



Research Paper

A Study Based On Gypsum Occurrences and Resources Around Bikaner, Rajasthan

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ABSTRACT:-Gypsum is a mineral found in nature all throughout the world, including numerous locations in India. Calcium sulfate hydrous, to use its chemical name. $Ca(SO_4)_2(H_2O)$ is the chemical formula for pure gypsum. Chemically pure gypsum has calcium (Ca) concentrations of 23.28% and sulfur (S) concentrations of 18.62%, both in the easily accessible sulfate form (SO_4). While gypsum is widely used in agriculture, the Ca content of most commercially available sources ranges from 16%-23%, with most falling somewhere between 15%-19%, due to the presence of impurities. The majority of India's gypsum comes from the state of Rajasthan. The Bikaner District has the largest and most promising reserves. New, potentially fruitful Gypsum/Gypsite locations need to be prospected to keep up with rising demand. This study would aid in the hunt for additional supplies of natural Gypsum in the Bikaner District, which is needed to keep up with rising demand and the government's coffers would also be benefitted.

Keywords: Mineral Gypsum, new deposits, prospecting works.

I. INTRODUCTION

Gypsum, or calcium sulfate dihydrate, is a mineral found in the Thar Desert of Rajasthan, India. It can be either an opaque white or a transparent white. The region around Bikaner contains such deposits. However, it is also found in bands in other types of sedimentary rocks, including sandstones, shale, and limestone. It may be found in the Gothmanglod deposits of Nagaur as transparent crystals in clay.

DISTRIBUTION:-

There are various locations in India where gypsum deposits have been discovered. Tehri-Garhwal, Himachal Pradesh, and other places of western India also have gypsum deposits, albeit on a much lower scale than those in Rajasthan and southern India. The latter have seen less investigation. The North of India -The Uttara Pradesh regions of Dehra Dun, Nainital, and Tehri-Garhwal are also known to host minor gypsum deposits in the form of pockets and thin beds. About 200,000 metric tons are assumed to be in the reserves. Other deposits include those in the Sirmur area of Himachal Pradesh, where it is estimated that 1 million tons are present, and smaller deposits in Bhutan, Kashmir, and Rewa (Vindhya Pradesh), for which no estimates of the reserves are available. The sedimentary rocks of Saurashtra and Kutch include gypsum in the form of veins, thin beds, and crystals. It is expected that 6.4 million tons of reserves exist. There is likely 383 million tons of gypsum already underground. There are 92 million tons of fertilizer/pottery grade, 76 million tons of cement/paint grade, and 2 million tons of surgical/plaster grade among these totals. The soil is categorised as either 13 million tons of reclamation grade or not at all. In Rajasthan, there are about 105.5 million tons of gypsum reserves that can be mined out. The majority of India's gypsum is found in the form of thin beds, veins, lenses, and isolated clusters of crystals. The mineral anhydrite, which is often found in close proximity to gypsum, has not been detected in any of India's known gypsum deposits.

However, the state of Rajasthan alone accounts for nearly all of India's natural gypsum production. Bikaner, Sri-Ganganagar, and Nagaur are all key production districts of Rajasthan. They might be as thin as a few inches or as thick as ten feet or more. Reserves are expected to exceed 40 million metric tons, according to estimates.

USES: Gypsum Products: Special Qualities Gypsum has a high fire resistance. Gypsum plasterboards are naturally fire resistant because of the nature of gypsum. It provides a high-quality approach to stopping the spread of fire in structures and efficiently defending the occupant from fire. $CaSO_4, 2H_2O$ is the chemical formula for gypsum. because the water is very clear. One square meter of plasterboard with a 15 mm thickness

made of gypsum holds about 3 liters of crystal clear water. The crystal water evaporates as a result of the heat from the fire, creating a barrier of sum. As long as water is released from the Gypsum, the material under fire assault underneath this layer maintains a constant temperature of roughly 100° C, preventing a fire from spreading to other areas of the building. Gypsum boards' ability to resist fire by keeping their structural integrity when burning is improved by the addition of glass fibers to the boards. Because of its non-combustibility and capacity to prevent the spread of fire for up to four hours, gypsum is a potent fire retardant material in the building industry.

