10.2024 in his 90th year.

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

OBITUARY



Prof. Bharat Bhushan Dhar

LM no – 1298

New Delhi Chapter

Date of Demise: 29-10-2024

Prof. Bharat Bhushan Dhar academic career took him from Srinagar (Kashmir) to the Banaras Hindu University from where he earned a graduate degree in B.Sc. Mining Engineering. He obtained his M.Eng. and Ph.D. degrees from McGill University, Montreal, Canada.

Prof. Dhar was involved with various Government organizations like Chairman, Expert Group on Prevention, Abatement and Control of Pollution, MoEF; Member, Task Force on MOU Ministry of Heavy Industries and Public Enterprises etc. He was a member of Research Council of CSIR-Institute of Minerals & Materials Technology and Research Council of Advanced Materials and Processes Research Institute, Bhopal. Prof. Dhar was on the Board of Governors of several public sector organizations. He was Director, Tamil Nadu Industrial Explosives Ltd., a Government of Tamil Nadu undertaking. He was a member of the National Accreditation Board for Education and Training, Quality Council of India.

Prof. Bharat B. Dhar was Senior Vice President, Ritnand Balved Education Foundation (an umbrella organisation for Amity Institutions). He was Director (Research), Association of Indian Universities, New Delhi (1998-2002). Earlier, he was Director, CSIR-Central Institute of Mining and Fuel Research (CIMFR), Council of Scientific and Industrial Research (CSIR), Government of India, Dhanbad (1991-97). Professor of Mining Engineering at Banaras Hindu University (since 1979), Chief Proctor, BHU (1979-81) and Head of Department of Mining Engineering (1981-83, 1985-87 and 1997-98) and Director, Academic Staff College, Banaras Hindu University – 1987-91 – A Central University of the Government of India. He was Member, Forest Advisory Committee, MOEF, Govt. of India, Member, Board of Directors, Kudremukh Iron Ore Company Limited, Govt. of India. Prof. Dhar was President, Mining, Geological and Metallurgical Institute of India (MGMI) (1993-94), National Institute of Small Mining, Calcutta (1994-95).

He was Chairman, Institution of Engineers, Dhanbad Centre (1994-96). Prof. Dhar has published over 120 scientific and technical papers and edited five books, including the Indian edition of “UNDP Training Manual on Environmental Management of Mine Sites” published by Oxford and IBH Publishing Co. Ltd., New Delhi (1992-1997). He has released a book on ‘Mining and Environment’, published by APH Publishing Corporation, New Delhi (1999). He was on the editorial board of three technical journals, two of which were published from abroad and was editor in chief, Journal of Mining Research’ published by Wiley Easter Ltd., New Delhi (till 1997).

He was also on the editorial committee of ‘University News’ (A weekly journal of higher education) published by the Association of Indian Universities, New Delhi (1999-2002).

Prof. Dhar was Awarded Lifetime Achievement Award 2016-17 by MEAI. Prof. Dhar was awarded the National Mineral Award in 1994 by Government of India, for his significant contribution in the field of Mining Technology. He was also awarded CSIR Technology Award in 1995, and the prestigious NRDC Award for invention on the FIRST TECHNOLOGY DAY OF INDIA, on May 11, 1999. He was also the recipient of the Dewan Bahadur D D Thacker Coal Mining Gold Medal of MGMI; Rajendra Prasad Gold Medal of Institution of Engineers.; and many other prestigious awards. Indian Mining and Engineering Journal have adjudged him as ‘Man of the Year’ for 1992. He has been placed as ‘Men of Achievement’ by the International Biographical Centre, Cambridge, UK in the field of environment.

Prof. Dhar's role in the Mining Industry stands as a testament to his visionary leadership and unwavering commitment to advancing mining engineering. As a pioneer, he laid the groundwork for transformative initiatives that enriched the field, tirelessly promoting innovation, research, and best practices. His contributions have served as a guiding light, empowering generations of mining professionals to aspire toward excellence, safety, and sustainability. Indeed, Prof. Dhar's legacy as a torchbearer in the Mining Industry continues to inspire and shape the future of mining engineers in India and beyond.

