

BARYTES



Indian Minerals Yearbook 2016

(Part- III : Mineral Reviews)



55th Edition

BARYTES

(FINAL RELEASE)

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

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3 Barytes

Baryte or barite is a moderately soft crystalline mineral form of barium sulphate (BaSO₄). Approximately, 80% barytes produced worldwide is used for oil and gas drilling as a weighting agent in the drill mud, primarily to prevent the explosive release of gas and oil during drilling. Its unique physical and chemical properties like heavyness, high specific gravity, chemical and physical inertness, very low solubility and magnetic neutrality. Barium compounds are utilised as filler, extender and aggregate. Barytes after converting to barium carbonate, is used in the manufacture of ceramic and glass. The Mangampet deposit in Kadapa district of Andhra Pradesh is the single largest barytes deposit in the world. India is one of the leading producers and exporters of barytes in the world.

RESERVES/RESOURCES

The total reserves/resources of barytes in India as on 1.4.2015 as per NMI database, based on UNFC system have been placed at 86.67 million tonnes of which 59% constitute reserves and 41% remaining resources. By grades, 64% resources are of Oil-well drilling grade followed by 6% of Chemical grade (Chemical-A & Chemical-B), 1% of Paint grade and 27% constitute low grade. About 3% resources are of Other, Unclassified and Not-known categories. Among the states Andhra Pradesh alone accounts for 92% of the country's barytes resources. As per the information available, National Data Sharing and Accessibility Policy (NDSAP), the deposits of barytes are located at Relpataliya (Rajasthan), Chimalapenta, Mangampeta and at Vemula (Andhra Pradesh & Telangana), Ghatihosahalli (Karnataka) and at Sukwari (Madhya Pradesh) (Table - 1).

EXPLORATION & DEVELOPMENT

No exploration was reported by any exploration agency during the year 2015-16.

PRODUCTION

As per Govt. of India Notification S.O. 423(E) dated 10th February 2015 barytes has been declared as 'Minor Mineral' hence the production beyond January 2015 is not available with IBM. List of producers of Barytes is given in Table-2.

Table – 2: Producers of Barytes

Name and address of producer	Location of mine	
	State	District
Andhra Pradesh Mineral Development Corpn. Ltd, HMWSSB, Rear Block, 3 rd Floor, Khairatabad, Hyderabad - 500 004, Andhra Pradesh.	Andhra Pradesh	Kadapa
Sudarsan Barytes Company Arthi Apartment, No.150, Habibullah Road, Post: T Nagar, Chennai-600 017 Tamil Nadu.	Andhra Pradesh	Nellore
S. Ramdas, Arthi Apartment, No.150, Habibullah Road, Post: T Nagar, Chennai-600 017 Tamil Nadu.	Andhra Pradesh	Nellore
Viswabharati Mining Corpn. Ltd, 1/397, Court Road, Kadapa - 516 001, Andhra Pradesh.	Telangana	Khammam

MINING, MARKETING AND TRANSPORT

Barytes mines in India are worked by opencast method. Andhra Pradesh Mineral Development Corp. Ltd, (APMDC), the largest producer, obtains barytes from the mechanised opencast mine in Mangampet area in Kadapa district, Andhra Pradesh. Drill machines, loaders, dozers and dumper-trucks are used for removing overburden. Barytes is won from benches using jackhammer drilling followed by blasting and then loading into

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**Table – 1 : Reserves/Resources of Barytes as on 1.4.2015
(By Grades/States)**

