

PLATINUM AND PALLADIUM



Indian Minerals Yearbook 2022 (Part- II : Metals & Alloys)

61st Edition

PLATINUM AND PALLADIUM

(ADVANCE RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

February, 2024

13 Platinum and Palladium

Platinum Group of Metals (PGM) is a family comprised of 6 metals— platinum, palladium, rhodium, iridium, osmium and ruthenium. They have similar physical and chemical properties and tend to occur together in the same mineral deposits. These six elements are classified into two groups with reference to the specific gravity of gold (19.2). The elements, Ru, Rh, Pd (sp. gr. 12–12.4) are lighter, while the other three specific gravity elements, Os, Ir and Pt are heavier than gold but within the range of 21.0 to 21.5. Platinum is an extremely rare metal occurring at a concentration of only 0.005 ppm in earth's crust. Major applications of platinum and palladium are in Automotive Sector for emission control and in chemical and petroleum refining.

RESERVES/RESOURCES

Reserves/Resources of PGM in the country as on 1.4.2020 as per NMI Database, based on UNFC System, are placed at 20.92 tonnes of metal content. By State, Odisha alone accounts for 67% of country's resources of PGE followed by Uttar Pradesh (13%) and Tamil Nadu (8%) with negligible amount (Table-1).

Boula–Nausahi, a 3 km-long belt, 170 km NE of Bhubaneswar, Odisha, is the only proven Platinum Group of Metals (PGM) deposit in the country. Preliminary assessment of PGMs in Sukinda ultramafic field indicated isolated anomalous values in chromite. Platinum values of 2 to 400 ppb and palladium values of 1 to 500 ppb were established on analysis. The limonite cappings over ultramafic rocks showed combined platinum and palladium

values between 40 and 290 ppb. In Boula–Nuasahi ultramafic complex, the easternmost chromite band known as Shankar-Ganga load, investigations revealed potential PGM mineralisation. In Sittampudi Complex, Salem district, Tamil Nadu, analysis of chromite bands showed 0.03 to 0.75 ppm Pt and 0.1 to 1.0 ppm Pd, where as amphibolite samples showed 0.03 to 0.05 ppm Pt and 0.03 to 0.5 ppm Pd. A platinum-rich chromite-ferro-chromite breccia zone stretching to about hundred metres in gabbroic matrix was identified in the southern extension of the already known Boula–Nuasahi area in Kendujhar district, Odisha. In Usgaon area, Southern Goa, PGM samples analysed up to 0.03 ppm Pt and 0.03 to 0.15 ppm Pd. In recent past, occurrences of PGE mineralisation were reported in mafic-ultramafic complex of Shivamogga schist belt in Davanagere district of Karnataka. Three zones having 10 to 830 ppb of platinum and 50 to 1,500 ppb of palladium were established (Table-1).

EXPLORATION & DEVELOPMENT

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

USES

China and India are moving forward with large-scale plans to reduce the amount of carbon emission in their respective countries. Currently, more than half of platinum and palladium mineral goes into making catalytic converters in automobiles. Automobiles that run on diesel predominantly use platinum for catalytic conversion. Platinum-cured

Table – 1: Reserves/Resources of PGM as on 1.4.2020(P)

(In tonnes of metal content)

State	Reserves Total (A)	Remaining resources			Total Resources	
		Indicated STD 332	Inferred STD 333	Reconnaissance STD 334	Total (B)	Total (A+B)
India	-	11.66	7.4	1.86	20.92	20.92
Karnataka	-	-	-	1.5	1.5	1.5
Kerala	-	-	0.18	-	0.18	0.18
Odisha	-	7.7	6.5	-	14.2	14.2
Tamil Nadu	-	0.61	0.72	0.36	1.69	1.69
Uttar Pradesh	-	3.35	-	-	3.35	3.35

Figures rounded off

silicones are used to coat and protect automotive air bags from their explosive system. The air bags contain an initiator sensor, which uses a fine platinum wire coated with explosive material to facilitate release of the air bag. The chemical inertness and refractory properties of these metals are conducive for their applications in electrical, electronics, dental, medical fields and in the Glass Industry. These metals are also used as catalyst in various chemical processes, viz, in organic synthesis in hydrogenation, de-hydrogenation and isomerisation, production of nitric acid, the raw material for the manufacture of fertilizers, explosives & polymers and fabrication of laboratory equipment.

