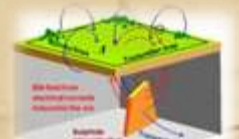




Exploration Scenario of Mineral Sector

S.K. Adhikari

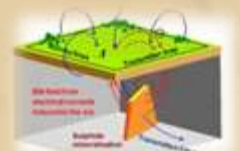
Chief Mining Geologist
Indian Bureau of Mines





Exploration : World Scenario

- During a 30-year period from 1975–2005 the number of discoveries closely tracked exploration spending
- Exploration spending climbed sharply between 2005-2012 peaking in 2012 at \$23 billion
- Despite increased spending, no corresponding increase in number of discoveries
- On an average, 60-70 discoveries are made world wide Every year . Junior Companies account for 50-60% discoveries
- Global Exploration Expenditures are in decreasing order : **Gold > Base Metals > Uranium > Diamond > Iron ore > Coal**
- China is among the highest spender on exploration

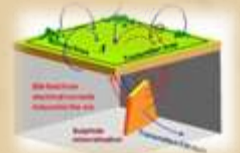




Exploration : World Scenario

Cont...

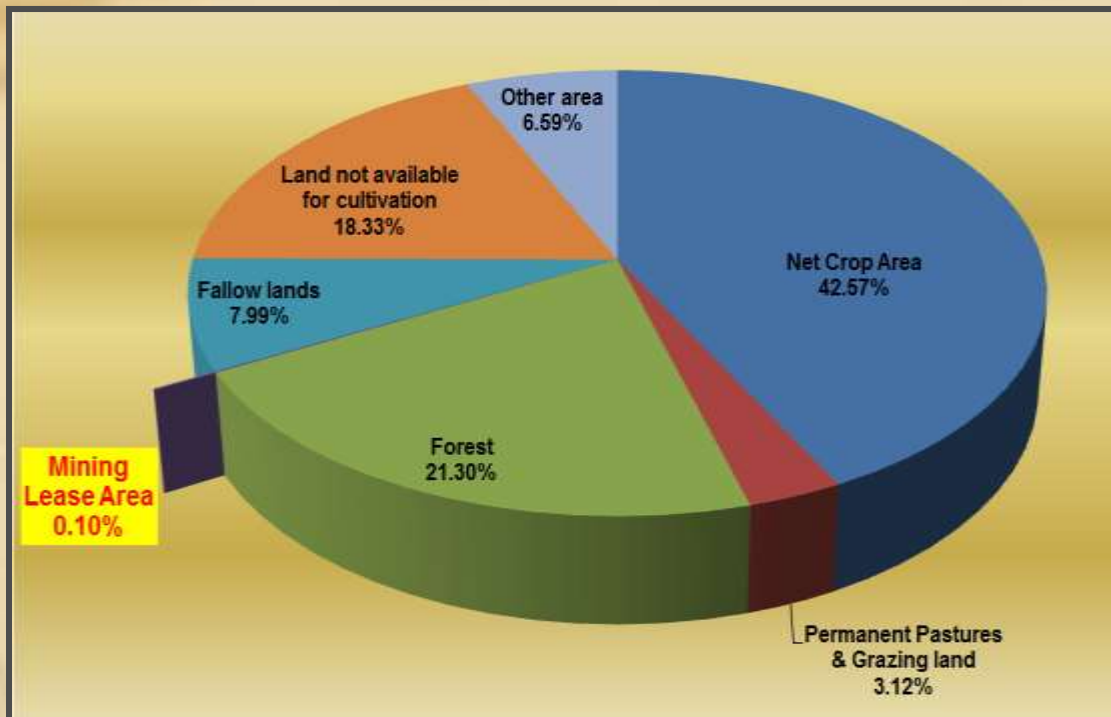
- **Reasons for declining investment in exploration :**
 - Cyclical increase in exploration expenditure between 2005-2012 commodity price boom
 - Since 2012, exploration spending has fallen sharply, inline with low commodity price cycle
 - Most of the outcropping and shallow ore bodies already discovered
 - Aggregate cost of exploration for each discovery is on the rise as focus is now on “Deep Seated” deposits
 - Global capital pool available for exploration has significantly gone down





Land use Scenario: India

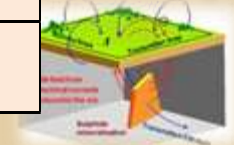
Total geographical area: 328.73 million hectares



All figures In million hectares

Net Area Sown (Crop Area)	Permanent Pastures & Grazing land	Forest	Mining Lease Area	Fallow lands	Land not available for cultivation	Other area
139.93	10.24	70.01	0.34	26.28	60.27	21.66

