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PLATINUM AND PALLADIUM

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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13 Platinum and Palladium

Platinum Group of Metals (PGM) are 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 elements, Os, Ir and Pt are heavier than gold with sp. gr. in the range of 21.0-21.5. 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.

RESERVE/RESOURCES

Reserve/Resources of PGE in the country as on 1.4.2015 as per NMI Database, based on UNFC System are placed at 15.71 tonnes. Reserve/Resources are grouped under remaining resources category. By state, Odisha alone accounts for 90% of country's reserve/ resources of PGE followed by Karnataka (10%) & negligible amount by Uttar Pradesh.

Baula - 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, whereas amphibolite samples showed 0.03 to 0.05 ppm Pt and 0.03 to 0.5 ppm Pd. A platinum-rich chromite-ferrochromite 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 1500 ppb of palladium were established.

The major part of 15.7 million tonnes UNFC reserve/ resources of PGE estimated so far, i.e. 14.2 million tonnes of PGE ore are located in Nilgiri, Boula-Nuasahi and Sukinda areas in Odisha and remaining 1.5 million tonnes of PGE ore in Hanumalpura area in Shivamogga schist belt of Karnataka. About 49% resources are under pre-feasibility category and the remaining under inferred and reconnaissance category. The reserve/ resources of PGM in Uttar Pradesh reported here as first time as on 1.4.2015 as per NMI Database, based on UNFC system are furnished in Table-1.

EXPLORATION

GSI carried out exploration in various areas in the states of Madhya Pradesh, Odisha, Tamil Nadu and Kerala. The details are furnished in Table-2.

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. The chemical inertness and refractory properties of these metals are conducive for their applications in electrical, electronics, dental, medical fields and 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.

Table – 1: Reserves/Resources of PGE ore as on 1.4.2015

(In tonnes of metal content)

State	Reserves Total (A)	Remaining resources				Total Resources
		Indicated STD 332	Inferred STD 333	Reconnaissance STD 334	Total (B)	(A+B)
India	**-**	**7.71**	**6.5**	**1.5**	**15.71**	**15.71**
Karnataka	-	-	-	1.5	1.5	1.5
Odisha	-	7.7	6.5	-	14.2	14.2
Uttar Pradesh	-	0.01	-	-	0.01	0.01

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, cell phones, 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.

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.

SUBSTITUTES

Platinum and palladium are two of the most expensive metal on the planet. Platinum is currently running about 30% more expensive than gold. Palladium is about half the cost of gold, but its still way up there. 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 aeromatics hydrogenation catalysts have been investigated. Recently, a new type of iron and carbon - based catalysts have 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.

Table – 2 : Details of Exploration Activities for PGM/PGE, 2015-16

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage		Reserves/resources estimated
GSI							
Madhya Pradesh							
Chhindwara	Mordongri	1:12500	50	-			A G4 stage investigation was taken up in the main Mordongri mafic-ultramafic body show intrusive contact with tuffaceous rhyolite and has been observed in and around south of Mordongri, Jamtara,Piparia and Jilharighat area. The quartz/granite veins intruded within gabbro and at the contact considerable amount of sulphide (pyrite, chalcopyrite etc.) has been developed. Besides, sulphides of Ni, Cu, Fe and oxides of Ti and Mn, two grains of gold have also been identified by petrography and SEM-EDX studies. Geochemical results are awaited. The project is completed.
Odisha							
Kendujhar and Dhenkanal	Patakhali-Balijori and Ghuturigaon-Mundasahi	1:12500	-	-	-	156	A G4 stage investigation was taken up with an objective of delineating prospective areas for PGE. A total 104 BRS and 52 PTS were collected. Analytical results of all the samples for Cr, Ni, Cu and Co were received. One laterite sample located in the west of Baiganapal show anomalous Cr (0.60%), Ni (0.355), Co(0.16%) and Cu(140ppm). High values of Cr and Ni were recorded from trenches in Baiganapal and Ghuturigan area.
Tamil Nadu							
Namakkal	Tasampalaiyam block (T 3 Sector)	1:12500	-	13	1046.65	199	A G3 stage investigation was taken up to prove the depth persistence of the PGE mineralisation in the central part of Tasampalaiyam block (T3 sector). During 2015-16, second level drilling was continued in T3 sector and 10 second level boreholes were drilled. In totality, eleven second level boreholes with borehole spacing varying from 75 to 120 m were drilled. The boreholes have intersected number of chromite/ chromiferous metapyroxenite bands with width of the individual bands varying from 0.20 m to 2.39 m. The grade and width of the chromite/chromiferous metapyroxenite bands show drastic variation from profile to profile.
	Tasampalaiyam Block (T 2 Sector)	1:12500	-	20	1790.80	457	G2 stage investigation was taken up in T2 sector of Tasampalaiyam with an objective to assess the resources of PGE. The exploration work involving closed-spaced trenching at 25 m interval and first and second level drilling at 50 m spacing was carried out. In trench section the analytical results varies from 30 ppb to 3458 ppb and first and second level borehole section, the analytical result varies from 0.235 ppm to 2.114 ppm.

