

BAUXITE



Indian Minerals Yearbook 2021

(Part- III : MINERAL REVIEWS)

60th Edition

BAUXITE

(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, 2022

3 Bauxite

Bauxite is basically an aluminous rock that contains hydrated aluminium oxide as main constituent and iron oxide, silica & titania as minor constituents present in varying proportions. Hydrated aluminium oxides present in the bauxite ore are diaspore and boehmite, $Al_2O_3 \cdot H_2O$ (Al_2O_3 :85%; Al:45%); gibbsite or hydrargillite, $Al_2O_3 \cdot 3H_2O$ (Al_2O_3 :65.4%; Al:34.6%), and bauxite (containing colloidal alumina hydrogel), $Al_2O_3 \cdot 2H_2O$ (Al_2O_3 :73.9%; Al:39.1%). The iron oxide in bauxite ore is present as haematite or goethite; silica as clay; and free quartz & titania as leucosene or rutile. Bauxite is the principal ore of aluminium which is one of the most important non-ferrous metals used in the modern industry. It is also an essential ore for Refractory and Chemical industries.

RESERVES/RESOURCES

Reserves/Resources of bauxite in the country as on 1.4.2020, as per NMI database, based on UNFC system have been placed at 4958 million tonnes. These resources include 646 million tonnes Reserves and 4311 million tonnes Remaining Resources. By grades, about 77% resources are of Metallurgical grade(I&II). The resources of Refractory and Chemical grades are limited and together account for about 4%. By States, Odisha alone accounts for 41% of country's resources of bauxite followed by Chhattisgarh 20%, Andhra Pradesh (12%), Gujarat (8%), Jharkhand (6%), Maharashtra (5%) and Madhya Pradesh (4%). Major bauxite resources are concentrated in the East Coast bauxite deposits in Odisha and Andhra Pradesh (Table-1).

EXPLORATION & DEVELOPMENT

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

PRODUCTION & STOCKS

The production of bauxite at 20368 thousand tonnes in 2020-21 decreased by about 7% as compared to that of the previous year.

There were 131 reporting mines in 2020-21 as against 144 in the previous year. Besides, produc-

tion of bauxite was reported as an associated mineral by 6 mines during the year. In all, 54 producers reported production of bauxite in 2020-21. Out of these, ten principal producers having 39 mines contributed about 99.25% of the total production.

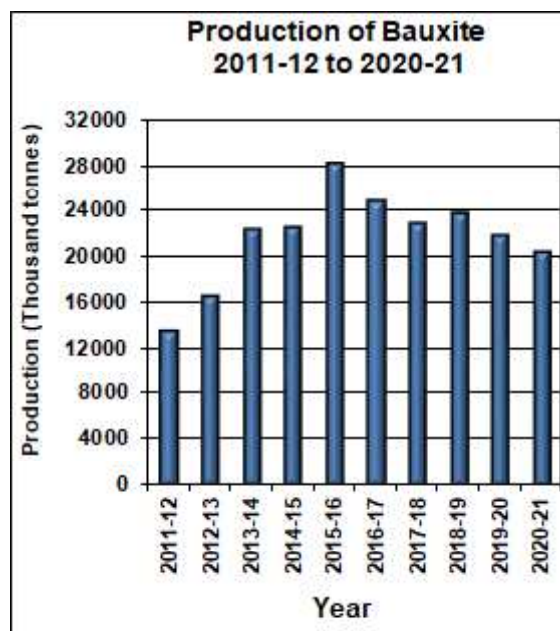
NALCO is the leading producer of bauxite and contributed 36% to the total production. The share of Public Sector mines was about 52% of the total production in 2020-21, as against 50% in the previous year.

About 84% of the total production of bauxite was of 40–45% Al_2O_3 grade, 9% was of Cement grade, 4% of 45% to 50% Al_2O_3 , 1% below 40% Al_2O_3 and the remaining production was reported in other grades except two grades 50-55%, 55-60% and (above 60% Al_2O_3 grade), during the year 2020-21.

Odisha emerged as the leading producing State accounting for about 76% of the total production during 2020-21 (Tables -2 to 5).

Mine-head closing stocks of bauxite in 2020-21 were 18204 thousand tonnes as compared to 15290 thousand tonnes in the previous year. About 81% of the total stock was held in Gujarat at the end of the year (Tables- 6 'A' & 6 'B').

The average daily employment of labour in bauxite mines was 5,023 in 2020-21 as against 6,162 in the previous year.



