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EXPLORATION FOR DEEP-SEATED / CONCEALED MINERALS

(as on 20th March, 2018)

Minerals can broadly be divided into two categories:

(i) **Surficial deposits**: minerals such as iron ore, bauxite, limestone, dolomite, manganese, chrome, etc. These minerals are mostly found on surface or shallow depths, although some of them are also worked underground such as manganese and chromite in India and iron ore (Kiruna) in Sweden.

(ii) **Deep-seated / concealed deposits**: minerals such as gold, lead, zinc, copper, nickel, PGMs, diamond, REE etc. These are mostly deep-seated or concealed but are also worked open cast such as copper in Malanjkhand, gold (super-pit mine) in Western Australia.

The definition is thus nebulous. Both categories require detailed exploration but deep-seated minerals, which are very vital for India, require state-of-the-art technologies not available in India and heavy financial expenditure.

Most of the discoveries in India have been by chance or old workings such as lead and zinc in Udaipur (Rajasthan), chromite in Odisha, copper in Malanjkhand (Madhya Pradesh), bauxite in East Coast, gold deposits in Hutti and Bharat Gold mines in Karnataka.

Need for detailed exploration

The need for systematic and detailed exploration and development of the deep-seated minerals can be realised from the following table which demonstrates that the country in wholly or substantially dependent on their imports:

Table

Import of vital minerals / metals

(Value : in Rs Crore)

Minerals / Metals	Unit	2013–2014		2014-2015		2015-2016		2016-2017	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Copper ores and concentrate	million tonnes	2.08	33226.74	1.70	28502.82	1.89	26296.53	1.14	18298.69
Diamond	'000 crt	149916	134915.50	151359	125214.09	151535.00	110378.47	159421.05	129595.41
Nickel ores and concentrates	million tonnes	0.00134	120.71	0.0041	384.24	0.0032	245.38	0.00106	81.80
Lead ores and concentrates	tonnes	0.033	388.09	0.039441	384.68	0.0053	26.46	0.0062	31.86
Zinc ores and concentrates	million tonnes	0.033	156.22	0.035	169.38	0.00038	1.87	0.0017	8.66
Gold	tonnes	661	166242.62	915	210658.40	968	207487.49	780	184438.75
Platinum Group of Metals	Kg	6493	1401.73	7818	1524.79	8460	1375.68	**NA**	**NA**
Total			**336451.61**	**Total**	**336451.61**		**366838.40**		**345811.90**

Source: Ministry of Commerce and Industry

Exploration strategy in future has therefore to be oriented towards locating the resources of these minerals.

Exploration of deep-seated ore deposits, despite its intrinsic uncertainty and risk, is essentially a sequential procedure, to be explored with the state-of-the-art technologies which go on evolving depending on ground situation.

Diminishing rate of discoveries

Discovery rates for different minerals are dependent upon ideal geological conditions which differ for diamond, gold and platinum group of metals.

In a potential geological condition, studies of discoveries made during the period 1950-2010, have shown that the rate of discovery is directly proportional to the exploration expenditure.

The number of discoveries per year used to be about 25 between 1950 and 1990 in advanced countries such as Canada, Australia and USA. However, thereafter despite being the largest spenders in exploration **(Annexure)** and latest technologies, the rate of discovery has fallen in these countries.

Worldwide, up to now, only around 15% of kimberlites are diamondiferous and less than 1% have resulted into diamond mines. Worldwide up to now about 8000 kimberlites have been discovered, of which only about 1200 are diamondiferos, resulting in only 67 diamond mines. Thus the discovery rate for diamond is very low and therefore the risk of exploration for diamonds is extremely high.

De Beers India has carried out reconnaissance for diamonds over an area of 80,160 sq.km. on 53 RPs, discovering 58 kimberlites. De Beers also carried out prospecting over 343 sq.km on PLs granted on RPs in AP. However, none of the kimberlites were either diamondiferous or of any economic significance. Since 2000, De Beers and Rio Tinto have discovered almost 100 kimberlites in India, equivalent to what GSI discovered in the last 60 years. (Total kimberlites discovered in India is around 220).

However, the ratio between the attempts made by companies and the discoveries that have led to development of mines varies among the 3 precious metals / minerals. In case of diamond and platinum, it is 1:1500 to 1:1000; and gold 1:800 to 1:400.

Resource-rich nations averse to 'spend' tax payers' money on exploration

Mineral exploration is a highly competitive and specialized job. The expertise and the technology to explore and extract these minerals is available with private companies, popularly known as *junior exploration companies*. Their exploration expertise in most cases is linked to a particular mineral or group of minerals.

The exploration work is extremely risky: if during aerial survey, 1000 anomalies are observed, it may be that only 100 anomalies are worth ground prospecting and it may again be that only one out of these 100 turns out to be worth economic exploitation. The Governments do not therefore prefer to spend the tax payers' money on exploration because it does not want the tax payers' money to be invested in risky and hazardous ventures like exploration.

