Mineral Resources of Bikaner

The district derives its name from its principal city Bikaner which perpetuates the memory of its founder Rao Bika. Lying in the northwestern part of Rajasthan, the district is located between 27^0 11' and 29^0 03' north latitude and 71^0 54' and 72^0 12' east longitude. The district has an area of 27,244 sq km and a population of 1,209,107 (1991 census). It is bounded in north by Ganganagar and Hanumangarh districts, in east by Churu, in south by Jodhpur and Nagaur districts, and in west partly by Jaisalmer district and partly by Pakistan. It comprises of 4 tehshils namely Lunkaransar, Bikaner, Kolayat and Nokha. The district head quarter Bikaner is 361 km from Jaipur and is well connected by broad gauge railway line of northern railway with Jodhpur, Phulera and by meter gauge railway line with Delhi.

The major part of the district covers desolate and dreary regions, which form part of the Great Indian Desert of Thar. The district can be classified into two natural divisions (i) north and western desert and (ii) south and eastern semi desert. In greater part of the district the plain is undulating or interspersed with shifting sand hills, the slopes of which are slightly furrowed by the action of wind. There are no hills and no rivulets or streams of any significance. The district has a dry climate with large variations of temperature and scanty rainfall.

Geology

The district of Bikaner is a vast sandy tract. Three of the four tehshils are covered with sand except some exposures near Kolayat and in Nokha tehshil. These are locally called as Magras. In these areas various types of sandstone, clay and limestone have been revealed at different levels. Thus the geology of the district is based on subsurface studies only.

Many geologists believe that during the Jurassic, Cretaceous and Eocene periods the western part of Rajasthan including Bikaner district was under the sea. Later in upper Tertiary period area got up lifted into dry land.

Geologically the oldest rocks exposed in the limited area and encountered in dug and tube wells, etc. have been equated to upper Vindhyan of southeast Rajasthan known as trans Aravalli-Vindhyans overlying them are tertiary formations followed by quaternary to recent sediments.

The geological succession is as follows:

Age	Formation	Rock Type
Recent	Quaternary Sediments	Sands and sandy alluvium grit, calcareous Kankarand semi consolidated conglomerate and selenite.
Pleistocene	Bap Boulders and Lambariyan diamictite	Associated pebbles, cobbles, boulders and erratic of granite, quartzite, rhyolite and dolomite.
----------UNCONFORMITY----------		
Lower to Middle Eocene	Jogiara Formation	Shaly and crystalline Limestone with foraminifers and fuller's earth with lamellibranches and gastropods.
----------DISCONFORMITY----------		
Upper Palaeocene	Marh Formation	Ferruginous gritty sandstone with white plastic clay bands, siltstone with leaf impressions.
Lower Palaeocene	Palana Formation	Finegrained Sandstone, Carbonaceous shale and lignite
----------UNCONFORMITY----------		
Paleozoic Cambrian Marwar	Nagaur Formation	Brick red to fine grained, sandstone with Supergroup of Nagaur group shales gypsum and conglomerates.

(Source: GSI After Mukhopadhyay, A.K. 1970-75 and Ghosh, R.N. 1970-71)

Rock formation belonging to Naguar group of Trans Aravali Vindhyans (Marwar Supergroup) include basel conglomerates, sandstone, siltstone, shale, clay, limestone, anhydrite and halite.

Tertiary rocks are represented by Palana, Marh and Jogiara formation omprising fine-grained sandstone, sandy clay variegated clays and lignite.

Quaternary formation includes. Sandy alluvium, sand, kankar, iron stone nodule, etc.

Minerals of Bikaner District

Bikaner district has some very important nonmetallic mineral deposits in state. It has vast resources of lignite and gypsum, besides clay, fullers earth, ochre and grit. The best quality gypsum in India was found at Jamsar, small occurrences of red sandstone and limestone are also found at places. Limestone at Sarunda is high grade at places (up to 54% CaO) but the deposit is small and suitable for a mini cement plant. Glass sand is utilized in glass industry. There have been continuous efforts for development and use

of lignite deposits. Recently an MOU has been signed for exploitation of Barsingasar deposit.

