

Mining Engineers' Journal



Official Publication of
Mining Engineers' Association of India

Price ₹100/-

Vol. 22

No. 5

MONTHLY

December - 2020



SUSTAINABLE MINING
for a Renewable Tomorrow

In pursuit of
Sustainable Mining



Odisha Mining Corporation Ltd.

An ISO 9001:2015, ISO 14001:2015 & BS OHSAS 18001:2007 Certified Company

www.omcltd.in OmcOdisha @Odisha_mining

Mining Engineers' Association of India

Flat-608 & 609, Raghava Ratna Towers, A-Block, VI Floor, Chirag Ali Lane, Abids, Hyderabad - 500001

Ph.: 040 - 66339625, 23200510, Email: meai1957@gmail.com Website: www.meai.org

India's Single Largest Producer of Iron Ore



NMDC has triumphantly completed the Diamond Jubilee Year with a string of laudable achievements. The Company's remarkable growth in these six decades is a testament to its strong fundamentals.

- One of the best performing Public Sector Enterprises of India.
- The single largest producer of iron ore in India.
- Bringing socio-economic transformation through innovative and impactful CSR initiatives in the less developed regions of the Country.
- Sole producer of Diamonds in India.
- Venturing into steel by commissioning 3.0 MTPA Steel Plant at Nagarnar, Chhattisgarh.

NMDC re-dedicate itself with a fresh zeal and renewed enthusiasm, energy and strategy to achieve greater heights in delivering value for all its stakeholders



NMDC Limited

(A Government of India Enterprise)
'Khanij Bhavan', 10-3-311/A, Castle Hills,
Masab Tank, Hyderabad-500 028. INDIA
website: www.nmdc.co.in

Mining Engineers' Journal

ISSN 0975 - 3001



Official Publication of
Mining Engineers' Association of India

Vol. 22

No. 5

MONTHLY

December - 2020



President

Sanjay Kumar Pattnaik

Vice President - I
K. Madhusudhana

Vice President - II
S.N. Mathur

Vice President - III
O.P. Gupta

Secretary General
M. Narsaiah

Jt. Secretary cum. Treasurer
B. S. P. Raju

Ex-officio Council Members
Arun Kumar Kothari, T. Victor

Council Members (Elected)

P.K. Satpathy, D.B. Sundar Raman, A.B. Panigrahi, Dr. Abani Ranjan Samal, Prof. Arvind Kumar Mishra, T.N. Gunaseelan, Pankaj Kumar Satija, Prof. B.B. Dhar, Ravindra Kumar Sharma, Dileep Kumar Saxena, Rajendra Singh Rathore, Prof. S.K. Parihar, Prof. Sushil Bhandari, Maheem Kachhawaha, L.S. Shekhawat, R.H. Sawkar, M.S. Raju, P. Srinivasa Rao, Dr. N.K. Nanda, Dr. M.S. Venkataramayya, M. Sathish Kumar, P. Balamadeswaran, M. James, Dr. K. Srihari, Dhananjay Kumar, Rachappa, D.R. Vaze, Manish Kumar Yadav

Representatives of Life Institutional Members

Sagar Cements Ltd. (LIM-21), The K.C.P. Ltd. (LIM-22), Jubilee Granites India Pvt. Ltd. (LIM-23), Shri Sharda Cold Retreads (P) Ltd. (LIM-24), ACC Ltd. (LIM-25)

Nominated Members

Sitaram Kemmannu, Sunil Kumar Vashisth, Dr. T.N. Venugopal, S. Kumaraswamy, A.K. Jaiswal

Co-Opted Members

Deepak Vidyarthi, Chandra Mohan, Prof. Bhabesh.C. Sarkar, Atul Kumar Bhatnagar, Bidyut Chakraborty

this issue contains...

President's Message	5
Editor's Desk	7
News from the Mining World	9
Generating Muck Pile Characteristics for Efficient Loading By Excavator - A Review (Part 1) - M.O. Sarathy	15
Potential for Hydrocarbon Exploration in Jhuran Formation of Kachchh Mainland, Gujarat, Western India - Dharendra Kumar Pandey, Ravindra Chaudhary, Rajesh Singh Shekhawat, Jitendra Kumar Sharma, Suraj Bhosale, Ketan Chaskar	23
MEAI News	29
Conferences, Seminars, Workshops etc.	38

Correspondence Address

MEAI National Headquarters

Contact: **Secretary General,**

Mining Engineers' Association of India

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

Ph.: 040-66339625, 23200510

E-mail : meai1957@gmail.com

website : www.meai.org

The Views expressed by the authors in these pages are not necessarily those of Publisher / Editor / MEAI. Reproduction in whole or in part is strictly prohibited without written permission from the publisher.



TOUCHING LIVES



Bringing change through education

Our community initiatives take care that the rural child is not left behind in the nation's march towards prosperity. Ground breaking initiatives like Gurudikhya, Samarpan & Manthan engage innovative approach towards taking rural education to the next level, while ensuring lowest dropout rates and improved academic results.



TATA STEEL LONG PRODUCTS LIMITED

(Formerly Tata Sponge Iron Limited)

www.tatasteellp.com



President's Message.....

Dear readers

Greetings!!

The COVID-19 pandemic is undoubtedly the defining global health crisis of our time, with governments and health services alike racing to slow the spread of the virus. Nevertheless, beyond the impact on global health, COVID-19 has shown its potential to create devastating social, economic and political challenges that will have lasting repercussions.

The mining industry's response has been swift and aligned, and has been driven by two key priorities. Firstly, protecting the health and safety of employees and local communities; and secondly, laying the groundwork to support the longer-term economic recovery, which includes supporting livelihoods, protecting severely disrupted supply chains, and helping to build long-term community resilience to any future crises. What this response has made immediately clear is that companies, governments and communities must work in collaboration to aid recovery efforts. Working independently will only hinder the ability to recover and rebuild.

The conclusion of first round of Commercial Coal Mining and the encouraging participation of the bidders gives a new ray of hope to the contribution of the mining sector in the recovery and is a testimony to the significant steps taken by the Government for revival of the sector.

Recent measures taken by Environment Ministry to streamline the Environment Clearance process is a step further to rebuild the mining sector.

It gives me immense pleasure to acknowledge the efforts of various MEAI chapters in conducting many webinars on diverse and apt topics, which has made interaction and knowledge sharing possible during these difficult pandemic times.

MEAI and NACRI, conducted a Webinar on ***Adopting International Standards for 'Mineral Resource Reporting' 'Way to attract FDI in India'*** on 27th October 2020 in association with Metalogic Projects Management Services Pvt. Ltd. In India, roughly 17% of Mineral Resources only have been exploited. This indicates there is a huge scope for exploration and exploitation of minerals in India, so the requirement for a robust mineral reporting standard becomes more pertinent in India.


UN framework has not improved over a period and the reliability of UNFC is questioned many times. Unlike UNFC, the CRIRSCO compliant public report system is open and transparent.

Austrade organized a virtual session on Safety in Mining on 3rd November 2020 where various aspects of Mining safety were discussed and use of technology in improving safety was emphasised.

MEAI Rayalaseema Chapter organized a Webinar on "Lightning Protection Adequacy Study for Mines" on 4th November 2020, where the measures to be taken for lightning protection in mines were discussed. MEAI Hyderabad chapter organised a paper meet on 22nd November on Metal Mining Scenario with Specific Reference to Lead & Zinc.

At the end, I would like to request the readers to continue following Covid appropriate behaviour to prevent the spread of the virus.

With best wishes.


Sanjay Kumar Pattnaik
President



Mining Engineers' Association of India

Regd. Office : Rungta House, Barbil (Odisha)

Presidents & Hony. Secretaries / Secretary Generals

MINING ENGINEERS' ASSOCIATION

Period	President	Secretary/ Secretary Generals
1957-64	B.L. Verma	B.N. Kanwar
1964-67	N.S. Claire	R.C. B. Srivastava
1967-68	L.A. Hill	S. Chandra
1968-69	H.L. Chopra	M.G. Jhingran
1969-70	S.S. Manjrekar	V.S. Rao
1970-71	R.C.B. Srivastava	M.G. Jhingran
1971-72	R.K. Gandhi	B. Roy Chowdhury
1972-73	I.N. Marwaha	D.D. Sharan
1973-75	R.S. Sastry	M.S. Vig
1975-76	G.L. Tandon	K.K. Biran

MINING ENGINEERS' ASSOCIATION OF INDIA

Period	President	Secretary/ Secretary Generals
1975-76	G.L. Tandon	K.K. Biran
1976-78	D.L. Patni	A.K. Basu
1978-80	R.C. Mohanty	S.K. De
1980-81	M.K. Batra	R.C. Dutta
1981-82	D.K. Bose	S.B. Mukherjee
1982-83	P.R. Merh	M.K. Srivastava
1983-86	V.S. Rao	L.S. Sinha
1986-88	M.A.Khan	D.K. Sen
1988-90	Saligram Singh	A. Panigrahi
1990-93	M. Fasihuddin	B. Mishra
1993-95	K.K. Biran	S. Chandrasekaran
1995-97	N.S. Malliwal	Dr. P.V. Rao
1997-2001	T.V. Chowdary	C.L.V.R. Anjaneyulu (S.G)
2001-2003	R.N. Singh	C.L.V.R. Anjaneyulu (S.G)
2003-2007	Meda Venkataiah	C.L.V.R. Anjaneyulu (S.G)
2007-2009	R.P. Gupta	C.L.V.R. Anjaneyulu & A.S. Rao
2009-2011	Dr. V.D. Rajagopal	A.S. Rao
2011-2013	Dr. S.K. Sarangi	A.S. Rao
2013-2015	A. Bagchi	Koneru Venkateswara Rao
2015-2017	T. Victor	Koneru Venkateswara Rao
2017-2019	Arun Kumar Kothari	Dr.H.Sarvothaman, S. Krishnamurthy
2019-2021	S.K. Pattnaik	S. Krishnamurthy, M. Narsaiah

Chapter Chairman Secretary

Chapter	Chairman	Secretary
1. Ahmedabad	A.K. Garg	Dr. D.A. Pancholi
2. Bailadila	A.K. Prajapati	S.S. Prasad
3. Bangalore	Dhananjaya G Reddy	N. Rajendran
4. Barajamda	Atul Kumar Bhatnagar	R.P. Mali
5. Belgaum	S.R. Hegde	Dr. P.T. Hanamgond
6. Bellary-Hospet	K. Prabhakar Reddy	S.H.M. Mallikarjuna
7. Bhubaneswar	M.C. Thomas	Dipak Behera
8. Dhanbad	Dr. Pradeep K Singh	Dr. Sanjay Kumar Roy
9. Goa	Cletus T D'souza	Rakesh B. Singh
10. Himalayan	-	Dr. S.S. Randhawa
11. Hutti-Kalaburagi	V.D. Mali	Shiojee Roy
12. Hyderabad	B.R.V.Susheel Kumar	Dr. C. Narsimulu
13. Jabalpur	-	-
14. Kolkata	S.C. Singh	Shameek Chattopadhyay
15. Mumbai	Ravi Chandran Raj	Subodh Kasangottuwar
16. Nagpur	P.N. Sharma	Dr Y.G. Kale
17. New Delhi	A.K. Bhandari	Deepak Gupta
18. Rajasthan-Jaipur	M.L. Gupta	Dr. Manoj Pandit
19. Rajasthan-Jodhpur	P.R. Dave	Y. S. Sankhla
20. Rajasthan-Udaipur	Y.C. Gupta	M.S. Paliwal
21. Raipur	B.L. Bhati	Dinesh Singh
22. Rayalaseema	K. Karunakara Rao	Kalidindi Sudhakar
23. Singareni	S. Chandrasekhar	K. Laxminarayana
24. Tamil Nadu	G. Raghunath Singh	K.Sendil Kumar
25. Veraval-Porbandar	Ajay Kumar Jain	C.M. Dwivedi
26. Visakhapatnam	Dr. C.H. Rao	Harikrishna Karumudi

LIFE INSTITUTIONAL MEMBERS

1 A.P. Mineral Dev. Corp.Ltd.	(LIM-12)	41 Obulapuram Mining Co. (P) Ltd.	(LIM-54)
2 Aarvee Associates, Architects, Engineers & Consultants Pvt. Ltd.	(LIM-49)	42 Orient Cement	(LIM-59)
3 ACC Ltd.	(LIM-25)	43 Panduronga - Timblo Industries	(LIM-56)
4 Ambuja Cements Ltd.	(LIM-3)	44 Pearl Mineral Ltd.	(LIM-39)
5 Aravali Minerals & Chemical Industries(P)Ltd.	(LIM-48)	45 Priyadarshini Cement Ltd.	(LIM-5)
6 Associated Mining Co.	(LIM-19)	46 R.K. Marbles Pvt. Ltd.	(LIM-52)
7 Associated Soapstone Distributing Co.(P)Ltd.	(LIM-57)	47 Radials International	(LIM-29)
8 Belgaum Minerals	(LIM-64)	48 Rajasthan State Mines & Minerals	(LIM-53)
9 Bharat Alloys & Energy Ltd.	(LIM-36)	49 Rajgarhia Group of Industries	(LIM-50)
10 Capstone Geo Consultants (India) Pvt. Ltd.	(LIM-66)	50 S.N. Mohanty	(LIM-62)
11 Dalmia Bharat (Cement) Ltd.	(LIM-71)	51 Sagar Cements Ltd.	(LIM-21)
12 Designer Rocks (P) Ltd.	(LIM-32)	52 Sandvik Asia Limited	(LIM-46)
13 FCI Aravali Gypsum & Minerals India Ltd.	(LIM-61)	53 Sesa Goa Ltd.	(LIM-11)
14 Grasim Industries Ltd.	(LIM-26)	54 Shivalik Silica	(LIM-72)
15 Gujarat Heavy Chemicals Ltd.	(LIM-6)	55 Shree Cement Ltd.	(LIM-51)
16 Gujarat Mineral Dev. Copr Ltd.	(LIM-18)	56 Shree Engineering Services	(LIM-15)
17 Gujarat Sidhee Cements Ltd.	(LIM-4)	57 Shri Sharda Cold Retreads (P) Ltd.	(LIM-24)
18 Gulf Oil Corporation Ltd.	(LIM-9)	58 South India Mines & Minerals Industries	(LIM-2)
19 Hindustan Zinc Ltd.	(LIM-60)	59 South West Mining Ltd.	(LIM-40)
20 Indian Rare Earths Ltd.	(LIM-35)	60 Sri Kumarswamy Mineral Exports	(LIM-43)
21 J.K. Cement Ltd.	(LIM-58)	61 Sudarshan Group of Industries	(LIM-47)
22 JSW Cement Ltd.	(LIM-63)	62 Tata Chemicals Ltd.	(LIM-7)
23 Jubilee Granites India Pvt. Ltd.	(LIM-23)	63 Tata Steel Limited	(LIM-8)
24 Kariganur Mineral Mining Industry	(LIM-41)	64 Telangana State Mineral Development Corporation Limited	(LIM-75)
25 Kirloskar Ferrous Industries Ltd.	(LIM-33)	65 Terra Reserves Determination Technologies (P) Ltd.	(LIM-55)
26 Krishna Mines	(LIM-27)	66 The India Cements Ltd.	(LIM-16)
27 Lafarge India Pvt. Ltd.	(LIM-69)	67 The K.C.P. Ltd.	(LIM-22)
28 M.P.L. Parts & Services Ltd.	(LIM-14)	68 The Singareni Collieries Company Ltd	(LIM-73)
29 Madras Cements Ltd.	(LIM-17)	69 Thriveni Earthmovers (P) Ltd.	(LIM-31)
30 Mahashakti Infrastructure	(LIM-77)	70 Transworld Garnet India Pvt. Ltd.	(LIM-67)
31 Maheswari Minerals	(LIM-65)	71 Tungabhadra Minerals Pvt. Ltd.	(LIM-42)
32 Mangala Associates Pvt. Ltd.	(LIM-74)	72 Ultra Tech Cement Ltd.	(LIM-10)
33 Manganese Ore (India) Ltd.	(LIM-37)	73 UltraTech Cement Ltd.A.P.Cement Works	(LIM-28)
34 Mewara Mining	(LIM-78)	74 V. Thirupathi Naidu	(LIM-34)
35 MSPL Limited	(LIM-30)	75 V.V. Mineral (LIM-68)	
36 My Home Industries Limited	(LIM-70)	76 Veerabhadrapa Sangappa & Company	(LIM-44)
37 Mysore Minerals Limited	(LIM-45)	77 VS Lad & Sons	(LIM-38)
38 National Aluminium Co. Ltd.	(LIM-1)	78 W.B. Engineers International Pvt. Ltd	(LIM-13)
39 National Institute of Rock Mechanics	(LIM-76)		
40 NMDC Ltd.	(LIM-20)		

EDITOR'S DESK



Dr. P.V. Rao
Editor, MEJ

Luminary of the government Padmabhushan Dr V.K. Saraswat, Member NITI Aayog was the Keynote speaker in a webinar entitled 'Adopting International standards for Mineral Resource Reporting – Way to Attract FDI in India' organised by the Mining Engineers' Association of India (MEAI) in partnership with Metalogic PMS on October 27, 2020. Other distinguished speakers in the webinar included Mr Sanjay Pattnaik, President of MEAI, Dr Aruna Sharma, IAS (Retd), Mr Ken Lomberg, Chairperson CRIRSCO from South Africa, Mr Neil Wells, Immediate past Chairperson of CRIRSCO from UK, Dr P.V. Rao, Co-Chair NACRI, and Dr Abani Samal, former Co-Chair NACRI from USA. The highlight of the webinar was the landmark speech delivered by the keynote speaker.

Dr VK Saraswat's speech, which was clear and loud, galvanized the hearts of every attendee from the Indian Resource Sector. He tried to share the current thinking prevailing at the highest levels of the NITI Aayog and the government to enable FDI in the exploration and mining sectors. As anticipated, his speech could not miss the attention of the press and it was published verbatim by many print media houses in India. His speech was also uploaded on YouTube channel for the benefit of those that could not participate in the webinar live. Since an eminent member of NITI Aayog delivered the speech which has direct relevance to the resource sector, excerpts of the same (sourced from PTI) are reproduced below.