In addition, platinum, palladium and a variety of complex gold-silver-copper alloys are used as dental restorative materials. The non-corrosive and non-allergic properties of platinum find varied applications in the medical field. Platinum's excellent compatibility with living tissue unaffected by the oxidising reaction of blood, enables its utility in pacemakers.

The primary usage of PGM is in chemotherapy for treatment of cancer. It has the ability to prevent division of certain living cells, a remarkable characteristic which finds profound application in treatment of cancer. Besides, platinum-iridium alloys are extensively used in prosthetics and biomedical devices.

Platinum's excellent conductivity lends itself for use in the electrodes of phosphoric acid fuel cells for generating electricity. Another significant use of platinum and its alloys, in cast or wrought form is in jewellery. Platinum-iridium alloys find major application in making crucibles for growing crystals. Glass made with platinum and rhodium is used in housing construction, flat screen televisions, computer monitors, display panels, automobile displays, factory monitoring equipment, etc. Recently, a new metallic glass featuring micro-alloys of palladium with silicon, germanium, silver, etc. was reportedly developed at University of California. The glass is characterised by strength and toughness. Platinum

is used to enhance storage capacity of devices, such as, computer hard discs, cellphones, digital cameras and personal music players. Recently, palladium-silver resistors have been used in secondary lightning surge protection devices. In Electronic Industry, palladium's use is for Multi-Layer Ceramic Capacitors (MLCC). The effect of miniaturisation of MLCC has not reduced the quantum of palladium used as more number of MLCC are required for the same electronic device. Platinum-based fuel cells are proving to be more cost effective, cleaner and more reliable than alternatives, such as, diesel generators.

Rhodium usage is also on the rise in the Automotive Industry apart from fibre glass. Platinum is the catalyst used by fuel cells to convert hydrogen and oxygen to electricity.

Palladium is also likely to play a role in fuel cells. Platinum acts as an effective and durable catalyst in hydrogen-powered Fuel Cell Electric Vehicles (FCEVs).

SUBSTITUTES

Platinum and palladium are two of the most expensive metals on the planet. Platinum is currently about 30% more expensive than gold while palladium is about half the cost of gold. It is usually easier to substitute metals of the platinum group for one another, especially in alloys, than to use alternative materials, which is evident from the total dominance of ruthenium-based resistors over the palladium-silver resistors for high-powered applications. Substitutes in electrical use include tungsten, nickel, silver, gold and silicon carbide. Alternative catalysts include nickel, molybdenum, tungsten, chromium, cobalt, vanadium, silver and rare earths. Rhenium, however, has been used most satisfactorily as substitute for platinum as a catalyst in petroleum refining. Stainless steel and ceramics can be substituted where resistance to corrosion is the primary concern. Some motor vehicle manufacturers have substituted platinum by palladium in catalytic converters, especially for petrol engines. Particulate

matter and residual sulphur contaminate palladium and hence, it was excluded from catalysts used in diesel vehicles. A new technology now allows up to 25% substitution of platinum in diesel catalytic converters with palladium.

Similarly, manufacturers of electronic parts are also reducing the average palladium content of the conductive pastes used to form the electrodes of multi-layer ceramic capacitors, substituting base metals or silver-palladium pastes which contain significantly less palladium.

Rhenium, tungsten and molybdenum as substitute for platinum in aromatics hydrogenation catalysts have been investigated. Recently, a new type of iron and carbon-based catalysts has been discovered which is stable and active in both acidic and alkaline media and may even eliminate the need of platinum in catalysts and thus revolutionise the Proton Exchange Membrane Fuel Cell (PEFC) Industry.

TECHNICAL POSSIBILITIES

The spent converters contain platinum and palladium in 3:1 ratio, but heavy shift towards use of palladium to meet stringent emission controls will change this proportion of recovery.

The emergence of Polymer Electrolytic Membrane (PEM) fuel cells developed for passenger cars and trucks will boost prospects of platinum in near future by replacing the high energy battery-operated options for emission controls. The costs of higher range of driving and quick refuelling of fuel cells are, however, 10 times more than the cost of petrol engine.

The development of Solid Oxide Fuel Cell (SOFC) in Japan will eliminate the use of platinum converter as it is compact and gives consistent performance as conversion of conventional fuels into hydrogen is avoided.