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

CONFERENCES, SEMINARS, WORKSHOPS ETC.

INDIA

21-22 Dec 2024: National Seminar on Dynamics in Mineral Sector for Viksit Bharat 2047. Organised by the Society of Geoscientists and Allied Technologists (SGAT) at Bhubaneswar. For details contact: Mr T. Mohanta, General Secretary, SGAT at Tel: +91 674 2557516; Email: sgatodisha@gmail.com; Website: <https://sgat.in>

21- 22 Dec 2024: QGIS & DNR GPS Training – Organised by MEAI, Rajasthan Chapter-Jaipur at Mining Welfare Centre, Near Parishkar College, Off Shipra Path, Mansarovar, Jaipur - 302020, Rajasthan. It will be held in Hybrid mode using a meeting link (will be provided to enrolled delegates). For details contact: +91 988 7444 744 or meaijpr2010@gmail.com

15 Feb 2025: Surveyors Meet. Organized by Bellary-Hospet Chapter at Hosapet, Karnataka. For details please contact, Mr P Venkateswara Rao, Secretary, Bellary-Hospet Chapter at +91 9900256764

ABROAD

03-05 Dec 2024: Resourcing Tomorrow 2024. Organised at Business Design Centre, 52 Upper Street, Islington, London, N1 0QH, United Kingdom. Contact: +44 (0)20 7288 6475 or connect@resourcingtomorrow.com.

3-6 Feb 2025: Investing in African Mining INDABA. CTICC Cape Town, South Africa. Contact info@miningindaba.com.

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

23-26 Feb 2025: MINEXCHANGE 2025 SME Annual Conference & Expo and CMA 127th National Western Mining Conference co-located with World Gold 2025. Colorado Convention Center, 700 14th St., Denver, CO 80202. Contact: cs@smenet.org

02-05 Mar 2025: PDAC 2025. Organised at Metro Toronto Convention Centre, 222 Bremner Blvd, Toronto, Ontario, Canada. Contact information: 416 362 1969 or info@pdac.ca.

09-12 Mar 2025: EnviroTech Athens - 2025 - The Gateway to Green Cement. Greece. Contact: enquiries@globalminingreview.com

7 - 9 Apr 2025: Underground Operators Conference 2025. Adelaide Convention Centre, Adelaide, Australia. Contact: 1800 657 985 or +61 3 9658 6100 (if overseas)

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

4-7 May 2025: CIM CONNECT. Montreal, QC, Canada. Organised by The Canadian Institute of Mining, Metallurgy and Petroleum. Contact Chantal Murphy, Conference Planner (Technical Program) at cmurphy@cim.org or +1-514-939-2710 ext. 1309.

7-8 May 2025: Mineral Resource Estimation Conference 2025. Perth, Australia. Contact: 1800 657 985 or +61 3 9658 6100 (if overseas)

20-22 May 2025: Global Resources Innovation Expo 2025. Brisbane, Australia. Contact: 1800 657 985 or +61 3 9658 6100 (if overseas)

21-22 May 2025: AUSTMINE 2025. Brisbane Convention and Exhibition Centre. Contact: Jason Berman, Event Director, jberman@etf.com.au, +61 2 9556 7991

Jun 2025: UK Mining Conference in Cornwall. Organised at Princess Pavilion, 41 Melvill Road, Falmouth, Cornwall, TR11 4AR, United Kingdom. Contact: +44 7885 131097 or info@ukminingconference.co.uk.

21-22 Jun 2025: International Conference on Oil, Gas and Petroleum Geology ICOGPG 2025. Vienna, Austria. Website URL: <https://waset.org/oil-gas-and-petroleum-geology-conference-in-june-2025-in-vienna>. Organised by World Academy of Science, Engineering and Technology.

REQUEST TO READERS/ MEMBERS OF MEAI

The Editorial Board of the Mining Engineers' Journal (MEJ) requests our esteemed Readers/ Members of MEAI to share their valuable Research work in geosciences/ mining or Best practices developed/ adopted while employed in the mineral industry, for publication in our Mining Engineers' Journal (MEJ), for the benefit of the mineral industry fraternity.