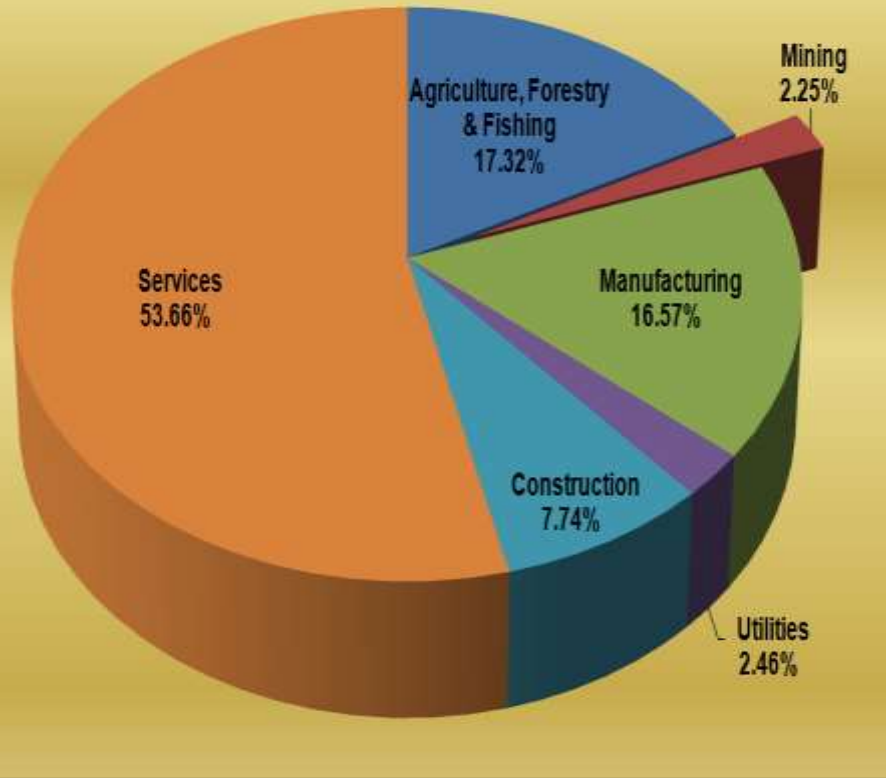
Source: Directorate of Economics & Statistics, Dept. of Agriculture & Cooperation, Pocket book of Agricultural statistics, 2015
 Mining Lease Area : ML Directory as on 31.03.2015 prepared by IBM based on data received from State Govts./Uts. (Excluding coal, lignite, petroleum, natural gas, atomic mineral and minor mineral)





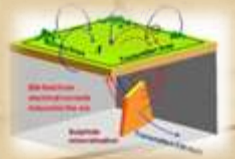
Mining Sector Overview- India

Contribution of Mining to GDP



Value of mineral production has risen from Rs. 32crore in 1954 (for metallic and non metallic minerals) to Rs.56336 crore in 2016-17(excluding minor minerals, coal, petroleum and atomic minerals)

Contribution of mining sector to GDP: India -2.25%
Australia-10%



42.5% crop area contributes 17.32% to GDP

Less than 1% ML area contributes 2.25% to GDP

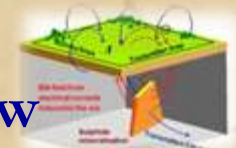


Mining Sector Overview- India

Mineral Production: 1954 to 2016-17

(Million Tonnes)

Mineral	1954	2016-17 (Provisional)	X times increase
iron ore	6	192	33
Bauxite	0.08	24.49	322
chromite	0.05	3.73	4381
Manganese	1.54	2.35	1.5
Limestone	7	313	43
Rock Phosphate	0.002	1.18	590
Magnesite	0.07	0.30	4.2



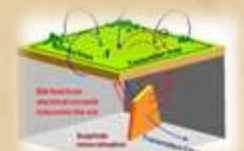
India per capita consumption of minerals continues to be low



Resource augmentation 1960-2015

(in Million Tonnes)

MINERAL	Reserves 1960	Total Resources 01.04.2015	X Times
BARYTES	0.7	86.67	124
BAUXITE	276	3,896.86	14
CHROMITE	4.86	344.00	70
COPPER	40	1,511.49	38
DOLOMITE	302.51	8,414.89	28
GOLD	4.11	501.83	122
IRON ORE (HEAMATITE)	788.5	22,486.96	29
IRON ORE (MAGNETITE)		10,789.15	
LEAD-ZINC ORE	28.45	749.45	26
LIMESTONE	-	2,03,224.75	
MAGNESITE	86	393.98	5
MANGANESE ORE	60	495.87	8
ROCK PHOSPHATE	-	312.67	
SILVER		511.95	
TIN	-	83.72	
TUNGSTEN	-	87.38	
NICKEL (ORE)	-	189	

