

STATE REVIEWS



Indian Minerals Yearbook 2018

(Part- I)

57th Edition

STATE REVIEWS
(Odisha)

(FINAL 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

December, 2019

ODISHA

Mineral Resources

Odisha is the leading producer of chromite, garnet (abrasive), bauxite, manganese ore, iron ore, sillimanite, quartzite and dolomite. The State hosts the country's sole resources of ruby. It accounts for the country's 96% chromite, 93% nickel ore, 90% PGM metal, 69% cobalt ore, 51% bauxite, 44% manganese, 34% iron ore (haematite), 25% sillimanite, 24% fireclay, 23% pyrophyllite, 20% vanadium ore, 17% mica and 10% dolomite resources. As per AMD of the Department of Atomic Energy, Odisha accounted for 150.62 million tonnes of ilmenite resources.

Important minerals that occur in the State are: **bauxite** in Balangir, Kalahandi, Kandhamal, Kendujhar, Koraput, Malkangiri, Rayagada & Sundargarh districts; **china clay** in Bargarh, Boudh, Balangir, Kendujhar, Koraput, Mayurbhanj, Sambalpur & Sundargarh districts; and **chromite** in Balasore, Cuttack, Dhenkanal, Jajpur & Kendujhar districts. Chromite deposits of Sukinda and Nuasahi ultramafic belt constitute 95% of the country's chromite resources. Besides, **coal** occurs in Ib river valley and Talcher coalfield, Dhenkanal district; **dolomite** in Bargarh, Kendujhar, Koraput, Sambalpur & Sundargarh districts; **dunite/pyroxenite** in Kendujhar and Sundargarh districts; **fireclay** in Angul, Cuttack, Dhenkanal, Jharsuguda, Khurda, Puri, Sambalpur & Sundargarh districts; **garnet** in Ganjam, Kalahandi & Sambalpur districts; **graphite** in Bargarh, Boudh, Balangir, Kalahandi, Koraput, Nuapada & Rayagada districts; **iron ore (haematite)** in Dhenkanal, Jajpur, Kendujhar, Koraput, Mayurbhanj, Sambalpur & Sundargarh districts; **iron ore (magnetite)** in Mayurbhanj district;

limestone in Bargarh, Koraput, Malkangiri, Nuapada, Sambalpur & Sundargarh districts; **manganese ore** in Balangir, Kendujhar, Koraput, Rayagada, Sambalpur & Sundargarh districts; **Pyrophyllite** in Kendujhar district; **quartz/silica sand** in Boudh, Balangir, Kalahandi, Sambalpur & Sundargarh districts; **quartzite** in Balangir, Dhenkanal, Jajpur, Jharsuguda, Kendujhar, Mayurbhanj, Sambalpur & Sundargarh districts; **sillimanite** in Ganjam & Sambalpur districts; **talc/steatite/soapstone** in Mayurbhanj, Sundargarh & Sambalpur districts; **titanium minerals** in Dhenkanal, Ganjam, Jajpur & Mayurbhanj districts; and **zircon** in Ganjam district.

Other minerals that occur in the State are **asbestos** in Kendujhar district; **cobalt** in Cuttack & Jajpur districts; **copper** in Mayurbhanj & Sambalpur districts; **granite** in Angul, Boudh, Balangir, Cuttack, Deogarh, Dhenkanal, Ganjam, Kendujhar, Khurda, Koraput, Mayurbhanj, Nuapada, Rayagada & Sambalpur districts; **lead** in Sargipalli area, Sundargarh district; **mica** in Sonapur district and **nickel** in Cuttack, Kendujhar & Mayurbhanj districts. Occurrences of **ruby** and **emerald** are reported from Balangir and Kalahandi districts, respectively. **Platinum Group of Metals** occur in Kendujhar district; **silver** in Sundargarh district; **tin** in Koraput and Malkangiri districts; and **vanadiferous magnetite** occurs in Balasore and Mayurbhanj districts (Table-1). The various coalfields along with their reserves/resources are given in Table - 2.

Exploration & Development

The details of exploration activities conducted by GSI for Iron ore, manganese ore, coal & REE and other agencies during 2017-18 are furnished in Table-3.

Table – 2: Reserves/Resources of Coal as on 1.4.2018: Odisha

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	37391.10	34165.54	7739.16	79294.80
Ib-River	12933.35	11504.21	3636.57	28074.13
Talcher	24457.75	22660.33	4102.59	51220.67