Interested professionals may please contact the Editor, MEJ for obtaining "Author(s) guidelines" for submitting technical papers at editor.mej.meai@gmail.com.

Editor, MEJ

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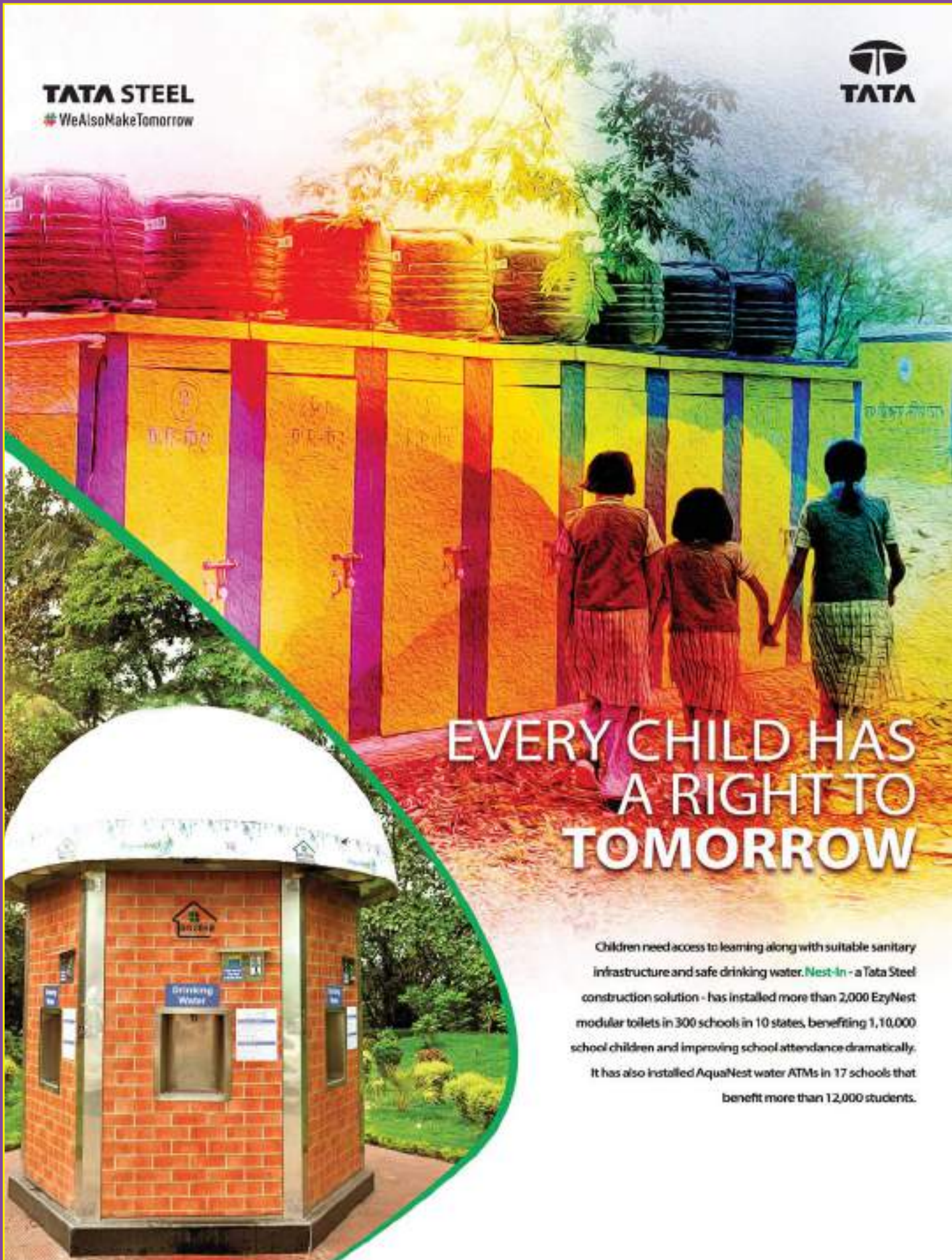
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