Lignite

Bikaner district is well known for its lignite deposits. During the erstwhile Bikaner state thermal power generation was based on the lignite resources of Palana. During the last two decades the department of Mines & Geology and other exploration agencies have carried out detailed exploration for lignite in different parts of the district. The investigation was guided by the stratigraphic control of deposition of lignite and all tertiary formation have been examined in detail and a number of lignite bearing areas identified. A brief account of each area is summarized below: -

Palana

It is located about 23 km. S.E. of Bikaner city. About 6.71 sq km area was prospected by D.M.G. by carrying out about 35493.0 mtrs drilling spread over 482 boreholes. The lignite seams were intersected between 40 to 98 mts depth with cumulative thickness of few cm to 18.0 mts. The analytical results in dicate that Ash content varies from 3.5-8% V.M. 20-35%, FC 21% and C.V. 3200-3500 K. Cal/kg. Based on exploratory drilling geological reserves of the order of 23.57 M.T. were estimated in the area. The area was previously being worked for power generation but due to fire in the mines, it was closed.

Barsingsar

This area is located about 25 km. S.W. of Bikaner and 3 km. S.W. of Palana lignite area. Barsingsar lignite prospect was located and explored by the state department and M.E.C.L. by carrying out 35487.75 mts. drilling (313 boreholes) over an area of about 5.35 sq. kms. Exploratory drilling indicates the presence of lignite seams at about 67 mts. depth. The thickness of lignite seams varies from 6.30 mts. to 45.50 mts. The lignite of this area contains 2.4-10% Ash. 20-28% V.M., 16-28% F.C. and C.V. 3000 K.Cal/kg. Based on exploration data 77.83 M.T. reserves have been estimated.

Gurha

Gurha lignite deposit is located 22 km. N.W. of Kolayat. The Geological Survey of India first noticed the presence of lignite in the area. The detail exploration was initiated by state department by carrying out 849.60 mts. drilling in 76 boreholes over an area of 9.0 sq. km. Exploratory drilling intersected 20 to 42.90 mts. thick lignite seam at 38 m to 148.0 mts. varying depth. About 38.00 million tones of in situ reserves have been estimated in this area with 1:15 lignite overburden ration. Average ash content is 11.9%, V.M. is 31.81, FC is 21.28% and calorific value at 45% in situ moisture is 2867 K Cal/kg.

Subsequently M.E.C.L. has carried out 42,867.85 mts. drilling in 322 boreholes in Gurha east and west blocks. Total insitu reserves in these two blocks are estimated to be around 50 million tones.

The details of each block are given below.

Block	**Tones** (M.T.)	**Grade** K.Cal/kg.	**Area** Sq. km.	**Average** thickness mts.
Gurha East	20.94	2010	1.48	14.21
Gurha West	29.12	2580	4.60	6.74

Apparently, Gurha deposits appear to be exploitable by open cast mining.

Bithnoke & Bithnoke Ext.

Area is located about 30 km. west of Kolayat Exploratory drilling was initiated by MECL by carrying out 9358.20 mts. drilling in 50 boreholes over an area of 3 sq. km. M.E.C.L. intersected a 2 to 14.00 mts. thick lignite seam at depths varying from 100 to 150 mts. in this area. About 78 M.T. geological reserves have been estimated with 1:8 to 1:10 lignite overburden ration. The average calorific value at 45% in situ moisture is 2500 K Cal/kg (indicative). The Ash content varies from 15 to 20% and V.M. from 20 to 25%.

Mandal-Charnan

Mandal-Charnan lignite prospects are located about 20 km S.S.W. of Kolayat. The area was explored by the department, which drilled 19 boreholes totaling 2893.05 mts drilling over an area of 8 sq km. Based on exploration data 17.7 M.T. reserves have been estimated in the area with 1:40 lignite overburden ratio. The lignite of the area contain 12.77% Ash, 18.54% V.M. 22.94% F.C. and 2626 K. Cal/kg. C.V.

