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DIAMOND

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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9 Diamond

Diamond has been the most valuable among gems for more than 2,000 years. Diamond occurs in two types of deposits, primarily in igneous rocks of basic or ultrabasic composition and in alluvial deposits derived from the primary sources. Its composition is pure carbon and has cubic crystal system and common form octahedron. India is known for its diamond cutting & polishing business especially for small sized diamonds. Most of the world's diamond cutting and polishing business comes to India, particularly to Surat in Gujarat. India depends largely on imports of rough gem diamonds for its Cutting and Polishing Industry as there is no notable production except for two producers in Madhya Pradesh whose limited production is too sparse to meet the Cutting and Polishing Industry's requirements. The cut and polished diamonds are predominantly re-exported.

Diamond has a high refractive index and strong dispersion which gives it exciting brilliance when cut as a faceted stone. Gem diamonds are transparent and colourless or show faint shades of different colours.

Flawless stones of good colour are abundantly used in gem trade while off-colour, flawed & defective stones, chips & cuttings as well as small grains & dust are used in many other ways in the industry. Industrial grade diamond, i.e., diamond that does not meet gem quality standards in terms of colour, clarity, size or shape and those that are produced as a by-product of mining gem diamonds continue to be used principally as abrasives in many applications despite their initial cost. Although diamond is more expensive than the other abrasive materials, it is more cost-effective in numerous industrial processes because it lasts longer than any other material.

Broadly, industrial diamonds have three varieties viz, 'ballas' which is mass of minute diamond crystals difficult to cleave; 'bort' is yellowish grey to black colour and massive, flawed or irregular in shape and 'carbonado' is black, very hard, opaque and without cleavage.

RESERVES/RESOURCES

Diamond occurrences are reported since prehistoric times in the country. Presently, diamond fields of India are grouped into four regions:

1. South Indian tract of Andhra Pradesh, comprising parts of Anantapur, Kadapa, Guntur, Krishna, Mahabubnagar and Kurnool districts;
2. Central Indian tract of Madhya Pradesh, comprising Panna belt;
3. Behradin-Kodawali area in Raipur district and Tokapal, Dugapal, etc. areas in Bastar district of Chhattisgarh; and
4. Eastern Indian tract mostly of Odisha, lying between Mahanadi and Godavari valleys.

As per the NMI data, based on UNFC system as on 1.4.2015, all India reserves/resources of diamond have been placed at 31.83 million carats. Out of these, 0.95 million carats are placed under Reserves category and 30.87 million carats under Remaining Resources category. By grades, about 2.37% resources are of Gem variety, 2.64% of Industrial variety and bulk of the resources (95%) are placed under Unclassified category. By States, Madhya Pradesh accounts for about 90.18% resources followed by Andhra Pradesh 5.72% and Chhattisgarh 4.09% (Table-1).

EXPLORATION & DEVELOPMENT

The Exploration & Development details, if any, are covered in the Review on Exploration & Development under "General Reviews".

Table –1 : Reserves/Resources of Diamond as on 1.4.2015
(By Grades/States)

(In carats)

State/Grades	Reserves				Remaining Resources								Total Resources (A+B)
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
	STD111			(A)	STD211			STD331	STD332	STD333	STD334	(B)	
		STD121	STD122			STD221	STD222						
All India:Total	**959500**	**-**	**159**	**959659**	**-**	**-**	**-**	**304601**	**1524317**	**29047514**	**-**	**30876432**	**31836091**
By Grades													
Gem	-	-	-	-	-	-	-	158819	1017	596929	-	756765	756765
Industrial	-	-	-	-	-	-	-	41664	223	798936	-	840823	840823
Unclassified	959500	-	159	959659	-	-	-	104118	1523077	27651649	-	29278844	30238503
By States													
Andhra Pradesh	-	-	-	-	-	-	-	200483	1524317	98155	-	1822955	1822955
Chhattisgarh	-	-	-	-	-	-	-	-	-	1304000	-	1304000	1304000
Madhya Pradesh	959500	-	159	959659	-	-	-	104118	-	27645359	-	27749477	28709136

Figures rounded off

PRODUCTION & STOCKS

Production of diamond at 28,816 carats decreased by 25% in 2019-20 as against 38,437 carats in the previous year. There were two reporting mines, both under Public Sector located in district Panna of, Madhya Pradesh (Tables- 2 & 3).