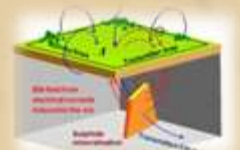




Exploration : Indian Scenario

Important discoveries since independence –

- **Gold:** Hira-Budini, Hutti-Maski, Ajjanhalli & Chinmulgund (Karnataka)
- **Copper:** Khetri (Rajasthan), Malanjkhand (M.P.), Rakha (Bihar)
- **Base metal:** Rajpura-Dariba, Rampura-Agucha (Rajasthan)
- **Iron Ore:** Dalli-Rajhara, Bailadila (Chattisgarh); Kudremukh (Karnataka)
- **Bauxite:** Amarkantak & Phutka Pahar (M.P.), East Coast Bauxite (Odisha, Andhra Pradesh)
- **Chromite:** Sukinda (Odisha); **Molybdenum:** Harur (Tamil Nadu)
- **Diamond :** Wajrakarur (A.P.), Bunder (M.P.)
- **Barytes:** Mangampet(A.P.); **Rock Phosphate:** Jhabua (Rajasthan)



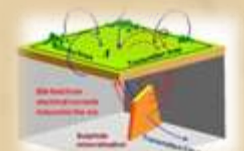


Exploration : Indian Scenario

Resource Augmentation 2005-2015

in million tonnes and gold in tonnes

Mineral	2005	2015	% of Increase/ Decrease
Bauxite	3290	3897	18.5
Lead-Zinc Ore	523	749	43.4
Chromite	213	344	61.5
Iron Ore- Haematite	14630	22487	53.7
Iron Ore-Magnetite	10619	10789	1.6
Manganese ore	379	496	31.0
Gold metal (primary)	491	655	33.4
Magnesite	338	394	16.6
Rock Phosphate	269	313	16.4
Copper metal	11	12	6.5
Limestone	175345	203225	15.9

