

GYPSUM



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(Part-III : Mineral Reviews)



55th Edition

GYPSUM

(FINAL RELEASE)

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

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Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is a hydrated calcium sulphate used widely in various industries because of its special property of losing three-fourth of the combined water of crystallisation when moderately heated (calcined) to about 130°C . Besides, calcined gypsum when cooled, finely ground and made plastic with water can be spread out, cast or moulded to any desired surface or form. On drying, it sets into a hard rock-like form. Selenite is a colourless, transparent, naturally occurring crystalline variety of gypsum and is used extensively in Ceramic Industry and for manufacturing surgical grade plaster of Paris, whereas alabaster is a fine-grained, massive variety, white or shaded in colour. Silky and fibrous variety of gypsum is called satin spar. Anhydrite (CaSO_4) is a calcium sulphate mineral found associated with gypsum commonly as a massive or fibrous mineral.

Gypsum that occurs in nature is called mineral gypsum. In addition to mineral gypsum, seawater and some chemical and fertilizer plants are sources of by-product marine gypsum and by-product chemical gypsum, respectively. The latter is obtained as by-product phospho-gypsum or fluoro-gypsum or boro-gypsum, depending upon the source. Phosphoric acid plants are important sources of by-product phospho-gypsum.

Marine gypsum is recovered from salt pans during production of common salt in coastal region, particularly in Gujarat and Tamil Nadu. The recovery of by-product gypsum and marine gypsum together is substantial and is comparable with the production of mineral gypsum.

FGD Gypsum is a unique synthetic product derived from flue gas desulphurisation (FGD) systems at electric power plants. Sulphur dioxide emission control systems used by coal-fired power plants remove sulphur from combustion gases using 'scrubbers'. In addition to FGD

gypsum, synthetic gypsum includes materials such as phospho-gypsum, titano-gypsum, fluoro-gypsum and citro-gypsum.

Various grades of gypsum (as per $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ content) are produced and consumed by industries like cement, fertilizer plants, plaster of Paris etc. Gypsum also acts as a neutralising agent and helps in improving soil permeability.

In gypsum, calcium or magnesium carbonate, chlorides, other sulphate minerals, clay minerals or silica are considered as deleterious constituents. As a result, mostly mine production of gypsum possess purity ranging between 70 to 95%.

RESERVES/RESOURCES

As per NMI database, based on UNFC system, the total reserves/resources of mineral gypsum in India as on 1.4.2015 have been estimated at 1,330 million tonnes of which 37 million tonnes have been placed under 'Reserves' and 1,293 million tonnes under 'Remaining Resources' category.

Of the total reserves/resources, Fertilizer/Pottery grade accounts for about 80% and Cement/Paint grade 13%. The Unclassified and Not-known grades together account for 5% resources. The remaining two percent of resources is shared by Surgical Plaster and Soil Reclamation grades. By States, Rajasthan alone accounts for 81% resources, Jammu & Kashmir 14% and Tamil Nadu 2% resources. The remaining 3% resources are in Gujarat, Himachal Pradesh, Karnataka, Uttarakhand, Andhra Pradesh and Madhya Pradesh (Table- 1).

EXPLORATION & DEVELOPMENT

The details of work carried out by the GSI in Chhattisgarh and Uttar Pradesh in 2015-16 are summarised in Table-2.

