Journal of Advances and Scholarly Researches in Allied Education
Vol. 19, Issue No. 4, July-2022, ISSN 2230-7540

A Critical Study of Mineral Resources in Bikaner District (Rajasthan)

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Abstract - Western part of Thar desert comprises of several minerals. Bikaner district is rich in deposits of non metallic type of minerals like gypsum , Fuller's Earth, Lignite, Glass sand , rock salt and clay .The geology of the area shows that the oldest rock encounter at shallow depth are referable to the Trans-Aravalli-Vindhyan of western Rajasthan. Aravalli-Vindhyan are the Tertiary sediments which include Palana formation of sandstone and shale with lignite.

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INRODUCTION

Most of the district is devoid of rock exposures and the only notable outcrops are seen near Kolayat and at few places to the south of Nokha and Dhulmera. Assuch the geological succession in the district has been built up on the basis of surface geological data obtained from dug wells, tube wells and a few boreholes.

The oldest rock encountered at shallow depth are referable to the Trans- Aravalli- Vindhyans of WesternRajasthan. These constitute theseliments of the Jodhpur, bilara and Nagaur Groups, assentially comprising sandstone, dolomite,evaporites, limestone, claystone and shales. Overlying theTrans-Aravalli-Vindhyans are the Tertiary sediments which include Palana formation (sandstone and shale with lignite seams), March Formation (ferruginousSand-stone and clay) and Jogira Formation (ferruginous sand-stone and clay) and Jogira Formation (Foraminiferal 1imestone).

The Trans-Aravalli – vindhyam basin extends dipwards into the Upper Indus-basin of Pakistan. There is a vast spread of sedimentaries from near jodhpur south to as far as saltBange in the north and these rocks are correlatable with the rocks of the Jhelam series of Cambrian affinity .The trans- Aravalli-Vindhyan basin had conditions of sublittoral intertidal zone in the arenaceous Jodhpur group , epineritic to infreneritic environment in the calcareous Bilara Group and deltaic-intertidal to beach environment with prevalance of oxidation in the Nagaurgroup (Lukose, 1977). The evaporite Sequence in the Bikaner andGanganagar districts has been interpreted to represent a facies variation from Calcareous to evaporite facies along the dip of the formations to the west and northwest.

The neighbouring areas of Bikaner district to the north, south and east represent the extension of the rocks of the Nagaur basin. In the adjoining Jaisalmer district to the southwest, the Jurassic and Cretaceous formations representedby Lathi, Jaisalmer, Baisakhi, and Bedesar formations are exposed.Further westward cretaceous (Parihar and Abur Formations).

Overlain by the Khuia-la and Bandah formation of tertiary age are exposed.

MINERAL RESOURCES

TheMineral resources of Bikaner district comprise several economic minerals of non-metallic type. 0f these,gypsum, fuller's earth, lignite,glass sand, rock salt(halite) and clay are the promising deposite of the district. No deposit of any metallic mineral has been reported so far in the district.

(1) GYPSUM

Gypsum, a hydrated sulphate of calcium (Cas04, 2H20) is a widely distributed mineral and is generally colourless or white in colour. It occurs both as massive or fibrous lumps and transparent plates. Its crystalline variety is known as selenite and fibrous and sikky variety as satinspar.

Gypsum occurs as massive granular plates of fibrous aggregates mixed up with sand, clay and calcareous matter i.e. gypsite. The desert gypsum occurs in depressions in lower elevations . Gypsite is recorded as lenticular beds or persistent layers under a cover of sand. In Bikaner district good quality gypsum occursin large quantities near Dhirana (28° 27': 73° 38'), Dholera (28°25':73°13'), Bharru (28° 12' : 73° 13'), Kaoni (28°09' : 73° 06') , Nausher (28°35':72°35') and Siaser (28° 25': 72°55'). However, the most important depos it is located at Jamser (28° 16 : 73° 13'). The reserve estimated of all the deposite is 6.89 million tonnes.The entire Production of Gypsum comes from Sub-surface deposits.

Gypsum is chiefly used in the manufacture of ammonium Sulphate for artificial fertilizers. Sindri Fertilizer & Chemicals Ltd. Is the main consumer. When heated to 1750°C,The gypsum becomes plastic like mass by losing about 3/4th of the water molecules and is called Plaster of Paris. The product is then used for several purposes after its casting.