EDITORIAL BOARD

President - MEAI	Chairman
Editor - MEJ	Member
Publisher - MEJ	Member
Prof. H.S. Pandalai	Member
Prof. Singham Jayanthu	Member
Prof. Sushil Bhandari	Member
Prof. Biswajit Samanta	Member
Dr. Abani Samal	Member
Dr. A Srikant	Member
Dr. SK Wadhawan	Member
Immediate Past President	Member

Dr Saraswat while questioning the existing *There is a need for a change in India and reporting system stated that 'the present reporting CRIRSCO's Template is very positive. The Government of India is thinking in that direction, a new framework is going to emerge.*

resource estimation and forecast with objective as reliable mineral inventory to underpin mineral policies available for exploration and mining companies to attract inward investment and exploration activities. We have to see whether the platform (UNFC) which we adopted has really improved and brought in the required amount of investment in this particular sector. As the participation of the private sector increases, is the information available to the public good enough to take risks which are involved in doing the mining operations?'

He further indicated that 'the reliability and accuracy of information/ data available presently is always questioned as India is losing FDI in this particular sector. CRIRSCO is for public reporting whereas UNFC is not acceptable for public reporting. In CRIRSCO, we have a mandatory system for classification whereas in UNFC it is a voluntary system of classification with the choice of 48 categories and no rules are imposed on disclosure of categories of resources. CRIRSCO is about public reports based on the work undertaken by Competent Person whereas in UNFC it is left to adopting countries.'

He stressed that 'If we can follow CRIRSCO International template for reporting then we can certainly standardize the whole process. There is a need for a change in India and CRIRSCO's Template is very positive. The Government of India is thinking in that direction, a new framework is going to emerge. Inputs from this webinar are certainly very useful and they will be put in use when the final policy papers on this are submitted in front of the government of India.'

He further commended that 'the 5-year long collective efforts of NACRI-MEAI fructified with the CRIRSCO recognizing NACRI as the NRO, MEAI as the PO and the IMIC (Indian Mineral Industry Code for Reporting Mineral Resources and Reserves in India) as the National Reporting Standard of India, with effect from August 1, 2019. The IMIC is a Made in India code and internationally recognized standard for reporting Exploration results, Mineral Resources and Reserves in India. The implementation of IMIC will enhance the probabilities of attracting FDI in the Indian resource sector manifold, as envisaged in the Indian National Mineral Policy 2019.'

Dr. Aruna Sharma, Former Steel Secretary advocated that 'In India if we want to raise money through stock exchanges then SEBI may like to issue an order that anybody who would like to list the mineral based company should disclose the resource statement compliant to CRIRSCO standards. And if we want FDI, then the government will have to harmonize the various routes to open the window to make adoption of CRIRSCO standards mandatory.'

It is time for the policy makers and regulators alike to take note of the impending need to introduce IMIC in India. In the interest of the Nation in general and the Mineral industry in particular, it becomes pertinent for the Government of India to recognise the NACRI and MEAI as its trusted partners in fostering the Indian Resource Sector.

- Editor

EDITOR

Dr. P.V. Rao
(Off. : 040 - 23200510)
Cell : 96180 91039
Email: editor.mej.meai@gmail.com

PUBLISHER

M. Narsaiah
Secretary General,
Mining Engineers' Association of India
Mob: 79819 05231

SUBSCRIPTION RATES

	India	Foreign
1. Subscription for 1 Year	Rs. 1000/-	US\$120
2. Single Copy	Rs. 100/-	



Mining | Pellet | DRI | Steel | Power

Minera Steel & Power Private Limited

A Minera Group Company

Registered Office: Prestige Minera, No 6, 3rd Floor, Main Guard Cross Road, Shivaji Nagar, Bangalore 01.
Karnataka, India.

T +91 80 25550559 / 4169 3666, 4666 **F** + 91 80 4169 1666 **E** info@mineragroup.com **W** www.mineragroup.com

Works: Yerabanahally Village 583 115, Sandur Tq, Bellary Dist. **T** +91 8392 237801, 07 **F** +91 8392 237899

NEWS FROM THE MINING WORLD

➤ Mining reforms in a month; auction of 500 blocks in 2-3 yrs: Pralhad Joshi

The Centre is planning to come out with the proposed mining reforms in a month or so and the auction of mineral blocks will kickstart two to three months after the amendments take place

The Centre is planning to come out with the proposed mining reforms in a month or so and the auction of mineral blocks will kickstart two to three months after the amendments take place, Coal and Mines Minister Pralhad Joshi has said. The mines ministry had earlier sought suggestions from the general public, mining industry and other stakeholders on the proposed reforms in the Mines and Minerals (Development and Regulation) Act, 1957.

"We want to bring these reforms very shortly... In another month or so reforms (proposed mining reforms) should come out," Joshi said in an interview to PTI. The government, he said, is looking into the feedback it has received on the proposed reforms and stressed that the Centre wishes to auction at least 500 mineral blocks in the coming two to three years. The slew of reform proposals include amending the contentious provisions of 10A(2)(b) and 10A (2)(C) of the MMDR Act, a move that would pave the way for auctioning of around 500 potential leases stuck in legacy issues now. Section 10A(2)(b) deals with leases where reconnaissance permit or prospecting licence were granted while 10A(2)(c) relates to grant of mining leases. Joshi said there is mixed opinion on 10A(2)(b) and 10A (2)(C) of the Act and stressed that it does not want to go into the details on the same.

The mines minister was of the view that the Centre would have to convince state governments before the auction of mineral blocks as the mines ministry was just the policy maker and "rest (with regard to auction) is with the state government." Under the Aatmanirbhar Bharat scheme, the Centre had in May announced enhancing private investments in the mineral sector and bringing in other reforms.

In order to implement the announcements, the mines ministry has proposed legislative amendments to the MMDR Act, 1957 for undertaking structural reforms in mineral sector with the objective of accelerating growth and employment generation. The proposals include increasing mineral production and employment generation by redefining the norms of exploration for auction of mineral blocks and ensuring seamless

transition from exploration to production. They also include resolving legacy issues to move towards an auction only regime for allocation of mineral resources, removing the distinction between captive and non-captive mines, developing a transparent National Mineral Index and clarifying the definition of illegal mining, among others.

Press Trust of India, New Delhi | November 15, 2020

➤ Resuming mining in Goa to give much needed fillip to state economy: GCCI

GCCI made a case for the resumption of mining in the state, saying it will give much needed fillip to the state's economy in form royalty and taxes and also prove to be a viable source of livelihood

The Goa Chamber of Commerce and Industry (GCCI) on Tuesday made a case for the resumption of mining in the state, saying it will give much needed fillip to the state's economy in form royalty and taxes and also prove to be a viable source of livelihood for the people in these trying times. The prolonged economic slowdown followed by the COVID-19 pandemic has adversely affected almost all the sectors of the state economy, it said.

Mining is at a standstill and tourism, which was the highest revenue generating sector for the state, has all but dried up and inflows of visitors are at a standstill, the GCCI said in a statement.

This has caused huge discomfort and financial distress to the state and its people, the industry body said adding that it is estimated by various agencies that the state's tourism industry -- which is the second largest revenue earner in Goa -- has lost about Rs 1,000 crore worth of business because of the lockdown.

On October 14, the Goa government approved the state's tourism policy after a long wait of six years and when the sector is in most distress. The policy document envisages tourism for the next 25 years with a vision to make the state the most preferred destination around the year for high spending tourists by 2024. The government has made a provision for setting up new tourism board, which will be the backbone for all decisions pertaining to planning, development and marketing of tourism in Goa.

Now, the government is solely depending on tourism to increase its dwindling revenues. The state, which collected Rs 15,000 crore in revenues last year, is

already facing a 70 per cent revenue shortfall in the current fiscal in past couple of months. In this backdrop, it is of paramount importance that mining resumes in the state of Goa at the earliest. "We welcome the proactive steps taken by Chief Minister of Goa Pramod Sawant for resumption of mining activities in the state wherein he had meeting with the Prime Minister and Union mines minister," GCCCI president Manoj Caculo said.

"We are hopeful that the follow up meetings shall be held at the earliest and an appropriate decision to resume mining in the interest of State of Goa and its subjects shall be taken at the earliest," he added.

Press Trust of India, New Delhi | October 27, 2020

➤ **Tighter environment standards to impact coal consumption across Asia: Moody's**

Mumbai: As countries including India, China, Japan and Korea would look to meet their carbon emission standards they are set to cut down on consumption of coal Moody's research said. The research said that most countries would gradually aim at reducing their dependence on power generated from coal.

We expect governments across Asia to tighten environmental standards, to meet their commitments to curb carbon emissions and to improve air quality, through review of those policies and measures, the report said. Countries including China, Japan and Korea have recently pledged to reach net zero emissions by 2050-60. This also comes at a time when Covid pandemic is set to push back the recovery of the global economy by two years to 2023.

"We expect a nascent economic rebound to take hold globally but recovery will remain fragile amid the coronavirus pandemic, thereby creating uncertainty around the pace of recovery of power demand growth and sustained levels going forward. Coal-fired power producers will likely bear the brunt of demand reductions in major countries including China, India, Japan, Korea and Indonesia. This is because renewable energy will play an increasingly important role in power supply given governments' clean energy policies and initiatives for green recovery," the report added.

Sachin Dave, ET Bureau | Nov 19, 2020

➤ **India-Indonesia joint working group on coal holds discussions**

New Delhi: The fifth Joint Working Group (JWG) on coal between India and Indonesia discussed various issues through video conferencing and the coal ministry

provided an overview of the domestic coal sector. The meeting of the JWG was hosted through video conferencing due to travel restrictions on account of COVID-19 pandemic.

It was chaired from the Indian side by Additional Secretary at the coal ministry Vinod Kumar Tiwari. From the Indonesian side, the meeting was chaired by Jonson Pakpahan, Director for Mineral and Coal, Non Tax State Revenue of Ministry of Energy and Mineral Resources, the ministry said in a statement on Thursday.

In his opening remarks, Tiwari provided an overview of the coal sector in India and presented emerging scenario for the future. He highlighted India's initiatives for self-sufficiency in coal under Aatmanirbhar Bharat and imperatives for businesses in coal sector in both the countries. The ministry made presentations on Indian coal policy reforms, coking coal exploration and commercial mining, followed by presentations by the Indonesian side on coal policy and current coal business updates, deep seated coal potential in Indonesia, according to the statement.

For flagging the legacy trade issues by investors, a B2B session coordinated by Confederation of Indian Industry (CII) provided for frank discussions and sought resolution of issues by the Governments of Indonesian and India, it added. "Emerging business opportunities in both the countries were highlighted by respective delegations," the statement said.

PTI | Nov 05, 2020

➤ **Seaborne thermal coal demand to rise over next decade – report**

The Minerals Council of Australia released a report related to the outlook for seaborne thermal coal in terms of demand to 2030 in the Asia Pacific region. The report was commissioned to Commodity Insights and it states that Asian thermal coal imports are expected to grow by more than 270 million tonnes (Mt) to 1.1 billion tonnes per annum over the next decade. The market analyst says that this growth stands on the same drivers that allowed seaborne thermal coal volumes to double between 2006 and 2019, from 500Mt to 1,000Mt, rising in volume every year of that period except in 2015.

These driving factors are high electricity demand across developing nations, pushed by strong economic growth, increasing industrialization and higher electrification rates; high population growth, particularly India and Southeast Asia; significant coal-fired generation capacity commissioned in many countries; and, in some regions, an inability of domestic coal production

to keep pace with demand growth, amplified by increasing demand for high-quality thermal coal, which is typical of seaborne traded coals.

According to the report, even though growth will be negative in 2020 due to the impact of covid-19, it will be followed by a solid recovery and most countries are expected to increase imports, with only Taiwan and Korea reducing volumes. Moreover, five countries – among them The Philippines, India, and Vietnam – are forecast to increase demand by more than 30Mt. In Commodity Insights' view, such a rise illustrates the breadth of market demand growth for imported thermal coal – which is not reliant on growth from China.

MINING.COM Staff Writer | October 28, 2020

➤ **NASA finds rare metal asteroid worth more than global economy**

NASA's Hubble Telescope has obtained images of an asteroid so rich in metals that its worth puts our global economy to shame. Think \$10,000 quadrillion (\$10,000,000,000,000,000,000), compared to the world's economy, which was worth about \$142 trillion in 2019. The rare heavy-metal object, called "16 Psyche," is one of the largest celestial bodies in the Solar System's main asteroid belt, orbiting between Mars and Jupiter. It's located at roughly 370 million km (230 million miles) from Earth and measures 226 km (140 miles) across.

16 Psyche was actually discovered in 1852, but this is the first time scientists can get a closer look. What makes it special is that, unlike most asteroids that are either rocky or icy, 16 Psyche is made almost entirely of iron and nickel, a study published this week in *The Planetary Science Journal* shows. Tracy Becker, a planetary scientist and author of the paper, says the asteroid is likely the leftover core of a planet that never properly formed because it was hit by objects in our solar system and effectively lost its mantle and crust.

Closer look

While Hubble has been able to get clear images of 16 Psyche, only a visit to its surface will reveal what it's really like. NASA already has plans to do just that as part of its Discovery Program, with an orbiter set to launch from Florida's Kennedy Space Center in August 2022.

The mission would arrive at 16 Psyche in January 2026 and spend at least 21 months mapping and studying the asteroid's unique properties. "To understand what really makes up a planet and to potentially see the inside of a planet is fascinating," says Becker, who

works at the Southwest Research Institute in San Antonio, Texas. "Once we get to Psyche, we're really going to understand if that's the case, even if it doesn't turn out as we expect."



Artist's-concept illustration depicts NASA's Psyche mission spacecraft near the metal asteroid 16 Psyche. (Image courtesy of NASA.)

If the mission could kindly bring the asteroid back to Earth, every person on the planet — all 7.8 billion of us — would get roughly \$1.2 billion, based on current metal prices.

Cecilia Jamasmie | October 29, 2020

➤ **Four countries have more heap leach mines than the rest of the world combined**

Heap leaching is a processing and extraction technology that has become increasingly popular over recent years due to the cost advantages and environmental benefits it offers to miners.

Using data compiled by Mining Intelligence, MINING.COM takes a look at mining operations that are currently applying this technology, formulating a global ranking of countries with the most heap leach operations. Russia takes the top spot in this regard, with a total of 45 producing heap leach operations. The US ranks in second place (41), followed by Chile (35).

Rounding out the top 10 list are: Mexico (28), China (16), Peru (14), Kazakhstan (13), Zambia (10) and the Democratic Republic of the Congo (9). Australia, Indonesia and Zimbabwe share the tenth spot with six heap leach operations each. In most places, heap leach operations are predominantly gold or gold-silver, with the exception of Chile, where most of its mines are copper-focused.

WORLDWIDE HEAP LEACH OPERATIONS

Rank	Country	Heap leach operations in production	Percentage of total
1	Russia	45	16%
2	United States	41	14%
3	Chile	35	12%
4	Mexico	28	10%
5	China	16	6%
6	Peru	14	5%
7	Kazakhstan	13	5%
8	Zambia	10	3%
9	Dem. Republic of the Congo	9	3%
(10)	Australia	6	2%
(10)	Indonesia	6	2%

MINING.com Editor | November 10, 2020

➤ **Deep-sea mineral platform launches for mining dialogue**

Sea-floor deposits of cobalt, nickel and lithium and other minerals could soon become commercially available. New resource exploitation industries need new frameworks for governance and these frameworks are taking shape for deep-sea minerals, according to a new paper published by the World Economic Forum (WEF).

Deep-Sea Minerals: What Manufacturers and Markets Need to Know, asserts that mineral sourcing manufacturers and metal markets need to engage in the deep-sea mineral discussion.

A new way to meet the growing demand for minerals critical to electric vehicle, electronics and battery manufacturers could become commercially available within this decade, the paper predicts. To create the space for industry to come together, discuss and engage on this complex issue, the World Economic Forum also launched the Deep-Sea Minerals Dialogue.

Significant public and private investment have gone into how to extract cobalt, nickel, lithium and other minerals from the deep seabed; however, more than 80 non-governmental organizations have voiced concerns about the dangers of commercial extraction. Environmentalists have called for a ban on deep-seabed mining that would extract resources including

copper, cobalt, nickel, zinc, lithium, and rare earth elements from nodules on the ocean floor.

While venues exist for countries, scientists, seabed mining industry and environmental organizations to discuss deep-sea mining, companies that use these kinds of minerals – the product manufactures and metal markets – previously did not have a place to learn about and discuss this topic, WEF reports. The new platform will leverage experts with different points of views and analyze decision-making systems and learnings from existing industries.

“Deep-sea mining is a cross-cutting topic that could affect both progress on climate action as well as the preservation of biodiversity and is connected with the transition to a circular economy,” Dominic Waughray, Managing Director, World Economic Forum said in a media statement. The next years are critical as regulatory, technology and investment decisions are being made. These decisions could determine the environmental and social impact of deep-sea minerals, WEF says. Although the minerals may not enter supply chain for a few years, examples involving cobalt mining from the Democratic Republic of Congo and palm oil supply from Indonesia, show that failing to act early, can result in costly efforts to clean up the supply chain and reputational impact afterwards.

The paper underscores a trend of manufacturers and metal markets increasing their attention to the environmental and social conditions of the minerals they source. It is the first in a series of three about the potential extraction of deep-sea minerals, written for manufacturers and market exchanges. “Decisions being taken now on the development of deep-sea minerals have implications for ocean conservation, responsible sourcing, sustainable production and even for our fight against accelerating climate change,” says Assheton Stewart Carter, CEO of TDI Sustainability.

We have learned from other industries – such as oil sands development, hydro-electric dams, nuclear power generation – that’s when decisions to proceed with megaprojects fail to be inclusive and informed by science, it can lead to delays, irreversible social and ecological damage, or abandoned assets.”

MINING.com Editor | November 11, 2020



REGISTRATION OF COMPETENT PERSON UNDER IMIC



Mining Engineers' Association of India (MEAI) proposes to rollout the registration of Competent Person (RCP) under Indian Mineral Industry Code (IMIC). MEAI is a Professional Organisation (PO) in India, recognised by National Committee for Reporting Mineral Resources and Reserves in India (NACRI), with the obligation to offer professional development programs to its members, register competent persons and oversee the ethical behaviour of RCPs. NACRI is the National Reporting Organisation (NRO) recognised by Committee for Mineral Reserves International Reporting Standards (CRIRSCO).