Even though it only makes up 4%-5% of cement, it is a crucial ingredient. Plaster of Paris, ceramic industry molds, nitrogen chalk, divider blocks, sheets, tiles, plastics, etc. all utilise this material in some way. It can be easily applied as a topsoil plaster in farming to help retain soil moisture and increase the soil's capacity to absorb nitrogen. Other than farming, gypsum had a wide variety of applications. Blackboard chalk, cement, wall board, Plaster of Paris, dental molds, paint filler, toothpaste, molds for casting metals, coagulating Tofu, enhancing the mineral content of brewing water, dietary calcium additives in breads and cereals, and pharmaceuticals are just some of the many products and processes that use gypsum.

GEOLOGY OF BIKANER

Sediments of the Bikaner basin are located in two distinct regions, divided by the araceous high that is the origin of the Marwar Super gp. Sediments from both continents and the ocean were deposited atop the Neoproterozoic Nagaur Group (Marwar Supergroup) to form the Tertiary series. The Palana, Marh, and Jogira Formations, in that sequence, are representative of this type of rock because of the conformability of their connections. East-West trading faults outline its northern and southern boundaries, while the heights in Dulmera and the surrounding area serve as landmarks. The Bikaner basin, also known as the Palana - Ganganagar shelf, is a 200-kilometer-long, 50-kilometer-wide East-West trading elongated basin. The basin protects the encircled eastern end of the Palana and Sri Ganganagar embayments, which lead to the Indus basin. The entire region is buried in a blanket of Thar desert sand whipped up by the wind.

TECTONO-SRATIOGRAPHY OF BIKANER BASIN

	Geological Age	Formation Thickness in (m)	Depositional Environment	Tectono Depositional System
Quaternary	Pleistocene – Recent	Alluvium (80-85)	Shallow Water	Upliftment Clastic Dominant System
Tertiary	Aleocene-Eocene	Palana & Marh Formation (20-110)	Shallow Marin	
Mesozoic	Cretaceous	Parh Eqy. Fm (30- 35)	Terrestrial	
	Jurrassic	Lathi Eqy. Fm (290-380)	Fluvio - Glacial	
	Permo-Triassic	Bap & Badhura Fm (55-65)		
Paleozoic	Cambrian	Fm. Carbonate (250-600)	Transgressive Marine	Post rift Clastic Carbonate System
		Nagaur Fm (150-190)	Marginal Marin Clastic	Syn rift Clastic Carbonate System
Proterozoic	Infra Cambrian	Hanseran Evaporatite Fm (160-150)	Intertidal Evaporite Transgressive Marine	
		Bilara Fm.(50-55)	Fluvia	
		Jodhpur Fm(25-35)		
	Pre-Cambrian	Malani Ign. Suite		volcanism