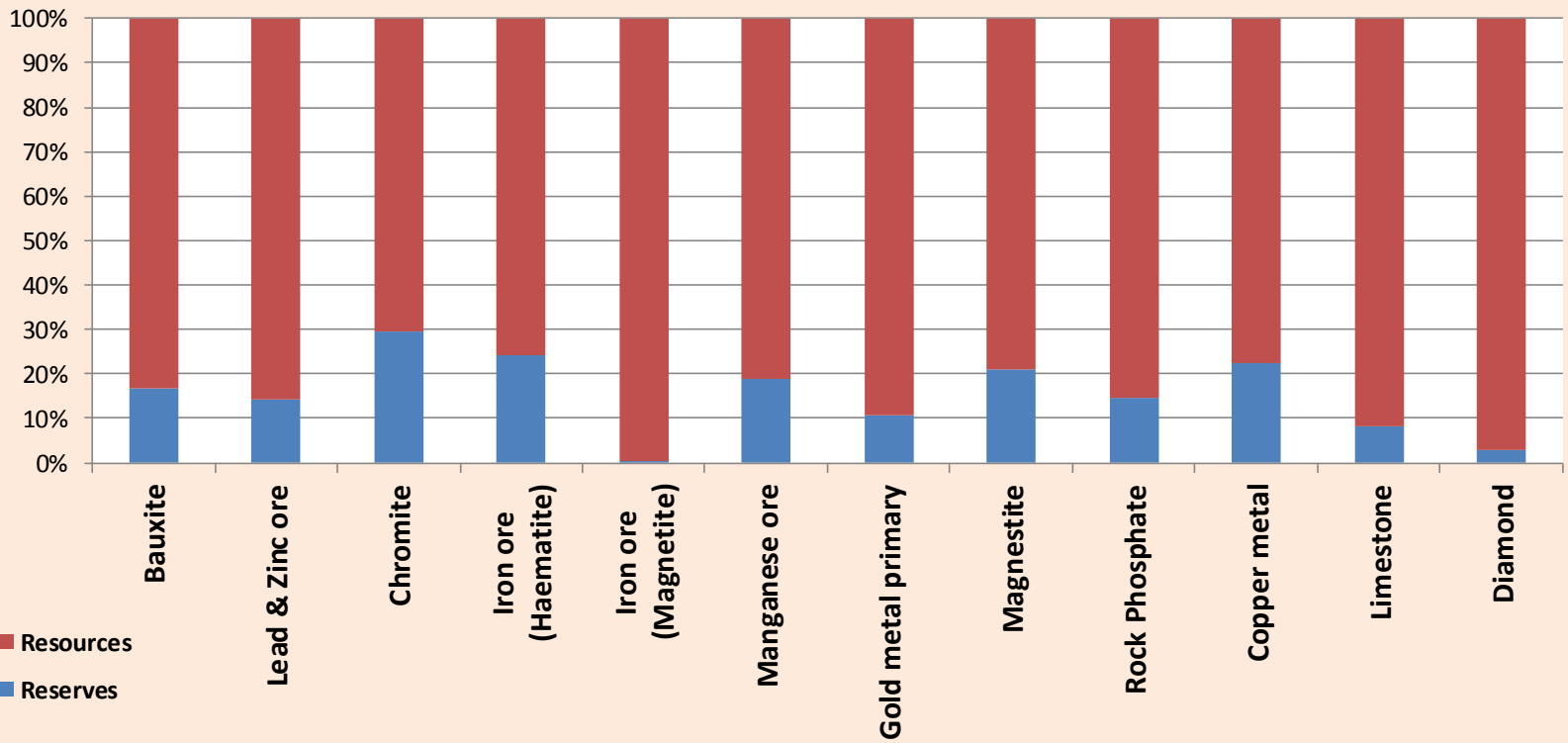




Exploration : Indian Scenario

Significant scope for conversion of resources to reserves

Year 2015



Total Resources Values in million tones; gold in Tonnes and Diamond in carots

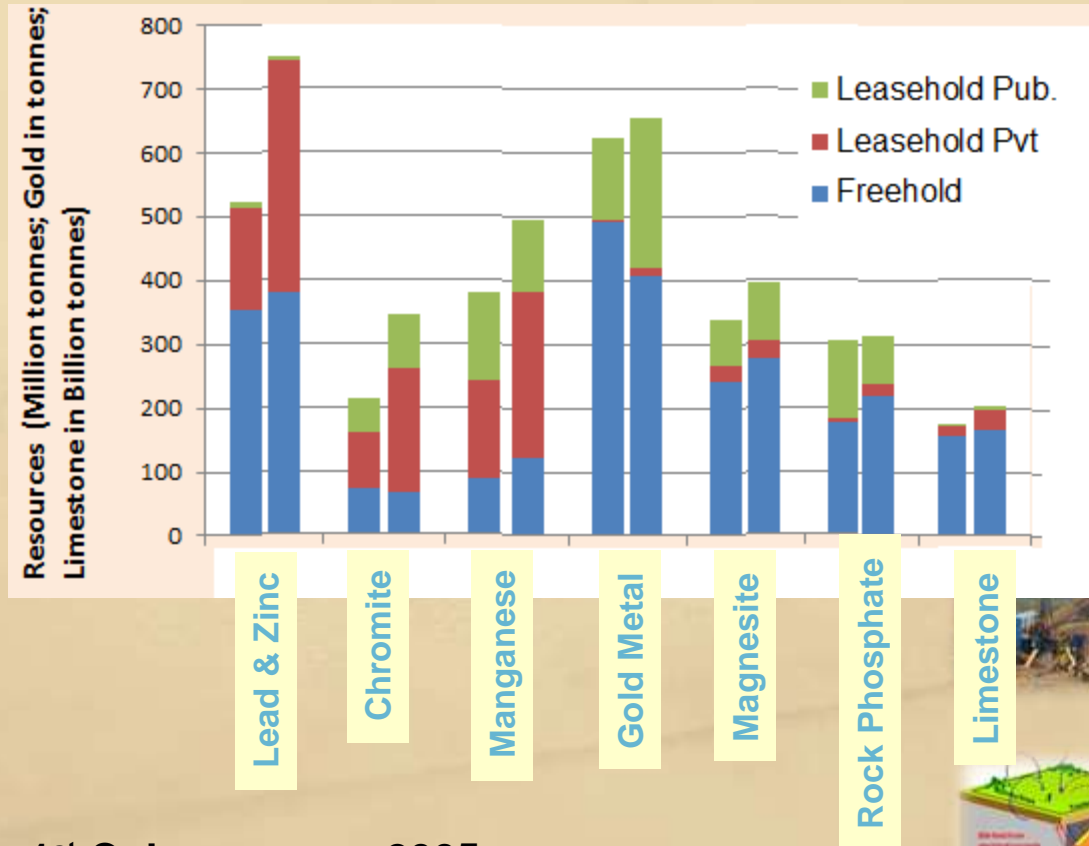
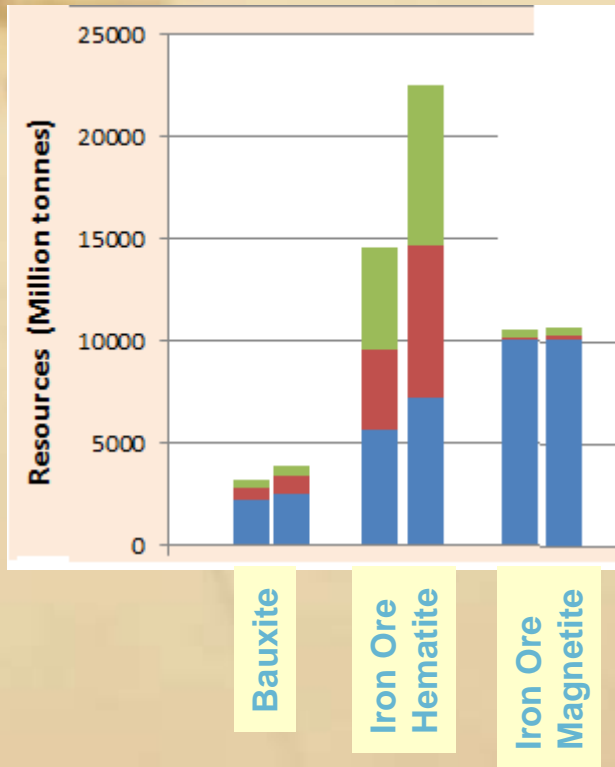