Source: Coal Directory of India, 2017-18

STATE REVIEWS

Table – 1: Reserves/Resources of Minerals as on 1.4.2015: Odisha

Mineral	Unit	Reserves				Remaining Resources				Total resources (A+B)				
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331		Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)
			STD121	STD122			STD221	STD222						
Asbestos	tonne	-	-	-	-	-	-	-	37200	9500	-	56700	56700	
Bauxite	'000 tonnes	176002	411	148856	325269	166547	66189	280396	365938	590780	44202	1669305	1994574	
China clay [#]	'000 tonnes	-	-	-	-	3600	3503	5018	368	35770	1354	286157	286157	
Chromite	'000 tonnes	64150	12427	24835	101412	67311	15529	33354	26850	33434	20452	229301	330714	
Cobalt	million tonnes	-	-	-	-	-	-	-	30.63	0.28	-	30.91	30.91	
Copper														
Ore	'000 tonnes	-	-	-	-	-	-	-	1420	2536	2095	6051	6051	
Metal	'000 tonnes	-	-	-	-	-	-	-	21.69	21.06	-	63.44	63.44	
Dolomite [#]	'000 tonnes	109551	6421	34839	150811	42521	33896	110904	48535	330660	85884	699082	849892	
Dunite [#]	'000 tonnes	308	-	-	308	172	1925	6215	686	2531	-	11837	12145	
Fireclay [#]	'000 tonnes	133	-	40	173	3074	12376	4495	26219	83662	-	172751	172924	
Garnet	tonne	8459821	-	585130	9044951	5	-	-	-	348000	-	348005	9392956	
Granite [#]														
(Dim. Stone)	'000 cum	-	80000	-	80000	-	-	-	330328	-	1432492	5160	1767980	1847980
Graphite	tonne	209795	-	249176	458971	9314306	3312065	1415295	696021	838559	2628394	304628	18509268	18968239
Iron ore														
(Haematite)	'000 tonnes	1830569	252615	489034	2572217	1180055	704302	530440	271349	426493	1773077	100730	4986447	7558664
Iron ore														
(Magnetite)	'000 tonnes	74	-	-	74	8	-	-	27	-	43	-	79	152
Laterite #	'000 tonnes	-	-	-	-	-	-	-	-	-	-	1227	1227	
Lead-Zinc														
Ore	'000 tonnes	-	-	-	-	-	961	119	-	-	670	-	1750	1750
Lead metal	'000 tonnes	-	-	-	-	-	34.32	4.25	-	-	38.39	-	76.96	76.96
Limestone	'000 tonnes	255555	77879	61007	394442	173797	548527	420634	139924	50397	361350	32635	1727264	2121706
Manganese ore	'000 tonnes	16703	10528	3413	30643	32622	23942	37292	16130	15119	48764	11889	185760	216403
Mica [#]	kg.	-	-	-	-	-	-	51856000	-	26712000	26712000	-	105280000	105280000
Nickel ore	Million tonnes	-	-	-	-	-	20.84	20.62	30.85	51.06	51.26	-	174.63	174.63
Pt. Group of metals	tonne	-	-	-	-	-	-	-	-	7.7	6.5	-	14.2	14.2
Pyrophyllite [#]	tonne	2781889	1094902	-	3876791	6978702	216661	766105	80	40	1782070	68401	9812058	13688848
Quartzite [#]	'000 tonnes	20050	151	18381	38582	16861	6914	5128	364	274	71503	927	101971	140554
Quartz-														
Silica sand [#]	'000 tonnes	567	109	725	1401	344	2038	2918	93	63308	3944	179	72824	74225
Rare earth elements	tonne	-	-	-	-	-	-	-	-	6353	19140	-	25493	25493
Ruby	kg.	-	-	-	-	-	429	3296	-	-	1623	-	5349	5349
Sillimanite	tonne	-	572868	427705	6156573	-	-	6557013	-	-	4943600	-	11500613	17657186

(Contd)

STATE REVIEWS

Table – 1 (Concl'd)

Mineral	Unit	Reserves			Pre-feasibility			Remaining Resources				Total resources (A+B)	
		Proved STD 111	Probable STD121	Total (A) STD122	Feasibility STD211	STD221	STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
Silver													
Ore	tonne	-	-	-	-	960500	119000	-	-	670000	-	1749500	1749500
Metal	tonne	-	-	-	-	27.34	3.4	-	-	34.17	-	64.91	64.91
Talc/Steatite/ Soapstone#	000 tonnes	-	-	8	10	89	193	151	-	278	-	817	827
Tin													
Ore	tonne	-	-	-	-	636	-	-	1166	1000	-	15494	15494
Metal	tonne	-	-	-	-	500.78	-	-	22.2	10	-	567.61	567.61
Vanadium													
Ore	tonne	-	-	-	-	1220000	-	-	232000	3412795	-	4864795	4864795
Metal	tonne	-	-	-	-	2135	-	-	487.2	10935.74	-	13557.94	13557.94

Figures rounded off

Declared as Minor Mineral vide Gazette Notification dated 10.02.2015

Minor Mineral before Gazette Notification dated 10.02.2015

STATE REVIEWS

Table – 3: Details of Exploration Activities in Odisha, 2017-18

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
GSI							
Coal							
Angul	Kantaikoliya , north block, Talcher coalfield,	1:10000	2	2	1083.90	-	General exploration for coal was carried out in this block by mapping. Exploration comprised of mapping of 2 sq. km area on 1:10000 scale and drilling of two boreholes to a total depth of 1,083.90 m.
	Kantaikoliya , north block, Talcher coalfield,	1:10000	4	-	2260.10	-	A total area of 4 sq. km were mapped on 1:10000 scale and a total meterage of 2,260.10 m were drilled. The area is covered by rocks of Kamthi Formation. The lithounits of Kamthi Formation (max. thickness 184.42 m), Barren Measure (max. thickness 136.38 m), Barakar Formation (max. thickness 363.68 m) and Karharbari Formation (max. thickness 115.13 m) have been intersected in the boreholes. Ten regional coal seam zones (II to XI in ascending order) were intersected between the depth ranges of 151.40 m to 518.85 m in Barakar Formation. The cumulative coal thickness varied from 44.62 m to 69.96 m. The Seam Zone IX was the thickest seam (14.08 m to 21.67 m) and it was intersected between the depth range of 216.30 m to 328.31 m.
Jharsuguda	Teteliabahal, block, Ib-River coalfield,	1:10000	5	6	4975.60	-	G2 level general exploration was carried out for coal in this block. A total of 5 sq. km area were geologically mapped on 1:10000 scale; 4,975.60 m drilling were carried out in 6 boreholes and 3,299 m geophysical borehole logging was done in four completed boreholes. A total of 716.49 m coal core samples were gathered. Four regional coal seam zones of Raniganj Formation, i.e. R-IV, R-III, R-II and R-I and four regional coal seam zones of Barakar Formation, i.e., Belpahar, Parkhani, Lajkura and Rampur have been intersected in the boreholes. Coal seam zones of Raniganj Formation occur at shallow depth, i.e., within 350 m, between 89.33 m and 312.43 m depth. Cumulative coal thickness of R-IV, R-III, R-II and R-I intersected in the