Out of the total output, Gem variety covering rough & uncut constituted 36% and the remaining 64% was of Industrial grade varieties (Table-4).

Mine- head closing stocks during the year 2019-20 were 33,938 carats as against 39,163 carats in the previous year (Table-5).

The average daily employment of labour during 2019-20 was 156 as against 131 in 2018-19.

Table – 2 : Principal Producers of Diamond, 2019-20

Name and address of producer	Location of mine	
	State	District
National Mineral Development Corporation Ltd 10-3-311/A, Khanij Bhavan, Castle Hills, Masab Tank, Hyderabad-500 028, Andhra Pradesh	Madhya Pradesh	Panna
Directorate of Geology & Mining (Diamond Project) Government of Madhya Pradesh, Khanij Bhavan, 29-A, Arera Hills, Bhopal - 462 016, Madhya Pradesh.	Madhya Pradesh	Panna

Table – 3 : Production of Diamond, 2017-18 to 2019-20 (By State)

(Quantity in carats; Value in `'000)

State	2017-18		2018-19		2019-20 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**39699**	**374110**	**38437**	**539062**	**28816**	**398070**
Madhya Pradesh	39699	374110	38437	539062	28816	398070

Table – 4 : Production of Diamond, 2018-19 & 2019-20 (By Sector/State/District/Grades)

(Quantity in carats; Value in `'000)

State/District	2018-19					2019-20 (P)				
	No. of mines	Quantity			Value	No. of mines	Quantity			Value
		Gem (rough & uncut)	Industrial*	Total			Gem (rough & uncut)	Industrial*	Total	
India	**2**	**13877**	**24560**	**38437**	**539062**	**2**	**10301**	**18515**	**28816**	**398070**
Public Sector	2	13877	24560	38437	539062	2	10301	18515	28816	398070
Madhya Pradesh	**2**	**13877**	**24560**	**38437**	**539062**	**2**	**10301**	**18515**	**28816**	398070
Panna	2	13877	24560	38437	539062	2	10301	18515	28816	398070

** Includes off-colour and dark-brown varieties of diamond.*

Table – 5 : Mine-head Closing Stocks of Diamond, 2018-19 & 2019-20
(By State)

(In carats)

State	2018-19	2019-20 (P)
India	**39163**	**33938**
Madhya Pradesh	39163	33938

MINING & PROCESSING

Majhgawan in Madhya Pradesh is a fully mechanised mine operated by National Mineral Development Corporation Ltd. It is worked by opencast method in tuff rock by deploying 4.1 cu. m hydraulic shovel and 40 tonnes dumpers in combination. The mine benches have been designed with a height of about 10 m. A few benches are of 4-5 m height. Drilling is done by 4-inch diameter drills and charged with slurry explosives, and about 40-50 holes are blasted at a time with delay pattern. The capacity of the mine is about 30,000 carats per year. Diamonds are also recovered from conglomerate and gravel beds at shallow depths by small operations on the basis of annual permits granted by Diamond Officer, Government of Madhya Pradesh. At Majhgawan, kimberlite rock, after mining the ore is stockpiled for weathering action and then is fed to crushing plant. It is processed through Heavy Media Separation System in processing plant for recovery of diamond. Recently, X-ray diamond sorter has been installed for sorting of diamonds from ore and this has increased the recovery of raw diamonds to 98%.

Diamond Mining Factors

Grade

Grade is the weight of diamond expressed as carats per tonne (ct/t) of ore. It varies widely from one mine to another but generally falls somewhere between 0.3 and 1.3 ct/t. One carat is equivalent to 0.2 grams.

