

Indian Minerals Yearbook 2019

(Part-III: Mineral Reviews)

58th Edition

DIAMOND

(FINAL RELEASE)

GOVERNMENT OF INDIA MINISTRY OF MINES INDIAN BUREAU OF MINES

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August, 2021

9 Diamond

iamond 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 pre-historic times in the country. Presently, diamond fields of India are grouped into four regions:

- South Indian tract of Andhra Pradesh, comprising parts of Anantapur, Kadapa, Guntur, Krishna, Mahabubnagar and Kurnool districts:
- 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)
		Res	Reserves					Remaining	Remaining Resources				
													Total
State/Grades	Proved	Pro	Probable	Total	Feasibility	Pre-feasibility		feasured	Measured Indicated Inferred	Inferred	Reconnaissance Total		Resources
	STD111			(A)	STD211			STD331	STD332	STD333	STD334	(B)	(A+B)
		STD121	STD122			STD221 ST	STD222						
All India:Total	959500	•	159	959659	•			304601	1524317	29047514	٠	30876432	31836091
By Grades													
Gem	ı	1	1	ı	1		1	158819	1017	596929	•	756765	756765
Industrial	1	1	1	ı	1	1	1	41664	223	798936	1	840823	840823
Unclassified	005656	1	159	659656	1	,		104118	1523077	27651649	1	29278844	30238503
By States													
Andhra Pradesh	1	1	1	ı	,			200483	1524317	98155	,	1822955	1822955
Chhattisgarh	ı	ı	ı	ı	ı	1	1		ı	1304000		1304000	1304000
Madhya Pradesh	959500	1	159	959659	1	1	1	104118	1	27645359	1	27749477	28709136

Figures rounded off

PRODUCTION & STOCKS

Production of diamond was at 38,437 carats in 2018-19 as against 39,699 carats in the previous year. There were two reporting 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 36% and the remaining 64% was industrial -grade varieties (Table-4).

Mine- head closing stocks during the year 2018-19 were 39,163 carats as against 25,637 carats in the previous year (Table-5).

The average daily employment of labour during 2018-19 was 143 as against 135 in 2017-18.

Table - 2: Principal Producers of Diamond, 2018-19

N 6 11 6 1	Location of	of Mine	
Name & address of producer	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 -462016, Madhya Pradesh	Madhya Pradesh	Panna	

Table – 3: Production of Diamond, 2016-17 to 2018-19 (By State)

(Quantity in carats; Value in `'000)

	2016	-17	2017	7-18	2018-1	19 (P)
State	Quantity	Value	Quantity	Value	Quantity	Value
India/ Madhya Pradesh	36491	639562	39699	374110	38437	581058

Table – 4 : Production of Diamond, 2017-18 & 2018-19 (By Sector/State/District/Grades)

(Quantity in carats; Value in `'000)

			2017-18					2018-19 (P)		
G /D:	No. of		Quantity		Value	No. of		Quantity		Value
State/District	mines	Gem (rough & uncut)	Industrial*	Total		mines	Gem (rough & uncut)	Industrial*	Total	
India/Public Sector	2	13150	26549	39699	374110	2	13719	24718	38437	581058
Madhya Pradesh/ Panna	2	13150	26549	39699	374110	2	13719	24718	38437	581058

^{*} Includes off-colour and dark-brown varieties of diamond

Table – 5: Mine-head Closing Stocks of Diamond, 2017-18 & 2018-19 (By State)

 State
 2017-18
 2018-19 (P)

 India/Madhya Pradesh
 25637
 39163

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 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, NMDC has applied for 3 large area prospective blocks namely Damoh, Chhatarpur Panna Block-1 and Chhatarpur Panna Block-2 for diamond exploration. Triparte MoU among DGM, MP, MPSMCL and NMDC was signed for geological and geophysical exploration in Madhya Pradesh.NMDC has also applied for 12 additional Diamond prospective Blocks in Panna, Damoh, Sagar and Chhatarpur for exploration under Section 4(1) of MMDR Act, 1957.