BAUXITE

Table – 1 : Reserves/Resources of Bauxite as on 1.4.2020 (P)
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining Resources						Total Resources (A+B)		
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)
		STD121	STD122			STD221	STD222						
All India : Total	560865	15553	70076	646493	268398	128409	316835	526286	843058	2044653	184116	4311754	4958248
By Grades													
Chemical	5454	480	706	6639	1936	4819	528	2877	182	5063	-	15405	22044
Refactory	30120	437	11806	42363	5705	8788	46667	6737	184	31999	628	100709	143072
Chemical/Refactory	1301	120	154	1575	6037	3202	793	3378	216	11161	-	24786	26362
Mixed with others													
Metallurgical-1	468244	9495	29788	507527	164431	44265	188496	390814	427586	1410328	19573	2645493	3153020
Metallurgical-2	27772	986	8342	37100	25714	21567	37982	19638	138352	334894	7640	585786	622886
Metallurgical mixed	6443	310	2030	8783	8463	5085	7378	58958	11308	38329	16846	146366	155149
Low Grade	7920	2673	16056	26649	22851	4619	17908	24414	211839	151151	88692	521473	548122
Beneficial	832	-	-	832	-	756	-	-	34424	4610	39260	79050	79883
Mixed grade Excluding Chem./Refrac.	7503	561	339	8403	22017	12399	7563	6839	4370	13387	-	66576	74979
Abrasive	-	-	-	-	264	740	123	92	56	961	840	3076	3076
Others	3192	-	855	4047	5971	137	8754	11999	5600	9250	1545	43257	47304
Unclassified	2084	491	-	2576	4303	22033	643	535	8940	12093	8954	57500	60076
Not-known	-	-	-	-	706	-	-	5	-	21427	138	22276	22276
By States													
Andhra Pradesh	-	-	-	-	-	-	-	188971	138120	288176	-	615267	615267
Bihar	-	-	-	-	-	-	-	-	-	4114	-	4114	4114
Chhattisgarh	19202	1073	3420	23695	14306	4727	46620	37763	75682	771015	18747	968860	992555
Goa	7963	-	1650	9613	5222	1097	8195	6820	-	36910	-	58244	67857
Gujarat	83448	2005	15777	101230	86746	41434	21913	29145	22107	82774	11678	295797	397027
Jammu & Kashmir	-	-	-	-	-	-	-	1323	182	1220	-	2725	2725
Jharkhand	29524	731	9717	39972	25895	7647	14969	25962	63224	70527	41050	249272	289244
Karnataka	126	194	4887	5207	2468	864	88	82	2220	35520	-	41242	46449
Kerala	-	-	-	-	29	-	24	2037	14637	2722	-	19449	19449
Madhya Pradesh	13584	631	4349	18564	20389	13358	1738	22060	54577	50172	-	167695	186259
Maharashtra	18833	3573	16065	38472	15794	1981	21023	38931	32875	83354	-	193958	232430
Meghalaya	-	-	-	-	-	-	-	-	-	4300	-	4300	4300
Odisha	388184	7346	14210	409740	97550	56160	193301	161842	428849	596940	11642	1647284	2057024
Rajasthan	-	-	-	-	-	-	-	-	-	528	-	528	528
Tamil Nadu	-	-	-	-	-	1141	3564	960	10084	8363	-	24112	24112
Uttar Pradesh	-	-	-	-	-	-	-	10390	500	8018	-	18908	18908

Figures rounded off

BAUXITE

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

Table- 2 (Concl'd)

Name & address of producers	Location of mine		Name & address of producer	Location of mine	
	State	District		State	District
National Aluminium Co. Ltd, NALCO Bhawan, P-1, Nayapalli, Bhubaneswar-751 061, Odisha.	Odisha	Koraput	Minerals & Minerals Ltd, Court Road, Lohardaga-835 302, Jharkhand.	Jharkhand	Lohardaga Gumla
Utkal Alumina International Ltd, J-6, Jayadev-Vihar, Bhubaneswar-751 013, Odisha.	Odisha	Raygada	Gujarat Mineral Development Corporation Ltd, Khanij Bhavan, 132 Feet Ring Road, Near University Ground, Vastrapur, Ahmedabad -380 052, Gujarat.	Gujarat	Devbhoomi- Dwarka Kachchh
Odisha Mining Corporation Ltd. OMC House, Unit-V, Post Box No. 34, Bhubaneswar- 751 001 Odisha .	Odisha	Koraput	Saurashtra Minerals Pvt. Ltd. East Kadia Plots. Porbandar -360575 Gujarat.	Gujarat	Porbandar
Hindalco Industries Ltd, Ahura Centre, 1 st Floor, B-Wing, Mahakali Caves Road, Andheri (East), Mumbai-400 093, Maharashtra.	Chhattisgarh Jharkhand Maharashtra	Surguja Gumla Latehar Lohardaga Kolhapur	Alimiya Imamali Saiyad, FF/16, Samruddhi Complex, Near L.I.C. Office, Himmatnagar, Dist, Sabarkantha-383 001 Gujarat.	Gujarat	Sabarkantha
Smt P. H. Joshi 216, Shivam Complex, Opp. Hetarth party plot, Sola science city Road Gujarat-388225, Ahmedabad	Gujarat	Kheda	Bhartesh Construction Company, Maharashtra Pro. of M/s Bharatesh Construction Co. Shop No. 34, Goaves, Hindwadi, Belgaum - 590 011 Karnataka		Kolhapur

(Contd)

**Table – 3 : Production of Bauxite, 2018-19 to 2020-21
(By States)**

(Quantity in tonnes; Value in ₹'000)

States	2018-19		2019-20		2020-21 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	23689619	17836033	21825227	16299333	20368665	16667101
Chhattisgarh	1502350	1607698	1565307	1609377	715296	751480
Goa	518	104	-	-	-	-
Gujarat	2185325	1412294	2076329	1439889	1497712	1196637
Jharkhand	2412486	2479551	1418794	1400830	1497473	1586192
Madhya Pradesh	750433	599967	685929	546953	621505	472602
Maharashtra	1424865	736127	595562	401196	471068	335740
Odisha	15413642	11000292	15483307	10901088	15565611	12324450

BAUXITE

Table – 4 (A) : Gradewise Production of Bauxite, 2019-20 (P)
(By Sectors/States/Districts)