Recycling is a significant factor in the supply of many of the metals used in our society. It plays an important role in lowering the environmental foot-print of global PGM production. Over 95% of the PGM content of spent automotive catalysts can be repeatedly recovered. Cellphones are one of the major sources of secondary metals. Falconbridge Ltd estimated that in 1 tonne of obsolete cellphones (excluding batteries) the average palladium and platinum was about 130 g and 8 g respectively.

RESEARCH & DEVELOPMENT

The Mineral Processing Department of the Institute of Minerals & Material Technology (IMMT), Bhubaneswar (CSIR) had envisaged projects to pursue research focused on recovery of PGE values from the low tenor hosts like Boula–Nuasahi igneous complex by adopting suitable beneficiation tests and development of process flow sheet for recovery of PGE from Indian ores. The methods adopted elsewhere in the world perhaps may not suit in India because the PGE occurs in oxide of chromium and sulphide facies in very fine inclusions & exsolution form.

Bench-scale beneficiation of low-grade PGM samples from T2 sector, Tasampalayam block in Sitampundi Anorthosite complex in Tamil Nadu for GSI was carried out at the Modern Mineral Processing Laboratory and Pilot Plant, IBM, with the objective of enriching platinum group metal present in the sample and to evolve a suitable process flow sheet for recovery of PGM concentrate and chromite. The study indicated that the samples are amenable to beneficiation to produce platinum group of minerals.

WORLD REVIEW

The world reserves of PGM are estimated at 70,000 tonnes concentrated mostly in South Africa (90%) followed by Russia (8%), Zimbabwe (2%) and USA (1%) (Table - 2).

World mine production of PGMs increased by 10% to 472 tonnes of metal content in 2021 from 431 tonnes of metal content in 2020 (Table-3).

South Africa, which accounted for 60% of the total PGM mine production in 2021 was followed by Russia (23%), Zimbabwe (6%), Canada (5%), USA (4%) while other countries contributed the remaining 2 per cent.

Table – 2 : World Reserves of Platinum Group Metals (By Principal Countries)

(In kilograms of PGM content)	
Country	Reserves
World: Total (rounded off)	70,000,000
USA	900,000
Canada	310,000
Russia	5,500,000
South Africa	63,000,000
Zimbabwe	1,200,000
Other countries	NA

Source: USGS.Mineral Commodity Summaries, 2023,

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To provide a generalised view of the development in various countries, the countrywise description, **Table – 3 : World Mine Production of PGMs (By Principal Countries)**

Country	(In kilograms of metal content)		
	2019	2020	2021
World: Total (rounded off)	461 000	431 000	472 000
Finland			
Platinum	953	1 276	1 447
Palladium	699	858	1 036
Other platinum metals	52964	54395	46835
Poland			
Platinum ^(a)	* 8	* 8	* 8
Palladium ^(a)	* 7	* 7	* 7
Russia			
Platinum	22 100	23 500	* 21 000
Palladium	86 600	92 300	* 85 000
Other platinum metals	2 100	1 800	1 600
Serbia			
Platinum ^(c)	* 10	* 20	* 20
Palladium ^(c)	100	* 100	* 100
Ethiopia			
Platinum	* 2	* 2	* 2
South Africa			
Platinum	132 989	111 993	141 626
Palladium	80 684	66 264	84 336
Other platinum metals	54 395	46 835	59 344
Zimbabwe			
Platinum	13 857	15 004	14 732
Palladium	11 639	12 890	12 619
Other platinum metals	2 800	3 231	3 195
Canada			
Platinum	* 10 300	* 10 700	* 7 600
Palladium	* 17 900	* 18 600	* 13 300
Other platinum metals	* 1 200	* 1 200	* 900
USA			
Platinum	4 150	* 4 500	* 4 500
Palladium	14 300	* 14 800	* 14 800
Other platinum metals	* 100	* 100	* 100
Colombia			
	178	414	618
China			
Platinum	* 2 500	* 2 500	* 2 500
Palladium	* 1 300	* 1 300	* 1 300
Australia			
	483	522	470

Source: BGS, World Mineral Production, 2016-2020.

(a) Sales from mine production and stocks.

(b) Years ending 7th July of that stated.

as sourced from the latest available publication of Minerals Yearbook 'USGS' 2018, is furnished below:

Canada

In October, North American Palladium Ltd announced the results of a new feasibility study for its Lac des Iles Mine in northwestern Ontario. The report extended mine life by 1 year to 2027 with the average ore production rate doubling to 12,000 tonnes per day. In December, North American Palladium Ltd announced that it had entered into a contract with mining engineering firm Redpath Canada Ltd for a major expansion project for the Lac des Iles Mine. The mine development was predicted to take 2 years to complete.