Bauxite	Lead & Zinc ore	Chromite	Iron ore (Haematite)	Iron ore (Magnetite)	Manganese ore	Gold metal	Magnetite	Rock Phosphate	Copper metal	Limestone	Diamond
3896.9	749.5	344.0	22487.0	10789.2	495.9	654.7	394.0	312.7	12.2	203224.8	31836091



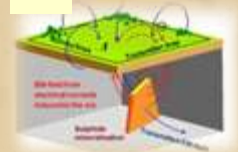
Comparison of Resources Augmentation

2005-2015 between Free hold, Private leasehold and Public lease hold



1st Column : year 2005

2nd Column : Year 2015





Five “E” for Expansion of Mining Sector

Exploration



Exploitation



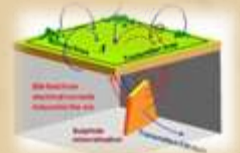
Extraction



End use value addition



Export



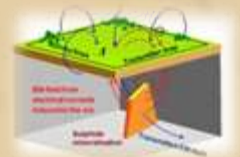


Importance of Exploration in Mining

Exploration is the foundation of all value creation in mining

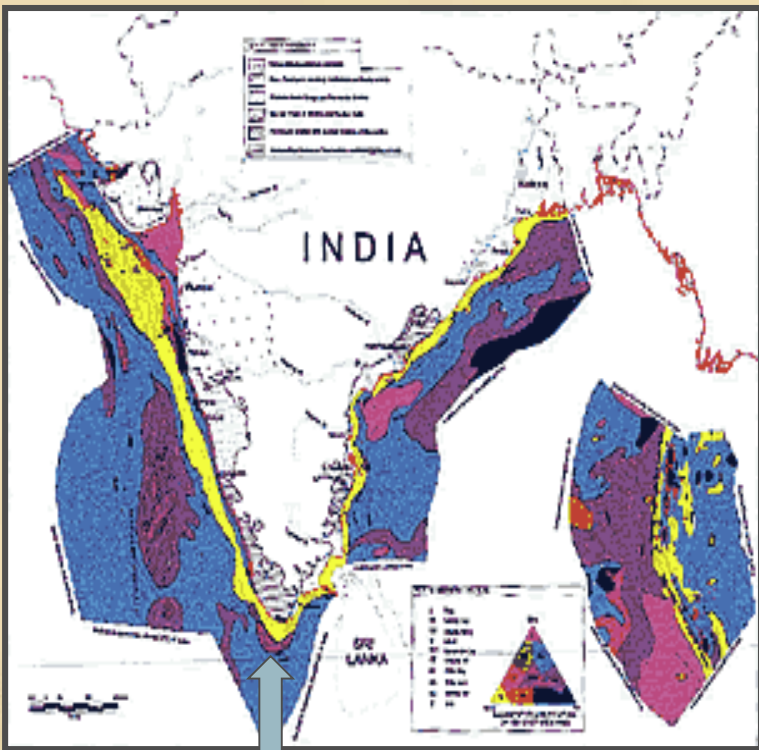
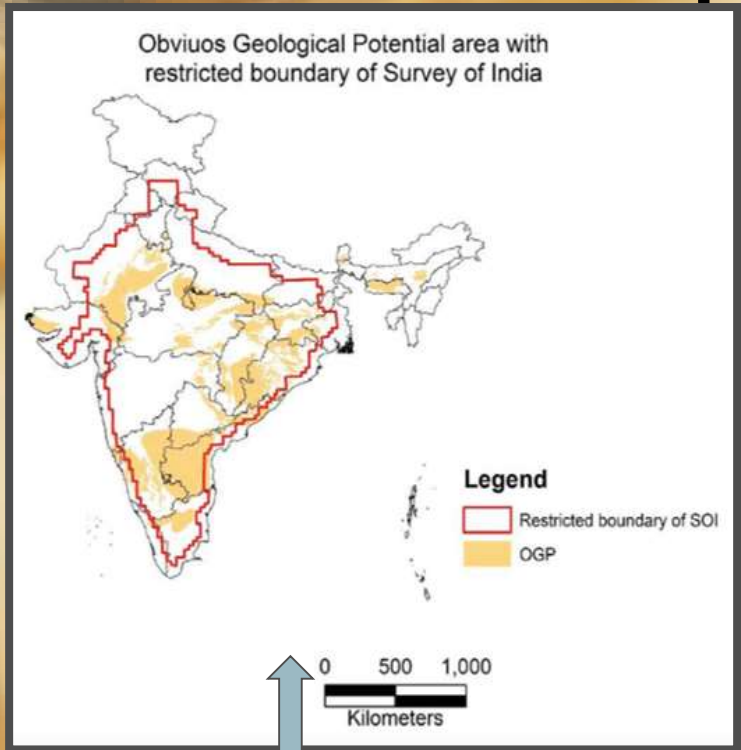
- Helps discovery of new deposits (GREEN FIELD)
- Augments reserves depleted through production (BROWN FIELD)
- Replaces those rendered uneconomic by falling commodity prices.
- Helps in better planning and resource management through utilization of low grade resources
- Effective economic viability and feasibility studies of a deposit
- Better valuation for company listed in stock exchanges
- Final mine closure planning

