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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 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 1.4.2020, all India reserves/resources of diamond have been placed at 31.72 million carats. Out of these, 0.84 million carats are placed under Reserves category and 30.87 million carats under Remaining Resources category. By grades, about 3.32% resources are of Gem variety, 3.45% of Industrial variety and bulk of the resources (93.22%) are placed under Unclassified category. By States, Madhya Pradesh accounts for about 90.14% resources followed by Andhra Pradesh 5.74% and Chhattisgarh 4.11% (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 1.4.2020
(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	**847400**	**0**	**159**	**847559**	**0**	**0**	**0**	**304601**	**1524317**	**29047514**	**0**	**30876432**	**31723991**
By Grades													
Gem	297692	0	0	297692	0	0	0	158819	1017	596929	0	756765	1054457
Industrial	254559	0	0	254559	0	0	0	41664	223	798936	0	840823	1095382
Unclassified	295149	0	159	295308	0	0	0	104118	1523077	27651649	0	29278844	29574152
By States													
Andhra Pradesh	0	0	0	0	0	0	0	200483	1524317	98155	0	1822955	1822955
Chhattisgarh	0	0	0	0	0	0	0	0	0	1304000	0	1304000	1304000
Madhya Pradesh	847400	0	159	847559	0	0	0	104118	0	27645359	0	27749477	28597036

Figures rounded off

PRODUCTION & STOCKS

Production of diamond at 13,917 carats decreased by 52% in 2020-21 as against 28,816 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 and other varieties (Table-4).

Mine-head closing stocks during the year 2020-21 were 25,329 carats as against 33,938 carats in the previous year (Table-5).

The average daily employment of labour during 2020-21 was 137 as against 161 in 2019-20.

Table – 2 : Principal Producers of Diamond, 2020-21

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, 2018-19 to 2020-21
(By State)

(Quantity in carats; Value in ₹'000)

State	2018-19		2019-20		2020-21 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**38437**	**539062**	**28816**	**352472**	**13917**	**220304**
Madhya Pradesh	38437	539062	28816	352472	13917	220304

Table – 4 : Production of Diamond, 2019-20 & 2020-21
(By Sector/State/District/Grades)

(Quantity in carats; Value in ₹'000)

State/District	2019-20						2020-21 (P)					
	No.of mines	Quantity				Value	No. of mines	Quantity				Value
		Gem (rough & uncut)	Industrial*	other	Total			Gem (rough & uncut)	Industrial*	other	Total	
India	**2**	**10400**	**9862**	**8554**	**28816**	**352472**	**2**	**4941**	**4619**	**4357**	**13917**	**220304**
Public Sector	2	10400	9862	8554	28816	352472	2	4941	4619	4357	13917	**220304**
Madhya Pradesh	**2**	**10400**	**9862**	**8554**	**28816**	**352472**	**2**	**4941**	**4619**	**4357**	**13917**	**220304**
Panna	2	10400	9862	8554	28816	352472	2	4941	4619	4357	13917	220304

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

Table – 5 : Mine-head Closing Stocks of Diamond, 2019-20 & 2020-21
(By State)

(In carats)

State	2019-20	2020-21 (P)
India	**33938**	**25329**
Madhya Pradesh	33938	25329

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 in 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.

Tripartite MoU among Government of Madhaya Pradesh (MRD, through DGM), MPSMCL & NMDC

was signed for geological and geophysical exploration in various Districts of Madhaya Pradesh In this regard, Government of Madhya Pradesh issued Gazette Notifications of 20 diamond prospective blocks which are 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 by NMDC 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. Ministry of Mines, Goverment of India vide G.S.R.744(E) dt 14.10.2021 granted reservation of Baloda–Belmundi Diamond Block for PL or ML in favour of NMDC-CMDC limited under Section 17A(1A) of MMDR Act, 1957. NCL vide letter dated 13.01.2022, submitted application to Secretary, MRD, Government of Chhattisgarh for grant of Prospecting Licence for Baloda–Belmundi Diamond Block.

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 to 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, Diamonds, whether or not worked, but not mounted or set, fall under 'Free' category as per the Import Policy ITC(HS), 2022 Schedule 1. 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 1,800 million carats located mainly in Russia (61%), Botswana (17%), Congo (Kinshasa) (8%), South Africa (7%) and Australia (0.6%). The world reserves of diamond are furnished in Table-6.