(Contd..)

Table – 2 (Concld.)

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks
		Scale	Area (sq km)	No. of bore-holes	Meterage		Reserves/resources estimated
Kerala							
Palakkad	Vellamari Block Attapadi Valley	1:2000 1: 12500	1.5 50	-	-	202	G4 stage investigation was taken up for delineating chromitite zones within the ultramafics and to evaluate its PGE potential. During detailed mapping the mafic & ultramafic rocks were mapped along with the gneissic country rock. Since the Chromites in the area are known to be PGE- bearing importance was given to trace the chromite-bearing zones in the ultramafics. The analytical results of the PGE values vary from 9 ppb to 726 ppb. The sample with 726 ppb is from Kalakandi magnesite mine dump. Higher values are 618 ppb, 541 ppb, 490 ppb, 266 ppb, 213 ppb and 205 ppb. Four PGE grains were found during EPMA analysis in four samples. A total of four PGE bearing minerals could be identified in 11 thin-polished sections during EPMA work carried out at EPMA Lab.

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.

The increased recovery of (PGM) in automotive catalytic converters. Three way catalysts using rhodium as opposed to platinum and palladium may become more important.

Recycling, a significant factor in the supply of many of the metals used in our society. Cell phones are one of the major source of secondary metals. Falconbridge Ltd. estimated that in 1 tonne of obsolate cell phones (excluding batteries) the average palladium and platinum was about 130 gms and 8 gms 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 occur in oxide of chromium and sulphide facies in very fine inclusions & exsolution form.

WORLD REVIEW

The world reserves of PGM are estimated at 67,000 tonnes concentrated mostly in South Africa (94%) followed by Zimbabwe and Russia with (2% each) and USA and Canada (1% each).

In 2015, world mine production of PGMs increased by 22% to 459 tonnes from 377 tonnes in 2014 (Table 4). South Africa accounted for 60% of total PGM mine production in 2015; Russia 22%, Canada 8%, Zimbabwe 6%, USA 3%, and other countries 1%. In 2015, world platinum mine production increased by 31%. In South Africa, which accounted for 73% of world platinum production, production totalled 139 tonnes of platinum, about 48% increase from that in 2014, accounting for most of the increase in global production. Global mine production of palladium in 2015 increased by 11% to 204 tonnes. South Africa accounting for 41% followed by Russia (37%),Canada (11%), USA (6%) and Zimbabwe (5%). World mine production of other PGMs (iridium, osmium, rhodium and rethenium) increased by 41% in 2015 as compared with that of 2014. South Africa, which accounted for 89% of global production, accounted for most of the increase of other PGMs. Estimated production in Zimbabwe (4%), the second leading producer, remained unchanged.

Canada

North American Palladium Ltd produced 5,420 kg of palladium and 407 kg of platinum from its Lac des Isles Mine in Ontario to registering an increase of 29% and 28%, respectively as compared to that of the production in 2013. The increases were attributed to increased mining and processing rates from the newly developed off set-zone, and, of low-grade stockpiled material.

Russia

Norilsk Nickel produced 82,700 kg of palladium and 19,400 kg of platinum in 2014, an increase of 3% palladium and marginally less in case of platinum from the production of 2013.

Zimbabwe

In 2014, palladium and platinum production increased by 5% each as compared to 2013 production. Amplats' Unki Mine produced 1,900 kg of platinum, 10% less than that produced in 2013. Production at the Mimosa Mine, a joint venture between Aquarius and Impala, was 2,700 kg of palladium and 3,400 kg of platinum, the figures showed an increase of 9% and 10%, respectively, from those of 2013. At Zimplats Holdings Ltd's a subsidiary of Impala Ngezi project, a major underground collapse in July resulted in the suspension of mining at the Bimha Mine. Redevelopment of the mine is under progress.