State/District	No. of Mines	For use in Alumina & Aluminium extraction : Al ₂ O ₃ content							For use other than Alumina & Aluminium extraction				Total	
		60% & above		55-60%		50-55%		45-50%		40-45%		Below 40%		
		60% & above	55-60%	50-55%	45-50%	40-45%	Below 40%	Abrasive	Refractory	Chemical	Quantity			
India	144(6)	-	5665	1701	121634	18635652	260591	2283453	67789	119736	329006	21825227	16299333	
Public Sector	21	-	-	-	29	10494669	16032	-	-	32832	316092	10859654	8017260	
Private Sector	123(6)	-	5665	1701	121605	8140983	244559	2283453	67789	86904	12914	10965573	8282073	
Chhattisgarh	15	-	-	-	29	1565278	-	-	-	-	-	1565307	1609377	
Kabirdham	2	-	-	-	29	469800	-	-	-	-	-	469829	550167	
Kondagaon	2*	-	-	-	-	-	-	-	-	-	-	-	-	
Surguja	11	-	-	-	-	1095478	-	-	-	-	-	1095478	1059210	
Gujarat	68	-	5665	1701	-	697118	16032	1533420	67705	65996	316092	2076329	1439889	
Amreli	1	-	-	-	-	2000	-	-	-	-	-	2000	1626	
Devbhoomi Dwarka	42	-	5665	1701	-	67718	-	266867	64335	38393	-	444679	325716	
Kheda	10	-	-	-	-	-	16032	471430	-	-	-	471430	337280	
Kutch	7	-	-	-	-	-	-	227283	-	22373	316092	354497	327958	
Porbandar	4	-	-	-	-	-	-	567840	3370	5230	-	567840	302513	
Sabarkantha	4	-	-	-	-	-	-	-	-	-	-	235883	144796	
Jharkhand	20	-	-	-	82305	1281286	11873	177	84	43068	-	1418793	1400830	
Gumla	14	-	-	-	82305	844431	11873	177	84	43068	-	981938	984772	
Latehar	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lohardaga	6	-	-	-	-	436855	-	-	-	-	-	436855	416058	
Karnataka	1*	-	-	-	-	-	-	-	-	-	-	-	-	
South Kanara	1*	-	-	-	-	-	-	-	-	-	-	-	-	
Madhya Pradesh	20(6)	-	-	-	-	124935	4223	533185	-	10672	12914	685929	546953	
Anuppur	1	-	-	-	-	-	-	24360	-	-	-	24360	15639	
Jabalpur	2	-	-	-	-	-	-	110030	-	-	1000	111030	84095	
Katni	8(4)	-	-	-	-	-	4223	274451	-	-	-	278674	193221	
Rewa	1	-	-	-	-	-	-	13890	-	-	-	13890	10418	
Satna	3(2)	-	-	-	-	-	-	35510	-	5974	11914	53398	58042	
Shahdol	2	-	-	-	-	124935	-	49990	-	-	-	174925	150334	
Sidhi	3	-	-	-	-	-	-	24954	-	4698	-	29652	35204	
Maharashtra	15	-	-	-	39300	334264	5327	216671	-	-	-	595562	401196	
Kolhapur	6	-	-	-	39300	295744	5327	-	-	-	-	340371	269518	
Raigad	6*	-	-	-	-	-	-	-	-	-	-	-	-	
Ratnagiri	3	-	-	-	-	38520	-	216671	-	-	-	255191	131678	
Odisha	5	-	-	-	-	15260171	223136	-	-	-	-	15483307	10901088	
Koraput	3	-	-	-	-	10186479	-	-	-	-	-	10186479	7378697	
Raygada	1	-	-	-	-	5073692	223136	-	-	-	-	5296828	3522391	
Sundargarh	1*	-	-	-	-	-	-	-	-	-	-	-	-	

Figures in parentheses indicate number of associated mines. * Only labour reported.

BAUXITE

**Table – 4 (B) : Gradewise Production of Bauxite, 2020-21
(By Sectors/States/Districts)**

State/District	No. of Mines	For use in Alumina & Aluminium extraction : Al ₂ O ₃ content						For use other than Alumina & Aluminium extraction						Total
		60%& above	55-60%	50-55%	45-50%	40-45%	Below 40%	Cement	Abrasive	Refractory	Chemical	Quantity	Value	
India	131(6)	-	-	877407	17055794	150114	1931077	89820	130735	133718	20368665	16667101		
Public Sector	20	-	-	-	10483896	750	15465	-	60696	113813	10674620	9344498		
Private Sector	111(6)	-	-	877407	6571898	149364	1915612	89820	70039	19905	9694045	7322603		
Chhattisgarh	14	-	-	446215	269081	-	-	-	-	-	715296	751480		
Kabirdham	2	-	-	-	575	-	-	-	-	-	575	533		
Kondagaon	2*	-	-	-	-	-	-	-	-	-	-	-		
Surguja	10	-	-	446215	268506	-	-	-	-	-	714721	750947		
Gujarat	60	-	-	-	51506	750	1172535	89820	69288	113813	1497712	11966637		
Amreli	1	-	-	-	-	-	500	-	-	-	500	433		
Devbhoomi Dwarka	32	-	-	-	51506	-	170577	87876	48212	-	358171	326403		
Kheda	10	-	-	-	-	-	457090	269	-	-	457359	343653		
Kutch	9	-	-	-	-	750	-	-	19086	113813	133649	152161		
Porbandar	4	-	-	-	-	-	257225	1675	1990	-	260890	198041		
Sabarkantha	4	-	-	-	-	-	287143	-	-	-	287143	175946		
Jharkhand	19	-	-	392196	1055260	-	-	-	50017	-	1497473	1586192		
Gumla	13	-	-	392196	486185	-	-	-	50017	-	928398	1015133		
Lohardaga	6	-	-	-	569075	-	-	-	-	-	569075	571059		
Madhya Pradesh	21(6)	-	-	-	68100	-	522070	-	11430	19905	621505	472602		
Anuppur	1	-	-	-	-	-	44548	-	-	-	44548	31494		
Jabalpur	2	-	-	-	-	-	95551	-	-	2500	98051	66517		
Katni	9(3)	-	-	-	-	-	273255	-	-	-	273255	195886		
Rewa	1	-	-	-	-	-	12255	-	-	-	12255	10344		
Satna	3(3)	-	-	-	-	-	9095	-	4046	17405	30546	32489		
Shahdol	2	-	-	-	68100	-	65115	-	-	-	133215	95760		
Sidhi	3	-	-	-	-	-	22251	-	7384	-	29635	40112		
Maharashtra	12	-	-	38996	195600	-	236472	-	-	-	471068	335740		
Kolhapur	6	-	-	38996	195600	-	-	-	-	-	234596	222672		
Raigad	3	-	-	-	-	-	97894	-	-	-	97894	53071		
Ratnagiri	3	-	-	-	-	-	138578	-	-	-	138578	59997		
Odisha	5	-	-	-	15416247	149364	-	-	-	-	15565611	12324450		
Koraput	3	-	-	-	10383785	-	-	-	-	-	10383785	9003950		
Raygada	1	-	-	-	5032462	149364	-	-	-	-	5181826	3320500		
Sundargarh	1*	-	-	-	-	-	-	-	-	-	-	-		

Figures in parentheses indicate number of associated mines. * Only labour reported.

