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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. Indian Diamond Industry handles about 80% of the global polished diamond market. 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 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 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 pre-historic 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 given in the review on Exploration & Development in "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 was at 39,699 carats in 2017-18 as against 36,491 carats in the previous year. There were two operating mines, both under Public Sector located in Panna district of Madhya Pradesh (Tabels- 2 & 3).

Out of the total output, gem variety covering rough & uncut constituted 33% and the remaining 67% was industrial grade varieties (Table-4).

Mine- head closing stocks during the year 2017-18 were 25,625 carats as against 24,102 carats in the previous year (Table-5).

The average daily employment of labour during 2017-18 was 134 as against 157 in 2016-17.

Table – 2 : Principal Producers of Diamond, 2017-18

Name & 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, 2015-16 to 2017-18
(By State)

(Quantity in carats; value in `'000)

State	2015-16		2016-17		2017-18 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**36044**	**621441**	**36491**	**639562**	**39699**	**410737**
Madhya Pradesh	36044	621441	36491	639562	39699	410737

Table – 4 : Production of Diamond, 2016-17 & 2017-18
(By Sector/State/District/Grades)

(Quantity in carats; value in `'000)

State/District	2016-17					2017-18 (P)				
	No. of mines	Quantity			Value	No. of mines	Quantity			Value
		Gem (rough & uncut)	Industrial*	Total			Gem (rough & uncut)	Industrial*	Total	
India	**2**	**13968**	**22523**	**36491**	**639562**	**2**	**12937**	**26762**	**39699**	**410737**
Public Sector	2	13968	22523	36491	639562	2	12937	26762	39699	410737
Madhya Pradesh/	**2**	**13968**	**22523**	**36491**	**639562**	**2**	**12937**	**26762**	**39699**	**410737**
Panna	2	13968	22523	36491	639562	2	12937	26762	39699	410737

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

Table – 5 : Mine-head Closing Stocks of Diamond, 2016-17 & 2017-18
(By State)

(In carats)

State	2016-17	2017-18 (P)
India/Madhya Pradesh	**24102**	**25625**

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. 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 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 unorganized 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 for doing 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.

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 1,200 million carats located mainly in Russia (54%), Congo (Kinshasa) (12.5%), Australia (10%), Botswana (7.5%) and South Africa (6%). The world reserves of diamond are furnished in Table-6.

The total world production of diamond increased from 121.7 million carats in 2016 to 146.7 million carats in 2017.

The principal producers were Russia (29%), Botswana (16%), Australia (12%), Congo, Dem. Rep. (11%), Canada (15%), Angola (6%) and South Africa (7%). During the year, sudden increase by about 105 % in diamond production was observed in Canada, while increase in production by Congo, Dem. Rep. (24%), Australia (23%), Zimbabwe (19%) and South Africa (15%) was recorded (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) for the year 2018 (By Principal Countries)

(In million carats)

Country	Reserves
World : Total (rounded off)	**1200**
Australia	120
Botswana	90
Congo (Kinshasa)	150
Russia	650
South Africa	70
Other countries	90

Source: *Mineral Commodity Summaries,USGS, 2019*

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

(In '000 carats)

Country	2015	2016	2017
World Total	**126400**	**121700**	**146700**
Angola	9019	9022	9439
Australia	13561	13958	17135
Botswana	20824	20954	22900
Canada	11677	11104	22724
Congo, Dem. P. R.	14284	12377	15404
Ghana	174	143	87
Guinea	167	113	181
Guyana	118	140	52
Lesotho	304	342	126
Namibia	1775	1584	1816
Russia	41912	40322	42615
Sierra Leone	500	550	289
South Africa	8233	8451	9685
Zimbabwe	3491	2103	2508
Other countries	646	791	1972

Source: *World Mineral Production,BGS, 2013-2017*

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.

FOREIGN TRADE

Exports

Value of exports of diamond decreased marginally to ` 1,62,022 crore in 2017-18 against ` 1,62,706 crore in the previous year. Diamond (mostly cut) alone accounted for almost cent-percent exports in terms of value. The share of industrial diamonds and diamond powder was about ` 61 crore and ` 30 crore, respectively in 2017-18. Exports were mainly to Hong Kong (40%), USA (30%), Belgium (9%), UAE (8%) and Israel (about 4%) (Tables- 8 to 11).

Imports

In 2017-18, imports value of diamond increased by about 47% to ` 1,90,203 crore from ` 1,29,674 crore in the previous year. Uncut diamond shared the bulk, i.e., almost cent-percent of the imports. Imports of industrial diamond and diamond powder were about 1.1 million carats and 699 million carats, respectively, valued at ` 91 crore and ` 200 crore, respectively. Imports were mainly from Unspecified countries (27%), UAE (15%), Belgium (14%), Russia (12%), Hong Kong (11%), Botswana (6%), Canada (4%) and Israel (3%) (Tables-12 to 15).