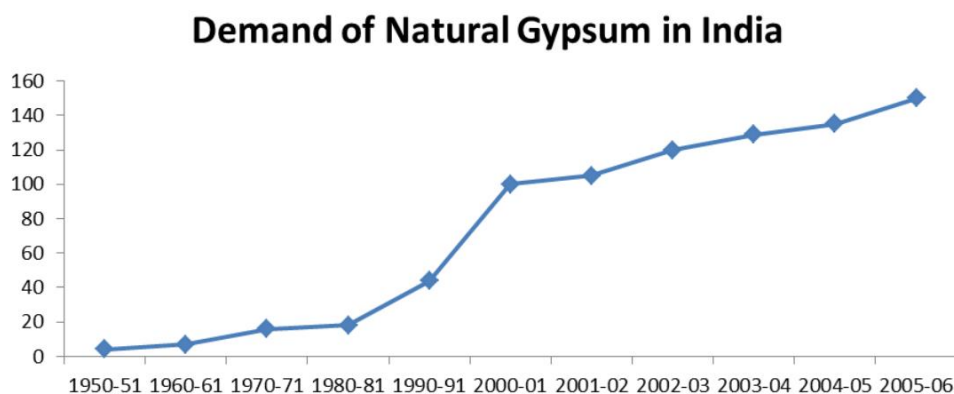
GYPSUM DEMAND AND SUPPLY

Construction uses most gypsum. Indian construction is growing 11% annually. This sector needs cement most. India's infrastructure investment increased with GDP, and cement consumption climbed with natural gypsum demand. India's cement industry grows. Indian cement consumption is predicted to rise 9–11% every year due to substantial infrastructure construction, according to research reports. The cement and building industries are struggling with rising gypsum and coal prices. Thus, natural gypsum exploration is crucial. Based on these projected cement production growth figures, as per the base line, India's cement industry will require over 428 million tons of gypsum over the next 15 years, compared to 115 million tons of local gypsum resources (natural and byproduct). This means India imports over 313 million tons of gypsum. For decades, cement will originate from natural gypsum. Cement manufacture cannot replace gypsum. Rajasthan reported 33 mines compared to 38 the year before. RSMML and FAGMIL produced 99% of gypsum. Five mines produced above 2 lakh tons annually, 2 mines produced between one and two lakh tons, 3 mines produced between 50 thousand tons and 1 lakh tons, and 15 mines produced between 10 thousand and 50 thousand tons. Gypsum demand is rising while production is dropping by 11% each year. Natural gypsum production is hampered by inconsistent quality. Due to this inconsistency, cement companies started importing and using alternative sources. These

imports hurt Indigenous miners and Indian natural Gypsum producers. So new viable sites and low-grade natural Gypsum buyers must be found.

Year	1951	1961	1971	1981	1990-91	2000-01	2002-11	
Production in '000 (MT)	207	866	1,086	957	15,89	12,586	33 million (MT)	

Chart:-1 Showing Growth in demand of Natural Gypsum In India: s



MINERAL GYPSUM OCCURRENCE IN BIKANER

Gypsum is found in Bikaner. Four of Bikaner's eight tehsils have natural gypsum. The surface has horizontal beds of these deposits. They lie in sand-dune depressions. Outcrops are bare. Gypsum beds sometimes fill depressions with these deposits. These are amorphous gypsites. Bed thickness is 0.20–2 m. The overburden, largely sand and clay, is a few centimeters thick but 3-4 m deep. Bikaner's gypsum beds are sand-covered. Since 2000, India's infrastructure developments enhanced the value of Bikaner's gypsum reserves. Indian infrastructure initiatives increased cement demand. Gypsum retards 5-7% of cement production. Gypsum/Gypsite deposits cover 60% of Bikaner's 28,466 km². Gypsites are thick to thin in 6 of 8 Tehsils. Bikaner, Pugal, Miranwala, Lunkaransar, Chattargarh, and NW Kolayat are the prominent tehsils. The district has 34 mineral gypsum mining leases, 11 of which are owned by Rajasthan or Central governments and 23 by private parties. Miranwala, Kolayat, Pugal, and Bikaner have major mining leases. Private mining leases are smaller than government ones. Surface indicators were used to plan prospecting. Gravimetric lab testing was done on samples from prospected locations.

SAMPLING AND ANALYSIS METHODOLOGY

Some samples were taken from various gypsum mining Leases areas including farm lands, road cuttings, tube well mud in such a way that the entire thickness of the deposits might be exposed. And were tested in the laboratory in Bikaner.

METHOD OF ANALYSIS OF GYPSUM PURITY%

Samples were gathered in 5-kg bags and marked with date and location. The lab crushed and quarter-conninged the boxed samples. The representative sample was quartered to 100 grams. Hot Air Oven at 40°C remoisturized it. Reweighing this 100-gram representative sample revealed moisture. One gram is taken from 100 grams for SO₃ or Gypsum Purity% examination. Add 25 ml of cold water and 5 ml of hydrochloric acid to one gram of sample. Stir well. Heat the solution and crush the material with a flattened glass rod until the cement decomposes. Dilute to 50 ml and digest for 15 minutes below boiling. Hot water-wash the residue. Leave the residue-covered filter paper. Boil 250 ml filtrate. Slowly add 10 ml of heated barium chloride (100 g/l) solution and boil until the precipitate forms. Steam the solution for 4 hours or overnight. Wash and filter the precipitate with Whatman No. 42 filter paper. Slowly incinerate the filter paper in a platinum or porcelain crucible. Then ignite at 800 to 900°C, cool in a desiccator, weigh the barium sulphate, and compute the sulfuric anhydride concentration of the test sample.