Size (weight) of Rough Diamonds in Deposit
Individually, rough diamonds can range from microweight to stones weighing more than 1,000 carats. Depending on the mine, the average size of rough diamond recovered can weigh from 0.01 ct (about 1 mm) to more than 0.7 ct. Many mines in the world show an average of about 0.4 to 0.5 ct per tonne.

INDUSTRY

Indian Diamond Industry enjoys credible standing and reputation in the world market, particularly for small diamonds used in jewellery. Indian diamond manufacturing standards are reckoned as the best in the world. Workmanship & skill of Indian artisans at polishing small diamonds economically and efficiently has been widely acknowledged. Surat in Gujarat is the main centre of the Cutting and Polishing Industry.

The Indian Diamond Industry thrives in the atmosphere of secrecy and informality that envelops the diamond trade and has for long been labeled as an unorganised sector of the economy. However, it resembles a close-knit community composed of thousands of small, medium and large sized CPD (cut and polished diamonds) units and has grown to become one of the highest foreign exchange earners for the country. An in-depth study of the Industry reveals that the so called unorganised sector is in fact highly organised and has great potential to offer useful insights to the field of management in terms of new forms of organising, networking, business processing and conducting international business.

India's predominance as leader in the world market is due to a combination of pragmatic policies of the Government and sustained efforts of exporters. Policy changes, such as, creation of Special Economic Zones (SEZ) is expected to boost the export prospects further. Several diamond polishing companies have already established offices in India for trading in rough & polished diamonds. India obtains rough diamonds from Belgium, UK, Hong Kong, UAE, Israel, etc. Indian diamond traders seek opportunities to establish direct trade ties with mining companies. The expectations of the Indian Diamond Industry are to access rough diamonds at competitive rates directly from the producers to maintain its lead in the world market.

NMDC is actively pursuing grant of 3 PLs that fall in the Kalyandurg area, Anantpur district of Andhra Pradesh. FAC recommended for forest permission for drilling. Further, in Madhya Pradesh, Government of Madhya Pradesh issued Gazette Notifications of 20 diamond prospective blocks alongwith various minerals prospective block which were applied under MoU for exploration and subsequent reservation.

Remote Sensing Studies have been completed in collaboration with NRSC. Chhattarpur-Panna Block 1, Chhattarpur-Panna Block 2 and Damoh Block, Panna (5 Prospective Blocks) and Additional 12 Diamond Blocks.

Several target areas were established after conducting ground magnetic, VLF-EM & Gravity surveys and stream sediment sampling and several additional anomalous areas were demarcated in the diamond blocks by processing the Raw Aeromagnetic Data acquired/provided by GSI in Diamond Blocks.

Forest applications for drilling has been prepared and submitted. The matter is being pursued with Forest Department for obtaining permission for drilling.

Proposals were submitted to the Government of Chhattisgarh for Baloda - Belmundi Diamond Block over an area of 156.80 sq km in Saraipali tehsil, Mahasamund district for reservation under Section 17(A) (2A) of MM (D&R) Amendment Act, 2015 for undertaking prospecting and exploitation operations. The matter is under consideration of Government of Chhattisgarh.

CONSUMPTION

Industrial diamonds are mostly consumed by manufacturers of drill bits, grinding tools and stone cutting & polishing machines and demand of industrial diamonds is mostly met by imports. There are many small-scale sector units that operate in cutting & polishing trade.