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

Country	2016-17		2017-18	
	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	**	**1627066250**	++	**1620221010**
Hong Kong	**	615325376	++	641616120
USA	**	494373745	++	486728583
Belgium	**	160166429	++	149405014
UAE	**	147895724	++	125868479
Israel	**	66511146	++	65950442
Thailand	**	35654022	++	37338144
Singapore	**	19935928	++	17811737
Japan	**	16082073	++	16034595
China	++	9355655	++	14052842
Switzerland	**	11591674	++	12434600
Other countries	**	50174478	++	52980454

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

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

Country	2016-17		2017-18	
	Qty (carats)	Value (`'000)	Qty (carats)	Value (`'000)
All Countries	**6769897**	**1099542**	**9739890**	**613848**
Belgium	653976	537642	730885	150772
Hong Kong	491610	23120	163671	98544
USA	770194	59240	709384	72304
UK	1565919	65332	1960195	65107
China	183714	16267	536214	53694
Ireland	610669	34112	974222	52427
Israel	1654586	54951	1416264	47725
UAE	609512	255578	317264	19202
Botswana	123632	39262	75941	18552
ChineseTaipei/ Taiwan	152	3681	597	14226
Other countries	105933	10357	2855253	21295

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

Country	2016-17		2017-18	
	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	******	**1625672978**	******	**1619309698**
Hong Kong	**	615284341	**	641508972
USA	**	494209520	**	486520616
Belgium	**	159583449	**	149214903
UAE	**	147640135	**	125849099
Israel	**	66430515	**	65877232
Thailand	**	35650539	**	37334192
Singapore	**	19935868	**	17811737
Japan	**	16071614	**	16030819
China	**	9337070	**	13998650
Switzerland	**	11575597	**	12420503
Other countries	**	49954330	**	52742975

*#: The quantity published in earlier issues for the years 2014-15 , 2015-16, 2016-17 may be treated as '**' since it is found that the unit quantities were non additive*

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

Country	2016-17		2017-18	
	Qty ('000 carats)	Value (`'000)	Qty ('000 carats)	Value (`'000)
All Countries	**8197**	**293730**	**11123**	**297464**
USA	2734	104985	4473	135663
Belgium	1221	45338	1106	39339
UK	609	20663	885	30174
Germany	706	25883	827	25892
Israel	1071	25680	1097	25485
Switzerland	842	16077	1937	14097
Ireland	439	15759	343	12124
Hong Kong	90	17915	117	8604
Canada	-	-	80	1073
Swaziland	-	-	10	767
Other countries	485	21430	248	4246

Table – 12 : Imports of Diamond (By Countries)

Country	2016-17		2017-18	
	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	****	**1296740696**	****	**1902035832**
UAE	**	297944868	**	292336251
Belgium	**	340326541	**	263833066
Russia	**	151287534	**	223550113
Hong Kong	**	140731408	**	200130173
Botswana	**	87586948	**	105556669
Canada	**	36923798	**	74430904
Israel	**	74632840	**	64103827
Angola	**	20838717	**	45427407
USA	**	27171166	**	27555973
Unspecified	**	5330434	**	508940629
Other countries	**	113966442	**	96170820

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

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

Country	2016-17		2017-18	
	Qty (carats)	Value (`'000)	Qty (carats)	Value (`'000)
All Countries	**954463**	**798242**	**1147013**	**910898**
Russia	254695	241486	355387	382848
Congo, Dem. Rep.	120903	198009	269519	151177
UAE	147806	74752	96159	109189
Hong Kong	7665	14850	24210	76107
Botswana	168632	49499	124417	63278
Zimbabwe	201826	119530	55145	45544
Congo, Peo. Rep	29893	57716	46607	42156
Belgium	11867	34218	171010	40026
Israel	1351	412	3353	225
Australia	1850	1252	700	174
Other countries	7975	6518	506	174

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

Country	2016-17		2017-18	
	Qty ('000 carats)	Value (`'000)	Qty ('000 carats)	Value (`'000)
All Countries	**387540**	**1516408**	**699426**	**1995246**
China	364461	1280078	678656	1780605
Ireland	5194	72782	6472	85239
USA	6238	61395	5059	59038
Korea, Rep. of	3643	34566	3613	30527
Belgium	1855	30755	1486	20397
Switzerland	675	9051	1007	11461
UK	167	3675	67	2899
Hong Kong	4478	11448	1164	2697
Germany	139	4175	1721	714
South Africa	-	-	26	613
Other countries	690	8483	155	1056

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

Country	2016-17		2017-18	
	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	****	**1294426046**	****	**1899129688**
UAE	**	297868963	**	292226668
Belgium	**	340261568	**	63772643
Russia	**	151043397	**	223167265
Hong Kong	**	140705110	**	200051369
Botswana	**	87537449	**	105493391
Canada	**	36923798	**	74430904
Israel	**	74632186	**	64103581
Angola	**	20838717	**	45427407
USA	**	27109680	**	27496935
Unspecified	**	5330434	**	508940413
Other countries	**	112174744	**	94019112

*#: The quantity published in earlier issues for the years 2014-15, 2015-16, 2016-17 may be treated as '**' since it is found that the unit quantities were non additive*

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 and 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 will have to face problems at home because India is not a large producer, and therefore, has to import 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 is set to emerge as the third-largest market for diamond jewellery by 2020, leaving behind Europe and Japan. Meanwhile, China and the US are expected to remain as the leading diamond jewellery markets.