(In 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	50449000	49358	848467	51346825	410466	323345	1258521	205834	1284390	31735548	105721	35323825	86670650
By Grades													
Chemical-A	121417	13860	77696	212973	52409	53695	49790	-	140553	509819	-	806266	1019239
Chemical -B	1517785	23213	512919	2053917	231053	175630	180872	20167	508494	911750	12835	2040801	4094718
Oil-well Drilling	48615140	9185	174458	48798783	14154	57060	345584	48550	177407	5734783	-	6377538	55176321
Paint	1768	3100	1118	5986	83194	24348	149670	48904	21608	147135	-	474859	480845
Low	-	-	-	-	-	3068	388928	1210	361950	22876753	92886	23724795	23724795
Others	135331	-	73771	209102	28206	9544	122322	-	-	12599	-	172671	381773
Unclassified	57559	-	8505	66064	1450	-	20935	83195	69878	1494283	-	1669741	1735805
Not-known	-	-	-	-	-	-	420	3808	4500	48426	-	57154	57154
By States													
Andhra Pradesh	48990002	49358	372296	49411656	186544	94489	988514	104322	389630	28165637	105721	30034857	79446513
Haryana	-	-	-	-	-	-	-	-	-	440	-	440	440
Himachal Pradesh	-	-	-	-	27288	12846	12645	48904	12370	3000	-	117053	117053
Jharkhand	-	-	-	-	-	-	-	-	-	35900	-	35900	35900
Karnataka	-	-	-	-	78296	136220	14252	-	-	15175	-	243943	243943
Madhya Pradesh	-	-	-	-	-	18500	4472	-	35000	233940	-	291912	291912
Maharashtra	-	-	-	-	-	-	-	14800	89450	18610	-	122860	122860
Rajasthan	134416	-	72571	207167	6018	15890	108577	37808	311500	2304688	-	2784481	2991648
Tamil Nadu	-	-	-	-	-	-	-	-	500	221919	-	222419	222419
Telangana	1324582	-	403420	1728002	112320	45400	130061	-	12940	711239	-	1011960	2739962
Uttarakhand	-	-	-	-	-	-	-	-	-	25000	-	25000	25000
West Bengal	-	-	-	-	-	-	-	-	433000	-	-	433000	433000

Figures rounded off.

trucks. The Corporation produces ore by engaging a raising contractor and supplies the ore to Exporters, Oil and Natural Gas Corporation Ltd, Oil India, Barium Chemical Industries and also to local Pulverising Industries. APMDC proposed to set-up beneficiation plant with private participation for beneficiation of low-grade barytes ore at Mangampet. This is due to the encouraging results of beneficiation study carried out by NML, Jamshedpur. It is expected to beneficiate 2 lakh tonnes of low-grade barytes ore per annum. APMDC has entered into an MoU with the ONGC Ltd to set up an industry for upgrading the quality of barytes mineral from Mangampeta. The MoU was to beneficiate about five lakh to seven lakh tonnes of inferior barytes per year. ONGC will use part of the beneficiated mineral and the rest will be exported to earn foreign exchange for the country. While marketing, barytes is graded into two varieties: off-colour and snow-white. The white and snow-white varieties are used generally as fillers in the manufacture of rubber goods and as an opacifying material in the manufacture of paints and paper. The off-colour barytes is used for manufacturing chemicals or as drilling muds. Both the well-known grades laid down by Oil Companies Material Association (OCMA) and American Petroleum Institute (API) were produced and marketed in the country. The country supplies drilling grade barytes to the countries in Middle East and South America. The other producer of barytes in the State of Telangana is IBC Ltd, Seripuram, district Khammam.

CONSUMPTION

The consumption of barytes was about 138 thousand tonnes in 2015-16 as compared to 137.60 thousand tonnes in 2014-15. The Oil-well drilling Industry is the main consumer of barytes, accounted for 69% consumption, which was followed by Chemical Industry (25%) while the other barytes consuming industries like Paint, Asbestos products, Glass, Rubber, Paper and Cement accounted for remaining about 6% of the consumption (Table-3).

USES AND SPECIFICATIONS

Oil and Gas Drilling

The properties like non-corrosive, non-abrasive, insolubility in water, inertness and high specific gravity enable barytes application as a weighting agent in drilling operations to remove the cutting from the bits, transport cutting to the surface to reduce the friction in the drilling string, control pressure, prevent blow-out and at the same time to provide lubrication. Barytes most desirable characteristics is its high specific gravity which makes it the only mineral used in substantial tonnages to increase the density of water based drilling. Barytes powder containing minimum 90% barium sulphate with 4.15 specific gravity is recommended for drilling. For offshore drilling, the specific gravity should be 4.2. At least 97% ground barytes should pass through 75- micron IS sieve and 95% through 53- micron IS sieve. BIS has prescribed IS:2881:1984 (Reaffirmed 2010) as specification of barytes for use in Chemical Industry and Oil-well drilling Industry.

**Table – 3 : Consumption* of Barytes, 2013-14 to 2015-16 (P)
(By Industries)**

Industry	(In tonnes)		
	2013-14	2014-15 (R)	2015-16 (P)
All Industries	138100	137600	138200
Asbestos products	1000	1000	1000
Chemical	34300	34300	34300
Glass	600	600	300
Oil-well drilling	95300	95300	95300
Paint	6800	6300	7200
Others (Paper, Rubber Refractories & Cement)	100	100	100

Figures rounded off.