Prerequisites for registration of CP

RCP has been defined under Clause #9 of IMIC, as follows:

RCP is a mineral industry professional who is a member of a professional organisation headquartered in India and approved by NACRI or a member of a 'Recognised Professional Organisation' (RPO), as included in a list of similar bodies headquartered outside India available on the NACRI website. These organisations have enforceable disciplinary processes including the powers to suspend or expel a member. An RCP must have a minimum of ten years professional experience, which includes five years relevant experience in the style of mineralisation or type of deposit under consideration, and in the activity which that person is undertaking.

In addition to the above minimum professional experience required by PO members for registration as RCP, the NACRI, vide Article 2.2.ii, further specifies that the potential RCP shall obtain at least 40 hours of professional development credits every year through participation in seminars, conferences, workshops, training programs or webinars, recognised by it.

Accordingly, those eligible mineral industry professionals in India interested in registering as Competent Person under IMIC should be a Life Member of MEAI, attained at least 10 years of professional experience and acquired 40 hours of professional development credits recognised by NACRI, at the time of making application to MEAI.

RCP certification shall be valid for one year from the date of issue of the certificate and renewed yearly thereafter. The annual CP registration fee has been fixed at Rs 5,000 (Rupees five thousand only) and payable to MEAI.

Professional Development Program on IMIC

The Professional Development Program on IMIC is a paid online mandatory training program. The fee chargeable for the 40-hour training program is Rs. 5,000 (Rupees five thousand only) and payable to:

MEAI-National Core Committee Fund; UCO Bank, Abid circle, Hyderabad; A/C no. **14410110037089**; IFSC: **UCBA0001441**

NACRI has formulated a 32-hour IMIC online training program, which every RCP must undergo before applying for RCP certificate. This IMIC training program includes basic knowledge sharing on all aspects of IMIC, including guidance to the prospective RCP. Another 8-hour online training program on mineral industry best practices will be organised by NACRI. The programs contents include:

- Introduction to MEAI/ NACRI Charter/ IMIC/ Code of Ethics
- Scope of IMIC
- Competence and Responsibility
- Reporting Terminology
- Reporting of Exploration Results
- Reporting of Mineral Resources
- Reporting of Mineral Reserves
- Reporting of Coal Exploration Results, Resources and Reserves
- Technical studies
- Other topics including CRIRSCO 2019
- Table 1 and QA/QC
- Industry best practices

RCP should undergo 8-hour mandatory refresher program on IMIC every year prior to applying for renewal of RCP. The RCPs may acquire additional professional development hours by attending NACRI accredited seminars/ workshops/ conferences/ training programs/ webinars. The MEAI headquarters will maintain the records of each trainee/ RCP and provide the same to the MEAI RCP Registration committee.

Professional development program schedule

The 40-hour online IMIC training program will be completed in a month's time by NACRI with the topics scheduled thrice a week, and each session not exceeding 3 hours at a stretch. The NACRI Professional Development Core Group will be responsible for conducting the training program under the guidance of Dr A. Srikant. It is scheduled to rollout the IMIC training program from January 2021.

Contact details

Interested members may please contact the Secretary General, MEAI at meai1957@gmail.com / Phone no. 040-66339625/ 040-23200510 or Dr PV Rao, Co-Chair NACRI at drpvrao@gmail.com for any further details on this subject matter.

Dr PV Rao
Co-Chair NACRI



#ThanksToMining
BingeWatching

From cameras to clapboards and make-up to mics. From servers to routers and TVs to tablets.
Mining is the backbone of everything

from film production to power generation and streaming infrastructure to viewing screens. In fact, if not for mining, even popcorn wouldn't be easy to pop as there would be no cookers nor any microwaves!

Without mining, it would be impossible to conceive our daily life or a sustainable future. Mining is responsible for powering human progress and national economies. The Baldota Group has been leading by example, by mining and processing iron ore responsibly for nearly six decades - which is way longer than even the longest running series on TV.



BALDOTA
WE ARE LIFE

Baldota Enclave, Abheraj Baldota Road, Hosapete 583203, Karnataka, India | www.baldota.co.in

cognitio

GENERATING MUCK PILE CHARACTERISTICS FOR EFFICIENT LOADING BY EXCAVATOR - A REVIEW (PART 1)

M.O. Sarathy

Abstract

Blasting using chemical energy viz explosives is still considered to be the most economic and efficient method to fragment and heave the material to be excavated from in-situ parent mass for further handling by excavator and transferring it to the desired site through truck or conveyor. The characteristics of the Muck pile is crucial for efficient loading by excavators. Excavation is carried out using various types of excavators such as Back-Hoe, Front End Loader (also known as Wheel Loader), Hydraulic Excavator, Hydraulic shovel, Rope Shovel and Dragline, each having its own requirements of fragmentation, Muck pile looseness and Muck pile profile. An attempt is made to review the various aspects of Muck pile characteristics vis-à-vis loading efficiency.

2. INTRODUCTION

Except few mines where ripping is deployed, all other surface mines utilize drilling and blasting as the main method of liberating material from the parent mass, followed by downstream operations of loading, hauling, crushing and additionally grinding where needed. Rock fragmentation refers to a process of size reduction of large rock masses into sizes suitable for the workings of subsequent equipment and machinery (Jethro et al⁹). Commensurate to scale of operations, production requirements, field lay-out and geology, projects deploy various types of excavators having different bucket sizes, digging depth (back-hoe), maximum reach (front end loader, hydraulic / rope shovel) and boom reach-swing-dump distance (dragline). Bucket size of excavator and grizzly size at crusher dictate the fragment size required from the primary blast. Muck pile looseness and Muck pile profile required are specific to the type of excavator deployed. Needless to say, good fragmentation and loose Muck pile improves loader's efficiency and thus productivity and lower maintenance cost. Excavator operator's skill, expertise, strategy and digging tactics employed to load the Muck pile have also been identified as important aspects of loading efficiency, productivity and longevity of excavator.

3. TYPES OF EXCAVATOR USED FOR LOADING

Mining industry uses 6 types of excavators to load the blasted material. They are:

- Front End Loaders (also known as Wheel Loaders).
- Hydraulic Excavator (fitted with reverse bucket to function as Back-Hoe).
- Hydraulic Shovel (fitted with bucket configuration for front loading).
- Rope Shovel (only front loading).
- Dragline (crawler mounted or walking type for large excavations).

- Back-Hoe and front-loading bucket fitted on either ends of tractor chassis.

3.1. Wheel loaders: require a well fragmented, low, flat, spread-out Muck pile as they cannot dig hard and poorly fragmented rock. They have difficulty in handling large fragments (oversize) in Muck pile and loading when the wheels are on soft / slippery surfaces, unlike track mounted excavators which are stable on all types of surfaces. Wheel loaders are highly mobile, have speeds of 20 kmph and have advantage of multi-face loading and operational flexibility. The maximum reach of wheel loader is less compared to excavators / shovels. While shovel and excavator remain stationary and load the truck by swiveling, wheel loaders have to reverse after filling the bucket and again move forward to position itself for discharge into truck. Tyre cost is a major maintenance expense with wheel loaders.

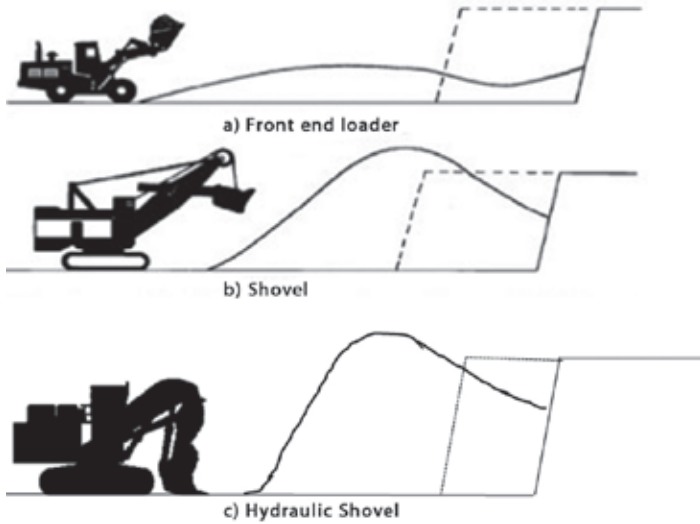
3.2. Hydraulic excavators: are powerful and bucket is fitted in reverse (back acting) as in a back-hoe. Hydraulic excavators normally sit on top of the Muck pile and load by digging from below. Loading is carried out by pulling the material towards itself.

3.3. Hydraulic Shovel / Rope shovel: Hydraulic and rope shovels are front loading. They have to be provided with compact / concentrated Muck pile of height equal to bench height and without much throw. Rope shovels have a higher reach compared to hydraulic shovel. Shovels push the bucket into the Muck pile (dig-crowd) away from machine during loading for filling the bucket.

3.4. Draglines: are usually made to sit on top of the Muck pile and require a well fragmented Muck pile stacked up against the bench face. They cannot handle poorly fragmented and tight Muck piles.

Lifemember - MEAI, sarathymo@yahoo.com

3.5. Wheel mounted back-hoe and front-loading bucket: fitted on tractor chassis, are less powerful. Used for small to medium scale excavations mostly in civil projects and few mines. Unlike shovels and excavators which rotate 360°, wheel mounted back-hoe has a limitation to swivel only 200°. Muck pile profiles (indicative) required for three types of excavators is given in Figure-1.



Optimum bucket sizes for different bench heights is given by Swanepoel¹⁷

Table 1 – Relationship of Bench Height and Bucket Size

Bucket size (m ³)	Bench height (m)
< 5	9
5 - 8	12
8 - 20	14
20 - 30	16
> 30	18

Optimum fragment size for given bucket size can be calculated by using the Rzhevsky formula (Choudhary^{3,4}).

$$X_{op} = (0.15 \text{ to } 0.2) B_c^{1/3}$$

where X_{op} = Optimum fragment size (m) and B_c = Nominal bucket capacity (m³)

4. MUCK PILE CHARACTERISTICS

The term 'Muck pile characteristics' encompasses a number of aspects of post-blast scenario / blast outcome and is a term mainly used to describe:

- Muck pile looseness: the result of good fragmentation, mean fragment size, uniformity index and unrestricted frontal movement of the fragmented mass during blasting.
- Muck pile profile after blast: controlled by bench height, delay pattern, initiation sequence and the delay interval provided viz milliseconds per foot (or metre) of burden distance.
- Angle of repose: angle (slope) at which Muck pile remains stable without rolling down.
- Swelling (Swell Factor), Void percentage, Fill factor: measure of Muck pile digability.
- Stickiness of material: specific to hydrophilic (having special affinity to water) materials.

Singh and Doorselaere¹⁶ have explained the importance of distributing explosive energy in rock mass on blast outcomes, generating the necessary fragmentation, heave and other requirements such as Muck pile profile, swell and digability from a blast. Extract is reproduced below:

Quote.... During rock blasting, the explosive in a drill hole is a source of energy that is distributed in space and time. After fragmentation of the rock mass, an explosive is expected to heave the into a configuration suitable for loading by a particular loading machine. The large volume of gases of explosion at high temperature and pressure tend to heave the broken burden forward. The total displacement of the fragmented rock depends upon the energy available in the expanding gases of explosion. With the increase in energy the fragmented burden moves with greater velocity and results in greater displacement from the pre-blasting location. Generally, the increased displacement is translated into higher swell factor and improved digability of the . The aim of achieving optimum productivity requires that rock displacement be controlled to produce configuration suitable to the type and size of the loading equipment. If front-end loaders are used, then blasting should produce maximum throw, swelling, adequate fragmentation and lower height. In the case of shovels, blasting should generate a with good fragmentation, limited throw, proper height and a few low productivity zones....Unquote.

According to Singh and Doorsleare¹⁶, blast design parameters form a bridge between rock mass characteristics and post-blast requirements, while Muck pile configuration is a bridge between the blasting parameters and performance of loading equipment. Hanspal et al⁸ mention that good fragmentation alone is not sufficient for optimization. Blast optimization process should also encompass the requirements in a Muck pile, which is tailored to suit the loading machine-system deployed.

LeJuge and Cox¹⁰ describe heave, displacement, swell and digability after detonation of explosive:

Quote.... Explosive detonation produces extremely high gas pressures in the blasthole. This high- pressure acts to heave the burden forward, with the total burden movement being determined by the energy available in the expanding gases. As this energy increases, the burden moves with greater velocity and achieves greater displacement from its initial location. This increased displacement generally results in an increased swell factor, and improved Muck pile digability. Optimum excavator productivity however requires that Muck pile displacement be controlled to produce profiles specific to the type and size of excavator.... Unquote

Fragmentation by blasting impacts load-haul performance of truck-shovel fleet through digability (dig time) and bucket payload (void ratio and fill factor). Digability is defined as digging time of loader. If dig time is low, then Muck pile is considered to have high digability and if the dig time is high, then the Muck pile is considered to have low digability. Oversize has a detrimental effect on loading. Larger fragments have an interlocking effect and resist easy penetration of bucket, thus increasing dig cycle times and low fill factor. Muck piles with large mean particle size leads to reduced productivity. A reasonable percentage of fines assists higher production rates as the fine material probably acts as a lubricant between the coarser muck and facilitates penetration of bucket. Mass of material in bucket decreases with increases in particle size. When force required to penetrate the Muck pile is less, bucket collects higher amount of material (Singh and Narendrula¹⁵). Fill factor is defined as the ratio between nominal volumetric capacity and volume of material in the bucket. It is also an operational variable, dependent on operator’s experience, loading strategy and willingness to fill the bucket. Fill factor is also affected by the angle of repose of muck above the bucket (rilling characteristics). High fill factor does not necessarily mean higher payload since loosely packed large fragments with lots of voids between fragments will have lower payload compared to a low fill factor of adequately fragmented and densely packed material inside the bucket (Doktan⁷). Confined spaces at loading point affects truck maneuverability during spotting (total time taken by truck to position itself for loading (Manyele¹¹).

Muck pile shape and swell are key factors for efficient excavation. The bucket fill time is affected by blast results and usually referred to as ‘instantaneous digging’ and rated as one of the best methods to evaluate the quality of macro-fragmentation in primary blast in mining operations (Couceiro and Santos⁵). Singh and Narendrula¹⁵ carried out studies both in the field and laboratory and listed the

important Muck pile characteristics as (a) fragmentation (b) geometry of Muck pile (c) angle of repose (d) looseness (e) spread (f) stickiness of muck due to moisture/water content (g) excavator design - bucket size/shape, break-out force, digging trajectory (h), excavator to muck orientation (i) void percentage.

5. MUCK PILE LOOSENESS

Mean particle size depends on blast design parameters, explosive properties and rock mass geology. Throw is caused by heave energy of explosive and appropriate selection of delay interval between drill holes in the row (along spacing) and between rows (across burden) viz creating effective free faces within the mass during in-blast. Effectiveness of stemming and its retention in the drill hole during blast confines explosive energy for a longer duration and improves fragmentation, heave / throw and thus Muck pile looseness. Shovel productivity reduces with increased percentage of oversized fragments in Muck pile. Muck pile looseness and angle of repose affect fill factor of excavator bucket, digging cycle time, and in turn, productivity. Muck pile looseness increases with increase in mean fragment size and uniformity index (n) upto a point. Bucket fill factor and rate of production decreases with increasing values of mean particle size and uniformity index (Manyele¹¹). Studies were carried out in the laboratory using a simulated loader to study bucket penetration rate (Mirabedi et al¹²). They observed lower penetration rate (mm/s) in piles having higher uniformity index and lower bulk specific gravity. An increase in mean fragment size increased loading time. Non-uniformity generally increased penetration rate and reduced loading time. For ‘n’ between 0.8-1.3, decrease in penetration rate was not rapid.

Uniformity Index: Cunningham⁶ defined uniformity index “n” by using the formula:

$$n = \left[2.2 - \frac{14B}{d} \right] \left[1 - \frac{W}{B} \right] \sqrt{\left(1 + \frac{S/B}{2} \right)} \left[0.1 + \text{abs} \left(\frac{BCL - CCL}{L} \right) + 0.1 \right]^{0.1} \left[\frac{L}{H} \right]$$

- | | |
|--|---|
| where B = Burden (m) | L = Charge length above grade level (m) |
| d = Drill hole diameter (mm) | H = Bench height (m) |
| S = Spacing (m) | BCL = Bottom charge length (m) |
| W = Standard deviation of drilling precision (m) | CCL = Column charge length (m) |

Note: if staggered drill pattern is used, then value of ‘n’ is increased by 10% viz n = n x 1.1.

'n' normally varies between 0.8 to 2.2, the lower values for non-uniformity in Muck pile containing dust, boulders and higher values for more uniformity with majority of fragments close to the mean.

If drill hole is charged with a single type of explosive charge, then length of column is considered.

5.1. Factors which control Muck pile looseness

- Blast geometry and blast design.
 - Mechanical properties and structural aspects of the strata / material and extent of energy being absorbed by the material that is being blasted.
 - Blast Geometry and design: burden, spacing, bench height, hole depth, sub-grade, stemming.
 - Explosive's characteristics mainly density, VOD, energy/strength (AWS/ABS), detonation stability, shock-heave energy partitioning.
- Using explosive with high VOD, high energy and high powder factor
 - Using explosive having high density, high VOD and high strength (energy). Explosive's performance and in-situ spatial distribution of charge in mass being blasted.
 - Powder factor (t/kg, m³/kg) or Specific charge (kg/t, kg/m³). Using high specific charge (high kg/t, kg/m³) viz low powder factor (low t/kg, m³/kg).
- Confinement of explosion gases after detonation through effective stemming.
 - Good stemming retention viz no stemming ejection, no premature venting of explosive energy during in-blast.
- Drill hole pattern and sequence of initiation of drill holes
 - placement, drilling accuracy and blasthole pattern: in-line or staggered, square or rectangular viz spatial distribution of drill holes within the rock mass charged with explosive.
 - Sequence of initiation of drill holes, delay interval provided between drill holes and across the burden and accuracy of firing times of drill holes (timing accuracy of initiation system). Providing adequate delay interval along row (spacing) and across rows (burden).
- 'Burden response' during in-blast.
 - Different types of strata, ores, minerals react differently under explosive loading. Explosive

characteristics, burden distance and longitudinal wave velocity govern burden response.