(Contd)

STATE REVIEWS

Table-3 (Contd)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							boreholes varied from 0.90 m to 14.45 m. The coal seam zones of Barakar Formation have been intersected between 280.89 m (IBTB-1) and 881.92 m (IBTB-6) depth. Cumulative coal thickness of Belpahar, Parkhani and Lajkura seam zones varied from 6.27 m to 10.65 m, 20.50 m to 25.79 m and 64.33 m to 71.33 m, respectively. Rampur seam zone has been intersected in Boreholes IBTB-1, 5 and 6 with coal thickness varying from 4.84 m to 18.21 m. Lajkura was the thickest among the Barakar coal seam zones.
Sundargarh	Kendudihi block, Ib-River coalfield	1:10000	3	4	2766.10	-	G2 level general exploration was carried out for coal in Kendudihi block, Ib-river coalfield. A total of 3 sq. km area were geologically mapped on 1:10000 scale. About 2,766.10 m drilling were carried out in 4 boreholes; 392.27 m coal core samples were generated and 1,310.10 m borehole geophysical logging were done in two boreholes. The boreholes intersected the rocks of Raniganj, Barren Measure, Barakar and Karharbari. Two regional coal seam zones of Raniganj Formation, i.e., R-II, and R-I and four regional coal seam zones of Barakar Formation, i.e., Parkhani, Lajkura, Rampur and Ib have been intersected in the boreholes. Coal seam zones of Raniganj Formation occur at shallow depth i.e. within 300 m, between 7.90 m and 62.50 m depth. R-II seam (2.86 m cumulative thickness) has been intersected in Borehole IBKD-1. Cumulative coal thickness of R-I varied from 4.50 m to 5.36 m. The coal seam zones of Barakar Formation have been intersected between 244.06 m and 747.24 m depth. Cumulative coal thickness of Parkhani, Lajkura, Rampur and Ib seam zones varied from 5.91 m to 7.74 m, 26.17 m to 37.35 m, 45.62 m to 55.92 m and 1.99 m to 13 m, respectively.
Gold							
Kendujhar & Dhenkanal	Bonai-Keonjhar belt (Kantalsua-Kulanga areas)	1:12500	110	-	-	17	During reconnaissance survey for gold in the volcano-sedimentary rocks of Bonai-Keonjhar belt in Kantalsua-Kulanga areas, an area of

(Contd)

STATE REVIEWS

Table-3 (Contd)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							110.0 sq. km was mapped on 1:12500 scale. The rock types identified in the study area included quartzite, quartz mica schist, amphibolite, metavolcanics, quartz vein, pegmatite, dolerite and laterite. Pyrite cubes are occasionally noticed in the contact zone of sheared quartzite. The contact zone between the metavolcanics and sheared quartzite was found to be marked by alteration with development of fuchsite and sericite. Analytical result received so far showed silver (Ag) value ranging from <0.2 to 0.28 ppm in 3 stream sediment samples and <0.2 ppm to 0.42 ppm in 13 soil samples. One bedrock sample yielded value of 0.75 ppm of Ag in quartz vein.
Iron ore Kendujhar	Rengalaberha north-east, extension block	1:2000	0.28	15	1501.05	1563	General Exploration for iron ore was carried out in this area. Detailed mapping of 0.28 sq. km on 1:2000 scale and drilling of 1,501.05 m in 15 boreholes were completed. The rock types exposed were mainly Fe-laterite iron ore (Hard Laminated Ore, Soft Laminated Ore and lateritic ore/ lateritised laminated ore and fragmentary ore. The cumulative thickness of ore zones intersected were 58.55 m, 48.55 m, 98.50 m, 130.50 m, 53.05 m, 26.50 m, 86.00 m, 70.00 m, 83.90 m, 72.90 m, 32.35 m, 44.60 m and 19.45 m in Boreholes OKR-23 to OKR-34 and OKR-37 respectively. The intersected ore zones comprised hard laminated ore, purple powdery ore, lateritised ore and soft laminated ore with intercalations of shale/ ferruginous shale with minor pieces of chert. The ore zones thickness intersected in the boreholes varied from 19.45 m to 130.50 m. The preliminary iron ore resources were estimated at 16.20 million tonnes which includes 15.07 million tonnes of high-grade iron ore and 1.13 million tonnes of low-grade iron ore.