China

Heraeus Precious Metals GmbH & Co. KG announced the opening of its new precious-metals plant in Nanjing, Jiangsu Province. The facility would increase the company's precious-metals and chemical products refining and recycling capacities, especially for PGMs. Its recycling rate and chemical production capacity were expected to increase to 3,000 tonnes per year (t/yr) and threefold, respectively (Heraeus Precious Metals GmbH & Co. KG, 2018).

Russia

In 2018, PJCS MMC Norilsk Nickel (Nornickel), a leading PGM producer in Russia, produced palladium and platinum at its two production assets in Russia—JSC Kolskaya Mining and Metallurgical Company (Kola MMC) on the Kola Peninsula and the Polar Division on the Taymyr Peninsula. Nornickel's PGM production decreased slightly compared with that in 2017 owing to a decrease in the amount of third-party material processed. In February, Nornickel and Russian Platinum LLC signed a deal to develop three PGM ore deposits in the Norilsk Industrial District in a 50–50 joint venture. The three deposits would produce a combined 70 to 100 t/yr of PGMs, 50,000 t/yr of nickel, and 70,000 t/yr of copper. A feasibility study was scheduled to be completed by the end of 2019, with the project beginning in 2020 and the first salable material expected in 2023.

South Africa

On April 2, six miners employed by African Rainbow Minerals Ltd were killed on their way to the Modikwa Mine. Since the beginning of 2016, more than 400 incidents of social unrest took place in the eastern portion of South Africa's platinum belt, according to data from Anglo American Platinum Ltd. The incidents were reportedly linked to conflicts between rival unions and grievances over jobs and revenue flows.

On August 2, Impala Platinum Holdings Ltd (Implats) published a strategic review of its Rustenburg operations in South Africa aimed at ensuring long-term profitability. The strategy would involve decreasing the operational mine shafts from 11 to 6 and cutting 13,000 jobs over the next 2 years. Annual production after the changes to operations was estimated to be 16,000 kg of PGMs, down from the current production of about 23,000 kg of PGMs. Implats clarified that the changes would affect only its Rustenburg operations and would not affect jobs at its mines in Zimbabwe.

Acquisitions of assets in South Africa that took place in 2018 included Northam Platinum Ltd's acquisition of Glencore plc's Eland platinum mine in January and Anglo American Platinum Ltd's acquisition of its joint-venture partners' shares in the Mototolo operations in November. Another new PGM project, the Waterberg joint venture, was announced by Platinum Group Metals Ltd, and a mining rights application was accepted by the South African Department of Mineral Resources in October. Other partners involved in the venture included Implats, Mnombo Wethu Consultants (Pty) Ltd, the Japan Oil, Gas and Metals National Corporation, Hanwa Co. Ltd, and Hosken Consolidated Investments Ltd.

Zimbabwe

In June, Zimplats Holdings Ltd (a subsidiary of Implats) announced that it had agreed to release 23,903 hectares of mining claims back to the Government of Zimbabwe. In 2013, the Government planned to compulsorily acquire a portion of Zimplats' mining claims to allocate to

other investors, which the company initially opposed. Karo Mining Holdings Ltd was awarded mining rights to the land area. The Government of Zimbabwe announced plans to construct a base- and precious-metals refinery that would be capable of processing all platinum material mined within the country. The Government also planned to place a 5% tax on exported platinum concentrates beginning in 2019 to encourage domestic refining.

FOREIGN TRADE

Exports

Exports of platinum alloys and related metals increased by about 94% to 1,194 kg valued at ₹ 479.51 crore in 2021-22 from 616 kg valued at ₹ 353.50 crore in the previous year. Exports were mainly to UK (88%), Italy (6%) and USA (3%). Exports in 2021-22 comprised of platinum (unwrought) at 869 kg and platinum (others) at 200 kg. During 2020-21, exports of other metals of platinum group were 125 kg as compared to 63 kg during the preceding year while that of platinum-powder were negligible as compared to 9 kg in the previous year (Tables- 4 to 11).