** Due to paucity of data, consumption may not be complete).*

Chemical

Major barium chemicals obtained from barytes are carbonate, chloride, oxide, hydroxide, nitrate, peroxide and sulphate. Barium carbonate is used in Glass Industry as a flux to add brilliance & clarity in electro-ceramics and for removing inconvenient impurities in phosphoric acid. Barium hydroxide is used in the preparation of barium salts of organic acids which are utilised as additives for lubricating oils and as stabilisers for PVC. Barium sulphate is used as pigment, extender and filler in Rubber and Paper Industries.

Lithopone, a mixture of BaSO₄ and ZnS, is used in Paint and Lacquer Industries as white pigment, extenders and fillers. Barium nitrate is used in green signal flares, tracer bullets, primers and detonators. Barium oxide is used in electric furnace. Barium titanate finds its use in miniature electronic and communication equipment. Barytes is also used in explosive manufacture.

For Chemical Industry, purity is the prime criterion, with ferric oxide and strontium sulphate limited to a maximum 1% and fluorine to traces. The mesh size is also important in manufacturing chemicals. Barytes used in explosive manufacture may be bleached or unbleached. It should be in dry powder form free from extraneous matter.

Paint

Barytes is used as filler and extender in Paint Industry. White pigment is manufactured from barytes. Barytes should be free from mud, clay or siliceous minerals. Presence of iron oxide is undesirable. The material should be in the form of dry powder.

Glass

In glass manufacturing, barytes is added to the glass melt for making the glass more workable and enhancing its brilliance. Iron is the most undesirable impurity in barytes.

Rubber

Barytes is used as a filler and extender in rubber products. It is added to rubber compounds to impart resiliency and durability. Barytes containing

minimum 99.5% BaSO₄ is usually preferred. Since such purity material is not found in nature, before use, barytes is normally bleached called 'blanc fixe' used as a best acid resistance. The sieve residue through 75-micron and 150-micron should be 4% and 0.01% max., respectively. BIS has prescribed IS:1683-1994 (Reaffirmed 2008) as specification of barytes for use in Rubber Industry.

Other Uses

Barytes is used in the manufacture of asbestos products required for autobrake lining and other frictional materials. It is used as a filler in Paper Industry, oil cloth, X-Ray proof plaster and rope finishes. Finely ground barytes and clay are used as suspension in Barvois system of coal washing. Barytes is also used in concrete aggregate as an absorber of gamma and X-Ray radiation required for reactor shielding. In medicine, it is used in radiodiagnosis to highlight the abnormalities in internal body parts. Barytes also finds use in explosives and pyrotechnics composition for which BIS has laid down specifications vide IS 7588-1992 (Reaffirmed 2011).

The specifications of barytes for various industries are detailed in Table - 4.

SUBSTITUTES AND TECHNICAL POSSIBILITIES

Drilling mud substitutes include celestite, witherite calcium carbonate, synthetic haematite and ilmenite but the low cost and technical advantages of barytes deter substitution. Iron ore fines and ilmenite are substitutes used for deep drilling. Apart from calcium carbonate, none of the mineral substitutes has had a major impact on the Barytes Drilling Mud Industry. Reclamation and recycling of drilling muds have been increasingly hampering the requirement for new supplies. Further new oil exploration techniques and drilling methods have reduced the need for new boreholes and wells, which have led to curtailment in the requirement for drilling muds. As a filler, barytes can be substituted by diatomite, feldspar, kaolin, mica, talc and silica flour.

Table -4 : Specifications of Barytes in Different Industries

Industry	IS Specifications/ Specifications of other organisation	Chemical constituent				Physical characteristic				Remarks					
		BaSO ₄	SiO ₂	Ca & Mg as CaCO ₃	Alumi- num as Al	Iron as Fe	Fineness	Relative density	Colour		Volatile matter	Residue on sieve	Oil absorption	pH	
1. Oil-well drilling	IS : 2881-1984, 90% (Reaffirmed 2010)	-	-	-	-	-	(a) Passing through 75-micron IS sieve : 97% min. (b) Passing through 53- micron IS sieve : 95% min.	4.15 at 27 °C	Off- colour	-	-	-	-	For offshore drilling, relative density shall be 4.20.	
	ONGC	-	-	-	-	-	Passing through 75 & 53- micron	-	-	75	-	-	-	-	
	Oil India Ltd.	90% min.	-	-	-	-	-	4.15 at 26+/-2 °C	white	-	-	-	-	-	
2. Chemical Revision, Reaffirmed 2003 Grade-1	IS : 2881-1984, Quality 'A' 97% min. Quality 'B' 90% min.	2% max.	0.1% max.	0.1% max.	0.1% max.	0.1% max.	-	-	-	-	-	-	-	-	Silica and aluminium oxide together shall be 6% max.