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
	Gandhalpada	-	-	-	-	-	General exploration for iron ore was carried out in Gandhalpada south block in Kendujhar district. During study, detailed mapping in 0.85 sq. km area with 50 cu. m of trenching and pitting and collection of 1,424 core samples, 50 PTS, 37 CS for P ₂ O ₅ and 52 check samples were carried out.
	Gandhalpada South block	-	0.85	20	2246.50	1563	Estimated iron ore resources in Gandhalpada South block, have been reported as 61.72 million tonnes at >45% Fe cut-off.
	Gandhalpada south-east, part – B	-	0.12	11	960.55	-	Preliminary exploration for iron ore was carried out in this area. The exploratory work comprised detailed mapping of 0.12 sq. km and drilling of 960.55 m in 11 boreholes. These boreholes were closed at depths of 108.10 m, 60.00 m, 79.20 m, 75.00 m, 93.10 m, 95.20 m, 134.00 m, 90.45 m, 73.00 m, 79.50 m and 73.00 m respectively and have intersected thick ore zone of 99.00 m, 35.00 m, 18.00 m, 52.40 m, 93.00 m, 55.00 m, 122.00 m, 61.00 m, 21.00 m, 30.00 m and 66.00 m respectively. The mapped area comprised lateritised hard laminated ore (HLO) and soft laminated ore (SLO) rich soil and laterite. Preliminary iron ore resources estimated over 0.81 sq. km area in the block have been placed at 113.53 million tonnes, which includes 98.90 million tonnes of high-grade powdery ore, 1.90 million tonnes of high-grade lumpy ore and 12.71 million tonnes of low-grade ore.
Sundargarh	Jjumka Pathiriposhi west block	1:4000	1.28	06	407.50	-	An area of 1.28 sq. km was mapped on 1:4000 scale during preliminary exploration for iron ore in Jjumka-Pathiriposhi west block in Sundargarh district. The study was continuation of previous field work. The mapped area comprised lateritised BHJ. A total of 407.50 m drilling were carried out in 06 boreholes, i.e., from SJP-1 to SJP-6. The width of the ore zone

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							intersected in boreholes were 30.00 m, 25.00 m, 31.45 m, 28.00 m, 18.90 m and 6.70 m respectively. A total drilling of 359.02 m were carried out till March, 2018, which included 259.90 m of in-house spill over drilling and 99.12 m of outsourced drilling. Ore zone thickness intersected in Boreholes SJP-7 to SJP-14 varied from 9.80 m to 54.65 m. Preliminary iron ore resources estimated over 0.64 sq. km area were placed at 13.34 million tonnes which includes 2.88 million tonnes of high- grade iron ore and 10.46 million tonnes of low-grade iron ore.
Manganese ore							
Rayagada	Tala-Chhelianal Block (Eastern Ghats Granulite Belt)	-	1.0	7	384.4	-	Preliminary exploration for manganese ore in Tala-Chhelianal Block in the central sector of the Eastern Ghats Granulite Belt, Rayagada district was carried out involving detailed geological mapping of 1 sq. km area along with 65 cu. m of pitting/ trenching and 384.4 m drilling in seven boreholes. Three discontinuous manganese ore bands were delineated for a strike length of 150 m, 50 m and 50 m respectively with width varying from 6 to 20 m. Manganese ore band was intersected in a borehole for a cumulative width of 4.4 m which was mainly powdery in nature. The manganese minerals found in the ore were generally pyrolusite, psilomelane and cyrtomelane. Chemical analysis of 50 bedrock samples showed Mn content varying from 0.42% to 39.60%. Chemical analysis of 151 trench samples showed Mn content varying from 0.01% to 33.52 % among these 75 samples showed >10% Mn values and 28 samples have shown Mn values >20%. Mn content in the ore zone varied from 2.19% to 33.52%. The average grade as determined from the ore zone in 12 trenches was 16.45% Mn in over 8 m width.

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
	Anujurhi Block Eastern Ghats Granulite Belt	-	1.5	3	213.80	64	During preliminary exploration in Anujurhi Block in the Central Sector of the Eastern Ghats Granulite Belt, Rayagada district, an area of 1.5 sq. km was covered by detailed mapping and drilling in three boreholes up to 213.80 m were carried out. The manganiferous ore body of 800 m strike length with an average width of 10 m within khondalite and quartzite was demarcated. The ore zone could be traceable with discontinuous/detached outcrops showing varying width ranging from 8 to 24 m. The chief minerals are pyrolusite, psilomelane, cryptomelane and todorokite. A total of 64 CS were collected. Analytical results of 85 bedrock samples indicated Mn content varying from 0.25% to 30.76 %, Fe 2.27% to 33.97%, P 0.14% to 1.65% and SiO ₂ 11.56 to 80.22%. Analytical results of PTS showed Mn in the range of 0.21% – 22.51% with an average grade of 13.25% over 5.0 m width.
	Rukunibori - Loharpadar Block Eastern Ghats Granulite Belt	1:2000	1.5	6	500	-	Preliminary exploration in Rukunibori - Loharpadar block in the Central Sector of Eastern Ghats Granulite belt was carried out involving mapping of 1.5 sq. km area on 1:2000 scale and drilling up to 500 m was carried out. The manganese ore zone with strike length of 180 m and width varying up to 8 m have been delineated. The ore was observed to be hard and lumpy and Mn content in ore zone ranged from 12.42–28.91% Mn with an average of 18.18%. The value of P ₂ O ₅ was seen to be <3.5% in this area. Three boreholes intersected the ore zone at 30 m vertical depth. The ore zone in Loharpadar block measured about 500 m in length with width varying up to 12 m. The manganese ore was observed to be hard, siliceous with intercalations of quartz and showed Mn content of 11.38 – 39.55% with mean value of 20.2% in bed