The total world production of diamond decreased by about 22% from 136.2 million carats in 2019 to 106.00 million carats in 2020.

The principal producers were Russia (29%), Botswana (16%), Canada (14%), Dem. Rep. of Congo (10%), Australia (9%), South Africa (8%) and Angola (7%). During the year, decrease in diamond production was observed in Russia Botswana,Australia,canada while increase in production was observed in South Africa and Zimbabwe (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)	**1800**
Australia	11[a]
Botswana	300
Congo (Kinshasa)	150
Russia	1100
South Africa	120
USA	NA
Zimbabwe	NA
Other countries	120

Source: *Mineral Commodity Summaries,USGS, 2022*
a - In Australia, Joint Ore Reserves Committee - compliants reserves were 10 million carats.

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

(In '000 carats)

Country	2018	2019	2020
World: Total	**149400**	**136200**	**106000**
Angola	8409	9150	7734
Australia	14008	12155	9980
Botswana	27373	23687	16868
Canada	22789	18491	15036
Congo, Dem. Rep.	15131	13470	10783
Namibia	2092	1745	1484
Russia	43161	45271	31187
South Africa	9911	7177	8478
Zimbabwe	3252	2119	2670
Other countries	3263	2960	1739

Source: *BGS World Mineral Production, 2016-2020*
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 2018' is furnished below.

Lesotho

The Liqhobong Diamond Mine in the Maluti Mountains of northern Lesotho began ramping up production in late 2016 and had its first full year of commercial production in 2018, when reported production was 8,36,000 carats. The mine was owned by Firestone Diamonds plc (75%) and the Government of Lesotho (25%).

Russia

ALROSA officially commissioned and started mining at the Verkhne-Munskoe Diamond Field in Yakutia on October 31, 2018. Four kimberlite pipes were explored during the last quarter of 2018. ALROSA estimated that the deposit would yield 1.8 million carats of rough diamonds per year, and the estimated reserves of the Verkhne-Munskoe diamond field were sufficient to operate for more than 20 years.

South Africa

De Beers Consolidated Mines Pty. Ltd. safely closed the mine in December 2018, but the South African Department of Mineral Resources continued looking for an operator capable of purchasing the mine. De Beers also operated the Venetia Mine in Limpopo Province, where it was conducting a $2 billion project to take the mine underground and extend its operating life into the 2040.

Exports

Value of exports of diamond decreased copnsiderably by 10% to ₹ 1,25,820 crore in 2020-21 against ₹ 1,40,033 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 ₹ 68 crore and ₹ 17 crore, respectively in 2020-21. Exports were mainly to USA (36%), Hong Kong (34%), Belgium & UAE (7% each) and Israel (5%) (Tables- 8 to 11).

Imports

In 2020-21, imports value of diamond decreased by about 14% to ₹ 1,28,351 crore from ₹ 1,48,735 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 8.72 million carats and 839.96 million carats, respectively, valued at ₹ 436 crore and ₹ 189 crore, respectively. Imports were mainly from UAE (29%), USA (21%), Belgium (20%), Hong Kong (13%), Russia (4%) and South Africa (3%) (Tables-12 to 15).

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

Country	2019-20 (R)		2020-21 (P)	
	Qty **	Value (₹'000)	Qty **	Value (₹'000)
All Countries	**	**1400336074**	**	**1258209200**
USA	**	490574966	**	457334506
Hong Kong	**	455362427	**	428968079
Belgium	**	147907639	**	93205300
UAE	**	90364448	**	82269885
Israel	**	64023387	**	60576761
Thailand	**	39823323	**	43003607
Japan	**	24916627	**	20619224
Botswana	**	8706004	**	9885172
Australia	**	9117527	**	9784895
UK	**	9541465	**	7183160
Other countries	**	59998261	**	45378611