SUBSTITUTES

Synthetic Diamond

Today, market for industrial diamond is dominated by synthetic stones, first developed in 1950s. Synthetic diamonds manufactured using high pressure and high temperature methods compete as an abrasive mineral with natural industrial diamonds and also with manufactured materials like silicon carbide (SiC), alumina (Al_2O_3), tungsten carbide (WC) and carbide boron nitrate (CBN). Synthetic diamonds being marketed are mostly 0.6-0.8 mm and smaller in size. Synthetic Diamond Abrasives (SDA) are used for sawing, drilling or milling hard stones, concrete aggregate, refractory materials, masonry and asphalt. In general, large crystals are used for cutting softer materials and smaller crystals for tougher jobs. Synthetic diamonds now account for bulk supply of industrial diamonds and are preferred over natural diamonds because their quality can be controlled to suit customer's requirements.

Synthetic diamonds were produced earlier by using graphite with a metal catalyst under very high pressure & temperature.

Of late a new process, such as, Chemical Vapour Deposition (CVD) has been evolved which requires relatively low pressure for production of synthetic diamonds. This process involves depositing tiny crystals of diamond on a film which can be built in complicated shapes and used at desired places or instruments, such as, machine part, heat conductors in micro circuit, shortwave UV, microwave sources and radiation detectors. In future, CVD can be a substitute for silicon in Computer Industry. In USA, developments have taken place in CVD method of growing 100% pure diamond using microwave plasma technology. This method is more economical and also enables production of larger crystals.

TRADE POLICY

Import of diamond under HS Code 7102, whether or not worked, but not mounted or set, fall under 'Free' category as per the Export-Import Policy 2015-2020. Foreign Direct Investment (FDI) in diamond mining up to 100% is admissible for automatic approval of Reserve Bank of India.

WORLD REVIEW

The world reserves of industrial diamond are about 1,400 million carats located mainly in Russia (46%), Botswana (22%),Congo (Kinshasa) (11%), South Africa (9%) and Australia (2%). The world reserves of diamond are furnished in Table-6.

The total world production of diamond decreased marginally by about 9% from 149.4 million carats in 2018 to 135.8 million carats in 2019.

The principal producers were Russia (33%), Botswana (17%), Canada (14%), Congo, Dem. Rep. (10%), Australia (9%), Angola (7%) and South Africa (5%). During the year, increase in diamond production was observed in Sierra Leone, while increase in production was observed in Russia and Angola (Table-7).

Natural diamonds are cut in about 52 countries. The major diamond cutting centres in the world are Antwerp in Belgium, Ramat Gan in Israel, New York in USA, Surat in India and Guangzhou & Shenzhen in China.

Table – 6 : World Reserves of Diamond (Industrial) (By Principal Countries)

(In million carats)

Country	Reserves
World : Total (rounded off)	**1400**
Australia	25[a]
Botswana	310
Congo (Kinshasa)	150
Russia	650
South Africa	130
USA	NA
Zimbabwe	NA
Other countries	120

Source: *Mineral Commodity Summaries,USGS, 2021*
a - In Australia, Joint Ore Reserves Committee - compliants reserves were 25 million carats.

Table – 7 : World Production of Diamond (By Principal Countries)

(In '000 carats)

Country	2017	2018	2019
World: Total	**150700**	**149400**	**135800**
Russia	42615	43161	45271
Botswana	22900	27373	23278
Canada	23199	22789	18491
Congo, Dem. Rep.	18892	15131	13470
Australia	17135	14008	12155
Angola	9439	8409	9150
South Africa	9685	9911	7177
Zimbabwe	2508	3252	2119
Namibia	1816	2092	1745
Other countries	2500	3263	2959

Source: *BGS World Mineral Production, 2015-2019*
Figures rounded off

For a generalised view of the development in various countries, the countrywise description sourced from the latest available publication of Minerals Yearbook 'USGS 2017' is furnished below.

Canada

The operator of a diamond mine in the Northwest Territories, Canada began commercial production from the A-21 kimberlite pipe during the fourth quarter of 2018.

Botswana

The Cut - 8 project at Jwaneg Mine in Botswana owned by De Beers will begin producing diamonds in 2017.

Russia

ALROSA's Verkhne-Munskoe Mine in the Republic of Sakha (Yakutia, Russia) started production during fourth quarter of 2017.