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							rock samples. Six boreholes were completed and these intersected the ore zone at 30 m vertical depth and had a maximum width of 16 m.
Manganese ore							
Kalahandi	Tekartola- Brahmani area	1:12500	100	-	-	165	Reconnaissance survey for manganese ore was taken up in Tekartola-Brahmani area. An area of 100 sq. km was mapped on 1:12500 scale and 100 bedrock samples, 50 pitting/trenching samples, 05 OM sample and 10 XRD samples were collected. Manganese ore minerals were found to be concentrated within the manganiferous quartzite. A discontinuous ore zone was delineated in the western slope of 519 hill range near Tekartola and the ore bodies were found to occur in the form of lenses, stringers and as fragmented bands. Four linear bands of manganese mineralisation of dimension (i) 30 m X 30 m X 13 m trending NW-SE, (ii) 60 m X 15 m trending NE-SW, (iii) 15 m X 10 m trending NW-SE and (iv) 50 m X 09 m trending NW-SE were located in the area.
	Raidanipadar – Kundeijharan area Eastern Ghats Granulite Belt	1:12500	100	-	-	-	Reconnaissance survey was taken up in and around Raidanipadar – Kundeijharan area. An area of 100 sq. km was mapped on 1:12500 scale along with 50 cu. m of trenching. The rock types exposed were khondalite, pyroxene granulite, quartzite, amphibolites, garnetiferous granite-gneiss, calc silicate, pegmatite and quartz veins. Manganese mineralisation in the Bazargarh reserve forest near Village Taprang was traced for a strike length of nearly 500 m with an average width of 15 m. A few trench samples (5 nos.) showed Mn content varying from 9% to 18%.
REE							
Sambalpur	Rairakhol area Eastern Ghats Granulite Belt	1:12500	100	-	-	276	Reconnaissance survey for REE in the alkaline rocks and associated pegmatites in association with the Eastern Ghats rocks around

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							Rairakhol area, Sambalpur district was carried out with mapping of 100 sq. km on 1:12500 scale. The alkaline units exposed mainly included nepheline syenite and syenite. Petrography, SEM-EDX and EPMA study indicated that nepheline syenite and syenites were the host rock for REE. The REE phases were mainly observed in association with feldspar, apatite, amphibole, sphene and zircon along their grain margins, as crack fillings and occasionally within the grains. A total of 276 samples were collected for analysis.
Graphite							
Angul	Dandatapa block	1:4000	1.5	4	328.1	15.2	During G3 level preliminary exploration for graphite, 35 cu. m of trenching were done in the area. Graphite mineralisation has been delineated through pitting and trenching for a length of 40-45 m with width of about 4-5 m. All the four boreholes intersected sporadic graphite mineralisation at different depths along the boreholes except 1.0 m graphite zone established in Borehole ODDAN-01 and 10 cm in Borehole ODDAN-04 with minor sulphides in the form of specks, stringers and occasional disseminations of pyrite, pyrrhotite and chalcopyrite.
Phosphorite							
Sundargarh	Ib-River Coalfield	1:12500	100.0	-	-	125	G4 stage survey for phosphorite was carried out in the Ib River Coalfield. The phosphorite as nodules up to 20 cm in size and sporadic in nature has been reported within siltstone and claystone and within fine-grained sandstone. At some places, the siltstone and claystone were found to be phosphatic. The phosphorite was found to have a maximum thickness of 0.5 m.
DGM Coal							
Jharsuguda	Madhupur Block Ib Valley, Coalfield	-	7.56	-	2911.10	-	Exploration for coal over an area of 7.56 sq. km was continued from previous field session in Madhupur block of Ib Valley coalfield, Jharsuguda district. A total of 2,911.10 m drilling have been carried out during the year 2017-18

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
Base metal							
Mayurbhanj	Kesharpur	1: 2000	1	-	-	-	Geophysical investigation for base metal was taken up in north of Kesharpur in Mayurbhanj district. Exploration was carried by SP survey of 1 sq. km on 1:2000 scale and IP survey of 0.75 sq. km on 50 m x 20 m spacing . Anomalous zones of causative bodies were indentified for further investigation.
Chromite							
Kendujhar	Madhuban area	1:5000	2.08	-	-	56	Directorate of Geology carried out exploration for chromite in this area. The work included mapping of 2.08 sq. km on 1:5000 scale and excavation of 76 cu m. A total 56 samples for chemical analysis were collected. No perceptible chromite mineralisation was noticed.
Sundargarh	Dholtapahar, Area	1:2000	0.60	-	700.25	700.25	During 2017-18, Directorate of Geology, Odisha had taken up exploration to assess iron ore resources in Dholtapahar, Sundergarh district. An area of 0.60 sq. km was mapped on 1:2000 scale. Cumulative drilling of 700.25 m was completed and 216 samples were collected for chemical analysis.
Limestone							
Bolangir	Lukapada	1:1000	0.51		21644.1	218	Exploration was taken up to assess limestone resources. Drilling data of 21 boreholes indicated that the limestone is crystalline in nature and occurs as irregular and impersistent bands within the host rock. Maximum and minimum thickness of limestone varied from 34.97 m to 8.25 m with maximum depth up to 37.30 m.
Quartz							
Boudh	Eastern bank of River Bagh around Lumurajhala-Sialimunda villages	1:2000	0.14	-	-	21	The average length and width of four quartz cores of disintegrated zoned pegmatite have been established—(i) North of Lumurajhal : 25m x 11 m, (ii) South of Lumurajhala : 48 m x 32 m, (iii) SW of Lumurajhala :