**Table – 1 : Reserves/Resources of Gypsum as on 1.4.2015
(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	35141	311	1169	36621	10826	93127	33419	9071	713834	428097	4518	1292892	1329513
By Grades													
Surgical Plaster	621	-	-	621	-	1039	82	-	-	3773	-	4894	5515
Fertilizer/Pottery	18933	-	45	18978	2296	9266	270	7680	703244	320454	-	1043211	1062189
Cement/Paint	11547	311	691	12549	7980	82430	30372	1148	3184	39191	10	164315	176864
Soil reclamation	-	-	-	-	185	392	2573	100	206	7939	2180	13576	13576
Unclassified	367	-	46	413	3	-	116	78	5548	33548	2328	41621	42034
Not-known	3670	-	387	4057	356	-	-	66	1652	23191	-	25265	29322
Others	3	-	-	3	5	-	5	-	-	-	-	11	14
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	404	-	404	404
Gujarat	4	5	24	33	4	-	-	616	308	15446	-	16374	16407
Haryana	-	-	-	-	-	-	-	-	-	-	2180	2180	2180
Himachal Pradesh	-	-	-	-	-	-	1365	-	-	3081	-	4446	4446
Jammu & Kashmir	11383	153	442	11977	4602	9844	6570	7680	2673	146914	2328	180610	192588
Karnataka	-	-	-	-	-	-	-	-	-	3784	-	3784	3784
Madhya Pradesh	-	-	-	-	-	-	-	-	-	69	-	69	69
Rajasthan	23617	153	658	24428	6201	82814	18663	750	710604	236847	-	1055878	1080306
Tamil Nadu	137	-	46	183	19	469	6786	25	249	19540	10	27099	27282
Uttarakhand	-	-	-	-	-	-	35	-	-	2012	-	2047	2047

Figures rounded off

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Table – 2 : Details of Exploration for Gypsum During 2015-16

Agency/ State/ District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI Chhattisgarh Bemetara	N/v Jhal, Atariya, Jhalam, Khursbod etc.	1:12500	100	9	309.5	95	Both massive & bedded type gypsum identified in boreholes. Resources not calculated.
Uttar Pradesh Jhansi, Hamirpur	N/v Kotra, Puraini	-	-	-	-	-	Near Puraini, gypsum (selenite) crystals occur at a depth of 1-2 m. Near Kotra, about 10 cm. clay bands are exposed which contained gypsum (alabaster variety). Resources not calculated.

PRODUCTION

As per GOI notification S.O.423(E) dated 10.02.2015, 'Gypsum' has been declared as a 'Minor Mineral', hence, the production beyond January, 2015 is not available with IBM. The mineral 'Selenite'

has not been included in the list of minor mineral by name, hence, it is covered in this review. The lists of producers of gypsum and selenite are furnished in Tables-3 and 4.

Table – 3 : Producers of Gypsum

Name and address of producer	Location of mine	
	State	District
Rajasthan State Mines & Minerals Ltd, C 89-90, Janpath, Lal Kothi Scheme, Jaipur- 302 015, Rajasthan.	Rajasthan	Bikaner Sri Ganganagar Hanumangarh Jaisalmer Jalore Nagaur
FCI Aravali Gypsum & Minerals India Ltd, (formerly known as Fertilizer Corp. of India Ltd) Mangu Singh Rajvi Marg, Paota 'B' Road, Jodhpur-342 010, Rajasthan.	Rajasthan	Bikaner Sri Ganganagar Jaisalmer

Selenite

The production of selenite was 3,103 tonnes in the year 2015-16 as against 207 tonnes during the previous year. The entire production of selenite was reported by Rajasthan State Mines & Minerals Ltd (RSMML), a Public Sector Undertaking, that operates three mines, two in Barmer and one in Bikaner district of Rajasthan (Tables- 5 & 6).

There were no mine-head closing stocks of selenite at the end year 2014-15 and 2015-16.

The average daily labour employed in selenite mines during 2015-16 was 21 as against 12 in the previous year.

Table – 4 : Principal Producers of Selenite, 2015-16

Name & Address of Producer	Location of Mines	
	State	District
Rajasthan State Mines & Minerals Ltd, C 89-90, Janpath, Lal Kothi Scheme, Jaipur –302 015, Rajasthan.	Rajasthan	Barmer Bikaner

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**Table –5 : Production of Selenite, 2013-14 to 2015-16
(By State)**

(Qty in tonnes; Value in ₹'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India/ Rajasthan	531	706	207	456	3103	6938

**Table – 6 : Production of Selenite, 2014-15 and 2015-16
(By Sector/State/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2014-15			2015-16 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	2	207	456	3	3103	6938
Public sector	2	207	456	3	3103	6938
Rajasthan	2	207	456	3	3103	6938
Barmer	1	207	456	2	3103	6938
Bikaner*	1	-	-	1	-	-

*: only labour reported.