BAUXITE

**Table – 5 : Production of Bauxite, 2019-20 and 2020-21
(By Frequency Groups)**

(Quantity in tonnes)

Production group	No. of mines		Production for the group		Percentage to total production		Cumulative percentage	
	2019-20	2020-21 (P)	2019-20	2020-21 (P)	2019-20	2020-21 (P)	2019-20	2020-21 (P)
Total	144(6)	131(6)	21825227	20368665	100.00	100.00	-	-
Up to 1000	57(1)	54(1)	1542	2628	0.01	0.01	0.0	0.01
1001 — 3000	6	5(1)	10299	10951	0.05	0.05	0.06	0.06
3001 — 5000	4(1)	3	21881	12290	0.10	0.06	0.16	0.12
5001 — 10000	7	6	51718	42665	0.24	0.21	0.4	0.33
10001 — 25000	11	16(1)	192378	268693	0.88	1.32	1.28	1.65
25001 — 50000	21(3)	18	961714	728460	4.41	3.58	5.69	5.23
50001 and above	38(1)	29(3)	20585695	19302978	94.31	94.77	100	100.00

Figures in parentheses indicate number of associated mines

**Table – 6 (A) : Mine-head Closing Stocks of Bauxite, 2019-20 (P)
(By States & Grades)**

(Quantity in tonnes)

State	For use in Alumina & Aluminium metal Extraction Al_2O_3 Content					For use other than Alumina & Aluminium metal extraction					
	60% & above	55—60%	50—55%	45—50%	40—45% Below 40%	Cement	Abrasive	Refractory	Chemical	Total	
India	-	-	-	700009	2541967	222631	10977584	98133	452513	296697	15289534
Chhattisgarh	-	-	-	1630	68727	300	-	95	-	-	70752
Gujarat	-	-	-	580919	448871	45773	10223530	98038	431961	283365	12112457
Jharkhand	-	-	-	46963	167947	20752	-	-	-	-	235662
Madhya Pradesh	-	-	-	3999	33154	32932	274002	-	20552	13332	377971
Maharashtra	-	-	-	53309	201528	111702	480052	-	-	-	846591
Odisha	-	-	-	13189	1621740	11172	-	-	-	-	1616101

BAUXITE

**Table – 6 (B) : Mine-head Closing Stocks of Bauxite, 2020-21 (P)
(By States & Grades)**

State	For use in Alumina & Aluminium metal Extraction Al ₂ O ₃ Content						For use other than Alumina & Aluminium metal extraction					(Qty in tonnes)
	60% & above	55%- 60%	50%- 55%	45%- 50%	40%- 45%	Below 40%	Cement	Abrasive	Refractory	Chemical	Total	
	India	-	-	-	640749	2424526	485123	13581499	509291	398583	163939	18203710
Chhattisgarh	-	-	-	19719	31091	-	-	95	1255	1261	53421	
Gujarat	-	-	-	499725	461804	46501	12795022	509196	375119	128740	14816107	
Jharkhand	-	-	-	22327	85139	11947	-	-	-	-	119413	
Karnataka	-	-	-	-	-	-	9000	-	-	-	9000	
Madhya Pradesh	-	-	-	3999	51720	303801	310782	-	22209	33938	726449	
Maharashtra	-	-	-	81790	197495	111702	466695	-	-	-	857682	
Odisha	-	-	-	13189	1597277	11172	-	-	-	-	1621638	

MINING & TRANSPORT

The mining of bauxite is carried out by opencast method. The mines are classified in the following three categories depending upon the level of mechanisation:

- (i) Manually operated mines
- (ii) Semi-mechanised mines
- (iii) Mechanised mines

Manually Operated Mines

Many bauxite mines are small and produce less than 10,000 tpy. The entire work of overburden removal, extraction of bauxite and loading of bauxite on to trucks is carried out manually and the bauxite is transported to respective railway siding or plants by road.

Semi-mechanised Mines

In semi-mechanised mines, mining operations are carried out by jack hammer drilling and normally ANFO mixture is used as an explosive for blasting in mineralised zone as well as in overburden, if required. Loading of mineral on to trucks or dumpers is done by payloaders or manually. Since bauxite occurs as small lenses or pockets or boulders or as segregations in murrum and laterite, it is difficult to mechanise the mining operations.

Mechanised Mines

Mechanised mining operations are carried out in a few captive mines of the alumina/aluminium

plants. These mines use compressed-air drills for drilling blastholes. Sometimes, compressed-air jack hammer drills are also used for drilling blastholes for secondary blasting of boulders and also for toe drilling in irregular bauxite faces caused due to improper fragmentation of bauxite. The blasted overburden/ore materials are handled and transported separately by using shovels or excavators and trucks/dumpers. Separate benches are maintained for overburden and ores. The height of benches in ore varies from 1.5 to 7.5 m. Hindalco has done away with drilling and blasting at its Durgmanwadi mines in Maharashtra and instead has adopted the state-of-the-art ripper dozer which is regarded as "Miner's Plough". The ripper dozer silently ploughs the mine surface to extract the mineral. It eliminates ground vibrations and air pollution normally causes dust, gases and noise.