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated	
		Scale	Area (sq. km)	No. of boreholes	Meterage			
							50 m x 10 m and (iv) SE of Lumurajhala : 70 m x 30 m. A total of 101 m ³ material were excavated by pitting/trenching.	
Quartz & Quartzite								
Mayurbhanj	Mundrajodi Pokharia in Sadar Sub-division	1:5000	0.5	-	-	28	Quartz body of length in about 120 m and width 70 m was established. Excavation of 100.4 cu. m was carried out.	
Decorative Stone								
Gajapati	Around Taraba & Lubarsing	1:25000 1:4000	200.0 0.65	-	-	46	Four number of deposits were identified, i.e., (i) Nuagan : 420 m x 400 m, (ii) Betarsing : 630 m x 600 m, (iii) Damba : 380 m x 270 m and (iv) Padmapur : 100 m x 70 m. A total of 16 m ³ material were excavated.	
	Antarba & Kandha Adaba	1:25000	210.0	-	-	57	Four deposits were identified, i.e., (i) Derab : 1,600 m x 900 m, (ii) Tentulikhunta : 700 m x 500 m, (iii) Barupada : 200 m x 150 m and (iv) Baharpada-Jamurhiha : 2,300 m x 500 m.	
Dhenkanal & Angul	Tulsipal, Nalatangra, Nuagaon & Sarapa	1:25000		213.0	-	-	66	The surface area of the four decorative stone occurrences were (i) Tulsipal-30,350.055 sq. m, (ii) Nalatangra-23,280.337 sq. m, (iii) Nuagaon- 4,719.4642 sq. m and (iv) Sarapa - 18,399.734 sq. m.
Pyrophyllite								
Kendujhar	Roduan	1:2000	0.508	-	-	20	Pyrophyllite was found to occur in the old abandoned mines below quartzite with thickness of 30 m. The thickness of ore body is about 4 to 5 m.	
Garnet								
Angul & Kendujhar	Birlamunda & Sarai villages	1:2000	1.145	-	-	42	In situ garnet mineralised zone extends for a cumulative length of 100 m and width of 50 m with thickness proved up to 4 m depth. A total of 4810 kg samples were collected. The garnet identified was of abrasive grade.	
MECL Iron Ore								
Sundargarh	Chandi-poshi block	1:2000	0.89	12	781.0	1461	G2 level exploration was carried out with the objective to generate additional sub-surface data by drilling in-filling boreholes between earlier drilled GSI boreholes and to upgrade the earlier estimation of	

(Contd)

Table-3 (Contd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							grade and ore resources. The exploration / project was funded by NMET. The gross resources at 55% Fe cut-off was estimated at 35.86 million tonnes and the net resources at 32.27 million tonnes after considering 10% depreciation factor. Similarly, 11.21 million tonnes of gross resources and 10.09 million tonnes of net resources at $\geq 45\%$ to $<55\%$ Fe cut-off were estimated separately.
Purhei-bahal block		1:2000	0.36	6	449.0	672	<p>Exploration was carried out with the following objectives:</p> <p>1) To generate additional sub-surface data in respect of the ore bodies along sections with GSI boreholes by drilling in-filling boreholes which will result the required clarity in undersatnding the geometry of the ore bodies.</p> <p>2) To upgrad the earlier estimation of grade and ore resource of G3/ G2 level considering these additional data thus generated to G2 level of UNFC norms as per Minerals (Evidence of Mineral Content) Rule, 2015.</p> <p>The gross/total reserves /resources at at 55% cut-off has been estimated at 35.86 million tonnes and the net reserves/resources were estimated at 32.27 million tonnes after considering the 10% depreciation factor. Similarly, gross/total reserves/ resources at greater than 45% to less than 55% Fe cut-off has been estimated at 11.21 million tonnes and the net reserves/resources were estimated at 10.09 million tonnes.</p>
OMC Chromite							
Jajpur	(i) South Kaliapani	1:1000	16 ha	25	4885.60	558	OMC carried out exploration for chromite in mining leases held by OMC in Jajpur district-- (i) South Kaliapani: mapping on 1:1000/ 1:2000 scale in 16 ha/103 ha, respectively, chemical analysis of 558 samples and core drilling of 4,885.60 m in 25 bore holes; (ii) Sukrangi: mapping on 1:1000 scale in 32 ha, chemical analysis of 105
	(ii) Sukrangi	1:2000	103 ha	6	306.40	105	
	(iii) Saruabil & Sukrangi	1:1000	32 ha	6	1033.30	21	

(Contd)

STATE REVIEWS

Table-3 (Contd)

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							samples and core drilling of 306.40 m in 6 boreholes, one seem to be feebly potential; (iii) Saruabil and Sukrangi: A total core drilling of 1,033.30 m in 6 boreholes, of 21 samples were analysed.
Kendujhar	Bangur mine	1:200	0.03 ha	19	5379	117	Exportaory work included mapping on 1:200 scale in 0.03 ha, chemical analysis of 117 samples and core drilling of 5379 m in 19 boreholes.
Iron & Magnanese							
Kendujhar & Sundargarh	(i) Daitari mine,	1:2000	24 ha	-	-	-	OMC carried out exploration in its nine iron ore mines and two iron & magnanese ore mines located in Kendujhar and Sundargarh districts. Odisha. The exploration activities carried out in (i) Daitari mine were with an objective to prove the ore body up to a depth on 810 mRL for detail mine planning. Quarry area of 24 ha was mapped on 1:2000 scale. Re-assessed resources of the mine were placed at 187.21 million tonnes with (+)45% Fe; (ii) Kumritar mine were with an objective to delineate the ore disposition and assessment of reserves. An area of 21 ha was mapped on 1:2000 scale and the total resources of the mine was placed at 180.85 million tonnes which include 42.85 million tonnes of (+)45% Fe resources; (iii) Rantha mine were—an area of 22.0 ha was mapped on 1:2000 scale and re-assessed resources were placed at 18.701 million tonnes which include 2.466 million tonnes of 45-58% Fe; (iv) Koira-Kasira mine were—an area of 20 ha was mapped on 1:2000 scale and the total resources estimated was at 7.77 million tonnes which include 4.97 million tonnes of (+)45% Fe; (v) Koira-Bhanjapalli mine were—an area of 22.0 ha was mapped on 1:2000 scale and resources estimated were at 6.948 million tonnes which include
	(ii) Kumritar mine	1:2000	21 ha	-	-	-	
	(iii) Rantha mine	1:2000	22 ha	-	-	-	
	(iv) Koira-Kasira mine	1:2000	20 ha	-	-	-	
	(v) Koira-Bhanjapalli mine	1:2000	22 ha	-	-	-	
	(vi) Tiringpahar mine	1:1000	79.3 ha	-	-	-	
	(vii) Khandbandh mine	1:1000	45 ha	-	-	-	
	(viii) Dubna-Sekradihi mine	1:1000	24 ha	-	-	-	
	(ix) Seremda Bhadrasahi mine	1:500/ 1:1000	13 ha	16	677.0	745	