MINING AND MARKETING

Gypsum deposits are usually found at shallow depths and are scattered over large areas. The deposits are mined out by opencast method and usually by manual mining except a few semi-mechanised mines in Rajasthan. In semi-mechanised mines, gypsum is excavated by back-hoe excavator and directly loaded into trucks/dumpers. The trucks and dumpers loaded with gypsum are despatched directly to the user-industry or are taken to railway siding for further loading into railway wagons for dispatch to far living user industry. In some mines of Rajasthan, the excavated gypsum is ground before despatching to the user or party. Based on the use of gypsum, the production is classified into different grades like Fertilizer grade, Cement grade, plaster of Paris grade, Surgical grade, etc.

Gypsum is mostly mined in Barmer, Bikaner and Jaisalmer & Sriganganagar districts of Thar

desert region of Rajasthan by M/s.FAGMIL (15 mines) and RSMML companies. Some gypsum mines in Bikaner district also produce crystalline variety, i.e., selenite. Gypsum from Rajasthan is despatched to cement plants in India spread over Rajasthan, Gujarat, Madhya Pradesh, West Bengal, Uttar Pradesh, Bihar, Jharkhand, Chhattisgarh, Himachal Pradesh, etc. Besides, a substantial quantity, containing about 60-70% CaSO₄.2H₂O is supplied to Punjab, Uttar Pradesh, Haryana, Delhi, etc. for reclaiming alkaline soil. A sizeable quantity of gypsum from mines in Barmer, Bikaner, Jaisalmer, Hanumangarh, Sri Ganganagar and Nagaur districts of Rajasthan is also supplied to the plaster of Paris units in Rajasthan, Uttar Pradesh, Haryana, Maharashtra, West Bengal, Delhi, etc.

M/s Saint Gobain Gyproc India Ltd and Boral Gypsum India Pvt Ltd are among the market leaders in plaster of Paris industries and specialise in dry construction techniques.

USES AND SPECIFICATIONS

Cement, fertilizer (ammonium sulphate) and plaster of Paris are the three important industries in which gypsum is utilised. Gypsum of less purity in crushed form is utilised in portland cement manufacturing for controlling the setting time of portland cement (i.e. as a retarder to prevent quick set). It is added to the clinker just before final grinding to finished cement. Proportion of gypsum in Cement Industry is 4-5% of the cement produced. Both, mineral and by-product gypsum are used in cement manufacture. Calcined gypsum finds use in manufacturing plaster of Paris. It is also used in manufacturing partition blocks, sheets & tiles, insulation boards for stucco and lattice works. Gypsum board is primarily used as a finish for walls and ceilings. It is also used as a binder in fast dry tennis court clay. Low-grade gypsum is calcined and used as gypsum plaster after preparation of mortar. It is used for internal plastering and masonry work. Requirement of low-grade gypsum for use in Building Industry as per IS:12654-1989 (Reaffirmed 2010) is: $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ not less than 60%. In pottery, calcined gypsum is used for preparation of moulds in the production of sanitarywares. The used and discarded moulds are in turn again used as source of gypsum in cement and other industries. Low-grade gypsum is used in conditioning of alkaline soil and as manure in agriculture mainly for correcting black alkali soils. BIS has also prescribed IS:6046-1982 (First Revision; reaffirmed 2008) for gypsum for agricultural use.

Selenite, a crystalline variety is used to a limited extent for gypsum plate for petrological

microscopes, known as Sensitive Tint. It is also used in the Ceramic Industry for making moulds, to manufacture surgical grade plaster of Paris and also for producing white cement. Plaster of Paris Industry requires high purity gypsum. Different grades of plaster of Paris are manufactured depending upon the period for setting. For surgical plaster, a minimum 96% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ grade gypsum is required.