5.2. Using higher strength explosive and higher powder factor - specific charge (kg/t, kg/m³)

Use of high density, high energy explosive improves fragmentation. Similarly use of higher specific charge (kg/t, kg/m³) [viz low powder factor (t/kg, m³/kg)] also generates finer fragmentation. As the spatial distribution of explosive in the mass being blasted increases, fragmentation also improves considerably. The horizontal distance thrown is directly related to powder factor (Thornton¹⁸). Performance of downstream operations such as loading of blasted material is potentially influenced by energy content in the blasting phase. 20 blasts were carried out using same blast parameters (drill hole diameter, drill pattern, stemming, explosive density and powder factor) in benches with similar geological and geotechnical properties, by dividing the blast zone into two areas, one charged with a watergel explosive having VOD of 5670 m/s, weight strength of 3.44 MJ/kg (822 kcal/kg) and an emulsion explosive having VOD of 5120 m/s, weight strength of 3.01 MJ/kg (719 kcal/kg). Both products were blended with 30% ANFO. After blast, fragmentation measurement and video analysis showed average bucket fill time of 58.31 seconds with emulsion and 45.3 seconds with watergel, viz a reduction of 22.4% in bucket fill time due to increased explosive energy and VOD. This work shows evidence that explosive VOD, energy affects bucket loading time, excavator cycle time and hence productivity. A mathematical relationship has been defined for prediction of loading performance (Couceiro and Santos⁵).

$$B_c = 42.87 (E_t)^{-1.318}$$

where B_c = Bucket fill time and E_t = Blast energy factor (MJ/ton)

Jethro et al⁹ reported results of field studies carried out in limestone quarry attached to cement plant:

Table-2: Effect of Powder Factor on Mean Fragment Size and Uniformity Index

Powder Factor (kg/m ³)	Uniformity index	Mean fragment size, cm (x ₅₀)
0.956	1.509	82.37
0.869	1.485	88.90
0.584	1.416	122.18
0.540	1.455	130.08

(two maximum and two minimum values are extracted for this paper - Author)

Table-3: Mean Fragment Size Vs Digging Time*

Sl. No.	Mean Fragment Size (cm)	Loading time (seconds)
1	32.71	11.50
2	25.35	11.10
3	21.23	10.85
4	19.02	9.6
5	11.26	8.55
6	2.41	6.99

(* - only digging time is considered and not the other stages of loading - swing, dump, return)

5.3. Effective Stemming retention (no venting of high-pressure gases viz explosive energy):

In mining, drilling is a costly and time-consuming operation. Hence it is prudent to utilize the drilled depth to the maximum extent. Stemming is necessary during blasting, but the oversize fragments invariably lie on top of the Muck pile and are mainly generated from the collar zone (stemming zone) as it is devoid of explosives. Only the portion charged with explosives is put to effective use (Worsey¹⁹). Stemming retains the expanding explosion gases which are at very high temperature and pressure inside the drill hole. When the confined gases act inside the rock mass for a longer duration, it results in finer fragmentation and higher heave (throw) resulting in a loose, well spread Muck pile. Explosion gases confined in drill hole for longer duration (few milliseconds more) increases the burden velocity and heave of fragments over a longer distance. Premature venting of explosion gases occurs due to several reasons such as inadequacy of stemming (stemming length, improper stemming material), excessive burdens causing a blow-out, ejection of stemming by initiation system such as detonating cord downline or due to geologic structure such as open cracks, joints, bedding planes present in the burden. This will cause the pressure to drop inside the drill hole rapidly and the gases will not have sufficient energy to penetrate the radial cracks to fragment or heave the rock mass resulting in coarser fragments and reduced throw. Venting causes airblast and can eject loose fragments lying on the bench or rock pieces that inadvertently roll into the drill hole during stemming as flyrock.

The drilled depth can be used more effectively by increasing the explosive column length and reducing stemming height thus improving fragmentation from the collar zone. Stemming length is reduced by:

- Using an initiation system that does not eject stemming.
- Using true bottom hole initiation of explosive inside the drill hole (using shock tube based non-electric

detonators or electronic detonators. Stemming length can be reduced by 25-30%.

- Use angular crushed stone as stemming instead of drill cuttings which are freely available at site. Angular crushed stone displaces water and interlocks with each other and resists ejection.
- Mechanical devices such as stemming plugs (various designs) and inflatable gas bags are used to enhance stemming effectiveness. Pre-cast concrete plugs, fast-setting molding plaster poured into drill hole have also been tried. The plugs resist ejection of stemming and help retain gases.

Due to easy availability and at no cost, drill cuttings are invariably used as stemming material. Drill cuttings mostly contain small stone chips, fines and dust. Drilling in sandstone generates sand particles and drilling in coal generates coal dust. Both are not effective stemming materials and definitely not recommended in drill holes containing water, as it mixes with the water, forms slush. This offers very little resistance to the expanding products of detonation and gets ejected out easily. Use of angular crushed stone of size equal to 1/15 to 1/20 of drill hole diameter is suggested. It is the best stemming material as it interlocks with one another and resists ejection. In watery drill holes, it does not mix with water but displaces the water. Stemming gets more easily ejected from the blast hole as the particle size of stemming decreases. Many large mines overseas procure crushed stone of desired size for use as stemming at extra cost. Mechanical stemming devices are also used for saving time and labour costs. In addition, devices such as stemming plugs or inflatable gas bags are placed above explosive column and the drill hole is stemmed using drill cuttings. Use with crushed stone would further enhance effectiveness. Air Ball, Para Plug, Max Blast, Pilgrim Hat, Rock Lock, Stemtite, Varistem, Stemming Plug are various brands used overseas and available for drill holes of 76-387 mm diameter.

5.3.1 - Effect of confinement (stemming effectiveness) on fragmentation and heave / throw:

Work carried out using high speed photography has shown that effectiveness of stemming is critical for maximum blast efficiency. Poor stemming practices, poor quality stemming material and type of initiation system used resulted in stemming ejection during blasting and resulted in loss of explosive energy in the form of premature release of explosive gases into the atmosphere from the collar zone. This resulted in reduced rock movement and displacement. It is also highly probable that fragmentation also gets affected. In scaled down bench tests in Dolomite, the burden rock velocity was found to be inversely proportional to the stemming ejection velocity. Burden velocities got reduced by a factor of three due to poor stemming effectiveness, compared to drill holes in which stemming was held for 8

milliseconds. Stemming ejection earlier to this showed reduced burden velocities (Worsey¹⁹).

Armstrong et.al¹ have observed that the retention of explosive energy in the ground by stemming the blast holes has a direct influence on the final blast result. Retention of gas energy within the blast hole is critical to both fragmentation and movement. The time period between detonation of explosive in the drill hole and beginning of movement of frontal burden is defined as 'time to initial movement'. Hence the initial movement time is the minimum time period over which the explosive gases must be retained within the drill hole. When stemming retention time was lower than the initial burden movement time, significant increase in the fragment size (larger fragments) and decrease in movement of the blasted material (lesser throw) was observed as the rate of release of gas energy during the blast increased (lesser stemming effectiveness).

A field study carried out confirmed that the quality of stemming material significantly influences blasting performance. Use of drill cuttings and crushed stone as stemming was compared in overburden blasts in a large

metalliferous mine. Average fragment size with drill cuttings was 0.58-0.77 m, whereas it was 0.45-0.59 m with crushed stone. Muck pile throw was 21.2% more and shovel loading rate was 18% higher in blasts stemmed with crushed stone indicating superior effectiveness of crushed stone over drill cuttings as stemming leading to better blast results (Sharma and Rai¹⁴).

5.4. Drill hole pattern and delay blasting techniques (timing and initiation sequence).

Delay blasting plays a very crucial role in Muck pile looseness. Adequate frontal movement is indicated by the 'power trough' (Figure-2) formed in front of the new bench face after blast. Power trough is the depressed portion of the Muck pile in front of the newly formed bench face (last row of a multi row blast). When adequate delay is provided, the lower portion of the bench moves forward and the upper portion falls into the void created by the forward movement. The width of power trough depends upon the inter-row delay, powder factor and total burden. Good power trough implies good free face formed during blast. Results of field studies of resulting power trough width formed for different inter-row delay times is given in Table-4 (Singh and Doorselaere¹⁶).

Table-4: Blast parameters and width of power trough (Singh and Doorselaere¹⁶)

SI No.	Bench height (m)	Burden (m)	Row-to-row delay (ms)	Powder Factor (kg/m ³)	Power Trough Width (m)
1	10.5	3.05	90	0.79	3
2	9.14	2.74	105	1.29	6
3	11.58	3.66	150	1.61	9

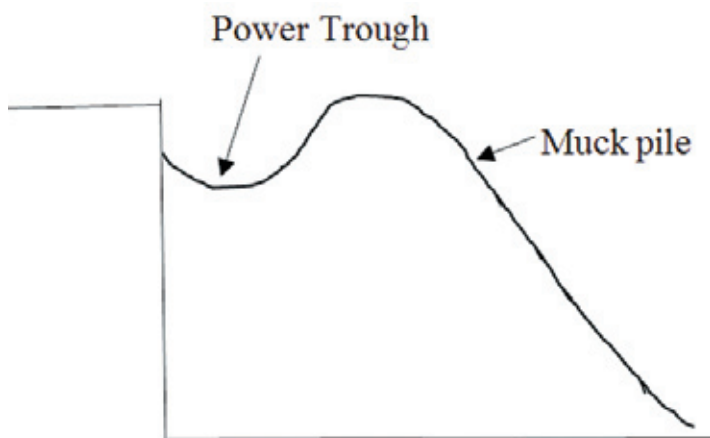


Figure- 2: Power trough. Photo: Good fragmentation with multi-row diagonal delay firing (Internet)

5.5 Ascertaining 'burden response' for fast and accurate optimization in blasting

The 'art of blasting' uses empirical formulae, a common sense approach to blasting and relies on experience of the blasting crew. On the other hand, the 'science of blasting' studies, measures and analyzes the dynamics of

explosive-rock-blast design interactions using sophisticated instrumentation during the three stages viz 'pre-blast', 'in-blast' and 'post-blast' (Sarathy¹³). High-speed videography is a powerful diagnostic tool used in analyzing blast events both qualitatively and quantitatively during the in-blast stage. The golden rule in a blast optimization programme is 'change

one parameter at a time'. With many field variables and many blast design inputs requiring to be tried, blast optimization through the commonly adopted 'trial and error' method would be highly time consuming and will not be practical in large opencast mines designed for high production capacities and consuming 150-200 metric tonnes or more of explosives in a single blast and loaded in 6-10 rows of drill holes. This has led to the understanding that there is no universal blast design and designs have to be both site-specific and explosive-specific. This is explained by Chiappetta² and an extract is reproduced below:

quote...For many operations today, blasting is where it all begins. There is no other single unit operation within the total mining system that can affect economies more than when poor blast results are experienced. Depending on the blasting application and ultimate material use, detrimental blast results may result in oversize, excessive fines, backbreak, flyrock, irregular Muck pile, tough digging conditions, potentially damaging ground vibrations and airblast etc.

With the advent of microchip technology, fast PCs, new blast monitoring instrumentation systems and recently developed analytical techniques of analysis, the end user of explosive products can now eliminate most of the guess work involved in blast designs and explosive performance assessments.

This means that the end user can evaluate full scale blasts in any particular environment, measure explosive performance, determine optimum delay intervals, profile the highwall in terms of true burdens, measure Muck pile profiles and volumes, estimate the percent Muck pile swell, simulate ground vibration results for an entire blast and generate site characteristic blast design curves...unquote.

5.5.1. Minimum Burden Response Time (t_{min})

Different types of rocks, ore, minerals and overburden respond differently when blasted using different types of explosives. 'Burden response' is a term used to define / describe the way in which the burden in front of a drill hole reacts after detonation of explosive in drill hole. After detonation which is considered as zero time, changes can be observed in the bench face after a certain lapse of time (time to initial movement). Change observed is the onset of frontal movement from the bench face after initiation, the minimum time before movement begins and this is denoted as t_{min} . Figure -3 gives details of observations made which are self-explanatory. T_{min} depends on: (a) Rock / ore type - hard / soft, fine grained / coarse grained, high density / low density (b) Explosive type - ANFO, Heavy ANFO, Watergel-Slurry

or Emulsion (c) Burden distance and drill hole diameter - larger drill holes / higher burden (d) Sonic/longitudinal wave velocity. The minimum response time can be decreased by reducing the burden distance, by using higher energy explosive or a combination of both (Chiappetta²).

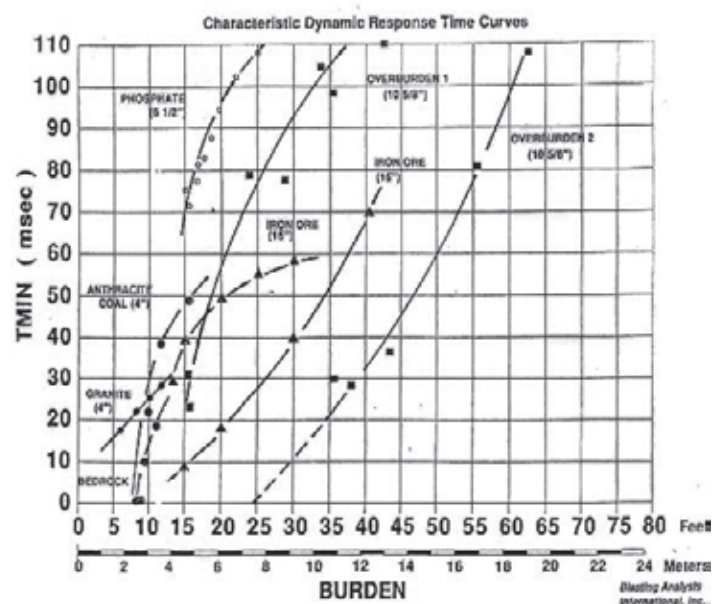


Figure-3: Burden response curves

6. REFERENCES

1. Armstrong. L.W. Moxon, N.T & Sen. G.C. 1993 - The effects of confinement on fragmentation and movement. Proceedings of the 9th Annual symposium on Explosives and Blasting Research, International Society of Explosives Engineers, USA.
2. Chiappetta. R.F - Generating site specific blast designs using state-of-the-art blast monitoring instrumentation and PC based analytical techniques. Proceedings ISEE 1991.
3. Choudhary. B.S - Effect of blast induced rock fragmentation and Muck pile angle on excavator performance in surface mines. Mining of Mineral Deposits, Volume 13, 2019.
4. Choudhary. B.S - Personal communication. May-June 2020
5. Couceiro. P and Santos. B - Influence of blasting energy factor on the loading performance. IJERT Volume 8, Issue 12, 2019.
6. Cunningham. C.V.B - The Kuz-Ram model – 20 years on. Proceedings EFEE Brighton Conference. 2005.
7. Doktan. M - Impact of blast fragmentation on truck shovel fleet performance. 17th International mining congress and exhibition of Turkey (IMCET) 2001.
8. Hanspal. S, Scoble. M and Lizotte. Y - Anatomy of a blast Muck pile: Influence on loading machine performance. Proceedings of the 21st Annual conference on Explosives and blasting, International Society of Explosives Engineers, Nashville, USA. 1995.
9. Jethro. M.A, Shehu. S.A and Kayode. T.S - Effect of fragmentation on loading at Obajana Cement Co Plc, Nigeria. IJSER Volume 7, Issue 4, April 2016.
10. LeJuge. G.E and Cox. N - The impact of explosive performance on quarry fragmentation. EXPLOR'95 Conference, AIMM and ISEE, Brisbane, Australia 1995.

OBITUARY



Shri N. S. Bohra
(17.11.1942 -16.11.2020)

Shri Niranjn Swaroop Bohra (L. M. No.-1509/Jodhpur) was born on 17.11.1942 at Jodhpur. His early education was from renowned Jodhpur Govt. School and graduation in Mining Engineering in the

year 1964 from M. B. M. Engineering College, Jai Narayan Vyas University, Jodhpur. After obtaining degree in Mining Engineering, he joined Directorate of Mines & Geology, Govt. of Rajasthan in November 1970 and retired as Director of DMG in October 2000. Thereafter he worked as Advisor to Ministry of Mines, Govt. of India from October 2000 to June 2003. He also served as Advisor to Hindustan Zinc Ltd. from October 2003 to April 2005. He maintained cordial relationship with the mining fraternity and actively indulges himself with the activities of every religious and social work apart from Mining Engineers' Association of India.

He became founder member of MEAI, Rajasthan Chapter-Udaipur and was actively involved in the activities of Rajasthan Chapter-Jodhpur. He was a strong believer of "Work is Worship; An Idle Mind is Devil's Workshop". Unfortunately, Mr. N. S. Bohra is not amongst us today but the society here will remain indebted to him. The members of the Association express their heartfelt condolences to the family of Mr. Bohra and pray for his soul rest in peace.

11. Manyele. S.V - Investigation of excavator performance factors in an open pit mine using loading cycle time. Engineering - 9, 2017.
12. Mirabedi. S.M.M, Khodaiari. A, Jafari. A and Yavari. M - The effect of important fragmented rock properties on the penetration rate of loader bucket. Geotech Geological Engineering-36, 2018.
13. Sarathy. M.O - Recent advances in surface blast monitoring and evaluation techniques: a review. IM&EJ Special Issue on IDL Chemicals Ltd. March 1994.
14. Sharma, Suresh and Rai, Piyush - Evaluation of use of crushed aggregate as stemming in bench blasting: a case study. Geotechnical and Geological Engineering, July 2015
15. Singh. S.P and Narendrula. R - Factors affecting the productivity of loaders in surface mines. International Journal of Mining, Reclamation and Environment. Vol 20 Vol.1 March 2006.
16. Singh. S.P and Van Doorselaere. D - The relationship between blasting parameters and Muck pile configuration. Proceedings Fragblast 11, Sydney Australia 2015.

OBITUARY



Shri G S Purohit
(05.08.1941 – 18.11.2020)

Born on 5th August 1941, Shri Purohit (LM/1246) graduated in Mining Engineering in 1965 from MBM Engineering College, University of Jodhpur. He held First class Mine Managers' Certificate of

Competency and was Fellow of Institute of Engineers. He had extensive training in IIM Ahmedabad, Calcutta and Bangalore as well as in other management Institutions of the Country and Abroad.

Shri Purohit was amongst senior MEAI members and was Chairman of Bailadila and Bellary-Hospet Chapters for many consecutive terms as well as council member of the Association.

He worked as head of Bailadila, Donimalai and Panna Projects of NMDC before his superannuation as Executive Director in 2001. Thereafter, Essar Group picked him up as their Senior Advisor for their Mining Business. He continued there for 6 years and created a full-fledged Mining Division in the company with Investigation and Geophysical prospecting facilities. He visited Many European Countries, Australia, Chile, Angola, Indonesia, Brazil, Iran etc and visited World Famous Iron ore Mines in these countries.