(Contd)

Table-3 (Concl'd)

STATE REVIEWS

Agency/ Mineral/ District	Location	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No. of boreholes	Meterage		
							2.138 million tonnes of 45-58% Fe; (vi) Tiringpahar mine were—an area of 79.3 ha was mapped on 1:1000 scale; (vii) Khandbandh mine were—an area of 45 ha was mapped on 1:1000 scale; (viii) Dubna-Sekradihi Fe-Mn mine were—an area of 24.00 ha was mapped on 1:1000 scale; (ix) Seremda Bhadrasahi Fe-Mn mine were—an area of 13.0 ha was mapped on 1:500/1:1000 scale, 16 boreholes for cumulative depth of 677.0 m were drilled and 745 samples were analysed. The total resources in the area was placed at 11.92 million tonnes.

Production

The important minerals produced in the State were coal, bauxite, chromite, iron ore and manganese ore, limestone etc. during 2017-18.

The value of minor minerals production was estimated at ` 86 crore for the year 2017-18.

The number of reporting mines in 2017-18 was 130 in case of MCDR minerals (Table-4).

**Table - 4 : Mineral Production in Odisha, 2015-16 to 2017-18
(Excluding Atomic Minerals)**

(Value in `000)

Mineral	Unit	2015-16			2016-17			2017-18 (P)		
		No. of mines	Qty	Value	No. of mines	Qty	Value	No. of mines	Qty	Value ^s
All Minerals		133	143747089		135	161051823		130	201774478	
Coal	'000 t	-	138461	-	-	139359	-	-	143328	
Bauxite	t	4	10839038	6278252	3	11990006	7238829	5	11447740	7799974
Chromite	t	21	2913686	21203174	22	3726994	31933702	21	3480911	32109100
Iron Ore	'000 t	66	79856	112112226	66	99617	115628185	60	102177	155456128
Manganese Ore	t	31	390233	1616875	32	587517	3547363	31	516865	3583768
Garnet (abrasive)*	t	-	14767	93564	-	22076	133979	-	34170	242053
Graphite (r.o.m.)	t	4	7783	4865	4	16374	10684	5	14674	7362
Sillimanite	t	1	13393	91755	1	15572	103865	1	16698	111499
Limestone	'000 t	6	4532	1489611	7	4752	1598449	7	4968	1607827
Sulphur [#]	t	-	-	-	-	86734	-	-	231075	-
Minor Minerals [@]		-	-	856767	-	-	856767	-	-	856767

Note: The number of mines excludes fuel minerals and minor minerals.

* Associated with Sillimanite. \$ Excluding fuel minerals.

@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data.

STATE REVIEWS

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important large and medium mineral-based industries in organised sector in the State are given in Table - 5.

Table – 5: Principal Mineral-based Industries in Odisha

Industry/plant	Capacity ('000 tpy)
Aluminium/Alumina	
Hindalco Industries Ltd, Hirakud.	215 (aluminium)
Hindalco Industries Ltd, Aditya Aluminium, Lapanga, Distt Sambalpur.	360 (aluminium)
NALCO, Damanjodi, Distt Koraput.	2275 (alumina)
NALCO, Angul.	460 (aluminium)
Utkal Aluma, Rayagada.	1500 (alumina)
Vedanta Aluminium Ltd, Lanjigarh, Distt Kalahandi.	1000 (alumina)
Vedanta Aluminium Ltd, Jharsuguda, Distt Sambalpur.	1750 (aluminium)
Asbestos Products	
UAL Industries Ltd, Korian, Distt Dhenkanal.	NA
Konark Cement & Asbestos Industries Ltd, Bhubaneshwar.	NA
Cement	
Bargarh Cement Ltd, Bargarh.	2500
Ultra-Tech Cement Ltd, Jharsuguda (G).	2600
OCL India Ltd, Rajgangpur, Distt Sundargarh.	4000
OCL India Ltd, Kapilas (G).	1350
Toshali Cements Pvt Ltd, Ampavalli, Distt Koraput.	200
Fertilizer	
IFFCO, Paradeep.	NA
Paradeep Phosphates Ltd, Paradeep.	NA
SAIL Fertilizer Plant, Rourkela, Distt Sundargarh.	NA
Iron & Steel	
SAIL, Rourkela Steel Plant, Rourkela, Distt Sundargarh.	5300 (sinter) 2120 (pig iron) 4400 (crude/liquid steel) 85 (tin plates)