High-purity gypsum can be utilised for manufacturing of ammonium sulphate fertilizer. Ground pure white gypsum is also used as a filler in paper, paints and textile goods. Ground low-grade gypsum is used in mine dusting, manufacture of black board chalks and as a filler in insecticides. Besides, gypsum is also used in other industries like pharmaceutical, textile and asbestos products.

Alabaster, a dense, massive, granular and translucent variety, is employed as ornamental stone in statuary and interior decoration.

BIS specification for by-product gypsum (IS:10170-1982, reaffirmed 2008) lays down a minimum 70% content of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and maximum limit of 0.75% Na, 1.0% F and 15% free moisture on dry basis. The material should pass through 2 mm sieve, but 50% of material should also pass through 0.25 mm (60 mesh) sieve. The specifications of by-product gypsum for use in plaster, blocks and boards, as per IS:12679-1989 (reaffirmed 2010), is given in Table-7. Besides, BIS has prescribed IS:1290-1973 (Second Revision; reaffirmed 2011) for mineral gypsum. Specifications of mineral gypsum for different industries is given in Table-8.

Table – 7 : Requirement of By-product Gypsum for Use in Plaster, Blocks and Boards (IS:12679 - 1989, Reaffirmed 2010)

Sl. No.	Characteristic	Requirement		
		Phospho-gypsum	Fluoro-gypsum	Marine-gypsum
1.	P_2O_5 % by mass (max)	0.40	–	–
2.	F % by mass (max)	0.40	1.00	–
3.	Na_2O % by mass (max)	0.10	–	–
4.	K_2O % by mass (max)	0.20	–	–
5.	Organic matter % by mass (max)	0.15	–	–
6.	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ % by mass (max)	85.00	90.00*	85.00
7.	Cl as NaCl % by mass (max)	0.10	–	0.10
8.	pH of 10% aqueous suspension of gypsum (min)	5.00	5.00	6.00

*Note: *Fluoro-gypsum shall be in anhydrous form (as CaSO_4).*

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Table – 8 : Specifications of Mineral Gypsum in Different Industries

Constituent	Surgical plaster	Ammonium sulphate fertilizer	Pottery	Cement	Reclamation of soil	Extender in paints
Free water	1.0% (max.)	–	1.0% (max.)	–	–	0.5% (max) when heated for 2 hr. at 45°C
CO ₂	1.0% (max.)	–	3.0% (max.)	–	–	–
SiO ₂ & other insoluble matter	0.7% (max.)	6.0% (max.)	6.0% (max.)	–	–	–
Iron & aluminium oxide	0.1% (max.)	1.5% (max.)	1.0% (max.)	–	–	–
MgO	0.5% (max.)	1.0% (max.)	1.5% (max.)	3.0 (max.)	–	–
CaSO ₄ .2H ₂ O	96.0% (min.)	85-90% (min.)	85.0% (min.)	70-75% (80-85% for export quality cement)	70% (min.)	75% (min.)
NaCl	0.01% (max.)	0.003% (max.)	0.1% (max.)	0.5% (max.)	–	–
Na ₂ O	–	–	–	–	0.75% (max.) (Na)	–
Fineness	–	–	–	–	Residue on 2 mm sieve : Nil & on 0.25 mm sieve : 50% (max.)	Residue on 240 mesh B.S. test sieve : 0.5%
Oil absorption	–	–	–	–	–	Within 5% of the approved sample
Colour	–	–	–	–	–	Close match to the approved sample
Lead & its compounds (calculated as metallic lead)	–	–	–	–	–	0.5% (max.) when lead-free gypsum is required.
Physical form	–	–	–	–	–	In the form of dry powder.
Microscopic form	–	–	–	–	–	Material should match entirely with the charac- teristics of gypsum crystals.