A total of 418 SSS were collected and are under process. About 800 line Km Magnetic and 400 line Km VLF-EM data were acquired in proposed 45 target areas suspected for Kimberlite rocks and Gravity Survey in 3 blocks has been completed and in other blocks, it is under progress.

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 (Al₂O₃), 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. However, import of unsorted diamonds (ITC-HS Code No.71021000) is free subject to policy conditions. 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 1,100 million carats located mainly in Russia (59%), Congo (Kinshasa) (14%), Botswana (8%), South Africa (5%) and Australia (4%). The world reserves of diamond are furnished in Table-6.

The total world production of diamond increased by about 2% from 147.2 million carats in 2017 to 149.8 million carats in 2018.

The principal producers were Russia (29%), Botswana (18%), Canada (16%), Congo, Dem. Rep.

(10%), Australia (9%), South Africa (7%) and Angola (6%). During the year, drastic increase in diamond production was observed in Sierra Leone, while increase in production was noticed by Sierra Leone - manifolds, Guinea 61%, Liberia 24%, Botswana 20% and Namibia 15% (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)	1100
Australia	40*
Botswana	90
Congo (Kinshasa)	150
Russia	650
South Africa	54
USA	NA
Zimbabwe	NA
Other countries	120

Source: Mineral Commodity Summaries, USGS, 2020

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

(In '000 carats)

Country	2016	2017	2018
World: Total	121700	147200	149800
Angola	9022	9439	8409
Australia	13958	17135	14008
Botswana	20954	22900	27373
Brazil	184	255	251
Canada	11104	23199	23240
Congo, Dem. P. R.	12377	15404	15131
Guinea	113	181	293
Lesotho	342	1126	1294
Liberia	60	61	75
Namibia	1584	1816	2092
Russia	40322	42615	43161
Sierra Leone	550	289	740
South Africa	8451	9685	9911
Tanzania	238	304	381
Zimbabwe	2103	2508	3255
Other countries	366	284	226

Source: BGS World Mineral Production, 2014-2018.

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.

FOREIGN TRADE

Exports

Value of exports of diamond increased to `1,75,817 crore in 2018-19 against `1,62,022 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 `54 crore and `29 crore, respectively in 2018-19. Exports were mainly to Hong Kong (38%), USA (33%), Belgium (9%), UAE (6%) and Israel (4%) (Tables- 8 to 11).

Imports

In 2018-19, imports value of diamond decreased by about 6% to `1,77,971 crore from `1,90,204 crore in the previous year. Diamond (mostly cut) shared the bulk, i.e., almost cent-percent of the imports in terms of value. Imports of industrial diamond and diamond powder were about 5.1 million carats and 764 million carats, respectively, valued at `386 crore and `207 crore, respectively. Imports were mainly from Belgium (26%), UAE & USA (22% each), Hong Kong (14%) and Botswana & Israel (4% each) (Tables-12 to 15).

^{* -} For Australia, Joint Ore Reserves Committee - compliants reserves were 39 million carats.

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

	2	2017-18(R)		2018-19 (P)
Country	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	**	1620221010	**	1758167200
Hong Kong	**	641616119	**	662244340
USA	**	486728583	**	576645999
Belgium	**	149405014	**	165839333
UAE	**	125868479	**	107448939
Israel	**	65950443	**	69846899
Thailand	**	37338144	**	36654897
Japan	**	16034595	**	27029235
Singapore	**	17811737	**	18024006
China	**	14052841	**	15926264
Switzerland	**	12434600	**	13522901
Other countries	**	52980455	**	64984387

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

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

	2017-	-18(R)	2018-	19 (P)
Country	Qty (carats)	Value (`'000)	Qty (carats)	Value (` '000)
All Countries	9739888	613848	7730667	545528
UAE	317264	19202	176697	110099
Belgium	730885	150772	818243	93070
UK	1960195	65107	2401928	70521
USA	709384	72304	905958	62178
Ireland	974222	52427	1383166	51874
China	536214	53694	637024	51686
Botswana	75941	18552	71820	31829
Israel	1416264	47725	1101300	28201
Taiwan	597	14226	1061	24581
Hong Kong	163671	98544	105156	9661
Other countries	2855251	21295	128314	11828