Selection of Minerals for exploration is primarily governed by : Potential Demand & Supply, International Prices, Technological Breakthrough, Government Policy, Strategic Factors, Fiscal incentives etc.





India- A land of opportunity for Mineral Exploration



Total land area: 3.28 M Sq Km
 Obvious Geological Potential (OGP) Area : 0.571 M Sq Km
 Mining lease area- 0.1%

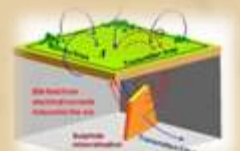
EEZ Area : 2.015 M Sq Km

(Excluding coal, lignite, petroleum, natural gas, atomic mineral and all minor minerals)



Exploration : Indian Scenario

Base line geosciences data by GSI



- **Geological Mapping:** 3.1 M Sq Km(98.48%)
- **Specialized Thematic Mapping:** 0.215 M Sq Km(6.24%)
- **Geochemical Mapping:** 0.4 M Sq Km (12.17%)
- **Geophysical Mapping:** 0.22M Sq Km(6.73%)
- **Marine/Bathymetric survey:** 1.98 M sq km(98.34%)



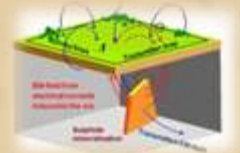
Exploration : Indian Scenario

Mining is the need of the country and exploration is the key

Exploration, a necessity for future growth of mining sector

Social and economic factors

- Burgeoning population
- Increasing urbanization and improving standards of living
- Huge population of young people with high aspirations
- Low per capita consumption of minerals as compared to other countries
- Consistent Strong economic growth
- Help reduce dependency on import of minerals and save foreign exchange
- Help to achieve increase in contribution of mining to GDP by 1%
- Focus on Make in India
- Plan to increase steel capacity to 300 million tonnes by 2030 from the present 126 million tonnes

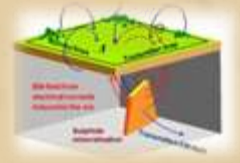




Exploration : Indian Scenario

Geo Technical factors:

- Exploration activities in the country conventional type with restricted input from geochemistry, geophysics and remote sensing etc.
- The finds so far, located near the surface (mostly up to 100 m).
- Fast depletion of shallow/near surface ore bodies.
- Need to identify newer areas for locating “deep seated” and “concealed/hidden” ore bodies through modern and sophisticated exploration methods/ techniques.
- Exploration spend needs to be increased to keep reserve augmentation in line with production.
- Exploration is high risk business Probability of making commercial discovery is 1:500 to 1:1000