Figures rounded off
Note:'**'Not additive

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (carats)	Value (₹'000)	Qty (carats)	Value (₹'000)
All Countries	**7410678**	**387188**	**7015880**	**688082**
UAE	132131	10833	888985	246629
Belgium	747702	46232	910757	131789
China	334208	26696	625042	119753
USA	892165	80051	532191	57876
Israel	1941004	45155	2360952	50514
Taiwan	1061	23588	1067	23159
Ireland	1135564	34091	794330	22380
U K	1969601	72923	812206	21261
Botswana	53061	20586	4421	4641
Germany	139177	15324	4777	4377
Other countries	65004	11709	81152	5703

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty **	Value (₹'000)	Qty **	Value (₹'000)
All Countries	**	**1399742298**	**	**1257345848**
USA	**	490408946	**	457215875
Hong Kong	**	455355721	**	428965865
Belgium	**	147833341	**	93050333
UAE	**	90353611	**	82023002
Israel	**	63945997	**	60500703
Thailand	**	39823237	**	43003607
Japan	**	24915356	**	20616732
Botswana	**	8685418	**	9880102
Australia	**	9117527	**	9784891
UK	**	9450922	**	7139914
Other countries	**	59852222	**	45164824

Figures rounded off
Note:'**'Not additive

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (TCA)	Value (₹'000)	Qty (TCA)	Value (₹'000)
All Countries	**8650**	**206588**	**10628**	**175270**
USA	4373	85969	4002	60755
Israel	1614	32235	1710	25544
Germany	482	13922	781	24045
Belgium	970	28066	716	23178
UK	558	17620	894	21985
Ireland	254	9278	231	7428
China	94	4504	1327	5966
Switzerland	163	10625	707	1844
Russia	-	-	60	1542
Egypt, A. Rep.	10	131	38	539
Other countries	132	4238	162	2444

Figures rounded off

Table – 12 : Imports of Diamond (By Countries)

Country	2019-20 (R)		2020-21 (P)	
	Qty	Value (₹'000)	Qty	Value (₹'000)
All Countries	**	**1487354319**	**	**1283511854**
UAE	**	351172420	**	367595066
USA	**	307848602	**	263507101
Belgium	**	361643797	**	256742721
Hong Kong	**	193079963	**	171122660
Russia	**	37913083	**	50361552
South Africa	**	41472377	**	40613537
Israel	**	45890141	**	16243763
Botswana	**	52770671	**	32833354
Thailand	**	16907190	**	18361551
Japan	**	1215438	**	9450366
Other countries	**	66504637	**	20680183

Figures rounded off.

Note:'**'Not additive

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (carats)	Value (₹'000)	Qty (carats)	Value (₹'000)
All Countries	**10427197**	**6024784**	**8725537**	**4362112**
UAE	7883170	4493361	6759538	3532523
Russia	647071	525002	423311	343374
Belgium	1048934	538646	752966	301629
South Africa	445066	182159	187761	81527
Hong Kong	187810	227557	78669	63307
Israel	140644	19915	499907	35363
Switzerland	-	-	5272	1866
UK	14617	2014	9471	1023
Ireland	3200	638	3150	562
Brazil	-	-	17	405
Other countries	56685	35492	5475	533

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (TCA)	Value (₹'000)	Qty (TCA)	Value (₹'000)
All Countries	**816431**	**1813540**	**839962**	**1898403**
China	793988	1594178	809594	1645875
Ireland	9439	85508	11283	95603
Hong Kong	3174	19055	9914	57581
U S A	3348	43875	3286	40671
Belgium	1495	27648	1660	19964
Switzerland	1601	17656	929	17559
Korea, Rep. of	2504	19259	1406	10624
Chile	-	-	1480	4598
UK	58	2403	80	1890
Italy	39	595	60	1391
Other countries	785	3363	270	2647

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty **	Value (₹'000)	Qty **	Value (₹'000)
All Countries	**	**1479515995**	**	**1277251339**
UAE	**	346677341	**	364062543
USA	**	307804695	**	263466281
Belgium	**	361077503	**	256421128
Hong Kong	**	192833351	**	171001772
Russia	**	37388081	**	50018178
South Africa	**	41290218	**	46532010
Israel	**	45870052	**	46208400
Botswana	**	52735211	**	32833354
Thailand	**	16906828	**	18360627
Japan	**	12151438	**	9450319
Other countries	**	64781277	**	18896727

Figures rounded off

Note:'**'Not 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 & 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 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.