The use of gypsum In cement industry, paper industry and as filler in insecticides is also important. Selenite, crystalline varity of gypsum is used for making gypusm plates in microscope.Gypsum of different specifications is required for the different uses . For fertili zer it should have 87%CaSo4, H20,NaCl and Si02 not more than 6%, with no clays. Gypsum with 82%Purity is preferred for cement industry. For plaster of paris , selenite crystals with 97% to 80% purity are preferred. Below75% purity , the gypsum is used for manure purposes.

(2) CLAY

Clay is the one of the earliest mineral Substances utilized by human beings for various domestic and ornamentalpurposes since the beginning of civilisation. In the modern industrial development weather in iron and steel or cement industries or in the power generation – one of the most basic requirement is the suitable good quality clay for use as lining in furnaces, as filler, as insulating material etc. About 80 of Rajasthan's total clay production comes from Bikaner district. The white plastic clay of sedimentary origin occur as beds within the March Formation, consisting of ferruginous sandstone and grits of Lower Tertiary age in this district.

The monotonous ferruginous nature of sediments, current bedding, ill-sorting, wide variation in texture from clay to grit and occurrence of leaf impressions indicate a shallow water continental (deltaic) to marginal marine (littoral) condition of their deposition under oxidising environment, with intermittent deepening of the basin favouring deposition of clay in a quieter environment. Such conditions might possibly related to relatively small oscillations of the strand line. The deposition of clay was probably enhanced due to salinity of the water since the clay particles quickly coagulate and precipitate in the saline medium.

Clay deposits in Bikaner district are located at March, Chandi, Palana ,. Kolayat between kotrigurha and Indika Bala.

(3) FIRE CLAY

Dark coloured fire clay with high alumina content has been recorded within a depth range of 39 to 76m and with thickness varying from 0.6 to 0.9 m, below the lignite bed at Palana district Bikaner. The clay is plastic and becomes white on firing and remains unused at 140° C . The clay analysed 59.24% Si02 ,23.40% A1203, 1.25% Fe203, 1.83% Ti02,0.34% Ca0 , 0.30% MgO, 0.40% Na20, 0.98% K20 and 12.28% loss on ignition. The clay occurring 3 km from Kolayat near Chandi, varies in thickness from 1 m to 8 m. It has 27.6% water of plasticity. Main industrial properties of a good quality fire clay are good plasticity, high pusion point, and shrinkage

After firing within 6-8% maximum. Refractory bricks made of fire clay are most Commonly used in boiler furnaces, glass melting furnaces , etc. Fire clay is classified under acid refractories.

(4) BALL CLAY

The chief occurrence of ball clay is located around Kolayat near Kotri, March and Palori in Bikaner district. The clay occurs in three horizons out of which the middle clay horizon extending over 9 km length is the most important one.The colour of clay varies from white to cream and brownish or greyish white. The content of clay material in the clays of all these beds varies between 45 and 60% by weight, the rest being silt and sand particles.

Ball clay, owing to the presence of small amounts of monmorillonite, and fine grained nature, is highly plastic for which it finds a good used in ceramics, in the making of sanitary ware, floor and wall tiles, spark plugs etc.The clays of Kolayat area are being mined by a number of private mining concerns ,and are being used as raw materials for various industries, including manufacture of stoneware,

Sanitary ware,ceramics, tiles,potteries, high tension insulators and as fillers in paper and textile industries and for manufacture of fire bricks also.The estimated reserve of clay around Kolayat in Bikaner district are 13.10 million tonnes upto a dip extension of 30 m and 43.67 million tonnes upto a dip extension of 100 m from the surface exposures. The tentative reserves of clay occurrences around Madhogarh,Nal and Golari are 0.10, 0.11 and 0.80 million tonnes respectively for a dip extension of 30m and 0.33, 0.35 and 0.26 million tonnes respectively for a dip extension of 100 m.

(5) FULLER's EARTH

Fuller's earth, also known as"Multani Mitti", is used for cleaning wollen fabrics and cloth, since fuller's earth has absorbent properties and thus enables it to remove greasy and oily matter. Women folk in Northern India also use it as a shampoo during bath for cleaning hair. In modern times, it is used in refining of petroleum, vegetable oils and animal fat.

In Bikaner district, fuller's earth is found near Jogira, Marh, Indoka Bala, Palana and Kesardasar . The district accounts for nearly 18% of the total 5,000 tonnes produced annually in the state.At Marh, the fuller's earth occurs in two horizons of 14m and 1m thickness respectively. The estimated reserve are 4.33 m.t. for high grade quality and 2.77 m.t. for the low grade, besides an inferred reserves of the order of 13 m.t.(Pareek,1975). With the increase in the output of mineral and vegetable oil products in India,

there are bright prospects for stepping up the exploration/exploitation of the mineral.