Calculation — Calculate the percentage of SO₃ as follows:

$$\text{SO}_3 \text{ percent} = W \times 34.3;$$

$$\text{PURITY \%} = 2.5 \times \text{SO}_3.$$

W = Weight of the sample in g. W = weight of residue (BaSO₄) in g; and

34.3 = molecular ratio of SO₃ to BaSO₄

NEW POTENTIAL AREAS OF GYPSUM IN BIKANER: -

The most potential gypsum bearing areas in the districts Bikaner are discovered in the north west direction of the city. The details of the area as under. Area having more potentials for new mining leases and investigated as follows: -

Sattasar Command Area: -

1. The thickness of the Gypsum bed, as examined by the trial pit, is approximately 1 meter, while the thickness of the overburden is 0.5 to 1.5 meters in the areas of 17 SMD and 12 DKD. About 400 X 70 M is the total area that can support gypsum. Reserves are expected to be 8 lac MT. Purity test average = 60–70%

2. Gypsum is found in a water tank in the 17 LKD area, around 2 meters below the sand cover. In cultivated fields, gypsum can also be found as flotation ore.

3. There is a sufficient deposit of gypsum in an area measuring around 1.5 km by 1.7 km between 17 LKD and C minor block. The gypsum bed appears on the surface here and there is no overburden to be seen.

4. The entire gypsum bearing area in the 16 LKD region is approximately 500 x 700 square meters. Gypsum bed thickness in the pit is between 1 and 1.5 meters, while overburden thickness is 0.50 meters.

5. Gypsum also occurs on the surface in the 13 DKD area. The gypsum carrying area measures approximately 500 X 500 square meters.

6. A small area of around 150 x 200 square meters of gypsum is present in the 6PB area. Gypsum is found on the surface, and the thickness of the gypsum bed is between 0.50 and 0.75 meters.

7 Bhagu Block: On Dantaur Road, Bhagu village is close to Khajuwala.

a. Gypsum is found below one meter from the surface around 6 kilometers from Khajuwala. Gypsum bed is roughly 0.60 meters thick. Gypsum bearing area measures roughly 600 m by 400 m.

b. Gypsum is found on the surface at a depth of 0.50 meters below the surface in the 16-acre agricultural field adjacent to the Anupgarh branch of the I.G. canal. Gypsum beds are one to five meters thick. The region that bears gypsum is roughly 600 by 400 square meters.

8. Siyasar Abadi: The settlement of Siyasar Abadi is close to a prospective gypsum resource. The trial pit measured the depth of this deposit. The deposit is between 0.50 and 1.50 meters deep. The entire gypsum bearing area is roughly 500 x 250 square kilometers.

9. Rawal Ali Talai: A 300 x 200 meter area of gypsum was noticed on the right hand side of the road between Pugal and Khajuwala, which is located 3 kilometers from Pugal. Sand dunes surround the region. Gypsum thicknesses range from 1 to 1.50 meters. The gypsum there is earthy and filthy white. Below a 0.25 meter thick soil cover, gypsum can be found.

10. Raola Khera: This region may be found 2 kilometers to the east of Pugal on the Pugal-Dkodha route. Gypsum is found in the depression (Talai) that is covered in dirt that is 0.50 meters thick. Gypsum bed is one meter thick as visible in the hole. 400 x 200 square meters of gypsum are exposed.

11. Chogolai Talai: In an area measuring 1 km by 1.5 km, the mineral gypsum has been determined to have potential. Due to salt encrustations, the surface had turned white. Gypsum debris was discovered at Tanka, however its thickness was not greater than 0.50 meters.

12. Chak 1 ADM: Gypsum occurrences were discovered in Muraba number 186/40 in a cultivable soil area measuring roughly 0.50 x 1.50 meters. Gypsum bearing area is therefore 250 x 100 meters.

13. 10 P.B. location: This location is located around 17 kilometers (km) from Pugal on Khajuwala road, 4 kilometers (km) west of the Sattasar bifurcation. Around Jallal Jaat Ki Dhani, gypsum occurrences were found in 4 Murabases, totaling 100 bigha, at Murabba Nos. 22, 23, 24, 14, and 1. Gypsum bed thickness ranges from 0.50 meters to 2 meters across a 300 by 200 meter area.

14. 7 P.B. : This region is close to Chak 10 P.B. About 4 murrabbases away from lichharam jaat ki Dhani, gypsum was discovered. Gypsum bed is 1 x 1.5 meters thick here, with a soil overlay of 0.50 to 1.50 meters.

15. 3 km west of the Sattasar bifurcation is where 8 P.B. is located. West of Kumharaon ki Dhani, in a region measuring approximately 3 km by 550 meters, gypsum was found. Gypsum in the trial pit was 1.60 meters thick when it was first discovered. Gypsum appears to be of good quality. In the area, there is 10 to 50 cm of overburden.