In Bagru Hill mines of Hindalco in Jharkhand, the blasted bauxite is transported with the help of dumpers to the crusher. The 4-inch crushed bauxite is then transported to Lohardaga railway station by a monocable aerial ropeway. BALCO also has monocable ropeway for transporting bauxite from its captive mines to the alumina plant at Korba in Chhattisgarh.

Computerised mine planning, use of mobile crusher, simultaneous land reclamation, restricting operations to small portions of mining area at a time, etc. have greatly helped in conserving energy and faster land rehabilitation.

BAUXITE

In Odisha, NALCO has adopted the mechanised 'Trench method' of opencast mining at Panchpatmali (North-Central Block) mine. In this method, a pilot trench is driven through the middle of the deposit and several other trenches are opened on both sides in a staggered pattern exposing and creating more number of working faces. Transportation of ore to alumina refinery at Damanjodi has been done through a 14.6 km long single-flight, multi-curve cable belt conveyor of 1800 TPH capacity. The mining operations involve dozing aside the top fertile soil which is usually preserved and hard laterite of 3 m thickness is drilled and blasted. The overburden is removed using higher capacity mobile equipment like dumpers and wheel loaders to expose the bauxite bed. The top slice of bauxite having 8–10 m thickness is loosened by drilling and blasting and the bauxite of 3–4 m thickness at the bottom contact is removed selectively using backhoe shovels.

The Government of Odisha has extended mining lease period of Panchpatmali (North-Central Block) mine up to 16.11.2032 from 31.03.2020 and Panchpatmali (South Block) up to 19.07.2029 from 31.03.2020. The Panchpatmali (North-Central Block) has achieved 100% capacity utilisation with transportation (production) of 6.825 million tonnes for third successive year and transportation from South block was 0.4 million tonnes during the year. The bauxite production from mines of NALCO during the year 2020-21 was about 7.36 million tonnes. The higher capacity mobile equipment like dumpers, wheel loaders, ripper dozers and faster drills have been introduced.

Pottangi Bauxite Mine (75 million tonnes) in the Koraput district of Odisha has been reserved by Government of India in favour of M/s NALCO. The Government of Odisha has issued terms and condition for grant of Pottangi lease over the reduced area of 697.979 ha.

CONSUMPTION

In 2019-20, the consumption of bauxite estimated at 24.03 million tonnes increased marginally by 8% as compared to 22.17 million tonnes in the previous year. Alumina/Aluminium Industry was the principal consumer of bauxite and accounted for 89% consumption in 2019-20 followed by Cement (8%) and Calcination (2%) (Table-7).

Gujarat was the main supplier of abrasive and refractory grade bauxite. Besides, Madhya Pradesh also produces refractory grade bauxite. Alumina plants draw supplies mostly from their captive mines. Hindalco sources bauxite from other suppliers too (Table- 8).

**Table-7 : Consumption* of Bauxite
2017-18 to 2019-20
(By Industries)**

Industry	(In tonnes)		
	2017-18	2018-19 (R)	2019-20 (P)
All Industries	20630600(59)	22170700(63)	24025300(58)
Abrasives	65700	35900	74600
Alumina	18385500	19714000	21388100
Calcination	283800	116300	457700
Cement	1806200	2214100	2036400
Ferroalloys	15900	19300	30500
Refractory ^{1/}	65500	70200	37100
Others (ceramic, chemical, Pulversing)	8000	900	900

Figures rounded off

** Includes actual reported consumption and/or estimates made wherever required and paucity of data, hence, coverage may not be completed.*

1/ Includes consumption of calcined bauxite.

() : Number of plants reported/estimated.

**Table – 8 : Domestic Sources of Supplies of
Bauxite to Alumina Plants**

Producer	Plant	Source of supply
NALCO	Damanjodi, Koraput (Odisha)	Captive mines at Panchpatmali Hills, Koraput distt. Odisha.
BALCO	Korba (Chhattisgarh)	Captive mines in Surguja & Bodai-Daldali in Kabirdham (Kawardha) distt. Chhattisgarh.
Hindalco Industries	Renukoot (Uttar Pradesh)	Captive mines in Shahdol distt. Madhya Pradesh; Gumla & Lohardaga distts. Jharkhand and Surguja distt. in Chhattisgarh. Also other suppliers include suppliers from Odisha, Madhya Pradesh and Jharkhand; Katni Bauxite Pvt. Ltd, Satna, Laxmidasji Ramji, Katni; and Minerals & Minerals Corp., Gujarat.
	Belagavi (Karnataka), Muri, Ranchi (Jharkhand)	Captive mines in Chandgad & Durgmanwadi, Kolhapur distt. Maharashtra and Lohardaga distt. in Jharkhand. Udgiri, Gudeghar, Kolhapur distt., Maharashtra and Bhoomi Resources Pvt Ltd, Maharashtra.
Utkal Alumina	Odisha	Baphlimali bauxite mine (Odisha)
Vedanta Aluminium	Lanjigarh (Odisha)	Supplier from Gujarat, BALCO, Bagmar Bauxite Industries Pvt Ltd, Chhattisgarh; LDR, M.P. and abroad.

USES & SPECIFICATIONS

Bauxite is primarily used to produce alumina through the Bayer process. Aluminium Industry normally uses bauxite containing minimum 40% Al_2O_3 . However, slightly inferior grades with a suitable blend are also used depending upon other characteristics, such as, solubility in caustic soda and absence of silica. The BIS has specified IS:5953-1985(Reaffirmed 2008 & 2014) specifications for metallurgical grade bauxite. Details of the industries are provided in a separate Review 'Aluminium and Alumina'.

In Steel Industry, bauxite is used as a slag corrector in place of fluorite and generally bauxite, containing 45 to 54% Al_2O_3 and 5% SiO_2 (max.) is consumed. Size preference is 25 to 125 mm with a tolerance of 5% (max.) for -25 mm & +100 mm fractions.