Mineral rich countries such as US, Canada, Australia, Brazil, South Africa, Chile, Mexico etc. are therefore averse 'to spend' tax payers money on the risky venture like exploration.

No mineral-rich country has developed its mining industry on the basis of government exploration in the last more than 30 years. The government in these countries create favourable conditions and provide necessary data to the private exploration companies to explore.

These countries therefore encourage the private companies to undertake detailed exploration by providing various incentives such as security of tenure besides seamless transition of exploration license to mineral concessions and freedom to sell / transfer the concessions.

For exploration job, these companies bank on venture capital or hedge funds. 80% of the exploration expenditure is financed by Toronto Stock Exchange and the balance by other stock exchanges e.g. New York, London and recently Perth.

Indian Exploration Policy

The Ministry of Mines notified Mineral (Non-Exclusive Reconnaissance Permits) Rules, 2015 on 29 June 2015 which delineates its Exploration Policy. Rule 3(11) of these Rules provide:

> "*The grant of a non-exclusive reconnaissance permit over any area shall not prohibit the State Government from notifying all or any part of such area for grant of a mining lease or a prospecting licence-cum-mining lease and upon such notification the validity of all non-exclusive reconnaissance permits over such notified area will stand automatically terminated*.

Further (Rule 4(1) stipulates that

> "*the holder of a non-exclusive reconnaissance permit may choose to submit its findings to the State Government and may request the State Government to conduct auction for grant of a prospecting licence-cum-mining lease or a mining lease based on such findings*.

Finally term and condition no. 4(e) of Schedule II stipulates that

> "*the NERP holder shall not be entitled to make any claim for the grant of any Composite Licence or Mining Lease on the basis of non-exclusive reconnaissance permit*".

It will be observed that with these Rules in place, no private sector or FDI will come for exploration in the country.

For deep-seated / concealed minerals, NMEP 2016 provides

- *Government will launch a special initiative to probe deep-seated/concealed mineral deposits.* ***(para 4.1(iv))***

- *Government's objective is to facilitate, encourage and incentivize private sector participation in all spheres of mineral exploration. Government intends to harness the technical expertise, technological capability and the financial resources of the private sector to discover and exploit the country's vast mineral resources.* ***(para 12.1)***

- *Different options can be exercised in combination or alone to attract global level exploration agencies for carrying out exploration especially for concealed and deep seated minerals like diamond, gold, PGE, nickel etc which require specialized technical knowledge and the latest technology.* ***(para 12.10)***

- To achieve private sector participation, Government has also realised that *participation of private sector in exploration depends on the following*:

  (a) *Availability and free accessibility of comprehensive, pre-competitive baseline geoscience data*;

  (b) *Incentives structures that provide an appropriate risk-return scenario*; and

  (c) *Ease of doing business and earning attractive returns from the investment.* ***(para 12.2)***

India is an under-explored country. The country does not have latest technology and even if we employ some exploration company, there is no guarantee of discovering world class economically viable deposit. It will therefore be better to invite junior exploration companies who have technologies and financial strength to undertake this task. This will avoid spending tax payers' money and help the country to become self-sufficient.

For attracting private junior exploration companies, the Government of India has to make appropriate changes in MMDR Act, 1957 as well as in its Mineral (Non-Exclusive Reconnaissance Permits) Rules, 2015.

Way forward : The Government has to ensure that in line with the practice followed in resource-rich countries:

— Once non-exclusive reconnaissance permit (NERP) is issued in favour of a party, no area coming within its ambit can be auctioned either for mining lease (ML) or prospecting-cum-mining lease (PL-cum-ML).

— Whichever holder of NERP comes on the ground first will have the priority on the area selected by him for detailed exploration.

— The balance area out of NERP can be explored by the other NERP holder(s), if any.

— In order that the area selected for detailed exploration is not blocked after a gap of an initial period, there has to be some annual charges (something on the pattern of dead rent), per hectare (or per sq. kilometre). These charges can go on increasing after a gap of every two or three years. These charges are in addition to whatever expenditure is incurred by the holder of NERP on exploration.

— Last but most important, Government should obtain forest and environment clearances before granting PL / ML.

Facilitating entry of private Junior Exploration Companies in mineral exploration

For encouraging private junior exploration companies who have the latest technologies and necessary financial wherewithal, the Government of India has to assure that

— the NERP will be seamlessly converted into PL-cum-ML or ML depending upon data generated during exploration.

— there should be freedom to sell PL-cum-ML or ML to any prospective buyer

— the NERP / PL-cum-ML / ML holder should have the freedom to enter into joint venture or partnership with anybody.

— there should be security of tenure with provision to renew the lease if there is mineral still available in the deposit.