BY-PRODUCT GYPSUM

Phospho-gypsum

Phospho-gypsum is produced as a by-product during the manufacture of phosphoric acid by wet process. The quality & quantum of phospho-gypsum generation depend upon the quality of the phosphate rock, process route used to produce phosphoric acid, calcium sulphate generated either

in dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) or the hemihydrate ($\text{CaSO}_4 \cdot 1/2 \text{H}_2\text{O}$) form. Generally, about 4 to 6 tonnes of phospho-gypsum are generated to recover one tonne of phosphoric acid. The purity of phospho-gypsum ranges from 77 to 98% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. It contains about 0.2 to 0.7% total P_2O_5 . Phospho-gypsum is mostly used in Cement and Fertilizer industries. The principal producer of phospho-gypsum are given in Table- 9.

Table – 9 : Principal Producers of Phospho-gypsum

State	Unit
Andhra Pradesh	Coromandel International Ltd, Visakhapatnam.
Gujarat	(i) Gujarat State Fertilizers and Chemicals Ltd, Fertilizernagar, Vadodara district. (ii) Hindalco Industries Ltd, P.O. - Dahej.
Kerala	(i) Fertilizers & Chemicals Travancore Ltd, Udyogamandal, Ernakulam district. (ii) Fertilizers & Chemicals Travancore Ltd, Ambalamedu, Ernakulam district.
Maharashtra	Rashtriya Chemicals & Fertilizers, Chembur, Mumbai.
Odisha	(i) Paradeep Phosphates Ltd. (ii) IFFCO, Paradeep, district Jagatsinghpur.
Tamil Nadu	(i) Southern Petrochemical Industries Corporation Ltd, Thoothukudi. (ii) Coromandel International Ltd, Ennore, Thiruvallur. (iii) Sterlite Industries (India) Ltd, Thoothukudi.
West Bengal	Tata Chemicals Ltd, Haldia.

Presently, most phosphoric acid plants dispose the phospho-gypsum generated, by way of stacking it within the plant premises. These stacks are subsequently sold off when demand arises for them. Phospho-gypsum generated from phosphoric acid plants contains three types of impurities such as residual acid, fluorine compounds and trace elements, including those that are radioactive that are considered to be potentially harmful.

The environmental concerns associated with phospho-gypsum stacks are fluoride uptake and ground & surface water pollution. For useful application of phospho-gypsum, the presence of fluorine and phosphate contents considered deleterious. The phosphate content affects setting properties of cement and fluorine content causes ring formation in kiln. Besides, phospho-gypsum also poses radiological hazard due to the presence of naturally occurring uranium and radium in the phosphate ore. Phospho-gypsum is known to contain about 1% P_2O_5 , 1% F and 10 to 30 times more radon, none of which is desirable.

These entities along with radon that were a scare in the 1980s resulted in a 1989 EPA (Environment Protection Agency, USA) ruling that phospho-gypsum is unsuitable for sale as common gypsum.

Fluoro-gypsum

Fluoro-gypsum is obtained as a by-product during the manufacture of aluminium fluoride and hydrofluoric acid using fluorite. Important units that produces aluminium fluoride are Navin Fluorine International Ltd, Udhana-Navsari Road, Surat district, Gujarat; Tanfac Industries Ltd, SIPCOT Industrial Complex, Cuddalore, Tamil Nadu; Maya Rasayan Ltd, Mumbai; Aegies Chemical Ltd Dombivali, Thane, Maharashtra, etc. and these in all likelihood recover fluoro-gypsum in their chemical plants.

Boro-gypsum

By-product boro-gypsum is obtained at a plant which refines calcium borates (colemanite and ulexite) to produce borax and boric acid. Borax Morarjee Ltd, Ambarnath, Thane district, Maharashtra is one of the main Company

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engaged in refining of borates and had reported production of by-product boro-gypsum in the past. However, detailed information on production of boro-gypsum is not available. National Peroxide Ltd, Kalyan, Maharashtra produces sodium perborate, information on production of boro-gypsum, if any at this plant is not available.