(Contd.)

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Table -4 (Concid.)

Industry	IS Specifications/ Specifications of other organisation	Chemical constituent				Physical characteristic				Remarks				
		BaSO ₄	SiO ₂	Ca & Mg as CaCO ₃	BaCO ₃	Alumi- num as Al	Iron as Fe	Fineness	Relative density		Colour	Volatile matter	Residue on sieve	Oil absorption
3. Paint	IS : 64-1972, (First Revision, Reaffirmed 2004) Type - I (Natural barytes) Grade - I	95% min.	-	-	2.24% max.	-	-	4.45 at 25 °C	Snow- white to white.	0.5% to max.	0.25% on 40-micron IS sieve (400 mesh)	6 to 12	6 to 8	Matter soluble in water should not be more than 0.5%.
	Grade-II	95% min.	-	-	2.24% max.	-	-	4.45 at 25 °C	-do-	0.5% max.	0.25% on 63-micron IS-Sieve (240 mesh)	6 to 12	6 to 8	Matter soluble in water should not be more than 0.5%.
	Type-II (Precipitated barytes)	97% min.	-	-	0.45% max.	-	-	3.36 at 25 °C	A close match to that of approved sample	0.5% max.	0.1% on 40-micron IS- sieve (400 mesh)	15 to 30	6 to 8	Matter soluble in water should not be more than 0.5%.
4. Glass	Based on user's demand	90 to 98% (preferably 96%)	1.5% max.	-	-	0.15% max. as to Al ₂ O ₃	0.3 0.5% max. (pre- ferably 0.1% Fe ₂ O ₃)	-	-	-	-	-	-	Iron is the most undesirable impurity; white colour or light shades are preferred.

Note: BIS has prescribed IS: 1683-1994 (Reaffirmed 2008) for specifications of barytes used in Rubber Industry and IS:7588-1992 (Reaffirmed 2011) for that used in Explosive Industry.

TRADE POLICY

As per Foreign Trade Policy (FTP) 2015-20, in force, import and export of barytes (both lumps and powder) as also witherite (natural barium carbonate) are allowed without restrictions under HS Code 2511.

WORLD REVIEW

The world reserves of barytes are assessed at 320 million tonnes. Kazakhstan (22%), India (10%), China (9%), and Iran (8%) accounted for 49% of the total world reserves (Table-5).

In response to concern about dwindling global reserves of 4.2 specific gravity barytes used by the Oil and Gas Drilling Industry, the American Petroleum Institute issued an alternate specification for 4.1 specific gravity barytes in 2010. This has likely stimulated exploration and expansion of global barytes resources.

The world production of barytes decreased considerably to 7.90 million tonnes in 2015 from 8.75 million tonnes in the previous year. The leading producers were China (44%), India (15%), Morocco (11%), USA (8%) and Iran (5%). The country-wise production of barytes is given in Table - 6.

Argentina

Grupo Transmerquim Argentina S.A was awarded a certificate to construct a baryte processing plant in Zapala. The facility was intended to produce baryte concentrate meeting API specifications for use in the development of the Vaca Muerta shale formation.

Iran

Baryte extraction at the Mehdiabad zinc and lead complex in central Yazd Province was expected to increase to 5,00,000 tonnes per year by March 2017. The mine, which received funding to resume zinc extraction and processing, also received a separate line of investment to construct a 1,000,000 tonnes per year baryte processing plant.

Kazakhstan

Halliburton, in conjunction with the Kazakhstan company LLP Karazhal Operating, completed construction of a baryte concentration plant in Karazhal in the Karaganda region. The facility, part of Kazakhstan's Industrialisation Map program, was designed to process as much as 2,00,000 tonnes per year of baryte mined from the Bestobe deposit. Approximately 30% of the baryte produced is anticipated to be used in the domestic Oil and Gas Industry, with the remainder exported to other Commonwealth of Independent States countries including Azerbaijan, Russia, Turkmenistan and Uzbekistan, as well as to oil and gas companies operating in the North Sea.