Raneri

The area is located about 80 kms. S.W. of Bikaner. The lignite prospects of the area was explored by department of Mines & Geology and so far 10187 mts. drilling in 69 boreholes have been carried out over an area of 28 sq. km. Exploration is still under progress. Borehole drilled so far indicated the lignite seam occurs at depth varying from 48.50 to 134.40 mts. The thickness of the seam varies from 0.50 to 12.00 mts. 30.92 million tones reserves have been estimated with 1:29.23 lignite overburden ratio and 4.54 million tones in 1:15 ratio.

Apart from above, department also carried out exploratory drilling for lignite in other parts of Bikaner district for lignite in other parts Bikaner district namely; Chak-Vijaising hpura, Badhnu-Bania, Hira Ki Dhani, Khari Charran, Ranasar, Bhojasar, Akasar, Lalmdesar-Bada Lalmdesar, Gajroopdesar, Surpura, Mion-Ki-Dhani, Gajner, Sarupdesar, Pyan Chhaneri, Mudhah-Kotri, etc. The lignite prospects in above areas are not encouraging and as such has no economic value.

Recently department has located a good prospect of lignite in Hadla area 8 km. west of Barsingsar. So far 9 boreholes have been put totaling 1289 mts. drilling. In the boreholes lignite seams were intersected at 93 to 124 mts. depths with thickness ranging from 13 to 18 mts. Work is under progress.

Gypsum

About 90% of the total Indian production of gypsum comes from western and northwestern Rajasthan having a total reserve of 1013.07 MT. As estimated by G.S.I. Bikaner contributes about 9 MT reserve important workable gypsite deposits are located at the following localities.

Jamsar

This was once the largest and most extensively worked deposit in the state. It occupies an area of about 4 km. by 1 km. There are three main gypsite beds varying in thickness from 2.4 to 3.7 meters with 85 to 98% $CaSO_4$, $2H_2O$ content. The deposit is being worked by RSMML in 13 quarries, which have gone up to 11 mts in depth. The bulk of the reserves, however, have already been mined out.

Dhirera

A gypsum bed 2.7 mts thick occurs in an area of about 0.83 sq. km. The deposit has a reserve of about 0.7 million tones containing 85% $CaSO_4$, $2H_2O$. It is being worked by RSMML.

Kaori

The deposit occurs in an area of about 3.0 sq. km. with an average thickness of 0.6 mts (Gypsite). Estimated reserves are 1 million tones with 70 to 85% $Caso_4$, $2H_2O$.

Bharru

The deposit covers an area of 3-4 sq. km. where the gypsite bed has an average thickness of 0.8-1.0 mts. About 3-4 million tones of reserves containing 20 to 80% $CaSo_4$, $2H_2O$ are estimated.

Other minor gypsite deposits occur at Dholera, Dhirava, Akasar (west) Dher, Akasar (east), Dher, Juna Akhusar, Jagdeowala No. 2, Dandla, Alladin Ka Bera, Neushera, Seasar Sammuwak Dher, Dandalwela Dher, Islamwala Dher and Karamwela Dher.

Selenite

Selenite crystals, varying in size from a few centimeters to 10 cm occur in black clay/mud at a depth of about one meter near lunkaransar. About 60% of the crystals are recoverable by washing and screening.

Clay

From mineral point of view Bikaner district can be called clay district. Out of 89 major mining leases in this district 78 are for various clays (china clay, ball clay and fire clay). Bikaner district alone accounts for 80% of Rajasthan's total clay production.

Kolayat, Kotri, Madh, Gurha

Clay occurs near Gurha, Kotri, Marh and Kolayat and was investigated by G.S.I. Three horizons of clay interbedded with sandstone are noted in this area.