Marine Gypsum

Marine gypsum is obtained as a by-product during the production of common salt by solar evaporation. The total production of marine gypsum as per the Salt Commissioner, Jaipur, was 246,687 tonnes in 2014-15 and 153,443 tonnes in 2015-16, reported from Gujarat and Tamil Nadu. Marine gypsum recovered from Gujarat, earlier, showed 89.72-92.62% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, 0.48 to 2.08% NaCl, 0.57% MgCl_2 , 3.42% MgSO_4 and 3.48 to 7.65% insolubles. No recent test results are available.

CONSUMPTION

About 10.31million tonnes gypsum in all forms was consumed in organised sector in 2015-16 as against 9.75 million tonnes in 2014-15. A substantial quantity of mineral gypsum as well as phospho-gypsum was used in agricultural sector for conditioning of alkaline soil. The respective share of natural gypsum, by-product gypsum and marine gypsum in total consumption during 2015-16 was about 58%, 37%, and 5%. Consumption of gypsum in Plaster of Paris moulds was negligible. Almost the entire quantity of natural gypsum in 2015-16 was consumed in the manufacture of cement (99%). The remaining nominal consumption was in plaster of paris, asbestos products, ceramic, fertilizer, refractories, textile, pharmaceutical and paint industries. The entire quantity of marine gypsum and gypsum moulds was also consumed in cement and ceramic industries respectively. By-product gypsum was also almost entirely consumed for manufacture of cement and meagre consumption was in ceramic and fertilizer industries in 2015-16 (Table- 10).

Table- 10 : Consumption* of Gypsum, 2013-14 to 2015-16 (By Industries & Categorywise)

		(In tonnes)		
Category	Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	Grand Total	9220800	9748900	10313900
Natural Gypsum	Total	5393100	5677900	6020700
	Asbestos products	700	700	700
	Cement	5353300	5640900	5965600
	Pharmaceutical	900	900	900
	Plaster of Paris	37700	13700	15700
	Refractories	++	21200	37300
	Others (ceramic, fertilizer, paint & textile)	500	500	500
By-product Gypsum	Total	3289900	3587400	3808700
	Cement	3287800	3585300	3806600
	Ceramic	600	600	600
	Fertilizer	1500	1500	1500
Marine Gypsum	Total	534900	481500	482400
	Cement	534900	481500	482400
Gypsum Moulds	Total	2900	2100	2100
	Ceramic	2900	2100	2100

Figures rounded off.

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

INDUSTRY

Saint-Gobain Gyproc India (formerly India Gypsum Ltd) has been a pioneer in introducing light weight interior construction practices. The Company manufactures an extensive range of gypsum boards & plasters systems, and providing solutions for partitions, wall panels, ceilings and internal wall linings. SGGI has three manufacturing plants located at Jind (Haryana), Wada (near Mumbai) and Bengaluru that produce light weight construction solution, gypsum plaster boards and other accessories. Saint-Gobain lays great emphasis on new business development models with an aim to strengthen its presence in the Indian market. With commitments to investments in manufacturing activities in place, the Company has operative plans to diversify by bringing in advanced technological competency for manufacturing state-of-the-art products and expanding its hold in the market.

Boral Gypsum India Pvt Ltd (BGI) is also among the market leader in designing, manufacturing and supplying gypsum board, standard and technical metal systems for ceilings & partition, aesthetic range of ceiling tiles, joint compounds and complete accessories. BGI makes use of mineral gypsum, sedimentary rock extracted from mines and synthetic gypsum, generated from by-products produced during energy generation or during processing of industrial waste. The mineral gypsum is mostly supplied from different mines of Rajasthan State Mines & Minerals Ltd and FCI Aravali Gypsum & Minerals India Ltd, located mainly in Rajasthan.

In the year 2008-09, Rashtriya Chemicals and Fertilizers Ltd (RCF) formed a Joint Venture Company with Fertilizers and Chemicals Travancore Limited (FACT) by incorporating FACT-RCF Building Products Ltd (FRBL) to set up a Rapidwall project at Kochi. Both RCF and FACT have 50:50 equity holding in the Company. The plant was commissioned in June 2012 and is in operation. The plant was set up to utilise by-product gypsum generated to produce load bearing wall panels, wall plaster and wall putty through Rapidwall technology provided by Rapid Building Systems Pty Ltd, Australia, a world leader in making large size load bearing building panels from Gypsum. The JV has obtained BMTPC Certification for the Gypwall panels.