FOREIGN TRADE

Exports

Exports of barytes increased considerably to 7.43 lakh tonnes in 2015-16 from 6.51 lakh tonnes in the previous year. Exports were mainly to Saudi Arabia (54%), USA (21%) and Kuwait (7%). On the other hand exports of witherite was negligible as compared to 10 tonnes in the previous year (Tables - 7 and 8).

**Table – 5 : World Reserves of Barytes
(By Principal Countries)**

(In '000 tonnes)	
Country	Reserves
World : Total (rounded)	320000
China	30000
India*	32000
Iran	24000
Kazakhstan	85000
Pakistan	14000
Russia	12000
Thailand	18000
Turkey	35000
Other countries	29000

Source: Mineral Commodity Summaries, 2017.

**India's total reserves/resources of barytes as per UNFC System are placed at 86.67 million tonnes as on 1.4.2015.*

**Table – 6: World Production of Barytes
(By Principal Countries)**

(In '000 tonnes)			
Country	2013	2014	2015
World : Total	8570	8753	7904
Algeria	30	31	30 ^c
Australia	13	15	6
Bolivia	30	26	47
Canada ^e	25	25	25
China	3500	4100	3000
Germany	45	88	45
India*	1171	911	900 ^c
Iran	436	441	290
Kazakhstan	530	200	210
Laos	27	46	92
Mexico	119	131	200
Morocco	1095	1007	1212
Myanmar	31	23	2 ^c
Pakistan	118	134	205
Peru	52	106	53 ^c
Russia ^e	64	45	60
Saudi Arabia	30	32	43
Slovakia	24	21	20
Thailand	107	135	171
Turkey ^e	250	340	310
UK ^e	30	44	50
USA	723	663	700 ^c
Vietnam	90	140	140
Other countries	27	50	92

Source: World Mineral Production, 2011-2015.

** India's production of barytes during 2012-13, 2013-14 and 2014-15 was 179 thousand tonnes, 1171 thousand tonnes and 910 thousand tonnes respectively.*

**Table – 7 : Exports of Barytes
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	651571	4525674	743407	6517077
Saudi Arabia	145754	1254063	404050	3683271
USA	304417	1559433	153291	1060594
Kuwait	43929	305499	52236	390500
Canada	15536	132621	37671	376996
Oman	10108	82858	36717	354944
Iraq	8534	72301	26471	281255
UAE	9622	83467	9976	103720
Qatar	7625	60638	4425	50434
Venezuela	10990	122888	2856	41239
Cuba	2646	22483	4028	38106
Other countries	92410	829423	11686	136018

**Table – 8: Exports of Witherite
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	10	526	++	241
Bangladesh	-	-	++	241
Kuwait	10	526	-	-

FUTURE OUTLOOK

India ranks second in the production of barytes in the world after China and is one of the important exporters in the world market. About 80% of the world's barytes is used in the Petroleum Industry. The worldwide demand for barytes would continue till petroleum products are preferred as chief source of energy given their importance in the transportation and industrial end-use sectors. The future growth in petroleum usage suggests that petroleum exploration will

Imports

In 2015-16, imports of barytes increased considerably to 8,433 tonnes as compared to 7,484 tonnes in the previous year. Imports were mainly from China (67%), Netherlands (20%) and Pakistan (9%). On the other hand import of witherite was negligible during 2015-16 as compared to 184 tonnes during the previous year (Tables-9 and 10).

**Table – 9 : Imports of Barytes
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	7484	146614	8433	189198
China	3911	79412	5658	126561
Netherlands	563	15826	1688	45814
Germany	27	922	247	8172
Pakistan	1715	15101	767	6032
USA	1	97	7	1292
South Africa	-	-	25	631
Thailand	-	-	15	338
Turkey	-	-	25	288
Spain	1	75	1	66
Korea, Rep. of	-	-	++	4
Other countries	1266	35181	-	-

**Table – 10: Imports of Witherite
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	184	5261	++	20
UK	-	-	++	20
Germany	164	4861	-	-
Slovak Rep.	20	400	-	-
Other countries	-	-	-	-

continue to grow and along with it barytes consumption, especially as more drilling has to be done per unit of oil as hydrocarbon discoveries become marginal and less productive with time. In the domestic front, however, exploration is necessary to locate new deposits of barytes especially in Rajasthan, Himachal Pradesh, etc. The apparent domestic demand of barytes is estimated to be 2.09 million tonnes by 2016-17 and is expected to grow at 9% growth rate.