(6) GLASS SAND

The deposit of glass sand is located at Marh in Bikaner district. This deposit is horizonatally disposed firable sandstone occuring over 0.8 km long and 240 m wide area. The sand Contäins 98.73 – 99.19% Si02 and 0.023 – 0.089% Fe203 and is suitable for glass making. The probabl reserves of the raw sand are 1.54 million tonnes. Besides the above occurrence the Lathi sands tones have also been found to contain pockets of glass sand at places.

Glass sand is fused and used for several purposes, such as for common glasses, ophthalmic glass, for electronic industry and in the polymerisation process for converting unsaturated hydrogen gases to high octane gasoline. Refineries use different grades of glass sand depending upon different grain sizes.In the glass industry,the sand grain size should be between 40 to 80 mesh, with minimum of 98% SiO2. Iron and chromium are highly objectionable impurities. It also finds its use in abrasives and refractories,in foundry industry, in ceramic industry and in paints.

(7) ROCK SALT (Halite)

The rock salt halite sequence forms a part of Hanseran Evaporite Group of rocks which is considered to be homotaxially equivalent to Bilara Group of rocks. The Hansaran Evaporites underlain by Jodhpurs and overlain by Nagaur Group of rocks The lower and upper contacts are gradational. The Nagaur Group of rocks is overlain by Tertiaries and Quaternaries with unconformable contacts. The beds are horizontally to Sub horizontally disposed with rolling dips of 30 10 due west and northwest.

The hanseran Evaporite Group of rocks comprised dolomite, anhydrite, clays, halite and potash salts (minor).Seven halite cycles numbered H1 to H14 (From bottom to top) have been recongnised in this evaporite sequence. These halite cycles are separated from one änother by intervening zones comprising anhydrite,clays and dolomite. At some places all the seven halite cycles are not developed.

During the course of investigation for potash in Nagaur Ganganagar Basin 50 Nos. of boreholes have been drilled, out of which eleven numbers of boreholes namely P-7 (Gus sainsar) P-8 (Kalu), P-11 (Bi kaner), P-12 (Hanseran), P-13 (Lakhasar), P-14(Malkisar),P-15(Gurha) ,P-16 (Chhotargarh), P-17(Garabdesar) , P-18 (Arjunsar) and P-50(Jaitpur) have been drilled in Bikaner district. Although no significant potash mineralisation has been intersected in these boreholes, but a huge thicknees of rock salt(halite) has been intersected in all the boreholes.

In all the eleven boreholes, drilled in Bikaner district, halite associated with Hanser an Evaporite Group of rocks has been intersected. A maximum cumulative thickness of 483.03m halite has been intersected in P-15 (Gurha)borehole.

(8) LIGNITE (Brown Coal)

The only known deposit of coal (lignite) in Rajasthan exists near Palana in Bikaner district and is being worked by the department of mines and Geology Rajasthan. The average annual production is about 30,000 tons. The coal or ,lignite of a dark brown colour was discovered in 1896 while sinking a well at Palana,south of the city of Bikaner. On the analysis made in the geological survey laboratory, following results wereobtained – Moisture 8.2% , Volatile matter 42.72%, Ash 7.8% thus indicating a fuel that would burn rapidly on account of large amount of Volatile matter. But would be some what deficient in thermal power operaLions started in 1898 and the colliery was connected by a rail link in 1899. The seam is 20 feet thick,250 ft. below the surface and 50 feet above the water level,more than two million tons of coal are estimated to exist and

The deposit has shown signs of exhaustion only in one direction. The extraction has grown steadily year by year

(9) LIME STONE

This miniral ha been discovered in Nokha tehsil of the district near Village Dawa-silwa. The mines are located 23 km (14 miles) away from the Nokha railway station

(10) GRIT BAJARI

This is found in large deposits near Gangashahar, Garsisar and Sheo-Bari and all around the Bikaner city within a radius of 11 km (7 miles) it is of considerable use in construction especially where reinformed concrete work is to be done.

(11) KANKAR

A good deposit of kankar is found at Darbari Nal and Gaharisar. The kankar is used locally for lime burning as well as for ballest.

(12) COPPER

The only metallic mineral found in Bikaner is copper. Tod' mentioned about the existence of two mines one at Biramsar and another at Bidasar (both in south of Bikaner) and wrote that the former did not repay the expense of working, while the latter having been worked for nearly thirty years was almost exhausted . According to the local choronicles the mine at Bidasar was discovered in 1751 and was never a paying concern owing to the absence of proper appliances for keeping down the water.

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