Angola

ALROSA announced in 2017 that it has plans to work with Endiama to develop the Luele kimberlite mine in the Luaxe concession in Angola.

Exports

Value of exports of diamond decreased copnsiderably by 20% to ` 1,40,033 crore in 2019-20 against ` 1,75,817 crore in the previous year. Diamond (mostly cut) alone accounted for almost cent per cent exports in terms of value during this year. The share of industrial diamonds and diamond powder was about ` 38 crore and ` 20 crore, respectively in 2019-20. Exports were mainly to USA (35%), Hong Kong (33%), Belgium (11%), UAE (6%) and Israel (5%) (Tables- 8 to 11).

Imports

In 2019-20, imports value of diamond decreased by about 16% to ` 1,48,735 crore from ` 1,77,971 crore in the previous year. Diamond (mostly cut) shared the bulk, i.e., almost cent per cent of the imports in terms of value. Imports of industrial diamond and diamond powder were about 10.43 million carats and 816.43 million carats, respectively, valued at ` 602 crore and ` 181 crore, respectively. Imports were mainly from Belgium & UAE (24% each), USA (21%), Hong Kong (13%), Botswana (4%) and Israel (3%) (Tables-12 to 15).

Table – 8 : Exports of Diamond : Total (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty **	Value (`'000)	Qty **	Value (`'000)
All Countries	**	**1758167200**	**	**1400336078**
USA	**	576645999	**	490574966
Hong Kong	**	662244340	**	455362427
Belgium	**	165839333	**	147907639
UAE	**	107448939	**	90364448
Israel	**	69846899	**	64023387
Thailand	**	36654897	**	39823323
Japan	**	27029235	**	24916626
Singapore	**	18024006	**	14500734
UK	**	9520690	**	9541466
Australia	**	10916386	**	9117527
Other countries	**	73996477	**	54203536

Figures rounded off

Note:''Quantity not given due to partial coverage; value figures, however, have full coverage

Table – 9 : Exports of Diamond (Industrial) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (carats)	Value (`'000)	Qty (carats)	Value (`'000)
All Countries	**7730667**	**545528**	**7410678**	**387187**
USA	905958	62178	892165	80051
UK	2401928	70521	1969601	72923
Belgium	818243	93070	747702	46232
Israel	1101300	28201	1941004	45155
Ireland	1383166	51874	1135564	34091
China	637024	51686	334208	26695
Taiwan	1061	24581	1061	23588
Botswana	71820	31829	53061	20586
Germany	124682	7430	139177	15325
UAE	176697	110099	132131	10833
Other countries	108788	14059	65004	11708

Figures rounded off

Table – 10 : Exports of Diamond (Mostly Cut)# (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty **	Value (`'000)	Qty **	Value (`'000)
All Countries	**	**1757329009**	**	**1399742301**
USA	**	576464431	**	490408946
Hong Kong	**	662230501	**	455355721
Belgium	**	165709427	**	147833342
UAE	**	107338789	**	90353610
Israel	**	69779598	**	63945997
Thailand	**	36649400	**	39823236
Japan	**	27021455	**	24915356
Singapore	**	18024006	**	14500734
UK	**	9419630	**	9450922
Australia	**	10916330	**	9117527
Other countries	**	73775444	**	54036909

Figures rounded off

Note:''Quantity not given due to partial coverage; value figures, however, have full coverage

Table – 11 : Exports of Diamond (Powder) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (TCA)	Value (`'000)	Qty (TCA)	Value (`'000)
All Countries	**10556**	**292662**	**8651**	**206591**
USA	4498	119390	4373	85969
Israel	1547	39100	1614	32235
Belgium	1026	36836	970	28066
UK	928	30539	558	17620
Germany	625	27464	482	13922
Switzerland	1325	11065	163	10625
Ireland	249	9583	254	9278
China	130	1120	94	4504
Swaziland	-	-	20	1665
Canada	-	-	50	653
Other countries	229	17564	73	2054