He took active part in the formation of the Rajasthan Chapter-Jaipur and remained active till the end. Shri Purohit breathed his last on 18th November 2020 after a brief illness and is survived by wife, a son and a daughter and full family. The members of the Association extend their heartfelt condolences to his bereaved family and pray for his soul rest in peace.

17. Swanepoel. W - The influence of bench height and equipment selection on effective mineral resource utilization. Thesis, Master of Engineering, University of Pretoria. 2003
18. Thornton. D M - Application of electronic monitors to understand blast movement dynamics and improve blast designs. Proceedings Fragblast, Granada, Spain, 2009.
19. Worsey, Paul - Experimental data indicating a direct link between rate of stemming ejection and the degree of rock face movement. Research Proceedings 16th ISEE Annual conference, Florida, USA. 1990.

POTENTIAL FOR HYDROCARBON EXPLORATION IN JHURAN FORMATION OF KACHCHH MAINLAND, GUJARAT, WESTERN INDIA

Dhirendra Kumar Pandey^{1*}, Ravindra Chaudhary², Rajesh Singh Shekhawat², Jitendra Kumar Sharma², Suraj Bhosale³, Ketan Chaskar³

Abstract

The siliciclastic Jhuran Formation of the Kachchh Basin ranges from deltaic settings in the early Late Jurassic (Kimmeridgian) exposed in the eastern part of the Kachchh Basin to marine settings in the late Late Jurassic to Early Cretaceous (Tithonian to Berriasian) exposed in the western part of the Kachchh Basin. In the present paper the temporal and spatial distribution of the Jhuran Formation in the Kachchh Basin has been discussed. The siliciclastic sediments along with subordinately black carbonaceous shales of the Jhuran Formation have been considered as a potential for the hydrocarbon reserve.

Keywords *Kimmeridgian to Berriasian, Jhuran Formation, Kachchh Basin.*

Introduction

Kachchh is a pericratonic sedimentary basin, located at the north-western margin of the Indian Craton (Fig. 1). The basin is significant from the point of view of its position of its formation along the southern margin of the Tethys sea during the Jurassic period.

The Jurassic sedimentary succession of the Kachchh Basin is extraordinarily rich in well preserved and diverse fossils. Because of its richness of fossils, the basin attracted palaeontologists and stratigraphers from all over the world for more than a century. Numerous of reports dealing with fossils, stratigraphy, depositional environment, tectonic framework and natural resources of the basin have been published (see Fürsich et al. 2013, 2020).

The lithostratigraphic scheme of the Jurassic rocks of the Kachchh Basin has been revised from time to time, in view of temporal and spatial distribution of diversity of sediments and fossils. The most recent classification of the Jurassic litho-stratigraphic units is reproduced here for a ready reference (Fig. 2).

Stratigraphy of Jhuran Formation

The formation name was proposed by Biswas (1980) grouping sediments of Kimmeridgian, Tithonian and Berriasian age (Table 1), although when he proposed the formation the upper age limit was not clear to him. Later workers, such as GSI (2017), Pandey et al. (2016) and Fürsich et al. (2020) investigated lower and upper age limit of the formation. The Kimmeridgian sediments were grouped into Katrol Group/Formation in the previously proposed fourfold stratigraphic

classification of Wagen (1873-'75), whereas, the Tithonian to Berriasian sediments were earlier grouped into Umia Group/Umia Formation by Spath (1933) and Fürsich & Pandey (2003).

The former Katrol Formation (mostly representing all three members of Biswas (1980) in the eastern part of the basin) is quite different from the former Umia Formation, which consists of highly asymmetric coarsening-fining-upward sequences, which display concentrations of trigonitids in some beds and correspond to transgressive-regressive cycles (Fürsich & Pandey 2003, Shome and Bardhan 2009). In the eastern part, there are some ammonite horizons in the Katrol Formation (Waagen 1873-75, Spath 1927-'33, Pandey et al. 2013) documenting Kimmeridgian age, whereas in the western part ammonites recorded by earlier workers represent a Tithonian to Berriasian age.

The Jhuran Formation predominantly consists of siliciclastic sediments ranging from siltstone to fine-, medium- and coarse-grained sandstones with subordinate shales or carbonaceous shales in the eastern part of the basin. It is divided into three members. The lower member consists of alternating sandstones and shale beds with late Early Kimmeridgian ammonites, abundant belemnite-bearing sandstone at the top. This member is only exposed along the Jhuran river-section near the village Jawahar Nagar in the eastern part of the basin. In the earlier fourfold classification of the Jhuran Formation of Biswas (1980) and also in the fourfold classification of the Jurassic rocks of the Kachchh Basin by Waagen (1873-'75) and following workers such as Spath (1927-'33), etc. it was designated as "Belemnite

¹Department of Geology, School of Earth, Biological and Environmental Science, Central University of South Bihar SH 7, Gaya-Panchanpur Road, Village Karhara, Post Fatehpur, Gaya 824236 (Bihar), India; e-mail: dhirendrap@cusb.ac.in, dhirendrap@hotmail.com; ²Department of Geology, University of Rajasthan, Jaipur 302004, India; ³Department of Earth and Environmental Science, KSKV Kachchh University, Bhuj, Kachchh, 370001, India; *corresponding author

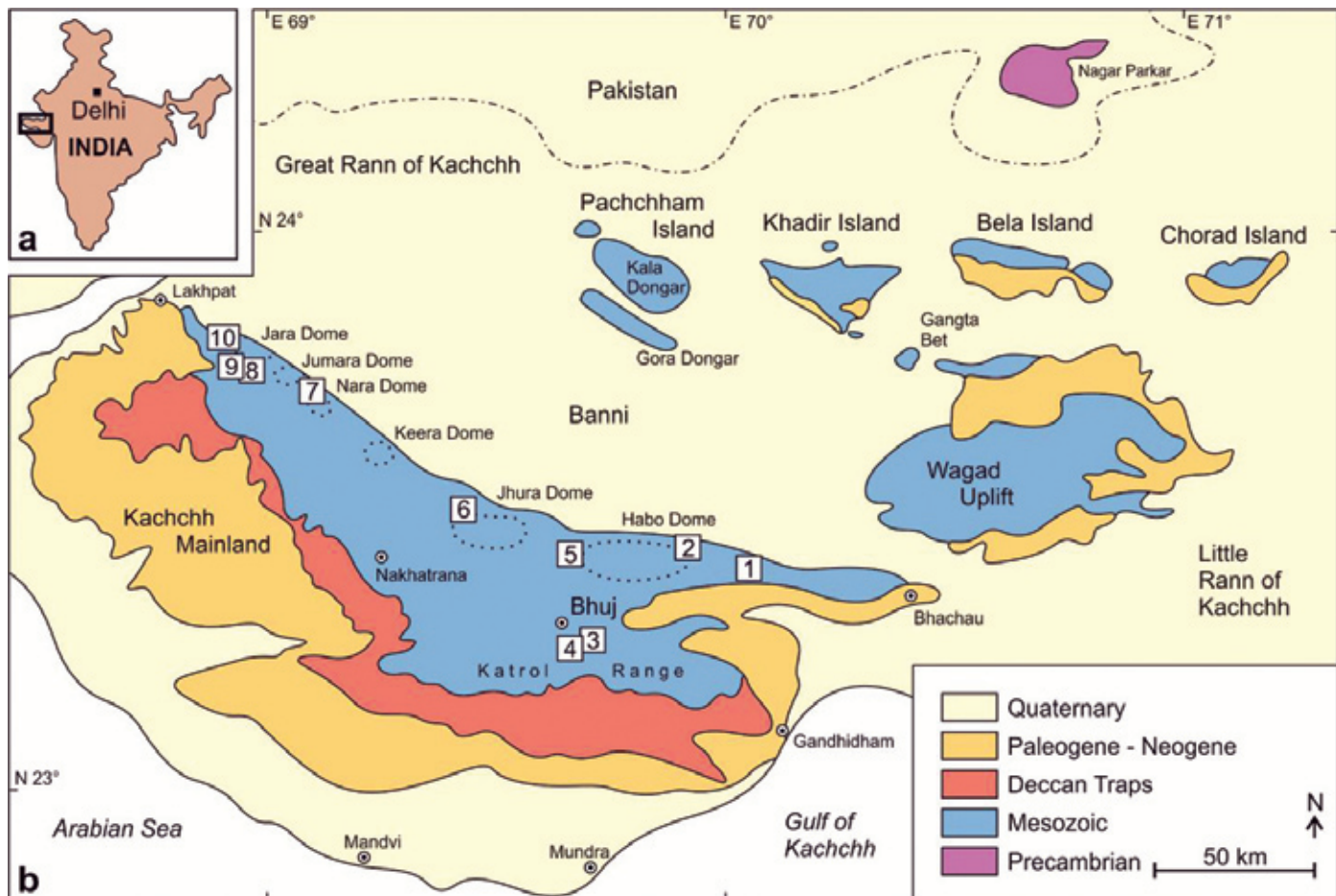


Fig.1 Geological map of the Kachchh Basin showing localities of the sections of the Jhuran Formation (Kimmeridgian to Berriasian);

1. Jhuran Nihmari Nadi section (N23°21'14.15", E69°59'20.87" and N23°21'33.21", E 69°59'20.87")
2. Lodai Dam section across Kas Hill (N23°22'48.70", E69°54'38.12")
3. Ler section (N23°11'38.6", E69°45'48.97")
4. Gangeshwar Dome section (N23°11'04.6" E69°43'34.9")
5. Rudramata section (Habo Dome)
6. Nirona Dam section (N23°26'36.91", E69°29'13.10") (Jhura Dome)
7. Nara Dome section (Churail Nadi section N23°39'54.29", E69°06'28.99")
8. Jaramara Hill section (N23°42'11.92", E69°0'42.10"),
9. North-western flank section (N23°43'29.30", E68°59'23.36") of Jara Dome
10. northern section of Mundhan anticline (N23°46'07.85", E68°55'30.04")

Marl" (Lower member of the Katrol Formation), although marl is barely exposed, instead the top of the member is characterised by calcareous coarse grained sandstone with abundant belemnites. The Middle member is exposed both in the eastern and in the western part of the basin along east-west transect, i.e. along Jhuran river section (compare Fürsich et al. 2020, see figs. 72, 74 - 76) in the east to Habo Dome, Jhura Dome, Jumara Dome, Nara Dome, Jaramara Hill to Jara Dome (compare Fürsich et al. 2020, see figs. 77 – 80) in the west. The lower and middle part of the member is characterised by carbonaceous shales, shaly siltstone and fine-grained sandstones with plant hash/debris, iron concretions, sedimentary dykes, seismites, convolute beddings, etc. The evidence of syn-sedimentary

tectonic activities in the member are a persistent character throughout the basin, however, this part of the member in the east contains abundant Kimmeridgian ammonites. The upper part of the Middle member in the east is characterised by cross-bedded medium sandstones with rare fossils, whereas, the top of the Middle member in the western part of the basin (i.e. at Mundhan anticline and Lakhapar sections) dominantly consisting of "Green Ammonites Beds" (GAB) (=Umia Ammonite beds): glauconites, *Megacucullaea* and late Tithonian-Berriasian ammonite-bearing beds. In the earlier fourfold classification of Waagen (1873-'75), it was assigned to Umia Formation. The Upper member of the formation, in the eastern part, is cross-bedded medium to coarse grained sandstones with rare Tithonian ammonites,

whereas in the western part it is dominantly calcareous cross-bedded, coarse grained sandstone with several shell beds or shells lenses. In the fourfold classification it was designated as Trigoniid beds* (*Trigonia* Ridge Sandstone), exposed at Mundhan anticline, Lakhapar section of the Jara Dome and some other nearby localities in the western part of the basin. These trigoniid beds are confined to the western part of the basin, previously were grouped as Umia Formation. In the western part, the ammonites of the Upper member suggest an Early Cretaceous age (Krishna 1991, Krishna et al. 1994) (Table 1).

The age of the members at different localities along an east-west transect differs as is evident from the ammonites. The spatial distribution of the Kimmeridgian sedimentary facies predominately shows prograding delta (Desai and Biswas 2018). Whereas that of Tithonian and Berriasian sediments, particularly in the western part of the basin, show marine transgressive-regressive cycles (Fürsich and Pandey 2003) (Fig. 3).

In the eastern part the succession of the Jhuran Formation has yielded *Planolites*, crustacean burrows *Thalassinoides*, *Gyrochorte*, *Ophiomorpha*, *Skolithos*, *Diplocraterion* and *Rhizocorallium*. In the western part, the trace fossils recorded also includes *Thalassinoides* but in two size classes (1-1.5 cm and 2.5-3 cm in diameter), fragments of *Gyrolithes* isp. and oblique to subhorizontal cylindrical burrows.

Petrographically, the oldest part in each section in the eastern part of the basin is finer grained shaly sandstone, whereas the upper parts consist predominantly of medium-grained sandstones. The terrigenous grains. i.e. predominately quartz, are moderately sorted. Some are poorly sorted. Mostly, the quartz grains are subrounded to subangular. In addition to quartz grains, muscovite and plagioclase feldspar grains are occasional. The successions exposed at Tapkeshwari temple and Katrol Hill sections shows undulose quartz grains. At few horizons polycrystalline quartz grains have also been observed in the Katrol Hill-section. Interestingly, at Jawahar Nagar-section only non-undulose quartz has been observed. Terrigenous grains are moderately to well packed with either point or floating contacts. A few are poorly packed. Cementing material is either calcareous or ferruginous.

In the western part of the basin, near the base of the Middle member investigated at Jara Dome, a bed yielding *Hildoglochiceras*, consists at the base coarse-grained micritic sandstone and the upper part consisting of marl with abundant scattered fine to coarse quartz grains. In addition to quartz, grains, subordinately, rounded rock fragments of sandstones and metamorphites have been recorded. The bioclasts include bivalves and echinoderm fragments.

Petrographically, the rock is a sandy bio-wacke- to floatstone (Fürsich et al. in press)

The top of the Middle member, studied at Lakhapar section, Katesar section and at Mundhan anticline is represented by the Green Ammonite Beds. These beds are rich in Tithonian ammonites and *Gryphaea*. They are characterized by coarse-grained sandstones with scattered quartz granules, ferruginous mudrock matrix, bioclasts and ferruginous ooids. The quartz grains are subrounded to rounded. The microfacies ranges from matrix- to grain-supported (Fürsich et al. in press).

Discussions

Sahani et al. (2018) investigated a total of 45 fresh shale samples from Jhuran Shale (Jhuran Formation) and provided the values TOC, HI, OI, S2 and Tmax. They also measured Vitrinite Reflectance. The study enabled them to understand the availability, maturity and hydrocarbon potential of organic matter within the Shale sequence of the Jhuran Formation. Simultaneously, Srivastava et al. (2018) concluded that organic carbon in the black shales from the Jhuran Formation indicates low concentration. Further, it consists of type IV organic carbon, i.e. without any potential to generate hydrocarbon.

In contrast, Oil and Natural Gas Corporation Ltd (ONGC) is planning production from the Kachchh Basin by 2020 (<https://ihsmarkit.com/research-analysis/the-kutch-basin-history-and-progression-into-indias-eighth-producing-basin.html>), keeping in view the geographic distribution of the Jhuran Formation from east to west in the Kachchh Basin and its further extension in the shelf area of the Arabian sea, the depositional environment from deltaic to marginal marine ranging from Kimmeridgian (Late Jurassic) Berriasian (Early Cretaceous) and the dominant mostly well sorted medium to coarse grained siliciclastic sediments along with subordinately black carbonaceous shales. Hence, in light of the description of the Jhuran Formation in the Kachchh Basin, the large geographical area, diversity in the depositional environment, well sorted siliciclastic sediments investigated in the present work further corroborate the potential for the hydrocarbon reserve, hence it must be explored for the hydrocarbon.

Acknowledgements

The authors thank Franz T. Fürsich and Mathias Alberti (Germany) for being associated in the present comprehensive project, carrying out field work for more than last 20 years, critically reviewing the present manuscript and having discussions on the subject from time to time. The authors also thank M. Thakkar and G. Chauhan (Bhuj) for logistic support. DKP is grateful to the Department of Science and Technology, new Delhi (project no. EMR/2015/001574) for

	Kachchh Mainland		Pachchham Island		Khadir, Bela & Chorad	Wagad
			Gora Dongar	Kala Dongar		
Tithonian-Berriasian	Bhuj Fm					
Kimm.	Jhuran Fm	Upper mb	(eroded)		Gamdau Fm	
		Middle mb				
		Lower mb				
Oxfordian	Dhosa Conglomerate Bed Dhosa Oolite mb				Kanthkot Fm	
Calloviaian	Jumara Formation	Dhosa Sandstone mb			Gadhada formation	
		Gypsiferous Shale mb				
		Ridge Sandstone mb				
		Shelly Shale mb				
		Keera Golden Oolite mb				
		Shelly Shale mb	Jumara Fm		Bambhanka/ Gangta mb	
Bathonian	Patcham Fm	Sponge Limestone mb	Raimalro Limestone Mb		Patcham Fm	Raimalro Limestone Mb
	Jhurio Formation	Purple Sandstone/ Echinoderm Packstone	Gadaputa Sandstone Mb		Goradongar Fm	Hadibhadang Sandstone mb
JCL mb		Goradongar Yellow Flagstone Mb				
GYF Mb		Middle Sandstone mb	LPR		Kaladongar Formation	Hadibhadang Shale mb
JGO mb		Lower Yellow Flagstone mb	Babia Cliff Sandstone mb			
CL/BLGO	Eomiodon Red Sandstone mb	Narewari Wandh mb				
Bajocian	Jhurio Formation	Badi White Limestone mb			Khadir Formation	Cheriya Bet Conglome- rate mb
Aalenian		'red beds'	Dingy Hill mb			Washtawa Formation
						UAB
						Adhoi mb
						LAB
						Fort Sand- stone mb
						Patasar Shale mb
						KAB
						Nara Shale/ Chitrod Sandstone mb
						Kharol Sandstone mb

Fig. 2. - Recent classification of the Jurassic litho-stratigraphic units (modified after Biswas 1980 and Fürsich et al. 2013, 2020)

Table 1 – Lithological description of the members Katrol (old fourfold classification) and comparable part of the Jhuran Formation. Note the age of the Trigonía Ridge Sandstone is early Cretaceous because the Cretaceous ammonites *Argentincerás longochensis* (Steuer) and *Spiticerás cf. ducale* (Matheron) were found in the uppermost bed of the GAB and thus below the Trigonía Ridge Sandstone. It corresponds to parts of the Umia Formation of earlier authors.