WORLD EXPLORATION EXPENDITURE

Table – I

Exploration Expenditure

Year	Companies involved	Amount spent (US$ billion)	% age increase / decrease over preceding year
2006	1624	7.1	45.5
2007	1821	9.9	40.0
2008	1912	12.6	26.0
2009	1846	7.32	(-) 42.0
2010	2089	10.68	45.45
2011	2400	17.25	61.52
2012	3500	20.53	19.00
2013	3500	14.43	(-) 29.70
2014	2700	10.74	(-) 26.00
2015	3500	9.20	(-)19.00
2016	1580	7.3	(-) 21.00
2017	1535	8.4	15.06

Source: Metals Economic Group, Canada (For 2006-15)
S&P Global Market Intelligence (For 2016 and 2017)

The exploration expenditure is dependent on the market conditions for a mineral / metal and swings in favour of one, whose demand and price is more attractive, than the one whose demand and consequently price is comparatively less attractive. This will be clear from the following table :

Table – II

Commodity-wise expenditure on exploration

(US$ billion)

Year	Gold	Base Metals (copper, nickel ,lead/zinc)	Diamond	PGM (platinum group of metals)	Other Minerals	Total
2006	3.21 (45%)	2.28 (32%)	0.86 (12%)	0.21 (3%)	0.57 (8%)	**7.13 (100%)**
2007	4.10 (41%)	3.60 (36%)	1.00 (10%)	0.30 (3%)	1.00 (10%)	**9.99 (100%)**
2008	4.91 (39%)	5.04 (40%)	1.008 (8%)	0.378 (3%)	1.26 (10%)	**12.6 (100%)**
2009	3.51 (48%)	2.64 (36%)	0.36 (5%)	0.15 (2%)	0.66 (9%)	**7.32 (100%)**
2010	5.45 (51%)	3.52 (33%)	0.32 (3%)	0.21 (2%)	1.18 (11%)	**10.68 (100%)**
2011	8.28 (48%)	5.35 (31%)	0.52 (3%)	0.26 (1.5%)	2.85 (16.5%)	**17.25 (100%)**

Year	Gold	Base Metals (copper, nickel ,lead/zinc)	Diamond	PGM (platinum group of metals)	Other Minerals	Total
2012	9.65 (47%)	6.57 (32%)	0.62 (3%)	0.31 (1.5%)	3.39 (16.5%)	**20.53 (100%)**
2013	6.64 (46%)	4.76 (33%)	0.58 (4%)	0.14 (1%)	2.31 (16%)	**14.43 (100%)**
2014	4.62 (43%)	3.76 (35%)	0.54 (5%)	0.21 (2%)	1.61 (15%)	**10.74 (100%)**
2015	4.14 (45%)	3.13 (34%)	0.46 (5%)	0.14 (1.5%)	1.33 (14.5%)	**9.20 (100%)**
2016	3.48 (50%)	2.16 (31%)	0.28 (4%)	0.070 (1%)	0.97 (14%)	**6.97 (100%)**
2017	4.05 (51%)	2.38 (30%)	0.25 (3%)	0.080 (1%)	1.19 (15%)	**7.95 (100%)**

Source: Metals Economic Group, Canada (For 2006-10)
S&P Global Market Intelligence (For 2011-17)

And, finally, which country has spent how much on exploration in last five years:

Table – III

Country-wise expenditure

(US$ billion)

Country	2012		2013		2014		2015		2016		2017	
	Amount	% Age	Amount	% Age	Amount	% Age	Amount	% Age	Amount	% Age	Amount	% Age
Canada	3.29	16	1.88	13	1.51	14	1.28	14	0.97	14	1.11	14
Australia	2.46	12	1.88	13	1.30	12	1.09	12	0.90	13	1.08	13
US	1.64	8	1.01	7	0.75	7	0.74	8	0.49	7	0.64	8
Russia	0.62	3	0.72	5	0.54	5	0.46	5	0.35	5	0.32	4
Mexico	1.23	6	0.87	6	0.75	7	0.54	6	0.42	6	0.48	6
Peru	1.03	5	0.72	5	0.54	5	0.54	6	0.42	6	0.56	7
Chile	1.03	5	0.87	6	0.75	7	0.69	7	0.42	6	0.64	8
South Africa	0.00	-	0.43	3	0.30	3	0.35	4	0.28	4	0.16	2
China	0.81	4	0.57	4	0.70	6	0.54	6	0.42	6	0.40	5
Brazil	0.62	3	0.04	3	0.30	3	0.27	3	0.28	4	0.24	3
Argentina	0.62	3	-	-	-	-	-	-	-	-	0.16	2
DRC	-	-	-	-	0.30	3	0.13	2	0.14	2	-	-
Other countries	7.18	35	5.44	35	3.00	28	2.57	27	1.88	27	2.16	28
Total	**20.53**	**100**	**14.43**	**100**	**10.74**	**100**	**9.20**	**100**	**6.97**	**100**	**7.95**	**100**

Source: Metals Economic Group, Canada (For 2011-15)
S&P Global Market Intelligence (For 2016 and 2017)

2. The above table indicates that India, though considered among mineral-rich countries, hardly spends anything on exploration. The amount mostly commonly mentioned is around US$ 15 million annually. This makes India as one of the least explored countries in the world. Since exploration was not encouraged, there was hardly any FDI in the mining sector despite the fact that since February 2000, the mining sector was opened up for 100% foreign direct investment.