Figures rounded off

Table – 12 : Imports of Diamond (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty **	Value (`'000)	Qty **	Value (`'000)
All Countries	****	**1779709899**	****	**1487354321**
Belgium	**	460461035	**	361643796
UAE	**	396088648	**	351172420
USA	**	385749791	**	307848602
Hong Kong	**	245024343	**	193079963
Botswana	**	68085363	**	52770671
Israel	**	62551818	**	45890142
South Africa	**	27538661	**	41472378
Russia	**	36540173	**	37913083
Canada	**	18710080	**	25664519
UK	**	17403353	**	18949349
Other countries	**	61556633	**	50949399

Figures rounded off.

Note:'**'Quantity iven due to partial coverage;value figures, however, have full coverage.

Table – 13 : Imports of Diamond (Industrial) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (carats)	Value (`'000)	Qty (carats)	Value (`'000)
All Countries	**5120796**	**3864007**	**10427197**	**6024785**
UAE	3009997	2094735	7883170	4493361
Belgium	833002	421642	1048934	538646
Russia	684819	912984	647071	525002
Hong Kong	182846	266818	187810	227558
South Africa	245169	121818	445066	182160
Botswana	29724	28104	56544	35460
Israel	31794	5944	140644	19915
UK	38993	5651	14617	2014
Ireland	1000	367	3200	638
USA	62444	3878	141	32
Other countries	1008	2066	-	-

Figures rounded off

Table – 14 : Imports of Diamond (Powder) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (TCA)	Value (`'000)	Qty (TCA)	Value (`'000)
All Countries	**763772**	**2073544**	**816432**	**1813541**
China	738559	1837935	793988	1594178
Ireland	12050	97743	9439	85508
USA	5277	63588	3348	43875
Belgium	1833	20849	1495	27648
Korea, Rep. of	3604	27590	2504	19259
Hong Kong	918	6343	3175	19055
Switzerland	1008	12974	1601	17656
UK	78	3530	58	2403
UAE	319	1045	661	1718
Iran	--	--	75	780
Other countries	126	1946	90	1462

Figures rounded off

Table – 15 : Imports of Diamond (Mostly cut) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty **	Value (`'000)	Qty **	Value (`'000)
All Countries	******	**1773772348**	******	**1479515995**
Belgium	**	460018543	**	361077503
UAE	**	393992868	**	346677341
USA	**	385682325	**	307804696
Hong Kong	**	244751182	**	192833350
Botswana	**	68057259	**	52735211
Israel	**	62545739	**	45870053
South Africa	**	27416843	**	41290218
Russia	**	35627189	**	37388081
Canada	**	18710080	**	25664519
UK	**	17394172	**	18944931
Other countries	**	59576148	**	49230093

Figures rounded off

Note:'**'Quantity not given due to partial coverage;value figures, however, have full coverage.

FUTURE OUTLOOK

The Diamond Industry in the country currently employs over 8 lakh artisans who are experts in cutting and polishing of small diamonds and are now in a position to process full range of sizes and qualities of gemstones using latest technology.

The Chinese Government has begun to initiate multi-billion dollar deals for rough diamonds in exchange for things that China produces like medicines, oils and industrial goods & services. Also, China's investment in Africa is a large threat to the Indian diamond cutting and polishing industry. There is a growing preference for polishing diamonds in countries where the diamonds are mined, like in Africa. It means that the Indian sector may face problems as India is not a large producer, and depends on import of rough diamonds from Africa. Low profit margins in the cutting and polishing segment have heightened midstream players' interest in synthetic diamonds, but synthetics have to be contented with only limited acceptance among jewellery retailers and end consumers.

With the support in the form of increasing urbanisation, middle-class expansion and appeal as engagement rings, India will be emerge as a third largest market for diamond jewellery leaving behind Europe and Japan. Meanwhile, China and the US are expected to remain as the leading diamond jewellery markets.