		KACHCHH BASIN		
		Spath 1933	Biswas 1980	Proposed status
Berriasian	Umia Fm.	Umia Ammonite beds	Katesar member: cross-bedded and bioturbated sandstones	Upper member: Trigoniid beds (Trigonia Ridge Sandstone), cross-bedded sandstones, (Mundhan anticline and Lakhapar section, Jara Dome, Jhuran River)
			Upper member: Glauconite-bearing Umia Ammonite beds (GAB) overlain by trigoniid-bearing beds (Mundhan anticline and Lakhapar sections)	
Tithonian	Umia Fm.	Gadjinsir beds and Zamia Shales (K4) Hard barren Sandstone	Middle member (=Rudramata shale): fine-grain sandstones and siltstones with several erosional surfaces	Lower member: alternating sandstones and shale beds with thin bands of fossiliferous, pebbly calcareous sandstone. Abundant belemnite-bearing calcareous sandstone at the top
		(K3) Upper: shales		
		(K2) Middle: sandstones Basal Katrol 'Ammonite bed'		
		(K1) Lower: shales, Belemnite Marls at Jhuran (Nihwara Nadi section)		
Kimmeridgian	Katrol Formation			

Tithonian-Berriasian] ↔ [Early to Late Kimmeridgian

Marine transgressive / Regressive cycles

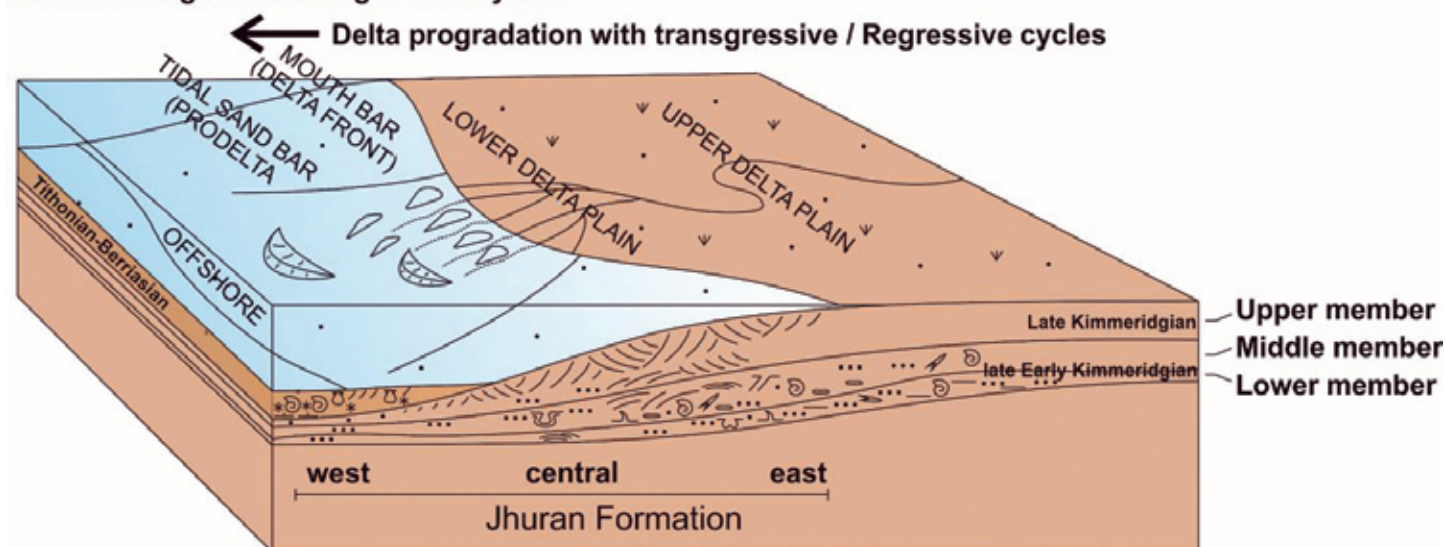


Fig. 3 – Schematic diagram showing depositional environment of the Jhuran Formation

the financial support. We also thank the reviewers for their constructive comments.

References

Biswas SK (1980) Mesozoic stratigraphy of Kutch, Gujarat. Quart J Geol Miner Metallurg Soc India 49:1–42 (for 1977)

Biswas SK (2016) Mesozoic and Tertiary stratigraphy of Kutch (Kachchh) – a review. Geol Soc India Spec Publ No 6:1–24

Desai BG, Biswas SK (2018) Post-rift deltaic sedimentation in western Kachchh Basin: insights from ichnology and sedimentology. Palaeogeogr Palaeoclimatol Palaeoecol 50:104–124

Fürsich FT, Alberti M, Pandey DK (2013) Stratigraphy and palaeoenvironments of Jurassic rocks of Kachchh. Field Guide. Beringeria, Spec Issue 7:3–174

Fürsich FT, Pandey DK (2003) Sequence stratigraphic significance of sedimentary cycles and shell concentrations in the Upper Jurassic-Lower Cretaceous of Kachchh, western India. Palaeogeogr Palaeoclimatol Palaeoecol 19:285–309

Fürsich FT, Pandey DK, Alberti M, Mukherjee D, Chauhan G (2020) Stratigraphic architecture and palaeoenvironments in the Kachchh rift basin during the Jurassic. 36th International Geological Congress, Field Trip Guide WR010, p 143

Geological Survey of India. 2017. Geology and Mineral Resources of Gujarat, Daman and Diu. Miscellaneous Publication No.30, Part14, 85p.

Krishna J (1991) Discovery of Lower Berriasian (Lower Cretaceous) ammonoid genus *Argentinceras* from Kachchh (India) and its relevance to Jurassic–Cretaceous boundary. Newsl Stratigr 23:141–150

Krishna J, Pathak DB, Pandey B (1994) New ammonoid evidence for the Jurassic/Cretaceous boundary in Kachchh western India, and long-distance correlation with southern Europe. Geobios, Mém special 17:327–335

Pandey DK, Alberti M, Fürsich FT, Bhaumik S, Ayoub-Hannaa W. 2016. A review of the Tithonian ammonites from the Kachchh Basin, western India. J Palaeont Soc India 61:141–173

Pandey, D.K., Alberti, M. & Fürsich, F.T., Główniak, Ewa, and Olóriz, Federico. 2013. Ammonites from the Oxfordian-Kimmeridgian boundary and the Lower-Upper Kimmeridgian of Kachchh, western India. – Volumina Jurassica XI: 97–146

Sahani Harsh Kumar, Singh Ajendra, Pharate Neela, Pandey Mithil, Pahari Sukumar, Desai Bhawanisingh G. 2018. Characterization of Organic Potential of Jhuran Shale Formation of Kutch Basin, GeolIndia 2918, Paper ID ST497.

Shome, S. & Bardhan, S. 2009. A new Late Tithonian ammonite assemblage from Kutch, western India. – Journal of the Palaeontological Society of India 54: 1–18.

Spath, L.R. 1927-1933. Revision of the Jurassic cephalopod fauna of Kachchh (Cutch). – Memoirs of the Geological Survey of India, Palaeontologia Indica, New Series 9(2): 1–945.

Srivastava, Hema, Bhaumik, Ajoy K, Tiwari, Devleena, Mohanty, Sarada P and Patil, Dattatray J. 2018. Characterization of organic carbon in black shales of the Kachchh basin, Gujarat, India - *J. Earth Syst. Sci.* 127: 93, <https://doi.org/10.1007/s12040-018-1002-8>

Waagen, W. 1873-1875. Jurassic fauna of Cutch. The Cephalopoda. – Memoirs of the Geological Survey of India, Palaeontologia Indica, Series 9, 1(1-4): 1–247.



Mines Ministry to Facilitate Higher Rating for all Mines Across India

..... Mines Secretary.

Looking for the coveted **5 STAR rating** for the mining operations?

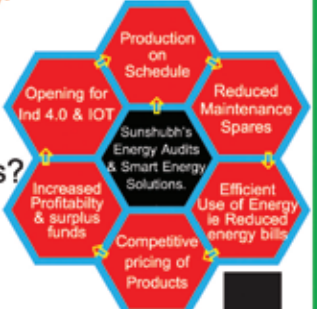
We assist you get 5+.

Benefits:

- Optimised cost of mining.
- Safety checks.
- Reduced fuel consumption...
- Move towards ISO 50001

Environment:

- Reduced dust cloud.
- Rainwater management.
- Lowest Carbon Footprint.



Star Rating of Mines



SUNSHUBH
SMART ENERGY SOLUTIONS

Mallikarjun A Kambalyal.
SUNSHUBH RENEWABLES & RESEARCH CENTRE.


India off:120-2, LGF, A-Wing, IT Park, Hubli - 580029, Karnataka.
Germany Off: 166, Neuer Weg, 47803, Krefeld, Dusseldorf.

Registration:
India: BEE: Certified Energy Auditor -EA 3485
Germany : BAFA: Anbieter Nr - 1041388
Global: ISO 50001, ISO 14001 LA

email: ceo@sunshubhrenewables.com, mallu.energy@gmail.com
visit: www.sunshubhrenewables.com Ph: +91 94490 33505, 94492 83505

Our Clientele








MEAI NEWS

MEAI HEADQUARTERS AND HYDERABAD CHAPTER

Indian Mining Day 2020

On the occasion of Indian Mining Day being observed every year on 1st November, MEAI Headquarters and Hyderabad Chapter jointly organized Indian Mining Day celebrations. The theme for this year was 'Net Zero Mining'. A Webinar was also organized on this occasion.

Shri B.R.V. Susheel Kumar, Chairman, Hyderabad Chapter delivered welcome address. In his welcome address, he emphasized that as per Paris Agreement the emission rates in the Mining Industry shall conform to the norms and all the efforts should be made for adhering to the norms.

Shri Sanjay Kumar Pattnaik, President, Mining Engineers' Association of India addressed the participants. In his Presidential address, he read out the **PLEDGE** that was recited by all the participants. The Pledge as follows:

We the Members of the
Mining Engineers' Association of India
Salute Our National Flag and Pledge,
To observe 1st November of every year as
'Indian Mining Day'.
Further it will be our endeavor to uphold and follow,
With all Sincerity, Honesty and Integrity,
The Best Scientific Methods & Practices
To PROSPECT, PRODUCE, and PRESERVE
The MINERAL RESOURCES
For the PROBITY & PROSPERITY of our Nation

He told that the theme for Indian Mining Day for this year is 'Net Zero Mining' which means it is not only limited to the emission of gases but to the overall activity of the mining by which the nature is being disturbed. He added that the disturbance caused due to Mining activity to the flora and fauna and also on the nearby villages should be brought to zero by taking appropriate measures by the Mining Industry. Mining Industry has to make a lot of publicity regarding the good work apart from doing mining.

On this occasion, Shri Sumit Deb, Chairman and Managing Director, NMDC was the Chief Guest, Shri Malay Tikadar, Deputy Director General, (DGMS) and Shri S. Chandrasekhar, Director (Operations), The Singareni Collieries Company Limited, were the Guests of Honour.

Shri Sumit Deb, Chief Guest in his speech stressed that action taken by National Mineral Development Corporation adheres to the Net Zero Mining principles. He stated that NMDC has developed lot of green cover on waste

dumps and adhering to the norms of the law by providing appropriate measures for reduction of dust produced in the Mining area in surrounding areas of the NMDC mines. He also added that NMDC has demarcated a separate fund for innovation through start-up activities to develop through IIT, Hyderabad.

Shri Malay Tikadar, Guest of Honour stated that due to green gas effect lot of damage is being done to the nature which is indirectly being reflected in the form of unknown diseases spread across the world. So more emphasis has to be given first to protect the nature as it is. If that is not possible actions are to be taken to nullify the damage caused by mining.

Shri S. Chandrasekhar, Guest of Honour in his address stated that The Singareni Collieries Company Limited making lot of efforts for redressal of the damage caused due to mining. He stated that as a principle, The Singareni Collieries Company Limited is doing lot of plantation works on waste dumps and in non-mining areas, which are not being utilized for any purpose. This action was initiated 15 years back and now these areas are full-fledged forest. He also stated that latest technology is being adopted for minimizing the damage caused due to mining activity. By introducing new technology and training their work force, M/s. SCCL also started 10 MW Solar Power Plant, as a measure towards elimination of GCH.

Shri V.S. Rao, Shri Fasihuddin, Shri T.V. Chowdary, Dr. V.D. Rajagopal, the Past Presidents of MEAI, Shri D.N. Prasad, Adviser (Mining), M/s. SCCL & Former Adviser and JS;MoC; Gol, Dr. N.K. Nanda, Former Director Technical, NMDC, Shri K.J. Amarnath, Former GM, M/s. SCCL also addressed the gathering about Net Zero Mining.

Meeting ended with vote of thanks from Dr. C. Narsimulu, Secretary, Hyderabad Chapter.

BAILADILA CHAPTER

Bailadila Chapter celebrated Indian Mining Day 2020. One presentation on **Net Zero Mining** was made by Shri Pawan Kumar and another presentation on **Bailadila Sector a step towards Net Zero Mining** was made by Shri Ignatius Minj. The Chapter also organized Competition of Posters and Slogans Competitions on Net Zero Mining. Shri A.K. Prajapati, Chairman and Shri R. Govindarajan - Vice Chairman of the Chapter addressed the participants. Shri S.S. Prasad, Secretary of Chapter delivered vote of thanks.

BANGALORE CHAPTER

Indian Mining Day 2020

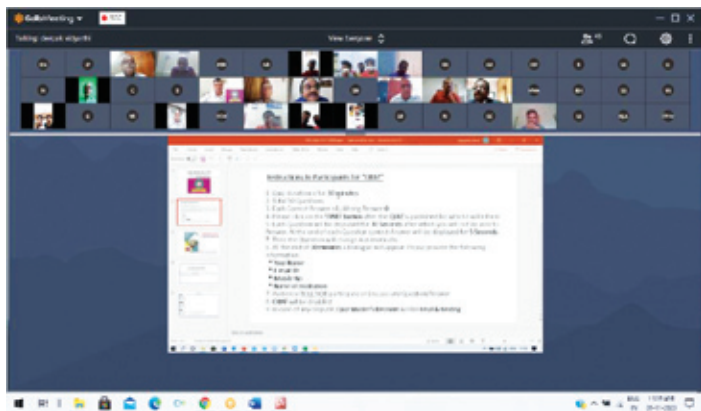
The Indian Mining Day was celebrated on 1st November,

2020 in virtual mode using GoToMeeting platform. More than 40 members including Industry professionals and mining engineering faculty and students from Government School of Mines (SoM), KGF, Dr. T. Thimmaiah Institute of Technology (Dr. TTIT), KGF, Acharya Polytechnic (AP), Bengaluru and National Institute of Technology, Karnataka (NITK), Surathkal participated in the event. Mr. Dhananjaya G. Reddy, Chairman of the Chapter extended a warm welcome to the guests, senior members, life members of the Chapter and participants on the occasion of the Indian Mining Day and the Karnataka Rajyothswa Day. He made special mention about the efforts being made by mining companies to achieve 'Zero Emission' to meet the Global commitment to control the Global warming. He administered the Mining Day Pledge. The mining day events included essay writing, quiz and debate competitions for engineering students and invited talks on the theme of the Mining Day

Competitions

Quiz: The quiz competition was organised online by Mr. Deepak Vidyarthi, and Mr. Sabyasachi Nayak, Executive Members of the Chapter on the subjects related to '**Mining**'. The Quiz included 50 multiple-choice questions, answered through a web application. Ms. Nishath Fatima of Dr TTIT, Mr. Anil of SoM and Mr. Inzamam of AP won the first, second and third prizes, respectively.

Debate: Elocution competition was organised on the theme of Mining Day - **Net Zero Mining**. Two students each from the four institutions have registered for the debate. Each student was given four minutes time to present on the theme. However, due to network issues, only two students could participate in the event. Executive body members Mr. V. Nagaraj and Mr. Cyriac Joseph acted as the judges of the competition. Mr. Yash Kumar of Dr.TTIT bagged the first prize for his excellent presentation. Ms. Nishath Fatima of Dr.TTIT was awarded the second prize.



Essay writing: Essay competition on the theme of the Mining Day – **Net Zero Mining** was organised during October in SoM, KGF, Dr.TTIT, KGF, AP, Bengaluru and NITK, Surathkal. In all

15 students participated. The essays were evaluated by Mr. Cyriac Joseph, Mr. Deepak Vidyarthi, Executive Committee members and Mr. K. Ramani, Treasurer, Bangalore Chapter. Mr. Yash Kumar of Dr TTIT, Ms. Prerana Singh of NITK and Mr. M. Dinesh of SoM, KGF, won the first, second and third prizes, respectively.

Mr. Deepak Vidyarthi, who organised the events, announced the list of prizewinners. The prizes include certificate of merit and cash award of ₹3000, ₹2000 & ₹1000 for the 1st, 2nd & 3rd prizes respectively for each event.

Technical Presentations

Dr. Meda Venkataiah, Former President, MEAI and Executive Director, MSPL delivered the keynote address on the theme of the Mining Day. He made an elaborate presentation covering various aspects of mining industry, its effect on ecology, conservation of minerals and water, use of lower grade ores, reduction of emission by adopting conveyer systems, use of non-conventional energy, mass plantation, recycling, etc. He also pointed out that though the government has been implementing various regulations, still there are deviations in adoption. He pointed out that it is important for the Mining Industry be seen not only as lever for National Economic Growth but also as making a meaningful contribution to Socio-economic wellbeing of local communities. He also stressed on the need for research and development as well as structured long-term plan to reach the goal of Net Zero Mining.

Mr. Muralidhar Bidari, Director of Mines Safety, Bengaluru Region, DGMS, who was the Guest of Honour, in his address highlighted the recent legislative changes wherein 44 labour laws have been subsumed in four codes – Wages, Industrial Relations, Social Security, and Safety, Health and Working Conditions. He has also mentioned about the Digital India programme, Unified Shram Suvidha Portal, and reduction of 24 different records into five easy forms for online submission. He added that stress is given to the women empowerment in the mining industry.