Factors with potential impact on exploration

Government Policy

Environment

Forest

Social factors

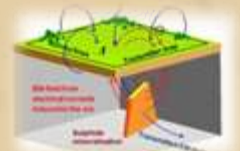
Land acquisition

Latest technology

Lack of commodity specific experts

Availability of funds

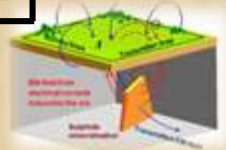
Taxation policy





Policy initiatives:

MMDR Amendment Act, 2015; Concession Grant Process



Prior to MMDR
Amendment Act, 2015

Exclusivity and Seamless Transition

Reconnaissance
Permit (RP)

Prospecting
Licence (PL)

Mining
Lease (ML)

Grant on Application (1st Come, 1st Serve)

After MMDR
Amendment Act, 2015

**No Exclusivity and
No Transition**

**In-built Exclusivity
and Transition**

Non-Exclusive RP

Composite License
(PL-cum-ML)

Mining Lease

Grant on Application

Grant through auction



Policy initiatives:

Amendment in section 4 of Act to notify entities for exploration



New section “9C” in Act for setting up National Mineral Exploration Trust



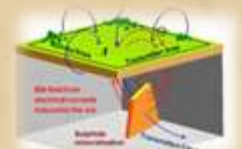
Transfer of mineral Concessions: section 12A



National Mineral Exploration Policy-2016



Empanelment of Mineral Exploration Entities to carryout exploration on behalf of the Government





Notified Agencies

• Under the Second Proviso to sub-section (1) of Section 4 of the MMDR Act, 1957

• Geological Survey of India

• Indian Bureau of Mines

• Atomic Minerals Directorate for Exploration and Research

• Mineral Exploration Corporation Limited

• Various State Directorates of Geology and Mining

• **Subsequently Notified Exploration Agencies (11) by the Central Government**

• Rashtriya Ispat Nigam Limited

• Steel Authority of India Limited

• NMDC Ltd.

• KIOCL Ltd.

• MOIL Ltd.

• Chhattisgarh Mineral Development Corporation Ltd.

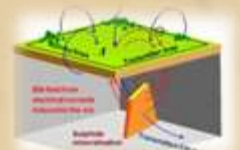
• Madhya Pradesh State Mining Corporation Ltd.

• Andhra Pradesh Mineral Development Corporation Ltd.

• Gujarat Mineral Development Corporation Ltd.

• Singareni Collieries Company Ltd.

• Telangana State Mineral Development Corporation Ltd.





Reforms to boost exploration: National Mineral Exploration Trust

National Mineral Exploration Trust
: Established in 2015 to
expedite mineral exploration

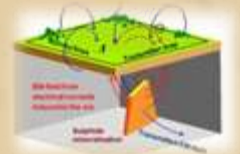
Fund accrued to NMET so far :
Rs 8,27.69 crore

Projects Sponsored through NMET :
60

National Aero-Geophysical
Mapping Programme (NAGMP) by
GSI of Rs.351 crore for the OGP area
through NMET.