BIS has prescribed the specifications of bauxite 'IS : 10817-1984 (Reaffirmed in 2020) for Refractory Industry.

The IS specifications of bauxite for consumption in Chemical and Petroleum industries are given in 'IS : 3605-1984 (Reaffirmed 2020).

Apart from the chemical specifications, the physical requirements are that the material passing through 90-micron IS sieve but retained on 212-micron IS sieve should be 90% maximum; that passing through 300-micron IS sieve shall be 1% by mass maximum; and that passing through 212- micron IS sieve but retained on 300-micron IS sieve should be 10% maximum.

The other specifications laid down by BIS are 'IS:8228-1976 (Reaffirmed 2020)' for bauxite sand and 'IS:8988-1978 (Reaffirmed 2019)' for bauxite powder for foundry washes.

As per Ministry of Mines Notification dated 25th April 2018, the threshold value of bauxite mineral has been classified into the following two categories:

- (i) For Aluminous laterite: Al_2O_3 – 20% (min.)
- (ii) For Bauxite: Al_2O_3 – 30% (min.) and SiO_2
(Total) –7% (max.)

SUBSTITUTION

There is no substitute for bauxite as source for aluminium metal extraction carried out on a large

scale. However, calcined clay can be substituted for refractory bauxite but only with reduction in time and stock resistance. Sillimanite, alumina, silicon carbide, magnesite–chromite and carbon–magnesite refractories are the other alternatives for high-alumina material but these would entail higher cost. Silicon carbide and diamonds can substitute for fused aluminium oxide in abrasive use but these would entail again at higher cost. Synthetic mullite is a probable substitute for bauxite-based refractories.

Silicon carbide and alumina–zirconia are costlier substitutes for bauxite-based abrasives. The raw material like alunite, anorthosite, coal wastes and oil shales are other potential sources of alumina. The extraction, however, would require new plants with different technology. These non-bauxitic materials could satisfy the demand for primary metal, refractories, aluminium chemicals and abrasives.

TRADE POLICY

As per the Foreign Trade Policy 2015-2020 and policy on export and import, imports of aluminium ores and concentrates including natural bauxite, calcined and activated bauxite and others are permitted free. There are no policy restrictions on the export of bauxite.

WORLD REVIEW

The world bauxite reserves are estimated at 32 billion tonnes and are located mainly in Guinea (23%), Vietnam (18%), Australia (17%), Brazil (8%), Jamaica (7%), Indonesia (4%), China (3%) and Russia (2%). Countrywise reserves of bauxite are furnished in Table-9.

The world production of bauxite increased marginally by 5% to 368 million tonnes in 2020 as compared to 349 million tonnes in preceding year. Australia continued to be the major producer and accounted for about 28% share in the total production, followed by Bosnia & Herzegovina (23%), Brazil (17%) and China (9%). (Table-10).

To provide generalised view of the development in various countries the country wise description sourced from latest available publication of USGS, Mineral Year Book, 2018 is detailed below:

**Table – 9 : World Reserves of Bauxite
(By Principal Countries)**

(In '000 tonnes)	
Country	Reserves
World: Total (rounded off)	32000000
Guinea	7400000
Vietnam	5800000
Australia	5300000
Brazil	2700000
Jamaica	2000000
Indonesia	1200000
China	1000000
India	660000
Russia	500000
Saudi Arabia	180000
Kazakhstan	160000
United States	20000
Other countries	5100000

*Source: USGS, Mineral Commodity Summaries, 2022.
(a) For Australia, joint Ore Reserves Committee - compliant reserves were 2.2 billion tonnes.*

Australia

Bauxite production decreased by 3% (3.02 Mt) and alumina production was essentially unchanged compared with that in 2017. Decreased bauxite production was attributed to a labour dispute which lasted about 8 weeks. The capacities of the Kwinana, Pinjarra, and Wagerup refineries were 2.2 Mt/yr, 4.2 Mt/yr, and 2.6 Mt/yr, respectively. The Huntly Mine capacity was 26 Mt/yr and the Willowdale Mine capacity was 10 Mt/yr. The mines and refineries were operated by Alcoa (60%) as part of its joint venture with Alumina Ltd (40%). Rio Tinto plc continued construction of the Amrun Mine in Queensland and made the first shipment of bauxite from the mine in December. Completion of the 22.8-Mt/yr bauxite mine was scheduled for March 2019. The bauxite would be shipped through the Port of Cape York and upgraded port facilities would increase export capacity by about 10 Mt/yr. Production from the Amrun Mine would replace production from the East Weipa Mine about 40 kilometers (km) away which was nearing the end of its reserved Metro Mining

Ltd started production from the Bauxite Hills Mine in Queensland in April. By August, the mine was producing at a rate of 2.4 Mt/yr. The mine was scheduled to reach a production rate of 3.5 Mt/yr in 2019. Further capacity expansion to 6 Mt/yr was planned by yearend 2021. The bauxite deposit reserves were reported to be 109.5 Mt.

Canada

Orbite Technologies Inc. was repairing equipment that failed during trial production from its high-purity alumina refinery in Cap-Chat, Quebec. Trial production from the 3-metric-ton-per-day plant was halted in March after 2 months owing to equipment issues. Inspection of the plant's calciner identified problems with the heating system. As a result of the shutdown and equipment issues, Orbite filed for protection under the Bankruptcy and Insolvency Act in April. In addition to high-purity alumina, Orbite's plant was designed to produce gallium, iron oxide, rare-earth elements, and high-purity silica from high-alumina clay.