Figures rounded off

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

	201	7-18(R)	20	18-19 (P)
Country	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	**	1619309698	**	1757329009
Hong Kong	**	641508972	**	662230501
USA	**	486520616	**	576464431
Belgium	**	149214903	**	165709427
UAE	**	125849099	**	107338789
Israel	**	65877232	**	69779598
Thailand	**	37334192	**	36649400
Japan	**	16030819	**	27021455
Singapore	**	17811737	**	18024006
China	**	13998650	**	15873458
Switzerland	**	12420503	**	13511836
Other countries	**	52742975	**	64726110

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

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

C	201	7-18 (R)	2018	3-19 (P)
Country	Qty (carats)	Value (`'000)	Qty (carats)	Value (`'000)
All Countries	11125003	297465	10556251	292662
USA	4472784	135663	4497640	119390
Israel	1097400	25485	1547184	39100
Belgium	1105590	39339	1026470	36836
UK	885047	30174	927585	30539
Germany	827045	25892	624883	27464
Switzerland	1936645	14097	1324500	11065
Ireland	342900	12124	248590	9583
Thailand	15020	130	121941	5451
Hong Kong	117483	8604	8333	4178
Japan	-	-	4425	3681
Other countri	ies 325089	5957	224700	5375

Figures rounded off

Table – 12 : Imports of Diamond (By Countries)

G	20	017-18 (P)		2018-19 (P)
Country	Qty (**)	Value (` '000)	Qty (**)	Value (`'000)
All Countries	**	1902035829	**	1779709903
Belgium	**	263833065	**	460461035
UAE	**	292336250	**	396088649
USA	**	27555974	**	385749791
Hong Kong	**	200130173	**	245024343
Botswana	**	105556669	**	68085363
Israel	**	64103826	**	62551818
Russia	**	223550114	**	36540173
South Africa	**	26888793	**	27538661
Singapore	**	17356191	**	19483995
Canada	**	74430904	**	18710080
Other countries	**	606293870	**	59475995

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

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

	201	7-18 (P)	2018-	-19 (P)
Country	Qty (carats)	Value (^ '000)	Qty (carats)	Value (` '000)
All Countries	1147013	910898	5120796	3864006
UAE	96159	109189	3009997	2094735
Russia	355387	382848	684819	912984
Belgium	171010	40026	833002	421642
Hong Kong	24210	76107	182846	266818
South Africa	306	28	245169	121818
Botswana	124417	63278	29724	28104
Israel	3353	225	31794	5944
UK	-	-	38993	5651
USA	-	-	62444	3878
Switzerland	-	-	3	1649
Other countries	372171	239197	2005	783

Figures rounded off

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

Country	2017-18 (P)		2018-19 (P)	
	Qty (carats)	Value (`'000)	Qty (carats)	Value (` '000)
All Countries	703178341	1995246	763771932	2073542
China	682336155	1780605	738559430	1837935
Ireland	6487350	85239	12049650	97743
USA	5078520	59038	5277100	63588
Korea, Rep. of	3625940	30527	3604327	27590
Belgium	1487045	20397	1832720	20849
Switzerland	1027415	11461	1008110	12974
Hong Kong	1164201	2697	918320	6343
UK	70700	2899	77520	3530
UAE	100000	394	319000	1045
France	2000	34	58000	727
Other countries	1799015	1955	67755	1218

Figures rounded off

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

Country	2017-18 (P)		2018-19 (P)	
	Qty (**)	Value (`'000)	Qty (**)	Value (`'000)
All Countries	**	1899129689	**	1773772348
Belgium	**	263772643	**	460018543
UAE	**	292226668	* *	393992869
USA	**	27496935	**	385682324
Hong Kong	**	200051369	* *	244751182
Botswana	**	105493391	**	68057259
Israel	**	64103581	**	62545739
Russia	**	223167266	**	35627189
South Africa	**	26888153	**	27416843
Singapore	**	17356191	**	19483995
Canada	**	74430904	* *	18710080
Other countries	**	604142588	**	57486325

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

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

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.