(Contd)

Table - 5 (Contd)

Industry/plant	Capacity ('000 tpy)
Visa Steel Ltd, Kalinganagar, Distt Jajpur.	225 (pig iron) 300 (sponge iron) 500 (special steel)
OCL India Ltd, Lamloi, Distt Sundargarh.	120 (sponge iron) 85 (billets)
Orissa Sponge Iron Ltd, Palaspanga, Distt Kendujhar.	250 (sponge iron) 100 (steel ingot)
Neelachal Ispat Nigam Ltd, Dubri, Distt Jajpur.	1711 (sinter) 855 (pellets) 920 (crude/liquid steel) 13 (A/S)
Bhushan Power & Steel, Sambalpur.	1000 (sinter) 2300 (crude steel)
Bhushan Steel Ltd, Dhenkanal.	5585 (crude Steel)
Jindal Stainless Steel Ltd, Kalinganagar, Gadapur.	1000 (Stainless steel) 250 (ferro alloys)
Jindal Steel & Power Ltd, Barbil.	9000 (pellets)
Arya Iron & Steel Co. Pvt. Ltd, Barbil.	1200 (pellets)
Essar Steel Ltd, Paradip.	6000 (pellets)
Rexon Strips Ltd, Kumakela, Distt Sundargarh.	300 (pellets) 60 (sponge iron) 25 (M. S. ingots)
Tata Steel Ltd., Kalinga Nagar Works, Kalinganagar, Odisha	2800
Pig Iron	
IDCOL Kalinga Iron Works Ltd, Barbil, Distt Kendujhar.	180
Sponge Iron	
Action Ispat & Power (P) Ltd, Pandripathar, Distt Jharsuguda.	250
Adhunik Metaliks Ltd, Chandrihariharpur, Distt Sundargarh.	270
Beekay Steel & Power Ltd, Uliburu, Distt Barbil.	115.5
Bhusan Steels Ltd, Meramandali, Distt Dhenkanal.	900
Crackers India (Alloy) Ltd, Gobardhanpur, Distt Kendujhar.	60
Dinabandhu Steel & Power Ltd, Kalinganagar, Distt Jajpur.	60

(Contd)

STATE REVIEWS

Table - 5 (Contd)

Industry/plant	Capacity ('000 tpy)
Jay Iron & Steel Ltd, Balanda, Rourkela, Distt Sundargarh.	60
Jindal Steel & Power Ltd, Nisha, Distt Angul	1800
MGM Minerals Ltd, Forest Park, Bhubaneswar	105
Ganesh Sponge Pvt Ltd, Krushnachandrapur, Distt Angul.	900
Rungta Mines Ltd, Unit-I, Karakola, Barbil, Distt Kendujhar Unit-II, Kamando, Distt Sundargarh.	150
SMC Power Generation Ltd, Jharsuguda	200
Scaw Industries Pvt. Ltd, Gundichapara, Distt Dhenkanal.	100
Sree Metallic Ltd, Loidapada, Distt Kendujhar.	300
Suraj Products Ltd, Barpalli, Distt Sundargarh.	36
Swastik Ispat Pvt. Ltd	45
Tata Sponge Iron Ltd, Joda, Distt Kendujhar	390
Vikram Pvt Ltd, Tumkela, Distt Sundargarh.	60
Ferro Alloys	
Balasore Alloys Ltd, Balgopalpur, Distt Balasore.	95 (57 MVA)
FACOR, Charge Chrome Plant, Randia, Distt Bhadrak.	65
IDCOL Ferro Chrome & Alloys Ltd, Distt Jajpur.	18
Indian Metal & Ferro alloys Ltd (Indian Charge Chrome Ltd, Choudwar & Indian Metals & Ferro Alloys Ltd, Therubali), Distt Cuttack.	275 (Total)
Jindal Stainless Ltd, Kalinganagar, Jajpur.	250
Nav Bharat Ventures Ltd, Ferro Alloys Plant, Khargprasad, Distt Dhenkanal.	75

(Contd)

Table - 5 (Concl)

Industry/plant	Capacity ('000 tpy)
Rohit Ferro-Tech Ltd, Kalinganagar, Distt Jajpur.	110
Jeypore Sugar Co. Ltd, Rayagada	22.5
Tata Steel Ltd (Ferro alloys and Minerals Div.), Joda, Distt Kendujhar.	52
Tata Steel Ltd (Ferro alloys and Minerals Div.), Bannipal, Distt Kendujhar.	60
Tata Steel Ltd (Ferro alloys and Minerals Div.), Distt Cuttack	50
T.S.Alloys Ltd, Anantpur, (Rawmet Ferrous Industries Ltd), Cuttack.	52
Visa Steel, Kalinganagar.	180
Refractory	
IFGL Refractory Ltd, Kalunga, Distt Sundargarh.	80000 pc (continuous casting refractories)
Orissa Industries Ltd, Lakhikata, Distt Sundargarh.	125
Orissa Industries Ltd, Barang, Distt Cuttack.	19 5 (DBM)
TRL Krosaki Refractories Ltd, Belpahar, Distt Jharsuguda.	247.89 18 (Taphole clay)
Silicon Carbide	
Indian Metals & Carbide Ltd, Therubali.	NA
Synthetic Rutile	
IREL, Orissa Sands Complex, Ganjam	100
<i>(G): Grinding units.</i>	
<i>Note: Data, not readily available for fertilizer and cement industries on respective websites.</i>	