China

Alumina production increased by 5% (3.51 Mt) to 72.5 Mt, compared with that in 2017. The increased production was attributed to production from new capacity and restarts of capacity at several refineries that had been temporarily shut down to comply with environmental regulations. Alumina capacity at yearend 2018 was estimated to be 83.4 Mt/yr, a 3% increase from 81 Mt/yr at yearend 2017. Approximately 73.5 Mt/yr of capacity was in use at yearend. Although new capacity was added, some startups were delayed until permits were issued and because of limited bauxite supplies at some refineries in the northern part of the country. Many of the new alumina refineries under construction or planned for construction were located in port cities rather than adjacent to inland bauxite deposits. Stricter enforcement of environmental regulations and decreasing quality of bauxite reserves discouraged new refineries in many inland cities while availability of abundant bauxite imports made port locations more attractive. China imported 511,000 t of alumina, 82% less than the 2.86 Mt imported in 2017. The leading sources of alumina imports, in descending order, were Australia (49%) and Indonesia (12%). China exported 1.46 Mt of alumina in 2018 compared with 56,000 t in 2017, as the alumina price in the world

market increased in response to refinery shutdowns in Australia and Brazil. China imported 82.6 Mt of bauxite, 20% more than the 68.6 Mt imported in 2017. The leading sources of bauxite imports, in descending order, were Guinea (46%), Australia (36%) and Indonesia (9%). Imports from Australia, Guinea and Indonesia increased by 4.29 Mt (17%), 10.6 Mt (38%) and 6.25 Mt (483%), respectively, compared with those in 2017, accounting for the increased imports. These increases were partially offset by decreased imports from Brazil (by 1.71 Mt), India (by 1.47 Mt) and Malaysia (by 4.22 Mt).

The Government of China ordered alumina refineries and aluminum smelters in certain regions to shut down 30% of capacity from November 15, 2017, until March 15, 2018. The order to shut down capacity cited environmental concerns about pollution produced by refineries, smelters and powerplants during the winter. Refineries and smelters in 31 cities, mainly in the central and eastern Provinces, were affected by the order. When the restrictions expired, some of the capacity affected by the policy was restarted. The Government instituted a similar shutdown from October 1, 2018, to March 31, 2019, to reduce pollution during the winter, requiring alumina refineries and aluminum smelters in 26 cities to close 30% of their capacity.

Indonesia

Bauxite production was 11 Mt in 2018 compared with 2.9 Mt in 2017, 1.4 Mt in 2016, 472,000 t in 2015, 2.56 Mt in 2014, and 57 Mt in 2013. The overall increase in production was attributed to the rampup of production from mines that supplied two alumina refineries and some mines that were permitted to export bauxite. Alumina production was estimated to be 1 Mt in 2018, the same as the revised estimate in 2017, compared with 600,000 t in 2016, and 70,000 t in 2015. A ban on exporting bauxite and other unprocessed mineral ores took effect on January 12, 2014. The export ban was part of the 2009 Mining Law and was intended to increase economic development in the country through investment in mineral-processing facilities. Exports of bauxite resumed in July 2017 for the first time since the ban started in 2014. The Government of Indonesia issued export licenses to PT Aneka Tambang Tbk (Antam) and PT Bintan Alumina Indonesia Ltd. (Bintan) so that they could use proceeds of bauxite sales to finance construction of alumina refineries. The permit

system was scheduled to end in 2023. Antam completed a bankable feasibility study for a 1-Mt/yr alumina refinery in Mempawah, West Kalimantan Province, with PT Indonesia Asahan Aluminium Ltd (Inalum). Construction was scheduled to start in the first quarter of 2019. Expansion to 2 Mt/yr would begin after production of the first phase was ramped up. The refinery would supply Inalum's aluminum smelter in Asahan, North Sumatra Province, which Inalum planned to expand to 500,000 t/yr from 250,000 t/yr by 2020 (PT Aneka Tambang Tbk, 2018, p. 289, 322; 2019, p. 343). In December, Bintan started construction of a 1-Mt/yr alumina refinery in Galang Batang, Riau Islands Province. Bintan was a joint venture among Shandong Nanshan Aluminum Co. Ltd (China) (94%), Redstone Alumina International Pte. (Australia) (5%), and PT Makhota Karya Utama (1%). A construction schedule was not available.

Brazil

Bauxite production decreased by 24% (9.12 Mt) and alumina production decreased by 26% (2.91 Mt) compared with the revised amounts in 2017. Decreased bauxite and alumina production was attributed to environmental regulators' order to Norsk Hydro ASA to temporarily shut down one-half of the 6.3-Mt/yr capacity of the Alunorte alumina refinery on February 27. Heavy rainfall on February 16 and 17 resulted in high water levels in one of the refinery's waste disposal impounds. Monitoring of the impounds did not detect any leakage or failure, but the water level in one impound reached a dangerous point, prompting the order to shut down some production. On October 3, the mine and refinery shut down all capacity for a few weeks when the red mud impoundment reached its maximum capacity. However, production was restarted at one half of the capacity at the end of October when permits to use a new impoundment and filter press were issued. At yearend, the mine and refinery were producing at one-half of capacity while the company waited for approval to restart the other one-half of capacity. Norsk Hydro also shut down 230,000 t/yr of capacity at the adjacent 460,000-t/yr Albras primary aluminum smelter in April citing a shortage of alumina resulting from the refinery shutdown. An expansion project, started in 2016, was completed at the Juruti Mine, increasing capacity to 6.5 Mt/yr from 5.7 Mt/yr. The mine was a joint venture of Alcoa (60%) and Alumina Ltd. (40%).

BAUXITE

**Table – 10 : World Production of Bauxite 2018 to 2020
(By Principal Countries)**

	(In '000 tonnes)		
Country	2018	2019	2020
World: Total (rounded off)	337703	349580	368604
Australia	95947	105543	103626
Bosnia & Herzegovina	59573	70173	87766
Brazil	70751	62000	62000
China	32377	31937	32897
Colombia	13243	16592	25860
Croatia	23687	22073	19700
Dominican Republic	10058	9022	7546
Fiji	5651	5574	5570
France	4730	5031	4945
Ghana	5736	4118	4057
Other countries	15946	17513	14633

Source: BGS World Mineral Production, 2016-2020.