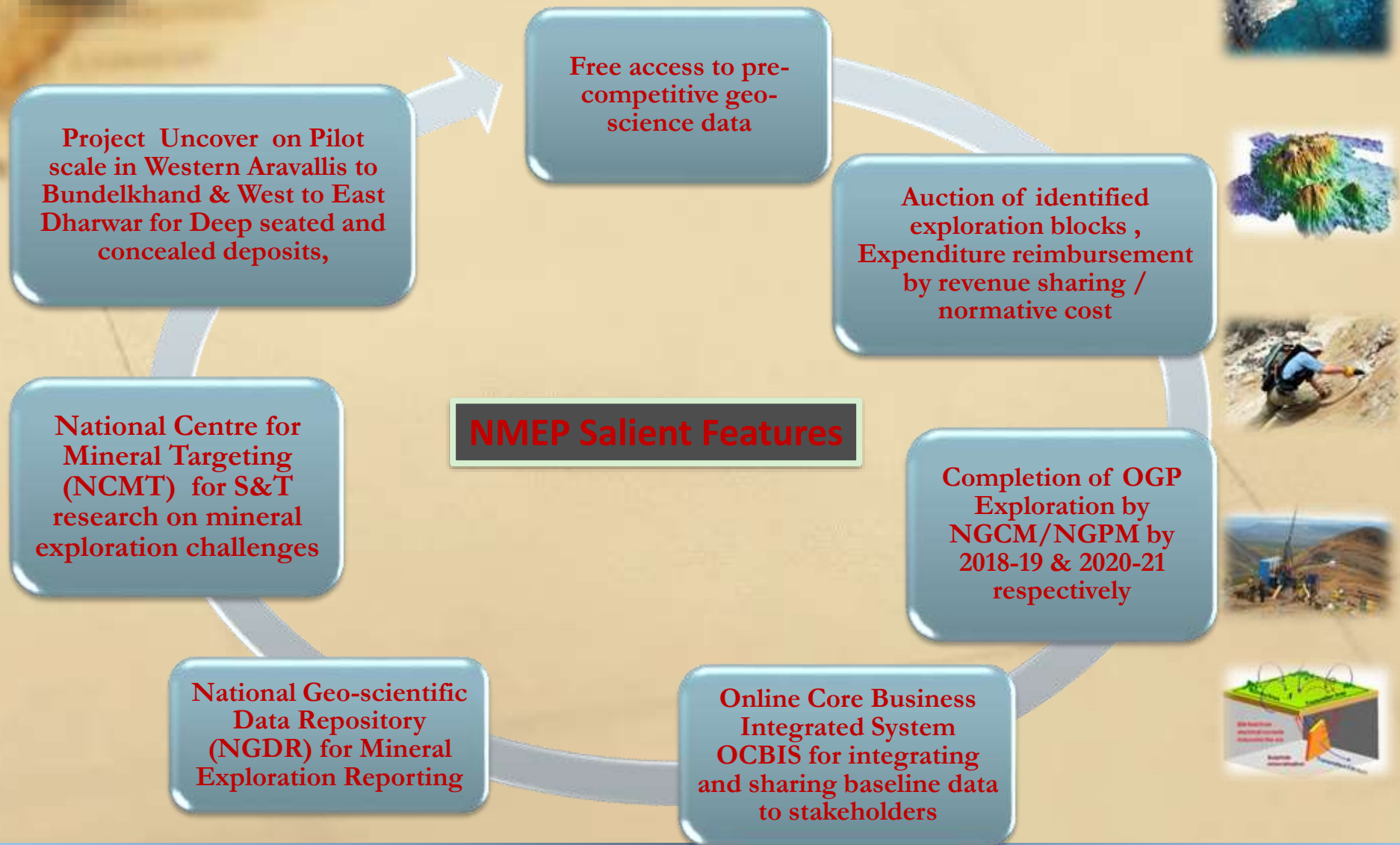
100 exploration blocks identified for
regional/detailed exploration

S. No	State	Total Project	Cost of Project (Rs)
1	Andhra Pradesh	5	208158000
2	Chhattisgarh	5	243851189
3	Jharkhand	5	105402000
4	Karnataka	5	127999000
5	Kerala	2	42148000
6	Madhya Pradesh	9	162993783
7	Maharashtra	6	138007911
8	Odisha	5	166446525
9	Rajasthan	13	403646000
10	Tamil Nadu	5	866674000
Total		60	2465326408





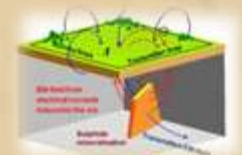
National Mineral Exploration Policy: Salient Features



Explore India : Way Forward



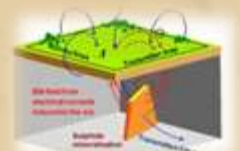
- Being a part of Paleozoic landmass Gondwanaland, India's Geological & metallogenic history similar to Australia, S. Africa & S. America.
- India's mineral discoveries were up till now lagging behind significantly due to meager exploration expenditure.
- With recent reforms to boost exploration, specific thrust may be targeted towards the following regions:
 - Rajasthan for base metal mineralization in the Delhi-Aravalli region,
 - Chhattisgarh for kimberlite, precious stones, tin,
 - Karnataka for gold and basemetal mineralization in Granite-Greenstone belts.
 - Odisha for manganese, iron ore and chromite deposits from the Precambrian metallogenic belts.
 - Tamil Nadu for potential mafic-ultramafic suites which host PGE, Ni, Cr.




Explore India : Way Forward



- Shift focus from Notified Minerals to high value minerals Copper, Lead-Zinc, Gold-Silver, Rare Earths, PGE, Diamonds etc.)
- More thrust on exploration for Fertilizer Minerals such as Rock Phosphate & Potash.
- As Mineral Discovery is an expensive, risky and time taking process and as exploration to discovery to establishing an economic resource could last for decades, response to auction mode of concessions to be closely monitored to remove bottlenecks.
- Exploration up to desired level for leases expiring in 2020.
- Incentives to encourage max. participation of Indian & Global exploration companies through various fiscal measures
- Focus on exploration in other than OGP areas holding enormous geological potential including Offshore.





“We look forward to marching ahead with greater confidence and expect some groundbreaking discoveries to endorse the recent reforms.”

Thanks