Mr. K.S. Raju, former Controller General, Indian Bureau of Mines, who graced the occasion as Chief Guest, traced the 'Net Zero' concept to the Paris Conference on Climate Change held in 2015, in which 175 countries participated. An increase of 0.9°C during the period from 1880 to 2012 due to emission of Green House Gases (GHG) caused by industrialisation and combustion of fossil fuels resulting in release of CO₂. An increase by about 4° to 5° is expected if left unchecked and it was emphasised that the rise of temperature should be controlled within 1.5°. He also pointed out that the Mining Industry also contributes CO₂ in various activities and stressed the need for growing vegetation in the mining areas, conservation of water and other measures

to achieve the Net Zero in Mining Industry and this will help in meeting the India's commitment to achieve the targeted emission level by 2050.

The event concluded with vote of thanks proposed by Mr. N. Rajendran, Secretary of the Chapter.

BELGAUM CHAPTER

Report on Virtual Seminar

The virtual seminar was organized on the eve of Indian Mining Day Celebrations held on 1st November 2020, by Belgaum Chapter, in association with the MoU institutes Department of Geology, GSS College, Belagavi and SG Balekundri Institute of Technology. At the outset, Dr P.T. Hanamgond, Secretary welcomed all the participants and wished them on Indian Mining Day. He also asked everyone to read after him the Oath provided by MEAI headquarters.

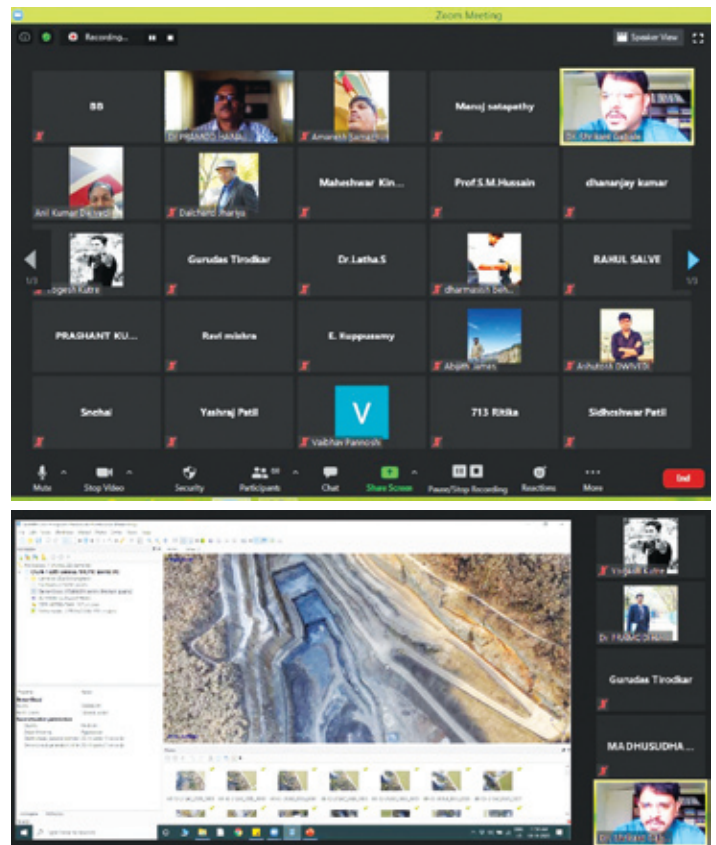
Shri Sagar Waghmare introduced the guest speaker. Dr. Sainath Aher, Asst Professor, Sangamner College, Sangamner was the resource person. He highlighted the importance and use of Remote Sensing, Geographical Information System and Global Positioning System in Mining and mapping. He highlighted how these modern technologies are used in geology and mining, giving examples of various mines from India and abroad. Over 45 Participants from various parts of India including MEAI members, professionals and students participated in this seminar. Shri Yogesh Kutre, proposed the vote of thanks.



Virtual Seminar on OCTOBER 18, 2020

Another virtual seminar was organized on 18th October 2020 by MoU institute, Belgaum Chapter, in association with the MoU institute Department of Geology, GSS College, Belagavi.

Dr. Shrikant Gabale, Director–Unity Geospatial LLP, Pune was the resource person. He highlighted the importance of Drone survey in Mining, types of drones used, specifications, permissions required, cost of equipment etc. He highlighted how drone survey is used for mining industry, giving an example of a mine and using over 270 photographs captured by drone and using the software how 3D images are prepared and used for mine management towards safety, production, mitigation of hazards etc. Over 63 Participants from various parts of India including MEAI members, professionals and students participated in this seminar.



BELLARY-HOPSET CHAPTER

INDIAN MINING DAY & KANNADA RAJYOTSAVA CELEBRATIONS

Bellary-Hospet Chapter in association of TMAES Polytechnic celebrated INDIAN MINING DAY & KANNADA RAJYOTSAVA on 1st November, 2020 in the premises of TMAES polytechnic, Hosapete. Owing to restrictions imposed by Covid-19 Pandemic only 20 persons were present for the celebrations and for the convenience of all other life members & students

a live telecast of the event was made available on Zoom App at 11 a.m on 1st Nov, 2020.

The event was chaired by Sri. K. Madhuudhana-Vice-President-I, MEAI & V.P. (Mines), M/s MSPL Ltd., Sri. K. Prabhakara Reddy, Chairman of the Chapter & CEO, SUMS, Hosapete and Sri. S.H.M Mallikarjuna, Secretary of the Chapter & AGM, M/s JSW Ltd., Sandur along with Sri. H.K. Shankarnanda, HOD-E&C Dept., TMAES Polytechnic, Hosapete.

The celebrations started with watering of plants by Sri. K. Madhuudhana, Sri. K. Prabhakara Reddy, Sri. S.H.M Mallikarjuna, Sri. H.K. Shankarnanda, HOD-E&C Dept and Sri. T.L. Yoganada, HOD-Dept. of Mining & Metallurgy, TMAES Polytechnic.

Sri. K. Madhusudhana briefed on the Theme of the INDIAN MINING DAY – NET ZERO MINING and wished the participants on the occasion of INDIAN MINING DAY & KANNADA RAJYOTSAVA. Sri. K. Prabhakara Reddy has given suggestions to the Mining students to take up the field of Surveying after completion of Diploma because there is scarcity of Surveyors in the of Mining Industry. He also expressed his good wishes on the occasion.

Sri.S.H.M.Mallikarjuna has presented his views on NETZERO MINING and wished on the occasion of INDIAN MINING DAY & KANNADA RAJYOTSAVA. Sri. H.K. Shankarnanda, HOD-E&C Dept., TMAES Polytechnic, Hosapete has participated in the event on behalf of Sri. T.M. Vijayakumar, the Principal of TMAES Polytechnic. He guided to the students on career development and expressed his wishes on the occasion of INDIAN MINING DAY & KANNADA RAJYOTSAVA.



Inauguration of the event

On the occasion of celebrations of INDIAN MINING DAY, Online Quiz program was conducted for the students

of TMAES polytechnic, Hosapete, Graduate Engineer Trainees and Mine Foremen working in mining Industry. Top three scorers were awarded with Prizes at the event of celebrations on 01.11.2020. Total 62 viewers logged in to see the live telecast of the celebrations.

Sri. T.L. Yoganada, proposed vote of thanks.



Chief guest with other guests

DHANBAD CHAPTER

Indian Mining Day 2020

Indian Mining Day was celebrated on 1st November 2020 in CSIR-CIMFR, Dhanbad. This event was jointly organised by CSIR-CIMFR, Dhanbad and Mining Engineers' Association of India (MEAI), Dhanbad Chapter.

On this occasion, Dr. Raj Shekhar Singh, Ex-Senior Principal Scientist, CSIR-CIMFR, Dhanbad, delivered a lecture on the selected topic 'Net-Zero Mining'. Over 100 participants have attended his lecture though MS-Team (online) and MEAI members from CSIR-CIMFR has attended the lecture at CSIR-CIMFR Committee Room.

Dr. Raj Shekhar Singh presented data highlighting the environmental impacts of mining and various measures being or to be adopted to achieve the goal of 'Net Zero Mining' for sustainable mining operations. He also illustrated various CSIR-CIMFR inventions and continuing efforts towards reducing the environmental effects and effective use of unwanted materials generated during mining operations.



Members of Dhanbad Chapter, members of CSIR-CIMFR, Dhanbad and Dr. P. K. Singh attending the lecture

On this auspicious occasion, Dr. P. K. Singh, Director, CSIR-CIMFR, and Chairman of the Chapter, also graced

this lecture. He also highlighted the need for environment-friendly and sustainable mining in India.

HYDERABAD CHAPTER

International Webinar on Innovation through Startup in Mining & Mineral Sector

At the outset, Shri M. Narsaiah, Secretary General, MEAI has delivered welcome speech and Shri Sanjay Kumar Pattnaik, President, MEAI has presented his inaugural Presidential Address. Dr. N.K. Nanda, Former Director, NMDC has made moderation in the Webinar. Shri B.R.V. Susheel Kumar, Chairman, Hyderabad Chapter has summed up the conclusions. Dr. C. Narsimulu, Secretary, Hyderabad Chapter has proposed Vote of thanks.

The Key speakers in the webinar were Mr. Sunil Vedula, CEO & Founder at Nanoprecise Sci Corp., Jorge Pedrals, President of the Mining Policy Commission of Instituto de Ingenieros de Chile, President of the Mining Policy Commission of Instituto de Ingenieros de Chile, Dr. Srikanta Mishra, currently Senior Research Leader (Energy) at Battelle Memorial Institute, Anirudh Reddy, founder of Einsite and Victor Chaves, CEO of RIO Analytics.

Sri Sunil Vedula, spoke on IoT based condition monitoring system that acts like a machine doctor. This system not only detects any anomaly in the system but also predicts mechanical faults related to imbalance, misalignment, looseness, bearing and gearbox. Furthermore, by using the fault characteristics frequency of equipment Nanoprecise's solution can predict the remaining useful life of the equipment. To achieve this goal, Nanoprecise has created a "unique" patent-pending solution (hardware + software) called RotationLF, that combines physics, material science and data analytics to diagnose issues with rotating equipment. RotationLF is now operating successfully in many processing industries in India including the Hindustan Zinc's Chanderiya Lead-Zinc Smelter.

Jorge Pedrals spoke on the issues related to the practical problems one can face while implementing the Start-up Project. He also emphasized on the impact of the Project on the nearby villages flora and fauna. While implementing the Project, these problems are to be taken into consideration.

Dr. Srikanta Mishra, spoke on developing and managing a geoscience-oriented technology portfolio related to computational modeling, risk assessment and data analytics for carbon sequestration, shale gas and oil development, and improved oil recovery projects.

Anirudh Reddy spoke on a start-up leveraging AI and IoT to track and boost productivity on construction and mining sites using real-time data from cameras and sensors that

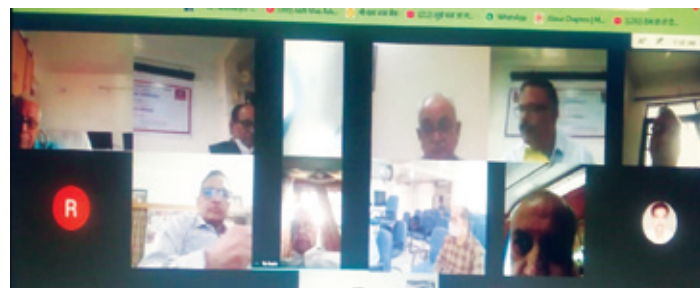
are installed on heavy-machines and plants to generate actionable insights that help CXOs, managers, and operators better run their sites.

RAJASTHAN CHAPTER- UDAIPUR

Indian Mining Day 2020

The Indian Mining Day was celebrated on 1st November, 2020 by Rajasthan Chapter-Udaipur through Google Meet App Video Conferencing during 11:00 AM to 12:00 NOON.

Shri Arun Misra, CEO, HZL communicated his message on the occasion. He congratulated all members of MEAI and wished that mining community would continue to cater to the needs of the society as was done in the past. His message was read out by Dr S K Vashisth, Council member on his behalf.



At the start of programme, Shri YC, Gupta, Chairman, of the Chapter welcomed Chief Guest Shri R P Dashora, Head Mining, HZL, Former National President MEAI Shri A K Kothari, Shri R P Gupta, speakers, all guests and participants. He further said that it looks that words **Net Zero** originated from commercial buildings. First attractive buildings were constructed to attract customers but later on, it was realized that they consume good power. On the other hand, the aim of mining is different i.e to produce mineral where cost mattered. Since the beginning all efforts we made to reduce cost on all fronts like:

- Reduction of wastage
- Reduction of Cut of grade
- Substitution of Large machines with small machines
- Substitution of Diesel operated machines with power operated machines
- Recycling of water

We belong to that culture where in all efforts are made to use any product to its logical end. For example, a worn out saree is used for various purposes. Some of the development, seen in mines of Rajasthan, during last 50 years are:

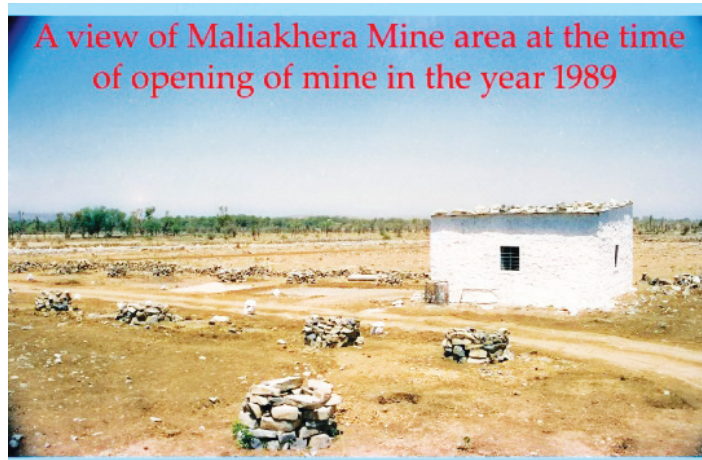
- Wall rock which was partially metamorphosed in soapstone mines was utilized in insecticides & pesticides manufacturing to be used as filler. This reduced waste generation

- 2. Large size cutting machines were substituted by small machines in stone and marble mines
- 3. Even small pieces of dimension stones were carefully transported to factories to give them shape to use them commercially

List is unending.

What is required is projection of all these efforts made by miners before the public towards the goal to achieve Net zero mining. He further suggested that all these developments are pen down and uploaded online in the similar manner of compilation of 100 innovations made in mining (which is available on line).

The first Speaker Sh R.C. Purohit, (Retd.) AVP (Mines), M/S JK Cement Ltd in his presentation introduced the subject of Net Zero mining. Then he gave details of efforts made at J K Cement Limestone mine of Maliakhera, Distt. Chittorgarh, Rajasthan. The 2 photographs would give clear picture. The first photo was taken at the opening of mine. The second photo is of year 2014.



He further detailed the initiatives and improvement which have taken place in Cement Manufacturing especially:

1. WASTE UTILIZATION AS ALTERNATE FUEL

The advantages of co processing of alternate fuel in cement plant:

- Co processing ranks higher in the waste processing hierarchy.
- High flame temperature (2000°C) – ensures complete destruction of harmful pollutants
- Residence time of combustion gases above 1000°C In excess of 3-4 seconds – ensures complete destruction of pollutants.
- Complete destruction of organic compounds
- Total neutralization of acid gases, sulphur oxides and hydrogen chloride, by the active lime in the kiln load, in large excess to the stoichiometry.
- Embedding of the traces of heavy metals in the clinker structure with very stable links (metallic silicates formation).
- No production of by-products such as ash or liquid residue from gas cleaning.
- Produces overall environmental benefits by reducing releases to air, water and land.
- Maximizes the recovery of energy while ensuring their safe disposal
- Saving of non-renewable fossil fuels. Substitution of coal with waste. Savings are made through resource conservation and associated CO2 emissions.
- Up to 2009 India average of AFR use was less than one percent.
- As of now average use of AFR in India is 4%
- Highest use in one plant is 25%
- JK Cement is using 10-12 % in its plant situated in Karnataka.

2. WASTE HEAT RECOVERY is widely adopted in cement industries to recover heat of from gases being emitted to atmosphere. This recovered heat is utilised for power generation. In this way unnecessary heat is not pushed into atmosphere as well as there is saving of coal substituted with waste heat to generate that much of power. It is a great initiative towards Net Zero.





Green Environment View OF RK Marble

The second speaker was Sh Rajendra Bora, Sr. GM, M/S R.K. Marble Pvt. Ltd. He presented forcefully the achievements of net zero mining goal through Morwad marble mines of M/S R.K. Marble. This mine has gone to a depth of 200m already.

All around the mine, good plantation has been done. Temple constructed on the mine dumps and also a stadium. The company had replaced all diesel compressors by electric compressors w.e.f. 2010. Further reduction in carbon footprints has been done through Electric Commando (DC-120) Drill Machine instead conventional compressed air drills. Sewage water treatment plant has been installed. Rain water is harvested for use in the mines. Water is also supplied to nearby village pond. In nutshell, all available technologies have been introduced in the mine to reduce generation of greenhouse gases and to reduce power consumption.

Chief Guest Shri R P Dashora, Head Mining, HZL, in his address said as per the societal need, net zero mining is done and environment is protected at all cost.



(L to R) Sh OP Soni, Vice-Chairman, MEAI-Udr, Sh Madhu Sudan Paliwal, Secretary, MEAI-Udr, Sh. RC Purohit, (Retd.) AVP (Mines), M/S JK Cement Ltd.

Shri AK Kothari, Former National President, MEAI delivered PLEDGE to members. He highlighted the history of how the celebration of Mining day started and the importance of celebration of this Day.

In the end, Dr. S.S. Rathore, Ex-Chairman of the Chapter proposed vote of thanks.