The middle horizon is traceable for about 18 km length and provides clay of the best quality. It comprises fire clay beds 1 to 3 mts, thick. The clay is white to creamy or brownish white, and turns white on firing. The clay contains 57.02% SiO_2 27.73% AI_2 O3 1.73% TiO, with 10.49% LoI. Fe_2 O_3, CaO alkalies and MgO are in traces up to 1%.

The upper horizon consists of a single clay bed 3 mts to 7 mts thick, exposed over a strike length of 5 km between Madh and Jogira Talao. It is similar to that of the middle horizon in physical and chemical properties.

The two bands in the lower horizon are 1.5 to 2.5 mts in the thickness. It is highly plastic, fine grained and composed mostly of kaolinite. The water of plasticity is about 27.6%.

A total reserve of 13.10 million tones of clay was estimated for a dip extension of 30 mts and 43.67 million tones for a dip extension of 100 mts.

Khari Charnan

Near Khari Charan, clay occurs in two horizons. The upper one is 1 m thick while the lower one 1.70 mts thick. These are separated by 0.5 m to 1 m thick ferruginous siltstone. The clay is fine-grained plastic, free from grits, whitish gray in colour with occasional iron stains.

Chandi

The deposit occurs 1 km north of Chandi. The thickness of the clay band varies from 1 to 8 mts. Estimated reserve is 3 million tones. The water of plasticity is 27.6%. The P.C.E. value of orton cone is 1650^0–1688^0 C.

Gurha

A large clay deposit is located near village Gurha. The deposit is very extensive with an average thickness of about 3 mts. The estimated reserve is about 2 million tones. The dull white colour clay is good and plastic, stakes in water readily and has a soapy hand feeling. Sub surface clay horizons have been encountered in exploratory boreholes over vast area for lignite.

Mudh

Deposit lies N.W. of village Mudh, about 4.8 km from Shri Kolayatji railway station. It is grayish white in colour, practically free from grit and is mainly kaolinite, fine grained in nature having good plasticity, water of plasticity 27.6% and has a clay substance of 61.2% PCE values of orton cone 30-31 i.e. 1650-1680^0 C, fires to a cream colour.

Indo-Ka-Bala, Madhogarh and Suraj Ki Dhani, are other small deposit of clay in the district.

Limestone

Sarunda-Mendelia

The limestone occurs near Sarunda-Mandelia, tehsil Nokha in form of isolated patches. Mandelia is about 55 km S.W. of Nokha. Limestone is dirty white gray in colour. Gray colour limestone is cement grade in nature and dirty white pinkish colour is dolomitic and cherty. Investigation have been carried out by the department and a reserve of 10.2 million tones have been assessed containing CaO 40 to 54%, MgO 2 to 6% and SiO_2 t to 10%.

Dawa, Selwa

It is located about 23 kms south of Nokha. Limestone and dolomitic limestone occurs as five isolated mounds over a strike length of 3.2 kms with width varying from 30 to 200 mts. Limestone is fine grained hard compact, light gray in colour with bands of chety and dolomitic limestone. About 5.50 million tones geological reserves are inferred. The analytical result, indicate 23.38% to 43.19% CaO, 12.7% to 18.70% MgO and 6.84% to 24.9% SiO_2.

Sandstone

Ochres are mineral pigments in which iron acts as the colouring material either in the form of hematite (Red) or limonite (Yellow) or both. In Bikaner district ocheres have been known to occur in Mudh-Kolayat areas as pockets with clay deposits.

Potash

The discovery of Halite at Lakhasar (28^0 06'-73^0 52') in a drilling hole put there as a part of the UNDP Project by GSI has led to believe that potash minerals are occurring near Bikaner city. It is expected that the potash mineralization is extending further in the Bikaner district also, looking to the general geological setting of the area.

Bajri and Grit

These are clastic rocks consisting of medium size grains of silica and found south of Bikaner city where it is being mined for building purpose. The paleochannel of river saraswati can be good source of Bajri. Department has identified some areas by remote sensing study of imageries.

Glass Sand

Huge deposits of good quality glass sand are found near Mudh. The exposures are as along the sides of the Nallah, presently being used by glass factory of Bikaner glassware.