Imports

Imports of platinum alloys and related metal decreased slightly by 10% to 9,603 kg valued at ₹ 3,756 crore during 2021-22 as compared to 10,719 kg valued at ₹ 3,833 crore in the previous year. Imports were mainly from UK (37%), South Africa (19%), Germany (14%) and USA (9%). Imports in 2021-22 comprised of platinum (powder, unwrought & others) at 6,020 kg, platinum (others) 2,371 kg and other metals of platinum group (iridium, osmium, rothenium etc. unwrought) at 1,212 kg. Imports of other metals of platinum group were mainly from UK & South Africa (22% each), USA & Hong Kong (21% each) and Germany (10%). During 2021-22, imports of platinum-clad base (precious metals) increased substantially by 149% to 178 kg as compared to 73 kg in the previous year. Imports were mainly from USA (56%), Italy (23%) and Spain (17%). During 2021-22, imports of platinum powder were at 530 kg as compared to 786 kg in the preceding year. Imports were mainly from USA (53%), Germany (18%) and South Africa (14%) (Tables-12 to 19).

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**Table – 4: Exports of Platinum Alloys & Related Metals: Total
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	616	3535012	1194	4795081
UK	381	2798842	1047	4338221
Italy	16	35268	72	333322
USA	65	246419	32	76559
Japan	8	195961	1	28189
UAE	++	2	6	12791
Israel	1	358	++	2996
Bahrain	++	638	++	1592
Belgium	—	—	++	493
Bangladesh	130	93	35	404
Germany	1	15435	++	212
Other Countries	14	241996	1	302

Figures rounded off

**Table – 5 : Export of Platinum (Powder, Unwrought & Others)
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	507	552422	869	917208
UK	307	255329	836	832403
USA	60	143589	31	76264
Japan	-	-	++	3103
Israel	1	318	++	2781
Bahrain	++	638	++	1592
Belgium	-	-	++	493
Bangladesh	130	93	++	400
Netherlands	-	-	1	114
Nepal	-	-	++	19
Australia	-	-	++	16
Other Countries	9	152455	1	23

Figures rounded off

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**Table – 6 : Exports of Platinum (Unwrought)
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	498	401315	869	914077
UK	307	255329	836	832403
USA	60	143589	31	76252
Israel	1	318	++	2781
Bahrain	++	638	++	1592
Belgium	—	—	++	493
Bangladesh	130	93	++	400
Netherlands	—	—	1	114
Nepal	—	—	++	19
UAE	—	—	1	15
Korea, Rep. of	—	—	++	8
Other Countries	++	1348	++	++

Figures rounded off

**Table –7 : Exports of Platinum (Others)
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	46	343359	200	1555483
UK	38	206137	111	1280086
Italy	2	11235	52	249860
Japan	6	125985	1	25086
Germany	-	-	++	212
Nepal	-	-	++	144
USA	-	-	1	90
Bangladesh	-	-	35	4
Oman	-	-	++	1
Malaysia	-	-	++	++
UAE	++	2	-	-
Other Countries	-	-	-	-

Figures rounded off

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**Table – 8 : Exports of Platinum (Powder)
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	9	151107	++	3131
Japan	-	-	++	3103
Australia	-	-	++	16
USA	-	-	++	12
Singapore	9	151107	-	-

Figures rounded off

**Table – 9 : Exports of Other Metals of Platinum Group
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	63	2639231	125	2322390
UK	36	2337376	100	2225732
Italy	14	24033	20	83462
UAE	-	-	5	12776
Israel	++	40	++	215
USA	5	102830	++	205
Singapore	5	89454	-	-
Japan	2	69976	-	-
Germany	1	15435	-	-
Sweden	++	87	-	-

Figures rounded off

**Table – 10 : Exports of Platinum-Clad Base/Precious Metal
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	700	50	70	6
Mauritius	-	-	70	6
Bangladesh	700	50	-	-

Figures rounded off

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Table –11: Export of Other Metals of Platinum Group (Iridium, Osmium, Ruthenium etc. unwrought) (By Countries)

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	109	2982590	325	3877873
UK	74	2543513	211	3505818
Italy	16	35268	72	333322
Japan	8	195961	1	25086
UAE	++	2	5	12776
U S A	5	102830	1	295
Israel	++	40	++	215
Germany	1	15435	++	212
Nepal	-	-	++	144
Bangladesh	-	-	35	4
Oman	-	-	++	1
Other Countries	5	89541	++	++

Figures rounded off

Table – 12 : Imports of Platinum Alloys and Related Metals : Total (By Countries)