FOREIGN TRADE

Exports

Exports of platinum and related metals decreased drastically to 36 kg valued at ₹ 13 crore in 2015-16 from 78 kg valued at ₹8.37 crore in the previous year. Exports in 2015-16 comprised of platinum unwrought at 19 kg, & platinum others at 16 kg. During 2015-16 export of other metals of platinum group was nil. During 2015-16 export of platinum-clad base/precious metal was at 10 kg as compared to 11 kg in the previous year. Exports were mainly to Mauritius (80%), Gabon and UAE (10% each) (Tables- 5 to 10).

Imports

Imports of platinum alloys and related metals increased marginally in 2015-16 to 8,536 kg valued at ₹ 1,376 crore as against 7,818 kg valued at ₹ 1,525 crore in the previous year. Imports in 2015-16 comprised of platinum (powder, unwrought & others) 3,740 kg, platinum (others) 1,980 kg and other metals of platinum group 4,796 kg. Imports of other metals of platinum group were mainly from UK (31%), USA, South Africa (25%each), Switzerland (7%) and Germany (3%). (Table 11 to 17)

Table – 3 : World Reserves of PGMs (By Principal Countries)

(In tonnes of metal content)

Country	Reserves
World: Total (rounded)	**67000**
Canada	310
Russia	1100
South Africa	63000
USA	900
Zimbabwe	1200

Source: *Mineral Commodity Summaries, 2017.*

Table – 4 : World Mine Production of PGMs (By Principal Countries)

(In tonnes of metal content)

Country	2013	2014	2015
World: Total	**455.27**	**377.01**	**458.74**
Botswana			
Platinum	0.22	0.12	0.03
Palladium	1.34	0.56	0.16
Canada[e]			
Platinum	9.70	12.00	12.80
Palladium	19.80	21.00	22.30
Other platinum metals	0.00	1.40	1.50
China[e]			
Platinum	1.40	1.40	1.40
Russia			
Platinum	25.00	22.00	20.80
Palladium	84.00	81.30	75.50
Other platinum metals	2.60	2.80	2.50
South Africa			
Platinum	137.02	93.99	139.13
Palladium	76.01	58.41	82.69
Other platinum metals	51.16	36.04	53.70
USA			
Platinum	3.72	3.66	3.70[e]
Palladium	12.60	12.40	12.5[e]
Zimbabwe			
Platinum	13.07	12.48	12.8
Palladium	10.15	10.14	10.5
Other platinum metals	2.68	2.67	2.70[e]
Other countries	4.81	4.63	4.04

Source: *World Mineral Production, 2011-2015.*

Table – 5 : Exports of Platinum Alloys & Related Metals : Total (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**78**	**83710**	**36**	**21310**
Italy	6	8445	8	11677
Hong Kong	9	7471	1	137
USA	7	6574	4	3204
South Africa	-	-	1	1352
Israel	3	3258	1	1398
Honduras	-	-	1	1044
Singapore	2	140	3	211
UK	3	645	11	2135
UAE	20	47631	2	90
Oman	-	-	1	39
Other countries	28	9546	3	23

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

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**41**	**69015**	**19**	**8184**
UK	1	79	11	2135
USA	2	6036	1	1949
Israel	3	3258	1	1398
South Africa	-	-	1	1352
Honduras	-	-	1	1044
Singapore	1	94	1	156
Hong Kong	6	5049	1	137
Germany	2	1367	1	7
Algeria	-	-	1	6
UAE	19	46625	-	-
Other countries	7	6507	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**35**	**13643**	**16**	**13076**
Italy	6	8445	8	11677
Hong Kong	3	2422	-	-
Belgium	16	1274	-	-
UK	2	566	-	-
USA	5	538	3	1255
Germany	1	182	1	10
Nicaragua	1	110	-	-
Oman	-	-	1	39
Singapore	-	-	1	5
UAE	-	-	2	90
Other countries	1	106	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**1**	**46**	**-**	**-**
Singapore	1	46	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**1**	**1006**	**-**	**-**
UAE	1	1006	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**11**	**625**	**10**	**86**
Gabon	-	-	1	41
Mauritius	1	40	8	40
UAE	-	-	1	5
Switzerland	8	546	-	-
Sri Lanka	1	29	-	-
Baharain	1	10	-	-

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Table – 11 : Imports of Platinum Alloys and Related Metals (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**7818**	**15247930**	**8536**	**13756838**
UK	1917	4224722	1846	2831672
USA	2308	3941780	2116	3111298
South Africa	1575	2652000	2467	4158651
Belgium	644	1701335	902	1921753
Germany	538	1238147	369	664790
Japan	293	499549	146	208830
Italy	150	267152	253	248969
Russia	26	61184	37	50585
Switzerland	92	158537	330	466867
Hong Kong	45	72679	22	31292
Other countries	230	430845	48	62131