** Estimated*

(f) Years ended 31 March following that stated.

(n) No adjustment has been made for moisture content

***India's production of bauxite during 2018-19, 2019-20 and 2020-21 was 23.69 million tonnes, 21.82 million tonnes and 20.36 million tonnes, respectively.*

FOREIGN TRADE

Exports

In 2020-21, exports of bauxite decreased drastically by 55% to 240 thousand tonnes from 524 thousand tonnes in the previous year. Exports were mainly to Nepal (65%), Oman (22%) and Slovenia (5%). Export of bauxite other (aluminium ores & concentrate) were at 176 thousand tonnes during 2020-21 which increased manifold from 40 thousand tonnes reported in the preceding year. Exports were mainly to Nepal (70%) and Oman (29%). Export of bauxite (aluminium & concentrate) also decreased substantially by 87% to 63 thousand tonnes during 2020-21 from 484 thousand tonnes in the preceding year. Exports were mainly to Nepal (55%), and Slovenia (17%). (Tables-11 to 13).

Imports

Import of bauxite increased by 35% to 3034 thousand tonnes during 2020-21 from 2246 thousand tonnes in the previous year. Imports were mainly from Guinea (96%) and China (2%). Imports of bauxite other (aluminium ores & concentrates) increased by 52% to 333 tonnes during 2020-21 from 218 tonnes in the previous year. Imports were mainly from Turkey (48%), Ukraine (32%) and China (14%). On the other hand, imports of bauxite (aluminium & concentrates) increased by 35% to 3033 thousand tonnes during 2020-21 from 2246 thousand tonnes in the preceding year. Imports were mainly from Guinea (96%) and China (2%) (Tables-14 to 16).

BAUXITE

**Table – 11 : Export of Bauxite
(By Countries)**

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	524229	1421269	240841	951442
Nepal	126962	300387	158165	331823
Slovenia	10749	159121	11407	178458
Oman	16500	25750	54703	123786
UK	1826	48373	2420	77353
Italy	4386	78520	1583	36292
Germany	1050	19883	1350	31087
Sweden	500	8892	1154	20465
France	1762	25699	1191	18222
Australia	475	10441	714	14989
Spain	1750	35035	600	14104
Other countries	358269	709271	7554	104863

Figures rounded off

**Table – 12 : Export of Bauxite: Other
Aluminium Ores & Concentrates
(By Countries)**

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	40004	98805	176955	389007
Nepal	39308	93654	122172	264087
Oman	-	-	54690	123435
Cameroon	-	-	54	858
China	-	++	21	349
Ethiopia	-	-	10	135
Sudan	-	-	7	115
U A E	1	21	1	28
Germany	-	-	++	++
Korea	614	3358	-	-
Bangladesh	80	1738	-	-
Other countries	1	34	-	-

Figures rounded off

**Table – 13: Exports of Bauxite: Aluminium &
Concentrates
(By Countries)**

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	484225	1322464	63886	562435
Slovenia	10749	159121	11407	178458
UK	1826	48373	2420	77353
Nepal	87654	206733	35993	67736
Italy	4386	78520	1583	36292
Germany	1050	19883	1350	31087
Sweden	500	8892	1154	20465
France	1762	25596	1191	18222
Australia	475	10441	714	14989
Spain	1750	35035	600	14104
Mexico	100	1979	575	12179
Other countries	373973	727891	6899	91550

Figures rounded off

**Table – 14: Imports of Bauxite
(By Countries)**

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	2246681	10817757	3034041	13709540
Guinea	1955721	8126743	2931220	11040863
China	55765	1380225	86044	2371446
Hong Kong	9955	218474	5516	124781
Guyana	1654	27617	8324	98512
Singapore	3925	92647	1175	34591
Netherlands	222	10414	294	13528
U K	++	14	221	6073
Malaysia	-	-	325	6054
U S A	++	708	245	3806
U A E	1037	12689	400	3496
Other countries	218402	948199	277	6390

Figures rounded off

BAUXITE

Table – 15: Imports of Bauxite:Other Aluminium Ores & Concentrates (By Countries)

Country	2019-20 (R)		2020-21(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	218	8946	333	8419
Turkey	-	-	160	3424
Ukrain	26	388	107	1649
Chain	158	4447	47	1119
U K	-	-	5	889
Netherlands	13	1079	8	622
Brazil	-	-	6	590
U S A	++	324	++	126
U A E	21	2702	-	-
Italy	++	6	-	-

Figures rounded off

Table – 16 : Imports of Bauxite: Aluminium & Concentrates (By Countries)

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	2246463	10808811	3033708	13701121
Guinea	1955721	8126743	2931220	11040863
China	55607	1375805	85997	2370327
Hong Kong	9955	218474	5516	124781
Guyana	1654	27617	8324	98512
Singapore	3925	92647	1175	34591
Netherlands	209	9335	286	12906
Malaysia	-	-	325	6054
U K	++	14	216	5184
U S A	++	384	245	3680
U A E	1016	9987	400	3496
Other countries	218376	947805	4	727

Figures rounded off

FUTURE OUTLOOK

The total resources of bauxite that comprise various grades, as found to occur in the country as on 1.4.2020, are estimated at 4,958 million tonnes. The resources of Metallurgical grade bauxite are adequate while those of the Chemical and Refractory grade bauxite are relatively limited considering the future requirements. India's strength in aluminium is production due to its rich reserve of bauxite, a core

resources used in production of aluminium. As per provision made in Mineral (Auction) Rule 2015, a total of 7 bauxite blocks were auctioned till June 2020 in the State of Maharashtra (6 blocks) and Madhya Pradesh (1block).

As per the FITCH Report, the production of bauxite is estimated to grow to 50.7 million tonnes by 2027.