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	10719	38332024	9603	37563471
UK	4307	15000141	3549	12116931
Germany	1678	7732200	1390	8241153
South Africa	1527	6584804	1843	8048617
USA	1632	7047110	911	4334047
Italy	486	862554	649	1439156
Russia	60	386469	172	1254043
Belgium	++	342	72	731752
UAE	62	161208	261	699525
Hong Kong	745	343291	295	330042
Ecuador	-	-	2	110924
Other Countries	222	213905	459	257281

Figures rounded off

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**Table – 13 : Imports of Platinum (Powder, Unwrought & Others)
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	5184	11561645	6020	14641574
UK	2488	5415404	2572	6380571
South Africa	655	1493557	1105	2798201
Germany	927	2114544	884	2190021
USA	807	1742403	538	1397343
Italy	144	374638	322	781370
UAE	62	161208	261	699525
Hong Kong	22	49906	44	116135
Russia	19	41440	40	97722
Czech Republic	17	71696	145	60747
Belgium	++	342	24	54049
Other Countries	43	96507	85	65890

Figures rounded off

**Table – 14 : Imports of Platinum–Unwrought
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	4398	9874821	5490	13309778
UK	2463	5355270	2560	6345842
South Africa	606	1385586	1029	2642518
Germany	772	1759798	788	1937685
Italy	144	374638	322	781370
UAE	62	161208	261	699525
USA	269	619870	255	660059
Hong Kong	22	49906	44	116135
Czech Republic	17	71696	145	60747
Switzerland	++	1857	11	25333
Norway	-	-	8	20521
Other Countries	43	94992	67	20043

Figures rounded off

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**Table – 15: Imports of Platinum (Others)
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	3676	19444680	2371	14122761
UK	1323	7413686	706	4459397
South Africa	543	2991103	468	3479679
Germany	692	4715147	389	3148306
Russia	41	345029	132	1156321
Italy	341	480220	327	657786
Belgium	-	-	44	529879
USA	605	3481428	114	478295
Ecuador	-	-	2	110924
France	++	1942	3	38321
Switzerland	++	48	8	35800
Other Countries	131	16077	178	28053

Figures rounded off

**Table – 17: Imports of Other Metals of Platinum Group
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	5535	26770379	3583	22921897
Germany	751	5617656	506	6051132
UK	1819	9584737	977	5736360
South Africa	872	5091247	738	5250416
USA	825	5304707	373	2936704
Russia	41	345029	132	1156321
Belgium	-	-	48	677703
Italy	342	487916	327	657786
Hong Kong	723	293385	251	213907
Ecuador	-	-	2	110924
Singapore	40	29768	45	52860
Other Countries	122	15934	184	77784

Figures rounded off

**Table – 16 : Imports of Platinum – Powder
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	786	1686824	530	1331796
USA	538	1122533	283	737284
Germany	155	354746	96	252336
South Africa	49	107971	76	155683
Russia	19	41440	40	97722
Belgium	-	-	23	54042
UK	25	60134	12	34729

Figures rounded off

**Table – 18 : Imports of Platinum - Clad Base / Precious Metal
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	73	42046	178	72575
USA	10	33322	100	64513
Spain	4	4014	30	4198
Italy	58	2151	41	2225
France	-	-	2	1316
Netherlands	1	795	5	323
UK	++	1552	-	-
Germany	++	212	-	-

Figures rounded off

PLATINUM AND PALLADIUM

Table – 19: Imports of Other Metals of Platinum Group
(Iridium, Osmium, Ruthenium etc. unwrought)
(By Countries)

Country	2020-21 (R)		2021-22 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	1859	7325699	1212	8799136
Germany	59	902509	117	2902826
USA	220	1823279	259	2458409
South Africa	329	2100144	270	1770737
UK	496	2171051	271	1276963
Hong Kong	723	293355	251	213907
Belgium	-	-	4	147824
Singapore	30	21701	40	28470
Italy	1	7696	-	-
Japan	1	5964	-	-

Figures rounded off

FUTURE OUTLOOK

India is meeting its demand entirely by imports. The demand for PGEs is expected to touch 120 tonnes by 2025, as per the Report of the Sub-group for 12th Plan period.

As per PGM Market Report, May, 2021 of "Johnson Matthey Platinum Group Metals Service" PGM supply

and demand fell in 2020, on account of covid related slump that affected the imports the automotive, industrial and jewellery sectors. However demand for platinum is forecast to bounce back strongly in 2021. Indian platinum jewellery demand is most likely to expand following successful industry marketing and campaigns to promote the purchase of platinum jewellery sets as wedding gift.