Table – 12 : Imports of Platinum (Powder, Unwrought & Others) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**3900**	**9251187**	**3740**	**7742373**
UK	919	2571757	373	837048
USA	799	1753218	906	1655047
South Africa	930	1734372	1266	2720078
Belgium	626	1672560	902	1921753
Germany	279	751373	204	429453
Italy	85	220937	33	67026
Hong Kong	24	67752	15	28288
Japan	19	48217	12	24329
Czech Republic	7	20281	9	22704
UAE	3	6497	8	17014
Other countries	209	404223	12	19633

Table – 13: Imports of Other Metals of Platinum Group (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**3918**	**5996743**	**4796**	**6014465**
South Africa	645	917628	1201	1438573
UK	998	1652965	1473	1994624
Japan	274	451332	134	184501
Germany	259	486774	165	235337
USA	1509	2188562	1210	1456251
Switzerland	87	146322	322	453229
Italy	65	46215	220	181943
Russia	6	10965	37	50585
Spain	-	-	19	8244
Singapore	3	4287	3	5110
Other countries	72	91693	12	6068

Table – 14: Imports of Platinum (Others) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**2130**	**3177572**	**1980**	**2371679**
USA	1350	2006817	858	1033864
UK	502	843020	742	1024551
Germany	80	132434	18	21895
Switzerland	1	413	113	122563
Italy	64	45672	136	65935
South Africa	68	42978	27	6525
Japan	25	40577	58	77834
Spain	-	-	19	8244
Singapore	3	4287	2	3818
Hong Kong	1	1595	2	2455
Other countries	36	59779	5	3995

Table – 15 : Imports of Platinum-Clad (Rolled Etc.) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**27**	**22865**	**3**	**736**
UAE	9	17869	-	-
USA	15	2936	1	120
Italy	1	1863	1	548
Hong Kong	1	113	-	-
China	1	84	1	68

Table – 16 : Imports of Platinum -Unwrought (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**2898**	**6558646**	**3158**	**6408992**
UAE	3	6497	8	17014
South Africa	802	1385693	973	2019171
Belgium	513	1338673	902	1921753
USA	374	625434	796	1398904
Germany	59	160198	47	96507
UK	844	2381884	351	793663
Italy	44	119793	33	67026
Hong Kong	24	67752	15	28288
Japan	19	48217	12	24329
Czech Republic	7	20281	9	22704
Other countries	209	404224	12	19633

Table – 17 : Imports of Platinum -Powder (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	**1002**	**2692541**	**582**	**1333381**
USA	425	1127784	110	256143
Germany	220	591175	157	332946
South Africa	128	348678	293	700907
Belgium	113	333887	-	-
UK	75	189873	22	43385
Italy	41	101144	-	-

FUTURE OUTLOOK

India is not a platinum group of elements (PGEs) producing country and is meeting its demand entirely by imports. The demand for PGEs is expected to touch 80 tonnes by 2017 and may touch 120 tonnes by 2025, as per the Report of the Sub-Group for 12th Plan period. Assuming the success of sustained efforts directed towards mining of the known resources at BNUC (Odisha) and development of a beneficiation flow sheet during the 12th Plan, a plant of 2 tonnes per annum capacity can be envisaged by the middle of the 13th Plan. The Sub-Group recommends that the preparation of feasibility report in this regard may be assigned to any National Laboratory on priority basis. It expects that an additional 10-20 tonnes per annum should be recovered from recycling by 2017.

As per PGM Market Report, Nov. 2015 of "Johnson Matthey Platinum Group Metals Service" there has been a sharp decline in sales relating to jewellery markets in China, where the pace to retail expansion has slowed, and the rate of store closures has increased ; thus, reducing the need for retailers to purchase new stock. A long period of low prices has rendered platinum less attractive to Chinese consumers, who like to see the value of their purchases appreciate over time. However, Indian platinum jewellery demand will expand by nearly a third in 2015 following successful industry marketing campaigns to promote the purchase of platinum jewellery sets as a wedding gift.

The palladium consumption in industrial applications will rise slightly in 2015-16, but with strong sales of palladium catalysts to the chemical industry offsetting gradual erosion of demand in the electronics and dental sectors. However, Global jewellery demand is forecast to fall by a further 12%, due to the collapse in the palladium jewellery market in China.