16. Chak 2 HWM: On the Khajuwala to Ballar route, it is situated 12 kilometers from Khajuwala. Four Murabbases have occurrences of gypsum. 2 pits with dimensions of 100 x 50 m and 80 x 70 m are present here. A 50 cms thick overburden of soil was found to be below a 1.5 m x 1.5 m thick gypsum bed.

17. Ranewala: This region is located 6 kilometers south of Ballar. There have been reports of gypsum in various areas of 5 Murabbases. It was unknown how thick the gypsum bed was because there was no pit nearby. Only plowing brought gypsum to the surface.

18. Chak 16 KHM: A 300 meter by 100 meter patch of gypsum on the Bajju-Dantor road's right hand side. Sand dunes surround the region. Gypsum beds range in thickness from 0.50 to 1.50 meters. The gypsum there is

earthy and filthy white. Below a 0.25 m thick soil cover, gypsum can be discovered. Two trenches with diameters of 25x15 meters and 15x20 meters are present.

19. Near 4 & 6 PRM abadi: On the Pugal to Dantore road, this place is close to the 4 and 6 PRM abadi area. North of the Abadi area, in a roughly 700x500 meter area, gypsum was found. Gypsum was discovered 50 cms below the overburden.

20. 17 Chak A 2 km by 2 km patch of gypsum is designated as 23 BLD.8 kilometers from Ballar, on the Dantore to Ballar route (Bhawani Ram Khumar, Murraba no. 217/1). Gypsum beds range in thickness from 0.50 to 1.50 meters. Below a 0.30 meter thick soil cover, gypsum can be found.

21. Bhagu (village), 13 bld. A tiny gypsum pit may be observed on the Dantor to Pugal Road on the left side of the road, 15 kilometers NE of the Dantor Scl office. Avg. Purity% = 45-65% and Estimated Reserved = 30 lac MT.

22. Kawani (village): Kawani is the next sampling area village, located 2 kilometers NNW of the RSMM mines. This location is located 33 kilometers northwest of the Bikaner District Headquarters. Almost the entire area is government-owned land, uncovered through illegal mining. Gypsum bed is 2.0-3.50 feet thick, while O.B. is 4.0-6.0 feet thick.

Reserves are expected to be 15 lac MT.

Tested average purity: 50–55%

The next village in the area to be visited was Ranasar, in the Tehsil Kolayat. This region is 75–80 km (33 km) west of the Bikaner Dist. headquarters. Almost the entire area is government-owned land, uncovered through illegal mining. Gypsum bed thickness ranges from 2.0 to 3 feet, while O.B. ranges from 2.0 to 6.0 feet.

Reserves are expected to be 10 lac MT.

50–65% for the tested average purity.

II. DISCUSSION AND CONCLUSION

Despite the usage of synthetic gypsum in coastal areas, there has been an increase in natural gypsum output over the past twenty years due to rising demand for plasterboard and cement. Given the rising need for cement in India, the future prospects for gypsum in Bikaner and the adjacent regions are highly positive. Gypsum is readily accessible on the surface of the land and is simple to mine and extract in large quantities. To boost the production and use of gypsum, the following steps are required. Policy for mining gypsum. Gypsum is currently regarded as a key mineral and as such needs numerous approvals from environmental and various levels of governmental organizations. Which prevents gypsum production from rising? Gypsum must be converted from a major mineral to a minor mineral since it is readily available on the surface and easy to process, in order to enhance production. Gypsum-bearing lands' titles should be temporarily surrendered to the government, and once the gypsum has been removed, the land may be given back to the private Khatedars who own it. The Khatedar do not recognize the value of these abundant minerals, therefore they forbid excavation and instead sell the ore to illicit gypsum traffickers, which hinders efforts to boost output and assist poor farmers.

The newly discovered regions that were prospected and covered above will aid in creating new potential deposits and enhancing already-existing natural gypsum resources. Other than this, the expected reserves will increase in supplying the numerous sectors employing natural Bikaner gypsum. The natural gypsum mines in Bikaner, Rajasthan, would be given fresh life by the newly discovered reserves. However, this would also benefit Bikaner's plaster producers, who are vying for gypsum of high grade. But in order for these noted regions to be developed, we also need to keep an eye on the illegal miners.

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