FRBL, Kochi, manufactures PREFAB GYPWALL which is a revolutionary low-cost load bearing pre-fabricated walling system with broad construction application. Glass fibre reinforced gypsum (GFRG) wall, a new composite wall product, is made of gypsum plaster reinforced with glass fibre. GFRG Wall panel is suitable for use in residential, commercial and industrial building construction. FRBL also manufactures gypsum based silky wall plaster/shine wall putty, a unique light weight material and is an advanced substitute to the conventional cement and sand plastering. FRBL plaster reduces plastering/finishing time by about 60% providing smooth shrinkage crack free walls and ceilings. The plaster can be applied directly over brick /stone masonry or concrete surfaces which does not require water curing and is ready to be painted in less than 48 hours.

M/s FAGMIL is presently engaged in the mining and marketing of gypsum. FAGMIL company is situated in the mineral rich region of Rajasthan. The 15 gypsum mines of FAGMIL are located in Barmer, Bikaner, Jaisalmer & Sriganganagar districts of Rajasthan. The company intends to increase its capacity by getting new lease areas and enhancing the annual capacities of existing mines. Annual capacity of FAGMIL will increase from 0.96 million tonnes to 1.16 million tonnes by the end of 2015-16.

M/s RSMML, a public sector company, is a leading producer of natural gypsum and selenite variety, producing about 3 million tonnes per year from Thar desert areas of Rajasthan. Gypsum with (+)70% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ purity produced by RSMML fulfils the demands of the cement industries and powder gypsum is used by farmers as a direct fertilizer for re-conditioning of alkaline soils for reducing alkanity and improving crop production.

WORLD REVIEW

The world reserves of gypsum are large. The total reported production of gypsum in 2015 was about 268.2 million tonnes as against 263.5 million tonnes in 2014. China was the largest producer accounting for 49%, followed by Iran (8%), Thailand (5%), USA & Iraq (4% each), Turkey, Spain & Mexico (3% each), Oman, Japan, Russia, Germany & Australia (2% each) (Tables- 11 & 12).

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**Table – 11 : World Reserves of Gypsum
(By Principal Countries)**

(In '000 tonnes)	
Country	Reserves
World: Total (Rounded)	Large
Brazil	290000
Canada	450000
India*	39000
Iran	1600
Oman	4900
USA	700000

Source: Mineral Commodity Summaries, 2017.

* India's total resources of gypsum as per NMI database based on UNFC have been placed at 1,330 million tonnes as on 1.4.2015.

FOREIGN TRADE

Exports

Exports of gypsum and plaster at 110,882 tonnes in 2015-16 increased by 69% from 65,645 tonnes in the preceding year. Exports of alabaster was not reported during 2015-16, although during 2014-15, it was 21 tonnes. Gypsum & plaster were exported mainly to Nepal (98%) (Table-13).

**Table – 13: Exports of Gypsum & Plaster
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	65645	158036	110882	291059
Nepal	60297	92993	108491	260015
Singapore	80	3945	101	5181
UAE	287	7419	583	4352
Bangladesh	548	4536	464	4171
Kenya	162	2360	251	2885
Sri Lanka	320	5897	279	2687
Tanzania	134	2388	113	2640
Germany	2	10	21	2124
Maldives	22	501	72	1374
Ghana	-	-	153	1008
Other countries	3793	37987	354	4622