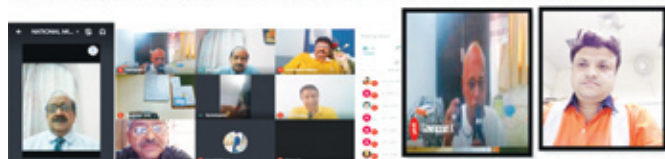
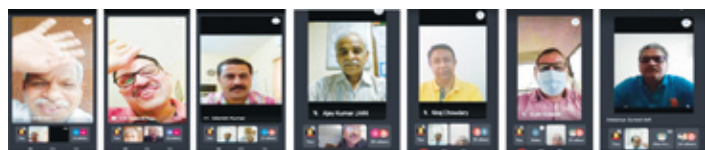
VERAVAL- PORBANDAR CHAPTER INDIAN MINING DAY 2020

Veraval-Porbandar Chapter celebrated the Indian Mining Day on 1st November 2020 during 9.15 am to 10.45 am through google meet and controlled by the Chapter from Ambujanagar, District Gir-Somnath, Gujarat in an unique manner . This program was arranged virtually and more than 40 people have joined online. Program started with IMD pledge, paying Homage to 1.21 Lakh persons who lost their lives due to Corona pandemic in India. Also paid homage to our old Mining fraternity like S/Shri Late TVS Naryan, M Sengupta, SC Chitagi, DP Verma , SK Jain , KS Rajpurohit, KK Kattal, Ramnik Lal Thanki etc by remembering their valuable contribution to Saurashtra. In the beginning of the program Chapter Chairman Shri. Ajay Kumar Jain welcomed all the members. The program was completely organised under his guidance.

The uniqueness of this program is that V P chapter tried to recollect all the old Mining fraternity who have worked and was associated in the Saurashtra Mining Belt since 1980 . All the retired seniors enjoyed and refreshed themselves while meeting their old professional friends and memorizing the glimpses of their working days. M/s GPS Kapoor, KL Shukla, Gowrappan K, L Behera, NK Mitra ,P Sarkar, GK Jangid, RK Mahapatra,,SK Bhakta, Vijay singh Rathore, Vijay Kumar, Dr Ganesh, Basav Raju, Dr AK Singh, Dhananjay Singh, Umesh Tiwari, Karunakara, Neeraj Chaudhary, CS Soni, Mayank Srivastava, Ganpat Ram, Mukesh Kumar, Rama Krishna, MC Upadhyay, Yuvraj Jadeja , AK Sahu and the Executive body of the Chapter witnessed this successful program. M/s JL Mathur, MNP Singh, NK Nuwal, UR Raju , A Banerjee, N V Hathiholi, K Krishnana, MS Nagesan, SP Goyal, VV Yagnik, MK Nayak, Vivek Uplanchiwar, Pappu Kumar, JP Mot, and Hemant Kumar took part in the programme through their text messages. Video messages received from M/s GPS Kapoor, A Baerjee, UR Raju, Gowrappan K, L Behera, MS Nagesan, KL Shukla, CS Soni, P Sarkar , Hemant Kumar SK Bhakta, SP Goyal and Dr Ganesh have been shared among all members through Chapter's whatsapp group . Mr. Sanjay kumar Patnaik, National President of MEAI also greeted and was very delighted to know the successful organising of IMD 2020 celebration by the Chapter.

Mr Anil Jadia , Senior most Geologist (M Tech , 1977 from University of Saugar, MP) from Kota presented a nice paper

on Saurashtra's Limestone formation about genesis, mining scenario, post rehabilitated best reclamation practices etc. Mr CM Dwivedi, Tata Chemicals, also shared his expert technical comments. Shri Gowrappan K , founder member of the Chapter expressed his happiness the Chapter's progress and gathering of seniors and juniors that are associated with Saurashtra mining. Shri L Behra (Founder Member of the Chapter) motivated the members. Open discussion was held on latest issues also. Shri GPS Kapoor also extended his best wishes to all and expressed happiness to participate in the program. He and Shri Y Raghavendra Rao in association with Shri (Late) TVS Narayan, Shri (Late) M Sengupta and other old famous mining engineers, geologists, environment engineers of Saurashtra had to put in lots of effort to start up the Chapter in 1993. Shri GPS Kapoor said in his message that the seed sowed in 1993 has now become a tree, which is proving shade and fruits.



**MINING ENGINEERS' ASSOCIATION OF INDIA
VERAVAL PORBANDAR CHAPTER**

NET ZERO MINING

Cordially Invites you to Join the Virtual Celebrations of **INDIAN MINING DAY 2020**

ON 1ST NOVEMBER 2020, AT 9.15A.M.

A.K.Jain M.K.Yadav C.M.Dwivedi D.Dhrude Amol Dhomne
Chairman Vice Chairman Secretary Joint Secretary Treasurer

Use the link to join-meet.google.com/tkj-ajqg-pvm

Shri Ajay Kumar Jain, Chairman presented a summary report of the Chapter. List of 112 members has been updated. Mr. Amol Dhomne Mines Manager Ambuja Cements Ltd. (Chapter Treasurer) has arranged the program very nicely in a very lively manner in this pandemic period, which was highly appreciated by all the members. Shri. Satish Mohanty, Geologist, Ambuja Cements Ltd tirelessly worked in the communication and technical support for the successes of this program. Shri Manish Yadav, GHCL (Vice Chairman) gave vote of thanks.

OTHER CHAPTERS

Indian Mining Day 2020

The following chapters also celebrated Indian Mining Day on 1st November 2020.

1. Ahmedabad; 2. Jodhpur; 3. Jaipur; 4. Veraval-Porbandar;
5. Rayalaseema; 6. Tamilnadu; 7. Belgaum; 8. Goa;
9. Bhubaneswar

HONoured IN MINING & METALLURGY



Prof. Lala Behari Sukla has been named in the world ranking of top two percent Scientists, drawn up on the basis of a subject - wise analysis conducted by the Stanford University, USA. His rank is 328 in the area of Mining & Metallurgy. The list of top scientists was created by Stanford experts

on the basis of standardised citation indicators like information on citations, h-index, co-authorship, and a composite indicator. He is an Editorial board member of Scientific Reports, a journal from Nature Publishing Group.

Prof. Sukla, is the Director in Biofuels and Bioprocessing Research Center (BBRC), Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar. He has worked as Chief Scientist and headed the Bio resources Engineering Department in CSIR-IMMT, Bhubaneswar, India. He was also Emeritus Scientist, CSIR and Emeritus Professor, AcSIR, New Delhi.

He has more than 44 years of R&D experience in the area of Bio-mineral Processing and Hydrometallurgy and contributed over 226 papers in International & National Journals . He has published 5 books and 10 patents and seven students have been awarded PhD degrees under his guidance. Prof. Sukla is a recipient of several prestigious awards.

MEAI WEBINAR LAUNCHED FROM THE INDIAN CAPITAL

The Mining Engineers' Association of India (MEAI) organised a webinar on October 27, 2020 on **Adopting International standards for Mineral Resource Reporting – Way to Attract FDI in India**. The webinar was held to commemorate the successful admission of National Committee for Reporting Mineral Resources and Reserves in India (NACRI) as the National Reporting Organisation (NRO), MEAI as the Professional Organisation (PO), and recognition of Indian Mineral Industry Code (IMIC) developed by the NACRI by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) on August 1, 2019. Mr Sanjay Pattnaik, President MEAI introduced the speakers and sketched the role of MEAI in leading the CRIRSCO initiative in India.

Dr Aruna Sharma, IAS (Retd), Co-Chair, Foundation of Resource Convergence set tone to the webinar by highlighting the issues related to implementation of IMIC in public reporting of Mineral Resources and Reserves in India and plausible solutions. Eminent speakers Mr Ken Lomborg, Chairperson and Mr Neil Wells, Immediate past Chairperson of CRIRSCO spoke on the benefits of the CRIRSCO market related Mineral Resource and Reserve reporting systems, and Development of Mineral Resource and Mineral Reserves Reporting Standards, respectively. Dr P.V. Rao, Co-Chair NACRI elucidated the constructive role played by NACRI in introducing international best practices on public reporting of Mineral Resources and Reserves in India.

Padmabhushan Dr V.K. Saraswat, Member NITI Aayog was the Keynote speaker. He spoke at length and spelt out the immediate need of adopting international standards in public reporting to attract much needed FDI in Indian mineral sector and assured of positive action being taken by the Indian government in introducing IMIC in India (for more details please read the editorial column).

Dr Abani Samal, former Co-Chair, NACRI delved on the Importance of IMIC in generating private investment opportunities for the Indian mining sector. Mr Pankaj Satija, MEAI Council member proposed vote of thanks along with his concluding remarks. Ms Monica Bachchan, founder, Metalogic PMS Pvt Ltd facilitated the holding of the webinar.

Important takeaways from the Webinar were:

- appreciating the benefits of adopting market related CRIRSCO compliant 'Indian Mineral Industry Code (IMIC)'
- learning more about the importance of adopting international best practices for the growth of Indian Resource Sector
- learning more on how the IMIC compliant and reliable resource reports can win investors' confidence
- knowing on why the global stock exchanges recognise only the CRIRSCO compliant reporting standards for listing of exploration and mining companies

The webinar was one of the best organised by the MEAI where best of the national and international think tank on public reporting of Mineral Resources and Reserves converged.



The video of this webinar is available at <https://www.youtube.com/watch?v=KYQqXnWNwNo>

Print media references on the webinar:

PTI: http://www.ptinews.com/pressrelease/43471_press-subNeed-for-a-Change-in-Mineral-Reporting-Standards--Dr-VK-Saraswat--NITI-Aayog

Business Standard: https://www.business-standard.com/content/press-releases-ani/need-for-a-change-in-mineral-reporting-standards-dr-vk-saraswat-niti-aayog-120102900557_1.html

CONFERENCES, SEMINARS, WORKSHOPS ETC.

MEAI

18 Dec 2020: National Webinar on The Occupational Safety, Health and Working conditions Code 2020. Rescheduled from 19 Dec 2020. Organised by the Bangalore Chapter. Contact: Mr N. Rajendran, Secretary Bangalore Chapter at meaibengaluruchapter@gmail.com

INDIA

2-4 Dec 2020: GLOBAL MINING SUMMIT (GMS) and International Mining Machinery Exhibition (IMME) 2020. Organised by Confederation of Indian Industry (CII). Virtual platform. Revitalizing natural resources to achieve 5 Trillion economy. India's largest virtual exhibition for the Mining Sector. For details contact: Mob +918056268841, Email imme@cii.in.

17-19 Dec 2020: MMMM- 13th International Exhibition and Conference on Minerals, Metals, Metallurgy & Materials. Venue: Pragati Maidan, New Delhi, India. Contact Shailendra Malik, Project Head, Ph: +91 9873949319, E: Shailendra.malik@hyve.group

22-24, Jan 2021: 5th Exhibition cum conference on Steel. Organised by Federation of Indian chambers of commerce & Industry (FICCI) along with the Ministry of Steel. Venue: Mumbai Exhibition Centre, Mumbai, India. Contact Mr. Arpan Gupta, Deputy Director & Head, Mines & Metals, FICCI, Mobile: +91 98 1057 2331, E-mail : arpan.gupta@ficci.com, ekta.ficci@gmail.com

ABROAD

10-13 Dec 2020: Mining Turkey 2020. Location: Tuyap Fair, Convention and Congress Center, Istanbul, Turkey. Event Organizers: Tuyap Fairs and Exhibitions Organization Inc. Contact: +90 212 867 11 00 – Direct: 11 45, Email: maden-pazarlama@tuyap.com.tr

07-08, January 2021: ICMT 2021: International Conference on Mining Technologies. Tokyo, Japan. Contact: <https://panel.waset.org/conference/2021/01/tokyo/program>

07-08, January 2021: ICRARSE 2021: 15. International Conference on Recent Advances in Rock Slope Engineering. Tokyo, Japan. Contact: <https://waset.org/recent-advances-in-rock-slope-engineering-conference-in-january-2021-in-tokyo>

14-15, January 2021: ICAEG 2021: International Conference on Advances in Engineering Geology. Bali, Indonesia. Contact: <https://waset.org/advances-in-engineering-geology-conference-in-january-2021-in-bali>

14-15, January 2021: ICMST 2021: 15. International Conference on Mining, Science and Technology. Zurich, Switzerland. Contact: <https://waset.org/mining-science-and-technology-conference-in-january-2021-in-zurich>

18-19, January 2021: ICAHGEG 2021: 15. International Conference on Advances in Hydrogeology, Geological Engineering and Geotechnics. Rome, Italy. Contact: <https://waset.org/advances-in-hydrogeology-geological-engineering-and-geotechnics-conference-in-january-2021-in-rome>

11-12, February 2021: ICEGGE 2021: 15. International Conference on Engineering Geology and Geotechnical Engineering. Barcelona, Spain. Contact: <https://waset.org/engineering-geology-and-geotechnical-engineering-conference-in-february-2021-in-barcelona>

15-16, February 2021: International Conference on Mining Engineering and Applications ICMEA. Istanbul, Turkey. Contact: <https://conferenceindex.org/event/international-conference-on-mining-engineering-and-applications-icmea-2021-february-istanbul-tr>

22-23 Feb 2021: Future of Mining | Australia 2020. Venue: Sofitel Sydney Wentworth, 61-101 Phillip St, Sydney NSW 2000, Australia. Contact: Phone: +61 2 9228 9188

15-17 Mar 2021: Underground Operators Conference 2021. Venue: Perth, Australia. Organized by AusIMM, Ground Floor, 204 Lygon Street, Carlton South, Victoria 3053 Australia. Telephone: +61 3 9658 6100

28-30 Apr 2021: Life of Mine Conference 2021. Venue: Brisbane, Australia. Organized by AusIMM, Ground Floor, 204 Lygon Street, Carlton South, Victoria 3053 Australia. Telephone: +61 3 9658 6100.

New Online Course on Introduction to Blasting by Edumine. Course details: Presenter - Dr. Anthony Konya. Duration: 3 hours, Learning Credits: PDH 3.0, Format: Short video modules. For registration contact. News@edumine.com

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



ERM Group Companies:

R.Praveen Chandra (Mine Owner and Entrepreneur)

E. Ramamurthy Minerals & Metals Pvt. Limited

Prakash Sponge Iron & Power Pvt. Limited

Benaka Minerals Trading Pvt. Limited

Codeland Infosolutions Pvt. Limited

Alfa Minerals



Admn. Office:

No. 32 (old 421), 7th 'B' Main,
4th Block, Jayanagar,
Bengaluru -560011, INDIA

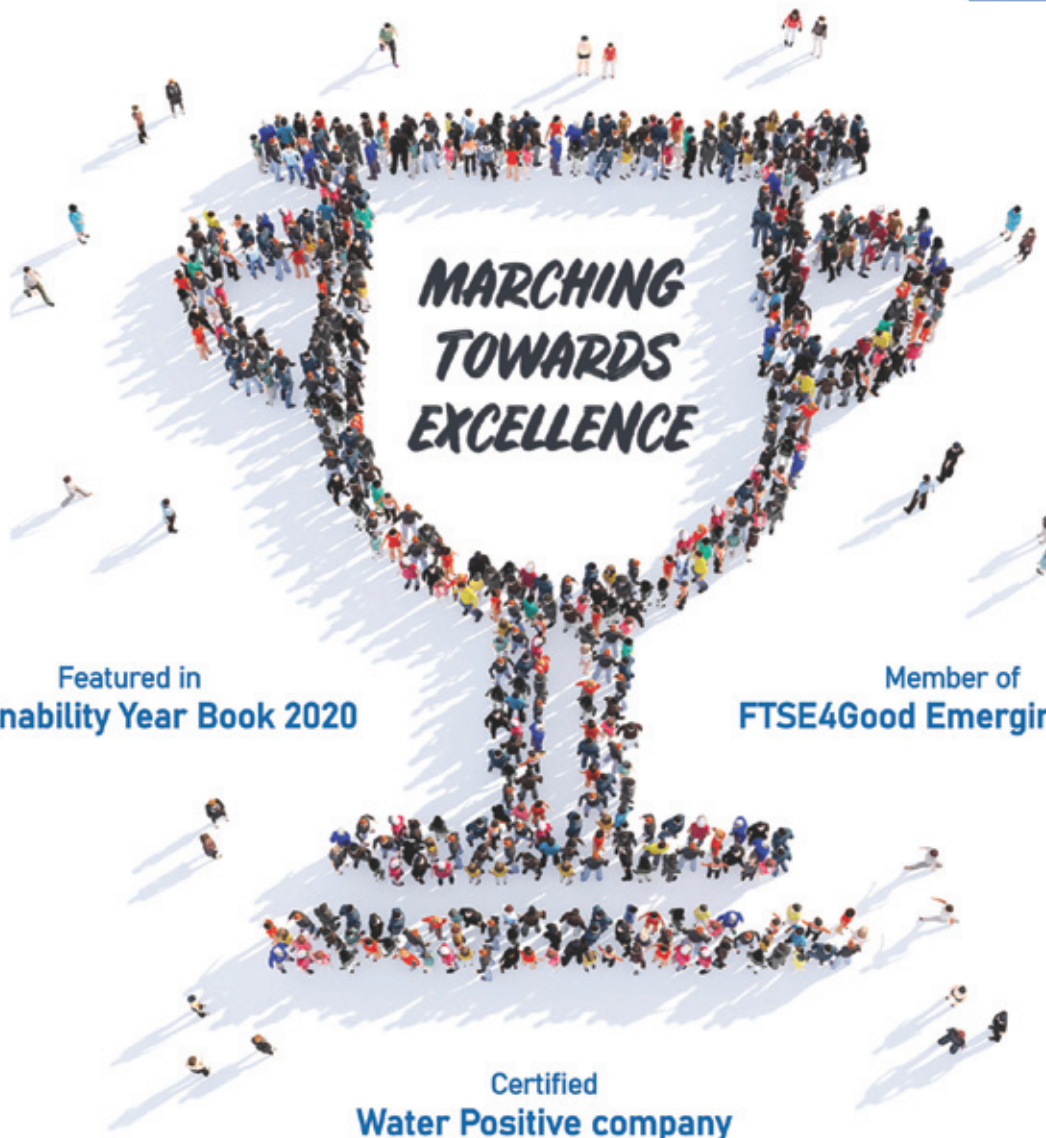
Tele: +9180 26655930
Fax: +9180 22440795
Email : mail@ermgroup.in

www.ermgroup.in

Regd. Office: No.59, 12th Main, Banashankari 1st Stage, 1st Block, Srinagar, Bengaluru-560 050



HINDUSTAN ZINC
Zinc & Silver of India



Featured in
Sustainability Year Book 2020

Member of
FTSE4Good Emerging Index

Certified
Water Positive company

'Good Cultural Foundation'
in Great Place to Work Survey

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

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

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

Hindustan Zinc Limited

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

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

www.facebook.com/HindustanZinc | www.twitter.com/CEO_HZL | www.twitter.com/Hindustan_Zinc | www.linkedin.com/company/hindustanzinc