**Table – 12: World Production of Gypsum
(By Principal Countries)**

(In '000 tonnes)			
Country	2013	2014	2015
World: Total	265220	263504	268207
Algeria	2078	2130	2000 ^(e)
Argentina ^(e)	1450	1500	1500
Australia	3589	3624	4065 ^(e)
Austria ^(a)	635	730	715
Brazil	3333	3447	3500 ^(e)
Canada ^(a)	2654	1811	1633
Chile	1015	843	860
China ^(e)	129000	130000	132000
Egypt ^(a)	941	872	850 ^(e)
France ^(a)	2079	1908	1808
Germany ^(a)	1778	4090	4200
India ^(e)	3116	2478	2500 ^(e)
Iran	17354	14870	22000 ^(e)
Iraq	10462	10462 ^(e)	10460 ^(e)
Italy ^(a)	3192	5887	421
Japan	4771	4674	5000 ^(e)
Mexico	7903	7044	7100 ^(e)
Oman	2785	3387	6181
Pakistan	1250	1326	1417
Poland ^(a)	1270	1232	1099
Russia ^(e)	5100	5300	4500
Saudi Arabia	1700	1780	1860
Spain	7389	6925	7100
Thailand ^(a)	13647	13422	12143
Turkey	9790	9051	8639
Ukraine ^(a)	2175	1525	1255
UK	1200	1200	1200
USA	12900	11000	11500 ^(e)
Other countries	10664	10985	10702

Source: World Mineral Production, 2011-2015.

(a): Including Anhydrite, *: Including Selenite,

Imports

Imports of gypsum at 40,68,412 tonnes in 2015-16 decreased 8% from 44,21,048 tonnes in 2014-15. Imports of alabaster increased marginally to 970 tonnes in 2015-16 from 912 tonnes in 2014-15. Gypsum was imported mainly from Oman (61%), Pakistan (20%), Iran (14%), UAE (3%) and Thailand (2%). Almost all the Alabaster was imported from Spain (Tables- 14 & 15).

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	4421048	6747745	4068412	5713627
Oman	3013022	4210918	2488727	3033454
Pakistan	905197	1281990	804210	1186944
Iran	356668	636536	586432	869699
Thailand	88298	279095	64102	266071
UAE	43003	73466	118909	208129
Korea, Rep.of	66	3839	1254	56242
China	1027	25285	1583	30427
USA	1734	86326	477	19695
Germany	494	19172	353	13114
UK	39	2688	100	8130
Other countries	11500	128430	2265	21722

**Table – 15 : Imports of Alabaster
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	912	24831	970	24062
Spain	912	24831	965	23807
China	-	-	5	255

TRADE POLICY

As per 'Export-Import Policy, 2015-2020, gypsum, anhydrite, plasters (consisting of calcined gypsum or calcium sulphate) whether or not coloured, with or without small quantities of accelerators or retarders are free under import policy under heading 2520.

FUTURE OUTLOOK

India's domestic resources of gypsum are large enough to meet increased demand. The apparent domestic demand of gypsum was estimated at 8.71 million tonnes by 2016-17 at 9% growth rate as per the Report of the Working Group for 12th Plan,

GYPSUM

Planning Commission of India, which has already surpassed the Planning Commission estimates during 2015-16. The consumption of gypsum (all industries) during 2015-16 was about 10.31 million tonnes.

With renewed focus on improving the economy and upscaling industrial developments, India lays greater emphasis on creation of infrastructure. As per the Working Group report, augmentation of infrastructural activities will endanger further growth of the Cement Industry which concomitantly will raise the consumption of gypsum and thereby its demand, with consequence, leading to increased dependence on imports and synthetic gypsum to meet cement demand. Further, as per the report, steps would be necessary to find out suitable mining technology to exploit, deep-seated gypsum

resources in Bhadvasi deposit, Nagaur district Rajasthan. State-of-the-art-technology needs to be adopted for the exploitation of deep-seated gypsum.

Other segments that would attract attention would be production of gypsum wallboard which is currently negligible in India. It could find better prospects because of its light weight and other special characteristics. It being an excellent partition material could facilitate its utility in high rise building constructions. In view of the environmental problem arising from huge accumulation of phospho-gypsum at different fertilizer plants, possibilities of finding other possible means for its utilisation has become a necessity. Low-grade gypsum being cheaper could find better prospects in its application more as a soil conditioner for reclamation of alkaline soils.